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STATE OF ALASKA
Keith H. Miller, Governor

ANNUAL REPORT OF PROGRESS, 1968 - 1969

FEDERAL AID IN FISH RESTORATION PROJECT F-9-1

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
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INTRODUCTION

This report of progress involves the findings and work accomplished under the State of Alaska, Federal Aid in Fish Restoration, Project F-9-1, "Sport Fish Investigations of Alaska".

The work conducted during this reporting period constitutes effort on nine separate studies which are crucial in evaluating the sport fishing resources of the State. Recreational demands have necessitated broadening our knowledge of the fishery. All 20 jobs were of continuing nature enabling the Department to keep abreast of present and future impacts on certain fish species. Specifically, the work included work on inventory and cataloging of the sport fish and sport fish waters of the State, sport fishery creel census and access. Special emphasis was given to Dolly Varden, silver salmon, anadromous fish, grayling, salmon, sheefish, pike, and char. The information gathered has provided supporting documentation for better fish management and a basis for necessary future investigations.

The subject matter contained in these reports may be inconclusive. The findings and interpretation are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA

Project No: F-9-1

Job No: 17-B

Name: Sport Fish Investigations of Alaska.

Title: Sheefish and Pike Investigations of the Upper Yukon and Kuskokwim Drainages with emphasis on Minto Flats Drainages.

Period Covered: July 1, 1968 to June 30, 1969.

ABSTRACT

During 1968, 809 sheefish, Stenodus leucichthys nelma (Pallas), were tagged in the Minto Flats drainage, Selawik area, Holitna and Koyukuk Rivers. Of the 457 fish tagged at Selawik, 16 were recaptured in the Selawik area, while 25 were recaptured in the Kobuk River. Sheefish tagged on the Holitna River were recaptured in the lower Kuskokwim River, and sheefish tagged by the Division of Commercial Fisheries in the lower Yukon River were recovered on the spawning grounds at Hughes.

The sheefish spawning migration up the Koyukuk and Alatna Rivers was followed by boat.

A weir was constructed across the upper Chatanika River which was an aid in enumerating the spawning population.

An age and growth study utilizing scales of 1,103 sheefish was completed. Growth rates for all samples were plotted. It was possible to separate sheefish in Alaska into five major populations based on their growth profile and on tag recovery. The five populations are: 1) Kuskokwim River, 2) lower Yukon River, including Koyukuk River, 3) Minto Flats, 4) upper Yukon River, and 5) Kobuk River-Selawik.

The egg take conducted on the upper Chatanika River yielded 438,000 eggs. Egg survival was higher than in 1967 due mainly to improved egg-taking and hatchery techniques. Total egg mortality was 22 percent.

Limited food habits analysis of Holitna River sheefish indicated that salmon smolts were the most important food item.

Parasites identified from sheefish were as follows: tapeworms, Proteocephalus exiguus, also one specimen of order Spathebothriidea, copepods, Salmincola inermis, and leeches, Piscicola sp.

RECOMMENDATIONS

1. Sheefish research during the 1969-70 field season should concentrate on a continuation of the long-term tagging program in the Minto Flats, Holitna and Koyukuk Rivers and tagging sheefish for another spring season at Selawik in cooperation with the Commercial Fisheries Division studies.

2. Some attempts should be made to tag sheefish in some of the smaller rivers to determine the population to which they belong. Data on the sheefish tagging program should be published.

3. Estimates and indices of spawning sheefish should be made utilizing aerial surveys. It is recommended that the Chatanika River weir not be operated this year.

4. Alternate sources of sheefish for the egg take should be located should weather conditions force a change in areas.

5. A long-term research project investigating the feasibility of stocked sheefish in lake environments should be initiated. In conjunction with this, attempts should be made to rear sheefish to fingerling size prior to stocking.

6. Primary emphasis in the pike study for 1969 should be the initiation of a through, statistically-based creel census program for the Minto Flats. A biologist should be stationed in the Flats for the duration of the fishing season. Angler interviews and aerial surveys will be utilized.

OBJECTIVES

1. To determine sheefish movements in the study area and initiate a study of the sheefish populations in the drainages of the upper Yukon River.

2. To determine spawning dates, areas, and make observations of spawning behavior and enumerate the spawning population.

3. To complete the age and growth study of sheefish from different waters in Alaska.

4. To continue the sheefish egg-take study and to further develop artificial rearing techniques.

5. To assess the present and potential sport fishery of sheefish and pike in the study areas.

6. To collect additional life history information on these species in conjunction with the above objectives.

TECHNIQUES USED

Most sheefish were captured by drifting a 100- by 8-foot gill net of five-inch stretch mesh. Fish were also taken by beach seine, hook and line and set gill nets of five- and six-inch stretch mesh. Sheefish from the spawning grounds on the upper Chatanika River were taken by an electro-fishing unit described by Van Hulle (1968). Sheefish scale samples from the lower Kuskokwim and lower Yukon Rivers were collected by Division of Commercial Fisheries personnel.

Study areas during the 1968 field season included the Minto Flats region, Selawik area, Holitna River, Koyukuk River (see Figures 1 through 4, Alt, 1968) and the upper Yukon River. Pike were collected by hook and line and gill nets of one-, five-, and six-inch stretch mesh.

