

AYK REGION  
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KOTZEBUE SOUND SHEEFISH STUDY  
1967

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Annual Technical Report

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## KOTZEBUE SOUND SHEEFISH STUDY

### INTRODUCTION

Kotzebue Sound sheefish spend a portion of their life history in the saline waters of Kotzebue Sound and in the brackish waters of Hotham Inlet and Selawik Lake. Like salmon, known spawning runs occur in the Kobuk and Selawik Rivers during June through September with spawning taking place hundreds of miles upstream from the ocean.

In the Kotzebue Sound region of northwestern Alaska (Figure 6), sheefish are taken mainly for subsistence by village residents. A limited number of sheefish are also harvested for commercial utilization for local markets. Expansion of the commercial fishery depends on development of outside markets and establishment of suitable processing facilities.

Basic life history studies of sheefish populations and accurate records of subsistence and commercial catches are essential for proper management of the fishery. In order to develop sound management practices, biological investigations of sheefish were expanded in 1967 with emphasis on the following objectives:

1. Record the subsistence and commercial harvest data.
2. Obtain age-sex-size composition and fecundity information.
3. Obtain estimates of spawning populations and observe spawning behavior.
4. Determine movements of populations and seasonal abundance on a year-round basis.

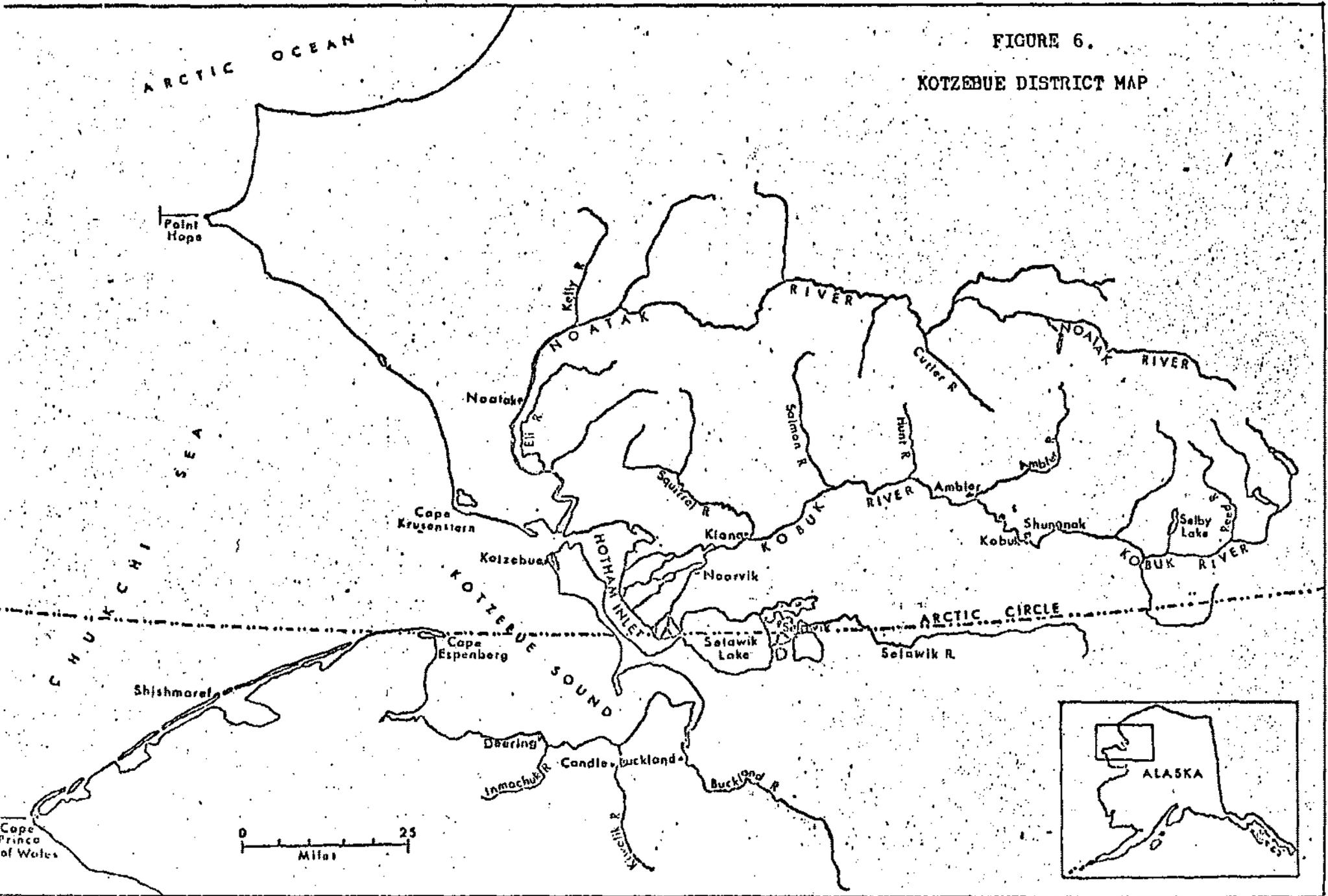
Detailed information regarding age-sex-size of sheefish is being analyzed and will be presented in later reports.

