

STATE OF ALASKA

Jay S. Hammond, Governor



Annual Performance Report for

INVENTORY AND CATALOGING OF SPORT FISH
AND SPORT FISH WATERS OF WESTERN
ALASKA

by

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Job No. G-I-P Inventory and Cataloging of Sport
Fish and Sport Fish Waters of
Western Alaska
By: Kenneth T. Alt

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RESEARCH PROJECT SEGMENT

| | | | |
|--------------|--------|--------------|---|
| State: | ALASKA | Name: | Sport Fish Investigations of Alaska |
| Project No.: | F-9-11 | | |
| Study No.: | G-I | Study Title: | INVENTORY AND CATALOGING |
| Job No.: | G-I-P | Job Title: | <u>Inventory and Cataloging of Sport Fish and Sport Fish Waters of Western Alaska</u> |

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

ABSTRACT

Studies in Seward Peninsula area and Kotzebue Sound area waters were designed to collect baseline information on fishes. More intense surveys and angler use studies were conducted in the more heavily utilized Nome area sport fisheries in 1977 and 1978.

Angler utilization studies in the Nome River indicated an estimated 1,210 fishermen. Limited information on catch is presented and the 1977 and 1978 seasons are compared.

Survey information on the Nome River is presented. Pink salmon, *Oncorhynchus gorbuscha* (Walbaum), and chum salmon, *O. keta* (Walbaum), are the most abundant species, and 1978 had the largest pink salmon run ever recorded. Biological information is presented for salmon, least cisco, *Coregonus sardinella* Valenciennes, and round whitefish, *Prosopium cylindraceum* (Pallas). Least cisco and round whitefish from the Nome River grew slower than the same species from Interior Alaska waters.

Test netting in the Kotzebue Sound, Hotham Inlet, and Kobuk River delta areas indicated presence of immature sheefish, *Stenodus leucichthys* (Guldenstadt), humpback whitefish, *C. pidschian* (Gmelin), and least cisco in brackish water environments, while mature individuals of the three species were more abundant in fresh water. Pike, *Esox lucius* Linnaeus, were the most abundant species encountered in fresh water. Herring, *Clupea harengus pallasii* Valenciennes, in spawning condition were taken in Kotzebue Lagoon, Hotham Inlet, and Selawik Lake.

BACKGROUND

A two-year Nome area angler utilization study was begun in 1977. Emphasis was switched to the Nome River when it was determined that most fishing pressure occurred there. In 1978, the Nome River census continued but with less intensity than in 1977. The results of the two

seasons' work gives a general idea of fishing pressure during varying weather conditions and differing run timing and availability of fish runs, especially Arctic char and salmon. Data from the first year's study appeared in Study G-I-P, Volume 19, Federal Aid in Fish Restoration Study, Inventory and Cataloging of Western Alaska waters.

Along with the angler utilization study a two-year study of the Nome River was begun. Most of the results are in the present report although biological data on grayling and Arctic char were included in the 1978 report.

Data were collected and observations made of the Pilgrim River during 1977 and 1978. The grayling data was published in 1978, but other information is still fragmentary. Since grayling are an important sport fish in the Pilgrim River, and subject to heavy fishing pressure, further research will be conducted on the stream if manpower is available in 1979.

The Kotzebue Sound survey was designed to provide information on distribution and abundance of fish in the estuarine and freshwater environments of Kotzebue Sound, Hotham Inlet, and the Kobuk River delta and to locate rearing areas of sheefish.

A secondary objective was to determine dates of Arctic char spring out-migration and fall immigration. Few char were captured, thus that objective was not fulfilled. More detailed information on sheefish is included in the 1980 Federal Aid in Fish Restoration, Annual Report R-II, Volume 20, Sheefish and Whitefish Life History Studies in Alaska.

The limited previous netting conducted in the Kotzebue Sound-Hotham Inlet areas related to studies on chum salmon and sheefish.

A list of species encountered in this study is included (Table 1).

A map of the Seward Peninsula study area is included in the 1978 report, page 39, and a map of the Kotzebue study area is included with this report (Fig. 1).

RECOMMENDATIONS

Management

Angler use studies of the Nome River should be conducted at irregular intervals.

Research

1. The Pilgrim River study with emphasis on Arctic grayling should be completed.

Table 1. Fish species of Seward Peninsula and Kotzebue Sound - Northern Inlet area.

| Species | Scientific Name & Author | Abbreviation |
|-----------------------|--|--------------|
| Pink salmon | <i>Oncorhynchus gorbusha</i> (Walbaum) | PS |
| Chum salmon | <i>Oncorhynchus keta</i> (Walbaum) | CS |
| Coho salmon | <i>Oncorhynchus kisutch</i> (Walbaum) | SS |
| Red salmon | <i>Oncorhynchus nerka</i> (Walbaum) | RS |
| King salmon | <i>Oncorhynchus tshawytscha</i> (Walbaum) | KS |
| Arctic char | <i>Salvelinus alpinus</i> (Linnaeus) | AC |
| Sheefish | <i>Stenodus leucichthys</i> Guldenstadt | SF |
| Least cisco | <i>Coregonus sardinella</i> Valenciennes | LCI |
| Bering cisco | <i>Coregonus laurettae</i> Bean | BCI |
| Humpback whitefish | <i>Coregonus pidschian</i> (Gmelin) | HWF |
| Broad whitefish | <i>Coregonus nasus</i> (Gmelin) | BWF |
| Round whitefish | <i>Prosopium cylindraceum</i> (Pallas) | RWF |
| Grayling | <i>Thymallus arcticus</i> (Pallas) | GR |
| Ninespine stickleback | <i>Pungitius pungitius</i> (Linnaeus) | NSB |
| Northern pike | <i>Esox lucius</i> Linnaeus | NP |
| Slimy sculpin | <i>Cottus cognatus</i> Richardson | SSC |
| Pacific herring | <i>Clupea harengus pallasii</i> Valenciennes | PH |
| Fourhorn sculpin | <i>Myoxocephalus quadricornis</i> (Linnaeus) | FHS |
| Saffron cod | <i>Eleginus gracilis</i> (Tilesius) | SC |
| Arctic flounder | <i>Liopsetta glacialis</i> (Pallas) | AF |