Sheefish movements were determined through a tag and recovery program. Yellow and white spaghetti tags were used and tag recoveries were made by Fish and Game personnel and subsistence fishermen. A $1.00 reward was paid to native subsistence fishermen for the return of each tag.

The spawning migration up the Koyukuk and Alatna Rivers was followed by boat in September.

Possible spawning areas of Holitna River sheefish were investigated by plane and riverboat. A weir was constructed on the Chatanika River to obtain estimates of the spawning population.

FINDINGS

SHEEFISH INVESTIGATIONS:

Movements

Major emphasis of the sheefish project in 1968 was placed on continuation of the long-term tagging program. A total of 809 sheefish was tagged in 1968.

Minto Flats:

Five sheefish were taken by gill net on May 23 at the junction of Swanneck Slough and the Tolovana River. This was evidently the beginning of the upstream migration in the Flats, as no fish could be found farther upstream in the vicinity of the mouth of the Chatanika River.

The main upstream movement to the junction of the Chatanika and Tolovana was between June 20 and July 1. During this period, 54 sheefish were tagged, with the best fishing success occurring between June 25 and 29. After July 1, the native subsistence catch at the mouth of the Chatanika and the sport catch reduced drastically. Fish were tagged in the vicinity of the Fish and Game cabin, Rock Island Slough, mouth of the Chatanika River, mouth of the Tatalina River, and four miles up the Tolovana River from its confluence with the Chatanika River. Five of the 1968 tagged sheefish were recaptured at the weir on the upper Chatanika River in late September, and one was recaptured in the Tanana River at Nenana on August 20. During September, 81 sheefish were tagged in the vicinity of the Chatanika weir, six of which were subsequently taken by sport fishermen.

Selawik:

The sheefish tagging operation at Selawik was a cooperative venture between the Division of Sport Fish and Division of Commercial Fisheries. The ice break-up occurred in the Selawik River on June 1. Sheefish were captured by drift gill net in the Selawik River-Inland Lake area on June 2. At Inland Lake, 194 sheefish were tagged. The tagging operation was moved to the mouth of the Tuklomarak River on Selawik Lake on June 8 when the channels became ice-free. From June 8 to 15, 263 sheefish were tagged in Selawik Lake. Of the 457 fish tagged at Selawik, 41 were recaptured by subsistence fishermen and Division of Commercial Fisheries biologists. Sixteen of these were captured in the Selawik area, while 25 were taken in the Kobuk River. During 1968, four sheefish tagged on the upper Kobuk River spawning grounds in 1967 were recaptured in the Selawik area.

This tag recovery data and aerial surveys of the Kobuk River and Selawik River spawning grounds indicate that the Kobuk River is possibly the main spawning area and that the Selawik area is the main wintering and feeding area of the Kobuk River-Selawik population.

Holitna River:

Tributaries of the Kuskokwim River from McGrath to Sleetmute were checked by set gill net, drift gill net and hook and line from July 5 to 7. Sheefish were taken only at the mouth of the Takotna River near McGrath and the mouth of the Tatlawiksuk River, 110 miles farther downstream, although local residents report their presence in other tributary streams in this 150-mile section of the river.

Between July 7 and 21, 142 sheefish were tagged in the Holitna River and 15 at the mouth of the Tatlawiksuk River. Holitna River fish were taken at the mouth of the river and 20 miles upriver.

Of the 75 sheefish tagged in the Holitna River in 1967, one was recaptured in the Kuskokwim River upstream from the mouth of the Holitna and three in the same area as tagged. Four of the 1968 fish were recovered in November and December in the Kuskokwim River near Napakiak and Oscarville, 320 miles downstream from the tagging site.

Koyukuk River:

In 1968 the period from September 14 to 26 was spent observing sheefish movements up the Koyukuk and Alatna Rivers. From September 21 to 24, two sheefish were tagged in the Koyukuk River between Hughes and Allakaket, 18 were tagged in the lower two miles of the Alatna River, and 37 were tagged 55 miles up the Alatna River.

Sheefish going up the Koyukuk River in September evidently do not migrate upstream in the Koyukuk past Allakaket, but rather, travel up the Alatna River to spawn.

Sheefish were moving upstream in the Koyukuk and Alatna in small groups. The Alatna River was clear and very shallow in late September, and compact groups of 10 or less fish could be observed traveling upstream. Often a single sheefish was seen with a large school of whitefish.

A sheefish tagged on the spawning ground above Hughes in 1967 was recaptured at Hughes in 1968. This was a significant tag recovery in that this male had been used in the 1967 egg take. The fish was ripe and ready to spawn when captured in 1968. This recovery indicates that at least the males are capable of reproducing every year.

Two sheefish tagged in early July near Dogfish Village, 227 miles up the Yukon River, were recaptured at Hughes, a distance of 650 miles. This confirms the theory that sheefish spawning in the Koyukuk and Alatna Rivers are members of the lower Yukon River population. No tagged sheefish were captured by the subsistence fishermen during the downstream migration in 1968. This is in contrast with the higher number of downstream migrating tagged sheefish captured in the Kobuk River; however, there is a much higher fishing effort in the Kobuk River.

