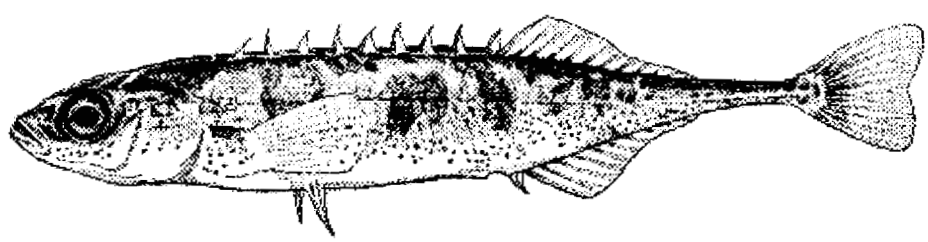
FISH SURVEYS OF SELECTED COASTAL STREAMS SAGAVANIRKTOK RIVER TO BULLEN POINT, 1995

By
Carl R. Hemming

Technical Report No. 96-3



Alaska Department of Fish and Game
Habitat and Restoration Division

April 1996

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Executive Summary

In 1995, we investigated fish use of six coastal streams within the proposed Badami development area. The six streams surveyed are located between the Sagavanirktok River and Bullen Point. We captured five fish species including freshwater, anadromous, and marine life history types. Freshwater fish included Arctic grayling (*Thymallus articus*) and round whitefish (*Prosopium cylindracelum)*, anadromous life history types were Dolly Varden (*Salvelinus malma*) and ninespine stickleback (*Pungitius pungitius*), while Fourhorn sculpin (*Myoxocephalus quadricornis*) was the only marine species captured.

Ninespine stickleback were most frequently captured in each of the six coastal streams and were found in each system during the three sample periods. Dolly Varden were also found in all streams sampled but the timing of capture varied among streams. Arctic grayling were found in all systems except East Badami Creek.

Acknowledgments

We appreciate the financial and logistical support provided by BP Exploration (Alaska) Inc. In particular Karen Wuestenfeld and Chris Herlugson assisted in the development of a proposal to conduct coastal stream investigations and provided the coordination needed to arrange logistics for the project. Special thanks go to the personnel at Endicott and ERA Helicopters who provided the food, lodging, and transportation that allowed us to get the job done without compromising safety.

Capable field assistance was provided by Carl Lunderstadt. Al Ott provided overall direction for the project, provided constructive review of this report and assisted with the fish squeezing. Sheree Warner assisted in the preparation of this report.

INTRODUCTION

BP Exploration (Alaska) Inc. proposes to develop the Badami oilfield, located between the Shaviovik River and Bullen Point, approximately 40 km east of the Prudhoe Bay Oilfield. The project as originally proposed included an onshore production well pad, 45 km of buried pipeline, a dock, a short in-field road system, gravel sources, and an airstrip (BP Exploration 1995).

Modifications to the proposed project have occurred with additional information on the oil reservoir and efforts to reduce project costs. The currently proposed Badami Project includes an elevated oil pipeline with buried river crossings. The project differs from other North Slope oil and gas development projects because it does not include a gravel access road between the development area and the existing oilfield road system. Buried pipeline river crossings will be required where the east west pipeline alignment intersects north flowing drainages.

In 1994, The Alaska Department of Fish and Game (ADF&G) conducted field investigations in the Badami development area (Hemming and Ott 1994). These investigations included reconnaissance of pipeline stream crossing areas and fish sampling at proposed gravel mine site locations (East and West Badami Creek). In 1995, we continued and expanded field investigations in the Badami development area. The 1995 program included fish sampling and photographic documentation at six stream systems located between the Sagavanirktok River and Bullen Point. West Badami Creek is no longer under consideration as a gravel source and was not included in the 1995 sampling program.

BACKGROUND

Nearly all the fisheries information for the North Slope region of Alaska has been generated from studies related to oil and gas development projects. These studies have focused on nearshore areas of the Beaufort Sea with the goal of evaluating the impact of existing or proposed gravel causeways on anadromous fish populations. ADF&G Habitat and Restoration Division investigated fish use of freshwater habitats in the Prudhoe Bay and Kuparuk oilfield areas with emphasis on flooded gravel mine sites and tundra stream systems. The tundra stream investigations indicate that relatively few fish species use small coastal drainages in the North Slope oilfield area and fish abundance is low in relation to the volume of rearing habitat available (Hemming 1993). The tundra stream systems investigated contained productive aquatic habitats characterized by extensive shallow water areas supporting emergent and submerged aquatic vegetative communities, but fish use of these areas is thought to be limited by the absence of suitable wintering areas.

Deep water habitat suitable for wintering fish was determined to be a limiting factor that controls fish species richness and the relative abundance of fish found in North Slope coastal streams. Freshwater fish such as Arctic grayling (*Thymallus arcticus*) were found in small drainages that are tributary to larger rivers (e.g. Kuparuk River) with deep water areas suitable for wintering fish and in similar small streams that drain into the Beaufort Sea where the stream mouth shares a common delta or is in close proximity to a large river system. Adult grayling migration between coastal drainages has been documented in the Arctic National Wildlife Refuge (ANWR) using radio telemetry. In the ANWR study adult grayling moved from summer rearing areas in coastal steams to nearshore areas of the Beaufort Sea and from there into other drainages with wintering habitat (West et al. 1992). In 1994, we found juvenile grayling in two small coastal streams (East and West Badami Creeks) in the Badami development area.

