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FALL MOVEMENTS AND OVERWINTERING OF ARCTIC GRAYLING IN THE ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA, 1985

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Key words: Arctic grayling, movements, overwintering, Arctic National Wildlife Refuge

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Fall movements and overwintering of Arctic grayling in the Arctic National Wildlife Refuge, Alaska, 1985.

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Abstract: Radio transmitters were surgically implanted in 38 Arctic grayling (Thymallus arcticus) from three north slope drainages in the Arctic National Wildlife Refuge, Alaska in July and August 1985. These fish were tracked periodically by air until late December 1985. Radio-tagged grayling began their migration to overwintering locations in August and were at or near those sites by early September. Grayling from the Tamayariak River were relocated in the lower mainstem of the Canning River and lower Canning River delta. Grayling from Itkilyariak Creek were relocated in the Sadlerochit River near its confluence with the Itkilyariak, below Sadlerochit Springs in the main river, along the Kekiktuk River, and in Schrader Lake. Grayling from the Akutoktak River were relocated at Fish Holes #1 and #2 on the Hulahula River, near the mouth of the Hulahula River, near the confluence of the Okpilak and Akutoktak Rivers, and in the Okpilak River where it emerges from the foothills. The signals from three radio-transmitters implanted in fish in 1984 were also received during 1985 tracking periods.

INTRODUCTION

Arctic grayling (Thymallus arcticus) during summer months are distributed throughout the Arctic National Wildlife Refuge in tundra streams (Smith and Glesne 1982, Daum et al. 1984, West and Wiswar 1985). Flowing water becomes scarce by late November and the habitat available to Arctic grayling is restricted to springs and deeper pools. A radio telemetry project was initiated in 1984 to determine fall movements and identify overwintering locations of grayling. In 1985, this method was used again to confirm multi-year use of the overwintering locations. Three river drainages on the west side of the refuge were examined: the Tamayariak River, Sadlerochit River/Itkilyariak Creek, and Okpilak/Akutoktak Rivers.

METHODS

The Tamayariak and Akutoktak Rivers and Itkilyariak Creek are tundra streams (Craig and McCart 1974b) and have been described by Smith and Glesne (1982) and Daum et al. (1984). These rivers are tributaries to mountain streams (Craig and McCart 1974b) and do not flow directly to the Beaufort Sea. The Tamayariak River shares a large delta with the Canning River (Fig. 2). Itkilyariak Creek and Akutoktak River are tributaries to the Sadlerochit and Okpilak Rivers, respectively (Figs. 1, 3 and 4).

Telonics radio transmitters were surgically implanted in grayling. The characteristics of the transmitters were:

life expectancy = 90 days
mean weight = 14.8 g
mean length = 48 mm
mean width = 14 mm
pulse rate = 34 pulses per minute.

Arctic grayling selected for transmitter implantation were not less than 355 mm in fork length. Grayling were captured by angling and anesthetized in tricaine methanesulfonate (MS-222). Transmitters were surgically implanted through a small incision anterior to the pelvic girdle. The whip antenna was threaded under the pelvic girdle with the aid of a surgical needle and allowed to trail behind the fish. The incision was closed with 7 to 10 stitches from a 2/0 suture. Fish were immediately placed in shallow backwaters for recovery; most resumed posture within 7 minutes.

Transmitters were implanted in 9 grayling in the lower 10 km of the Tamayariak River between August 28 and 29, in 14 grayling on Itkilyariak Creek (near its confluence with the Sadlerochit River) between August 22 and 26, and in 15 grayling on the Akutoktak River between July 26 and 29.

Aerial tracking using a Cessna 185 outfitted with wing-mounted "H" antennas and a Telonics scanner-receiver was conducted periodically (at 3-6 week intervals) between August and December 1985. Altitudes varied from 300 to 1500 feet. Locations were plotted on USGS 1:250,000 topographic maps and distances were measured using a map wheel.

