TECHNICAL REPORT NO. 08-05

FISH SAMPLING OF TUNDRA STREAMS AND LAKES IN THE KUPARUK RIVER AND MILNE POINT UNITS, NORTH SLOPE OIL FIELDS, ALASKA. 2006 AND 2007

by William Morris
Jack Winters

Sea run juvenile Dolly Varden. Photo by William Morris ADNR, OHMP

April 2008

Alaska Department of Natural Resources Office of Habitat Management and Permitting

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Fish Sampling of Tundra Streams and Lakes in the Kuparuk River and Milne Point Units, North Slope Oil Fields, Alaska. 2006 and 2007

Technical Report No. 08-05

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Introduction

Construction of the necessary infrastructure to produce the State of Alaska's oil reserves has, in the past, required a substantial network of gravel roads, pipelines, power lines and facilities. In recent years the need for extensive networks of gravel roads for exploration and production has been reduced as technological advances with exploration and production methods have occurred. However, oilfield infrastructure built in the Kuparuk and Milne Point units in the 1980's relied heavily on a web of gravel roads to access drill sites sometimes quite close to others. Throughout the process of construction of both oil fields, numerous small tundra drainages deemed as low quality fish habitat, based almost entirely on their size, were crossed by gravel roads. Historically, little or no fish use data were collected for these small drainages that sometimes exist as little more than a trickle of water during summer months. Based on the lack of fish information and lack of State oversight during the early 1980's, most of these crossings were not constructed with fish passage as a design criterion.

Over the years, State oversight and the level of understanding regarding the significance of small tundra streams to fish has increased. As a result, the Office of Habitat Management and Permitting began sampling small tundra drainages and lakes within the Kuparuk and Milne Point oil fields in 2006.

Fyke nets were fished in ten streams and two lakes between August 8 and August 14, 2006. Fyke nets were reset in eight of the ten creeks and at two lakes between July 5 and July 12, 2007 (Figure 1). Nine of the streams and the lakes surveyed had not previously been sampled for fish. The July 2007 sampling occurred at the same creek sites as in 2006 with the exceptions that Kalubik and East creeks, and Drill Site 3H Lake were not sampled for fish in 2007. Additionally, I Pad Lake was sampled for fish in 2007 but not in 2006. Our objective was to identify fish species and age classes using each stream or lake during the late part of the summer season, 2006 and during early summer, 2007. Objectives for fish sampling in East Creek (East Milne Creek) were to document the continued presence of broad whitefish (*Coregonus nasus*) in the system and to determine if Arctic grayling (*Thymallus arcticus*) fry were present. The following is a summary of data collected during August 2006 and July 2007.

Methods

Fyke nets, passive fish traps, were set at all sites and checked once per 24 hour period. Nets set in creeks were typically set to block the stream channel and to capture fish moving both up- and downstream. Nets set in lakes were set offshore at the maximum length of the lead net where possible. Tables 1 and 2 describe the net set used at each site in 2006 and 2007.

All fish captured were identified, measured to the nearest mm from the tip of the snout to the fork of the tail and released. Arctic grayling, broad whitefish and least cisco longer than 200 mm fork length were tagged with individually numbered FLOY® t-bar anchor tags prior to release. Water temperature was recorded at each net during checks.

Detailed descriptions of streams and road crossings can be obtained from Morris and Winters, 2008.

Results

General Results

Fyke nets were fished at each site between 43 and 119 hours in August 2006 and between 70 and 166 hours in July 2007. During the period sampled in both years water temperatures initially climbed but rapidly dropped towards the end of the sampling period. It appears that we caught a portion of the outmigration of fish from several of the streams sampled in 2006. Tables 1 and 2 provide a summary of data for each site sampled in August 2006 and July 2007.

Fish were captured at all streams sampled and at two of three lakes sampled (Figure 1). DS3H Lake is a tundra lake with no obvious connections to any streams and is likely perched at an elevation above breakup flood water elevations. The lake was sampled for 45.45 hours and only tadpole shrimp were captured. Dense clouds of copepods were observed near the lake shore, a further indication that fish do not use the lake. Of the sites identified to support fish use, all but 3 were used by anadromous fish species (broad whitefish, least cisco (*Coregonus sardinella*), or Dolly Varden (*Salvelinus malma*) (Figure 1). The Caribou Creek drainage, which drains directly to Harrison Bay, did not contain anadromous species during sampling in 2006 or 2007.

Anadromous fish were not captured in the West Fork of Nowhere Creek in 2006 or 2007, however; sampling sites in Nowhere Creek and East Fork Nowhere Creek, upstream from the West Fork of Nowhere Creek, were used by anadromous fish species in both years (Figure 1, Table 1, Table 2). I Pad Lake, located along the Milne Point Road has seasonal connections to fish bearing waters but only ninespine stickleback (*Pungitius pungitius*) were captured in the lake.

Catch per unit of effort (CPUE) for all non-stickleback species, expressed as number of fish captured per day (24 hour period), was generally higher in August 2006 than in July 2007 for sites sampled in both years (Figure 2). However, CPUE was higher in July 2007 than in August 2006 in Nowhere and Milne B Pad creeks (Figure 2). CPUE was the highest in the Ugnuravik River and tributaries in both years and high in East Creek in 2006. Ninespine stickleback CPUE was more variable among sites and between years sampled but generally was highest in Ugnuravik River tributaries and lowest in lakes (Figure 3). Extreme differences in ninespine stickleback CPUE was observed between August 2006 and July 2007 in Ugnuravik River tributaries where catches in July 2007 were a fraction of those in August 2006.

Sites with the highest non-stickleback CPUE (East Creek and Ugnuravik River and tributaries) tended to be dominated by juvenile Arctic grayling (Figure 4). Catches for most other species were very low. CPUE for broad whitefish was highest in East Creek, Kalubik Creek and Nowhere and East Fork Nowhere creeks, both tributaries to Kalubik Creek (Figure 4). Dolly Varden were only captured in the unnamed creek by Milne B Pad and in Nowhere Creek. However, catch rates were extremely low and never exceeded 0.2 fish per day (Figure 4). Least cisco were only captured in the unnamed creek by Milne B Pad and in the Ugnuravik River and its tributaries; CPUE was less than 1.5 fish per day at all locations (Figure 4). Round whitefish were only captured in Kalubik Creek. Threespine stickleback (*Gasterosteus aculeatus*) were only captured in 2006 and only at the unnamed creek by Milne B Pad and in East Fork Nowhere Creek.

Table 1. A summary of all results for each net site sampled in 2006 is presented in the table. Site and net set descriptions are provided as well as photographic index numbers that correspond with the photographs in the photograph section of the document. Water temperature records are included and a summary of total fish caught by species with catch per 24 hour period. Total hours fished, total fish captured (not including stickleback species) and total catch per unit effort for non-stickleback species is also included in the boxed area for each net site. Yellow blocks denote anadromous catches.

