SURVEYS OF FISH HABITATS IN THE TESHEKPUK LAKE REGION, 2003-2005

Final Report
December 2007

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North Slope Borough
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ABSTRACT

Fish habitats and populations in and around Teshekpuk Lake were investigated during summers 2003 to 2005. Sampling was primarily by fyke net, supplemented by gill net. The area of focused study was selected after obtaining traditional local knowledge and reviewing fishing patterns in the region. While broad whitefish was the primary species of interest, data were obtained on all captured species. Length, weight, age, sex, maturity and stomach samples were obtained for the three dominant species, broad whitefish, least cisco and Arctic grayling. Broad whitefish and Arctic grayling were tagged with T-bar anchor tags. Radio transmitters were implanted in 94 selected broad whitefish. Water depth was measured throughout the study area to identify potential wintering areas. Invertebrate prey species were sampled by Petite Ponar, plankton net and sweep net.

Over 200 mi^2 of habitat deeper than 7 feet are present in the main basin of Teshekpuk Lake, while large relict lake basins that form the outlet of the lake provide an additional 21.5 mi^2 of potential wintering habitat. Results from radio-tagged broad whitefish confirmed that the outlet region of Teshekpuk Lake is the most heavily used wintering area within the system, with few radio-tagged broad whitefish using the main basins of Teshekpuk Lake for wintering.

There were substantial differences in growth of broad whitefish and least cisco sampled in 2003-2005 when compared to the growth in 1990-1992. The differences were likely a result of the different habitats being sampled in the two time periods. Arctic grayling growth rates between the two periods did not show any difference. At this time, there is no evidence for detectable changes in fish growth or condition that can be attributed to climate change.

Heat has historically been a scarce resource in the arctic and fish will, up to a point, seek out warmer habitats to feed and grow, especially when fish are dispersing from wintering areas to begin feeding after the long period of winter fasting. Warmer habitats will have higher primary productivity, which can lead to abundant prey populations. In the Teshekpuk Lake study area, water temperatures at the tributary stations were higher than those at the outlet stream stations during June of both 2003 and 2004. Fish appeared to congregate in these warmer lateral habitats, leading to high catch rates of feeding broad whitefish, least cisco and Arctic grayling. These high concentrations of fish apparently attracted northern pike and burbot. The warm, lateral habitats typified by the tributary mouths contained extensive vegetation beds that support high densities of chironomids and snails, in contrast to the main outlet channel, which contained mostly amphipods. Chironomids and snails proved to be the predominant prey for broad whitefish. Another factor that appears to increase the value of specific tributaries is the extent of connected lake habitat.

Radio-tagged broad whitefish moved widely within the Teshekpuk Lake/Ikpikpuk River system. Fish moving into the upper Ikpikpuk region tended to be fish heading for spawning areas, while fish remaining in the outlet region tended to be non-spawning fish.

Fish moving into the upper Ikpikpuk overwintered in deep pools near spawning habitats or dispersed to downstream riverine habitats or lakes.

Key Words: North Slope, Teshekpuk Lake, broad whitefish, least cisco, Arctic grayling, wintering habitat, traditional knowledge, fyke net sampling, radio telemetry, radio tagging, fish habitat

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INTRODUCTION

Freshwater and anadromous fish species in the National Petroleum Reserve – Alaska (NPRA) provide significant subsistence fisheries for the villages of Atqasuk, Nuiqsut, and Barrow. Studies of subsistence fisheries in the Barrow area have reported annual harvests of close to 30,000 kg (Underwood et al. 1978, Braund et al. 1988). Despite the well-recognized importance of subsistence fisheries to the people of the area, few studies other than those directly related to oil development have examined these fisheries or associated habitats. Most studies on the North Slope have focused on surveying fish communities and habitats directly related to petroleum leases and have focused on the area immediately affected by the development (e.g., Moulton 1997, 2003, 2004) Examples include the Alpine Development-related studies in the Colville River Delta and in the Northeast Planning area of NPR-A.

Most subsistence harvest for Barrow occurs in the Dease Inlet/Admiralty Bay area (Philo et al. 1993). The area consists of a complex network of interconnected streams and lakes that drain into Admiralty Bay (Philo et al. 1993). Five major river systems—the Chipp, Alaktak, Topagoruk, Meade, and Inaru rivers—drain into the Bay. Teshekpuk Lake, the third largest lake in Alaska, is connected to the Dease Inlet/Admiralty Bay system by way of the Ikpikpuk/Chipp River system. The Miguakiak (Mayuġiaq) River (pronounced “May-or-ee-ak”), the sole outlet for Teshekpuk Lake, flows into the Ikpikpuk River.

Previous work in Teshekpuk Lake has indicated that the lake does not provide particularly important summer habitat for fish, likely because water temperatures remain cold during the summer growing season; however, the lake’s value as overwintering habitat has not yet been adequately investigated. In the Arctic, free water is reduced by nearly 95% in winter and becomes a scarce, critical resource (Craig 1989). The large volume of Teshekpuk Lake that is deeper than 6-7 feet (typical maximum ice thickness) may provide significant overwintering fish habitat. Portions of the Ikpikpuk and Mayuġiaq river channels also may have the necessary attributes for successful overwinter survival.

The Teshekpuk Lake study program was initiated in 2003 with a long-term goal of developing an understanding of fish populations using freshwater habitats linked to Teshekpuk Lake. Defining the Teshekpuk Lake system is difficult due to the complex web of interactions among streams, sloughs and lakes in the region. In addition, there are seasonally connected habitats and freshwater nearshore habitats that temporarily link additional regions after spring breakup. While Teshekpuk Lake itself covers an area in excess of 830 km^2 (320 mi^2), fish using the system of connected channels, lakes and nearshore regions may have access to an area encompassing over 32,600 km^2 (12,600 mi^2) (Figure 1).

Objectives of the study program are to obtain ecosystem information about the Teshekpuk Lake aquatic system to better understand habitat use patterns by fish within the system and identify regions especially important to fish populations. Information from the study program is intended to provide a basis for improved management decisions as use and resource development of the region increases. Priority is placed on broad whitefish, which is the species most important to subsistence users.

Specific objectives of the 2003-2005 fish survey were to conduct studies on the Teshekpuk Lake drainage system to:

a) Evaluate potential fish wintering areas in and around Teshekpuk Lake,

b) Describe habitat use patterns and characteristics of fish populations in habitats associated with the Teshekpuk Lake system,

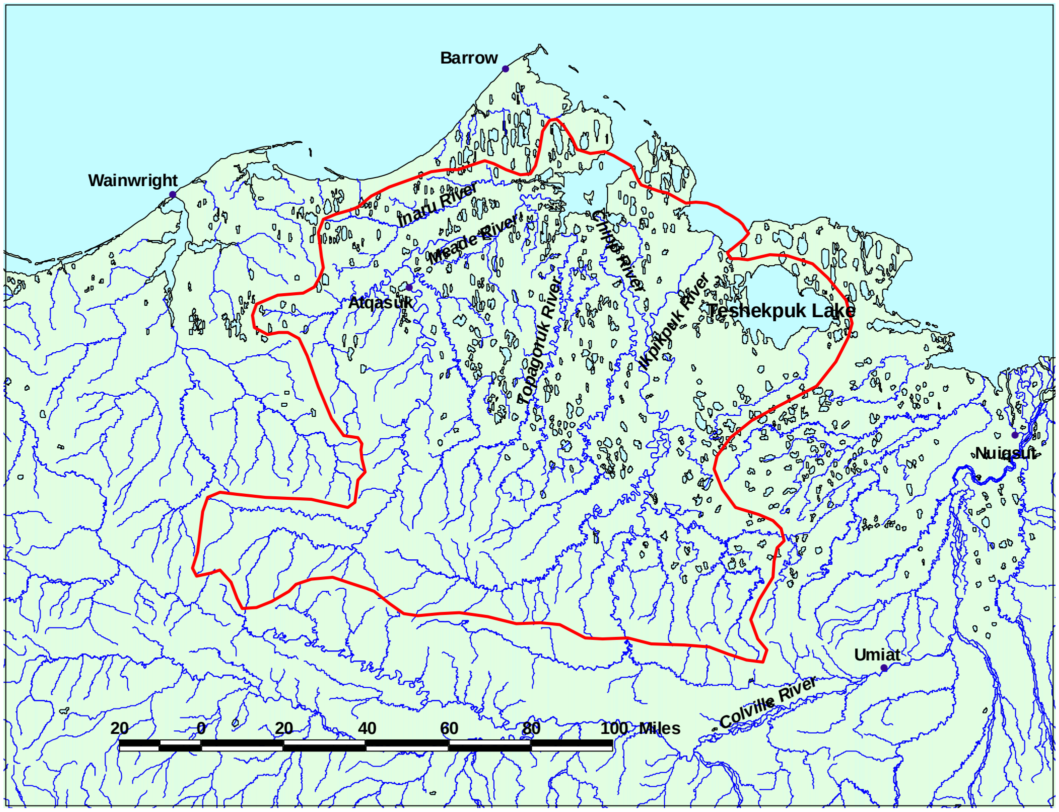

Figure 1. Approximate boundary of fresh and brackish water habitats expected to be used by fish associated with the Teshekpuk Lake drainage.

c) Evaluate fish feeding patterns in different habitats,

d) Obtain information on fish movements within the system, and

e) Compare results to information obtained in previous studies conducted from 1990-1992.

In 2003-2004, effort was focused on the Mayuġiaq River because it is known locally as providing important habitat for broad whitefish. This importance is reflected in the large number of fishing camps along its banks, and by information gained from interviewing people who use the area.

In 2005, effort shifted to the southeastern portion of the lake and Kealok Creek to investigate use of this region by fish in general and broad whitefish in particular.

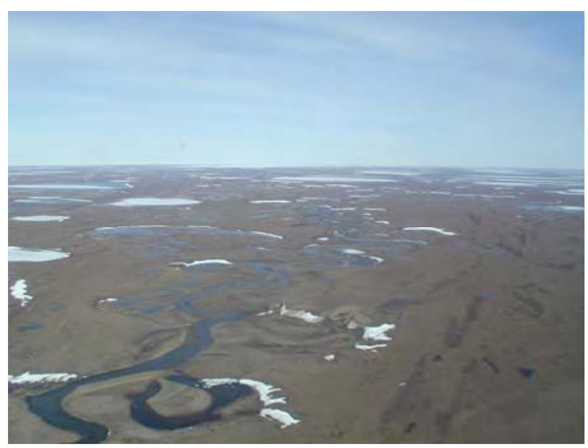

Figure 2. Broad whitefish (Aanaakliq) habitat with connected rivers, lakes and streams in the Kallilkpik River, southeast of Teshekpuk Lake. Aanaakliq require all three habitats for their life cycle.