### METHODS AND MATERIALS

The methods and materials used in the sheefish studies were as follows:

FIGURE 6.

KOTZEBUE DISTRICT MAP



1. Subsistence catch data was obtained primarily by personal interviews of fishing families in the following villages: Kotzebue, Selawik, Noorvik, Kiana, Ambler, Shungnak, and Kobuk. Catch questionnaire forms were distributed to those fishermen not contacted. Records of commercial catches were obtained from fish tickets and personal interviews.
2. Age-sex-size composition data was collected by sampling the commercial, subsistence and test catches taken in Kotzebue Sound, Hotham Inlet, and Kobuk River. Lengths were measured from the tip of the snout to the fork of the tail in centimeters. Weight was recorded in pounds. Sex was determined by examination of gonads or external observations of sexually mature fish on the spawning grounds. Sex could not be determined for frozen sheefish caught in the winter or spring. Scale smears were taken above the lateral line between the dorsal and adipose fin. Fecundity information was collected from test catches taken near the spawning grounds on the upper Kobuk River. Estimates of the fecundity of five female fish were calculated by weight of a sample count of 1,000 eggs compared to the weight of both ovaries of each fish.
3. Aerial surveys of known spawning grounds were conducted. Observations of spawning behavior were conducted during late September on the upper Kobuk River. Daily water temperatures and climatological data was recorded. Known spawning areas were marked and depth of river and the type of streambed gravel was noted.
4. Movements and seasonal abundance of sheefish populations were studied by a tag-recovery program. Sheefish were captured with set gill nets and rod and reel for tagging in the upper Kobuk River. Yellow spaghetti tags were used and a one-dollar reward was offered for each tag recovery.

Assistance in planning and conducting some of the field studies was given by Ken Alt of the Division of Sport Fish.

## RESULTS

Subsistence and Commercial Catches: In Table 31 catch data for the

Table 31. Subsistence and Commercial Sheefish Catches, Kotzebue District,  
1966-1967

SUBSISTENCE CATCH

<u>Village</u>	<u>Fishermen Interviewed</u>	<u>Number of Sheefish</u>
Noorvik	28	3,792
Kiana	19	925
Ambler	11	194
Shungnak	11	166
Kobuk	<u>7</u>	<u>99</u>
SUBTOTAL	76	5,166 (June, 1967 - October, 1967)
Kotzebue	30	10,060 (October, 1966 - May, 1967)
Selawik	<u>29</u>	<u>7,164</u> (March, 1967 - November, 1967)
TOTAL DISTRICT CATCH	135	22,390

COMMERCIAL CATCH

Kotzebue	10	992 (October, 1966 - May, 1967)
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Kobuk River villages, Kotzebue and Selawik are presented. An extensive subsistence survey of the villages was conducted for the first time in 1967. Recorded catches are believed to represent approximately 90 percent of the actual harvest. The total subsistence catch was 22,390 sheefish taken from the fall of 1966 to the fall of 1967.