Site Description	Net Set Description	Photograph	Set Date	Check Date	Set Duration	Temp/Set	Temp/Chk	BWF	RWF	AG	DV	LCI	NSB	TSB	Inverts	Notes
3H Lake	Lake set	1	8/8/06 10:38	8/9/06 8:40	22.03	9.5	9.5								Some tps & fs, many copepods	
			8/9/06 9:35	8/10/06 9:00	23.42	9.5	10.5									
				Total:	**45.45 hrs**	**Total Fish:**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
					CPUE(Catch/Day)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Caribou by 3A	Upstream from road	2	8/8/06 11:08	8/9/06 9:00	21.87	8.5	7.8									
	Stream blocked		8/9/06 9:00	8/10/06 9:20	24.33	7.8	10									
	Fishing up and		8/10/06 9:20	8/11/06 9:20	24.00	10	10.2								A few tps	Most NSB > 30 mm
	downstream movement		8/11/06 9:20	8/12/06 8:30	23.17	10.2	6.5									
				Total:	**93.37 hrs**	**Total Fish:**	**0**	**0**	**0**	**0**	**0**	**0**	**393**	**0**		
					CPUE(Catch/Day)		**0**	**0**	**0**	**0**	**0**	**0**	**101.02**	**0**		
E Fk Nowhere	Upstream from road	3	8/8/06 11:40	8/9/06 9:20	21.67	7.8	7									
	Stream blocked		8/9/06 9:20	8/10/06 9:40	24.33	7	9									
	Fishing up and		8/10/06 9:40	8/11/06 9:40	24.00	9	9									Most NSB > 30 mm
	downstream movement		8/11/06 9:40	8/12/06 8:55	23.25	9	5.5									
			8/12/06 8:55	8/13/06 8:55	24.00	5.5	4.9									
				Total:	**117.25 hrs**	**Total Fish:**	**15**	**12**	**0**	**3**	**0**	**0**	**409**	**1**		
					CPUE(Catch/Day)		**3.07**	**2.4563**	**0**	**0.6141**	**0**	**0**	**83.719**	**0.2047**		
WF Nowhere	Upstream from road	4	8/8/06 12:00	8/9/06 9:52	21.87	7	7									
	Stream blocked		8/9/06 9:52	8/10/06 10:04	24.20	7	8									
	Fishing up and		8/10/06 10:04	8/11/06 10:02	23.97	8	8.8									
	downstream movement		8/11/06 10:02	8/12/06 9:20	23.30	8.8	5									
			8/12/06 9:20	8/13/06 9:25	24.08	5	3.8									
				Total:	**117.42 hrs**	**Total Fish:**	**0**	**0**	**0**	**0**	**0**	**0**	**206**	**0**		
					CPUE(Catch/Day)		**0**	**0**	**0**	**0**	**0**	**0**	**42.106**	**0**		
Nowhere	Downstream from road	5	8/8/06 12:45	8/9/06 9:30	20.75	8.5	8									
	Stream blocked		8/9/06 9:30	8/10/06 9:55	24.42	8	9.3									
	Fishing up and		8/10/06 9:55	8/11/06 9:55	24.00	9.3	9.8									
	downstream movement		8/11/06 9:55	8/12/06 9:05	23.17	9.8	7.5									
			8/12/06 9:05	8/13/06 9:15	24.17	7.5	5.2									
				Total:	**116.50 hrs**	**Total Fish:**	**6**	**3**	**0**	**3**	**0**	**0**	**94**	**0**		
					CPUE(Catch/Day)		**1.24**	**0.618**	**0**	**0.618**	**0**	**0**	**19.365**	**0**		
WF Ugnu Tributary	Upstream from road	6	8/8/06 13:10	8/9/06 10:26	21.27	9	8.5									Many NSB < 30mm
N of 1Q	Stream blocked		8/9/06 10:26	8/10/06 10:35	24.15	8.5	10									
	Fishing up and		8/10/06 10:35	8/11/06 10:24	23.82	10	10									
	downstream movement		8/11/06 10:24	8/12/06 9:47	23.38	10	7.5									
			8/12/06 9:47	8/13/06 9:55	24.13	7.5	4.9									
				Total:	**116.75 hrs**	**Total Fish:**	**44**	**0**	**0**	**37**	**0**	**7**	**2641**	**0**		
					CPUE(Catch/Day)		**9.04**	**0**	**0**	**7.606**	**0**	**1.44**	**542.9**	**0**		
WF Ugnu Tributary	Upstream from road	7	8/9/06 10:40	8/10/06 10:50	24.17	9.5	11									
S of 1Q	Stream blocked		8/10/06 10:50	8/11/06 10:45	23.92	11	10.5									
	Fishing up and		8/11/06 10:45	8/12/06 10:00	23.25	10.5	8.5									
	downstream movement		8/12/06 10:00	8/13/06 10:15	24.25	8.5	6.5									
				Total:	**95.58 hrs**	**Total Fish:**	**34**	**1**	**0**	**33**	**0**	**0**	**4310**	**0**		
					CPUE(Catch/Day)		**8.54**	**0.2511**	**0**	**8.286**	**0**	**0**	**1082.2**	**0**		
WF Ugnu between	Upstream from road	8	8/8/06 14:35	8/9/06 11:15	20.67	9	9									Water up 1 to 2 inches
1L and 1F	Stream blocked		8/9/06 11:15	8/10/06 11:20	24.08	9	10.5									
	Fishing up and		8/10/06 11:50	8/11/06 11:15	23.42	10.5	10.5									
	downstream movement		8/11/06 11:15	8/12/06 11:05	23.83	10.5	8									
			8/12/06 11:05	8/13/06 14:05	27.00	8	6									
				Total:	**119.00 hrs**	**Total Fish:**	**331**	**0**	**0**	**325**	**0**	**6**	**101**	**0**		
					CPUE(Catch/Day)		**66.76**	**0**	**0**	**65.546**	**0**	**1.21**	**20.37**	**0**		
Milne B Pad Ck	Downstream from road	9	8/8/06 17:00	8/9/06 13:45	20.75	9	10									
	Stream blocked	10	8/9/06 13:45	8/10/06 12:40	22.92	10	9.7									
	Fishing up and		8/10/06 12:40	8/11/06 12:25	23.75	9.7	9.5								few tps	
	downstream movement		8/11/06 12:25	8/12/06 12:20	23.92	9.5	6									
			8/12/06 12:20	8/13/06 15:45	27.42	6	5									
				Total:	**118.75 hrs**	**Total Fish:**	**3**	**1**	**0**	**0**	**1**	**1**	**68**	**4**		
					CPUE(Catch/Day)		**0.61**	**0.2021**	**0**	**0**	**0.2**	**0.2**	**13.743**	**0.8084**		
Milne B Pad Lk	Lake set	11	8/9/06 14:20	8/10/06 12:50	22.50	9.5	10									
		12	8/10/06 12:50	8/11/06 12:35	23.75	10	9.5								1000+ tps	
		13	8/11/06 12:35	8/12/06 12:30	23.92	9.5	6.5									
			8/12/06 12:30	8/13/06 16:00	27.50	6.5	4.8									
				Total:	**97.67 hrs**	**Total Fish:**	**2**	**1**	**0**	**0**	**1**	**0**	**55**	**0**		
					CPUE(Catch/Day)		**0.02**	**0.0102**	**0**	**0**	**0.01**	**0**	**0.5631**	**0**		
Kalubik by 2a 4way	Upstream from road	14	8/11/06 16:00	8/12/06 10:30	18.50	11.5	8.2									
	Stream blocked		8/12/06 10:30	8/13/06 10:50	24.33	8.2	6									
	Fishing up and		8/13/06 10:50	8/14/06 10:10	23.33	6	5.7									
	downstream movement			**Total:**	**66.17 hrs**	**Total Fish:**	**8**	**7**	**1**	**0**	**0**	**0**	**468**	**0**		
					CPUE(Catch/Day)		**2.90**	**2.539**	**0.3627**	**0**	**0**	**0**	**169.75**	**0**		
East Cr. Mp1 Rd.	Stream blocked	15	8/12/06 15:50	8/13/06 17:05	25.25	7.8	6									
	Fishing up and		8/13/06 17:05	8/14/06 10:55	17.83	6	5.1									
	downstream movement			**Total**	**43.08 hrs**	**Total Fish:**	**57**	**4**	**0**	**53**	**0**	**0**	**0**	**0**		
					CPUE(Catch/Day)		**31.75**	**2.2282**	**0**	**29.524**	**0**	**0**	**0**	**0**		

Key to Fish and Invertebrate Abbreviations

BWF	Broad whitefish
RWF	Round whitefish
AG	Arctic grayling
DV	Dolly Varden
LCI	Least cisco
NSB	Ninespine stickleback
TSB	Threespine stickleback
tps	tadpole shrimp
fs	fairy shrimp

NOTE: Total number of fish and combined CPUE values do not include ninespine or threespine stickleback

Table 2. A summary of all results for each net site sampled in 2007 is presented in the table. Site and net set descriptions are provided. Water temperature records are included and a summary of total fish caught by species with catch per 24 hr period. Total hours fished, total fish captured (not including stickleback species) and total catch per unit effort for non-stickleback species is also included in the boxed area for each net site. Yellow blocks denote anadromous catches.