Upper Yukon River:

A short exploratory trip to the upper Yukon River tributaries was taken in August to check on sheefish availability. Because of high water which was due to recent rains, it was difficult to find sites to set a gill net at the mouths of the rivers. A small number of sheefish was taken by hook and line at the mouth of the Nation and Tatonduk Rivers.

Spawning

The sheefish spawning migration up the Koyukuk River was followed by boat from Hughes in September. Sheefish began passing Hughes in late August and large numbers were taken by subsistence fishermen in September. The village of Allakaket, 75 miles upstream from Hughes, is evidently the limit of upstream movement in the main Koyukuk. The fish then travel up the Alatna River. Main spawning grounds in the Alatna River are reported to be 55 miles upriver, near the mouth of Siruk Creek. Forty-seven sheefish were captured by set gill net in this area between September 21 and 24. No spawning had occurred by September 24 when slush ice formation precluded further study. Small schools of sheefish were still observed migrating upstream in the Alatna and Koyukuk on September 24 and 25.

Plans had been made to conduct aerial surveys on the Koyukuk and Alatna Rivers on September 25, but the early freeze-up and adverse flying conditions forced cancellation.

It appears that sheefish in the Koyukuk River spawn in the area immediately above Hughes (Alt, 1968) and approximately 55 miles up the Alatna River. No spawning activity was observed on the Koyukuk system in 1968 up to September 28, even though the water temperature was 10°C. This would indicate that the date of sheefish spawning is probably more related to gonad development and timing than to water temperature. This is further corroborated by observations on the Kobuk River where, in 1965, 1966, and 1967, spawning occurred the same date in late September even though water temperatures were different each year.

Chatanika River:

A weir was constructed across the Chatanika River near the Elliott Highway bridge in early August. The first sheefish appeared at the weir on September 1, but by mid-September, only six sheefish had passed through the weir. The remainder of the upper Chatanika River spawning population remained concentrated in pools below the weir where they could be counted by foot survey. Between September 1 and 28, 39 sheefish were taken by hook and line below the weir and were tagged. Four of these subsequently were taken by sport fishermen. Between September 30 and October 1, 66 sheefish were taken below the weir by the electrofishing unit, including 25 of the 29 tagged sheefish remaining below the weir. Using the Petersen formula, a total population of 73 sheefish below the weir was estimated, in addition to which the 21 fish that were either taken by anglers or passed upstream gives a total spawning population in the upper Chatanika River of 94 fish. Before the weir was installed, it was believed that the majority of the Minto Flats sheefish population spawned in the upper Chatanika River. This was proven to be false. Only five of 56 sheefish tagged in the Minto Flats area in 1968 were recaptured near the weir. Based on the age of the fish tagged, it is estimated that 90 percent of the fish tagged in the Flats were mature and would possibly spawn in the fall. The remainder of the Minto Flats population probably spawn farther down the Chatanika River or possibly in the Tolovana River. The 67 sheefish for which sex could be ascertained included 21 females averaging 79.6 cm in length and 13.4 pounds in weight and 46 males averaging 70.6 cm in length and 8.6 pounds in weight. The length range of the females was 72.3 to 88.2 cm, with a weight range of 9.5 to 21 pounds; while the males ranged in length from 58.3 to 79.0 cm, with a weight range of 5.5 to 11.25 pounds. No reason can be given for the large difference in sex ratios. Data from the Kobuk River in past years indicates a sex ratio of nearly 1:1 on the spawning grounds.

Some of the sheefish taken by the shocker unit on September 30 and October 1 were partially spent. Water temperature at this time was 2.8°C. It is felt that the presence of the weir seriously disrupted normal sheefish spawning. Most of the fish probably spawned, but a few were able to get up to their normal spawning grounds. Some of the sheefish (12 on October 7) released upstream after being taken by the electrofishing unit were seen in a pool under the bridge, 200 meters upstream from the weir.

The sheefish that had been passed through the weir between September 10 and 27 had completed spawning by October 2, as they were found in the downstream trap on that date. No spawning observations were made in 1968, but many of the fish probably spawned along with three species of whitefish in the area below the weir.

The Holitna River was surveyed by boat and small plane in July, and probable sheefish spawning grounds were located.

Age and Growth

An age and growth study of five major sheefish populations in Alaska was completed and readied for publication in the Journal of the Fisheries Research Board of Canada.

Scale samples of 1,103 sheefish were used including 125 from the Holitna and Tatlawiksuk Rivers, 62 from the lower Kuskokwim River, 66 from the upper Yukon River (data from Alt, 1969), 98 from the Minto Flats drainage, 136 from the Koyukuk and Alatna Rivers, 69 from the lower Yukon River, and 547 from the Selawik-Kobuk drainage.

Length of fish at the end of each year of life was back calculated using the anterior scale radius and the method of Van Oosten (1929). Growth rate tables were constructed for each sample and data for males and females was combined.

