Volume 20 Study R-II

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

A LIFE HISTORY STUDY OF SHEEFISH AND WHITEFISH IN ALASKA

by

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Volume 20 Study No. R-II

RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska

Project No.: F-9-11

Study No.: R-II Study Title: A LIFE HISTORY STUDY OF SHEEFISH AND WHITEFISH IN ALASKA

Period Covered: July 1, 1978 to June 30, 1979

ABSTRACT

Sheefish, *Stenodus leucichthys* (Guldenstadt), stocked in Eielson Cooling Pond showed excellent growth, with fish ranging in length from 378 to 436 millimeters and weight from 500 to 800 grams at Age II. Two males were sexually mature. Sheefish captured from Four Mile Lake continue their slow growth and more fish of the 1969 plant than the 1968 plant were captured. Sheefish of Age Class V captured in Lost Lake ranged in length from 230 to 738 millimeters and in weight from 110 to 6,500 grams. Data on the sheefish sport fishery are presented.

A survey in mid-May of tributary streams of the lower Tanana River and mainstem Tanana indicated no sheefish upstream movement in the main river but did reveal presence of adult feeding sheefish (mainly nonconsective spawners) at the mouths of the Tolovana, Cosna, and Chitanana rivers, and Baker Creek.

Sheefish found in the lower 16 kilometers (10 miles) of the Nowitna River included rearing fish of Age Classes I (0+) and III (2+) as well as nonconsecutive spawners and prespawners.

Test netting in the lower Koyukuk River in late July failed to take any prespawning sheefish and thus places time of immigration of these fish at August and September.

A search for spawning members of the anadromous segment of the lower Yukon River population was conducted in the upper Yukon River in late September, but no prespawning fish were captured.

Rearing areas of sheefish were found in estuarine areas of Kotzebue Sound, with lesser numbers rearing in Hotham Inlet, lower Kobuk River, and upper Selawik Lake. Rearing fish of Age Classes I and II were not located and most rearing fish captured ranged in age from IV to IX.

BACKGROUND

In past years major emphasis of the lake and river adaptability study has been on egg takes, sheefish rearing, assessing growth and survival of stocked fish, and surveying new waters for introduction.

Egg takes are no longer conducted under this project, although the feasibility of using pxespawning fish from stocked lakes will be investigated in the future. Surveys of new waters for introduction of sheefish have slowed in recent years because of insufficient fry and fingerlings to stock in lakes already surveyed.

Many of the lakes selected for stocking are in. the Delta Junction - Ft. Greely area. Nearly all are barren and landlocked. Those lakes containing populations of rough fish (suckers and lake chubs) will not be stocked until sufficient numbers of fingerling sheefish are available. In surveys of new lakes, angler access presence of other game fish, and winter dissolved oxygen will be factors considered in selecting a lake for stocking.

Keeping sheefish fry alive in the hatchery is still beset with difficulties and stocking of fry through the ice in February has been unsuccessful. Therefore interim rearing of fry, especially in Eielson Cooling Pond, will be continued. The first year of interim rearing produced fish measuring 27-35 mm in 3 months, 270 mm in 8 months, and 370-436 mm in 22 months.

Considerable data on growth of sheefish stocked in Four Mile Lake in 1968 and 1969 are available (Alt, 1971, 1974, 1978). These data indicate rapid growth during early years then a slowing of growth to nearly a stunted condition during the last 2 years. The initial stock of 4,000 fry in June, 1968 has provided most of the fish taken by angling and gill net, but fish that were stocked as fry under the ice in February, 1969 (90,000 fish) finally comprised over 50% of the fish taken in 1977.

The sheefish life history study is completed as far as collection of basic data on the major populations in Alaska. The major data gaps are: (1) spawning ground locations of the anadromous segment of the lower Yukon River population which spawns above Rampart, (2) location of additional spawning grounds of Kuskokwim River sheefish, and **(3)** location of rearing areas of Kobuk-Selawik, Kuskokwim River, Minto Flats, and lower Yukon River sheefish. Life history and population dynamics of local populations of sheefish in various areas of the Yukon River as well as the Koyuk River also need to be studied.

Harvest studies of sheefish need to be continued in conjunction with other studies to determine changes in patterns of utilization among subsistence, commercial, and recreational users.

Population dynamics studies of sheefish of the Kuskokwim River population have been initiated; when completed in 1980, t'he population structure of sheefish in the Holitna River during 1978-1'980 will be compared with

the sheefish population structure of 1967-1971. Table 1 lists common names, scientific names, and abbreviations of fish mentioned in this report.

TECHNIQUES USED

Sheefish captured during this study were taken mainly by gill net, although a fyke net was used unsuccessfully at Eielson Cooling Pond. Small sheefish were captured by seine.