INUPIAT LOCAL KNOWLEDGE OF FISH IN THE IKPIKPUK/TESHEKPUK REGION

The earliest evidence indicates that occupation of Northern Alaska probably began about 11,000 years ago, however, it is not known when people first settled in the Chipp-Ikpikpuk region. Reliable estimates of the earliest use of the Ikpikpuk system date to about 1,600 years ago. Arundale and Schneider, (1987) report that three "societies" of Inland Eskimos, or Ikpikpangmiut, lived in the area around the upper Chipp-Ikpikpuk region. Prehistoric remains of some semi-permanent settlements are at the confluence of the Kigali River and Maybe Creek.

These people subsisted on fish and caribou in winter but moved to the Beaufort Sea coast during summer for marine mammal hunting and fishing (Arundale and Schneider, 1987). They also participated in the trade fair at Nigliq at the western edge of the Colville Delta and a smaller one at Pigniq (where?). In 1826, Sir John Franklin reported that the Nunamiut people near the Colville River Delta had already acquired Russian trade goods including iron, knives, beads and tobacco via Kotzebue Sound Eskimos. It is likely the Ikpikpangmiut also had such items.

The scarcity of caribou North Slope around the turn of the 20th century is well documented in oral history and written accounts (Arundale and Schneider, 1987). Stephenson (1909) reported that fish and seal became one of the staples for both coastal and inland people during this period of caribou scarcity. Anadromous fish are a relatively stable food resource compared with other Arctic species and as such serve as an important supplementary food. In a recent interview, Mary Lou Leavitt whom grew up near Teshekpuk Lake told us that caribou were scarce in the 1920s and 30s and fish were their stable food item.

Traditional fishing equipment consisted of nets, spears and hand lines. Murdock (1892) and Bockstoce (1988) made reference the Ikpikpuk River fishery in the last century at Barrow. Maguire noted:

> *"October 24, 1853 ....The people seem to depend a good deal this season upon the fish and Venison brought in from the land, as parties are continually setting out to assist in bringing in what is already on the way or in procuring other supplies- They still try for small fish along the cracks in the ice but their success is indifferent....." (Bockstoce, 1988).*

Inupiat fishermen sustain a considerable body of knowledge about fish biology for the Ikpikpuk/Teshekpuk region and elsewhere in NPRA. Fish are an important resource, even to coastal marine mammal hunters in this region, because they are a predictable food source (M. Leavitt, pers. comm.). In fact, for people living in the Teshekpuk Lake area in the 1920-40s fish may have formed the most important food source. As mentioned, this was a period where caribou populations in Northern Alaska were at a nadir, resulting in considerable movement of people and near-starvation for the Nunamuit.

Fish are harvested throughout the year but mainly in summer, autumn and early winter. Fishermen have identified the locations and times when fish are most vulnerable to catch. Most fishing is done with gill nets, however burbot, Arctic cod and some grayling are taken by jigging or rod-and-reel.

Fishing is almost always a family activity and includes extended family as well. Most fishing is done at either permanent camps and cabins along the major rivers however increasingly there are more nets set along the coast near Barrow in summer. In summer 2006, over 16 gill nets were set in Elson Lagoon and that was during a cold summer with poor catches, which suppressed fishing effort.

In the NPRA region, *aanaakliq* or broad whitefish (*Coregonus nasus*) are the preferred and most targeted fish species. However, other desirable species include Arctic grayling (*Thymallus arcticus*), burbot (*Lota lota*), Arctic cisco (*C. autumnalis*), lake trout (*Salvelinus namaycush*), Dolly Varden (*S. malma*), and Chinook (*Oncorhynchus tshawytscha*) and chum salmon (*O. keta*).

Fish are distributed during several festivals and traditional meals, including: Nalukutak (whaling festival), Thanksgiving and Christmas. Fish are distributed frozen. *Aanaakliq* are often cut into sections before distribution.

Fishermen recognize the importance of attached lakes by feeder streams to the major drainages. Arnold Brower, Sr. (2004) described dispersal of young fish after breakup. He said that in the summertime the creeks are shallow, consisting of grass and about 2 inches of water. Despite the low flows, the fish move from the creeks back into the main river in the fall. During summer the fish moved into marshy areas and small ponds connected to the streams, often referred to as rearing ponds. He identified one rearing pond at Lake 11 near Alaktak that he fished in fall 2004.

Arnold Brower, Sr. reports that the largest *aanaakliq* he has seen was from Teshekpuk, and that the fat ones are right from that area. He indicates that some of the small lakes in this area [south of Teshekpuk] are 50 feet deep, and they contain large *aanaakliq*. The fish are often too large for the mesh sizes typically used, and the fish tangle in the nets.

Life history TEK information for a few selected fish species are listed below.

Broad Whitefish (*Aanaakliq*)

Fishermen related that *aanaakliq* spawn in several river drainages but particularly along the Chipp/Ikpikpuk river system. Spawning takes place in deep holes with slow water termed "*qaaġlu*". Many of the camps and cabins along the Chipp river are built near *qaaġlu.* Some of the oldest and most productive include "Chipp 2" and "Chipp 9". Spawning females with rich eggs and high fat content are a preferred catch. Many post-spawning fish will often move down-river to overwinter in deep holes in the rivers. Some fish will overwinter in lakes. They have not observed spawning in lakes with the exception of a *pitaq* or "breached lake". An example is Pitalurak Lake which drains into Dease Inlet (A. Brower, Sr., 2007). The fish are usually not heavily harvested when spawning is complete.

In spring (breakup), young of the year (YOY) *aanaakliq* are reported to enter lakes attached to streams, often wriggling though flooded tundra (in the grass). Arnold Brower, Sr. has seen adults exiting lakes during the same period in the shallow connecting streams. Fish that become entrained in lakes grow very fat but will not spawn in lakes. Some fishermen prefer the taste of lake-caught fish over river-caught fish.

Arnold Brower, Sr., Sadie Neakok and others describe an area called "Avullaġvik" on the Chipp River as an important fishing area. This is now a 'dead-channel' since the river cut through some attached lakes in the 1960s. USGS quadrangle maps still show this as the main channel. They recall that the peak catch rates in the early years were between 28 September and 4 October in the under-ice fishery in the 1920s and 1930s. The timing has changed somewhat in recent years with climate warming and often the rivers are either slushy or barely frozen over during the spawning period, making gillnetting difficult or impossible. Late freeze up together with lack of fixed-winged charter service since about 2000 has reduced *aanaakliq* catches considerably (Charlie N. Brower, pers. comm.)

In some years there are unusually large runs of *aanaakliq* at *Iqsinit* on the lower Ikpikpuk River. These large runs may occur in years in which the east branch of the Ikpikpuk was open. During one of these runs, one fisherman described catching 300 hundred spawning condition *aanaakliq* in an over-night set.

Arctic cisco (Q*aaktaaq)*

Qaaktaaq occur within the NPRA region but are not as abundant as they are in the Colville River area. Still, they are sought as a good eating fish. Fishermen target them in late autumn in the brackish deltas primarily in the Chipp and Meade River deltas. They have to wait for the marine intrusion and salinity drop in the river deltas to bring in the *qaaktaaq*. Some of the cisco in the Chipp/Ikpikpuk area may in fact be Bering Cisco or "*Tiipuq*" and some fishermen say they prefer the taste of the "Arctic cisco" from the drainages near Barrow.

Norman Leavitt fished the Meade Delta region at Nayuliq and is considered an expert on *qaaktaaq* fishing in this area. In that area he harvests: northern pike, broad whitefish, humpback whitefish, and Arctic cisco in fair numbers.

N. Leavitt reports the Meade River Delta near "Kitinuraaq" (near "Ruth" on the USGS maps at roughly 70° 45' N; 156° 02' W) is a major overwintering area. Water depth in the narrow channel averages about 3 meters, and goes as deep as 6 meters, to at least 10 km inland from the river mouth.

In Fall 1990, he fished the mouth of the Chipp and Topagaruk River for *qaaktaaq* . He said the *qaaktaaq* fishing improves in December but he would often quit in November. He also reports that a fisherman can get *qaaktaaq* every year but some years are better than others. He indicated that 1988 was a fairly good year while 1987 was rather poor, (he didn't seem sure about these dates), while 1990 was moderately good.

N. Leavitt had never seen *qaaktaaq* in spawning condition but suggested that *qaaktaaq* may be spring spawners in the Dease Inlet area.

Arctic Grayling (*Sulukpaugaq)*

Fishermen at Barrow related that people of Barrow depend upon *sulukpaugaq* as one of the staples. However, most fishermen agree that whitefish are the target species and not many would go inland specifically for grayling. Harry Brower, Sr. (1988) said grayling are especially abundant in the fall on part of Inaru River and stay there all winter. They are often caught in fall when gill netting for whitefish. Billy Adams noted at Pulayaaq, "Grayling can be so plentiful, we would go in there, go out with a hook, and clean the hole out." Grayling feed on whitefish eggs in spawning areas. Adams (1988) noted: "When pulling nets the whitefish were so full of roe they'd be milking."

Fishermen say that *sulukpaugaq* are in all rivers but avoid brackish areas. Harry Brower, Sr. noted that as the ice gets thicker the fish move into deeper waters.

In terms of spawning, fishermen understand that grayling are different than whitefish in that they are spring spawners. Harry related some observations from another fisherman:

"He put nets in the deep hollows in the Inaru River and fished grayling until March. The ice was about 6 feet thick. When the sun started coming up, the eggs were real round, real ready. That's what this guy who fished the Inaru River all winter long there said. And then eat frozen, cut-up sulukpaugaq and the eggs were really ripe. In the fall time there is just little streak of eggs in them. In March he was fishing and had these grayling just pulled out of fish net and eggs were real bright".

Regarding abundance, Harry Brower, Sr. (1988) noted the cycle of fish that some years you get less and some years there are lots of them. *"Like with grayling, some years you don't get many and some years you get as many as your arms can pull out. Some years you just get one fish on a hook. It is about the same today as was in the past."*

Figure 3. Itta's camp at Shukluq. The small but very productive stream is about 1 km east of this camp. Fishermen Billy Itta, who does much of the fishing at Shukluq, is shown in the inset.

Figure 4. Roy Ahmaogak is one of the "high-effort" fisherman along the Mayuġiaq River. The family camp is near Tributary No. 2. Here Roy steers his boat with his father (Lawrence Savik), mother (Myrna), dog (Dawson) upriver to fish for grayling in a hole near the western basin of Teshekpuk Lake.

