

STATE OF ALASKA

Jay S. Hammond, Governor



Annual Performance Report for

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

WULIK-KIVALINA RIVERS STUDY

by

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations
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Sport Fish and Sport Fish
Waters of Western Alaska -
Wulik-Kivalina Rivers Study

Period Covered: July 1, 1975 to June 30, 1978

ABSTRACT

Information collected on various life history aspects of Wulik River and Kivalina River Arctic char, Salvelinus alpinus (Linnaeus), is presented. Major spawning grounds on both the Kivalina and Wulik rivers have been located and delineated. Overwintering areas are generally described. Information on migrations, size and structure of the spawning population, number and location of spawners, spawning behavior, and location of char fry is also presented. Approximately 3,200 Arctic char spawn in the Wulik-Kivalina system, with 60% spawning in the Kivalina River system. The sex ratio at spawning is approximately three females per male. Grayling Creek is the most important spawning area. The main utilization of these char is for subsistence with a few taken by sport anglers.

RECOMMENDATIONS

1. Monitoring of sport and subsistence take and of spawning populations should be continued.
2. System interchange between the Wulik and Kivalina rivers and between these two streams and other Chukchi Sea waters should be determined.
3. Other streams adjacent to the Kivalina River should be surveyed to determine use by char.
4. Age at first seaward migration should be determined.
5. Overwintering studies should be conducted.
6. Marine studies on char should be conducted.

7. Movement of char in relation to water level fluctuations should be determined.

OBJECTIVES

1. To compile past research information by the Alaska Department of Fish and Game on Arctic char of the Wulik and Kivalina rivers.

BACKGROUND AND INTRODUCTION

The Wulik and Kivalina rivers have long been known as having large populations of Arctic char. These rivers empty into the Chukchi Sea near the village of Kivalina at 67°54'N, 160°31'W and support important subsistence and sport fisheries.

Saario and Kessel (1966) collected information on subsistence utilization of char, and Winslow (1969) documented the fall subsistence harvest on the Wulik River. Winslow also presented the first biological data on Wulik River char. He sampled 130 char ranging in length from 284 to 835 mm and in age from 3 to 16 years and found no evidence of spawning fish.

On September 16, 1968 the Division of Commercial Fisheries, Alaska Department of Fish and Game conducted an aerial survey of the Wulik and Kivalina rivers. In the Wulik River they counted 90,235 char and estimated that 180,500-225,600 were present, and in the Kivalina River they counted 27,460 char and estimated that 46,000 were present. A Division of Commercial Fisheries survey on September 20, 1976, gave a minimum count of 68,200 char in the Wulik River and 12,600 in the Kivalina River. The 1976 survey did not estimate the percentage of the population they felt were enumerated.

The present study was begun in 1975 with the objective of obtaining information on the sport harvest. During subsequent years limited research, mainly on spawning aspects, was conducted in conjunction with collection of angler use data. I spent a week each year, in July of 1975 and August of 1976 and 1977, on the Wulik and Kivalina rivers. In addition to my research, information was obtained from residents of Kivalina, especially Clinton Swan, Bob Halley, and Dan Norton. Phil Driver, who operates a sport fishing lodge on the Wulik River below Ikalukrok Creek, has greatly assisted the project by locating spawning grounds and making observations of run timing, overwintering locations, spawning dates, and angler utilization.

The purpose of this report is to bring together the available knowledge of the Arctic char populations of the Wulik and Kivalina rivers to provide a focal point for further research.

TECHNIQUES

Char were enumerated by walking streams, counting redds, floating streams with a raft and by fixed wing aircraft.

Juvenile char were collected by dip net and gill net while larger char were captured by hook and line.

Study Area

The Kivalina and Wulik rivers are located in northwest Alaska and empty into Kivalina Lagoon then into the Chukchi Sea at 67°54'N, 160°31'W (Fig. 1). Both rivers are clear, fast flowing and located in tundra habitat. The Wulik River is approximately 160 km (100 miles) long with a watershed of 2,227 square km (860 square miles) and the Kivalina River is approximately 113 km (70 miles) long with a watershed of 1,761 square km (680 square miles). Both streams have numerous gravel bars in the upper reaches. The lower reaches of both have deep pools with gravel and sand bottoms.

The Kivalina Village Corporation claims the land surrounding the lower 48 km (30 miles) of each stream. The upper reaches of both streams are under consideration for selection by the Northwest Alaska Native Association (NANA) Regional Corporation as regional deficiency land. Sections of the two rivers not chosen by NANA will revert to public domain.