We found anadromous fish in small coastal stream systems within the Prudhoe Bay and Kuparuk oilfield areas. Least cisco (*Coregonus sardinella*), broad whitefish (*Coregonus*

nasus), Arctic cisco (*Coregonus autumnalis*), and Dolly Varden (*Salvelinus malma*) were captured in coastal streams west of the Badami project area (Hemming 1993). In contrast grayling, ninespine stickleback (*Pugitius pungitius*) and Dolly Varden were the most common species found in ANWR coastal streams located east of the Badami study area (West and Fruge 1989). Ward and Craig (1974) surveyed the Kadleroshilik and Shaviovik rivers. They found grayling and slimy sculpin (*Cottus cognatus*) in the Kadleroshilik River and grayling, Dolly Varden and ninespine stickleback in the Shaviovik River.

STUDY AREA

General Description

The Badami project is within the Arctic Coastal Plain physiographic province (Wahrhaftig 1965). The area has little topographic relief and numerous shallow lakes and lake basins. The study area is within the Arctic climate zone, which has extremely cold winters and cool summers (BP 1985). The prevailing wind direction is east-northeast with average speeds of 10 to 15 mph and 30 to 50 mph winds common during storm events.

Streams in the study area flow in a northerly direction and empty into the Beaufort Sea. The smaller drainages originating in the coastal plain are poorly developed because frozen ground resists erosion. Small drainages form when near surface ground ice melts; normally along ice-wedge polygon boundaries (BP 1995). Streams in the study area exhibit wide fluctuation in flow due to snow accumulation, near year-round freezing temperatures, permafrost, and lack of groundwater storage to stabilize flows. These systems are characterized by an extremely peaked runoff hydrograph with most of the annual discharge resulting from snow melt during the first two weeks in June.

Study Area Streams

East Badami Creek

East Badami Creek is a 25 km long single channel system. The active channel is 10 to 15 m wide in late summer. East Badami Creek has gravel bar deposits on the inside of meander bends with tundra vegetation occurring on the cutbank side. Cutbanks are less than 2 m. Water depth does not exceed 2 m and substrate materials are composed of gravel.

No Name River

No Name River is a 67 km coastal system that drains a 380 km^2 tundra area. The river mouth is located 2.5 km east of the Shaviovik River. No Name River is a single channel system with extensive gravel bars. Vegetated terraces are found on both sides of the active channel. The active channel is 70 to 100 m wide in the lower part of the drainage in late summer. Water depths do not exceed 2 m.

Shaviovik River

With the exception of the Sagavanirktok River the Shaviovik River is the largest river in the Badami Project area. The Shaviovik is a braided mountain stream system and the headwater reaches contain perennial springs or groundwater upwelling areas. The river system is 160 km long draining a 4,506 km^2 area. The floodplain contains extensive gravel bars, multiple channels and vegetated terraces. The floodplain including vegetated terrace areas is up to 3 km wide in the lower reaches.

West Shaviovik Creek

West Shaviovik Creek is a beaded tundra stream that drains an area west of the Shaviovik River joining the main river 5 km upstream from the river mouth. The stream is a single channel system consisting of large deep pools separated by narrow riffle areas typical of beaded systems. The substrate consists of soft organic material with dense stands of emergent vegetation in the shallower areas. The stream banks are vegetated and spring flood waters spread out over vegetated areas adjacent to the stream channel.

Kadleroshilik River

The Kadleroshilik River is a 104 km long coastal stream system that drains a 1,290 km^2 area. It is a split channel system with large bars composed of uncompacted coarse gravel. Vegetated cutbanks to 3 m occur on the outside of meander bends. Water depths do not exceed 2 m in the lower portion of the drainage.

East Sag Creek

East Sag Creek is a beaded tundra stream that empties into the delta of the East Channel of the Sagavnirktok River. The stream system contains deep pools and submerged and emergent aquatic vegetative communities. At a point 5 km upstream from the mouth the drainage branches into two separate channels.

OBJECTIVES

Objectives for the 1995 Badami coastal stream investigations were:

1. To evaluate the species composition and length frequency distribution of fish using coastal streams in the Badami development area.
2. To collect photographic information at selected stream crossing locations for the proposed Badami pipeline.

METHODS

We used helicopter transportable fyke nets to sample fish in six coastal stream systems in the Badami development area (Figure 1). The nets were 3.7 m in length with two 0.9 m square entrance frames, five hoops, a 1.8 m cod end, and 0.9 m by 7.6 m net wings attached to the entrance frame. A 15 m center lead was anchored to shore and attached to the trap frame. Net placement was determined by water depth and velocity.

We used a Bell 206 L helicopter to access the study streams (Figure 2) . Sample sites were selected in the vicinity of the proposed pipeline crossing locations with adjustments to obtain conditions suitable for net deployment. The site on East Badami Creek was located downstream of the proposed gravel mine site. We obtained GPS locations for each sample site.

Waterbody	GPS Location	
East Badami Creek	70° 08.756'	146° 59.474'
No Name River	70° 08.705'	147° 12.586'
Shaviovik River	70° 09.120'	147° 16.106'
West Shaviovik Creek	70° 08.478'	147° 21.146'
Kadleroshilik River	70° 10.479'	147° 39.220
East Sag Creek	70° 11.474'	147° 52.744'

We sampled fish at the six listed locations from June 20 to 23, July 17 to 20, and August 28 to 31. The traps were checked once a day and fish were identified, lengths were