Measurements were taken according to standard techniques.

Ages were determined through scale analysis.

Maturity was determined through gross examination of the gonads in the field.

Sheefish utilization information was collected through discussions with guides and local residents, and spot checks by biologists, usually in conjunction with other life history studies. Transportation was by riverboat based out of Fairbanks, Kotzebue, or Circle.

RECOMMENDATIONS

Research

1. Interim rearing of sheefish at Eielson Cooling Pond should be continued.
2. Evaluation of past sheefish plants should be continued.
3. Rearing sheefish should be searched for in the Selawik area.
4. The population dynamics study on Holitna River should be continued.
5. Data on least cisco should be published.

Management

1. Spot harvest checks on major sheefish fishing areas should be continued.
2. Public use of stocked sheefish lakes should be monitored.

Table 1. Fish species referred to in this report.

Species	Scientific Name and Author	Abbreviation
Arctic flounder	*Liopsetta glacialis* (Pallas)	AF
Bering cisco	*Coregonus laurettae* (Bean)	BCI
Broad whitefish	*Coregonus nasus* (Pallas)	BWF
Burbot	*Lota lota* (Linnaeus)	BB
Chum salmon	*Oncorhynchus keta* (Walbaum)	CS
Silver salmon	*Oncorhynchus kisutch* (Walbaum)	SS
Fourhorn sculpin	*Myoxocephalus quadricornus* Thompson	FHS
Grayling	*Thymallus arcticus* (Pallas)	GR
Humpback whitefish	*Coregonus pidschian* (Gmelin)	HWF
King salmon	*Oncorhynchus tshawytscha* (Walbaum)	KS
Lake chub	*Couesius plumbeus* (Agassiz)	LC
Lamprey	*Lamperta japponica* (Martens)	AL
Least cisco	*Coregonus sardinella* Valenciennes	LCI
Longnose sucker	*Catostomus catostomus* (Forster)	LNS
Ninespine stickleback	*Pungitius pungitius* (Linnaeus)	NSB
Northern pike	*Esox lucius* Linnaeus	NP
Pacific herring	*Clupea harengus pallasi* Valenciennes	PH
Rainbow smelt	*Osrnerus mordax* (Mitchill)	RSM
Rainbow trout	*Salmo gairdneri* Richardson	RT
Round whitefish	*Prosopium cylindraceum* (Pallas)	RWF
Sheefish	*Stenodus Zeucichthys* Guldenstadt	SF
Slimy sculpin	*Cottus cognatus* Richardson	SSC

Job R-11-A A Sheefish Lake and River Adaptability Study.

OBJECTIVES

1. To assist F.R.E.D. Division in sheefish egg take.
2. To interim rear sheefish to fingerling size.
3. To stock various lakes and streams in Interior Alaska.
4. To evaluate success of past plants.

FINDINGS

1978 Stocking Results

Twenty thousand sheefish fry were placed in holding pens in Eielson Air Force Base Cooling Pond on February 10, one week after completion of hatching at Fire Lake Hatchery. Even though fry were in good condition when stocked, all had died by March 1. The 53,500 fry remaining at Fire Lake Hatchery were kept for feeding experiments. Fry were fed a mash diet prepared by the United States Fish and Wildlife Service laboratory at Spearfish, South Dakota. During March, 48,500 of these escaped from the troughs and were lost. The 5,000 survivors were fed with automatic feeders and showed good growth and survival until early April when they experienced total mortality from clubbed gill disease.

In February and March, 1978, 166 yearling sheefish were captured (158 by gill net, 1 by fyke net, and 7 on hook and line). Seventy-six died, mainly from gill net injuries. Sixty-seven fish were stocked in Walden Pond, located at Mile 17 Chena Hot Springs Road, on February 28; and 23 were stocked through the ice in Manchu Lake (Fort Wainwright) on March 17.

Evaluation of Stocked Lakes

Walden Pond:

Two Age I sheefish were captured during one net night of fishing in August. One fish was 362 mm FL and weighed 525 g and the other 409 mm and 700 g. Size of fish when stocked in March ranged from 260 to 370 mm in length and 280 to 410 g in weight.

Stomachs contained chironomid larvae. Growth of these stocked fish in the five months since stocking appears excellent.

Manchu Lake:

Test netting of Manchu Lake in November, 1978 resulted in capture of no sheefish.

Eielson Cooling Pond:

In December, 1978, six sheefish were captured in Eielson Cooling Pond during one net night of fishing. Very rapid growth of these fish is evidenced by the presence of 48-60 widely spaced circuli to the first annulus, whereas the average number of circuli for natural populations of sheefish is 14-24. These Age I fish included four males (402-420 mm and 675-750 g) and two females (378-436 mm and 500-800 g). Two of the males had enlarged white testes, indicating sexual maturity, while the other males and the two females were immature.