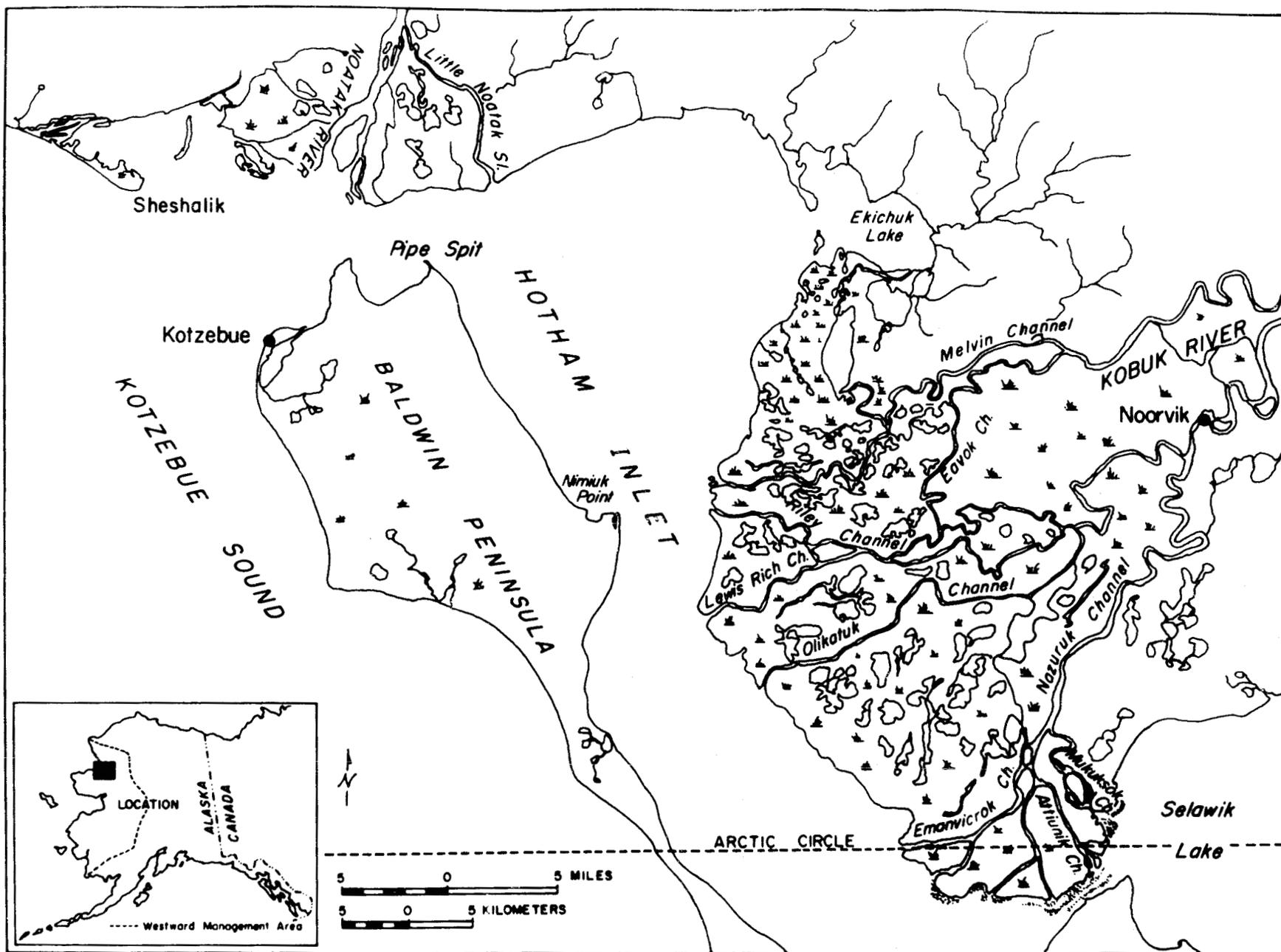


Figure 1. Kotzebue Sound, Hotham Inlet and Kobuk River delta study area.

2. Catalog and inventory studies should begin in the lower Yukon River.
3. Survey of waters of Kuskokwim River under the study should continue.

OBJECTIVES

1. To determine angler utilization in the Nome and Seward Peninsula areas.
2. To complete a physical-biological study of the Nome River.
3. To survey other waters of Western Alaska as time permits with emphasis on the Seward Peninsula, Norton Sound, and St. Lawrence Island.