METHODS

Biological Sampling

During summer 2003-2004, fyke nets were used to sample a variety of stations in the western portion of Teshekpuk Lake (Figures 6 and 7). Most of the sampling effort was focused on habitats associated with the Mayuġiaq River, the lake's outlet stream. In summer 2005, nets were deployed in the southeast region of the lake and in 2 tributary streams (Kealok and Rose creeks).

Figure 5. A typical research camp on Teshekpuk Lake (south basin). The wall tent is used for cooking and research activities.

Four stations (MTRIB1, MTRIB3, JOE3 and JOE4) were selected as long-term monitoring stations to evaluate changes in catch and species composition through time. MTRIB1, MTRIB3 and JOE4 were in the lower portion of tributaries to the Mayuġiaq River. These tributaries drain areas with extensive lakes and wetlands, which are considered to be preferred habitat for broad whitefish. The fourth station, JOE3, is in the Mayuġiaq River at Iksuġvik (at traditional fishing area at the mouth of Joe Creek). Two of the other stations are also at areas traditionally used for fishing – MTRIB1 is at Nigligaak, MTRIB3 is at Shukluq.

Two of the long-term stations, Nigligaak (MTRIB1) and Shukluq (MTRIB3) are near subsistence camps, and sampling was suspended so as not to interfere with subsistence activities when camp users were harvesting in the area. As a result, there are gaps in the long-term monitoring data set. At these times, additional stations were added to evaluate fish use of other locations.

Table 1. Stations sampled during the 1990-1992 and 2003-2005 Teshekpuk Lake fish study. (locations in WGS84 datum)

Station Type	Station Designation	Local Name	Location.	Year Sampled	Gear[1] Used	Latitude	Longitude
Lake							
	T611		SW Shoreline	1991	FN	70.52975	153.99923
	T701		NSB Cabin Shore	1990	GN	70.72288	153.73504
	T711		North Shoreline	1991	FN	70.72224	153.54756
	T721		Kuvralik West	1990	FN	70.70056	153.44387
	T725		Kuvralik East	1991-1992	FN	70.69688	153.41714
	T730		East Shoreline	1992	FN	70.56461	152.97344
	T731		East Lake - Offhore	1992	GN	70.56201	152.97729
	T741		Mid-Lake	1991	GN	70.55613	153.65085
	T781		West Shoreline	1991	FN	70.65020	153.92094
	T791		Cabin Creek	1990-1992	FN	70.72382	153.74610
	T792		NSB Cabin Offshore 1	1991-1992	GN	70.72236	153.73510
	T793		NSB Cabin Offshore 2	1991	GN	70.72210	153.73509
	ETESH		East Teshekpuk No. 1	2004	GN	70.56667	152.95500
	ETL05		East Teshekpuk Lake	2005	FN	70.55689	152.89562
	KLK01		Lake in upper Kealok Ck	2005	FN/GN	70.1387	154.04730
	KLK02		Tapped Lake on Kealok	2005	FN	70.45807	153.27711
	KLK03		Lake east of Kealok	2005	FN	70.5194	153.14430
	TG0301		Teshekpuk L	2003	GN	70.65192	153.85323
	TL0501		Teshekpuk L	2005	FN	70.53352	153.21013
	TL0503		Teshekpuk L	2005	FN	70.47649	153.76062
	TL0504		Teshekpuk L	2005	FN	70.50180	153.76702
	TL0505		Teshekpuk L	2005	FN	70.48624	153.84859
	TL0506		Teshekpuk L	2005	FN	70.46499	153.74989
	TL0507		Teshekpuk L	2005	FN	70.47493	153.77343
	TSB0501		Teshekpuk L	2005	FN	70.45407	153.45673
	TSB0502		Teshekpuk L	2005	FN	70.45570	153.57120
	TSB0503		Teshekpuk L	2005	FN	70.47272	153.44148
River							
	DANLE		Ikpikpuk R.	2005	HL	70.71267	154.50267
	IKGN01		Ikpikpuk R.	2005	GN	70.70950	154.50612
	IKP1		Ikpikpuk R.	2003-2004	FN/GN	70.70300	154.53547
	IKP2		Ikpikpuk R.	2003	FN	70.71515	154.48580
	IKP3		Ikpikpuk R.	2003	TR	70.70338	154.53672
	IKP4		Ikpikpuk R.	2003	TR	70.70340	154.53573
	MD0501		Meade River	2005	FN	70.81964	156.23921
Lake Outlet Stream							
	JOE3	Iksuġvik	Tributary of Miguakiak	2003-2004	FN	70.63615	154.19672
	MIG01		Miguakiak R.	2003	FN	70.68990	154.47600
	MIG02		Miguakiak R.	2004	other	70.68043	154.42131
	MIG03		Miguakiak R.	2004	GN	70.65200	154.21880
	Neg 02	Nagaruk	Teshekpuk L	2003-2004	FN	70.63993	154.14539
	SK-01		Sakeagak Camp	2003	GN	70.66430	154.24950
	TL0301		Teshekpuk L	2003	FN	70.64102	154.04102
Tributary							
	JOE1	Iksuġvik	Tributary of Miguakiak	2003	FN	70.63335	154.19800
	JOE2	Iksuġvik	Tributary of Miguakiak	2003	FN	70.63253	154.20325
	JOE4	Iksuġvik	Tributary of Miguakiak	2004	FN/GN	70.63254	154.21371
	JOE5	Iksuġvik	Tributary of Miguakiak	2004	GN	70.63360	154.19110
	K0501		Kealok Creek	2005	FN	70.52002	153.16478
	MTRIB1	Nigligaak	Tributary of Miguakiak	2003-2004	FN	70.67992	154.42392
	MTRIB2		Tributary of Miguakiak	2003-2004	FN	70.65825	154.34618
	MTRIB3	Shuglak	Tributary of Miguakiak	2003	GN	70.67015	154.27940
	R0501DS		Rose Ck (E. of Kealok)	2005	FN	70.43539	152.87452
	R0501US		Rose Ck (E. of Kealok)	2005	FN	70.43553	152.87710
	SPEC1		Tributary to Teshekpuk L.	2004	FN	70.52277	154.05191
	SPEC2		Tributary to Teshekpuk L.	2004	FN	70.51053	154.11653
	RAD1		Tributary to Teshekpuk L.	2004	FN	70.50343	154.00005
	RAD2		Tributary to Teshekpuk L.	2004	FN	70.48827	154.04453

[1]Gear: FN = fyke net
GN = gill net
TR = trammel net
other = water or macroinvertebrate sample

During each year (2003-2005), sampling was conducted in three periods: late June, late July and late August. Periods sampled were as follows:

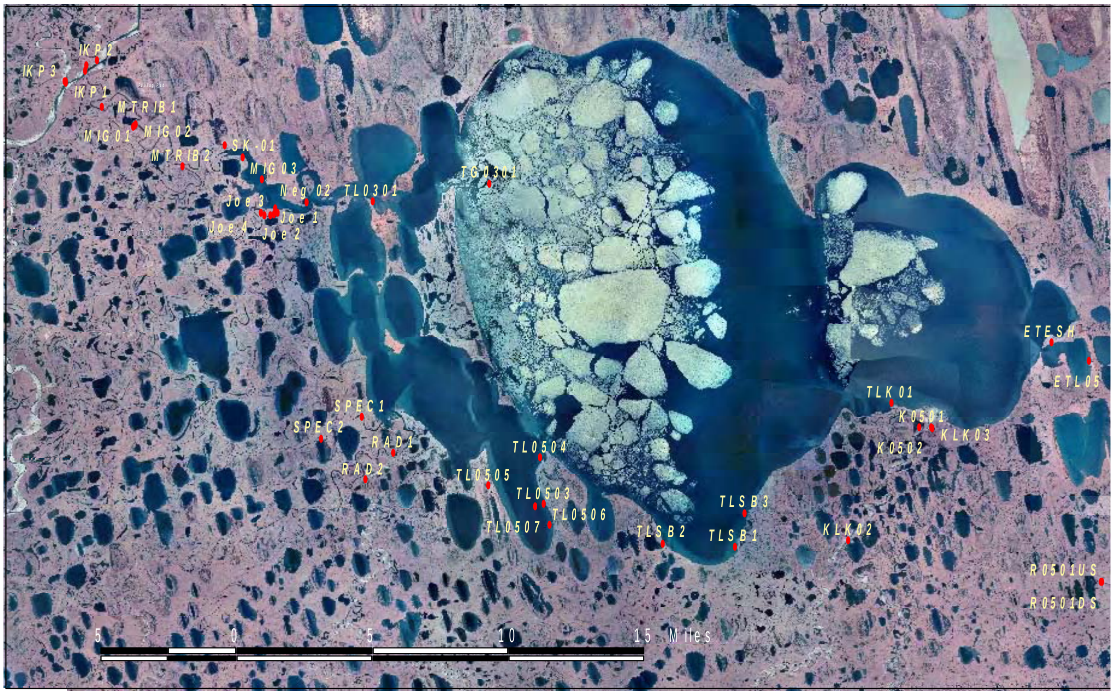

Figure 6. Stations sampled during the 2003-2005 fish study at Teshekpuk Lake.

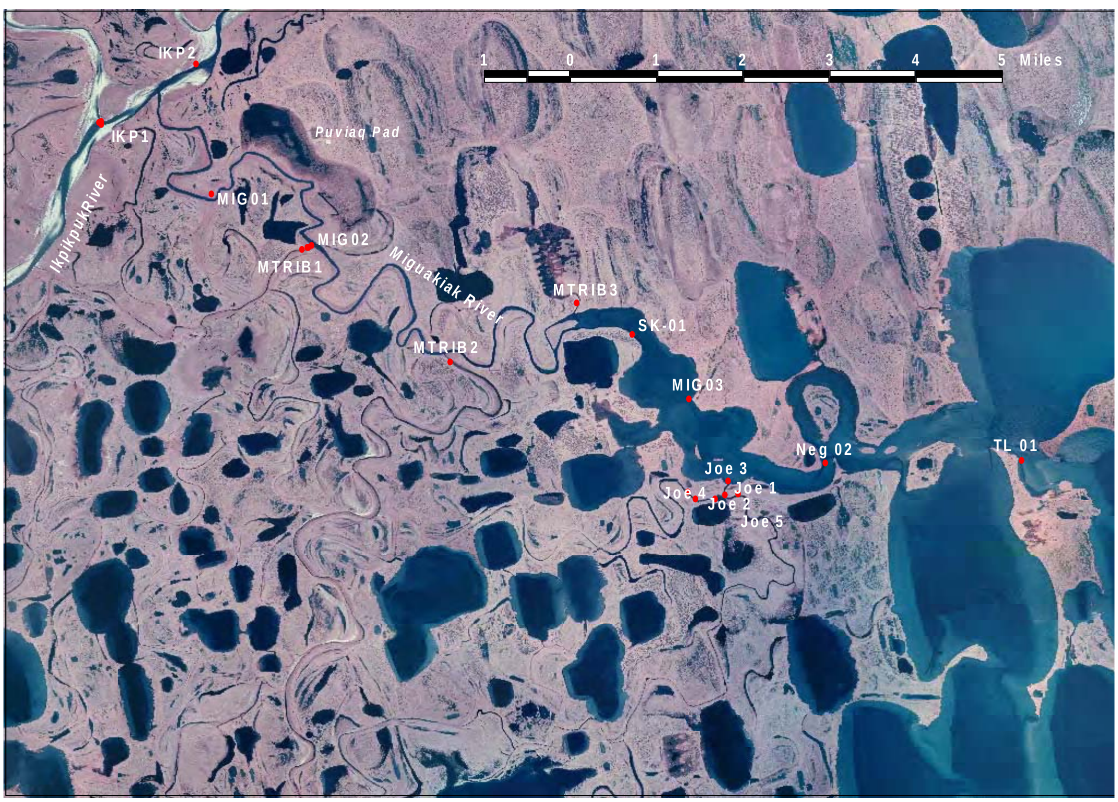

Figure 7. Stations sampled along the Mayuġiaq River during the 2003-2005 fish study at Teshekpuk Lake.