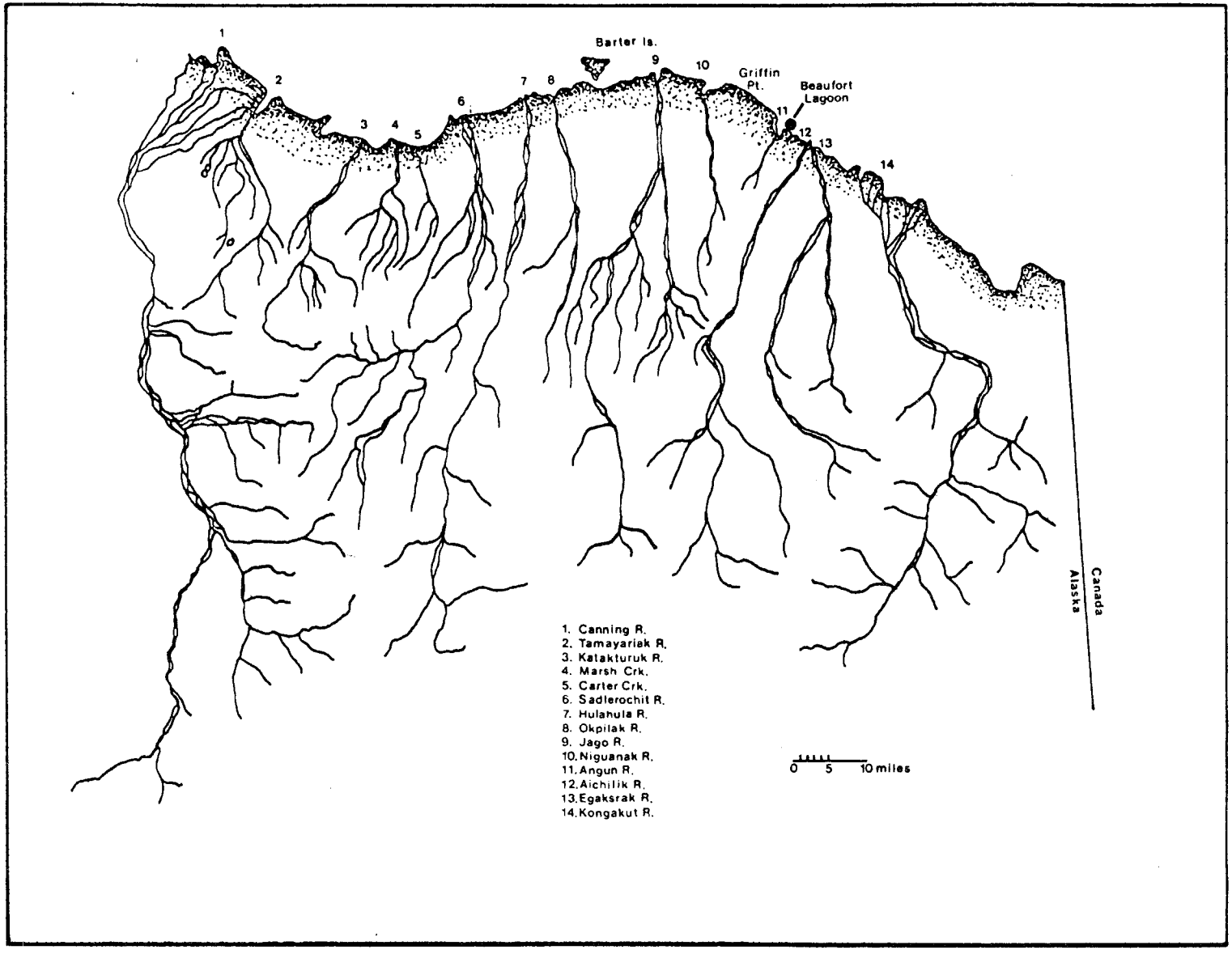

Figure 1. Major rivers on the north slope in the Arctic National Wildlife Refuge, Alaska.