It is interesting to note that five types of fishing gear are used to catch sheefish depending on location of fishermen and time of year. Kotzebue fishermen take large numbers of sheefish during the late fall and winter with gill nets set under the ice in Kotzebue Sound and Hotham Inlet. During the spring, the Kotzebue fishermen mostly jig with lures through the ice. Selawik residents also use this method in the spring. After break-up of the river ice in early June, the Selawik fishermen used rod and reel to catch large numbers of sheefish in the Tuklomarak and Selawik Rivers. Kobuk River fishermen primarily used gill nets during the summer to capture migrating sheefish bound for upriver spawning areas. In late September, villagers from Shungnak and Kobuk used beach seines to catch sheefish off the spawning grounds. Gill nets are again used by Kobuk River fishermen to take the post-spawning sheefish migrating downstream.

The commercial catch for the period October, 1966 to May, 1967 totaled 992 sheefish taken by ten Kotzebue fishermen (Table 32). Most of the catch was marketed in local stores of Kotzebue and Nome. The average weight of sheefish taken in commercial fishery was 6 pounds.

Table 32. Age-Sex-Size Composition and Fecundity Information: During the period August, 1966 to September, 1967 the following numbers of sheefish were sampled:

Date	Area	Gear	No. of Samples
8/66	Hotham Inlet	Commercial-set gill net	95
9/66	Kobuk River	Test gill net, rod & reel	
		Subsistence-beach seine	154
12/66	Hotham Inlet	Commercial-set gill net	84
5/67	Hotham Inlet	Subsistence-jigging	84
8/67	Kotzebue Sound	Test-gill net	8
9/67	Kobuk River	Test-gill net, rod & reel	
		Subsistence-beach seine	201

Size and sex composition data by gear has been tabulated for the

September, 1967 Kobuk River sample and is summarized in Table 33. Hook and line is selective toward the more active male sheefish while gill nets and beach seine capture more females. Due to differences in gear selectivity, it is difficult to determine the actual sex ratio of the spawning population. It is interesting to note that for the combined gear, the overall sex ratio of the September, 1967 sample is nearly 1:1 (103 males: 98 females).

Age, sex, and size composition for the above sample (gear combined) is presented in Table 34. All sheefish sampled were taken near the spawning grounds and presumed to be sexually mature. The age classes of male sheefish ranged from 7 to 14 years. Age 8 males were the most abundant. The age of females ranged from 9 to 20 years. The dominant age class of the female was age 14.

Fecundity of five female sheefish, ranging in size from 28.5 to 34.3 lbs., varied from 167,204 to 315,670 eggs per fish.

Estimate of Spawning Population Size: Aerial survey methods appear promising for obtaining an index of the spawning population size. Under good survey conditions (clear water, fair skies, and negligible wind) a minimum of 1,025 schooling sheefish were observed over a distance of about 40 river miles on the upper Kobuk River on September 20, 1967. In 1966 a total of 1,200 sheefish were observed in a single large school 26 miles above the village of Kobuk during an aerial survey of salmon spawning areas on September 5. During September of 1968, extensive aerial surveys of the upper Kobuk and Selawik Rivers will be conducted if favorable counting conditions exist.

Seasonal Distribution and Movements: During the past two years, valuable information on the movements of sheefish have been obtained from the release of tagged fish. In Table 35 tag and recovery data is presented for the years 1966 and 1967. One of the primary objectives of the tagging program was to determine movements of the Selawik and Kobuk River populations during the winter and spring. Prior to the tagging programs it was thought that the Selawik River population was found exclusively in Selawik Lake and the Kobuk River population resided in Hotham Inlet during the winter and spring. Recoveries of two tagged Kobuk River sheefish in Selawik Lake during late spring of 1967 indicated that the two populations intermingled in the Hotham Inlet and Selawik Lake areas.