Site Description	Net Description	Set Date	Check Date	Set Duration	Temp/Set	Temp/Chk	BWF	RWF	AG	DV	LCI	NSB	TSB	Inverts	Notes
Caribou by 3A	Upstream from road	7/5/07 9:40	7/6/07 8:20	22.67	9.30										
	Stream blocked	7/6/07 8:20	7/7/07 8:25	24.08		11.60									
	Fishing up and	7/7/07 8:25	7/8/07 8:30	24.08	11.60	12.80									
	downstream movement	7/8/07 8:30	7/9/07 8:00	23.50	12.80	8.90									
		7/9/07 8:00	7/10/07 7:55	23.92	8.90	6.00									
		7/10/07 7:55	7/11/07 7:55	24.00	6.00	6.00									
		7/11/07 7:55	7/12/07 8:00	24.08	6.00	8.00									
			Total:	**166.33 hrs**	**Fish**	**0.00**	**0**	**0**	**0**	**0**	**0**	**87**			
				CPUE(Catch/Day)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**12.55**			
WF Nowhere	Upstream from road	7/5/07 10:10	7/6/07 8:45	22.58	7.90	9.20									very shallow ds
	Stream blocked	7/6/07 8:45	7/7/07 8:45	24.00	9.20	10.20									
	Fishing up and	7/7/07 8:45	7/8/07 9:00	24.25	10.20	11.40									
	downstream movement		**Total:**	**70.83 hrs**	**Fish**	**0.00**	**0**	**0**	**0**	**0**	**0**	**65**			
				CPUE(Catch/Day)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**22.02**			
Nowhere	Downstream from road	7/5/07 10:30	7/6/07 9:00	22.50	9.80	10.60									
	Stream blocked	7/6/07 9:00	7/7/07 8:55	23.92	10.60	11.50									
	Fishing up and	7/7/07 8:55	7/8/07 9:10	24.25	11.50	12.60									
	downstream movement	7/8/07 9:10	7/9/07 8:30	23.33	12.60	9.70									
		7/9/07 8:30	7/10/07 8:10	23.67	9.70	7.00									
		7/10/07 8:10	7/11/07 8:25	24.25	7.00	6.40									
		7/11/07 8:25	7/12/07 8:40	24.25	6.40	7.40									
			Total:	**166.17 hrs**	**Fish**	**39.00**	**6**	**0**	**32**	**1**	**0**	**101**			
				CPUE(Catch/Day)		**5.63**	**0.87**	**0.00**	**4.62**	**0.14**	**0.00**	**14.59**			
E Fk Nowhere	Upstream from road	7/5/07 10:40	7/6/07 9:15	22.58	9.30	9.30									
	Stream blocked	7/6/07 9:15	7/7/07 9:10	23.92	9.30	9.70									
	Fishing up and	7/7/07 9:10	7/8/07 9:25	24.25	9.70	10.60									
	downstream movement	7/8/07 9:25	7/9/07 8:40	23.25	10.60	6.20									
		7/9/07 8:40	7/10/07 8:25	23.75	6.20	4.30									
		7/10/07 8:25	7/11/07 8:40	24.25	4.30	4.50									
		7/11/07 8:40	7/12/07 8:50	24.17	4.50	6.50									
			Total:	**166.17 hrs**	**Fish**	**20.00**	**3**	**0**	**17**	**0**	**0**	**664**			
				CPUE(Catch/Day)		**2.89**	**0.43**	**0.00**	**2.46**	**0.00**	**0.00**	**95.90**			
WF Ugnu Tributary	Upstream from road	7/5/07 11:10	7/6/07 9:45	22.58	10.30	11.30									
N of 1Q	Stream blocked	7/6/07 9:45	7/7/07 9:40	23.92	11.30	12.10									
	Fishing up and	7/7/07 9:40	7/8/07 9:50	24.17	12.10	13.40									
	downstream movement	7/8/07 9:50	7/9/07 9:20	23.50	13.40	10.60									
		7/9/07 9:20	7/10/07 8:45	23.42	10.60	6.90									
		7/10/07 8:45	7/11/07 9:00	24.25	6.90	6.80									
		7/11/07 9:00	7/12/07 9:15	24.25	6.80	8.60									
			Total:	**166.08 hrs**	**Fish**	**0.00**	**0**	**0**	**0**	**0**	**0**	**169**			
				CPUE(Catch/Day)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**24.42**			
WF Ugnu Tributary	Upstream from road	7/5/07 11:25	7/6/07 9:55	22.50	10.00	11.00									
S of 1Q	Stream blocked	7/6/07 9:55	7/7/07 9:50	23.92	11.00	12.00									
	Fishing up and	7/7/07 9:50	7/8/07 10:00	24.17	12.00	13.20									
	downstream movement	7/8/07 10:00	7/9/07 9:05	23.08	13.20	9.10									
		7/9/07 9:05	7/10/07 8:50	23.75	9.10	8.70									
		7/10/07 8:50	7/11/07 9:07	24.28	8.70	8.10									
		7/11/07 9:07	7/12/07 9:25	24.30	8.10	8.90									
			Total:	**166.00 hrs**	**Fish**	**2.00**	**0**	**0**	**1**	**0**	**1**	**868**			
				CPUE(Catch/Day)		**0.29**	**0.00**	**0.00**	**0.14**	**0.00**	**0.14**	**125.49**			
WF Ugnu between	Upstream from road	7/5/07 11:50	7/6/07 10:15	22.42	10.70	11.70									
1L and 1F	Stream blocked	7/6/07 10:15	7/7/07 10:25	24.17	11.70	12.50									
	Fishing up and	7/7/07 10:25	7/8/07 10:20	23.92	12.50	13.50									
	downstream movement	7/8/07 10:20	7/9/07 9:40	23.33	13.50	11.00									
		7/9/07 9:40	7/10/07 9:25	23.75	11.00	8.50									
		7/10/07 9:25	7/11/07 9:25	24.00	8.50	8.10									
		7/11/07 9:25	7/12/07 9:50	24.42	8.10	9.40									
			Total:	**166.00 hrs**	**Fish**	**280.00**	**0**	**0**	**279**	**0**	**1**	**493**			
				CPUE(Catch/Day)		**40.48**	**0.00**	**0.00**	**40.34**	**0.00**	**0.14**	**71.28**			
I Pad Lake	Lake set	7/5/07 12:15	7/6/07 11:30	23.25	10.30	10.70									
		7/6/07 11:30	7/7/07 11:20	23.83	10.70	11.30									
		7/7/07 11:20	7/8/07 11:10	23.83	11.30	12.00									
		7/8/07 11:10	7/9/07 10:25	23.25	12.00	9.50									
		7/9/07 10:25	7/10/07 10:10	23.75	9.50	7.80									
		7/10/07 10:10	7/11/07 10:07	23.95	7.80	7.40									a few copepods observed
		7/11/07 10:07	7/12/07 10:35	24.47	7.40	8.80									
			Total:	**166.33 hrs**	**Fish**	**0.00**	**0**	**0**	**0**	**0**	**0**	**17**			
				CPUE(Catch/Day)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.45**			
Milne B Pad Ck	Upstream from road	7/5/07 13:50	7/6/07 12:00	22.17	10.10	10.90									
	Stream blocked	7/6/07 12:00	7/7/07 11:45	23.75	10.90	11.00									
	Fishing up and	7/7/07 11:45	7/8/07 11:40	23.92	11.00	11.00									
	downstream movement	7/8/07 11:40	7/9/07 10:50	23.17	11.00	6.80									
		7/9/07 10:50	7/10/07 10:30	23.67	6.80	5.10									
		7/10/07 10:30	7/11/07 10:30	24.00	5.10	5.50									
		7/11/07 10:30	7/12/07 11:15	24.75	5.50	8.20									
			Total:	**165.42 hrs**	**Fish**	**12.00**	**3**	**0**	**2**	**0**	**7**	**414**			
				CPUE(Catch/Day)		**1.74**	**0.44**	**0.00**	**0.29**	**0.00**	**1.02**	**60.07**			
Milne B Pad Lk	Lake set	7/5/07 14:10	7/6/07 12:33	22.38	9.90	11.20									
		7/6/07 12:33	7/7/07 11:50	23.28	11.20	11.00									lead twisted
		7/7/07 11:50	7/8/07 11:50	24.00	11.00	11.40									
		7/8/07 11:50	7/9/07 10:55	23.08	11.40	7.90									
		7/9/07 10:55	7/10/07 10:40	23.75	7.90	5.90									
		7/10/07 10:40	7/11/07 10:45	24.08	5.90	6.00									
		7/11/07 10:45	7/12/07 11:30	24.75	6.00	8.40									
			Total:	**165.33 hrs**	**Fish**	**1.00**	**0**	**0**	**0**	**0**	**1**	**7**			
				CPUE(Catch/Day)		**0.15**	**0.00**	**0.00**	**0.00**	**0.00**	**0.15**	**1.02**			

Key to Fish and Invertebrate Abbreviations

BWF	Broad whitefish
RWF	Round whitefish
AG	Arctic grayling
DV	Dolly Varden
LCI	Least cisco
NSB	Ninespine stickleback
TSB	Threespine stickleback
tps	tadpole shrimp
fs	fairy shrimp

NOTE: Total number of fish and combined CPUE values do not include ninespine or threespine stickleback

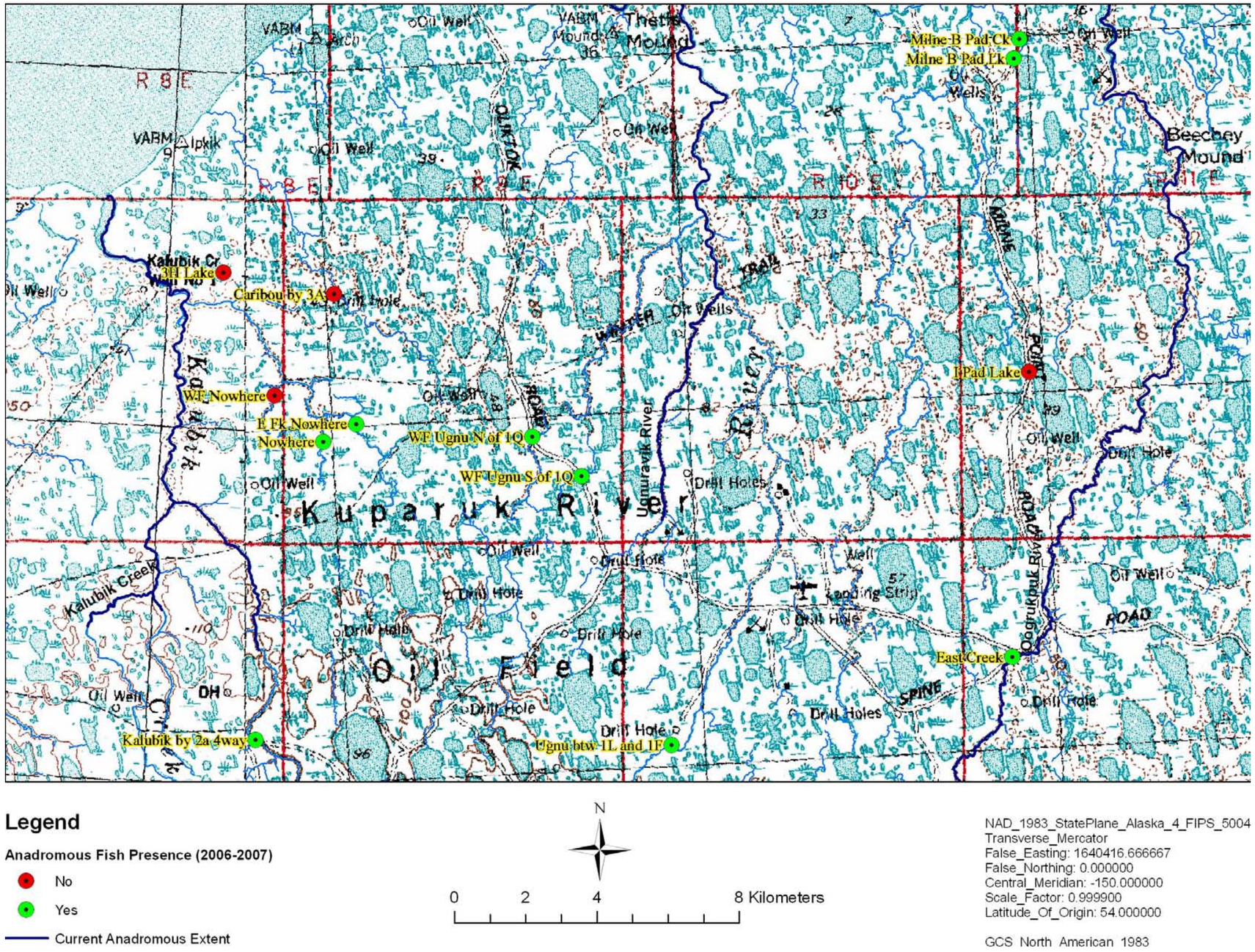


Figure 1. Map of streams and lakes sampled in August 2006 and/or July 2007. Fish were captured at all sites with the exception of 3H Lake, a perched tundra lake with no surface water connections to fish bearing water bodies. Anadromous fish were captured in all drainages with the exception of Caribou Creek. No anadromous fish were captured in the West Fork of Nowhere Creek or in I Pad Lake.