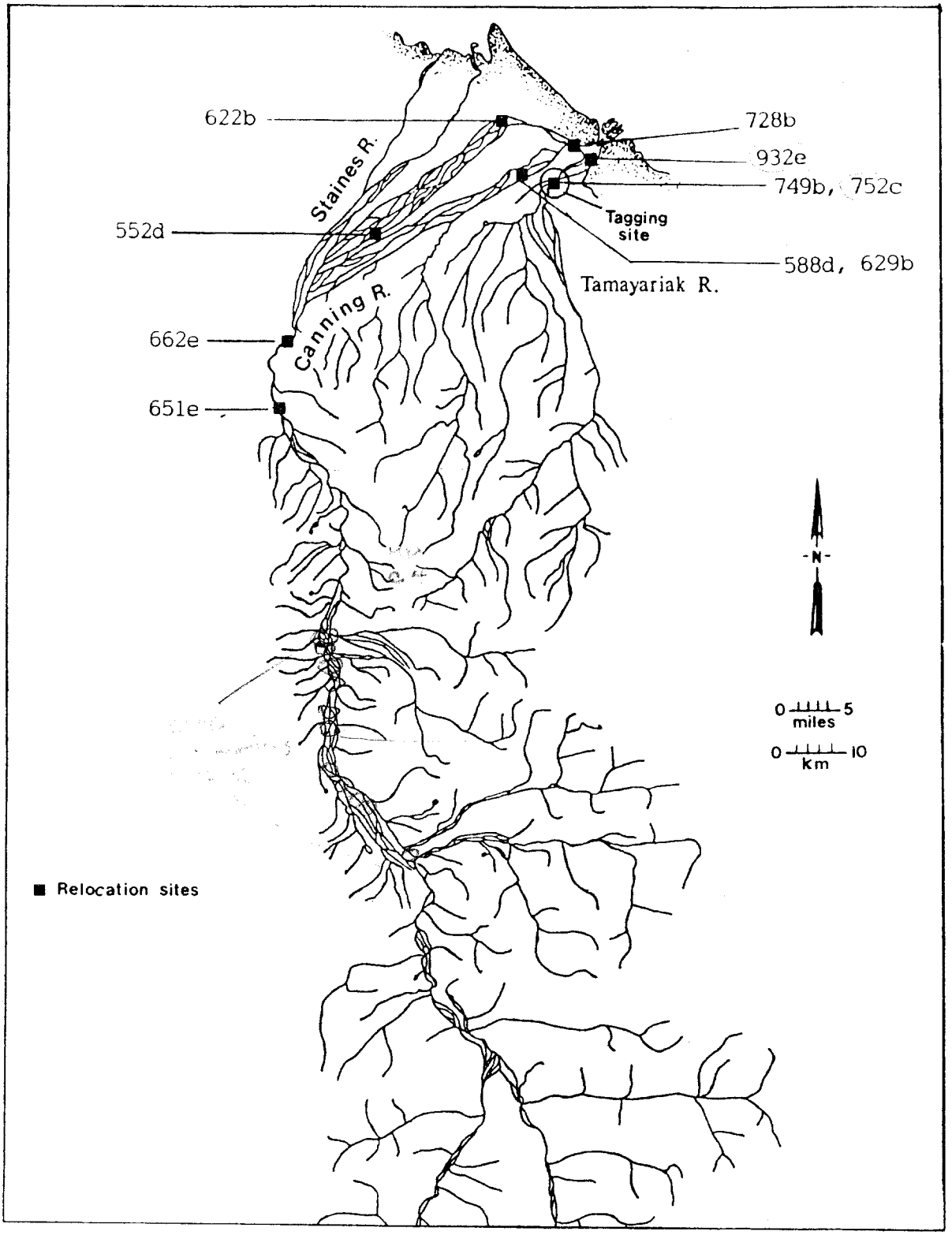

Figure 2. Tagging site and last known relocation sites of 10 radio-tagged Arctic grayling, Tamayariak and Canning Rivers, Alaska, 1985. Tracking periods: a = August, b = September, c = October, d = Novemeber, e = December. Information on individual fish and transmitter frequencies is given in Table 1.

