

# Informational Leaflet 30

RED SALMON SPAWNING GROUND SURVEY IN THE  
NUSHAGAK AND TOGIAK DISTRICTS - BRISTOL BAY,  
1961

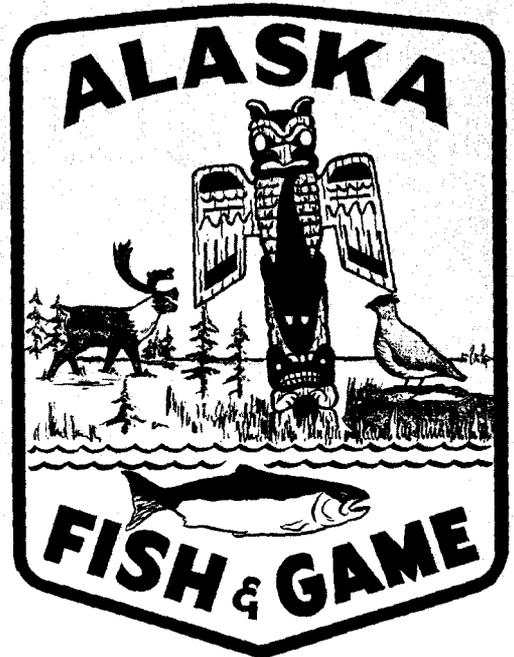
By:

Wilbur Church  
Division of Commercial Fisheries  
Dillingham, Alaska

June 20, 1963

STATE OF ALASKA  
WILLIAM A. EGAN - GOVERNOR

DEPARTMENT OF  
FISH AND GAME  
WALTER KIRKNESS - COMMISSIONER  
SUBPORT BUILDING, JUNEAU



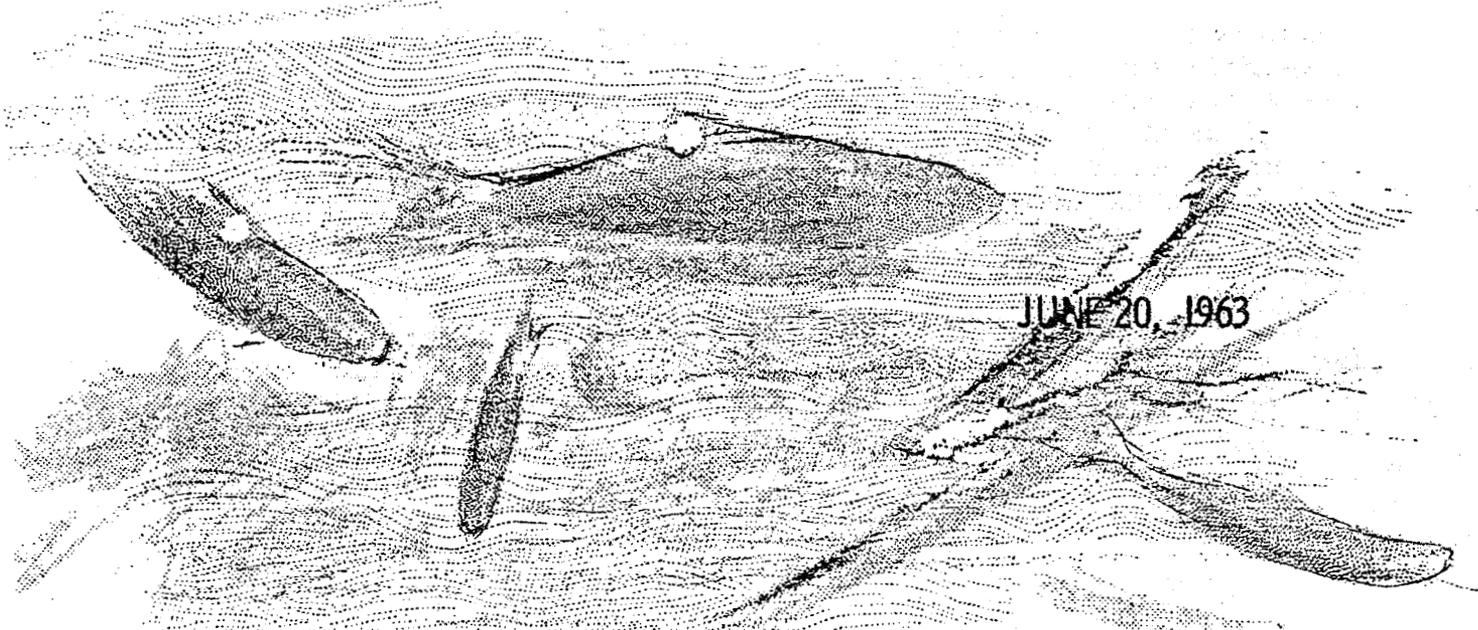
# Informational Leaflet

ALASKA DEPARTMENT OF FISH AND GAME

WILLIAM A EGAN , GOVERNOR

WALTER KIRKNESS, COMMISSIONER

30



JUNE 20, 1963

RED SALMON

## SPAWNING GROUND SURVEY

IN THE NUSHAGAK  
AND TOGIAK DISTRICTS

BRISTOL BAY

1961

BY WILBUR CHURCH

DIVISION OF COMMERCIAL FISHERIES

# RED SALMON SPAWNING GROUND SURVEYS IN THE NUSHAGAK AND TOGIK DISTRICTS

BRISTOL BAY, ALASKA, 1961

## INTRODUCTION

In 1961 the Alaska Department of Fish and Game conducted surveys of red salmon spawning grounds in the Nushagak and Togiak Districts, in western Alaska. The Department assumed the responsibility for such surveys in 1960 after 14 years of surveys by the Fisheries Research Institute. The purpose of the study is to obtain an accurate estimate of the abundance and distribution of fish in the various spawning areas.

Systems included in the surveys were the Wood River, Igushik, Nunavaugaluk, Tikchik, Nushagak-Mulchatna, Togiak, and Kulukak systems. These areas are shown in Figures 1-6.

## METHODS

### Survey Methods

Total escapements to the Wood River Lakes, Igushik Lakes, Tikchik Lakes, Togiak Lakes, and Lake Nunavaugaluk were estimated by the tower counting method. Escapements to the Nushagak-Mulchatna, Kulukak, and tributaries of the Togiak River were estimated by aerial surveys only.

A Cessna 180 floatplane was used for all aerial surveys. Numbers and location of fish were entered on large scale maps (1 inch = 2 miles) of the spawning systems while in flight. Supplemental ground surveys were made in several creeks of the lower Wood River Lakes as a check on the accuracy of the aerial estimates.