FINDINGS

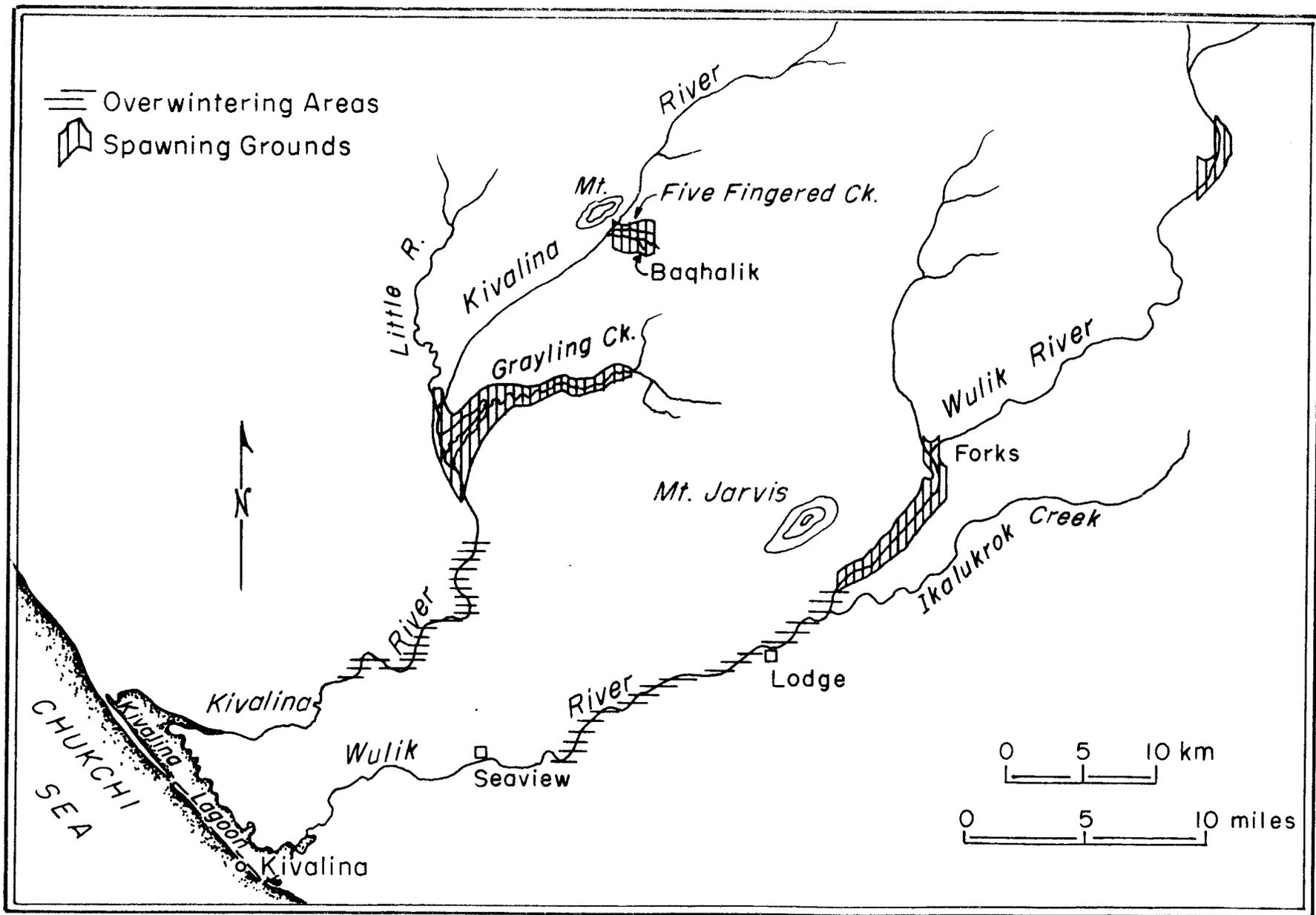
Arctic Char Distribution

In the Kivalina River Arctic char, Salvelinus alpinus (Linnaeus), are found in the mainstem river up to a point near 58°07'N, 103°57'W (opposite a small mountain to the west). At this point char enter either Baqhalik Creek or Five Fingered Creek to spawn. Aerial surveys in 1977 located a group of approximately 20 spawners in the lower 80 m (262 feet) of the West Fork (locally called Little River). No char have been observed farther upstream in this fork of the Kivalina River. Arctic char ascend Grayling Creek up to a distance of approximately 11.2 km (7 miles). Overwintering char are distributed in the lower Kivalina River approximately 14-40 km (9-25 miles) upstream. Wulik River char are distributed mainly in the mainstem river at the forks and below with overwintering concentrations in the 16 km below Ikalukrok Creek. Char have not been observed up the west fork of the Wulik River, but in most years varying numbers of spawning char migrate up the mainstem Wulik River to T 32N, R 19W DeLong Mountains Quadrangle. Other than a few char found in lower Ikalukrok Creek char do not enter tributaries of the Wulik River.