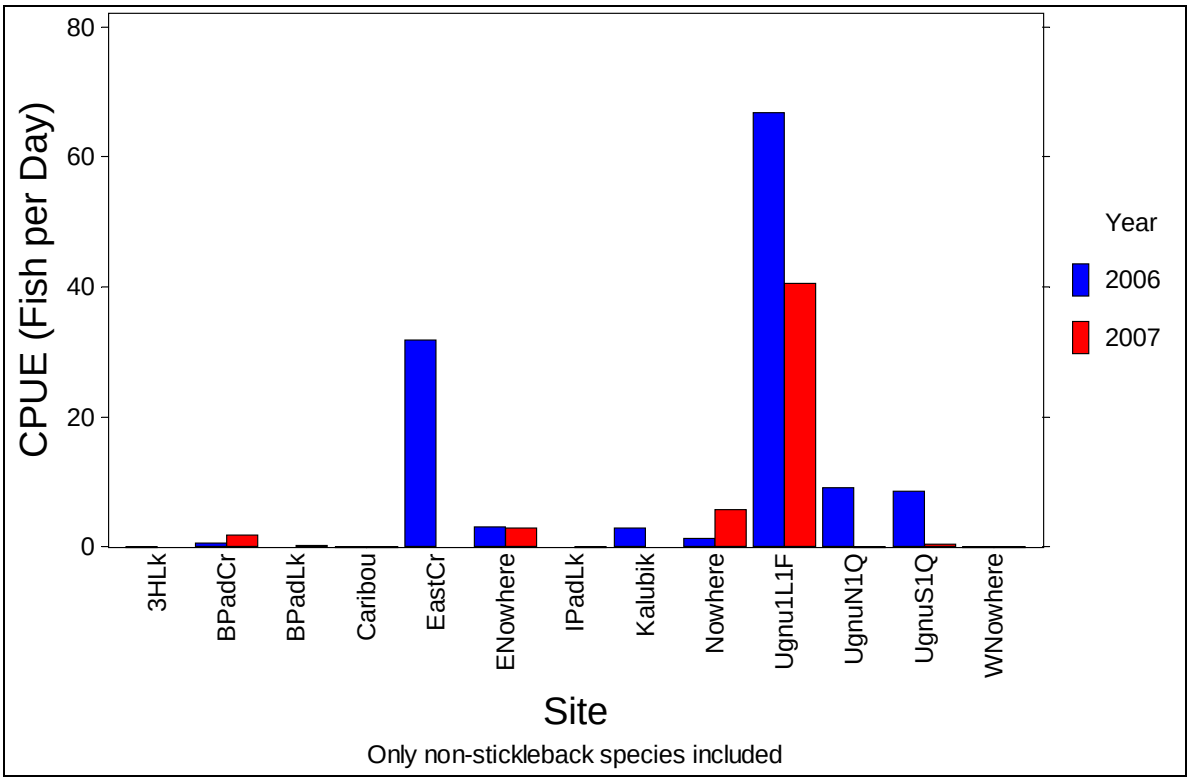


Figure 2. Catch Per Unit of Effort (fish per day/24 hour period) for all non-stickleback fish species captured during August 2006 and July 2007 sampling.

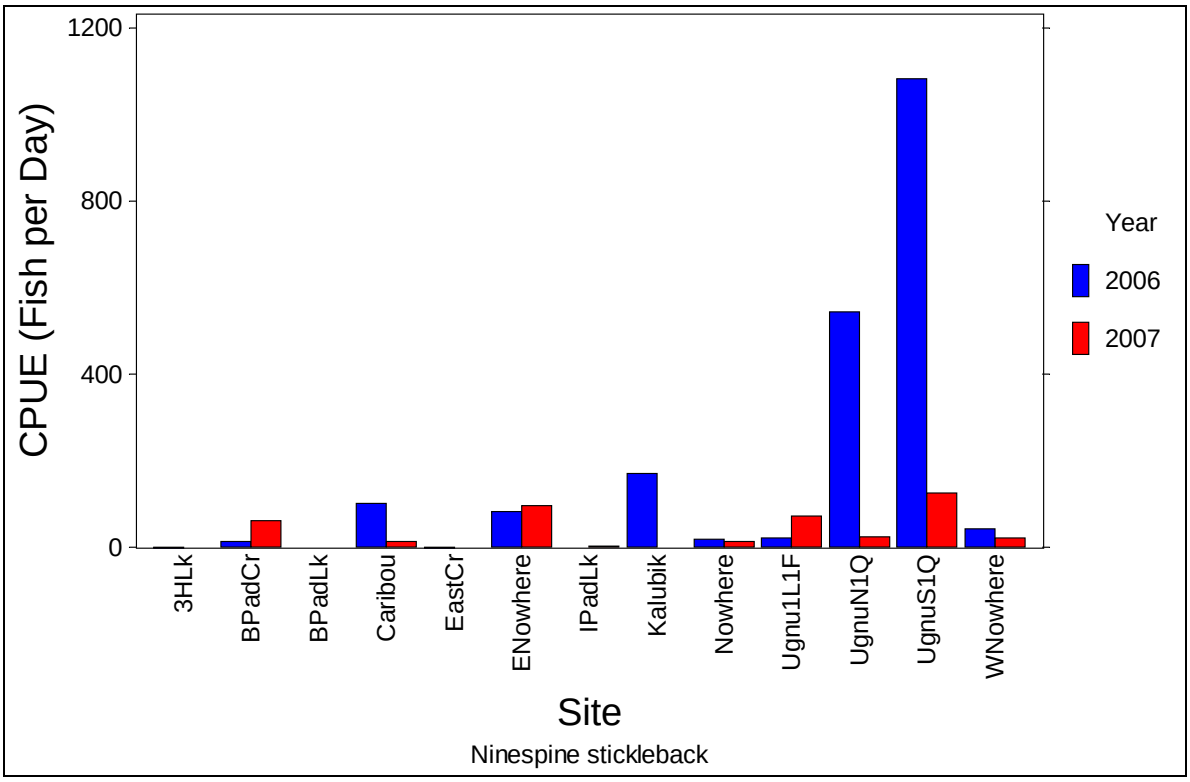


Figure 3. Catch Per Unit of Effort (fish per day/24 hour period) for ninespine stickleback captured during August 2006 and July 2007 sampling.