Surveys were timed to cover the peak period of spawning in each area. Preliminary surveys were often made of late spawning areas while enroute to areas of earlier spawning.

### Total Population Estimates

The chain-link method is used to derive total population estimates for each year by comparison with the estimates of the previous year.

In applying the method to 1961 data, peak spawning estimates from all areas within a given lake or river are added together. When compared with similar data gathered in 1960, the 1961-1960 ratio is obtained (Tables 1-4). The 1960 population estimates are then multiplied by the factor thus obtained to arrive at preliminary population estimates for each lake and river within the systems (Table 5-6). Preliminary population estimates are corrected to agree with tower counts by distributing the difference among all areas.

## ESTIMATES OF SPAWNING GROUND POPULATIONS IN THE NUSHAGAK DISTRICT

### Wood River Lakes

Peak estimates for 1960 and 1961, and peak estimate ratios for these two years are shown in Table 1. Preliminary population estimates and estimates adjusted to the tower count total are shown in Table 5.

### Adjustment of Population Estimates

The Fisheries Research Institute operated towers at the outlets of Little Togiak Lake and Lake Kulik in 1961. When the results of the 1961 aerial survey were first reported, the tower counts were not known to the writer. The figures shown in this report have been corrected to conform with the tower counts, consequently they will differ slightly from those originally reported.

The original estimate for Little Togiak Lake was 11,000 fish. This is now corrected to 10,500 to conform with the tower count. Likewise, the original estimate of 19,400 fish in Lake Kulik has been corrected to 20,800.

### Distribution of the Wood River Lakes Escapement

The 1961 escapement of 460,700 red salmon to the Wood River Lakes was 45% of that of 1960 and constituted 53.59% of the known Nushagak escapement (Table 5).

80% of the spawning was confined to three areas: Lake Nerka, Agulowak River, and Agulukpak River.

With the exception of Peace River, all rivers had large spawning populations compared with past years.

Ice Creek and Sunshine Creek were the chief contributors to the Aleknagik populations. Other areas were poor or only fair.

Creek spawning in Lake Nerka was generally poor. Best of the creeks were Pick Creek, Stovall Creek, and Kema Creek; each of these were well below 1960 populations. Beach spawning also declined in Lake Nerka. Main contributors were Anvil Bay, Allah Creek Beach, and the N4-N6 Beach.

Little Togiak Lake compared favorably with 1960, relative to the size of the total escapement.

Escapement to Lake Beverly was very poor. The only populations of any size were at Hardluck Bay, Silver Horn, and Moose Creek. Of these, only Moose Creek compared favorably with previous years.

Lake Kulik also had a poor escapement. Most of the spawning population was contained on the North Shore beaches, but was light and scattered compared with previous years.

Distribution of Wood River Lakes spawners changed considerably from 1960 (Table 8). River spawning increased from 11.6% of the total to 53.8%. Beach and creek spawning both declined.

63.59% of the total escapement was accounted for by peak surveys (Table 7). This is an increase over previous years and was made possible by the increase in river spawning. A higher percentage of the total population is observed in rivers than in either beaches or creeks.

### Igushik Lakes

Peak estimates for 1960 and 1961, and peak estimate ratios for these two years are shown in Table 2. Preliminary and adjusted estimates are shown in Table 5. 1961 peak estimates accounted for 39.24% of the tower count total (Table 7).

### Distribution of the Igushik Lakes Escapement

The 1961 escapement of 294,200 red salmon was 59% of that of 1960 and constituted 34.21% of the known Nushagak escapement (Table 5).

As in previous years, the majority of the escapement was contained in Lake Ualik and the Kathlene and Ongoke Rivers, while Lake Amanka supported a minor percentage of the population.

The major shift in distribution occurred in Kathlene River. The 1961 spawning took place almost altogether in the Upper River with only minor spawning in the lower river. This is a direct reversal of the 1960 distribution.

As in the Wood River Lakes, river spawning increased in relative importance (Table 8). The percentage of creek spawning also increased slightly, while beach spawning showed a decline.

### Lake Nunavaugaluk

Peak estimates for 1960 and 1961 and peak estimate ratios for those two years are shown in Table 2. Preliminary and adjusted population estimates are shown in Table 5. The 1961 peak estimates accounted for 52.45% of the tower count total (Table 7).

### Distribution of the Nunavaugaluk Lake Escapement

The 1961 escapement of 4,900 red salmon was 32% of that of 1960, and constituted only 1/2 of 1% of the known Nushagak escapement (Table 5).

Approximately half of the spawning population was contained in the lower southwest and south end of the lake, with the remainder thinly distributed in other portions of the lake.

Creek spawning was almost non-existent, causing an increase in the percentage of beach spawning (Table 8).

### Tikchik Lakes

Peak estimates for 1960 and 1961 and peak estimate ratios for these two years are shown in Table 3. Preliminary and adjusted population estimates are shown in Table 5. The 1961 peak estimates accounted for 34.31% of the tower count total (Table 7).

### Distribution of the Tikchik Lakes Escapement

The 1961 escapement of 79,800 red salmon was 55% of that of 1960, and constituted 9.28% of the known Nushagak escapement (Table 5).

The Tikchik River and Allen River Beach on Lake Chauekuktuli contained approximately 80% of the spawning population.

The Tikchik Lake population, composed entirely of creek spawning, declined considerably in relative importance.

Nuyakuk Lake beach spawning increased over that of 1960, but still remained scattered and of minor importance.

With the exception of the Allen River Beach, spawning was light and scattered in Lake Chauekuktuli.

### Nushagak-Mulchatna

Peak estimates for 1961 are shown in Table 3. No survey was made in this system in 1960.

The 1961 escapement estimate of 20,200 red salmon is based solely on aerial surveys. This constitutes only 2.35% of the known Nushagak escapement (Table 5).

In most of the system, fish were found in small groups and widely scattered. The largest concentration was found in the King Salmon River, where most of the population of that tributary was in one area.

Complete coverage of all tributaries was not attained, and some spawning areas were very probably missed in the survey. It is unlikely, however, that the numbers of fish missed would be sufficient to change the Nushagak system's total population estimate significantly.

## ESTIMATES OF SPAWNING GROUND POPULATIONS IN THE TOGIK DISTRICT

### Togiak Lakes

Peak estimates for 1960 and 1961, and peak estimate ratios for those two years are shown in Table 4. Preliminary and adjusted population estimates are shown in Table 6. The 1961 peak estimates accounted for 44.45% of the tower count total (Table 7).

### Distribution of Togiak Lakes Escapement

The 1961 escapement of 95,500 red salmon to the Togiak Lakes was 59% of that of 1960, and constituted 78.08% of the known Togiak escapement (Table 6).