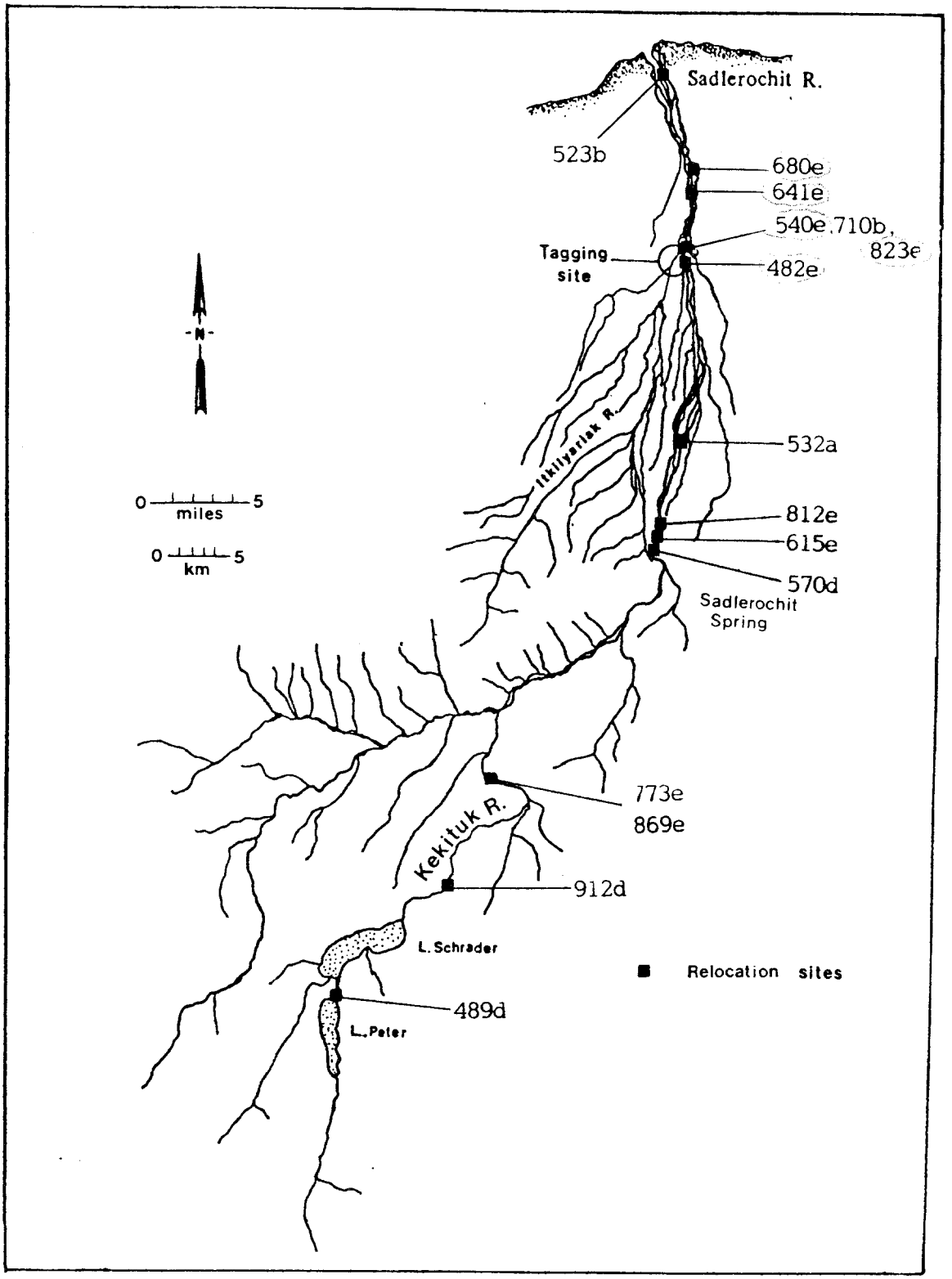

Figure 3. Tagging site and last known relocation sites of 15 radio-tagged Arctic grayling, Sadlerochit River, Alaska, 1985. Tracking periods: a = August, b = September, c = October, d = Novemeber, e = December. Information on individual fish and transmitter frequencies is given in Table 1.