Movements

Char of the Wulik and Kivalina rivers are anadromous and overwinter in fresh water. The general pattern of movement includes most fish spending

Fig. 1. Study area on the Wulik and Kivalina rivers depicting overwintering areas and spawning grounds of Arctic char.



the summer in the ocean, some spawners remaining in the stream all summer to spawn in early August, some spawners re-entering the streams throughout the summer, and nonspawning fish entering the streams to overwinter beginning in early August.

Overwintering

The Wulik River is the more important overwintering stream of the two while the Kivalina River is the more important spawning stream.

Nonspawning and immature char begin entering the Kivalina and Wulik rivers in early to mid-August. These fish generally cease feeding in fresh water. The fish move upstream slowly and reach overwintering grounds on the Wulik River below Ikalukrok Creek by early September. By late September overwintering grounds 10 km (6 miles) above Ikalukrok Creek to 24 km (15 miles) below Ikalukrok Creek are occupied. Kivalina River overwintering areas are not fully documented but probably extend from 16 to 48 km (river mile 10 to mile 30). Prime overwintering sites are in fairly swift waters, with clean gravel bottoms and water depths of 0.6-1.5 m (2-5 feet). Overwintering areas are not directly related to spring areas, yet many of the overwintering areas remain open all winter.

Movements into overwintering areas in 1975 were later than normal. This may have been a response to needing more feeding time in the ocean as close pack ice in 1975 prevented the fish from fully dispersing into the ocean until July 14.

Local Kivalina residents report four overlapping runs of overwintering char entering the Wulik and Kivalina rivers. The average weight of fish in each subsequent run increases, with the final run, which enters the river under the ice, containing the largest fish. The larger fish overwinter further downstream but there is some overlap. On August 22, 1977 there were approximately 10,000-20,000 char in the lower 26 km (16 miles) of the Wulik River. Twelve overwintering fish captured ranged in length from 41 to 56 cm (\bar{x} = 50.6 cm) and in weight from 0.8 to 2.0 kg (1 3/4 to 4 1/2 lbs) (\bar{x} = 1.55 kg). Some smaller char but no larger ones were observed. A group of sport fishermen who fished the same area the week of September 10 caught many char between 1.8 and 2.7 kg (4 and 6 lbs) and one of 3.6 kg (8 lbs). Winslow (1969) measured 462 subsistence caught char captured by seine in late September 1968. Fish ranged from 241-850 mm with most fish between 320-380 mm. Average estimated weight of these fish was 1.1 kg (2.4 lbs). Spent fish probably overwinter with the nonspawners but evidence suggests that some may go out to the ocean to feed for a month or two. The overwintering location of juveniles has not been investigated.

Spring Outmigration

At breakup, usually late May or early June, char migrate to the ocean. If the ice in the Chukchi Sea has moved far offshore, the migration to the sea will be of short duration and most char are gone by late June.

If the pack ice is hard on shore as during the summer of 1975 they remain in the lower Kivalina and Wulik rivers, Kivalina Lagoon, and the Chukchi Sea just outside the Kivalina Lagoon. On July 6, 1975 outmigrating char were being taken by subsistence fishermen at the mouth of the Wulik River and in a small open water area on the seaward side of Kivalina. Fish examined were 0.25-2.95 kg (0.5-6.5 lbs), silvery in color, and in poor condition. Appearance of the gonads of a few char indicated they would spawn the coming fall.

Summer Movements

In the Ocean:

Wulik and Kivalina river char move at least as far north as Point Hope and south to Kotzebue Sound during the summer. Phil Driver (pers. comm.) observed small schools of char in the Chukchi Sea off Kivalina in June and July, and Dave Rosenau, Biologist with Renewable Resources LTD., Fairbanks, (pers. comm.) observed char and captured them in a gill net off Cape Thompson in July. These char were definitely swimming north and Rosenau felt they were feeding on the abundant small cod (Genus and species unknown) associated with drifting ice floes. Both informants indicated that char are close to the surface of the ocean only in early summer. Kivalina residents mentioned that Point Hope people caught char only in mid summer and principally on the south side of the cape. They concluded that these fish were from Kivalina since the run of char in the Kukpuk River (north side of the cape) is small in magnitude and the fish are smaller.