Of sheefish thus far studied the youngest age at maturity for a male in Alaska is Age V (Chatanika River) and most common age at first spawning is Age VI to VII (Alt, 1973).

Lost Lake:

Five sheefish were captured during three net nights of fishing in August, 1978. These fish, stocked in February 1973, were all Age V (Table 2).

The great size disparity between the small and large fish is difficult to explain. Scale analysis indicates uniformly rapid growth for all fish up to formation of the first annulus (≈ June 1, 1974). Thereafter growth of the three smaller fish slowed dramatically and was less than 100 mm total for the next 4 years, while the two larger fish continued their rapid growth. In late 1974, 200,000 silver salmon were stocked in Lost Lake, thus seriously competing with sheefish for food. It was felt that the large fish changed to a fish diet (chubs and silver salmon) and grew rapidly, while the other fish ate plankton and insects, and thus became stunted. However, stomach analysis revealed the stomachs of the two large fish were empty while stomachs of the small fish contained remains of insects and lake chubs.

Sport fishing for sheefish in Lost Lake has been unsuccessful to date.

Four Mile Lake:

In 1978, 24 sheefish were captured in Four Mile Lake (3 in a gill net on May 30, 6 in a gill net on September 14, and the remainder by hook and line). The 16 fish examined included 10 Age IX fish and 6 Age X. This is the first year that fish from the 1969 plant outnumbered fish of the 1968 plant. The Age X fish averaged 673 mm (615-710 mm) and 3.3 kg (2.2-3.9 kg) for four females while two males ranged from 590 to 630 mm and from 2.0 to 2.5 kg. The Age IX fish averaged 621 mm (522-660 mm) and 2.4 kg (1.8-3.2 kg) for eight females while two males ranged from 600 to 674 mm and 2.2 to 2.9 kg.

Scale analysis indicates no acceleration of growth during the past year, indicating the sheefish did not significantly prey on the stocked rainbow trout. In fact, the rainbow trout were serious competitors with

Table 2. Length, weight, and maturity data for five sheefish captured from Lost Lake, 1978.

Fork Length (mm)	Weight (g)	Sex	Maturity
230	110	♀	Immature
239	115	♀	Immature
254	138	♂	Immature
625	2,727	♂	Developing
738	6,500	♀	Potential Spawner

sheefish for the available insects and freshwater shrimp and grew rapidly at the expense of sheefish. All sheefish stomachs examined were empty except one which contained a rainbow trout that had probably been dead long before ingestion.

It appears that sheefish in Four Mile Lake will continue to grow slowly, especially in competition with rainbow trout. Sport fishermen, however, have been more successful than in past years. Although angler effort throughout past years has been low, it is felt that the low population density and rich supply of food was responsible for poor angler success.

All fish captured in 1968 were mature, but 8 of 12 females (67%) were non-consecutive spawners (had retained eggs from the previous year and would not spawn in the current year), while 3 would spawn the current year. By contrast, in 1977 four of six females captured were potential spawners.

Fort Greely Lakes:

Two lakes stocked with 10,000 and 5,000 sheefish fry in February of 1977 were test netted in July, 1978. No sheefish were taken in either lake and it is felt that all stocked fish had died. Ice cover on the lakes remained for 3 months after stocking and low productivity of the lakes at this time may have caused starvation.

Job R-II-B Movements, Abundance and Spawning Ecology of Sheefish in Middle Yukon River and Lower Koyukuk River

OBJECTIVES

1. To determine spring run timing and abundance of sheefish in the lower Tanana River.

2. To determine angler use and general summer distribution of sheefish in the Nowitna, Melozitna, and lower Koyukuk rivers.

3. To locate spawning grounds of sheefish of the middle Yukon River population.

4. To collect life history and angler use information of sheefish from other areas of Alaska as time permits.

FINDINGS

Lower Tanana River

Twenty-nine sheefish were caught during seventeen net nights of fishing in the lower Tanana River in mid-May (Table 3). All sheefish captured

Table 3. Lower Tanana River test netting May 16-22, 1978.

Area	Net Nights	Species								
		SF	HWF	BWF	RWF	LCI	BB	NP	LNS	GR
Kantishna River	2					1	1		2	
Tanana River (Manley)	2				2	1		13	3	
Baker Creek	3	13	1					8		2
Zitziana River	1				2			7	3	
Cosna River	3	10	1			2		5		
Chitanana River	1	5		1				2	1	
Squaw Crossing Slough	1		6	13		46				
Lower Tanana River*	2		15	19		35	1	1		
Tolovana River Mouth	2	1		1		1		5		

* Also 6 chubs

were taken at mouths of four tributary streams, the Cosna, Tolovana, and Chitanana rivers, and Baker Creek.