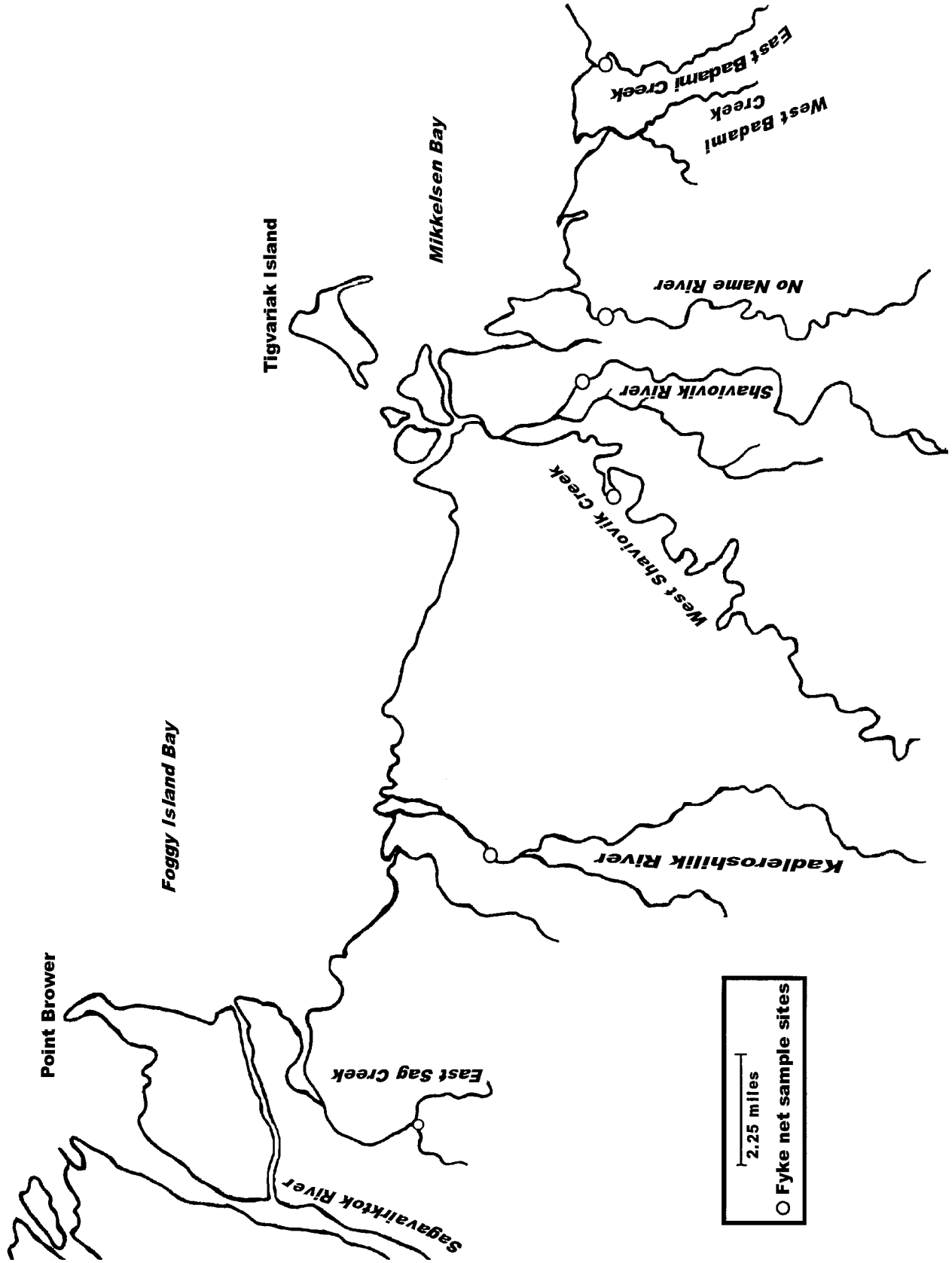

Figure 1. Map of Badami study area coastal streams, and fish sample sites.

Figure 2. Bell 206 L helicopter used to access sample sites (top), and fyke net sample site on East Badami Creek (bottom).

measured (fork length), and the fish were released. Ninespine stickleback were not measured, but were counted and released or when large catches occurred numbers were estimated using a 15 cm diameter scoop. The number of ninespine stickleback in a standard scoop was multiplied by the scoops required to empty the net to obtain an estimate of the number of ninespine stickleback captured (Hemming 1993). Time and water temperature were recorded when traps were checked. In August, 35 mm photographs were taken at each sample site and water samples were collected and delivered to Kuparuk Industrial Center Lab where specific conductance was measured. The photographs included the sample site and reaches upstream and downstream from each sample site.

RESULTS

East Badami Creek

We captured ninespine stickleback, Dolly Varden and fourhorn sculpin (Myoxocephalus quadricornis) in East Badami Creek (Table 1).

Table 1. Fish captured in East Badami Creek, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species *	Number Captured	CPUE Fish/Day
June 20-23	2.9	5.7	NSB	680	243.5
July 17-20	3.0	12.0	DV	1	0.3
			NSB	4,576	1,525.3
August 28-31	2.8	3.3	DV	2	0.7
			FSC	1	0.4
			NSB	1.287	459.6

*** DV = Dolly Varden, NSB = Ninespine stickleback, FHS = Fourhorn sculpin**

We captured ninespine stickleback in each of the three sample periods with the greatest catch rates in July. We found juvenile Dolly Varden in July and August while a single 132 mm fourhorn sculpin was captured in August (Appendix I). In August we collected a water sample and photographed the East Badami Creek sample site (Figure 3). We found freshwater conditions in August (287 umho/cm).

Figure 3. East Badami Creek looking south upstream of fyke net (top), and East Badami Creek looking north with the Beaufort Sea coast in the background (bottom).

No Name River

We captured ninespine stickleback, Dolly Varden, grayling, and round whitefish (*Prosopium cylindraceum*) in No Name River (Table 2).