Another objective of the tagging program was to determine the spawning frequency of sheefish. A 1967 recovery of a spent male sheefish that was tagged on the Kobuk River spawning grounds in 1966 in the same area indicated that

Table 33. Mean Fork Lengths, Mean Weight, and Sex Composition of Sheefish Taken by Hook and Line, Gill Net, and Beach Seine, Upper Kobuk River, 1967.

Sex	HOOK AND LINE				GILL NET				BEACH SEINE				COMBINED GEAR			
	No.	Percent	F.L. <sup>1/</sup>	Wt. <sup>2/</sup>	No.	Percent	F.L.	Wt.	No.	Percent	F.L.	Wt.	No.	Percent	F.L.	Wt.
Male	51	71.8	77.6	10.4	37	46.3	77.5	10.9	15	30.6	76.9	10.2	103	51.3	77.5	10
Female	21	29.2	93.8	21.7	43	53.7	99.9	25.2	34	69.4	98.2	21.8	98	48.7	98.0	23
Combined Sexes	72	100.0	82.3	13.7	80	100.0	89.5	18.6	49	100.0	91.9	18.2	201	100.0	87.5	16

<sup>1/</sup> Fork length in centimeters.

<sup>2/</sup> Weight in pounds.

TABLE 34

AGE, SEX, AND SIZE COMPOSITION OF SPAWNING SHEEFISH, UPPER KOBUK RIVER, 1967

Age Class	MALES				FEMALES				COMBINED SEXES			
	Number	Percent	Fork 1) Length	2) Weight	Number	Percent	Fork Length	Weight	Number	Percent	Fork Length	Weight
7+	10	4.9	66.5	6.3					10	4.9	66.5	6.3
8+	22	10.8	69.3	6.7					22	10.8	69.3	6.7
9+	18	8.9	72.9	8.7	1	0.5	89.0	12.0	19	9.4	73.8	8.8
10+	12	5.9	79.8	11.2					12	5.9	79.8	11.2
11+	16	7.9	83.7	13.2	5	2.5	87.2	15.1	21	10.4	84.5	13.6
12+	14	6.9	85.8	13.3	7	3.4	90.9	19.3	21	10.4	87.5	15.1
13+	8	3.9	86.8	15.4	19	9.4	93.2	20.9	27	13.3	91.3	17.7
14+	4	2.0	89.5	17.4	29	14.3	94.8	21.8	33	16.3	94.2	21.3
15+					15	7.4	96.8	21.7	15	7.4	96.8	21.7
16+					8	3.9	101.3	29.4	8	3.9	101.3	29.4
17+					8	3.9	100.7	30.1	8	3.9	100.7	30.1
18+					4	2.0	107.6	37.1	4	2.0	107.6	37.1
19+					2	1.0	113.3	35.4	2	1.0	113.3	35.4
20+					1	0.5	104.0	46.0	1	0.5	104.0	46.0

1) Centimeters

2) Pounds

TABLE 35. DAILY NUMBER OF SHEEPFISH TAGGED ON UPPER KOBUK RIVER AND NUMBER AND DATE OF RECOVERIES BY AREA, 1

Tagging Date	1966 TAGGING								
	Number Tagged	1966 Recoveries			1967 Recoveries			Total Recoveries	Number Tagged
		Spawning Area	Noorvik	Kiana	Spawning Area	Noorvik	Selawik Lake		
9-13									7
9-14									20
9-15									9
9-16									5
9-17	4					1(6-15)	1(5-5)	2	10
9-18	5								12
9-19	2					1(6-16)		1	7
9-20									11
9-21	9					2(6-15,17)		2	10
9-22	9	1(9-26,27)	1(12-15)	1(10-4)	1(9-30)			5	3
9-23	2								7
9-24	5								3
9-25	1						1(5-14)	1	4
9-26	1								5
9-27									2
9-28	2								
9-29									1
9-13	49	2	1	1	1	4	2	11	116