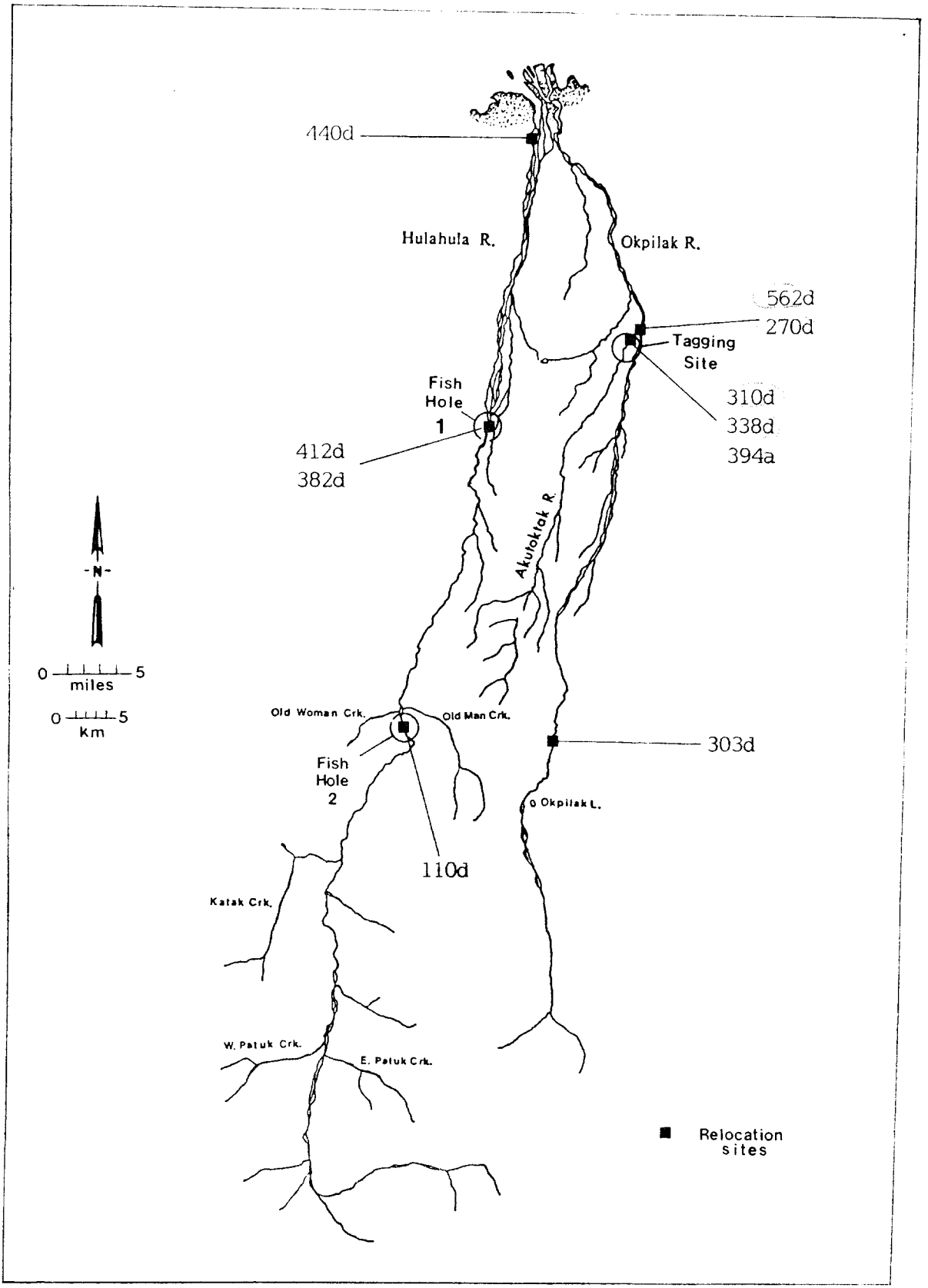

Figure 4. Tagging site and last known relocation sites of 10 radio-tagged Arctic grayling, Okpilak and Hulahula Rivers, Alaska, 1985. Tracking periods: a = August, b = September, c = October, d = Novemeber, e = December. Information on individual fish and transmitter frequencies is given in Table 1.