TECHNIQUES USED

The Nome River creel census was not statistically designed. During each trip the biologist counted anglers and at the end of the day estimated the percentage of anglers counted for the day. These figures were then expanded to give total estimated angler days during the season from June 2 to August 31 on the Nome River. On days when the biologist was on other duty the average number of anglers the previous day and the following day was used to estimate the number of fishermen. Fishing pressure on other streams in the study area was never as heavy as on the Nome River, thus only instantaneous spot counts were made.

The Nome River survey was conducted by a canoe float trip in early July, 1978. Vehicle access was used to collect physical and biological data in the area near Osborn. Information on salmon commercial harvests and escapements was provided by the Division of Commercial Fisheries, Nome. Kotzebue Sound - Kobuk River delta surveys were conducted by riverboat from a base in Kotzebue. Gill nets were set in a variety of habitats, both fresh and brackish water, and included lake and stream environments. In most cases floater gill nets were set, but deep sets with sinking gill nets were made in Hotham Inlet and Selawik Lake.

Fish for life history studies were collected by hook and line, gill net, and seine. Otoliths were used to age Arctic char, while scales were used for grayling and whitefish. Sex and stage of maturity were determined through gross examination of the gonads. An effort was made to differentiate between consecutive and nonconsecutive spawners by noting presence of retained eggs.

FINDINGS

Nome Area Angler Utilization

Nome River:

In 1978 Nome River angler counts were conducted periodically between June 2 and August 31 and gave an observed count of 605 fishermen. It was estimated that only 50% of the anglers were counted, giving an expanded angler count of approximately 1,200 fishermen. Because of an early spring breakup with subsequent rapid Arctic char outmigration and high waters conditions in September, little sport fishing was done outside of the census period.

In 1978 most fishing was done in July when salmon were available. Average length of a fishing trip was about 3 hours, similar to 1977.

The majority of angling occurred in the 0.8 km distance from the Nome River bridge to the mouth. Other important sport fishing areas on the Nome River are between Mile 8 and 13 on the Kougarok Road. This is an important grayling and Arctic char sport fishing area.

Pink salmon were the dominant sport species in the Nome River in 1978 and 350 were observed caught (Table 2). Only about 30% of the total harvest was estimated to have been observed. This catch reflects the high 1978 pink salmon escapement. The catch of chum salmon and grayling was low, reflecting a low 1978 chum salmon run and a small population of grayling.

In addition, subsistence fishermen at Ft. Davis (mouth of Nome River) took approximately 200 pink salmon by rod and reel.

There was about one-third less fishing pressure on the Nome River in 1978 than in 1977. This is directly related to poorer weather conditions in 1978 and drastic changes in runs of chum salmon and Arctic char. In 1977 Arctic char were available in large numbers in late June and late August, a situation not present in 1978. The high 1977 chum salmon run was offset by a poor 1978 run. Pink salmon, which are less desirable to sportsmen, were abundant in 1978. Grayling are taken by Nome River anglers when present, but the yearly catch is low.

Other Seward Peninsula Streams

Fishing pressure on other streams in the Nome area was lighter than in 1977 due to poor weather and nonavailability of Arctic char (Table 3). Grayling are the most sought after fish in these streams but little information on total catch was gathered. Since all streams in the Nome Area had exceptional pink salmon runs, their harvest exceeded the grayling harvest in most waters.

Table 2. Observed 1978 sport catch Nome River 1978.

| Species | Number Caught |
|-----------------|---------------|
| Pink salmon | 350 |
| Chum salmon | 28 |
| King salmon | 1 |
| Coho salmon | 16 |
| Arctic char | 69 |
| Grayling | 6 |
| Round whitefish | 2 |

Table 3. Instantaneous angler counts for other Nome area waters.

| Water | Number Days Observed | Number Anglers Observed |
|----------------------|----------------------|-------------------------|
| Snake R. | 13 | 53 |
| Pilgrim R. | 9 | 40 |
| Sinuk R. | 3 | 10 |
| Grand Central R. | 3 | 4 |
| Fish R. - Niukluk R. | 4 | 8 |
| Penny R. | 4 | 6 |
| Safety Sound | 3 | 9 |
| Kuzitrin R. | 2 | 4 |

Limited observations of other Seward Peninsula waters indicated exceptional pink runs, poor chum runs, virtually no spring char fishery because of rapid outmigration, and generally late fall char immigration.

The expected increase in angling pressure on the Fish-Niukluk River in 1978 did not materialize. A bridge over Safety Sound was not completed until fall, thus limiting vehicle access to the area. The Silvertip Lodge on the Unalakeet River indicated that good catches of king salmon were made in late June and early July and silver salmon in mid-August. The lodge had 120 clients but no figures on harvest are available. The commercial king salmon harvest from the Unalakeet River was 4,200 fish.

Comparisons of Sport Fishing in Nome Area Waters 1977 and 1978

Movements of fish and their availability to anglers as well as sport fishing pressure are affected by climate and weather. Normal spring breakup, and char movements usually permit sport angling in late May and the first week of June in the Nome area. Conditions of ice movement in the ocean have a profound effect on fish movements, and in 1977 ice was packed against the shore of the Seward Peninsula until mid-June. Even though breakup of local rivers was "normal" (late May) the Arctic char outmigration was held up, thus furnishing anglers with excellent fishing for about one month. In 1978, river ice and ocean ice breakup occurred simultaneously and Arctic char migrated rapidly to the ocean, thus furnishing little sport fishing.