Conclusive evidence of char movement south to Kotzebue Sound is provided by capture of four Kotzebue Sound tagged char in the Wulik River. Three were tagged at Sheshalik Spit on August 21 and recaptured between September 7 and September 28 in the Wulik River while the fourth fish was tagged at Kotzebue in mid August and recovered October 2 in the Wulik River (Yanagawa, 1969). These tag recoveries may indicate system interchange between the Wulik and Noatak or Kobuk rivers, but I believe that the normal southward summer movement of Wulik-Kivalina char extends only to the Kotzebue Sound area. Spawning char were observed migrating up Rabbit Creek (about 40 km south of the Wulik River) in early July and these fish might be expected to use the Wulik River for overwintering since Rabbit Creek is shallow throughout its length.

Summer Movements of Spawners

In the Wulik and Kivalina rivers probably in excess of 50% of the pre-spawning fish do not go out to the ocean at breakup but rather migrate upriver to spawning grounds. On July 5, 1975 I observed prespawning char on spawning grounds in the Wulik and Kivalina rivers and Grayling Creek (Kivalina River tributary). At this time char in the lower reaches of the two rivers were still going out to the ocean. Phil Driver (pers. comm.) observed char on the spawning grounds of both rivers as early as late June. Spawning grounds at the Wulik River forks are approximately 32 km (20 miles) above overwintering grounds. Other char were observed

moving upstream toward spawning grounds in mid July. Based on their dark coloration, it is postulated that these fish had not entered the ocean, but had overwintered farther downstream. In mid to late August silvery colored prespawning char were migrating upstream toward spawning grounds, but these fish had probably spent part of the summer in the ocean feeding. A 2 kg (4.5 lb) silver colored, prespawning female char was caught at the mouth of Grayling Creek on August 22, 1977. Most other char had already spawned at this time. It is probable that in most years the percentage of fish coming into the rivers to spawn after feeding in the ocean is much lower than the percentage of fish remaining in the river all summer. The movement into the river from the ocean and upstream is erratic and probably occurs in response to rises in the water level. Subsistence nets set at the mouth of the Wulik River by Eskimos are often removed when the water rises, thus they cannot fully document this immigration. Movement to the farthest upstream spawning grounds in the Wulik and Kivalina rivers is of longer duration and fish may not reach these areas until late August or September.

Post Spawning Movements

Char spawning in early and mid August leave the spawning grounds soon after spawning and migrate downstream. It is probable that some of the early spawners go out to the ocean to feed, then re-enter the river under the ice for overwintering. At completion of spawning these fish have been in the river for 12 months and it seems unlikely that they could spend another 9 months in fresh water without feeding.

Spent char caught on hook and line in late August were in poor condition but no dead fish were observed in spawning areas.

A few spent char are taken in subsistence gill nets at the mouth of the Wulik River in August and these are referred to as "sick rainbow trout" and are not utilized.

On August 23, 1976 about 90% of the char in Grayling Creek had left. Thirty females and 4 or 5 males were on spawning redds in the Kivalina River at the mouth of Grayling Creek (approximately 100 total redds) and some spawning char were on redds upstream of Grayling Creek. On August 25 over 85% the char on spawning grounds at the Wulik River forks had completed spawning and migrated downstream.

On August 21, 1977 about 75% of the char on the Grayling Creek spawning grounds had left.

Phil Driver (pers. comm.) observed spent fish moving down the Wulik River past his lodge below Ikalukrok Creek in late September of 1975. These late spawning char probably had been feeding in the ocean before spawning. They would probably join overwintering concentrations then migrate to sea the following spring.

Movements of Juveniles

Very few juvenile char have been found in the Wulik or Kivalina rivers, but thousands of young-of-the-year and some yearling char were found in spring areas adjacent to spawning grounds on Grayling Creek on August 21, 1977. Young-of-the-year char in Grayling Creek were concentrated in spring areas located above the existing water level of Grayling Creek. The char had probably moved into these spring areas when water levels were higher at breakup.

If age at first seaward migration is the same as for North Slope rivers, the Wulik-Kivalina char should migrate at age II to V with 95% of the fish smolting at age III and IV (152-195 mm) Yoshihara, (1973).

Spawning

Location of Spawning Grounds:

Arctic char spawn in both the Wulik and Kivalina rivers. In the Wulik River, spawning grounds are located from approximately 10 km (6 miles) above Ikalukrok Creek to the Wulik River forks, with lesser spawning grounds located in the vicinity of T 32N, R 19W DeLong Quadrangle. Spawning grounds are in the mainstem Wulik River with some spring influenced spawning areas located in small side channels below the Wulik River Forks. In the Kivalina River system spawning grounds are located in the mainstem Kivalina River from below Grayling Creek to 7 km (4 miles) above Grayling Creek with the largest grounds located at the mouth of Grayling Creek. Some spawning probably occurs in the lower 400 m of the Little River (western fork of Kivalina River). The three tributary streams of the Kivalina River that contain spawning grounds are entirely spring (groundwater) influenced. Grayling Creek is a very important spawning stream with most spawning occurring from Mile 1 (from mouth) to Mile 7. Concentration of redds is always immediately below a point where groundwater from a spring allows flow into Grayling Creek. The two small spring-fed streamlets entering the Kivalina from the east at 68°10'N, 163°55'W and approximately 21 km (13 miles) above Grayling Creek are used intermittently for spawning, depending on water level of the Kivalina River. The more northerly of the two, Five Fingered Creek, begins as a spring in the side of a hill about 300 m east of the Kivalina River. No flow measurements are available. The second spawning ground, called Baqhalik, is about 200 m downstream from Five Fingered Creek. Baqhalik begins as a spring in the side of a small hill and runs for about 150 m before joining a small stream that empties into the Kivalina River 200 m to the west. The creek has a number of mouths entering the Kivalina. Spawning grounds are located mainly in the area close to the spring.

In the Wulik River, spawning grounds are located in the mainstem Wulik from about Ikalukrok Creek to the Wulik River forks and isolated spawning grounds approximately 48 km (30 miles) above the Wulik River forks. Most spawning occurs in the forks and for 1.6 km (1 mile) below the forks. Except for a small side slough 1.6 km below the Wulik River

forks and the site 48 km (30 miles) above the forks, the Wulik River spawning grounds are not directly influenced by groundwater.

The Spawning Population:

It is estimated that 3,000-4,000 char may spawn in the Wulik and Kivalina rivers, with the Kivalina River probably containing 60% of the spawning fish. The Grayling Creek spawning ground was walked on August 20 and 21, 1977 and 633 spawning redds were counted, including 250 from Mile 7 to Mile 4, 454 from Mile 4 to Mile 2.5, and 62 in the lower 2.5 miles (4 km). One-hundred nine redds were counted in a single run below an extensive groundwater source. There were still nearly 200 char in the creek and some of these had not yet spawned, thus the total number of redds would total 700. The sex ratio was estimated at 3 females per 1 male to give a total spawning population for Grayling Creek of 933 fish. Spawners entering the stream in September would probably push the total over 1,000. In 1976 Grayling Creek was floated by raft on August 24 and 25 and fewer than 600 redds were counted. Most char had completed spawning and left the stream. It is felt that many redds were missed because of the mode of travel. In 1976 there were more redds in the lower 4 km (2.5 miles) of Grayling Creek than in 1977 (200 versus 62).

In 1977 spawning redds in the main Kivalina River could not be counted because of turbid water. On August 25, 1976, 150 redds were located below the mouth of Grayling Creek, about 50 were found in the 3.2 km (2 miles) below Grayling Creek to the Kivalina River forks and an unknown number of spawners were present in Baqhalik and Five Fingered Creek (average number of spawners probably totaled 500). Thus the estimated spawning population of the Kivalina River system is 1,900 fish. Phil Driver (pers. comm.) said that spawning char entered Five Fingered Creek in September and that fresh spawning char entered Grayling Creek in mid to late September.

At the Wulik River forks, 500 spawning redds were enumerated in this extensive spawning grounds on August 26, 1976. Fifty redds were observed in the 0.8 km (one-half mile) section below the Wulik River forks. Approximately 100 char were still in the vicinity of the spawning grounds near the forks, approximately 100 were aerielly enumerated near the spawning grounds 48 km (30 miles) above the forks and approximately 300 were enumerated in the area from Ikalukrok Creek to the area 0.8 km (one-half mile) below the forks. Assuming a 3:1 sex ratio the total spawning population on August 25 was 1,231 fish. Phil Driver (pers. comm.) said that more spawners arrived on the Wulik River spawning grounds in mid to late September and that numbers of spawners on the spawning ground 48 km (30 miles) above the forks fluctuates from zero in some years to as high as 400 fish.

Duration of Spawning:

Wulik and Kivalina river char spawn from early August to at least late September. In both 1976 and 1977 spawning ground surveys indicated that over 80% of the char of the 'early run' had completed spawning by

August 26. Some char would enter Grayling Creek, and the Wulik River later and spawn in September. Three female prespawning, silvery colored char were taken near Phil Driver's Lodge 4.8 km (3 miles) below Ikalukrok Creek between August 25 and 28, 1976. These females would probably not ripen and spawn for another three weeks. The peaks of spawning then, appear to be mid August and mid September. Char normally do not enter Baqhalik or Five Fingered Creek until early September. No observations were made of spawning grounds 48 km (30 miles) above the Wulik River forks but these fish probably spawn in September. Char in Grayling Creek spawned slightly before char in the main Kivalina or Wulik and char in lower Grayling Creek spawned slightly earlier than upper Grayling Creek char. Char spawning activity was observed during the daylight hours.