RESULTS

Thirty-eight Arctic grayling ranging in length from 355-433 mm were surgically implanted with radio transmitters (Table 1). Surgery time ranged from 5.5 to 15 minutes (mean = 8.9 minutes).

Only 5 grayling were not relocated. These 5 fish were from the Okpilak/ Akutoktak River drainage. Tracking success varied: 25 grayling (66%) were relocated in September, 17 (45%) in October, and 23 (61%) in November. In December only the lower Canning and Sadlerochit River drainages were flown due to poor visibility over the other rivers. Of the 23 fish tracked on these two drainages, 12 (52%) were relocated.

Canning/Tamayariak Rivers

All 9 Arctic grayling implanted with radio transmitters in the Tamayariak River were relocated on August 30, 1 to 2 days after transmitters were implanted (Table 1). There was little (less than 6 km) or no change in location from the release sites. By mid-September, four fish had moved to the lower Canning River, travelling between 9-20 km .

Three grayling were relocated on October 7 in the main channel of the Canning River just above the Staines River fork. Flowing water was still visible in the main channel of the Canning River at this time. Total migration distance from release site was about 45 km (Table 1), the longest recorded in this drainage. By the beginning of November flowing water was visible only at spring areas. Grayling were again found in the main channel of the Canning River below the Staines River fork and two were found in the east channel of the lower Canning River near the delta. On December 20, 3 grayling were located. These fish had moved little from their November locations. Overwintering locations appear to be distributed in the lower 5 km of the Canning and Tamayariak Rivers and in the main channel of the Canning, extending from the Staines River fork upstream approximately 10 km (Fig. 2).

Two grayling implanted with transmitters in the Tamayariak last year (August 1984) were located in the lower Canning and Tamayariak Rivers during this year's tracking (Table 1, Fig. 2). This was the first reception of radio signals from these fish since their release. Both fish were equipped with transmitters manufactured by Advanced Telemetry Systems (ATS), Minnesota, U.S.A.

Sadlerochit River/Itkilyariak Creek

All 14 Arctic grayling implanted with transmitters in Itkilyariak Creek were relocated by aerial tracking on August 29, 3 to 7 days after their release (Table 1). Eight fish remained in Itkilyariak Creek and moved little (less than 5 km) or no distance. The other six fish were distributed in the Sadlerochit River, moving 10-19 km upstream from the confluence of Itkilyariak Creek. One grayling tagged with an ATS transmitter in August 1984 was also

relocated on August 29, 1985 near the confluence of the Sadlerochit River and Itkilyariak Creek. Four more grayling had migrated out of the Itkilyariak before the September 12 tracking. One fish moved up the Sadlerochit River into the Kekiktuk River, a distance of about 48 km. Two fish moved upstream in the Sadlerochit River about 14 km, and one grayling moved downstream 13 km. Three of the six grayling that started upstream migrations in August continued upstream 16-26 km beyond their previous locations. The October 7 tracking, revealed grayling had moved little from the previous month's location. The greatest movement recorded was 11 km upstream. Grayling remained in the Sadlerochit River within 10 km of the Itkilyariak Creek confluence, in the Sadlerochit River adjacent to Sadlerochit Springs, and the lower Kekiktuk River. The distribution of fish in November and December was similar to the October distribution with one notable exception: one grayling was relocated in the small stream between Peters and Schrader Lakes (Fig. 3).