Almost half the spawning population of the lakes was concentrated in the Sunday Creek Beach area.

Jondik Creek contained the only creek spawning of any consequence.

The east side beaches were well populated, although, with the exception of Sunday Creek Beach, with smaller numbers than in 1960. West Side beaches and West Lake, areas of minor importance, had larger populations than in 1960.

Zwischen River contained nearly as many fish as in 1960. Upper Togiak Lake distribution showed little change in relation to the size of the total escapement.

### Togiak Tributaries

Peak estimates for 1960 and 1961, and peak estimate ratios for these two years are shown in Table 4. Preliminary and adjusted population estimates are shown in Table 6. No tower counts are available to determine the percentage of fish accounted for by peak estimates, but for the purpose of population estimates it is presumed to be identical with that of the Togiak Lakes (Table 7).

### Distribution of the Togiak Tributaries Escapement

The escapement of 26,800 red salmon estimated by aerial surveys was 92% of that of 1960, and constituted 21.92% of the known Togiak escapement (Table 6).

Distribution did not differ markedly from that of 1960. The Gechiak Lake system once again contained approximately two-thirds of the tributary population. Next in importance was Ongivinuk Lake, followed by minor populations in Pungokebuk and Narogurum Lakes.

### Kulukak District

Peak estimates for 1961 are shown in Table 4. No survey was made in this system in 1960.

The 1961 escapement estimate of 5,200 red salmon is based solely on aerial surveys and constitutes all of the known Kulukak escapement.

The majority of the fish accounted for by the surveys were observed in Tithe Creek ponds. The remainder were in Kulukak Lake and the creek which empties into it.

## SUMMARY

1. Surveys of the red salmon spawning grounds in the Nushagak and Togiak Districts were made by the Alaska Department of Fish and Game.
2. Aerial surveys served as the means of estimating the spawning distribution.
3. The runs to the river spawning areas in the Wood River system showed a major increase over the 1960 level.
4. A majority of the Wood River Lakes escapement was contained in Lake Nerka and the Agulowak and Agulukpak Rivers. Small populations were present in Lakes Aleknagik, Beverley, Kulik, and Mikchik.
5. The escapement to the Igushik Lakes was distributed essentially as in 1960, with most of the spawning population in Lake Ualik and the Kathlene and Ongoke Rivers.
6. The escapement to Lake Nunavaugaluk showed a marked decrease from that of 1960.
7. A majority of the Tikchik Lakes escapement was contained in the Tikchik River and Allen River Beach.
8. A survey of the Nushagak-Mulchatna system disclosed small, widely scattered groups of red salmon.
9. A majority of the Togiak Lakes escapement spawned in the Sunday Creek Beach area and Zwischen River.
10. The escapement to the Togiak tributaries was distributed essentially as in 1960, with most of the spawning population in the Gechiak Lake system.
11. The escapement to the Kulukak system was small. The majority of the population spawned in Tithe Creek ponds.

Table 1. Comparison of peak estimates - Wood River Lakes, 1960-1961.

Area	1960		1961		Ratio 1961/1960
	Date	No. Est.	Date	No. Est.	
Wood River	8/28	1,800	8/29	4,000	2.22
L. Aleknagik:					
Mission Creek	8/9	500	8/6	100	
Bear Creek	8/8	1,750	8/6	1,200	
Hansen Creek	8/9	2,900	8/6	700	
Happy Creek	8/11	650	8/6	800	
Ice Creek	8/9	7,000	8/6	2,500	
Yako Creek	8/10	700	8/6	100	
Sunshine Creek	8/9	2,000	8/6	3,000	
Whitefish Creek	8/9	2,000	8/6	300	
Northshore Creeks	8/9	400	8/6	100	
Northshore Beaches	8/28	200	8/29	600	
South Shore	8/28	800	8/29	860	
Yako Beach	8/9	<u>1,300</u>	8/29	<u>150</u>	
Aleknagik Total		20,200		10,410	.52
Agulowak River & Lower River Bay	8/28	37,000	8/29	100,000	2.70
Lake Nerka:					
Fenno Creek	8/9	5,000	8/6	1,200	
Upper River Bay, NW	8/18	400	8/29	100	
Upper River Bay, SE	8/28	7,000	8/29	1,600	
Allah Creek Beach	8/28	16,700	8/29	7,600	
Ross Creek-Pike Creek	8/9	3,000	8/6	200	
Pike Creek	8/9	10,000	8/6	1,500	
Stovall Creek & Lake	8/9	5,000	8/6	2,000	
Bear Creek	8/9	3,000	8/6	100	
Teal Creek	8/9	7,000	8/6	100	
River Bay-N4 Beach	8/28	300	8/29	150	
N4-N6 Beach	8/28	10,300	8/29	7,800	
Pick Creek Beach	8/28	1,000	8/29	700	
Pick Creek	8/9	25,000	8/6	4,500	
Elva Creek Beach	8/28	1,100	8/29	1,200	
Elva Creek	8/18	1,000	8/6	200	
Amakuk Arm	8/28	3,100	8/29	950	
Lynx Creek	8/18	3,000	8/16	100	
Lynx Lake	8/28	25,900	8/29	2,940	
Amakuk Arm-Ott's Bay	8/28	500	8/28	250	
Ott's Bay	8/28	2,900	8/28	2,000	
Ott's Bay-Agulupak River	8/28	200	8/28	100	
Kema Creek	8/18	15,200	8/16	2,000	

-Continued-

Table 1. Comparison of peak estimates - Wood River Lakes, 1960-1961 (cont.).

Area	1960		1961		Ratio 1961/1960
	Date	No. Est.	Date	No. Est.	
Hidden Lake Creek	8/18	8,000	8/16	600	
Anvil Bay	8/28	31,500	8/28	10,100	
Anvil Bay-Elbow Point	8/28	1,700	8/28	440	
Elbow Pt.-Lynx Creek	8/28	1,300	8/29	730	
Little Togiak River	8/9	<u>10,000</u>	8/16	<u>3,300</u>	
Nerka Total		199,100		52,460	.26
Little Togiak Lake	8/28	12,100	8/23	7,770	.64
Agulupak River	8/28	51,000	8/28	90,000	1.76
Lake Beverley:					
Hardluck Bay	8/28	27,800	8/28	5,050	
Sam's Beach	8/28	4,000	8/28	500	
Golden Horn	8/28	2,200	8/28	450	
Silver Horn	8/28	29,000	8/28	3,350	
B-12 Beach	8/28	9,000	8/28	500	
B-9 Beach	8/28	4,800	8/28	100	
Anniversary Bay	8/28	300	8/28	50	
Moose Creek	8/18	2,000	8/16	2,000	
Misc.		<u>300</u>		<u>100</u>	
Beverley Total		79,400		12,100	.15
Peace River	8/18	11,000	8/16	700	.06
Lake Mikchalk	8/28	15,300	8/28	2,200	.14
Wind River	8/28	540	8/28	1,300	2.41
Lake Kulik:					
North Shore	8/28	32,400	8/28	3,100	
West End	8/28	300	8/28	320	
South Shore	8/28	<u>1,400</u>	8/28	<u>610</u>	
Kulik Total		34,100		4,030	.12
Grant River	8/18	20,000	8/16	8,000	.40
Wood River Lakes Total		481,540		292,970	