Table 2. Fish captured in No Name River, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species *	Number Captured	CPUE Fish/Day
June 20-23	2.9	6.1	NSB	772	266.2
July 17-20	3.0	12.2	DV	2	0.7
			NSB	858	286.0
August 28-31	2.8	3.7	AG	1	0.4
			DV	7	2.5
			NSB	858	306.4
			RWF	1	0.4

*** AG = Arctic grayling, DV = Dolly Varden, NSB = Ninespine stickleback, RWF = Round whitefish**

We captured ninespine stickleback in June, July, and August, with similar catch rates in each of the three sample periods. In July and August we captured juvenile Dolly Varden, and in August a 194 mm grayling, and a 249 mm round whitefish were captured (Appendix I). In August we photographed the No Name River sample site and collected a water sample (Figure 4). We found freshwater conditions (199 umho/cm).

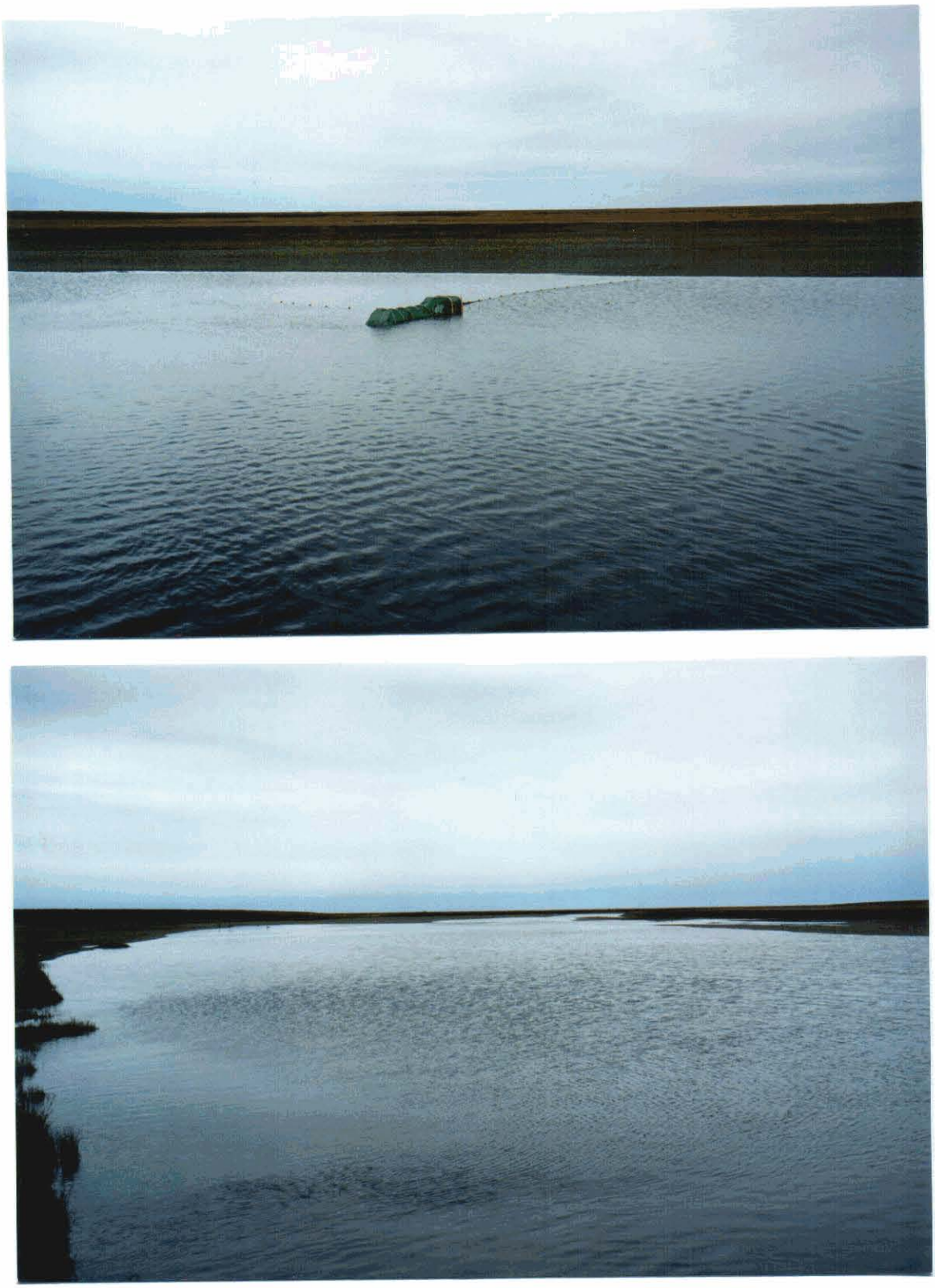

Figure 4. No Name River fyke net site (top), and No Name River looking north (bottom).

Shaviovik River

We captured grayling, Dolly Varden and ninespine stickleback in each of the three sample periods (Table 3).

Table 3. Fish captured in Shaviovik River, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species *	Number Captured	CPUE Fish/Day
June 20-23	2.9	6.4	AG	7	2.4
			DV	3	1.0
			NSB	107	36.9
July 17-20	3.0	12.3	AG	5	1.7
			DV	1	0.3
			NSB	429	143.0
August 28-31	2.7	3.8	AG	21	7.8
			DV	5	1.8
			NSB	54	20.0

*** AG = Arctic grayling, DV = Dolly Varden, NSB = Ninespine stickleback**

Grayling were most abundant in August when young-of-the-year were present (Appendix I). Juvenile Dolly Varden were captured in each of three sample periods and two larger (175 and 240 mm) sea run fish with silver coloration were captured in August. In August, we photographed the Shaviovik River sample site and collected a water sample (Figure 5). We found freshwater conditions (277 umho/cm).