Okpilak/Akutoktak Rivers

Nine grayling implanted with transmitters in this system were relocated on August 28, 34 to 37 days after tagging (Table 1). Five of these fish remained in the Akutoktak River or near its confluence with the Okpilak River. One migrated upstream approximately 40 km towards Okpilak Lake and 3 moved down the Okpilak River to the mouth and into the Hulahula River. The fish in the Hulahula River were found between the lower portion near the mouth and Fish Hole #1, river kilometer 32 (Fig. 4). Total migration distance was between 36 and 62 km from the release sites. The locations of grayling in September, October, November, and December were essentially the same as in August with two exceptions. One grayling which had not been detected in September was found in Fish Hole #2 on the Hulahula River (river kilometer 68) in October and November. The total migration distance was approximately 98 km from its release site. The grayling that migrated towards Okpilak Lake moved an additional 6 km upriver to just below the lake's outlet by October but was found 10 km downstream from the lake in November.

DISCUSSION

The results of this study indicate that Arctic grayling had begun their movements to overwintering sites by early September. Movements of grayling have been observed in other north slope streams to occur in August and September (Craig and Poulin 1974, Tripp and McCart 1974).

The mainstem of the Canning River from the confluence of the Staines River and upstream approximatetly 10 km is an overwintering area that has been utilized by grayling at least two consecutive years. Deep pools (greater than 2 m) were located in this area in August 1981 with the aid of a fathometer (Smith and Glesne 1983). Aerial surveys conducted in 1972 lnd 1973 identified this area, the east channel of the Canning River delta, and the area near the confluence of the Canning and Tamayariak Rivers as possible overwintering locations (Craig and McCart 1974a). The latter two were also identified by this study and in 1984 (West and Wiswar 1985). There are no perennial springs associated with these areas and it is suspected that deep pools provide the overwintering habitat.

Radio telemetry was used to identify overwintering locations of Arctic char on the Canning River from 1981 to 1983 (Smith and Glesne 1983, Daum et al. 1984). The overwintering locations found to be utilized by Arctic char included the deeper pools previously identified in August 1981. Fisheries investigations conducted during the Arctic Gas pipeline surveys in November 1973 (Ward and Craig 1974) caught Arctic grayling under the ice at an overwintering site identified by Smith and Glesne (1983).. It is likely that the Canning River contains more Arctic grayling overwintwring habitat than this study identified.

Overwintering locations on the Sadlerochit River that were utilized both years by radio-tagged grayling include much of the mainstem above the aufeis field, Peters and Schrader Lakes, and sections along the Kekiktuk River. The sites along the mainstem are probably marginal deep pools. No springs are known to this area. Overwintering habitat in the upper reach of Kekiktuk River is probably influenced by year-round overflow from Schrader Lake, while the lower section it is probably deep pools. The mainstem of the Sadlerochit River near Sadlerochit Springs was identified as a possoble overwintering location by Craig and McCart (1974a). Several fish were in this area in 1985 (Fig. 3, fish 570, 615 and 812). Sadlerochit Springs is located on a terrace above the Sadlerochit River floodplain and is geographically isolated from it. Water from the spring may perculate up into the main river to influence the site; however, deep pools along this reach of the Sadlerochit River are probably a more important feature.

Grayling from the Okpilak River drainage moved into the neighboring Hulahula River to overwinter as was observed in 1984 (Fig. 4). Grayling were found at Fish Hole #1 (32 km from the mouth) and Fish Hole #2 (68 km from the mouth). These sites are influenced by year-round flowing springs and are important overwintering sites for Arctic char as well. A third site on the Hulahula River about 6 km upstream from the mouth was identified in this study. No springs are associated with this area. The potential overwintering locations on the Okpilak River near its confluence with the Akutoktak River maybe marginal deep pools. On-the-ground-surveys during the tagging period did not reveal any deep pools or springs in this area. The fish found in this area may not have recovered adequetly from surgery to take their normal migration. Only one grayling tagged from the Okpilak River migrated upstream (Fig. 4, fish 303) in the river. This fish was relocated 10 km below Okpilak Lake. The lake probably does not contribute to overwintering habitat of stream resident fish. Overflow from the lake during the summer months is low and no flow was observed during the winter tracking. The trauma of surgey may have interfered with normal migratory behavior.

All relocations where little, no, or only downstream movements were recorded must be carefully reviewed. Some sites may prove to be actual overwintering sites while others may have been dead fish held in place by channel structures. On-the-ground checks will be attempted in the future to verify some of the questionable locations.