The nets set in the Tanana River above Manley took a large number of pike, but there was little indication of an upstream sheefish or whitefish movement in this section of the river.

Nets set in the lower Tanana were on the north side of the river at the mouth of a slough entering the Tanana from the Yukon River. At this time large numbers of whitefish (broad, humpback, and least cisco) were migrating upstream to enter Squaw Crossing Slough 1.6 km (1 mi) farther upstream.

No sheefish were captured in nets set in the lower 2 km (1.2 mi) of the Tanana River. Residents of Tanana mentioned that while a few sheefish are taken at the mouth of Fish Creek 20 km (12 mi) up from the Tanana River mouth, they have seldom caught them at the mouth of the Tanana River. They were aware of presence of sheefish at the mouth of the Chitanana River during summer months, but did not think any of the anadromous run passing Tanana village in August and September entered the Tanana River.

Age and Growth:

The 29 sheefish captured included 16 males and 15 females. Males ranged in age from VI to IX, in length from 605 to 790 mm, and in weight from 2,100 to 5,250 g. Females ranged in age from VIII to XII, in length from 660 to 890 m, and in weight from 3,400 to 9,320 g.

Lengths at various ages for sheefish captured in 1978 are similiar to age length data for Minto Flats sheefish (Alt, 1973).

All males captured in May were mature and the posterior enlargement and deep color of the testes indicated that most had spawned the previous fall. It was difficult to tell if any of these males would have spawned in the current year. The two males captured in late July in the lower Chitanana River would definitely spawn the current year. Of the 15 females captured, 5 were immature and 10 contained retained eggs, indicating spawning the previous fall. Nine of the ten were judged nonconsecutive spawners while one had redeveloping eggs greater than 1 mm in size and may have developed to spawn the current year.

Food:

Eight of the fish captured in May and both fish captured in July had empty stomachs. Among feeding fish, lampreys and sculpins were the most important food items, but some least cisco, humpback whitefish, and lake chubs were also eaten.

Discussion

Based on test net catches in the lower Tanana River in May of 1978, it is difficult to determine population status of these fish. The fish

captured appeared to be feeding at the mouths of tributary rivers rather than migrating to the Tolovana River system where the Minto Flats population spawns. But since most the sheefish captured in May were either immature or had spawned the previous fall they may be fish from the Minto Flats population occupying feeding areas at mouths of tributary rivers. Possibly the spawning population and many of the feeding fish had remained in the lower Tolovana all winter or entered soon after breakup.

The capture of two prespawning males in the lower Chitanana River in late July may indicate some spawning in local lower Tanana River streams. The absence of sheefish at the mouth of Baker Creek in late July may indicate dispersal in Baker Creek or migration to other areas of the Tanana River.

Fish captured in the lower Tanana River either belong to the Minto Flats population or constitute local populations. Evidence for the former hypothesis is (a) non-spawning condition of' fish captured, (b) small numbers of fish present, (c) absence of juvenile fish and, (d) absence of suitable gravel for spawning in the upper Zitziana, Cosna, Chitanana rivers and Baker Creek.

Evidence for the latter hypothesis is (a) presence of two prespawning fish at the mouth of Chitanana River in late July, and (b) failure to recapture tagged sheefish of the Minto Flats population downstream from the mouth of the Tolovana River. Further sampling in upper reaches of these tributary rivers and in the lower Tolovana Kver may provide additional evidence.

Summer Distribution of Sheefish in Nowitna, Melozitna, and Lower Koyukuk Rivers

Survey work consisting of gill net test netting, seining, angling, and discussions with local residents was conducted from July 18 to 27.

Gill nets set in the main Yukon River 20 km (12 mi) above Tanana took 2 sheefish (a prespawning male and prespawning female), (Table 4).

Nets set in the lower Nowitna River took 12: sheefish. In addition to one young-of-the year sheefish taken by gill net in Johnson Slough (16 km [10 mi] upstream) and in the lower 1 km of the river, seining captured young-of-the-year sheefish (109-135 mm) and a 223 mm Age II fish in grassy areas near the mouth of the Nowitna River. All other sheefish captured were mature and, except for two nonconsecutive spawning females, all would spawn the current season. Mature fish ranged in size from 670 to 809 mm and 3.4 to 5.5 kg and in age from VI to X. All except one had empty stomachs.

No sheefish were captured during two net nights of fishing and 4 hours of hook and line fishing at the mouth of the Melozitna River on July 22. Local residents said that none had been caught on hook and line for the past week, but prior to that time sheefish had been very abundant. Water temperature was 15°C (59°F).