2003	2004	2005
June 22-28	June 19-25	June 16-24
July 20-28	July 26-31	July 23-29
August 23-25	August 28-31	August 21-29

In 2005, additional sampling was conducted by gill nets set under ice from November 6 to 12.

Sampling was primarily by fyke net so that fish could be released unharmed. Fyke nets used had an opening 0.9 m deep by 1.1 m wide; the trap end was 4.9 m long, made of 9.5 mm mesh. The wings (5 m long) and lead (15 m long) were made of 12.7 mm mesh. The nets were emptied daily. Fish were measured and released, with no fish retained for laboratory analysis. Duration of each set was recorded to allow calculation of catch rates. In 2004, fyke nets at Nigligaak, Shukluq and Iksuġvik were arranged to sample fish moving both upstream and downstream. A long lead was set diagonally across the stream channel and the trap ends set to capture fish moving either upstream or downstream along the lead.

Figure 8. John Rose (ABR) and Luke George measure fish caught in a fyke net in the western basin of Teshekpuk Lake. The fish are anesthetized, measured, identified and then allowed to recover before returning them to the lake.

Occasional sets were made with multi-mesh gill nets (100 ft long, consisting of 25 ft panels: 3.0, 3.75, 4.5 and 5.0 inch stretched mesh) and large mesh (60 ft nets of 5.0 to 5.5 inch stretched mesh) subsistence nets to obtain fish for stomach analysis or obtain large specimens for aging. Sets with the multi-mesh gill net were typically short duration (1 to 4 hours), however, over night sets were made during the under-ice gill netting in November 2005. Sets with the large mesh nets were between 3 to 24 hours.

Fish longer than 300 mm were tagged to reveal fish movements within the drainage system. Floy FD-68B anchor tags (monofilament = 5/8 inch, vinyl = 1 1/8 inch) were primarily applied to broad whitefish and Arctic grayling caught by fyke net. Smaller numbers of humpback whitefish, least cisco, burbot, northern pike, and Arctic char were also tagged. Recaptures were from research sampling within the study area and the subsistence fishery.

Samples of broad whitefish, Arctic grayling and least cisco were retained for analysis of length-weight, age-length, and state of maturity. The sampling design was to obtain an equal sample size for each 50 mm length interval beginning at 50 mm. Fish sampled were re-measured to the nearest mm fork length and weighed to the nearest 0.1 gm. For mature or maturing females, the ovaries were removed and weighed to the nearest 0.1 gm. Otoliths were read using the break and burn technique. The otolith is broken across the transverse axis, held over a flame until the edge begins to discolor, and placed in isopropyl alcohol to be viewed with a dissecting microscope at 30 power. Annuli appear as narrow dark rings between the wider, lighter annual growth bands.

Figure 9. A typical fyke net fish catch from the Mayuġiaq River where it enters the western basin of Teshekpuk Lake. Shown are (top to bottom): least cisco, broad whitefish, Arctic grayling, broad whitefish, and ninespine stickleback.

Sex and maturity were determined for each sampled fish using the following maturity scale:

1. Immature: young individuals that have not engaged in reproduction; gonads very small, may be hard to identify sex.

2. Mature: non-spawners, eggs are distinguishable, ovary pink or orange, sex easy to identify. Testes light brown or ivory, but not enlarged.

3. Mature: pre-spawners, likely to spawn this year, ovaries large, individual eggs easy to see, may be 0.5 to 1.0 mm diameter. Testes white enlarged.

4. Spawning Condition: ripe, eggs or milt extruded when light pressure is applied to the belly.

5. Spent: sex products are discharged leaving the gonads appearing like deflated sacs, residual eggs and sperm may be present.

6. Recovering: ovaries or testes empty, flaccid; fish likely spawned during the previous season.

Figure 10. A fyke net set in the attached lake system on the west side of Teshekpuk Lake. View is looking east towards Teshekpuk Lake. The trap is set at the far end. Trapped fish can be handled, measured and returned to the water with little harm. Edwin Bodfish is in the blue jacket.

Radio Tagging

Radio tags were applied to 84 broad whitefish to evaluate movements within the Teshekpuk Lake drainage system. Radio tags were also applied to 10 broad whitefish in the Meade River in 2005. Radio tags weighing 10 g were used in 2003, while a combination of 10 g radio tags and 29 g radio tags were used in 2004 and 2005. The 94 tags applied by year were as follows: 2003 – 40 tagged, 2004 – 24 tagged, 2005 – 30 tagged.

Transmitter Implantation. Fish were selected for transmitter implantation based on their size and condition. Generally, transmitter weight was kept between 1 and 3% of body weight. However, space within the peritoneal cavity was the more restrictive metric for implanting transmitters in broad whitefish, not body weight. Minimum lengths of fish necessary to ensure safe transmitter implantation were determined from length/weight data for broad whitefish in the Teshekpuk Lake and Dease Inlet region. Fish over 390 mm (15 inches) in fork length were large enough to receive a small 10 g (0.35 oz) radio transmitter while fish over 500 mm (20 inches) fork length were large enough to receive a 29 g (1 oz) radio transmitter.

Fish appearing healthy and relatively unstressed were selected to receive a transmitter. This assessment was subjective, but fish with obvious external injuries, heavy parasite loads or fish in an obviously stressed condition (state of disequilibrium prior to anesthetic exposure) were not considered. Water temperature also played a role in the decision to radio tag fish. Previous studies have noted the severity of the additive effects of thermal stress and handling stress on broad whitefish (Morris 2000). By assessing fish size, condition and ensuring fish were not predisposed to stress from high water temperatures, we were able to increase the probability of fish survival.

A fish selected to receive a transmitter was placed in a tub containing an anesthetic solution of 10% clove oil extract/90% pure ethanol and water from the sampling site at a concentration of 20 parts per million (ppm) clove oil extract. Concentrations of the anesthetic were adjusted upwards as needed by adding additional clove oil solution. Concentrations around 20 ppm were usually adequate regardless of water temperature; however, concentrations as high as 30 ppm were required for some broad whitefish. Fish were held in anesthetic until they had reached the desired state of anesthesia, which was evidenced by loss of equilibrium, loss of swimming response and a flaccid body. Throughout the surgical procedure either water or anesthetic solution was continually applied to moisten the gills and to maintain the proper level of anesthesia. Just prior to completion of the surgical procedure water was applied to the gills to begin recovery.

Fish were removed from the anesthetic bath and placed ventral side up in a surgical trough lined with a moist towel. A 3 to 4 cm long (1½ inch) incision was made on the ventral side of the fish into the peritoneal cavity. A transmitter was then inserted into the cavity with the antenna end facing towards the tail. The antenna was routed out of the body cavity behind the pelvic girdle by inserting a needle guide into the incision and orienting the guide to the desired antenna exit point. A small horse catheter was inserted through the body wall using the guide to protect

Figure 11. Bill Morris conducts a surgery on a broad whitefish to insert a radio transmitter at Iksuġvik, the site of Eskimo games in the early 1900s. This view looks east over the Mayuġiaq River (pronounced "My-or-e-ak; on USGS maps is it called Miguakiak) where it widens near Teshekpuk Lake.

internal organs from the catheter needle. The antenna was threaded through the catheter and out of the body. The catheter and needle guide were removed and the incision closed. The incision area was dabbed with sterile gauze and surgical glue was applied to the incision area to provide a closed incision to aid in initial healing of the wound. Fish were then placed in a net pen at the capture site for recovery. Once equilibrium had been regained, fish were released in the vicinity of the capture site.

Fish Stomach Sampling

Short duration gill net sampling was used to obtain fish stomachs to evaluate feeding patterns (Figure 12). All fish were captured by short-duration gill net sets to ensure that the stomach contents reflected feeding activity near the time of capture. The abdominal cavity was opened and a small piece of twine was tied around both the esophagus and small intestine to ensure that the stomach did not evacuate when placed in preservative. Stomachs were preserved in 70% ethanol and shipped to Plateau Ecosystems Consulting, Inc. for processing.

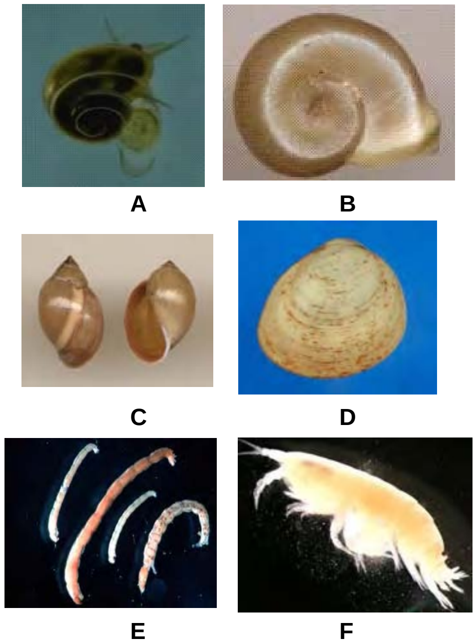

Figure 12. Prey items commonly found in fish stomachs, a. snail (Valvatidae), b. snail (Planorbidae), c. snail (Physidae), d. clam (Pisiidae), e. chironomids, f. amphipod (Monoporeia).