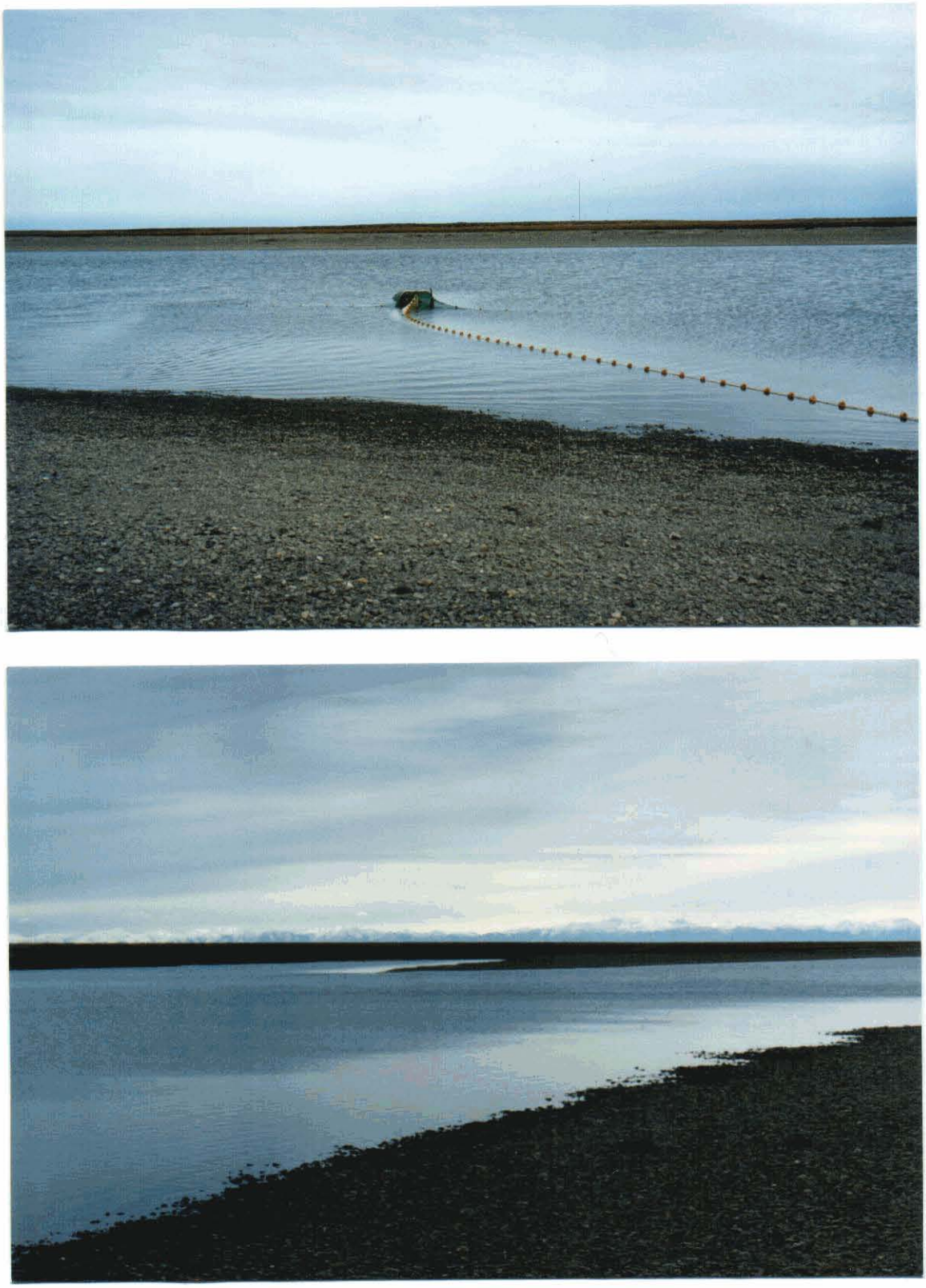

Figure 5. Shaviovik River fyke net site (top), and Shaviovik River looking south with the Brooks Range in the background (bottom).

West Shaviovik Creek

We captured grayling, Dolly Varden and ninespine stickleback in a beaded tributary to the Shaviovik River that we called West Shaviovik Creek (Table 4).

Table 4. Fish captured in West Shaviovik Creek, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species *	Number Captured	CPUE Fish/Day
June 20-23	2.9	7.2	NSB	365	125.9
July 17-20	3.0	13.8	AG	2	0.7
			DV	2	0.7
			NSB	14,157	4,719.0
August 28-31	2.8	4.0	NSB	469	167.5

*** AG = Arctic grayling, DV = Dolly Varden, NSB = Ninespine stickleback**

Ninespine stickleback were found in all sample periods but the greatest catch rates occurred in July. Grayling and Dolly Varden were only captured in July (Appendix I). We photographed the West Shaviovik River sample site and collected water samples in August (Figure 6). We found freshwater conditions (140 umho/cm).