Table 4. Test netting results middle Yukon River area July 19-25, 1978.

Area	Net Nights	Species									
		KS	CS	SF	BCI	HWF	BWF	LCI	NP	LNS	LC
Yukon River (above Tanana)	3	1	3	2	1	1	1	6	1		
Nowitna River	5		3	16		6	6	11	20		1
Melozitna River	2		5			1	1		2	3	
Koyukuk River mouth	7		41			1	1	2	24	1	
Koyukuk 15 Miles	3		52						2		

Nets set in the lower Koyukuk River July 24-26 took no sheefish (10 net nights). Angling was also unproductive. During discussions with residents of Koyukuk it was learned that two sheefish of mature size were taken with salmon subsistence gear at the mouth of the Koyukuk River. They mentioned that only a few prespawning sheefish are taken in July, but that the main run passes into the Koyukuk River during August and early September.

No rearing sheefish were captured in small mesh nets or seining operations in the main Koyukuk River and its sloughs, and it is assumed Koyukuk River fry migrate to the lower Yukon River for rearing.

Biological Information:

The Nowitna River sample of 10 young-of-the-year sheefish averaged 118 mm in late July (range 109-136 mm) and scales contained an average of 17 circuli. The only other rearing fish caught (Age Class II, 223 mm) was slower growing than other Nowitna River sheefish. All other sheefish taken in the lower Nowitna River were mature (ten prespawners and two nonconsecutive spawners). Ages VI-X were represented and their length at a given age corresponds closely with data presented by Alt (1974) from fish taken in late May and early June. In 1978, however, fewer fish of Age X-XII were taken in late July, probably because many of the older prespawning sheefish had moved further up the Nowitna River. Prior to 1978, only one sheefish younger than Age V had been captured in the Nowitna River.

Discussion:

Information gained during the middle Yukon River field trip added additional knowledge to mid-summer life history of sheefish.

Since sheefish are taken on rod and reel from the lower Melozitna River only during a short period of the summer, generally late June to mid-July, they are either a segment of the lower Yukon River population which are feeding in this area prior to the upstream migration beyond Rampart, or this group of sheefish moves up the Melozitna to spawn. The latter hypothesis seems unlikely since canyons and rapids 16 km up the Melozitna would probably block upstream movement. Rearing fish have not been captured in the area of the lower Melozitna. These fish could also be moving to the Nowitna River.

The Koyukuk River segment of the anadromous lower Yukon River population of sheefish was still downstream of the mouth of the Koyukuk River on July 22. Although a few prespawning migrants had been captured by gill net, indications are that the peak of the run does not enter the river until mid-August or later. No rearing sheefish were found in the lower Koyukuk River, indicating that rearing and overwintering both occur in the lower Yukon River.

Sheefish of the Nowitna River population remain mixed, with both spawners and nonspawners present in the lower reaches of the river in late July.

All pre-spawners had empty stomachs and would not feed until after spawning. Had additional test netting been conducted further upstream, prespawning sheefish would probably have been found there also. Prespawners in the lower reaches of the river would soon begin their upstream migration to spawning areas up the Sulukna River. Capture of young-of-the-year and Age II sheefish in various habitats in the lower Nowitna River indicate that sheefish of the Nowitna River population rear in the numerous sloughs and interconnected lakes of the lower Nowitna River as well as in slow moving waters of the main river.

The capture of two prespawning sheefish in the middle Yukon River, 22 km (13 mi) upstream from Tanana may indicate that some of the Yukon River spawning segment of the anadromous lower Yukon River population have already reached this upstream limit by late July. The peak of the run past this area is generally in late August.

They could also belong to the same population as sheefish found at the mouth of Hess Creek and Ray and Dall rivers. Hess Creek is the closest tributary stream, and located 80 km (48 mi) upstream. No rearing sheefish were taken in nets set in this area.

Upper Yukon River Spawning Ground Searches

During 11 net nights of test fishing in late September in the upper Yukon River six sheefish were captured (Table 5). In addition to gill net catches, three young-of-the-year and yearling sheefish were taken by seining at the mouths of the Nation and Tatonduk rivers. All sheefish captured were immature. They ranged in length from 131 to 543 mm and in age from I to IX. No test netting was conducted upstream in any of the tributary streams.

Sheefish captured belong to the local upper Yukon River population, based on their slow growth (Alt, 1973). Their spawning grounds have not been located, but some spawning probably occurs in the lower reaches of the Charley, Kandik, Nation, Tatonduk, and Seventymile rivers. Local residents have reported seeing large size sheefish in a deep hole approximately 14 km (9 mi) up the Tatonduk River. Surveys of the Charley, Kandik, Nation, Tatonduk, and Seventymile *rivers* in 1970 (Alt, 1971) indicated that gravel size and stream flow were suitable at least in the lower reaches of these tributary rivers. Young-of-the-year sheefish have been captured at the mouths of all tributary streams during past years' research.