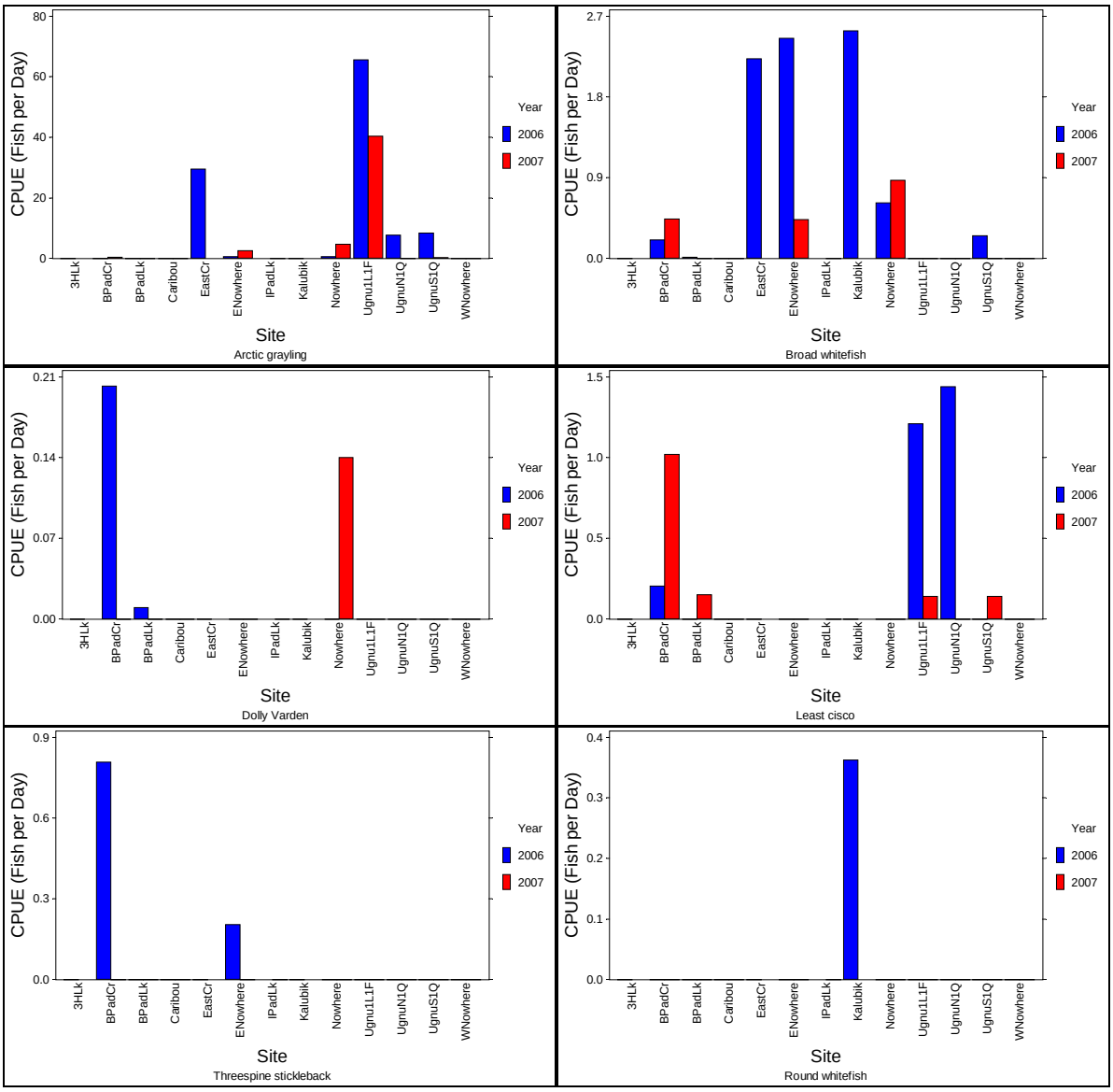


Figure 4. Catch Per Unit of Effort (fish per day/24 hour period) for Arctic grayling (top left), broad whitefish (top right), Dolly Varden (middle left), least cisco (middle right), threespine stickleback (bottom left), and round whitefish (bottom right) for all sites sampled in August 2006 and July 2007.

Area-Specific Results

Caribou Creek and Nowhere Creek Sampling: (Figure 5, Photographs 1-5)

A fyke net was set to capture fish moving upstream and downstream upstream from the Drill Site 3A access road in Caribou Creek for 93.37 hours between August 9 and August 12, 2006. Ninespine stickleback CPUE was 101 fish per day over the sampling period, yielding 393 fish (Table 1). No other species were captured. Water temperatures during sampling ranged from around 8.0 to 10.0 ^{o}C, but dropped to 6.5 ^{o}C on the final day of sampling.

A fyke net was set at the same sampling location in Caribou Creek on July 5, 2007 and was operated for a total of 166.33 hours; the net was removed on July 12, 2007. Similar to 2006, only ninespine stickleback were captured (Table 2). However, only 87 fish were captured yielding a CPUE of 12.55 fish per day, considerably lower than in 2006. Water temperatures generally were warmer in July 2007 than in August 2006 and ranged from 6.0 to 12.8 C. The warmest water temperatures occurred in the middle of the sampling period and the coolest generally occurred toward the end of sampling (Table 2).

A fyke net was set to capture fish moving upstream and downstream upstream from the access road crossing of the East Fork of Nowhere Creek for 117.25 hours between August 8 and August 13, 2006. Twelve age-0 broad whitefish were captured and ranged in length from 60 to 79 mm. Three juvenile Arctic grayling were also captured and ranged in length from 148 to 168 mm. Ninespine stickleback CPUE was 83.72 fish per day; 409 fish were captured. One threespine stickleback was captured. CPUE for non-stickleback species was approximately 3 fish per day (Table 1). Water temperatures remained between 7 and 9 ^{o}C until the last two days of sampling when water temperatures dropped to 5.5 ^{o}C on August 12 and 4.9 ^{o}C on August 13.

A fyke net was set in the same configuration and at the same location in the East Fork of Nowhere Creek on July 5, 2007. The net was fished for 166.17 hours and was removed on July 12, 2007. Seventeen juvenile Arctic grayling, ranging in length from 67 to 181 mm were captured. Only three juvenile broad whitefish were captured in July 2007, considerably fewer than were captured in 2006. Broad whitefish captured ranged in length from 96 to 101 mm. The

catch rate of ninespine stickleback in July 2007 was 95.9 fish per day, slightly higher than the catch rate in August 2006. (Table 1, Table 2). Water temperatures ranged from 4.3 ^{o}C, towards the end of sampling, to a peak on 10.6 ^{o}C on July 8, roughly in the middle of the sampling period.

A fyke net was set to capture fish moving upstream and downstream upstream from the road crossing of the West Fork of Nowhere Creek for 117.4 hours between August 8 and August 13, 2006. Ninespine stickleback CPUE was approximately 42.11 fish per day; 206 fish were captured (Table 1). No other fish species were captured. Water temperatures ranged from 7.5 ^{o}C to nearly 10 ^{o}C for most of the sampling period but dropped sharply by August 13 to 5.2 oC.

A net was reset in the West Fork of Nowhere Creek on July 5, 2007 and removed on July 8. The net was set for a total of 70.83 hours and captured 65 ninespine stickleback. The ninespine stickleback catch rate was only 22.0 fish per day, roughly 50% lower than catch rates in August 2006 (Table 1, Table 2). Water temperature was 7.9 ^{o}C on July 5 when the net was set and consistently warmed during sampling to 11.4 ^{o}C when the net was removed on July 8, 2007.

A fyke net was set downstream from the road crossing of Nowhere Creek for 116.5 hours between August 8 and August 13, 2006 to capture fish moving upstream and downstream. Three age-0 broad whitefish ranging in length from 60 to 63 mm were captured. Three juvenile Arctic grayling were captured and ranged in length from 62 to 121 mm. Ninespine stickleback were captured at a rate of 19.63 fish per; 94 fish were caught. CPUE for all non-stickleback species was approximately 1 fish per day (Table 1). Water temperatures ranged from 8 to 9.8 ^{o}C for the majority of the sampling period but dropped sharply to 5.2 ^{o}C by August 13.

The fyke net was reset at the same location in the same configuration on July 5, 2007. The net was operated for 166.17 hours and was removed on July 12, 2007. Six age-1 broad whitefish were captured and ranged in length from 83 to 93 mm. One 206 mm sea run Dolly Varden juvenile was also captured (Table 2). Ninespine stickleback were CPUE was about 14.5 fish per day in July 2007, down somewhat from catch rates in 2006. Water temperature was 9.8 ^{o}C on July 5, increased through July 8 when it peaked at 12.6 ^{o}C, then consistently dropped to a low of 6.4 ^{o}C on July 11.

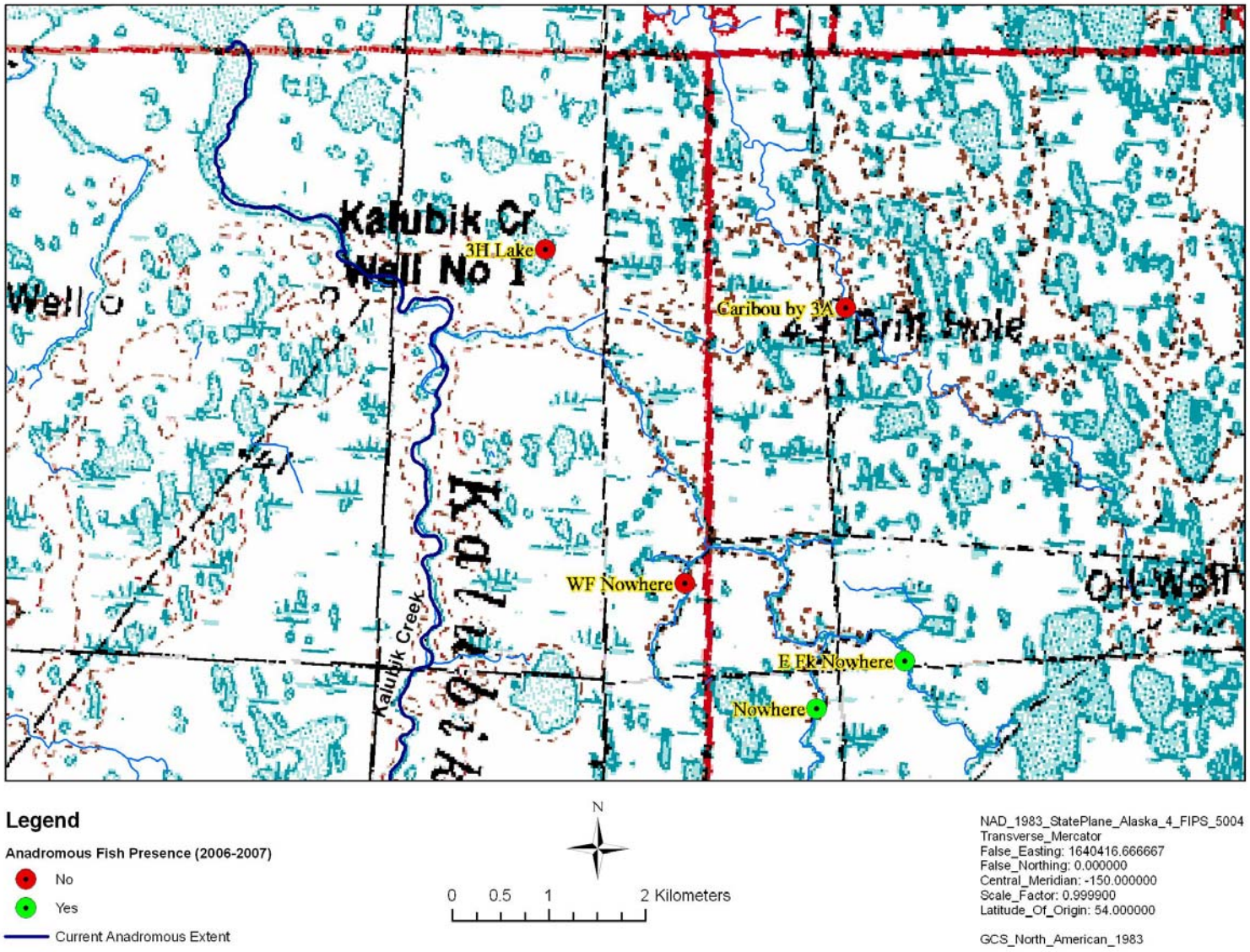


Figure 5. Map of sites sampled in August 2006 and July 2007 in the Caribou Creek and Nowhere Creek drainages; 3H Lake sample site is also shown.