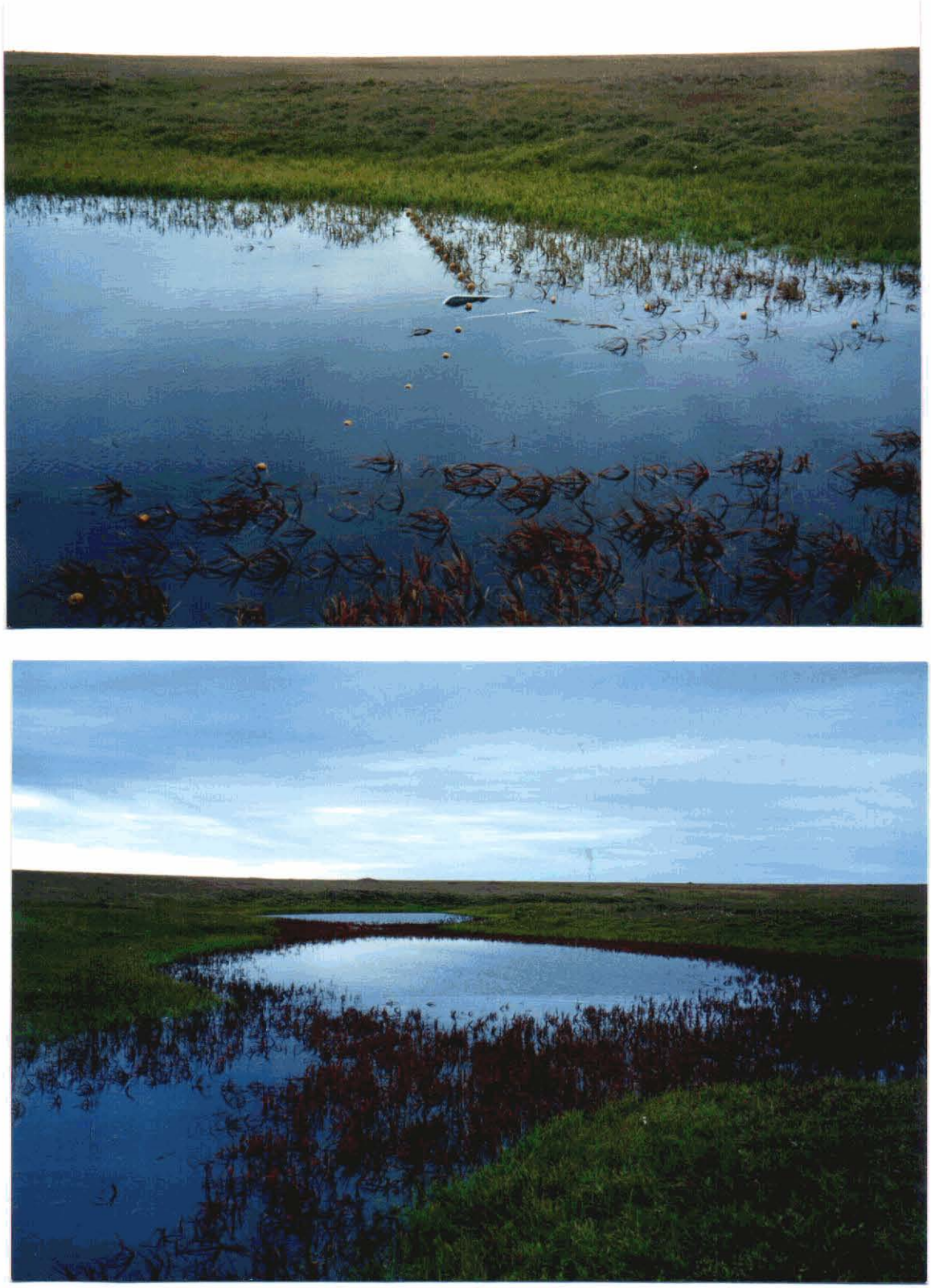

Figure 6. West Shaviovik Creek fyke net site (top), and West Shaviovik Creek downstream of net site. Note beaded pattern with emergent vegetation, Arctic pendant grass (*Arctophila fulva*).

Kadleroshilik River

We found grayling, Dolly Varden, and ninespine stickleback in the Kadleroshilik River. Ninespine stickleback were found in each sample period but the greatest catch rate occurred in June. We captured grayling in June and August while Dolly Varden appeared in our June and July sample catch (Table 5).

Table 5. Fish captured in Kadlerohilik River, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species	Number Captured	CPUE Fish/Day
June 20-23	2.9	5.9	AG	1	0.3
			DV	3	1.0
			NSB	580	200.0
July 17-20	3.0	11.9	DV	1	0.3
			NSB	148	49.3
August 28-31	2.7	4.3	AG	2	0.7
			NSB	172	63.7

*** AG = Arctic grayling, DV = Dolly Varden, NSB = Ninespine stickleback**

In August, we photographed the Kadleroshilik River sample site and collected a water sample (Figure 7). We found freshwater conditions (214 umho/cm).