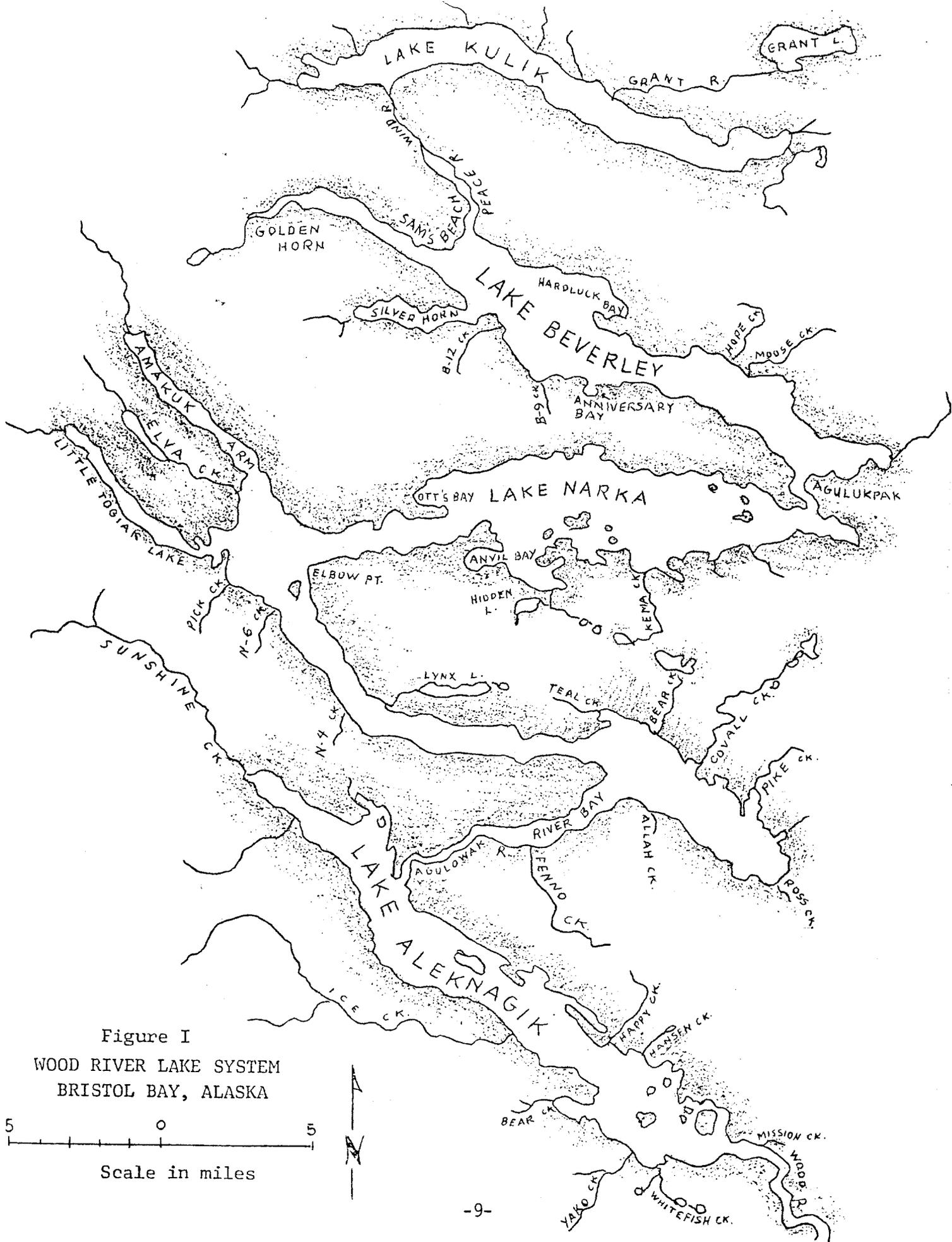


Figure I  
WOOD RIVER LAKE SYSTEM  
BRISTOL BAY, ALASKA

5 0 5  
Scale in miles

Table 2. Comparison of peak estimates - Igushik Lakes and Lake Nunavaugaluk, 1960-1961.

Area	1960		1961		Ratio 1961/1960
	Date	No. Est.	Date	No. Est.	
Igushik River	--	--	8/11	(100)	--
Lake Amanka:					
Longarm Creek	8/9	15,000	8/11	4,000	
Middle Creek	8/9	500	8/11	500	
South Creek	8/9	1,000	8/11	1,000	
Amanka Beaches	8/29	<u>1,600</u>	9/2	<u>800</u>	
Amanka Total		18,100		6,300	.35
Kathlene River:					
Lower River	8/29	20,000	8/11	100	
Upper River	8/9	5,000	8/11	30,000	
Ongoke River	8/9	<u>35,000</u>	8/11	<u>18,500</u>	
Kathlene River Total		60,000		48,600	.81
Lake Ualik:					
Frances Creek	8/9	25,000	8/11	20,000	
West Shore Creeks	8/9	2,000	8/11	1,000	
West Shore	8/29	108,000	9/2	36,500	
East Shore Creeks	8/9	500	8/11	400	
East Shore	8/29	<u>2,000</u>	9/2	<u>2,650</u>	
Ualik Total		137,500		60,550	.44
Igushik Lakes Total		215,600		115,450	
Lake Nunavaugaluk:					
Snake River	8/9	400	8/11	100	
Snake River-Eagle Creek	8/29	1,720	9/2	950	
Eagle Creek	8/9	50	8/11	120	
West Shore	8/29	890	8/11	200	
Killian Creek	8/9	2,500	8/11	450	
East Shore	8/29	1,100	8/11	450	
East Creek	8/9	1,000	8/11	50	
South Shore	8/29	<u>350</u>	9/2	<u>250</u>	
Nunavaugaluk Total		8,010		2,570	.32



Figure 2

IGUSHIK AND NUNAVAUGALUK LAKE SYSTEMS  
BRISTOL BAY, ALASKA

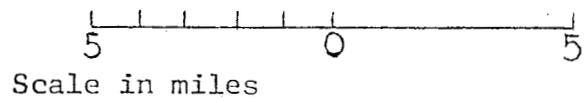


Table 3. Comparison of peak estimates - Tikchik Lakes and Nushagak-Mulchatna system, 1960-1961.