Ugnuravik River and Tributaries: (Figure 6, Photographs 6-8)

A fyke net was set to capture fish moving upstream and downstream upstream from the Spine Road crossing of a tributary to the West Fork of the Ugnuravik River north of Drill Site 1Q for 116.75 hours between August 8 and August 13, 2006. Thirty seven age-0 Arctic grayling were captured and ranged in length from 47 to 66 mm; seven age-0 least cisco were also captured and ranged in length from 56 to 63 mm. Ninespine stickleback CPUE was 542.9 fish per day; 2,641 fish were captured, many of which appeared to be age-0 fish. CPUE for all non-stickleback species was approximately 9 fish per day (Table 1). Water temperatures during sampling typically ranged from 7.5 to 10 ^{o}C but dropped to 4.9 ^{o}C on August 13.

The net was reset on July 5, 2007 and operated for 166.08 hours when it was removed on July 12, 2007. Only ninespine stickleback were captured at a catch rate of only 24.4 fish per day, about a 95% lower rate than in August 2006. Water temperature warmed from 10.3 ^{o}C on July 5 to 13.4 ^{o}C on July 9. Temperatures cooled from July 9 to a low of 6.8 ^{o}C on July 11, the day before the net was removed (Table 2).

A fyke net was set to capture fish moving upstream and downstream for 95.58 hours upstream from the Spine Road crossing of a tributary to the West Fork of the Ugnuravik River south of Drill Site 1Q between August 9 and August 13, 2006. One juvenile broad whitefish (228 mm long) and 33 Arctic grayling were captured. Arctic grayling were predominantly age-0 fish with 32 fish ranging in length from 49 to 63 mm, and one juvenile fish at 209 mm long. Ninespine stickleback CPUE was 1082 fish per day yielding 4,310 fish. CPUE for all non-stickleback species was approximately 8.6 fish per day (Table 1). Water temperatures were warm in this tributary during sampling and typically ranged from 8.5 to 11 ^{o}C with a drop in temperature to 6.5 ^{o}C on August 13.

The net was reset on July 5, 2007 and operated for 166.0 hours when it was removed on July 12, 2007. Only two non-stickleback fish were captured in July 2007; one 89 mm Arctic grayling and one 94 mm least cisco (Table 2). Ninespine stickle CPUE was about 125 fish per day, about

87% lower than in August 2006. Water temperature ranged from 8.1 ^{o}C to 13.2 ^{o}C with the peak temperature observed on July 8.

A fyke net was set to capture fish moving upstream and downstream upstream from the Drill Site 1L to Drill Site 1F access road crossing of the Ugnuravik River for 119 hours between August 8 and August 13, 2006. Three hundred twenty three age-0 Arctic grayling were captured and ranged in length from 35 to 67 mm (mean = 54.6mm, SD = 4.6); two older/larger juveniles (126 and 117 mm) were also captured. Six age-0 and larger size/age class least cisco were captured and ranged in size from 47 to 311 mm long. Ninespine stickleback CPUE was 20.37 fish per day yielding 101 fish. The catch rate for all non-stickleback species was approximately 67 fish per day (Table 1). Water temperatures were between 8 and 10.5 ^{o}C until August 13 when water temperatures dropped to 6 ^{o}C.

The net was reset on July 5, 2007 and operated for 166.0 hours when it was removed on July 12, 2007. One 80 mm least cisco was captured as well as 279 Arctic grayling (Table 2). Arctic grayling ranged in size from 51 to 263 mm (Mean = 79.1 mm, SD = 19.7); however, only eleven of the fish captured were greater than 100 mm. The catch rate for all non-stickleback species was 40.5 fish per day, lower than the catch rates observed in August 2006. However, the ninespine stickleback CPUE was 71.28 fish per day, over three times higher than the catch rate observed in August 2006. Water temperature was 10.7 ^{o}C on July 5 and steadily increased to a peak of 13.5 ^{o}C on July 8. Water temperature then decreased daily to a minimum of 8.1 ^{o}C on July 11, 2007.

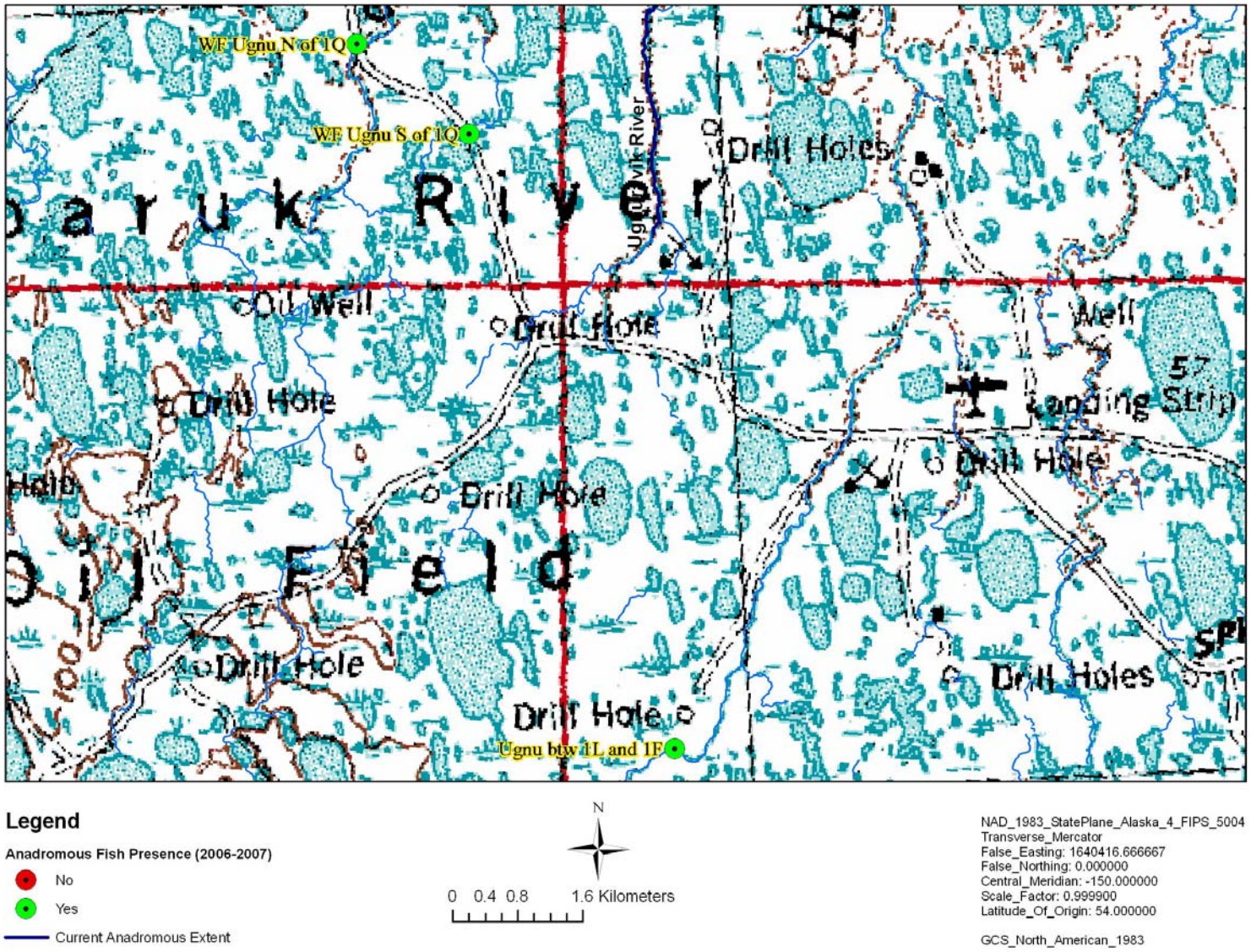


Figure 6. Map of August 2006 and July 2007 sample sites in the Ugnuravik River and West Fork Ugnuravik River tributaries.

Milne Point Area – B Pad Creek and Lake, I Pad Lake: (Figure 7, Photographs 9-13)

A fyke net set to capture fish moving upstream and downstream was fished for 97.67 hours between August 9 and August 13, 2006 in an unnamed creek (Milne B Pad Creek) downstream from the B Pad access road crossing. One juvenile broad whitefish (263 mm long) and one sea run Dolly Varden juvenile (240 mm long) were captured. Sixty eight ninespine and four threespine stickleback were also captured (Table 1). Water temperatures were between 9 and 10 ^{o}C during most of sampling but fell to 6 and 5 ^{o}C on August 12 and 13.

The fyke net was reset in Milne B Pad Creek on July 5, 2007 and was operated for 165.4 hours when it was removed on July 12, 2007. Three broad whitefish (487, 410, and 357 mm), two juvenile Arctic grayling (71 and 73 mm), and seven least cisco ranging in size from 262 to 434 mm were captured. The catch rate for non-stickleback species was 1.74 fish per day in July 2007 as opposed to 0.61 fish per day in August 2006 (Table 1, Table 2). The ninespine stickleback CPUE was about 60 fish per day whereas the August 2006 catch rate was only 0.56 fish per day. Water temperature peaked at 11.0 ^{o}C on July 8 but rapidly dropped to 5.1 ^{o}C on July 10, 2007.