Physical Description of Spawning Grounds:

Char spawn over a gravel bottom in water 0.15 to 1.22 m (6" to 4') deep with slow to moderate current. In Grayling Creek and at least one small side slough of the Wulik River redds were adjacent to and slightly downstream from spring areas. A large spring at the east side of Grayling Creek approximately 11 km (7 miles) upstream marks the upper limit of the spawning ground. Abundant groundwater sources cause the stream to increase rapidly in size. Upper Grayling Creek averages 0.9-1.5 m in width, 25-40 cm in depth and has current of 1.0-1.2 m/sec. Lower Grayling Creek (4.8 km upstream) is about 24 m wide and 0.3 m average depth with a current of 0.5 m/sec and a calculated flow of 3.47 m³/sec on August 25, 1976. Redds in the upper part of Grayling Creek (Mile 4-Mile 7) were in 0.3-0.75 m (12"-30") of water and bottom composition of redds was 10% sand and silt, 20% fine gravel (3.2-25 mm diameter), 30% medium gravel 25-50 mm diameter), 30% coarse gravel (50-250 mm diameter) and, 10% boulders. Redds in lower Grayling Creek were in 0.36-1.52 m (14"-60") of water. Bottom composition was 10% sand and silt, 20% fine gravel, 50% medium gravel and 20% coarse gravel. In all areas the substrate was very uncompacted, probably a result of groundwater flow.

Redds in the main Kivalina River were in 0.3-1.22 m (12"-48") of water, at a velocity of 0.38 m/sec (1.25 fps) with bottom composition similar to that found in lower Grayling Creek. Redds at the Wulik River forks were in 0.38-1.27 m (15"-50") of water, and bottom composition in the most concentrated spawning area was 10% sand, 10% fine gravel, 30% medium gravel and 50% coarse gravel. Current flow taken across a 58 m (190') wide channel that bisected many of the redds was 0.34 m/sec (1.1 fps) and the calculated flow was 7.78 m³/sec (278 cfs). Redds in Baqhalik and Five Fingered Creek would probably be in water shallower than 0.4 m (16"). Water from these two creeks form extensive aufeis areas in the Kivalina River which were still visible in July.

Water temperature on the spawning redds ranged from 6.5° to 11°C (Table 1).

Table 1. Water temperature from selected areas Kivalina and Wulik rivers.

Area	Water Temp. °C	Date	Spring Area Influence
Wulik R. Forks	11.0	8/28/76	no
		7/6/75	no
Wulik R. below Ikalukrak Cr.	11.5	8/20/77	no
			no
Kivalina R. (Grayling Cr. mouth)	11.0	7/6/75	no
	12.5	8/22/77	no
	8.0	8/27/76	no
Grayling Cr. mouth	9.0	7/6/75	no
	10.5	8/21/77	no
Grayling Cr. 2-3 miles (3.2-4.8 km) upstream	8.0	8/26/76	yes
	8.5	8/21/77	yes
Grayling Cr. 6 miles (9.6 km) upstream	6.5	8/20/77	yes
	6.0	8/26/76	yes
Grayling Cr. Springs	4.0	8/26/76	yes
Grayling Cr. Springs 6 miles (9.6 km) upstream	6.0	8/19/77	yes

Spawning Activity:

A male (approximately 4.5 kg or 10 lbs) and a female (approximately 2.27 kg or 5 lbs) were observed spawning in a redd that was approximately 2.4 x 1.2 m (8' long by 4' wide) in 0.4 m (16") of water. Probably other females had spawned in this redd and it was counted as two redds. The female did all of the digging, always on the upstream side of the redd. After digging for a period the female would lay some eggs and the male would fertilize them. The male would chase away other males and females and occasionally the spawning female would leave the redd and chase away other char. This redd, located about 10.4 km (6.5 miles) up Grayling Creek, was the largest seen and was downstream from groundwater sources in the main stream and off to the side of the stream. The bottom was uncompacted. Of fish observed on the spawning grounds there were approximately three females per male. No small residual males (dwarf mature fish which spent their entire life in the stream) were observed on the spawning grounds and it is assumed that each male spawns with three females or occasionally more. Since the size of redds varied considerably it appears that a number of females will spawn in a single redd with a single male, but on other occasions the females will each spawn in separate redds. On a number of occasions a male was observed resting on top of a redd with no female in the area. The female that had dug the redd probably left the area and the male was waiting for a new female. Egg diameter of prespawners on July 5 was 3.3 mm at the Wulik River spawning grounds and 3.3 mm from a female taken in the ocean at Kivalina. Unfertilized egg diameter at spawning was 5.0-5.5 mm. Yoshihara (1973) gave a mean diameter of 4.2 mm for Sagavanirktok River char eggs. Spent female char examined were in poor condition but no dead char were observed near the spawning grounds or downstream.