Macroinvertebrate Sampling

Invertebrate samples were collected from some of the habitats associated with the Mayuġiaq River (Nigligaak, Mayuġiaq River above Nigligaak, Shukluq and Iksuġvik) to evaluate prey availability. Multiple methods were used to sample the different invertebrate habitats (bottom substrate, vegetation, water column). For each method, three samples were composited in order to produce one set of results to characterize each site and date. Samples were processed by the Bureau of Land Management / Utah State University National Aquatic Monitoring Center. Macroinvertebrate samples were processed following procedures recommended by the United States Geological Survey (Cuffney et al. 1993) and described following Vinson and Hawkins (1996). Zooplankton samples were either sub-sampled or processed in their entirety, depending on the number of specimens.

Ponar Dredge. A Wildco Petite Ponar dredge was used to collect benthic invertebrate samples in the vicinity of the sites where fyke nets were placed. Samples were taken from water 0.5-1.5 m (1½ to 5 feet) deep, without regard to the presence or absence of aquatic vegetation. At each sample site, 3 dredge sample grabs were taken. Material from each grab was washed from the dredge into plastic dishpans, using water pre-filtered through a 500-micron mesh stainless steel sieve. The sample material was then placed in a 500-micron mesh sieve and rinsed. All remaining material (including sediment, vegetation, and macroinvertebrates) was placed in 1 liter (about 1 quart) polyethylene bottles and preserved with 95% ethanol. These were composited at the lab for processing. The area of a petite Ponar grab is known, thus the samples were processed as quantitative.

Sweep Net. A sweep sampling technique with a D-frame kick net (500 micron mesh) was used to collect macroinvertebrate samples from vegetated areas in the vicinity of fyke nets (e.g. Oswood et al. 2001). At each sampling site, three locations were selected in the littoral zone, with sweep sampling limited to water depths of less than 1.0-1.25 m (3.3-4 feet) deep. A sample was collected using an arc motion, sweeping the net from the water surface to the substrate, down through the water column and any present macrophytes, and back to the surface. This procedure was repeated two more times using sweeps that ran parallel and adjacent to the first sweep. The samples were composited, placed in polyethylene bottles, and preserved with 95% ethanol. These samples were qualitative since the actual sampled volume was unknown. However, results are comparable under the assumption that there was an equal sampling effort at each site.

Plankton Net. An 80μm plankton net with a 30 cm (12 inch) opening was used to collect invertebrates from the water column in close proximity to fish sampling sites. At each site, the sampler waded into water deep enough to sample a depth of approximately 1.0 m (3.3 feet). For as long as necessary prior to sampling, stirred up sediments were allowed to settle. From a stationary position a vertical tow was conducted. This process was completed three times, with the sampler moving to a slightly different position prior to each tow. Samples were placed in polyethylene bottles, preserved with 70% ethanol, and composited prior to processing. Results are semi-quantitative since approximately the same volume of water was sampled at each site.

Water Chemistry Sampling

Water chemistry parameters were measured to assess habitat conditions and provide information on the suitability of water for use. Water chemistry measurements included surface measures of water temperature, specific conductance, dissolved oxygen, pH, and turbidity. Temperature, specific conductance and dissolved oxygen were *in situ* measurements taken at a depth of approximately 0.5 m (1.5 ft) near the lead of the fyke net with a YSI Model 85 meter. A sample obtained from about 15 cm (6 inches) below the surface was returned to the field office to measure pH and turbidity. PH was measured with an Oaktron pH Tester III. Turbidity was measured with a LaMotte Model 2020 turbidity meter.

Data Analysis

Differences in catch rate for fish moving upstream and downstream at long-term stations in 2004 were evaluated using t-tests of CPUE (in fish per 24 hrs) using the transformation $\log_e$(CPUE+1). Data from Nigligaak, Shukluq and Iksuġvik were grouped by species and month and tests were run to evaluate differences in movement direction for each species/month category.

Age-length relationships for fish caught in 2003-2004 were compared to those caught in 1990-1992 to evaluate differences in growth rate between the two time periods. This comparison allows an evaluation of changes in growth rate that may be caused by long-term climatic changes. If the climate is overall warmer or cooler, this should be reflected in the time it takes for fish to reach a given length. Fish in northern regions increase length in a linear fashion with age until maturity, at which time growth virtually ceases; therefore, the growth comparison was between fish less than the age of first maturity. First, the age of maturity was determined by plotting the percent of mature fish at each age against age in years. Not all fish of a population mature at a given age, and it can take many years for an entire year class to reach maturity. After the age at first maturity was determined, the linear models describing the age-length relationships were compared using analysis of covariance to test for differences in slopes of the lines and adjusted means (i.e. intercept).

Length-weight relationships were similarly used to evaluate differences between fish caught in 2003-2004 and those caught in 1990-1992. Comparison of length-weight relationships allows an evaluation of body condition during the two time periods, which can reflect habitat quality and feeding conditions. As fish grow they go through stages where the body shape changes and have different length-weight relationships (Tesch 1968). To ensure a valid analysis, the length frequencies of fish caught in 2003-2004 were examined for discontinuities that may indicate different growth stages, then length and weight data from both periods (1990-1992 and 2003-2004) were grouped into the identified length groups. Analysis of covariance was used to test for differences in slopes of the lines and adjusted means (i.e. intercept) between length groups within a time period. If significant differences were not found, the length groups were pooled; if significant differences were found, the length groups were maintained. The second test compared length groups between time periods.

Habitat Mapping

Tributary habitats along the Mayuġiaq River were mapped to quantify the amount of various aquatic habitats available within the various drainages. A base map of geo-referenced infrared aerial photography by BLM taken July 18, 2002 was used to identify the drainage areas covered by stream systems that discharged into the Mayuġiaq River at Nigligaak, Shukluq and Iksuġvik. Lengths were measured for channels that appeared to be active. Lake areas were obtained and each lake was classified as being either on the active channel or off-channel. The off-channel lakes often had an identifiable outlet stream connected to the channel system, although some lakes may not be accessible every year.

Estimating Overwintering Habitat

Bathymetric data were collected in 2003 and 2004 to:

1) identify potential wintering areas in the Mayuġiaq River, and

2) estimate the surface area of potential wintering area in Teshekpuk Lake.

In 2003 and 2004, location and depth were recorded on a Lowrance Model LCX-15MT integrated GPS/depth sounder at approximately 1-2 second intervals. A bathymetric survey was conducted on the Mayuġiaq River from the field camp at N70.66430 W154.24950 to the mouth of the river. The survey was conducted on June 23, 2003 and consisted of driving downstream while attempting to follow the deepest portion of the river channel.

A bathymetric survey was conducted on August 28, 2004 to identify potential wintering areas in the lake basins at the outlet of Teshekpuk Lake. Potential wintering areas were defined as continuous areas with maximum depths exceeding 2.1 m (7 feet). A contour map of the surveyed lake basins was prepared with ArcView software by plotting the position and depth data obtained by GPS on a geo-referenced photo mosaic base map and plotting the 2.1 m (7-foot) depth contour on maps of the surveyed lake basins (included in Appendix F). Shoals, sand bars and shallow water are clearly observed on the photo mosaic, which was developed from infrared aerial photography by BLM taken July 18, 2002. The 2.1 m (7-foot) contour was estimated on unsurveyed lake basins by visual comparison of measured 2.1 m (7-foot) regions.

Potential wintering area in the two major basins within Teshekpuk Lake was estimated by plotting 151 depth measurements obtained in 1991 and 1992 (Philo et al. 1993) on the photo mosaic map described above and estimating the deep portion of the basins based on visual inspection of the lake shoreline and visible shoals. Additional bathymetric surveys were conducted in 2006 and 2007 in the southern and northern portions of the western basin. Results of these surveys were used to refine the initial contour map generated from the 1991-1992 data. While this map is a rough approximation of the depth profile of the lake, particularly in the eastern basin, it provides a first estimate of the magnitude of potential wintering habitat within the lake.

RESULTS

Physical Environment

Wintering Areas Associated with Teshekpuk Lake

Teshekpuk Lake is composed of two large basins separated by a shallow sill. The sill appears to be the submerged remnant of a lake shore that previously separated two large lakes that joined to form the present main basin (Figure 13). The western basin is the larger and deeper of the two, with a preliminary estimate of over 452 km^2 (175 mi^2) of water deeper than 7 feet (2.1 m) (Table 2). The eastern basin adds an additional 109 km^2 (42 mi^2) of deep water habitat, although this estimate is likely to increase as more depth information becomes available.

Lake basins that form the outlet of the lake, and the beginning of the Mayuġiaq River, contain additional deep water and provide additional winter area outside the main basin (Figure 14). These lake basins combine for approximately 56 km^2 (21.5 mi^2) of additional wintering area over 2.1 m (7 feet) deep (Table 2).

The Mayuġiaq River itself contains substantial wintering opportunities, with much of the channel length in excess of 2.1 m (7 feet) deep. During the survey on June 23, 2003, over