Coupled with the later breakup in 1977, chum and pink salmon entered the Nome River one to two weeks later than in 1978. The large and protracted run of chum salmon in 1977, however, resulted in excellent angling and catches. In 1978 the chum salmon run was weak but an exceptional pink run lasting from June 24 to late August provided good catches.

The normal fall migration pattern for Arctic char in Nome streams is a slow, protracted immigration from early to mid-August through September. In 1977 the fall migration was slightly earlier than normal, with some char entering the mouth of Nome River by late July. Fishing opportunities and catch in 1977 were excellent. In 1978 very few char had entered Nome area streams by the end of August. In the area approximately 22.5 km (14 mi) up the Nome River, where up to 100 char were seen near chum salmon spawning grounds in 1977, only one char was observed in mid-August of 1978. Coho salmon run timings were similar in both years but the 1978 run appeared to be smaller.

The summer of 1977 was generally sunny and dry, and Nome area residents spent a considerable amount of time sport fishing. By contrast, 1978 had poorer weather with much rain and periods of high turbid stream flow. This resulted in less fishing pressure in 1978.

Nome River Study

Physical and Chemical Characteristics:

The Nome River is a rapid runoff river with its headwaters in the Kigluaik Mountains. It flows in a southerly direction and enters Norton Sound 5.6 km (3.5 mi) east of Nome at latitude 166°35'W, longitude 64°29'N. The Nome River is 70 km (44 mi) in length, drains an area of 245 km² (153 mi²) and includes many small tributaries; the largest, Osborne Creek, enters from the east 14 km (9 mi) upstream from the Nome River mouth. All other tributaries are small, clear, rapid runoff streams draining an area from 1.6 to 11 km (1 to 7 mi) on either side of the main stem Nome River.

Although the River flows through alpine and coastal tundra for its entire length, the bank vegetation is predominately willow with only a few exposed tundra cutbanks. The channel is braided for the upper half of its length, becoming mostly a single channel below Basin Creek.

A water gauge was installed 16 km (10 mi) up the Nome River. Observations indicated that water levels rose swiftly with rainfall and dropped within two days after rain subsided as is typical of small rapid-runoff streams. A standard low water flow depth of 28 cm was measured throughout early June and again in mid-July through early August.

A high water level of 67 cm was reached in late June, showing an extreme fluctuation of 39 cm in an 11-day period.

A float survey of the river was made in early July, 1978. Gross chemical analysis yielded a pH of 8.9, total alkalinity of 103 ppm, and a hardness of 188 ppm. Invertebrates present in the freshwater sections of the stream included Diptera, Plecoptera, Ephemeroptera, Tricoptera, and Gastropoda. Fish species present included Arctic char, grayling, least cisco, round whitefish, slimy sculpin, ninespine stickleback, chum salmon, pink salmon, king salmon, coho salmon, and Bering cisco.

The Nome River was divided into three sections:

Section III includes the area from the headwaters to 13 Mile Bridge. Only the lower 13 km (8 mi) of this section were surveyed as the river above 34 km (21 mi) on the Kougarok Road was too small to float a canoe. The stream in this upper section is braided and flows rapidly over large gravel and rubble through willow banked alpine tundra. The average velocity was 1.05 m/s with an average volume flow of 147 m³/s (368 cfs). Bottom composition is mostly rubble and coarse gravel with only an estimated 30% less than 75 mm (3 in) in diameter. This section offers few potential spawning areas. Pool areas constituted about 15% of the overall stream surface, with some additional slow water sections in small sloughs and near tributary creek mouths. Most of these areas were walked to determine if rearing fish were present. Although some good rearing habitat was available in these areas, few small fish were observed and only rearing coho salmon captured. Only four grayling were captured in this section

by hook and line. These were adult fish and were captured in the lower part of the section. Only one fish was observed in the first 1.6 km (1 mi) of the trip. In addition to those fish captured, a total of 15 grayling, 5 chum salmon, and 2 round whitefish was observed in this section. Due to the clear water and reasonably good conditions for observation an estimated 60% of the fish in this section were observed. The only other fish species present in this section was slimy sculpin.

Section II includes the Nome River from 13 Mile Bridge to its confluence with Osborne Creek 6.4 km (3.8 mi). The current was still quite swift in this section 1.2 m/s (4.8 fps) over a medium gravel bottom. Gravel and cobble size ranged from 75 to 100 mm (3 to 4 in) average size in the upper areas of this section to an average of 25 to 5 mm (1 to 2 in) in the lower reaches. Pools were long and deep, occupying about 60% of the overall stream and contained much sand intermixed with small gravel. The stream is a single channel through most of this section with bank vegetation similar to the upper section, mostly willow with some tundra cutbanks. There were several non-vegetated areas consisting of tailing piles from past mining activities. Ten chum salmon, 15 round whitefish, 20 grayling, and 12 Arctic char were observed in this section, but due to the increased size of the river 206 m³/s (515 cfs) and the configuration of the pools, this is not a representative index of the numbers of fish present. Although no fingerling size rearing fish were observed, small side channels offered excellent habitat for them. Some unidentified fry (probably whitefish) were captured in the side channels of this section. Below 13 Mile Bridge a borrow pit which offers a suitable mid-river overwintering area has been incorporated into the river.