Area	1960		1961		Ratio 1961/1960
	Date	No. Est.	Date	No. Est.	
<b>Tikchik Lake:</b>					
Creek A	8/10	2,000	8/12	800	
Creek B	8/10	5,650	8/12	1,400	
Creek C	8/10	<u>50</u>	8/12	<u>50</u>	
<b>Tikchik Total</b>		<b>7,700</b>		<b>2,250</b>	<b>.29</b>
Tikchik River	8/10	12,000	8/12	10,000	.83
<b>Nuyakuk Lake:</b>					
North Shore	8/10	820	8/22	1,070	
South Shore	8/10	100	8/22	970	
Mirror Bay	8/10	900	8/22	730	
Rapids	8/29	<u>300</u>	8/22	<u>50</u>	
<b>Nuyakuk Total</b>		<b>2,120</b>		<b>2,820</b>	<b>1.33</b>
<b>Lake Chauekuktuli:</b>					
Creek #1	8/10	150	8/12	10	
Allen River Beach	8/29	17,500	8/22	10,500	
Allen River	8/10	250	8/12	500	
North Shore	8/29	4,760	8/22	800	
South Shore	8/29	<u>1,100</u>	8/22	<u>500</u>	
<b>Chauekuktuli Total</b>		<b>23,760</b>		<b>12,310</b>	<b>.52</b>
<b>Tikchik Lakes Total</b>		<b>45,580</b>		<b>27,380</b>	
<b>Mulchatna River</b>					
Mulchatna River	--	--	8/13	1,900	
Koktuli River	--	--	8/13	1,800	
Nushagak River	--	--	8/12	400	
King Salmon River	--	--	8/12	4,500	
Iowithla River	--	--	8/13	<u>1,500</u>	
<b>Nushagak-Mulchatna Total</b>		<b>--</b>		<b>10,100</b>	<b>--</b>

Figure 3  
TIKCHIK LAKE SYSTEM  
BRISTOL BAY, ALASKA

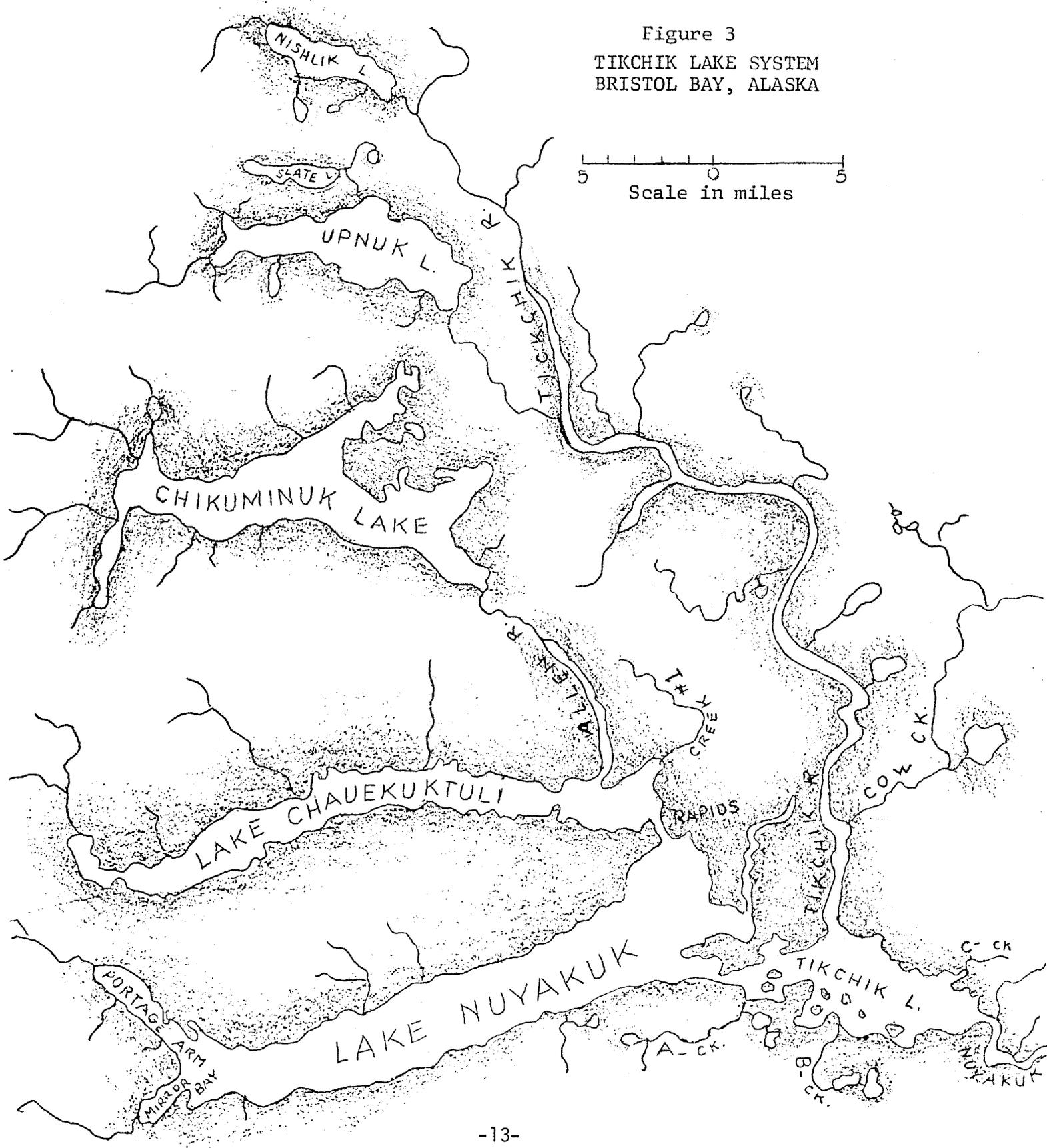
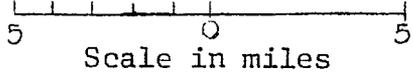


Table 4. Comparison of peak estimates - Togiak Lakes, 1960-1961.