In an attempt to determine if fish from the Holitna River and lower Kuskokwim River belong to the same population, absolute growth and average annual increment of growth were plotted graphically (Figure 1), which was also done to the lower Yukon River and Koyukuk River data. The growth curves for the Holitna and Kuskokwim fish are identical as are the curves for the lower Yukon and Koyukuk fish, thus indicating that there are only two populations of sheefish. This theory is further substantiated by recovery in the lower Kuskokwim River of fish tagged in the Holitna River and recovery on the Koyukuk River spawning grounds of fish tagged in the lower Yukon River. Data for the lower Kuskokwim and Holitna specimens were combined for Figure 2. This population is called the Kuskokwim River population. In like manner, the data for the lower Yukon and Koyukuk Rivers were combined; this group is termed the lower Yukon River population.

The mean calculated lengths of the five populations of Alaskan sheefish used in this study are presented in Table 1. Mean annual increment of growth in fork length is shown in parenthesis for each age group. The figures for growth in the terminal years of life for fish of all populations are from a small number of fish, which accounts for wide fluctuation in the average increment of growth. Figure 2, constructed from data in Table 1, depicts the growth of the five Alaskan populations.

Raw Data for Figure 1.

	Calculated Fork Length				Average Annual Increment			
Age	Lower Kuskokwim	Holitna	Lower Yukon	Koyukuk	Lower Kuskokwim	Holitna	Lower Yukon	Koyukuk
I	184	190	151	148	184	190	151	148
II	333	322	237	236	149	132	86	88
III	425	413	312	311	92	91	75	75
IV	506	491	384	384	81	78	72	73
V	574	558	460	456	68	67	76	72
VI	634	616	534	529	60	58	74	73
VII	687	669	597	599	53	53	63	70
VIII	737	722	669	668	50	53	72	69
IX	775	781	724	724	38	59	55	56
X	803	818	779	779	28	37	55	55
XI	839	857	833	842	36	39	54	63
XII	932	929	880	906	93	72	47	64
XIII	970	--	937	955	38	--	57	49
XIV	--	--	--	1,010	--	--	--	55
XV	--	--	--	1,040	--	--	--	30