A fyke net was fished in an unnamed lake in the B Pad Creek drainage (B Pad Lake), upstream from the B Pad access road crossing of the stream, for 97.7 hours between August 9 and August 13, 2006. One juvenile broad whitefish (207 mm long) and one juvenile sea-run Dolly Varden (215 mm long) were captured in the lake. Fifty five ninespine stickleback were also captured (Table 1). Water temperatures were between 9.5 and 10 ^{o}C from August 9 through August 11 and dropped to 6.5 and 4.8 ^{o}C on August 12 and 13.

The B Pad Lake net was reset on July 5, 2007 and operated for 165.33 hours when it was removed on July 12, 2007. Only seven ninespine stickleback and one 436 mm long least cisco were captured (Table 2). Water temperature fluctuated between 11.4 ^{o}C on July 8 and 5.9 ^{o}C on July 10.

A fyke net was set in I Pad Lake on July 5, 2007 and operated for 166.33 hours when it was removed on July 12, 2007. The lake is in the headwaters of Milne B Pad Creek, however; active connectivity with the stream probably occurs only briefly during high water events at break-up and during the fall rain season. Seventeen ninespine stickleback were captured. The lake is considerably farther south than the other sample sites in the stream and is much less affected by coastal weather patterns. Water temperature fluctuations were much less dramatic than those observed at the B Pad Creek and Lake sample sites in 2007 though the pattern was similar; water temperatures ranged from 7.4 ^{o}C on July 11 to 12.0 ^{o}C on July 8.

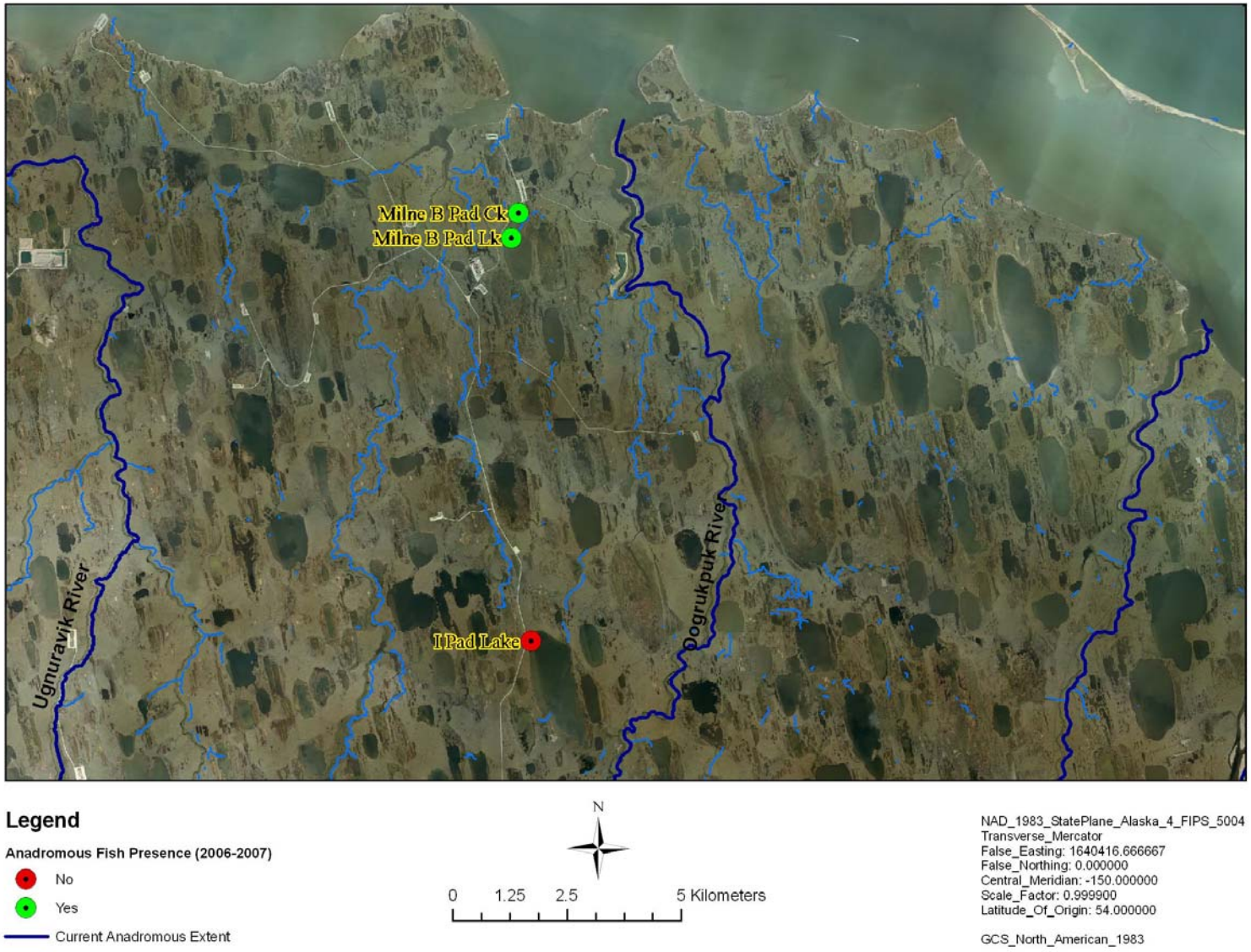


Figure 7. Map of sites sampled in August 2006 and July 2007 in an unnamed creek (Milne B Pad Creek) in the Milne Point Unit.

Kalubik Creek: (Figure 8, Photograph 14)

A fyke net was set to capture fish moving up and downstream in Kalubik Creek, upstream from the road crossing just east from the Drill Site 2A 4-way, for approximately 66 hours between August 11 and August 14, 2006. Water temperatures declined rapidly from 11.5 ^{o}C on August 11 to 5.7 ^{o}C on August 14. Seven broad whitefish were captured during the sampling event; three age-0 fish (55, 66, and 65 mm) and four juvenile to adult sized fish (328, 428, 450, and 470 mm). Additionally, one 275 mm round whitefish was captured. CPUE for non-stickleback species was 2.9 fish per day. Ninespine stickleback CPUE was 169.8 fish per day, for a total of 468 fish.

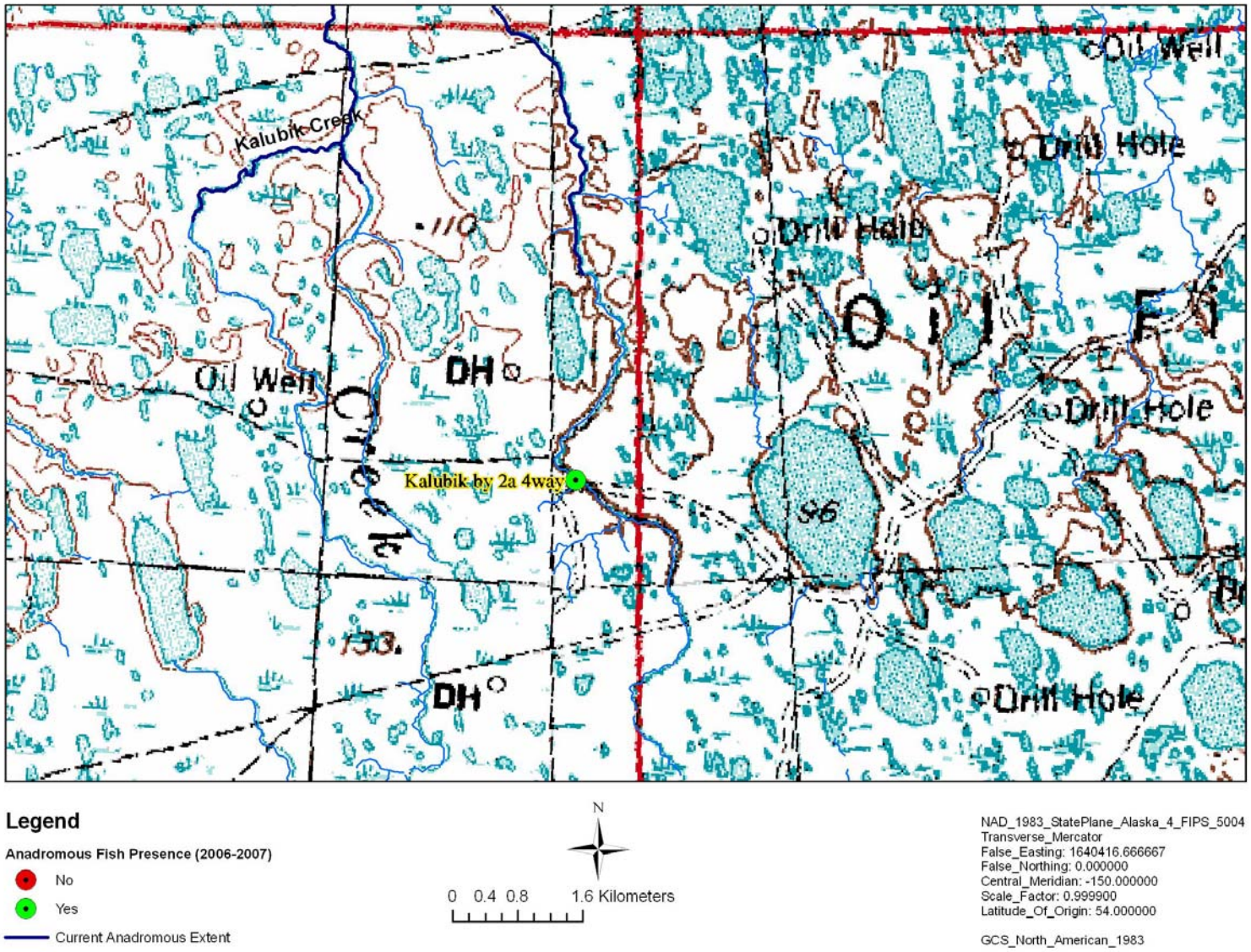


Figure 8. Map of Kalubik Creek sample site, August 2006.