Subsistence fishermen located in the area between Circle and Eagle stated that each camp captured 4 to 6 sheefish during the month of September in nets set in the main Yukon River and that most of the fish captured were spawners. It is probable that the fish are local upper Yukon River fish and were traveling to tributary streams to spawn. The small numbers of fish captured indicate that they are not part of the large anadromous run of sheefish belonging to the lower Yukon River population which passes through Rampart in August and September. Based on gill net catches during September it appears that the spawning segment

Table 5. Test netting results upper Yukon River, September 18-21, 1979.

Area	Net Nights	Water Temp°C(F°)	Species								
			CS	SF	HWF	BWF	LCI	GR	NP	LNS	LC
Yukon River above Circle	2	8.0°(46.4°)	25			1					
Kandik River mouth	1	5.5°(41.9°)		2	2				2	1	
Yukon River above Kandik River mouth	1	8.0°(46.4°)		2		5	3	2			1
Nation River* mouth	2	5.0°(41°)		1			5	4	3		
Tatonduk River mouth	1	4.5°(40.1°)	1	1	2			2	1	2	
Yukon River above Tatonduk mouth	3	8.0°(46.4°)	30			1					
Yukon River below Tatonduk mouth	1	8.0°(46.4°)	11								

* Caught one Bering cisco.

of the lower Yukon River population does not migrate into Canada to spawn but probably spawns in the area of Ft. Yukon or downstream.

Future searches for their spawning grounds should involve extensive netting combined with a radio tagging program conducted in the section from Rampart to Ft. Yukon.

Kotzebue Area Search For Rearing Fish

Test netting was conducted during June 11 through 18 and September 3 and 4 in estuarine areas of Kotzebue Sound, Hotham Inlet, and the freshwater habitats of the lower Kobuk River and Selawik Lake (Fig. 1). One hundred twenty-three sheefish were captured, including 106 in standard 30.4 m (100 ft) graduated mesh gill nets, 4 in 7.5 m (25 ft) gill nets, and 13 in 30.4 m (100 ft) 67 mm (2.5 in) gill nets (Table 6).

Dividing the catch into areas gave a catch of 56 fish (8 per net night) in the estuarine areas of Kotzebue Sound beginning at the ocean side of Pipe Spit and a catch of 34 fish (11 per net night) in the estuarine Kotzebue Lagoon. The freshwater catches included 19 fish (1.2 per net night) in lakes, sloughs, and channels of the Kobuk River delta and 14 fish (2.8 per net night) in Selawik Lake and Hotham Inlet. All fish captured in the estuarine areas were immature:, while 91% of those captured in Selawik Lake and lower Hotham Inlet were immature and 76% from the lower Kobuk river were immature.

The smallest sheefish were captured in estuarine areas. The smallest fish captured was 312 mm in length and all fish between 312 and 450 mm came from estuarine waters. Only four of the 45 sheefish smaller than 515 mm were taken in the freshwater areas (Hotham Inlet, Kobuk River delta, and Selawik Lake). The youngest fish captured was Age Class II; only one fish of that age class and one individual each of Age III and IV were taken. The most common ages of fish captured in the estuarine areas were Ages V, VI, and VII. These fish were all immature, and no mature fish were taken in estuarine waters. The spawners had probably already moved into the Kobuk River. Fish captured in the lakes, sloughs, and channels of the lower Kobuk River and in Hotham Inlet and Selawik Lake narrows were larger than those caught in estuarine areas. A few prespawning fish were found in this sample especially in Mukuksuk Channel. No sheefish were caught in gill nets set off the main channels of the lower Kobuk River (Eavok Creek, Eavok Channel Lake, Kobuk Delta Lake, and sloughs off Melvin Channel).

Seining with a 7.5 meter beach seine at the mouth of Melvin and Riley Channel failed to capture any rearing sheefish.