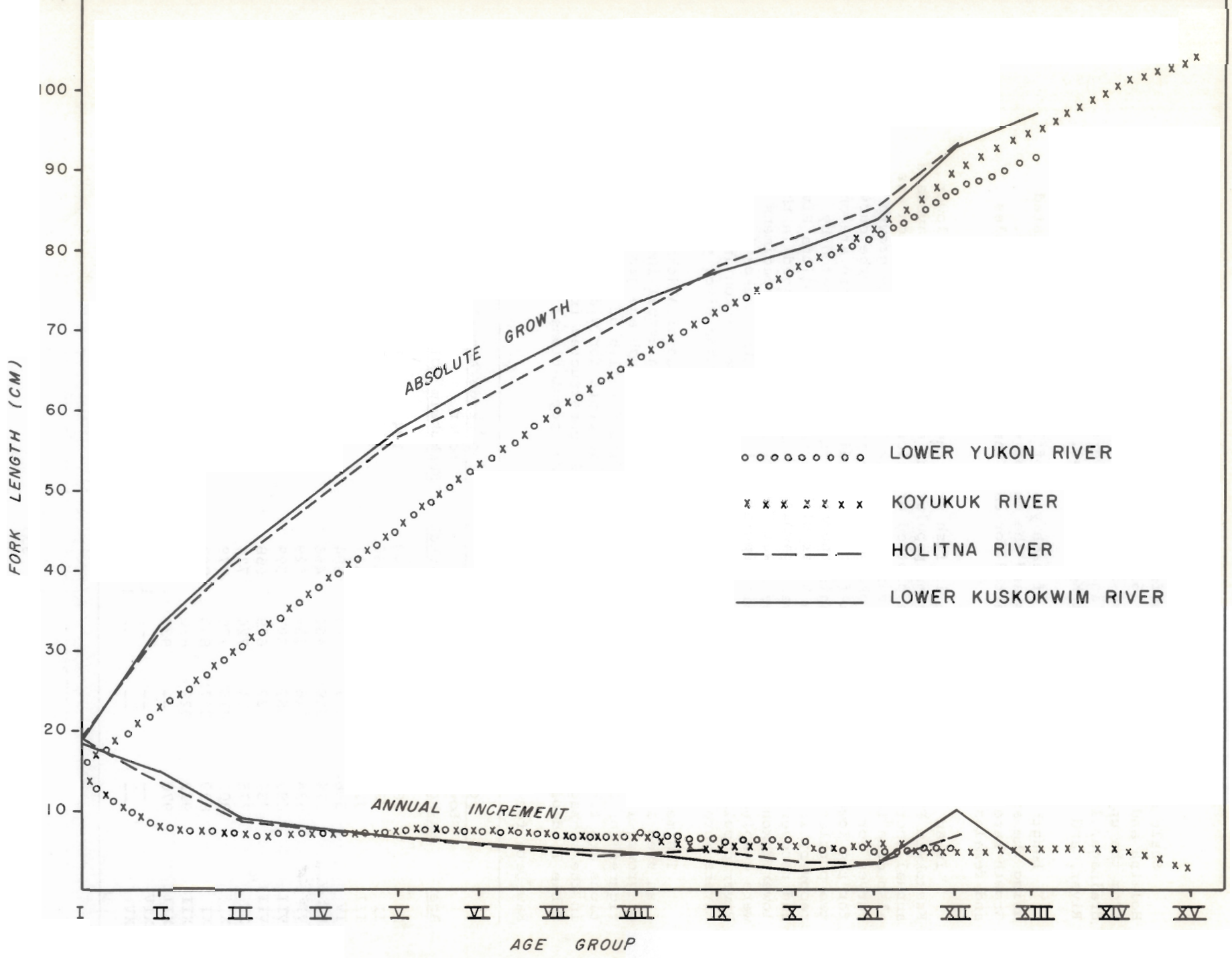

FIGURE 1. CALCULATED FORK LENGTH AND AVERAGE ANNUAL INCREMENT OF GROWTH IN LENGTH FOR SAMPLES OF ALASKAN SHEEFISH.

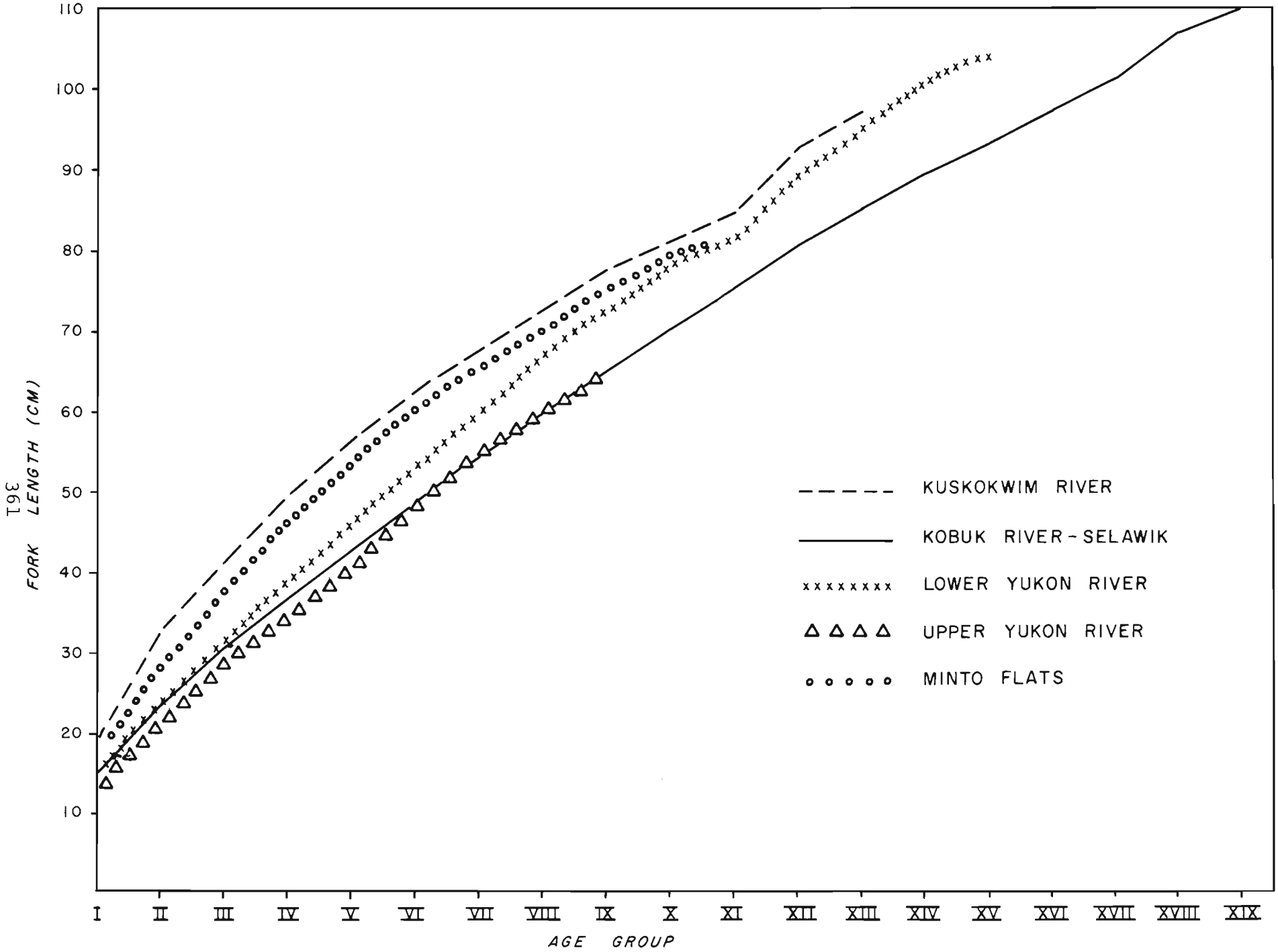

FIGURE 2. CALCULATED FORK LENGTH FOR FIVE POPULATIONS OF ALASKAN SHEEFISH.

TABLE 1 - Average Calculated Fork Length (mm) and Average Annual Increment (in parentheses) for Five Populations of Alaskan Inconnu.