Char redds ranged in shape from circular to rectangular and in size from 25 x 25 cm (10" x 10") to 2.4 x 1.2 m (8' x 4'). Most were circular and 35-46 cm (14"-18") in diameter. In Grayling Creek the larger redds were farther upstream and most redds in the lower 6.4 km (4 miles) were circular or slightly oblong and 35-46 cm (14"-18") in diameter. Redds in the main Kivalina and Wulik rivers were mainly of the smaller size. There appeared to be no correlation between size of redd and size of female.

Size of Spawners, Sex Ratio and Frequency of Spawning:

Fork length of spawning fish examined ranged from 49 cm to 78 cm (\bar{x} = 60 cm) and 1.36 to 4.68 kg (\bar{x} = 2.5 kg) for females (n = 37) and 48 cm to 82.5 cm (\bar{x} = 70.5 cm) and 1.02 to 6.02 kg (\bar{x} = 3.86 kg) for males (n = 15). Larger fish of both sexes were present on spawning grounds but were not captured.

Fish taken from the spawning grounds in early July weighed more per given length than fish captured in the same area during spawning. In July males averaging 74 cm weighed 5.33 kg while in late August a 74 cm spawning male could weigh less than 3.6 kg. Females averaging 62.5 cm

in July weighed 2.77 kg, while August spent fish of that length would weigh about 2.25 kg.

Sex ratio on spawning grounds of three females per male is estimated on the basis of char remaining on spawning beds after most of the spawning had been completed during mid to late August of 1976 and 1977. Char were counted on spawning grounds in Grayling Creek, the Kivalina River, and the Wulik River forks.

In early July of 1975, 11 of 14 char captured at the mouth of Grayling Creek were females and 7 of 9 captured at the Wulik River forks on July 5 were females. Phil Driver (pers. comm.) reported that sport fishermen caught 3-4 females per male in spawning areas in July.

An uneven sex ratio skewed toward females has also been found in other areas. Yoshihara (1973) found a sex ratio of one male per 1.29 females for all spawning char of the Sagavanirktok River and I found one male per 19 females at a spawning ground on Wrench Creek (Kelly River) and observed six males and about 50 females near spawning grounds on the Kelly River (Noatak system) on August 30, 1976.

During the three years of the study only one immature fish was observed in the vicinity of the spawning grounds.

Frequency of Spawning:

Some Wulik-Kivalina rivers char are probably nonconsecutive spawners although only indirect evidence is available.

Winslow (1969) examined 139 Wulik River Arctic char from overwintering areas in late September and found many large fish that were not in spawning condition. Interpretation of his data indicates that approximately 30 fish were nonconsecutive spawners (fork length 590-835 mm). He found no spent fish in the overwintering aggregation. From my observations on char captured and those observed in the lower Wulik River on August 23, 1977 all fish in the lower river at that time were immature. Larger char, many of them nonconsecutive spawners, evidently enter the river later in August and September. Furniss (1974) found, through an extensive tagging program, that 95% of the Sagavanirktok River Arctic char are nonconsecutive spawners and that some probably spawned every third year.

Age and Growth

The few char aged during the study complement Winslow's (1969) data and established age at maturity at VI-IX for females (515-600 mm) and probably VI-IX for males. Most Wulik-Kivalina char are probably mature at age IX. Mean age of female spawners, based on an average length of 60 cm, was estimated at age VIII to IX and mean age of male spawners (\bar{x} = 70.5 cm) is probably age XI-XIII.

Ages of immature overwintering fish captured by hook and line in the lower Wulik River on August 22 were VI and VII (n = 6) (fork length range = 47.5-55.5 cm).

Juvenile Char:

Young-of-the-year char examined in spring areas of Grayling Creek ranged in length from 38 to 52 mm on August 22. These fish are about the same size as young-of-the-year Sagavanirktok River char (39-70 mm in September) (Yoshihara, 1973). Very few rearing char of age I and over were captured or observed in the Wulik and Kivalina rivers. One age I char was 115 mm fork length in length in late September and two age II char were 124-126 mm fork length in late September. Winslow's (1969) data showed some age III char returning as overwintering fish.

Utilization

The greatest use of Arctic char in the Wulik and Kivalina rivers is for subsistence. The total harvest in past years has probably been slightly below the estimated 50,000 fish taken in 1960 (Saario and Kessel 1966) and in 1968 (Winslow, 1969). During the 1970's traditional fall seining, areas located approximately 40 km (25 miles) up the Wulik River were seldom used and fishing effort shifted to the lower Wulik River. Fish are captured by gill net and seines in the lower 16 km (10 miles) of the river and by hook and line in the lower Wulik River and in the ocean at Kivalina.