Section I includes the area from Osborne Creek to the mouth, 14.5 km (8.5 mi). This section is slow moving, with approximately 80% pool and 20% slow riffle. The average current speed in this section was 0.6 mps (2.3 fps) and the bottom was small gravel grading to sand and mud near the mouth. This section is mainly a single meandering channel, flowing through coastal tundra. The bank vegetation is mainly willows. The river widens to form a small lagoon below the Nome River Bridge before flowing into Norton Sound at Fort Davis.

Schools of both chum and pink salmon were seen in this section, but due to the wind-agitated surface, no accurate estimates of numbers could be made. Arctic char, grayling, and round whitefish were also observed in this section. Arctic char and grayling autopsized from this section had been feeding on small green mayflies. One 121 mm grayling was captured in the main channel of this section, indicating that some rearing does take place in the lower reaches of the river. Juvenile grayling have also been observed near the bridge on the Council Road. No immature grayling were observed in side channels of this section.

The main chum and pink salmon spawning areas are from Osborne Creek to the 13 Mile Bridge. Pink salmon spawn from the mouth to Mile 25.

The commercial pink salmon catch in 1977 was 65 and the 1978 catch was 22,869. The 1977 chum harvest was 15,802 fish, and the 1978 harvest was 8,646 fish.

The stream flow has been influenced in the past by extensive mining activity in the area. Remnants of this activity still exist, but except for the Miocene and Crampton ditches, there is little present influence on the river from past mining efforts. There is one gold dredge on a small tributary at Banner Creek 36 km (mi 22.5). The dredge is operated intermittently, and at times there is moderate siltation of this creek with some influence on the turbidity of Nome River in this vicinity.

Biological Aspects of Nome River Fish:

Seventeen fish species are present in the Nome River (Table 1). Chum and pink salmon are the most abundant species; the 1977-1978 chum salmon escapement was 4,144 and the 1977-1978 average pink salmon escapement was 18,313. The 1978 pink salmon run was exceptional, with an escapement in excess of 35,000 fish. Silver and king salmon runs are small, and probably less than 400 silver salmon and 20 king salmon enter the stream each year. Arctic char, grayling, and round whitefish populations are not high, but fish are distributed throughout the watershed. Few rearing fish have been found. Least and Bering ciscos have not been captured except near the mouth. It is not known if they spawn in the Nome River. The marine species, Arctic flounder, saffron cod, boreal smelt, fourhorn sculpin, and herring, enter the lower Nome River.

Movements and Abundance

Arctic char:

Arctic char migrate to salt water after breakup and spend the summer feeding in the ocean (Alt, 1978). In 1978, the movement was rapid and few char were found in the stream after June 1. A few char of various sizes were observed or captured in the Nome River throughout the summer. Two net nights of gill netting at the mouth of Nome River (June 13-14) took only one Arctic char. The 1978 fall immigration was slower and later than in 1977, and on September 1 only six char were observed in the area of 13 Mile Nome River where nearly 100 were observed in 1977. The fall upstream movement contains both spawning and non-spawning char. Spawning grounds of Nome River Arctic char have not been located.

Salmon:

In 1978, chum salmon were the first to enter the river (June 12), with the peak of the run occurring near July 1. Pink salmon entered the river on June 24 and the very strong 1978 run continued through July and August. Chums generally spawn in the area between Dexter and the 13 Mile Bridge 14-26 km (river miles 9 to 16) while pink salmon spawn from the mouth to beyond 13 Mile Bridge with some spawning 25 river miles upstream. The few king salmon entering Nome River generally arrive in late June to early July. In 1977, 25 were observed on spawning

grounds near Dexter. The 1978 coho salmon run began in mid-August about two weeks later than 1977. The run was small during both years of the study.

Coho salmon spawning grounds are located in the area between Osborne and the 13 Mile Bridge. The coho salmon smolt outmigration begins at breakup, and in 1978, 23 smolts were captured by gill net (two net nights) at Nome River mouth June 13-14. During netting operations in 1977, coho salmon smolts were captured by seine at the Nome River mouth.

Whitefish:

Round whitefish are distributed throughout the Nome River system. Population size is probably small and fish of all size groups were captured throughout the stream during summer months. Overwintering areas are probably in the deeper sections of the lower river and fish disperse after breakup. Round whitefish are somewhat concentrated in areas of salmon spawning during July and August. Spawning grounds were not located but suitable gravel exits over large portions of the river.

Least cisco were abundant at the mouth of the Nome River during periods of test netting in both 1977 and 1978, but most were taken early in the summer. Two net nights of fishing in mid-June took 93 least cisco, three net nights in July took 19 cisco, and three net nights in August took 7 least cisco. Movements of least cisco in the Nome River are not fully understood as none have been captured or observed upstream of the mouth. Netting results indicate an immigration during the summer, but there is no indication whether the fish overwintered in the ocean or in fresh water.

Bering cisco are present in low abundance; only five were taken during eight net nights of fishing at Nome River mouth. They are more common in the Safety Sound area.

Humpback whitefish have not been captured or observed in the Nome River.

Grayling:

Grayling movements in the Nome River in 1977 have been described (Alt, 1978). Observations in 1978 indicated that grayling were most numerous in the Nome River from 6.4 to 19 km (river miles 4 to 12) during early June. Movements of grayling during the rest of the summer are closely correlated to salmon spawning.