1/ Recovery dates in parenthesis.

sheefish are presumably capable of spawning annually once sexual maturity is reached. In addition, four sheefish (all males), tagged in 1966 on the spawning grounds, were captured in mid-June, 1967, near Noorvik about 38 miles above the mouth of the Kobuk River. However, it is not known if these fish were returning to the upper spawning grounds.

Verification of the scale method for age determination of sheefish was another objective of the tagging program. Scale smears were collected from each tagged fish prior to release and fishermen were asked to take a scale sample from each tagged fish caught. To date, no scale samples of tagged sheefish, taken after mid-June when annulus formation is believed to be completed, have been obtained. It is anticipated that scale samples will be collected from fishermen as more fish are tagged and as fishermen become better acquainted with the tagging program.

Spawning Observations: In 1966 and 1967, spawning observations were conducted during late September on the upper Kobuk River, between 24 and 30 miles above the village of Kobuk. Peak spawning in 1967 occurred during the period September 27-29, similar to 1966 spawning. The most active spawning occurs during the late afternoon and evening hours. Spawning occurred in water depths of 4 to 8 feet over gravel in moderately swift current of the main river. Water temperatures during spawning ranged from 40-43° Fahrenheit. Mortality of sheefish eggs, which sink to the stream bottom upon being discharged at the surface by the female, appeared to be substantial due to predation by grayling and whitefish. Several grayling and whitefish captured after completion of sheefish spawning contained large numbers of sheefish eggs in their stomachs.

## DISCUSSION

In the Kotzebue Sound area sheefish are intensively fished in Hotham Inlet, Selawik Lake, and to a lesser extent in Kotzebue Sound, during the period late October to late May. The movements and distribution of the Kobuk and Selawik River populations in these waters during the winter and spring months are unknown. One of the main goals of the current sheefish investigation is to determine the movements of the sheefish populations throughout the year by means of a tag and recovery program. This information is needed for proper management of the fishery. Expansion of the tagging program is planned for 1968 and will include the tagging of Selawik River sheefish during June.

Another important aim of the present study is to obtain an estimate of

spawning populations either by aerial survey or tag and recovery methods. A tag and recovery study may provide an estimate of the size of the spawning population, however, a reliable estimate would depend on fishermen accurately reporting their catches and turning in tag recoveries. At present, aerial survey counts appear to be the best approach toward obtaining an index or estimate of the spawning population. Studies of the Kobuk River indicate that sheefish utilize a relatively small spawning area and spawn during a short time span in late September when the river is low and clear.

### SUMMARY

1. Subsistence fishermen from Kotzebue, Selawik, and the Kobuk River villages harvested 22,390 sheefish during the 1966-67 season.
2. During the period October, 1966 to May, 1967 a total of 992 sheefish, averaging six pounds each, were taken in the commercial fishery.
3. Fecundity estimates of five sheefish ranged from 167,204 to 315,670 eggs per female fish.
4. Aerial surveys of Kobuk River spawning grounds indicate a minimum count of 1,025 sheefish in 1967 and 1,200 in 1966.
5. Recovery of two tagged Kobuk River sheefish in Selawik Lake indicates that intermixing does occur between the Kobuk River and Selawik River populations during the winter and spring months.
6. A 1967 recovery of a spent male sheefish, tagged on the spawning grounds in 1966, on the upper Kobuk River demonstrates that sheefish are capable of spawning annually upon reaching sexual maturity.
7. Peak spawning activity in 1966 and 1967 occurred during the period September 27-29. Water temperatures during peak spawning in 1967 ranged from 40-43° Fahrenheit. Mortality of spawned sheefish eggs was apparently high due to predation by grayling and whitefish.