A sport fishing lodge has been in operation approximately 6.4 km (4 miles) below Ikalukrak Creek on the Wulik River since 1973 and it recorded fishing pressure ranging from 70 man-days in 1977 to 400 man-days in 1975 and 230 days in 1976. This guided fishery kills very few char as most are returned to the water. Winslow (1969) reported 70-80 sport fishermen trips to the Wulik River in 1967 and 50-60 trips in 1968. The number of fishermen trips in years since that time (exclusive of those at the sport fishing lodge) has probably not increased in number.

It is estimated that the total sport catch is about 5% of the subsistence harvest and the majority of the sport harvest consists of immature and non-consecutive spawning overwintering fish taken in August and September. The subsistence fishery takes mainly nonspawning fish although some potential spawners are captured on their spring outmigration or early fall immigration.

Other Species

Grayling, Thymallus arcticus (Pallas), are common throughout the Wulik and Kivalina drainages and are very abundant in Grayling Creek. An estimated 4,000 were enumerated during a late August 1976 float of this stream. Phil Driver (pers. comm.) said these grayling leave Grayling Creek by September. Very few grayling under 200 mm fork length were observed, thus this spring fed creek may not be a grayling spawning

stream, a situation similar to that of spring fed streams in Interior Alaska. Young-of-the-year grayling were captured in front of Phil Driver's lodge on the Wulik River in August.

At least four species of salmon, Oncorhynchus sp., (chinook, coho, chum and pink) spawn in the Wulik-Kivalina system. According to Kivalina residents the salmon runs, especially chums, O. keta (Walbaum), have been steadily increasing in magnitude. Pink salmon, O. gorbuscha (Walbaum), spawn in the lower reaches of both rivers, two silver salmon, O. kisutch (Walbaum), were observed at the Wulik River forks in late August 1976 and two king salmon, O. tshawytscha (Walbaum), were observed about 10 miles up the Kivalina River on August 22, 1977. Nearly all chum salmon enter the Wulik River and spawn approximately 32 km (20 miles) up Ikalukrok Creek (approximately 500 fish). Six pairs of chums were observed spawning in the Kivalina River 40 m above the mouth of Grayling Creek on August 25, 1976. Sculpins, Cottus cognatus Richardson, and round whitefish, Prosopium cylindraceum (Pallas), are found upstream in the Wulik and Kivalina rivers. A school of approximately 100 round whitefish was observed in a slough 8 km (5 miles) up Grayling Creek.

Humpback whitefish, Coregonus pidschian (Gmelin), least cisco, Coregonus sardinella Valenciennes, Bering cisco, Coregonus laurettae Bean, and blackfish, Dallia pectoralis Bean, are present in the lower reaches of the two rivers but it is not known if they spawn in the Wulik or Kivalina.

MANAGEMENT CONSIDERATIONS

Important habitat areas of Wulik and Kivalina river char have been identified. Spawning areas located in the mid to upper reaches of both rivers are most important. Char are present in the Wulik and Kivalina rivers during the entire year, thus there is no "safe time" to conduct activities which might affect char habitat or spawning fish in the Wulik and Kivalina rivers. August and September are the most important months for spawning fish.

If the total spawning population of the Wulik and Kivalina rivers is indeed approximately 4,000 fish and the total population is 250,000 fish, it is felt that with a subsistence harvest of 40,000-50,000 fish and a sport harvest of approximately 5% of the subsistence harvest, the total harvest may be near the maximum allowable.

LITERATURE CITED

Furniss, R. 1974. Inventory and cataloging of Arctic area waters. Alaska Dept. Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress 1973-1974.

Saario, R. and B. Kessel. 1966. Human ecological investigations at Kivalina. In "Environment of the Cape Thompson Region, Alaska" Edited by N. Wilimovsky and J. Wolfe. U. S. Atomic Energy Commission. pp. 969-1040.

Winslow, P. 1969. Investigations and cataloging of sport fish and sport fish waters in Interior Alaska - char in Northwestern Alaska. Alaska Dept. Fish and Game. Federal Aid in Fish Restoration, Progress Report, 1968-1969. Project F-9-1, 10 (16-A).

Yanagawa, C. 1969. Kotzebue chum salmon tagging project 1966-1968. Fishery Bull. #7, AYK Region, Alaska Dept. Fish and Game, Anchorage.

Yoshihara, H. T. 1973. Monitoring and evaluation of Arctic waters with emphasis on the North Slope drainages. Alaska Dept. Fish and Game. Federal Aid in Fish Restoration, Annual Progress Report, 1972-1973. Project F-9-5, 14 (G-III-D).

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