Grayling had evidently completed spawning when field work began on June 1, 1978. Water temperature was 6.5°C (43.7°F). Foot surveys of Nome River tributaries and the upper river located no spawning or rearing fish. Four rearing grayling of 121-202 mm FL and Age I and II were captured in the lower Nome River.

Other Species:

Slimy sculpin are distributed throughout the Nome River but ninespine stickleback and the marine species entering the Nome River are only found in the lower reaches. Little is known of their movements.

Age and Growth

Salmon:

Nome River salmon were not aged but Fritz Kuhlman, Commercial Fish Division, (personal communication) reported that Age IV chum salmon make up 80% of the run while Age III and Age V fish make up 20% of the run. Age II pink salmon and Age III and IV silver salmon comprise the majority of the escapement for those species. Chum and pink salmon fry migrate to the ocean as fry but silver salmon spend generally 2 years in fresh water.

Arctic char:

Arctic char captured in the Nome River in 1977 ranged from Age III to XI, (Alt, 1978). Char collected during 1978 were of the same size and age range as 1977 char so were not included in the analysis.

Grayling:

Grayling from the Nome River captured in 1977 ranged from Age I to VIII (Alt, 1978). Only eight grayling were captured in 1978, including a 121 mm Age I fish and three Age II fish averaging 168 mm.

Least cisco:

Forty-four of 93 least cisco captured at the mouth of the Nome River were aged. Size range was 190-340 mm. Fish ranged from Age II to VII, with the majority of fish belonging to Age groups IV, V, and VI (Table 4). There was a large size range for each Age Class, indicating differential growth.

Weight range was 70 to 340 g which is typical of weights of coastal and northern populations of least cisco.

Males first matured at Age IV, with all being mature at Age VI, while females first became sexually mature at Age V and all were mature by Age VI.

Nome River least cisco grew slightly faster than Colville River (North Slope) least cisco but matured at the same age (Alt and Kogl, 1973). Nome River fish grew considerably slower and matured later than Chatanika River (Interior Alaska) fish (Alt, 1971).

Table 4. Length, weight, and maturity of 44 least cisco, Nome River at Ft. Davis. Maturity data is given as a percentage with total number of fish for each sex at each age group presented in parentheses.

| | | Age Class | | | | |
|------------|-----------|-----------|---------|---------|---------|---------|
| | | III | IV | V | VI | VII |
| F.L. | \bar{x} | 219 | 259 | 265 | 287 | 285 |
| | n | 2 | 10 | 20 | 11 | 1 |
| | Range | 197-240 | 242-281 | 225-315 | 257-340 | 285 |
| Weight | \bar{x} | | 131 | 152 | 227 | 190 |
| | n | | 10 | 20 | 11 | 1 |
| | Range | | 80-200 | 70-360 | 150-340 | 190 |
| % Maturity | | 0 (2) | 75 (4) | 0 (3) | 100 (3) | |
| | ♂♂ | | | | | |
| % Maturity | | 0 | 0 (4) | 25 (16) | 100 (8) | 100 (1) |
| | ♀♀ | | | | | |

Round whitefish:

Fourteen round whitefish from the Nome River were aged and yielded five fish of Age II and nine between VII and X. All fish over Age VIII were males. No round whitefish of the five missing age classes were observed or captured.

Growth of round whitefish from the Nome River is compared with growth from other Nome area waters (Table 5). Lake residents from Salmon Lake grew slower than stream residents, especially of the Nome and Pilgrim rivers. Pilgrim River round whitefish had the longest life span of any group studied (Age XIV).

Bering cisco:

Only four Bering cisco were captured in June and July during test netting at the Nome River mouth. One Age IV male was 337 mm and 450 g and three Age VI fish (one male, two females) ranged from 345 to 365 mm and 545 to 700 g. The two males were mature, all females were immature. Bering cisco have been captured in Safety Sound and the Port Clarence-Grantley Harbor areas of the Seward Peninsula and are probably present in other Seward Peninsula waters.

Kotzebue Sound - Hotham Inlet Survey

Waters of the Kotzebue Sound, Hotham Inlet, Kobuk River delta, and Selawik River were test netted in mid-June and September, mainly in an effort to capture rearing sheefish.

Seventeen species of fish were captured including seven marine species (Table 1). In addition chum, pink, and king salmon enter these waters and small numbers of Arctic flounders and saffron cod are present.

Northern pike and humpback whitefish were the most abundant and widely distributed species and were taken in nearly all freshwater net sites. Additionally, humpback whitefish were taken in brackish water (Table 6). Fourhorn sculpin, starry flounder, and herring were locally abundant. An upstream spawning run of boreal smelt had already passed upstream thus few were captured.

Nets set in the estuarine locations (Kotzebue Sound, Hotham Inlet) in both June and September took a wider variety of species and also considerably more of each species than nets set in fresh water.

Especially interesting is the abundance of the whitefish species (sheefish, humpback whitefish, and least cisco) in Kotzebue Sound. Most of these fish were immature, thus pointing out the importance of the estuarine environment for feeding and rearing. The delta of the Kobuk River, including channels, sloughs, and interconnected lakes, contained mainly pike and whitefish but very few rearing species of fish. The same was true for Selawik Lake and Hotham Inlet, and the expected discovery of sheefish rearing areas did not materialize.