Area	1960		1961		Ratio 1961/1960
	Date	No. Est.	Date	No. Est.	
Togiak River	8/29	1,000	8/22	850	.85
Togiak Lake:					
Outlet-Jondik Creek	8/29	3,500	9/8	730	
Jondik Creek	8/8	5,000	8/11	3,000	
Jondik Cr.-Bruin Cr.	8/29	14,300	9/8	1,800	
Bruin Cr.-Middle Pt.	8/29	3,400	9/8	1,020	
Middle Pt.-Sunday Cr.	8/29	18,950	9/8	20,730	
North Shore	8/29	3,800	9/8	2,100	
West Shore	8/29	1,200	9/8	2,010	
West Creek & Lake	8/8	<u>100</u>	8/11	<u>1,250</u>	
Togiak Total		50,250		32,640	.65
Zwischen River	8/29	7,650	8/22	5,150	.67
Upper Togiak Lake:					
Zwischen R.-Budole Cr.	8/29	3,800	9/8	1,650	
Budole Cr.-Upper Togiak Cr.	8/29	2,000	9/8	1,360	
North Shore	8/29	1,000	9/8	150	
Makoo Creek	8/29	0	9/8	150	
Upper Togiak Creek	8/29	0	9/8	150	
West Shore	8/29	<u>200</u>	9/8	<u>350</u>	
Upper Togiak Total		7,000		3,810	.54
Togiak Lakes Total		65,900		42,450	
Gechiak Lake	8/8	7,650	8/11	7,480	.98
Ongivinuk Lake	8/29	3,200	8/22	3,750	1.17
Pungokepuk Lake	8/8	950	8/11	400	.42
Miscellaneous	- -	- -		300	- -
Togiak Tributaries Total		11,800		11,930	
Kulukak River	- -	- -	8/11	500	- -
Tithe Creek	- -	- -	8/11	<u>2,100</u>	- -
Kulukak Total				2,600	

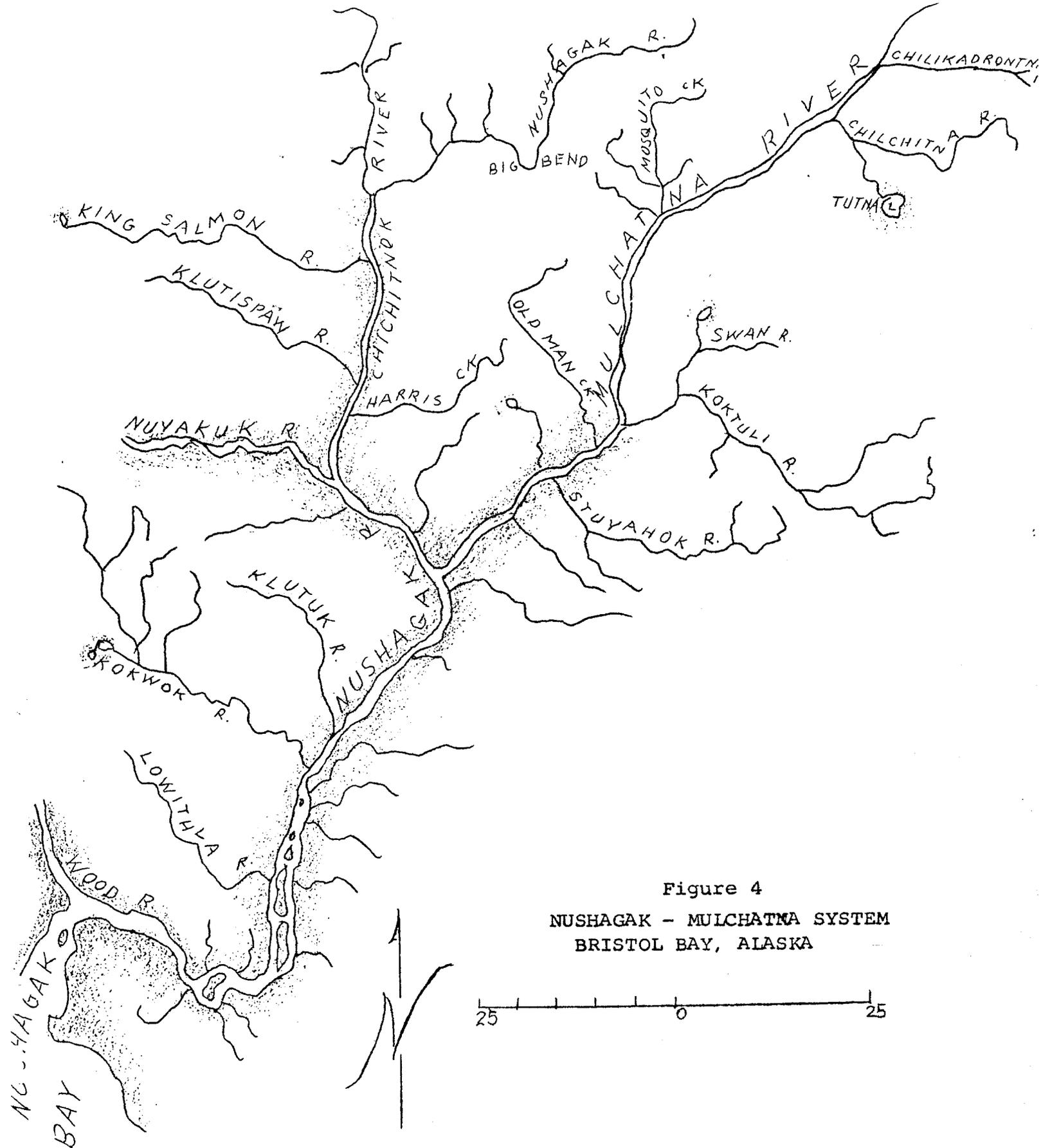


Figure 4  
 NUSHAGAK - MULCHATNA SYSTEM  
 BRISTOL BAY, ALASKA

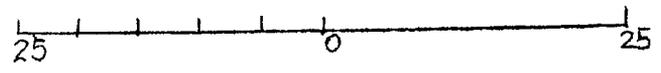


Table 5. Total population estimates of red salmon in the Nushagak District, 1960-1-61.