Of fish taken in estuarine areas, 35% contained food; mainly ninespine stickleback, but also some shrimp, smelt, and fish remains. No insects or whitefish were eaten by rearing fish. Forty-eight percent of the fish taken in fresh water contained food. Smelt were the main food item, but some of the 16 feeding fish had eaten herring, ninespine stickleback, and lamprey. Again no whitefish were found in the stomachs

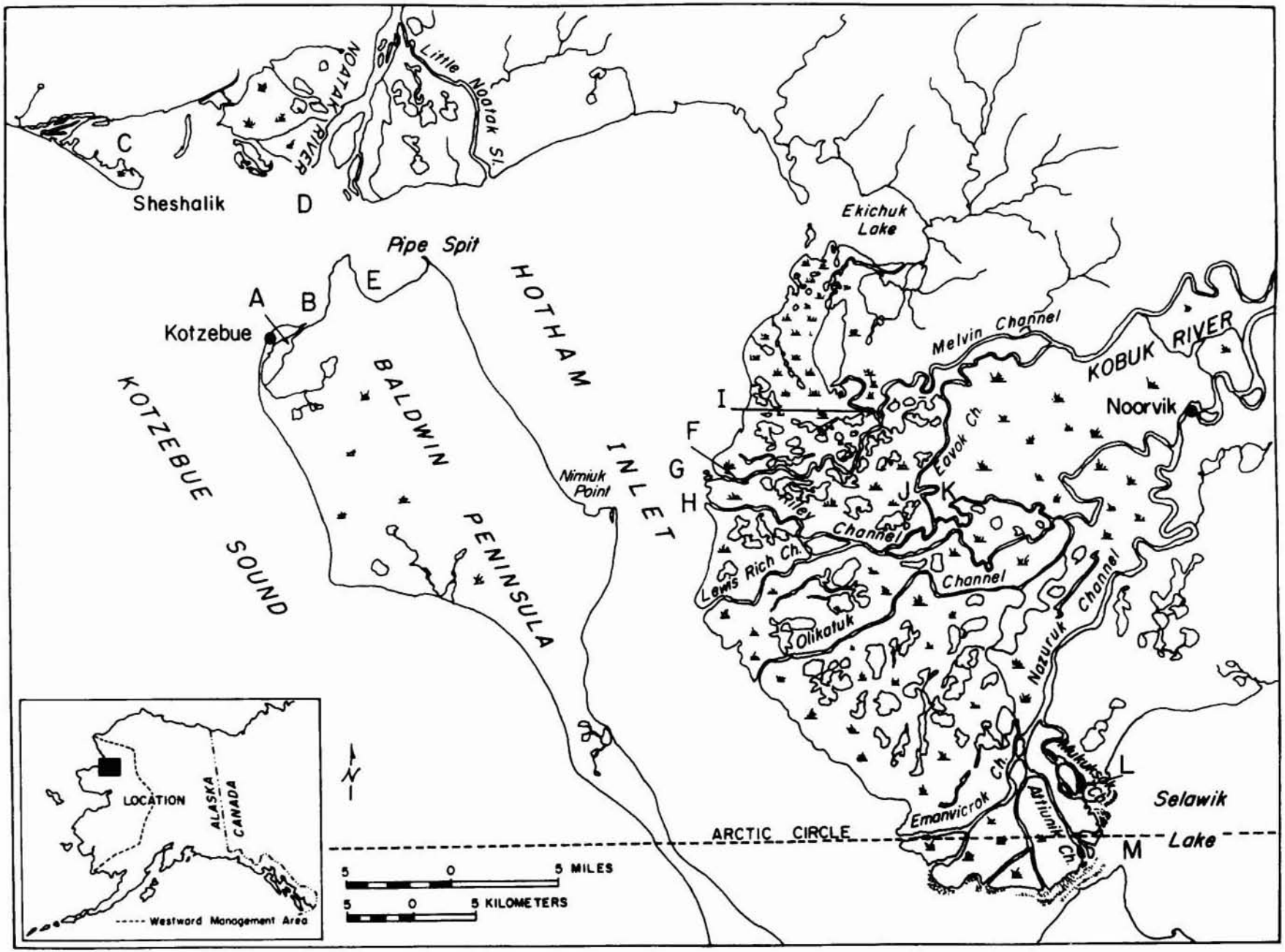

Figure 1. [illegible] = Kotzebue, [illegible], and Selawik Lakes.

Table Sheefish catch, size, and age distribution by rea: Kotzebue Sound, Kobuk River, Hotham Inlet and Selawik Lake, 1978.

Location	Fig. 1* Location	Net Nights	n	FL (mm) $\bar{x}$	FL (mm) Range	Wt. (kg) $\bar{x}$	Wt. (kg) Range	Age Range
Kotzebue Lagoon	A	3	34	492	406-580	1.07	0.52-1.80	5+ to 7+
Kotzebue Sound	B	2	25	494	398-695	1.11	0.50-3.00	4+ to 10+
Sheshalik	C	1	4					
Noatak Delta	D	1	0					
Pipe Spit	E	3	27	508	312-600	1.03	0.20-1 70	2+ to 7+
Melvin Channel	F	5	10	601	450-780		0.90-5 3	6+ to 11+
Hotham Inlet	G	1	6	656	515-800		1.00-5 3	6+ to 11+
Riley Channel	H	1	5	677	478-816	4.19	1.00-5 5	6+ to 13+
Kobuk Delta Lake	I	1	0					
Eavok Channel Lake	J	1	0					
Eavok Creek Lake	K	1	0					
Mukuksok Channel	L	6	7	765	552-965	3.53	1.4-10.0	6+ to 15+
Selawik Lake Narrows	M	4	8	649	482-887	3.14	0.95-7.25	7+ to 13+

* Refers to map location on Figure 1.