Table 5. Length (in mm), age, and weight (in grams) of round whitefish from Seward Peninsula, Alaska.

| | Age at Capture | | | | | | | | | | | | | |
|-------------------|----------------|-------------|-----|-------------|-------------|--------------|--------------|--------------|--------------|--------------|----------------|--------------|--------------|----------------|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XIII | XIV |
| Snake R. n=7 | | | | | | 351 (400) | 365 (500) | 385 (520) | | 412 (550) | | | 420 (690) | 494 (1,090) |
| Pilgram R. n=6 | | | | | | | | 409 (550) | 419 (660) | 465 (880) | 480 (1,000) | 495 (950) | | |
| Nome R. n=14 | | 205 (73) | | | | | 409 (600) | 434 (770) | 458 (845) | 475 (965) | | | | |
| Salmon L. n=26 | | | 135 | 200 (30) | 219 (53) | 261 (110) | 272 (140) | 333 (372) | 325 (355) | 353 (492) | | | | |

Table 6. Test net results 30 m graduated mesh gill nets Kotzebue Sound-Kobuk River delta area, June and September, 1978.

| Water | Date | Net Night | Species Captured | | | | | | | | | | | | | | | | |
|--------------------------------------|------|--------------|------------------|----|----|-----|-----|-----|-----|-----|----|----|-----|----|-----|-----|-----|-----|----|
| | | | HR | AC | SF | BWF | RWF | HWF | BCI | LCI | GR | NP | LNS | BB | SCD | FSC | STF | | |
| Kotzebue Sound | 6/10 | 2 | 14 | 1 | 25 | | 1 | 45 | 3 | 31 | 1 | | | | | | 88 | 46 | |
| Kobuk Delta Lake (Melvin Channel) | 6/12 | 1 | | | | 1 | | 8 | | 7 | | | | | | | 22 | | |
| Melvin Channel | 6/12 | 1 | | 5 | 1 | | | 2 | | | | | | | | | 7 | | |
| Melvin Channel (near mouth) | 6/12 | 1 | | | 2 | | | 1 | | | | | | | | | 14 | | |
| Melvin Channel | 6/13 | 1 | | 3 | | | | | | 1 | | | | | | | 10 | | |
| Hotham Inlet (off Melvin Channel) | 6/13 | 1 | 21 | | 6 | | | 2 | | 3 | | | | | | | 1 | 28 | |
| Melvin Channel (mouth) | 6/13 | 1 | | | 5 | | | 3 | | | | | | | | | 12 | | |
| Riley Channel (mouth) | 6/14 | 1 | | | 5 | 1 | | 3 | | | | | | | | | 10 | | |
| Eavok Channel Lake | 6/14 | 1 | | | | | | 12 | | | | | | | | | 6 | | |
| Eavok Lake Creek | 6/14 | 1 | | | | 1 | | 4 | | | | | | | | | 3 | | |
| Mukuksok Channel | 6/15 | 4 | | | 1 | 5 | | 9 | | | | | | | | | 41 | 5 1 | 8 |
| Selawik Lake (narrows) | 6/16 | 2 | | | | | | 2 | | 3 | | | | | | | 1 | 1 | 85 |
| Selawik Lake (narrows far side) | 6/16 | 1 | | | | | | | | 3 | | | | | | | 8 | | 1 |

Table 6. (cont.) Test net results 30 m graduated mesh gill nets Kotzebue Sound-Kobuk River delta area
June and September, 1978.

| Water | Date | Net Night | HR | AC | SF | BWF | RWF | HWF | BCI | LCI | GR | NP | LNS | BB | SCD | FSC | STF | |
|-------------------------------|------|--------------|----|----|----|-----|-----|-----|-----|-----|----|----|-----|----|-----|-----|-----|----|
| Kobuk Slough (above Kiana) | 6/17 | 1 | | | | | | 1 | | | 1 | 8 | | | | | | |
| Squirrel River | 6/17 | 1 | | | | | | 1 | | | | 3 | | | | | | |
| Kotzebue Lagoon | 9/02 | 3 | 7 | 4 | 34 | 3 | | 20 | | 17 | 2 | 14 | | 1 | 1 | 53 | 20 | |
| Hotham Inlet | 9/03 | 3 | 1 | 1 | 27 | | | 7 | 2 | 25 | | | | | | 9 | 13 | 53 |
| Noatak Delta | 9/04 | 1 | | | | | | | | | 1 | | | | | 2 | 3 | |

Herring captured in Kotzebue Sound, Kotzebue Lagoon, Hotham Inlet, and Selawik Lake were ripe, indicating spawning in these areas. Flounders captured off Melvin Channel had fed on pondweed containing herring roe.

In addition to 38-m (125-foot) variable mesh nets, small mesh 12 or 19 mm nets, (10 m x 2.4 m) were set in various areas in an effort to capture rearing fish. They added little additional information. One net set at the mouth of the Kobuk River in mid-June took 95 ripe boreal smelt, and a net set in Sheshalik ((Noatak) Lagoon for 3 hours in late June took four immature sheefish (Age IV-V).

Test netting in the Kobuk River above Kiana and in the lower Squirrel River took only grayling, pike, and broad whitefish. Three Arctic char smolts were captured in Melvin Channel in June and five were taken near Sheshalik.

These limited captures were insufficient to document the smolt out-migration and the fall immigration.