Age Group	Kuskokwim River (n=197)	Kobuk River-Selawik (n=547)	Lower Yukon River (n=205)	Upper Yukon River (n=66)	Minto Flats (n=98)
I	188 (188)	151 (151)	149 (149)	126 (126)	170 (170)
II	326 (138)	239 (88)	238 (89)	215 (89)	285 (115)
III	417 (91)	307 (68)	311 (73)	285 (70)	377 (92)
IV	496 (79)	369 (62)	384 (73)	345 (60)	466 (89)
V	563 (67)	430 (61)	459 (75)	406 (61)	534 (68)
VI	622 (59)	489 (59)	530 (71)	486 (80)	603 (69)
VII	676 (54)	546 (57)	598 (68)	548 (62)	658 (55)
VIII	729 (53)	598 (52)	668 (70)	594 (46)	704 (46)
IX	777 (48)	652 (54)	724 (56)	644 (50)	753 (49)
X	810 (33)	705 (53)	779 (55)	--	797 (44)
XI	847 (37)	759 (54)	837 (58)	--	828 (31)
XII	936 (89)	806 (47)	896 (59)	--	800 (--)
XIII	970 (34)	855 (49)	948 (52)	--	--
XIV	--	895 (40)	1,010 (52)	--	--
XV	--	937 (42)	1,040 (30)	--	--
XVI	--	978 (41)	--	--	--
XVII	--	1,016 (38)	--	--	--
XVIII	--	1,072 (56)	--	--	--
XIX	--	1,101 (29)	--	--	--
XX	--	1,094 (--)	--	--	--

The Kuskokwim River population, located the farthest south, exhibits the fastest growth rate while the two northern populations, upper Yukon River and Kobuk River-Selawik, are apparently the slowest growing.

The lower Yukon population is characterized by relatively slow growth the first years of life than a rate faster than other populations studied until at age 11; fish from the lower Yukon and Kuskokwim population are essentially the same length. Most lower Yukon sheefish scales are also characterized by a false annulus appearing 6 or 7 circuli from the focus.

Fish of the Kobuk River-Selawik population, in spite of their slow growth rate, attain the largest size in Alaska. These fish have a longer life span than any other population.

The Kuskokwim, lower Yukon, and Kobuk-Selawik populations are considered anadromous as they migrate from brackish water to freshwater streams to spawn, while the upper Yukon and Minto Flats populations are probably completely fluvial. The dividing line for the upper and lower Yukon River populations is not known but is probably in the vicinity of the Porcupine River. Further tagging and collection of scale samples of sheefish from these fringe areas, e.g. Nowitna, Melozitna, Ray, Porcupine, and Chena Rivers, will aid in assigning these splinter groups to a major population. Future management of sheefish in Alaska should be on the population concept.

Sheefish have been reported in increasing numbers the past two years from the Koyuk River in the northern part of Norton Sound. These sheefish may belong to another population.

Egg Take

In 1968 the Koyukuk River began to freeze before the sheefish spawned and the egg take was shifted to the Chatanika River, 20 miles northwest of Fairbanks. A boat-mounted electrofishing unit was used to capture sheefish which were concentrated in pools below the weir located downstream from the Elliott Highway bridge. On September 30, six females (three partially spent) and 15 males were used in the egg take. Water temperature of the Chatanika remained constant at 2.8°C during the egg-take operation. Eggs were flowing freely in all females captured. After fertilization, the eggs were rotated and rinsed constantly until they had water hardened. This virtually eliminated the clumping problems that had been associated with the 1967 operation. The 348,000 eggs reached the hatchery within eight hours of fertilization. On October 1, an additional 90,000 eggs were taken from three partially spent females. These eggs reached the hatchery at the same time as the September 30 shipment, but the gallon jar containing the eggs broke during the flight to Anchorage, killing many of the eggs. All sheefish were in good condition after the egg take and were tagged and released.

In addition to the sheefish eggs, 51,000 sheefish male X Coregonus lavaretus female hybrid eggs and 173,000 sheefish male X Coregonus autumnalis female hybrid eggs were shipped to the hatchery. The eggs of the sheefish X C. lavaretus cross hatched on January 20, and 26,000 were stocked in a study lake near the Canadian border.

The sheefish eggs were divided into two lots and placed in screened trays. A small number of eggs adhered to the sides of the containers and were lost. Daily treatments of malachite green were given to prevent fungus. Egg loss at eyeing was 13.5 percent in Lot A and 34.8 percent in Lot B (eggs from October 1). The eggs began hatching on January 23 at 764 temperature units. By April 1, 216,500 eggs had hatched.

The 1968 eggs showed a higher survival rate than the 1967 eggs. Elimination of the clumping problem, faster delivery of the eggs to the hatchery and possibly a higher initial fertilization rate were contributing factors in the increased survival. A comprehensive, long-term, sheefish stocking experimental program was outlined. This project will consist of collection of background physical, chemical, and biological data and evaluation of stocking of sheefish in various types of lake and river situations in Arctic and Interior Alaska. The long-term objective is to stock sheefish in waters that are now barren of sheefish and also to supplement existing populations where sport fishing pressure is heavy. Part of the success of this program will rest on our ability to rear sheefish to fingerling size before stocking. A rearing pond will be constructed near the site of the Sport Fish rearing station at Clear. Sheefish will be transferred to the rearing pond from the hatchery, then kept until early fall when they should be approximately four inches in length. Stocking of these fish will complement the 4,000 fry planted in Four-Mile Lake on the Taylor Highway in early June, 1968. Fish will also be stocked in Lost Lake, a lake already containing fish species.