By contrast Alt (1969), found whitefish to be the most important summer food items of Selawik area sheefish.

Discussion:

Summer gill net catches indicate that estuarine areas of Kotzebue Sound are important sheefish rearing areas. Very few rearing fish of Age Class IV or less (Ages 0, I, II, and III) were found, but available evidence indicates that they are probably also in estuarine areas.

Rearing areas are not in the lakes and interconnected sloughs of the lower Kobuk River delta, although some immature sheefish do rear in the lower reaches of the main channels of the Kobuk River. Northern pike were very abundant in all lakes and sloughs of the Kobuk delta and this may be one reason why sheefish were not rearing there. Only limited netting was conducted in Hotham Inlet and Selawik Lake, but no fish younger than Age VI were taken. Most of the fish captured in Selawik Lake and Hotham Inlet, however, were immature (91%) as most of the spawning fish had already moved upstream by late June, 1978. More extensive netting in Selawik Lake is scheduled for 1979.

Harvest Information

Because of logistical problems, economic considerations, and insufficient manpower, creel census programs were not set up on major sheefish sport fishing areas.

Rather, information on fisheries is gathered in conjunction with research activities in these areas and during short spot visits to major fishing areas.

This information gathering is often after the fact; nonetheless, an idea of utilization (both recreational and subsistence) can be obtained by discussions with local residents, guides, air taxi operators, etc.

Some of the major sheefish recreational fishing areas in Alaska are: (a) the Kobuk River, (b) Selawik area, (c) Sleetmute (Kuskokwim River), (d) Melozitna and Nowitna River, (e) Hess Creek and Dall River, (f) Hughes area (Koyukuk River), (g) Minto Flats, and (h) Porcupine River. Some sheefish are also caught in the Koyuk River, Aniak River, McGrath area, upper Yukon River tributaries, Chena River, Manley area, and Four Mile Lake (stocked lake).

In 1978, breakup on the Kobuk River occurred early (mid-May) and the upstream sheefish migration was two to three weeks earlier than normal. Residents of Noorvik and Kiana took large numbers of sheefish by hook and line and gill net during this period. Hook and line fishing occurred mainly in the lower Nazaruk Channel area (including Mukuksok, Attiunuk, and Emanvicrok Channel) and the Noorvik and Kiana areas. Although Mukuksok Channel had been the primary sport fishing area in late May and early June, fish could not be captured in this area in mid-June even by gill net. Sheefish, mainly immature fish and nonconsecutive spawners,

were present at the mouth of Attiunik, Riley, and Melvin channels and a limited number of prespawning fish were taken by Kiana area residents in an area 2 km (1.2 mi) upstream from Kiana. Approximately 400 sheefish were taken on hook and line by Noorvik and Kiana residents and 2,000 were taken by gill net by Noorvik residents. Most fish had been captured prior to June 15. Ten fish camps were established in the lower Kobuk River, near sloughs leading into lake systems, but few sheefish are captured in these areas.

Only minimal information on the fall fishery on the upper Kobuk River was collected. In mid-August sheefish were taken on hook and line by local residents in the Kobuk area and 32-48 km (20 to 30 mi) upstream. There were reports of nonresident sport fishermen with airplanes and boats fishing in the area above Kobuk, but none were observed on August 15 and 16. About 150 sheefish had been taken at Kobuk for subsistence and three fish camps upstream of Kobuk had taken 200 fish.

A slow breakup, coupled with low water levels, provided ideal feeding conditions for sheefish in the Holitna River as the chum salmon outmigration lasted from May through July. Large numbers of small, immature sheefish weighing 1.5 to 4 kg were feeding in the lower mile of the Holitna River and traditional feeding areas at the Holitna River mouth, Cutbank, 40 Mile Holitna, and Titnuk Creek. Between June 29 and July 6, there were 64 man-days of guided fishing (from Bristol Bay guides), 10 man-days of Anchorage and Fairbanks resident fishing, and 49 man-days of local resident sport fishing. A minimum of 30 sheefish were taken during this time. This time frame was probably the peak of the long sport fishing season lasting 8 weeks in 1978. In 1977, water conditions were the opposite of 1978 and fishing effort and success were very low. It was reported that less than 50 man-days of guided fishing occurred in 1977.

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