Area	Tot. Pop Est. 1960	Ratio 1961-1960	1961 Prelim.	1961 Adj. Est.	Percent of Total	Percent of Nushagak Total
Wood River	3,200	2.22	7,104	7,300	1.59	.85
Lake Aleknagik	35,800	.52	18,616	19,000	4.12	2.21
Agulowak River	46,100	2.70	124,470	127,200	27.61	14.79
Lake Nerka	523,900	.26	136,214	139,200	30.22	16.19
Little Togiak Lake	16,800	.64	10,752	10,500	2.28	1.22
Agulukpak River	56,500	1.76	99,440	101,600	22.05	11.82
Lake Beverley	189,600	.15	28,440	29,100	6.32	3.39
Peace River	13,000	.06	780	800	.17	.09
Lake Mikchalk	22,100	.14	3,094	3,200	.70	.37
Wind River	800	2.41	1,928	2,000	.43	.23
Lake Kulik	79,800	.12	9,576	9,500	2.06	1.11
Grant River	28,400	.40	11,360	11,300	2.45	1.32
<b>Totals</b>	<b>1,016,000</b>	<b>.44</b>	<b>451,774</b>	<b>460,700</b>	<b>100.00</b>	<b>53.59</b>
-91- Lake Nunavaugaluk	16,600	.32	5,325	4,900	100.00	.57
Lake Amanka	41,600	.35	14,481	16,100	5.47	1.87
Kathlene River	138,100	.81	111,861	124,100	42.18	14.43
Lake Ualik	315,100	.44	138,770	154,000	52.35	17.91
<b>Totals</b>	<b>494,800</b>	<b>.59</b>	<b>265,112</b>	<b>294,200</b>	<b>100.00</b>	<b>34.21</b>
Tikchik Lake	25,200	.29	7,363	6,700	8.40	.78
Tikchik River	39,200	.83	32,665	29,700	37.22	3.45
Nuyakuk Lake	7,000	1.33	9,311	8,500	10.65	.99
Lake Chauekuktuli	74,100	.52	38,391	34,900	43.73	4.06
<b>Totals</b>	<b>145,500</b>	<b>.55</b>	<b>87,730</b>	<b>79,800</b>	<b>100.00</b>	<b>9.28</b>
Mulchatna River	---	---	3,800	3,800	18.81	.44
Koktuli River	---	---	3,600	3,600	17.82	.42
Nushagak River	---	---	800	800	3.96	.09

-Continued-

Table 5. Total population estimates of red salmon in the Nushagak District, 1960-1961 (continued).

Area	Tot. Pop. Est. 1960	Ratio 1961-1960	1961 Prelim.	1961 Adj.Est.	Percent of Total	Percent of Nushagak Tot.
King Salmon River	---	---	9,000	9,000	44.56	1.05
Iowithla River	---	---	3,000	3,000	14.85	.35
Totals			20,200	20,000	100.00	2.35
NUSHAGAK DISTRICT TOTALS	1,672,900	.50	830,141	859,800		100.00

Figure 5  
 TOGIAK RIVER SYSTEM  
 BRISTOL BAY, ALASKA

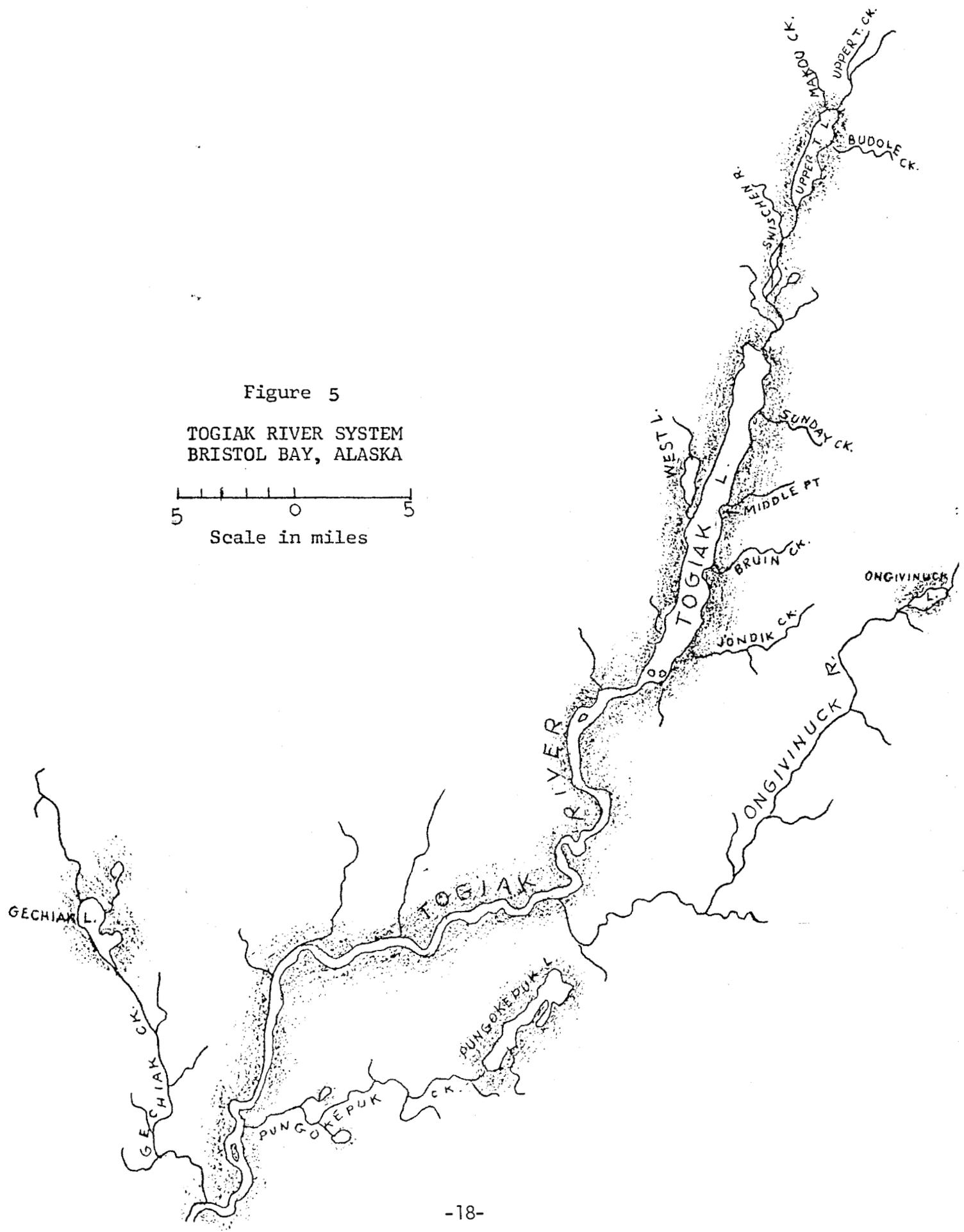
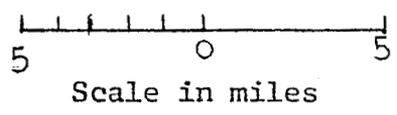


Table 6. Total population estimates of red salmon in the Togiak and Kulukak Districts, 1960-1961.