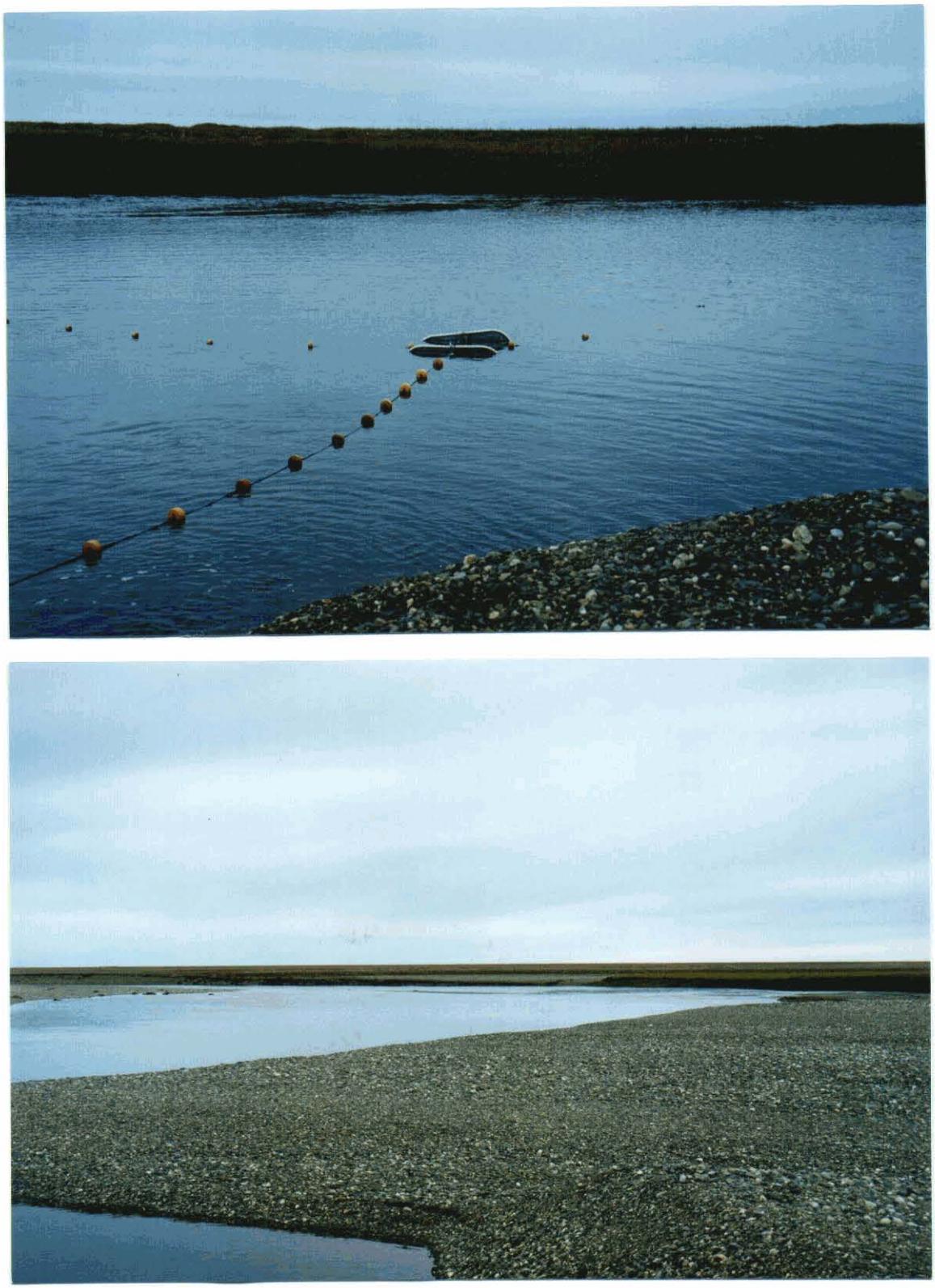

Figure 7. Kadleroshilik River fyke net site (top), and Kadleroshilik River looking north (bottom). Note extensive gravel bars composed of coarse material and vegetated cutbanks.

East Sag Creek

We captured grayling, Dolly Varden, and ninespine stickleback in a beaded tundra stream located east of the Sagavanirktok River that we called East Sag Creek. Ninespine stickleback and Dolly Varden were captured in each of the three sample periods while grayling were found only in August. In August, the net was set to completely block the stream channel and oriented to capture downstream migrating fish. With the net set in this configuration we captured an estimated 26,455 ninespine stickleback, the highest catch rate among the six coastal streams sampled (Table 6).

Table 6. Fish captured in East Sag Creek, 1995.

Dates	Time Fished Days	Mean Water Temp. ° C	Fish Species *	Number Captured	CPUE Fish/Day
June 20-23	2.9	5.4	DV	1	0.3
			NSB	1,430	493.1
July 17-20	3.0	13.4	DV	1	0.3
			NSB	4,290	1,430.0
August 28-31	2.7	4.3	AG	3	1.1
			DV	9	3.3
			NSB	26,455	9,798.1

*** AG = Arctic grayling, DV = Dolly Varden, NSB = Ninespine stickleback**

In August, we photographed East Sag Creek at the sample site and collected a water sample (Figure 8). We found freshwater conditions in East Sag Creek (267 umho/cm).

Figure 8. East Sag Creek fyke net location with net set to block stream channel (top), and East Sag Creek upstream of net site (bottom). Note emergent vegetation (*Arctophila fulva*) and low water conditions in late summer.

DISCUSSION

Badami area coastal streams support a similar fish species assemblage to that found in coastal streams in the Arctic National Wildlife Refuge. West and Fruge (1989) found grayling, char and ninespine stickleback to be the most commonly occurring fish species in 12 coastal stream systems between the Canning River and the Canadian border. Our investigation of 6 coastal streams between the Sagavanirktok River and Bullen Point found the same species occurring most frequently. Ninespine stickleback and Dolly Varden were found in each of the streams sampled in our study while grayling were found in 5 of 6 streams sampled. In 1995, LGL Alaska Research Inc. found coregonid fish in nearshore areas of Mikkelsen Bay, but these fish did not appear in our sample catch from coastal streams in the study area. A similar investigation of coastal streams located between the Sagavanirktok River and Kalubik Creek found coregonid fish in nearly all streams sampled (Hemming 1993). A review of coastal plain fish surveys including this study suggest that coregonid fish do not occur in streams east of the Sagavanirktok River while they do occur to the west.