Sport Fishery

During the two weeks spent in Selawik in early June, only three parties of sport fishermen were contacted. The Selawik area as well as the Kobuk River are fly-in fishing areas far removed from population centers. As of now, the Kobuk River gets more fishing pressure because of better advertisement and availability of facilities for anglers. Sport fishing for sheefish of the Selawik-Kobuk River population will become more important because this is the only area where large trophy-sized fish, 30 to 50 pounds in weight, are present in any numbers. The total subsistence catch of Selawik-Kobuk River sheefish from fall of 1967 to fall of 1968 was reported at 31,293 fish (Geiger, pers. comm.). The Kotzebue Sound commercial catch was reported to be 2,375 sheefish weighing 15,367 pounds.

From June 19 to 29, 16 sheefish were taken by subsistence fishermen in the Minto Flats, but only four sport-caught fish were observed. Little time was spent in the Minto Flats during July, but guides operating pike fishing camps reported very few sheefish taken during July. Gill nets set in the lower Tolovana and Chatanika Rivers in late July failed to take any sheefish. Once the sheefish reached the area of the Chatanika River bridge they were subjected to intense angling pressure. The fact that they were concentrated in pools below the weir made them extremely vulnerable to "sport" angling. The Chatanika River, from a point one mile above the weir to the lower Chatanika, was closed to the taking of sheefish by emergency regulation on September 24. Fifteen sheefish had been taken by that time. The small number of spawning Chatanika River sheefish available to the sport fishermen in September will require close scrutiny and possibly more stringent regulations in future years.

There was a great increase in sheefish sport fishing pressure on the Holitna River in 1968, due mainly to an increase in guides from the Bristol Bay area who fly their clients to the Holitna River. During one day in July, seven plane loads of fishermen were fishing at the mouth of the Holitna River. Most sport fishermen fly to Sleetmute or Mellisk's Trading Post, then rent a boat and fish the lower reaches of the Holitna. Some of the guides mentioned that this was the first summer that they had an unsuccessful fishing trip on the Holitna.

Sport fishing in the Koyukuk River was concentrated in the Hughes area and the mouth of the Alatna River during mid-September. The best sport fishing on the Koyukuk is in late September, but this year the River had frozen over by that time. The villages of Hughes and Allakaket took record subsistence catches in excess of 2,500 sheefish. These fish were taken almost exclusively by gill nets and ranged in weight from five to 24 pounds.

Other Findings

Holitna River Food Habits:

Owing to the difficulty of collecting sheefish in the Holitna during 1968, only 11 sheefish were available for stomach analysis. As in 1967, sheefish in the Holitna were feeding almost exclusively on salmon smolts. The 10 stomachs with food contained 67 chum salmon, 14 silver salmon, and one king salmon smolt, in addition to one small whitefish.

Parasites:

Sheefish taken in brackish water, after the downstream spawning migration, and fish taken during the upstream spawning migration, when sheefish do not feed, are relatively parasite free. Sheefish feeding in fresh water often are parasitized by tapeworms, leeches, and copepods. Sheefish taken in Selawik during June are often so full of tapeworms that the intestine is occluded. This tapeworm has been identified by Department Parasitologist, Ken Neiland, as Proteocephalus exiguus.

A single tapeworm of the order Spathebothriidea was identified from a sheefish taken in Selawk. This genus is very uncommon. No tapeworms were found in the flesh.

Parasitic copepods, numbering from one to 40 per fish, are often found on sheefish in fresh water. These copepods, identified as Salmincola inermis by Larry S. Roberts of the University of Massachusetts, are found on the gills and inner surface of the operculum. Leeches, Piscicola sp., are often found when sheefish are taken from the water. These leeches feed on the slime layer of the fish and usually fall off as soon as the fish is out of the water.

No data has been published on Alaskan sheefish parasites, but Hoffman (1967) lists 21 parasites found in Russian sheefish. Only Proteocephalus exiguus is common to sheefish of both countries.

Chatanika Weir:

A 125-foot wooden weir was constructed across the Chatanika River 300 meters below the Elliott Highway bridge. The water level was quite low during 1968, with the flow varying between 218 and 280 cfs during August and September. The main objective of the weir, to enumerate the spawning population, was accomplished in spite of the fact that sheefish were reluctant to pass through the weir and became concentrated in pools below it.

Much information and data on whitefish and other species were collected at the weir. During the 23 days the weir was in operation in August the following numbers of fish were passed upstream: 125 Arctic cisco, Coregonus autumnalis; 106 humpback whitefish, C. lavaretus; 392 round whitefish, Prosopium cylindraceum; 90 grayling, Thymallus arcticus; two king salmon, Oncorhynchus tschawytscha; 28 chum salmon, O. keta; five pike, Esox lucius; and 11 suckers, Catostomus catostomus. During September, 1,178 Arctic cisco, 1,433 humpback whitefish, 520 round whitefish, 873 grayling, and 8 chum salmon were passed upstream. The greatest movement through the weir for the grayling and whitefish occurred in late September, just before the whitefish spawned. It is felt that the grayling were moving up to feed on the whitefish and sheefish eggs.