Area	Tot. Pop. Est. 1960	Ratio 1961-1960	1961 Prelim.	1961 Adj. Est	Percent of Total	Percent of Togiak Total
Togiak River	2,500	.85	2,125	1,900	1.99	1.55
Togiak Lake	124,100	.65	80,615	73,400	76.86	60.02
Zwischen River	18,900	.67	12,723	11,600	12.15	9.48
Upper Togiak Lake	17,300	.54	9,416	8,600	9.00	7.03
Totals	162,800	.59	104,879	95,500	100.00	78.08
Gechiak Lake	18,900	.98	18,480	16,800	62.69	13.74
Ongivinuk Lake	7,900	1.17	9,258	8,400	31.34	6.87
Pungokepuk Lake	2,400	.42	1,011	900	3.36	.74
Miscellaneous	---	--	758	700	2.61	.57
Totals	29,200	.92	29,507	26,800	100.00	21.92
TOGIAK DISTRICT totals	192,000	.64	134,386	122,300		100.00
Kulukak River	---	--		1,000	19.23	
Tithe Creek	---	--		4,200	80.77	
Kulukak Total	---	--		5,200	100.00	

Figure 6  
KULUKAK SYSTEM  
BRISTOL BAY, ALASKA

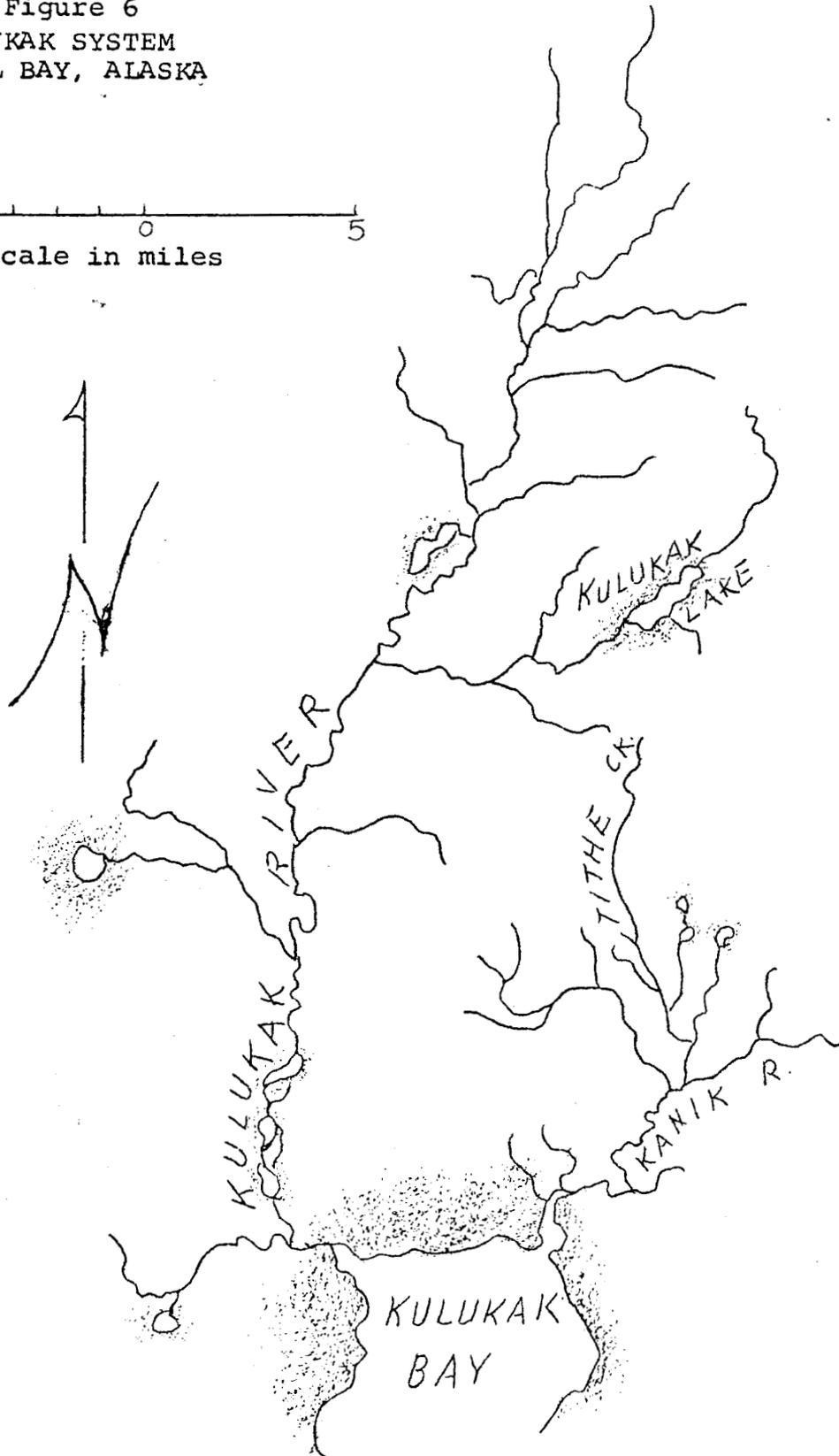
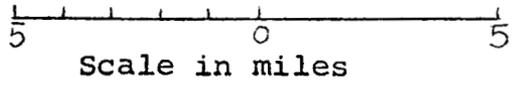


Table 7. Comparison of total population with sum of peak survey - estimates in the Nushagak and Togiak systems.

Area	Total Pop. Est. by Tower Counts	Sum of Peak Survey Estimates	Percent Acct. for by Peak Estimates
Wood River Lakes	460,700	292,970	63.59
Lake Nunavaugaluk	4,900	2,570	52.45
Igushik Lakes	294,200	115,450	39.24
Tikchik Lakes	79,800	27,380	34.31
Togiak Lakes	95,500	42,450	44.45
Total	935,100	480,820	51.42

Table 8. Percentage distribution of spawners in three major types of spawning areas in the Nushagak and Togiak systems, 1960-1961.

Area	1960			1961		
	Creeks	Beaches	Rivers	Creeks	Beaches	Rivers
Wood River Lakes	32.9	55.5	11.6	13.88	32.31	53.81
Lake Nunavaugaluk	44.3	50.7	5.0	24.12	71.99	3.89
Igushik Lakes	35.5	52.9	11.6	39.34	34.54	26.12
Tikchik Lakes	19.4	53.1	27.5	11.19	49.63	39.18
Togiak Lakes	12.3	76.6	11.1	15.89	73.07	11.04
Total	30.5	56.8	12.7	21.75	39.81	38.44

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