Ninespine stickleback were most abundant in each of the 6 coastal streams sampled and were the only species captured during every sample period in each stream. The high catch rate found in East Sag Creek in late August indicates that ninespine stickleback move downstream out of small coastal streams in late summer as water temperatures decrease to near 4° C . Prewinter downstream movement is likely the initiation of a seasonal migration to wintering areas. While ninespine stickleback are not an important fish for subsistence, commercial or sport fisheries the ecological significance of this species in Arctic food webs may be very important. Ninespine stickleback are the most widespread and abundant fish species in coastal streams draining the central Beaufort Sea coastal area and are commonly found as food items for piscivorous fish such as Dolly Varden and grayling as well as avian fish eaters such as loons. Small coastal drainages including beaded stream systems provide spawning and summer rearing habitat for ninepine stickleback.

We captured Dolly Varden in each of the stream systems sampled but timing varied between systems. We found Dolly Varden in the Shaviovik River during all three sample periods and two larger silvery colored fish were captured in August. Portions of Kavik and Shaviovik Rivers were identified in the Gas Arctic studies as perennial groundwater areas used for spawning and wintering by anadromous Dolly Varden, therefore the two larger fish captured in our study may have been migrating to perennial groundwater areas upstream of the sample site. Dolly Varden have been captured in nearly all coastal streams between the Sagavanirktok River and the Canadian border. While the number of Dolly Varden found in each system may be relatively small the numerous streams draining into the Beaufort Sea in aggregate represent important summer rearing habitat.

Grayling are a freshwater species but movements do occur between North Slope coastal stream systems (Hemming 1993). Small coastal streams are thought to provide only summer rearing habitat for grayling because winter ice depth eliminates all under ice water that might be used by overwintering fish. Larger river systems with perennial groundwater sources such as the Shaviovik River provide overwintering habitat. In our study, grayling were found in the Shaviovik River during each of the three sample periods and young-of-the-year were captured in August. Young-of-the-year grayling were not found in the other 5 streams investigated. The presence of young-of-the-year fish indicate that spawning occurs in the system. Grayling found in West Shaviovik Creek and No Name River may be part of the Shaviovik population that disperse to other areas during the summer rearing season. The Sagavanirktok River is a large river system with spawning and overwintering habitat. It is likely the grayling in East Sag Creek are part of the Sagavanirktok River population. Grayling were only captured in East Sag Creek in August when the net was oriented to capture fish moving downstream. It is possible these fish were moving out of East Sag Creek to wintering sites in the Sagavanirktok River. The Kadlerohilik River is an intermediate size drainage that may support spawning and overwintering grayling. Grayling were captured in the Kadlerohilik River in June and August.

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Appendix I. Fork length of fish captured in Badami area streams, 1995.

Location	Date	Water Temp ° C	Species	Fork Length (mm)	Comment
E. Badami Creek	7/18/95	12.5	Dolly Varden	83	
	8/29/95	4.0	Fourhorn sculpin	132	
	8/30/96	3.5	Dolly Varden	196	
	8/31/95	2.5	Dolly Varden	190	
No Name River	7/20/95	10.5	Dolly Varden	97	
				177	
	8/29/95	4.0	Dolly Varden	143	
				153	
	8/30/95	4.0	Dolly Varden	153	
			Round whitefish	249	
	8/31/95	3.0	Arctic grayling	194	
			Dolly Varden	151	
				155	
				170	
				174	
Shaviovik River	6/21/95	8.6	Dolly Varden	198	
	6/22/95	4.8	Arctic grayling	59	
				63	
				64	
				76	
				195	
				207	Tag Orange # 1624
				247	Tag Orange # 1625
			Dolly Varden	91	
	6/23/95	5.8	Dolly Varden	221	
	7/18/95	13.0	Arctic grayling	108	
				163	
	7/19/95	13.1	Arctic grayling	68	
				96	
				337	Tag Orange # 1601
			Dolly Varden	68	
	8/29/95	4.5	Arctic grayling	125	
				140	

Appendix I. Fork length of fish captured in Badami area streams, 1995.

Location	Date	Water Temp ° C	Species	Fork Length (mm)	Comment
Shaviovik River	8/29/95	4.5	Arctic grayling	198	
				220	
				248	
				248	
				250	
				262	
			Dolly Varden	175	Sea run silver color
				240	Sea run silver color
	8/30/95	4.0	Arctic grayling	54	young-of-the-year
				54	young-of-the-year
				55	young-of-the-year
				213	
				224	
			Dolly Varden	144	parr marks
				165	parr marks
	8/31/95	3.0	Arctic grayling	58	young-of-the-year
				205	
				205	
				210	
				215	
				235	
W. Shaviovik Cr.	7/18/95	13.8	Dolly Varden	162	
	7/19/95	14.4	Arctic grayling	229	Tag Orange # 1602
			Dolly Varden	161	
	7/20/95	13.1	Arctic grayling	205	Tag Orange # 1603
Kadleroshilik River	6/22/95	5.6	Arctic grayling	136	
			Dolly Varden	104	
				127	
				143	
	7/18/95	12.3	Dolly Varden	108	
Kadleroshilik River	8/30/95	4.5	Arctic grayling	68	
				319	Adult
E. Sag Creek	6/22/95	4.7	Dolly Varden	142	

Appendix I. Fork length of fish captured in Badami area streams, 1995.

Location	Date	Water Temp ° C	Species	Fork Length (mm)	Comment
E. Sag Creek	7/20/95	12.8	Dolly Varden	103	
	8/29/95	5.0	Arctic grayling	94	
			Dolly Varden	108	
	8/30/95	4.5	Arctic grayling	95	
			Dolly Varden	66	
				74	
				77	
				77	
				93	
				99	
				102	
	8/31/95	3.5	Arctic grayling	104	
			Dolly Varden	93	