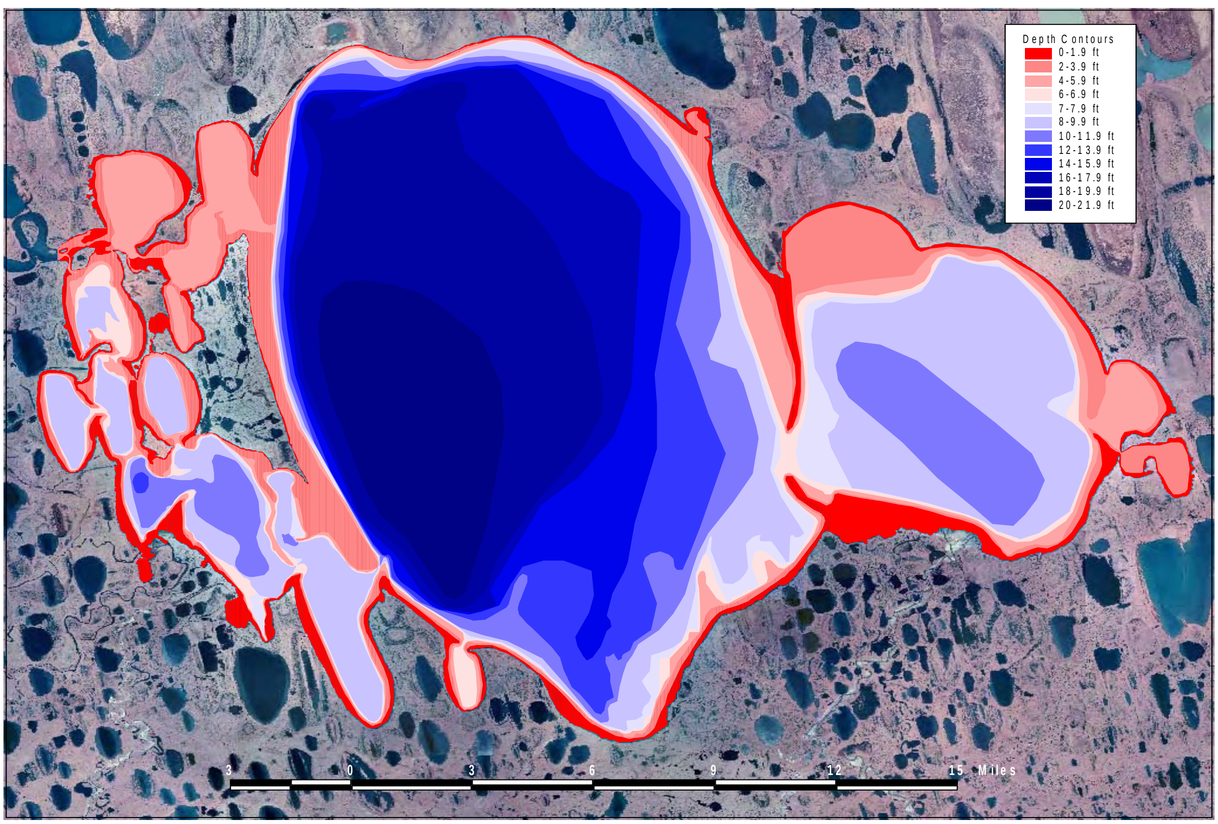

Figure 13. Potential wintering areas in Teshekpuk Lake; areas deeper than 7 feet, and likely to represent wintering habitat, are in blue (updated with 2006-2007 bathymetry).

Table 2. Areas within Teshekpuk Lake covered by water at least 7 feet deep and thus representing potential wintering habitat.

Area	Hectares	Square Kilometers	Acres	Square Miles
East Basin	10,882	108.8	26,891	42.0
West Basin	45,218	452.2	111,737	174.6
Outlet Lake 1	263	2.6	651	1.0
Outlet Lake 2	461	4.6	1,139	1.8
Outlet Lake 3	377	3.8	932	1.5
Outlet Lake 4	430	4.3	1,062	1.7
Outlet Lake 5	2,345	23.5	5,795	9.1
Outlet Lake 6	1,701	17.0	4,204	6.6
Total	61,678	616.8	152,410	238.1

18.3 km (11 miles) of the 22.6 surveyed km (13.6 miles, or 83%) were deeper than 2.1 m (7 feet) (Figure 16). Deep portions of meander bends typically exceeded 6 m (20 ft), with maximum depths approaching 11 m (35 ft).

Additional wintering areas are found in lakes along the Mayuġiaq River. Some of these are seasonally connected and most that are deeper than 2.4 m (8 feet) contain fish populations. Twelve lakes were surveyed for fish, water chemistry and water volume in support of the Puviaq Exploration (Figure 16; Moulton 2003). The twelve surveyed lakes contained 395 acres of water deeper than 2.4 m (8 feet), or 38% of the total surface area for the surveyed lakes (Table 3).

Table 3. Estimated wintering areas from surveyed lakes near the ConocoPhillips Puviaq Exploration Project in 2002.

Lake	Max. Depth (feet)	Surface Area (acres)	Area deeper than 8 ft (acres)	Percent Deeper than 8 ft	Sensitive Fish Species Present[1]	Resistant Fish Species Present[2]
M0205	18.8	67.5	45.6	67.5	LSCS	NSSB
M0206	19.5	54.6	18.5	33.9	LSCS	NSSB
M0207	14.5	26.2	20.6	78.6	LSCS	not detected
M0208	6.5	14.7	0.0	0.0	not sampled	NSSB
M0209	10.0	168.8	18.1	10.7	none caught	NSSB
M0210	11.4	39.1	4.0	10.4	BDWF	NSSB
M0211	11.0	89.3	43.6	48.9	BDWF, LSCS	NSSB
M0212	21.3	45.1	21.2	47.0	BDWF, LSCS	not detected
M0213	18.4	38.3	13.8	36.0	BDWF, LSCS	not detected
M0214	18.1	169.9	94.8	55.8	none caught	not detected
M0215	23.2	221.3	81.2	36.7	LKTR, LSCS	not detected
M0216	12.3	97.8	33.2	34.0	LSCS	not detected

[1] BDWF = broad whitefish, LSCS = least cisco, LKTR = lake trout
[2] NSSB = ninespine stickleback

Quantifying Aquatic Habitat in Mayuġiaq River Tributaries

The tributary system discharging into the Mayuġiaq River at Iksuġvik was the largest of the four measured systems, covering over 45 square miles (Table 4). The system discharging at Nigligaak was second, covering about half the Iksuġvik area. The Iksuġvik system contained 41 lakes, which covered over 33% of the drainage area (Figure 17). The second tributary (MTRIB2) system was the smallest and simplest, consisting of one major channel and a series of 15 off-channel lakes.

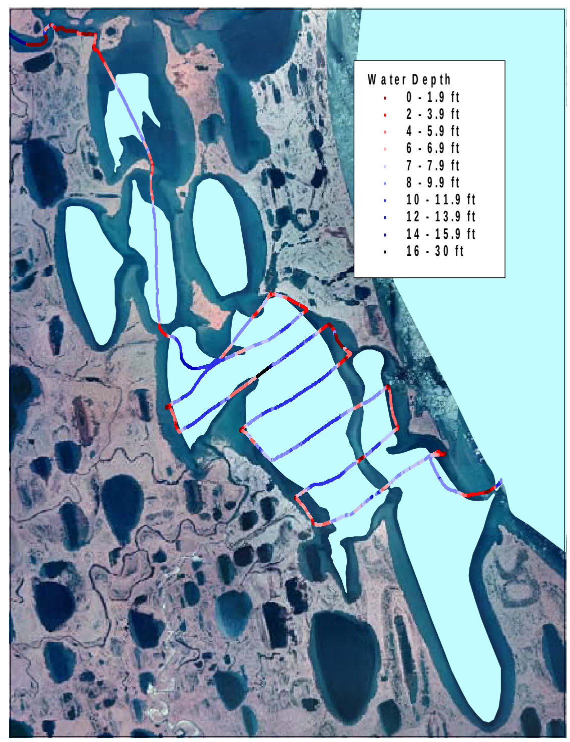

Figure 14. Potential wintering areas at the outlet of Teshekpuk Lake, showing depth transect used to identify regions deeper than 7 feet (in blue).

Physical Measurements

Sampling in 2003-2005 began in late June as stream flows were receding from peak break-up flows. By the onset of sampling on June 23, 2003, water temperatures in the streams were

Table 4. Abundance of aquatic habitats in the drainage basins covered by four main tributaries to the Mayuġiaq River.

Tributary	Channel Length (miles)	Drainage Area (acres)	Lake Type	No. of Lakes	Surface Area of Lakes (acres)	Percent of Drainage Covered by Lakes
Nigligaak	19.7	13,100	On-channel	7	1,506	32.0%
			Off-channel	25	2,683	
Trib. 2	23.9	11,550	On-channel	0	0.0	7.0%
			Off-channel	15	811	
Shukluq	6.1	2,331	On-channel	9	434	20.1%
			Off-channel	3	34	
Iksuġvik	38.9	28,868	On-channel	7	5,579	33.6%
			Off-channel	34	4,115	
Totals:	89	55,848	All	66	11,047	19.8%

already high, reaching between 10 to 14°C by the third week in June (Table 5, Figure 18). Temperatures in the Teshekpuk outlet stream, the Mayuġiaq River, were lower than temperatures in associated tributaries, a pattern that continued into July 2003. By late August, temperatures decreased to near 6°C.

Water temperatures in June 2004 at both outlet stream and tributary stations were significantly higher than observed in 2003 (t-test, outlet streams $p=0.002$; tributaries $p=0.005$); the difference continued into July at outlet stream stations (t-test, $p=0.01$), but was no longer evident at tributary stations (t-test, $p=0.466$) (Table 5). In both years, water temperatures were significantly higher at tributary stations as compared to outlet stream stations (2003: $p=0.0005$; 2004: $p=0.00001$). This difference continued into July. Specific conductance rose slowly at all sites through the summer as snow melt and runoff decreased (Figure 19). Some reversals to this trend were apparent after rain. No set of stations was consistently higher or lower than other sets. Turbidity in 2004 was highest after break-up, particularly at outlet stream stations, then declined through June sampling. Increases in turbidity during July 2004 were caused by high winds (Figure 19).

Figure 15. Bill Morris and Harry Brower, Jr. trying to move into Teshekpuk Lake in late July 2005. The lake typically holds ice until the third week in July but did not ice out until the first week of August in 2005. As a result, the lake remains relatively cool.

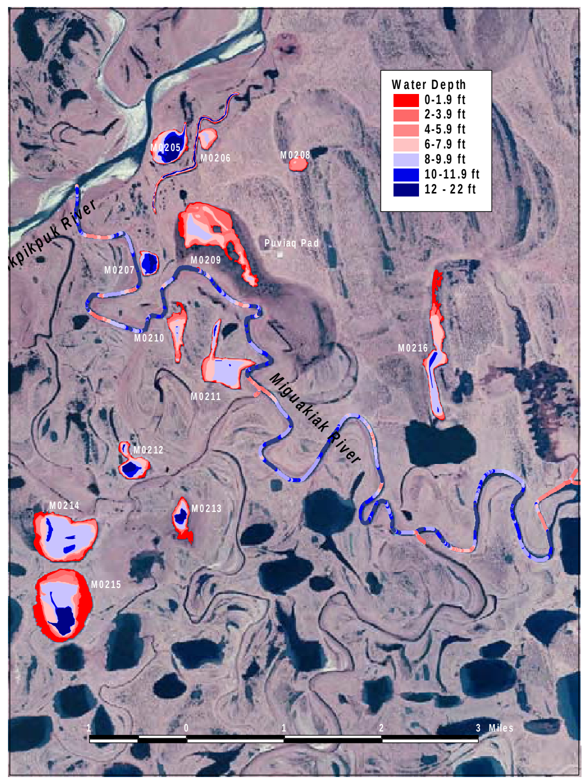

Figure 16. Potential wintering areas in the Mayuġiaq River and nearby lakes (deep areas in blue).

Table 5. Differences in water chemistry between the Teshekpuk Lake outlet stream and its tributaries, 2003-2004.