Oogrukpuk River (Milne East Creek, East Creek): (Figure 9, Photograph 15)

A fyke net was set to capture fish moving upstream and downstream in the Oogrukpuk River (East Creek) (USGS incorrect spelling) for 43.08 hours between August 13 and August 14, 2006. Arctic grayling CPUE was 29.5 fish per day, for a total of 53 fish. Nearly all Arctic grayling were large fish with mean fork length of 332 mm (mean excludes two age-0 fish at 51 and 56 mm). Of the 51 Arctic grayling large enough to have received a FLOY® tag in past years, 16, or just higher than 31% were recaptured fish from prior years. Four broad whitefish ranging in size from 356 mm to 505 mm were also captured. The 505 mm long fish had been radio tagged at the site in 2004. Only two age-0 Arctic grayling were captured in the Oogrukpuk River, suggesting poor fry survival in 2006. However, we may have missed the movement of these smallest fish with our very short sampling period. Water temperatures were decreasing over the brief sampling period and ranged from 7.8 ^{o}C at the initial set to 5.1 ^{o}C when the net was removed.

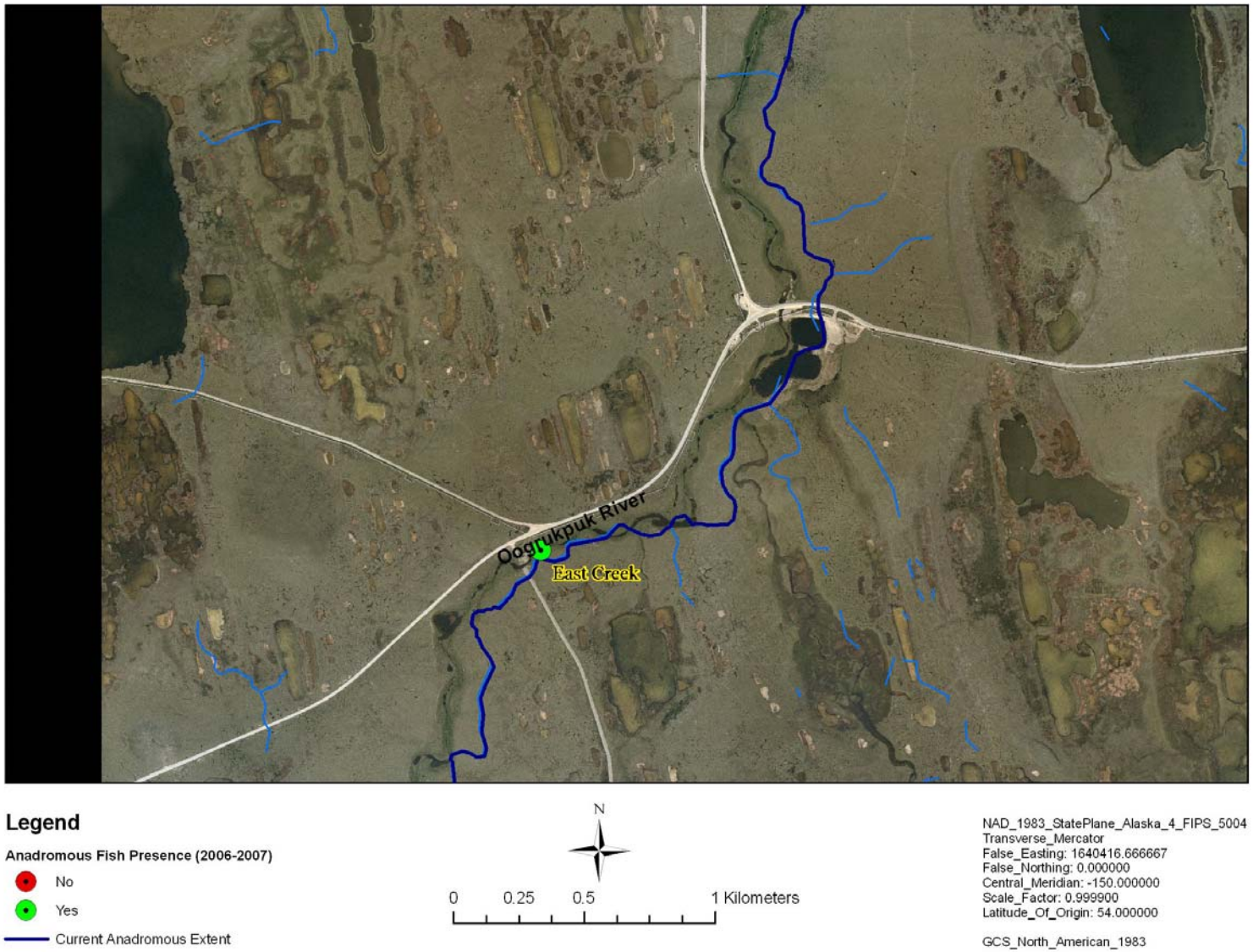


Figure 9. Map of August 2006 sample site in the Oogrukpuk River.

Discussion

All drainages sampled during August 2006 and July 2007 were used by fish with the exception of the DS3H Lake, an isolated tundra lake. While not all streams sampled were used by anadromous fish, all drainages sampled, except Caribou Creek, were used by fish. Regardless of size, most streams in the Kuparuk and Milne Point area are used by fish at least for summer rearing, and most, by both anadromous and resident fish species. Fyke net catches from the Oogrukpuk River (East Creek) continue to document use of the system by adult-sized broad whitefish, an occurrence that began in 2001. The recapture of a broad whitefish, likely radio tagged in the Oogrukpuk River in 2004, provides additional evidence of fidelity to the site by individuals that may have learned they can be successful by using the stream and the associated deep water habitat provided by Mine Site B.

Management Implications

Our low effort sampling program has identified resident fish species use of all sampled stream sites and all sampled lakes with a stream connection (whether continuous or discontinuous). Sampling also indicates that most systems, regardless of size, are used to some degree by anadromous fish species during summer. As such, development programs and even maintenance of existing stream crossings will be treated differently than pre-sampling when fish use was unknown or assumed not to occur. Streams shown to receive use by anadromous species have been nominated and approved for inclusion in the Anadromous Waters Catalog and as such will receive additional protection as required by statute. In fish bearing streams with only resident fish species, all activities in the stream must maintain fish passage while streams classified as important for anadromous fish are managed based on principles relating to the maintenance of fish habitat. Maintenance of fish passage is the minimum requirement for all fish bearing streams.

Recommendations for Future Work

Our recommendations for future work are to continue fish sampling of systems not previously sampled within the oilfields or those that have not been sampled in many years. Simple

sampling programs such as the one outlined in this report can provide information necessary for the proper protection of fish habitats previously overlooked and assumed of little to no value to fish.

Works Cited

Analytical Software, 2003. Statistix ® 8 User's Manual. Analytical Software, Tallahassee, Florida. 396 pp.

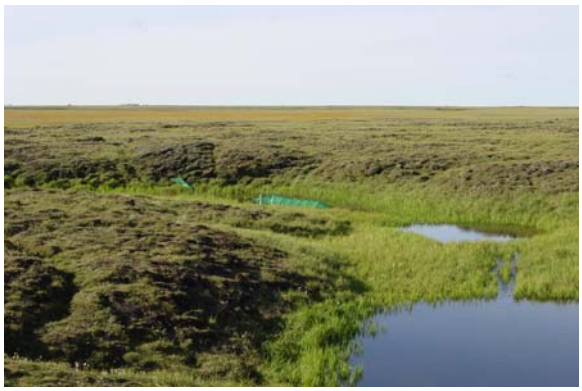
Morris, W.A, and J. F. Winters. 2007. A survey of stream crossing structures in the North Slope oil fields. Alaska Department of Natural Resources Tech. Rept. 08-01. Office of Habitat Management and Permitting. Juneau. 378 pp.

Photographs

Photograph 1- 3H Lake net set, August 2006.

Photograph 2- Caribou Creek net set, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 3- East Fork Nowhere Creek Nest Set, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.



Photograph 4- West Fork Nowhere Creek, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 5- Nowhere Creek nets set, August 2006. Net is set downstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 6- Tributary of the West Fork of the Ugnuravik River, north of Drill Site 1Q, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 7- Tributary of the West Fork of the Ugnuravik River, south of Drill Site 1Q, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 8- West Fork of the Ugnuravik River between drill sites 1L and 1F net set, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 9- Milne B Pad Creek net set, August 2006. Net is set downstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 10- Sea run Dolly Varden juvenile captured in 2006 in Milne B Pad Creek.

Photograph 11- Milne B Pad Lake net set, August 2006.

Photograph 12/13- Juvenile broad whitefish (left) and sea run Dolly Varden juvenile captured in August 2006 in Milne B Pad Lake.

Photograph 14- Kalubik Creek net set, August 2006. Net is set upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.

Photograph 15- Oogrukpuk River (East Creek) net set, August 2006. Net is set considerably upstream from the road and the creek is blocked such that fish moving in either direction will be intercepted.