As was noted with the sheefish, only a small percentage of whitefish also moved through the weir. While capturing sheefish for the egg take, whitefish estimated in the thousands were turned over by the electrofishing unit until at times nearly the entire Chatanika River for a distance of 200 meters was filled with immobilized whitefish. It was estimated that the ratio of humpback whitefish to Arctic cisco in the area of the weir was nearly 1:1. However, not all the Arctic cisco were mature. The three species of whitefish were observed spawning in the evenings of September 30 and October 1 in an area extending one mile below the weir.

Five fish (.3 percent of the total humpback whitefish passed through the weir) were identified as hybrids between the sheefish and the humpback whitefish. An additional hybrid was taken with the electrofishing unit shocker boat. Three of the hybrids were preserved, including one female which had already spawned and was taken in the downstream trap. The condition of the testes of the two males indicated that they were ready to spawn. The detailed measurements and meristic counts of these intergeneric hybrids have been sent to the Journal of the American Fisheries Society for publication.

NORTHERN PIKE INVESTIGATIONS:

A field trip was taken to the Minto Flats on May 20 approximately eight days after ice-breakup to check on northern pike abundance. Gill nets set at the mouth of the Chatanika River and Rock Island Slough May 21 to 22 took 20 pike. Of the three mature females examined, one had already spawned, one was partially spent and the other had not yet spawned. Water temperature at this time was 7.2°C.

During late June and late July, 235 pike were tagged in the Minto Flats. Major tagging areas were: (1) Tolovana River near the Fish and Game cabin; (2) Rock Island Slough; (3) mouth of Chatanika River; (4) Birch Creek Slough (30 miles up the Chatanika River); and (5) mouth of

Goldstream Creek. Only one of the 1968 tagged pike and five of the 1967 tagged fish were recaptured during 1968. All of these recoveries were made within six miles of the tagging area.

A selected sample of 77 pike scales was read and the data combined with the 100 scales sampled in 1968 (Table 2). Pike circuli grow so close together that annuli are difficult to distinguish, especially near the center of the scale; therefore, a special effort was made to capture small pike. A graph of the length-frequency data of these fish indicated three distinct age classes.

Thirty-nine scales of pike from East Twin Lake on the opposite side of the Tanana River from the Minto Flats were also read. This lake, accessible only by plane, contains many large pike and is very popular with Fairbanks fishermen. Many pike over 20 pounds in weight come from East Twin Lake. Results of reading this small sample of scales indicated that the sport catch was made up of fish from seven to 23 years of age and weighing up to 22 pounds. At this stage of the fishery, all pike less than 12 years of age would probably be released by the angler because larger fish are so abundant.

TABLE 2 - Length and Age of 177 Pike Taken in Minto Flats, Alaska, 1968.

Age at Capture	No. in Sample	Length Range Each Age Class (cm)	Mean Length Each Age Class (cm)
1+	24	10.0 to 19.0	14.6
2+	4	19.0 to 24.0	20.7
3+	9	27.5 to 33.9	30.0
4+	2	31.5 to 36.5	34.0
5+	4	43.0 to 45.8	44.6
6+	7	46.0 to 55.0	49.3
7+	7	46.5 to 53.6	49.8
8+	13	60.0 to 36.5	53.5
9+	12	73.0 to 52.5	60.3
10+	16	56.5 to 69.5	61.8
11+	6	71.0 to 62.5	66.1
12+	14	64.5 to 87.7	72.7
13+	15	69.6 to 88.8	77.7
14+	11	75.3 to 88.4	80.9
15+	4	87.8 to 77.7	82.0
16+	3	88.3 to 81.0	85.4
17+	4	83.1 to 94.6	90.3
18+	8	80.8 to 97.0	90.8
19+	4	98.0 to 82.4	92.2
20+	5	104.0 to 83.2	96.1
21+	3	101.5 to 98.0	99.5
22+	1	--	98.0
23+	1	--	96.7

Pike Sport Fishery

Due to manpower shortages, little creel census information was gathered. Voluntary creel census calendars were given to guides, cabin owners and pilots who fished in the Minto Flats. (Their cooperation was poor.)

Sport fishing in the Minot Flats is unproductive until the water begins dropping and the fish become more concentrated. In 1968, it was late June before any large catches were made. Native subsistence fishermen had taken 33 pike between June 19 and 29. During this time, 24 fishermen were observed in the western end of the Flats, and they had taken approximately 79 pike. In 1968, two guides from Fairbanks began operations in the Minto Flats. They reportedly had many clients. On the July Fourth weekend, 30 boatloads of fishermen were reported fishing at the mouth of the Chatanika River. Good catches were reported for a time, but then catches decreased drastically and it was late in July before any more fish were taken in the area. Evidently pike movements during the summer are such that once pike are fished out of an area it takes some time before more move in from the adjacent areas.

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