Species Accounts

Least cisco:

Least cisco are very abundant in the Kotzebue Sound area and are found in lakes, streams, and brackish waters. They were more abundant in brackish water than in fresh water and their frequency of occurrence was 14 times as great in salt water as in fresh water.

Rearing least cisco were taken in both brackish and fresh water, but were more common in brackish water. Cisco ranged in age from I to VII (Table 7). Length ranged from 117 to 320 mm and weight up to 330 g. Males matured at Age IV-VI and females Age IV-VII. Kotzebue Sound least cisco grow slightly slower than Nome River least cisco (Table 5).

Limited stomach analyses indicated least cisco were feeding on insects and shrimp.

Humpback whitefish:

Humpback whitefish were abundant in fresh and brackish waters but were taken four times as frequently in brackish water. Small rearing whitefish of Age I-III were captured only in brackish water. Immature and non-spawning fish were common in brackish water, while pre-spawning humpback whitefish were captured mainly in fresh water.

Humpback whitefish captured ranged in size from 130 to 555 mm FL and 40 to 2,000 g in weight (Table 8). Fish were Age I-XII, but fish of Age Class VI to VIII were most common. Growth was somewhat slower than for other Alaskan populations and maturity was reached considerably later than for other populations. Most fish were mature by Age VIII but a few

Table 7. Length, weight, and maturity of least cisco, Kotzebue Area (number of fish mature at each age group given in parentheses).

| Age | n | Fork Length (mm) | | Weight (g) | | Sex | | | Maturity | | % Maturity | |
|-----|----|------------------|------|------------|------|-----|---|-----|----------|-----|------------|---------|
| | | Range | Mean | Range | Mean | ♂ | ♀ | Unk | Imm | Mat | ♂ | ♀ |
| I | 4 | 117-144 | 129 | | | 2 | 2 | | 4 | | | |
| II | 11 | 126-208 | 160 | | | 5 | 6 | | 11 | | | |
| III | 4 | 190-230 | 208 | 40-100 | 76 | 2 | 2 | | 4 | | | |
| IV | 16 | 200-259 | 234 | 50-150 | 106 | 5 | 9 | 2 | 5 | 9 | 80 (5) | 56 (9) |
| V | 20 | 219-320 | 246 | 90-330 | 122 | 10 | 8 | 2 | 5 | 13 | 70 (10) | 75 (8) |
| VI | 8 | 230-280 | 261 | 100-200 | 151 | 1 | 7 | | 1 | 7 | 100 (1) | 86 (7) |
| VII | 1 | 270 | 270 | 125 | 125 | 0 | 1 | | 0 | 1 | | 100 (1) |

Table 8. Length, weight, and age relationships for humpback whitefish from Kotzebue Sound Area.

| Age | N | Length (mm) | | Weight (g) | |
|------|----|-------------|------|-------------|-------|
| | | Range | Mean | Range | Mean |
| I | 2 | 130-142 | 136 | | |
| II | 5 | 135-187 | 159 | | |
| III | 4 | 192-300 | 233 | 50-300 | 131 |
| IV | 3 | 242-288 | 260 | 100-225 | 150 |
| V | 9 | 261-330 | 292 | 150-300 | 232 |
| VI | 8 | 260-340 | 298 | 200-400 | 254 |
| VII | 10 | 302-353 | 335 | 250-400 | 348 |
| VIII | 9 | 328-365 | 343 | 300-450 | 368 |
| IX | 2 | 315-363 | 339 | 350-500 | 425 |
| X | 3 | 478-535 | 498 | 1,200-3,250 | 1,983 |
| XI | 1 | 555 | 555 | 2,000 | 2,000 |
| XII | 1 | 440 | 440 | 900 | 900 |

individuals were immature at Age VIII and IX. Food of humpback whitefish varied, with snails, clams, and insects being generally most important but herring eggs on pondweed (Hotham Inlet) and ninespine stickleback (Kotzebue Sound) being seasonally important.

Broad whitefish:

Only ten broad whitefish were taken, with capture locations in both fresh and brackish water. Fish were 307 to 470 mm and 300 to 1,350 g. Age Classes IV to XI were represented. Most Age VII males were mature. One female was mature at Age V, all Age VI were mature, but one Age VII female was immature. Stomachs contained snails, clams, and insects.

Northern pike:

Pike was the dominant species in lakes of the Kobuk River delta. They were also abundant in channels and sloughs of the delta and Selawik Lake and Hotham Inlet. Although large numbers of northern pike were captured only 17 were aged. Ages ranged from I through XIII. Fish ranged from 140 to 872 mm FL and up to 4.5 kg in weight.

Other species:

Round whitefish were rarely taken in the Kobuk delta and Kotzebue Sound but the presence of a round whitefish in the brackish Kotzebue Lagoon is noteworthy.

Sheefish:

Further information on sheefish is contained in the 1979 Annual Report of Progress for Sheefish Life History Study in Alaska. Job R-II, Volume 20.

Herring:

Ripe herring were captured by gill net in Kotzebue Lagoon, Kotzebue Sound, Hotham Inlet, and Selawik in mid-June, indicating probable spawning in these areas. Starry founders and humpback whitefish stomachs from Hotham Inlet off the Kobuk River delta contained herring eggs.

Herring data will be analyzed by research projects under the Outer Continental Shelf Environmental Assessment Program, Alaska Department of Fish and Game, Commercial Fish Division.

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