Water Temperature (°C)

Year	Parameter	June Lake Outlet	June Tributary	July Lake Outlet	July Tributary	August Lake Outlet	August Tributary
2003	Mean	8.05	10.11	8.63	11.68	5.30	6.00
	Standard Deviation	0.35	1.77	0.96	2.89	0.71	
	Number	2	9	3	11	2	1
	Minimum	7.80	8.30	7.60	7.30	4.80	6.00
	Maximum	8.30	14.30	9.50	17.20	5.80	6.00
2004	Mean	10.14	12.12	12.40	11.79	6.70	6.34
	Standard Deviation	1.05	1.35	3.56	3.53	0.99	0.56
	Number	16	19	8	14	2	7
	Minimum	8.40	9.50	7.60	7.10	6.00	5.40
	Maximum	12.10	14.00	17.80	18.60	7.40	7.30

Specific Conductance (microSiemens/cm)

Year	Parameter	June Lake Outlet	June Tributary	July Lake Outlet	July Tributary	August Lake Outlet	August Tributary
2003	Mean	271.7	176.5	187.1	218.6	244.5	219.7
	Standard Deviation	23.6	35.0	72.0	18.6	2.6	
	Number	2	9	3	11	2	1
	Minimum	255.0	132.8	104.4	169.7	242.6	219.7
	Maximum	288.4	225.5	235.9	234.2	246.3	219.7
2004	Mean	198.8	127.5	205.8	198.2	232.2	223.3
	Standard Deviation	19.5	38.4	13.4	13.4	7.2	2.2
	Number	16	19	8	14	2	7
	Minimum	167.5	84.0	192.0	167.5	227.1	220.3
	Maximum	235.2	219.9	231.0	214.0	237.3	227.1

Turbidity (NTU)

Year	Parameter	June Lake Outlet	June Tributary	July Lake Outlet	July Tributary	August Lake Outlet	August Tributary
2003	Mean	2.7	1.0	1.6	1.8	0.6	4.1
	Standard Deviation		0.6	1.1	1.8	0.2	
	Number	1	8	3	10	2	1
	Minimum	2.7	0.3	1.0	0.8	0.5	4.1
	Maximum	2.7	1.9	2.9	5.3	0.8	4.1
2004	Mean	5.4	2.8	4.1	1.8	0.5	2.4
	Standard Deviation	1.8	0.5	2.9	1.0	0.1	1.0
	Number	14	17	7	14	2	9
	Minimum	2.3	2.1	1.0	0.9	0.4	0.6
	Maximum	8.3	3.9	9.6	4.4	0.7	3.2

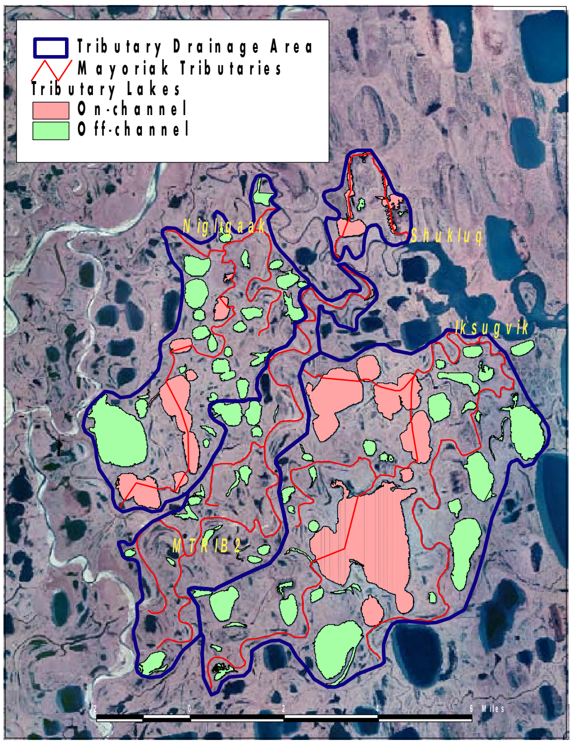

Figure 17. Drainage basins (outlined in blue) of four tributary systems to the Mayuġiaq River sampled during 2003-2004 (tributary channels in red).

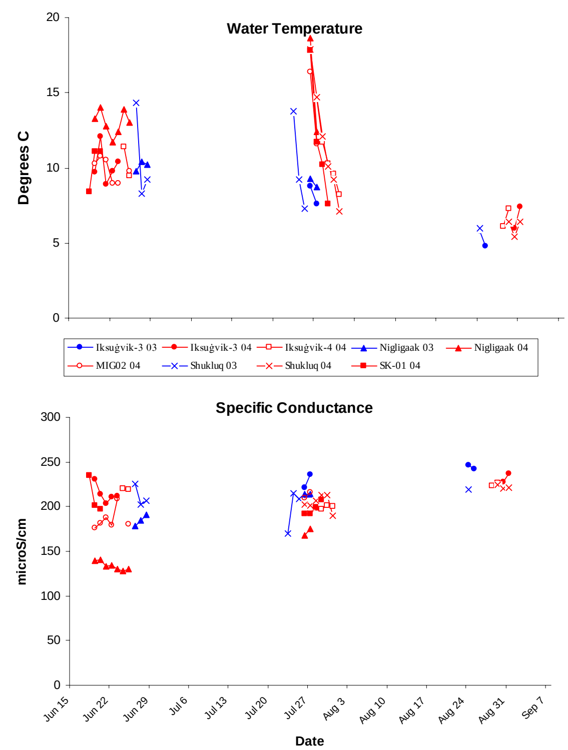

Figure 18. Water temperature and specific conductance at stations sampled in the Mayuġiaq River sampling area (blue = 2003, red = 2004).

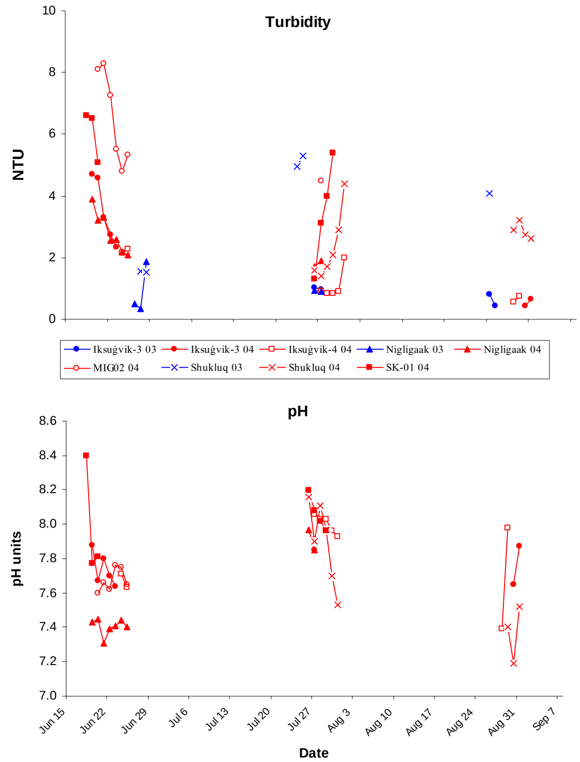

Figure 19. Turbidity and pH at stations sampled in the Mayuġiaq River sampling area (blue = 2003, red = 2004).

Biological Observations

Habitat Use by Dominant Species

During 2003-2005, 14 species of fish were caught by fyke net (Table 6). Three species (least cisco, broad whitefish, and Arctic grayling) comprised 71% of the catch, with least cisco the most abundant at 29% of the catch followed by Arctic grayling at 25%. Ninespine stickleback were an additional 28% of the catch. This greatly contrasts with sampling within Teshekpuk Lake during 1990-1992, when least cisco alone accounted for over 82% of the fish caught, with Arctic grayling less than 2% (Table 7). Burbot were frequently encountered during both sampling periods, and while not numerous, were conspicuous because of their large size. Other notable species encountered included Arctic char, northern pike, humpback whitefish, and ninespine stickleback, which was the second most abundant species in the catch during 2003-2005.

Table 6. Fish caught by fyke net during summer 2003-2005 sampling in the Teshekpuk Lake fish study.

	June			July			August			
Species	2003	2004	2005	2003	2004	2005	2003	2004	2005	Totals
Broad whitefish	296	338	62	75	668	227	50	370	272	2,358
Humpback whitefish	11	23	0	0	6	0	0	0	0	40
Least cisco	67	773	81	499	1,275	735	117	240	145	3,932
Bering cisco	0	1	0	0	0	0	0	0	0	1
Round whitefish	0	0	8	0	0	0	0	0	0	8
Arctic grayling	119	544	1,453	156	104	668	46	217	47	3,354
Arctic char	0	3	0	0	0	0	0	0	0	3
Lake trout	0	0	2	0	0	0	0	0	0	2
Burbot	18	20	5	0	0	2	0	16	1	62
Northern pike	3	6	0	0	1	0	1	0	0	11
Slimy sculpin	1	7	3	0	0	0	0	0	0	11
Alaska blackfish	1	2	0	0	0	0	0	0	0	3
Threespine stickleback	0	0	0	0	12	0	0	0	0	12
Ninespine stickleback	1	75	2,240	0	113	1,209	0	180	5	3,823
Total Fish:	517	1,792	3,854	730	2,179	2,841	214	1,023	470	13,620
No. of Species:	9	11	8	3	7	5	4	5	5	14
Total Effort (hrs):	428.9	512.1	544.3	349.5	632.1	439.0	93.3	214.4	263.7	3,477.5

Table 7. Fish caught by fyke net at each station during summer 1990-1992 sampling in the Teshekpuk Lake fish study.

	Aug 90	Aug 90	Aug 91	Aug 91	Aug 91	Aug 91	Aug 91	Aug 92	Aug 92	Aug 92	
Species	T721	T791	T611	T711	T725	T781	T791	T725	T730	T791	Total
Broad whitefish	507	36	34	24	389	147	112	48	430	55	1,782
Humpback whitefish	1	2					7			6	16
Least cisco	1,009	2,151	212	310	1,187	2,075	511	2,057	993	3,825	14,330
Bering cisco	1				1			1			3
Arctic grayling	19	76	12	5	39	7	59	2	43	22	284
Pink salmon		3								2	5
Burbot	3	4	1	1		2	3	1	1	5	21
Northern pike	1										1
Ninespine stickleback	34	81	34	23	441		154	19	11	107	904
Total Fish:	1,575	2,353	293	363	2,057	2,231	846	2,128	1,478	4,022	17,346
No. of Species:	8	7	5	5	5	4	6	6	5	7	9
Total Effort (hrs):	193.3	109.4	84.7	44.3	293.3	43.2	166.6	69.6	110.6	322.0	1,436.9

Broad Whitefish. Broad whitefish were the fourth most abundant fish caught in 2003-2005 (Table 6). They were the dominant species at Shukluq, but were also major components of the catch at Ikpikpuk River stations, and Nigligaak, Iksuġvik and Station TL01 (Figures 20 and 21). Of the four long-term stations, Shukluq produced the highest catch rates of broad whitefish, followed by Iksuġvik stations (Figure 23). While broad whitefish were a high proportion of the fish caught at Nigligaak, the overall catch rates were not high.