Table 1. Movements of radio-tagged Arctic grayling in drainages of the north slope of the Arctic National Wildlife Refuge. Tam. R. = Tamayariak River, Itk. Cr. = Itkilyariak Creek, Aku. R. = Akutoktok River.

Tag #	Date of Implant	Fork Length (mm)	Sex	Surgery Time (min)	Initial Location	Movement (km) Aug 21,28-30	Sep 12-13	Oct 7,10	Nov 6-7	Dec 20
Canning and Tamayariak Rivers					Tam. R.					
552	8/29/85	394	M	11.0	8	0	-	46	11	-
588	8/29/85	418	F	11.0	7	0	-	-	17	-
622	8/29/85	381	F	11.0	7	0	19	-	-	-
629	8/29/85	367	F	8.5	7	0	15	-	-	-
651	8/28/85	356	F	10.5	7	0	-	45	6	8
662	8/28/85	406	M	8.5	7	4	32	6	0	0
702	8/28/85	413	F	9.5	7	-	-	-	-	-
752	8/29/85	433	M	9.0	8	0	0	0	-	-
932	8/29/85	392	F	9.0	7	4	7	-	5	0
728*	8/18/84	410	M	14.0	7	-	13	-	-	-
749*	8/18/84	387	F	11.0	7	-	0	-	-	-
Sadlerochit River and Itkilyariak Creek					Itk. Cr.					
482	8/24/85	374	M	14.0	1	10	5	0	0	0
489	8/26/85	375	F	15.0	2	0	51	-	31	-
523	8/22/85	361	M	8.0	1	0	16	-	-	-
532	8/24/85	363	M	9.5	1	20	-	-	-	-
540	8/25/85	365	M	9.5	1	0	0	3	-	-
570	8/25/85	355	F	10.0	1	11	7	-	10	-
615	8/25/85	364	M	10.0	1	0	16	12	0	0
641	8/23/85	370	M	9.5	4	10	0	0	-	0
680	8/23/85	372	M	9.5	4	0	11	-	14	0
773	8/23/85	369	M	10.0	3	32	19	4	0	0
812	8/22/85	365	M	8.5	1	1	21	-	3	0
823	8/23/85	373	M	9.0	3	3	0	0	0	0
869	8/25/85	355	M	10.0	1	22	-	31	-	0
912	8/25/85	360	F	9.0	1	17	28	-	21	0
710*	8/03/84	375	M	17.0	2	0	0	-	-	-

Table 1. (Continued)

Tag #	Date of Implant	Fork Length (mm)	Sex	Surgery Time (min)	Initial Location	Movement (km) Aug 21,28-30	Sep 12-13	Oct 7,10	Nov 6-7	Dec 20
Okpilak and Akutaktak Rivers					Aku. R.					
110	7/28/85	368	-	6.5	2	-	-	125	0	
270	7/27/85	360	-	7.0	1	1	0	-	0	
303	7/28/85	370	M	5.5	2	44	3	4	10	
310	7/26/85	368	-	8.0	1	0	0	0	0	
333	7/27/85	397	M	8.0	1	-	-	-	-	
338	7/28/85	380	M	6.0	2	0	0	0	0	
370	7/26/85	385	-	7.0	1	-	-	-	-	
382	7/27/85	395	-	8.0	1	57	10	0	0	
394	7/26/85	407	-	8.0	1	0	-	-	-	
412	7/28/85	385	M	5.5	2	69	1	0	0	
430	7/27/85	368	F	9.0	1	-	-	-	-	
440	7/28/85	355	F	6.0	2	39	1	-	0	
460	7/26/85	382	-	9.0	1	-	-	-	-	
470	7/29/85	360	M	9.0	3	-	-	-	-	
562	7/29/85	365	M	8.0	3	0	1	2	0	

1 = Initial location is distance (km) from river mouth.
* Advanced Telemetry Systems (ATS) - transmitters from 1984 study that were still emitting a signal.
All other transmitters were Telonics.

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