During 1990-1992, broad whitefish were second in abundance to least cisco. The mean catch rate at that time was 33.7 fish per day, about 36% higher than the overall mean 21.3 fish per day observed at lake shore stations in 2005 (Figure 24).

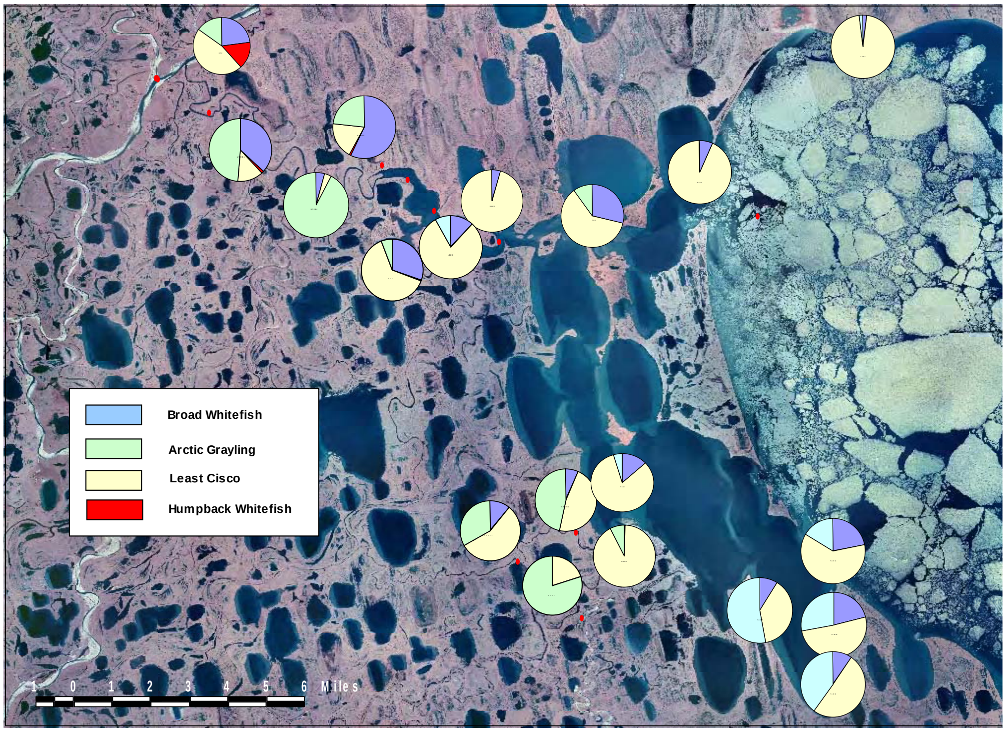

Figure 20. Catch composition by proportion of dominant species at western Teshekpuk Lake fyke net sampling stations, 1990-2005.

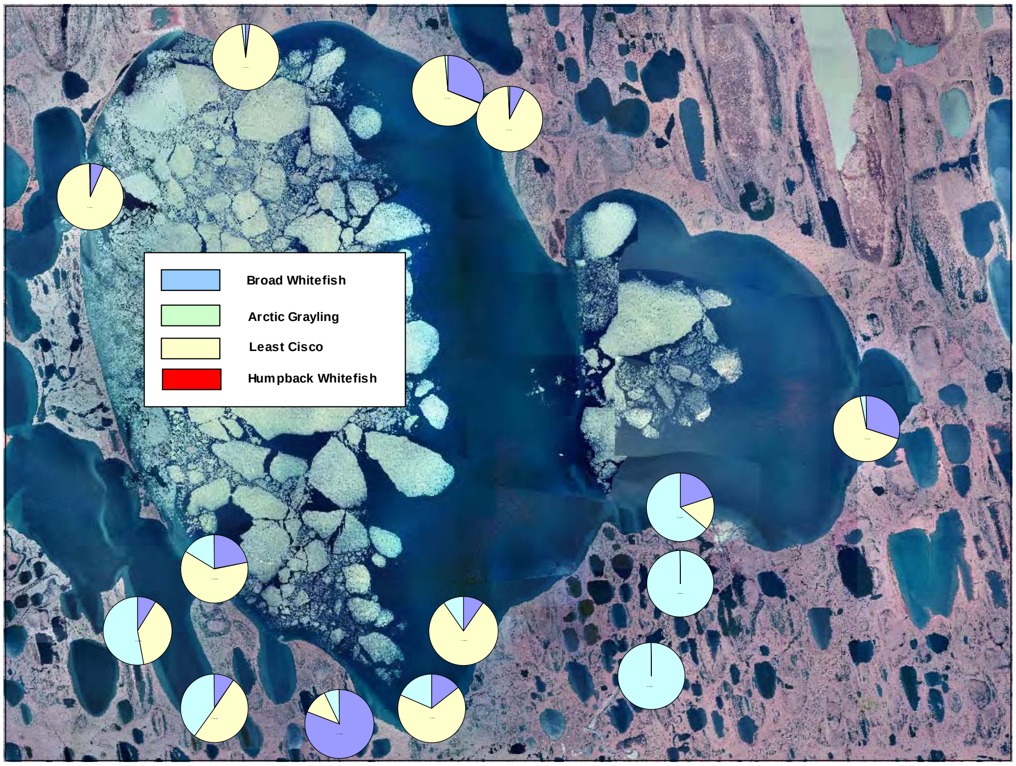

Figure 21. Catch composition by proportion of dominant species at eastern Teshekpuk Lake fyke net sampling stations, 1990-2005.

Figure 22. Luke George and Kyle Bodfish in the ice cellar at Shukluq (Noah Itta's camp) with two large broad whitefish (Aanaakliq). Aanaakliq are often the main target species for fisheries in the Chipp/Ikpikpuk/Teshekpuk region. Fish range in size from about 2-4 kg (~4.5-9 lbs). Broad whitefish mature late (~12 yrs) and fish of the size shown here are often 15-25 years old.

In all three sample periods during 2004, broad whitefish appeared to be moving downstream out of the tributaries (Table 8).

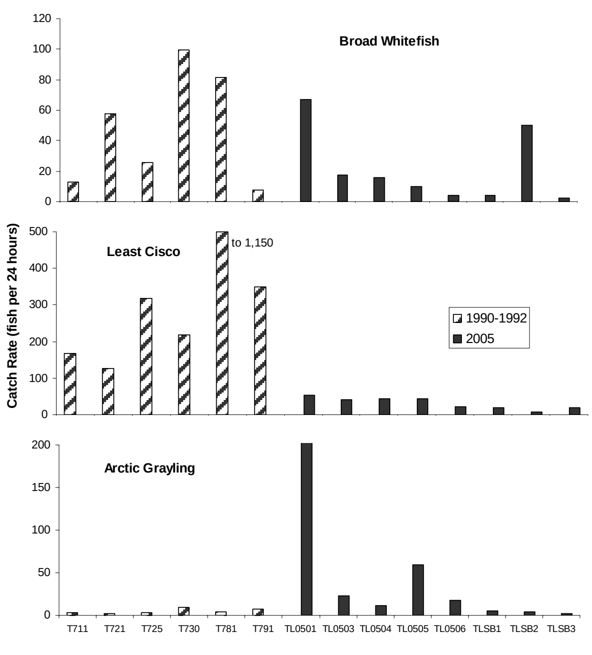

Figure 24. Comparison of catch rates at fyke net stations within Teshekpuk Lake for broad whitefish, least cisco and Arctic grayling between the two sampling periods, 1990-1992 and 2005.

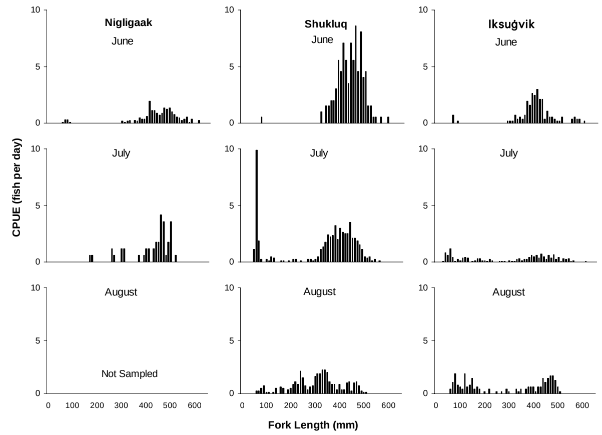

Figure 25. Comparison of broad whitefish length frequencies by season at long term stations on the Mayuġiaq River, 2003-2004. Catches in June were mostly large fish.

Broad whitefish length frequencies reflect the dominance of Shukluq station catches, particularly in June (Figure 25). Larger fish (in excess of 400 mm, 16 inches) tended to be more abundant at all stations in June, with smaller fish increasing in abundance later in summer. Large fish continued to be present through the summer.

Table 8. Catch rates (in fish per day) of dominant species by direction of movement for each sampling period, 2004

Broad whitefisl	Fish Moving Downstream				Fish Moving Upstream			
Sample Month	Mean (fish/day)	Standard Deviation	N	Range	Mean (fish/day)	Standard Deviation	N	Range
June	29.6	23.0	5	1.0-55.1	5.2	2.2	5	3.0-8.1
July	130.2	42.4	3	84.3-168.0	28.5	0.7	3	14.2-39.3
August	90.8	31.2	3	59.0-121.3	3.9	1.5	3	2.6-5.6

Least cisco	Fish Moving Downstream				Fish Moving Upstream			
Sample Month	Mean (fish/day)	Standard Deviation	N	Range	Mean (fish/day)	Standard Deviation	N	Range
June	20.2	14.0	5	5.2-38.0	7.2	3.3	5	4.0-11.7
July	83.9	124.7	3	11.2-227.8	140.4	14.6	3	7.1-305.8
August	35.8	27.1	3	14.0-66.1	10.7	2.1	3	8.8-13.0

Arctic grayling	Fish Moving Downstream				Fish Moving Upstream			
Sample Month	Mean (fish/day)	Standard Deviation	N	Range	Mean (fish/day)	Standard Deviation	N	Range
June	27.9	22.9	5	6.2-66.2	42.1	23.5	5	25.4-80.7
July	6.8	3.4	3	3.4-10.2	15.9	0.0	3	3.7-32.1
August	52.0	36.8	3	28.5-94.4	14.6	6.9	3	8.8-22.2

Burbot	Fish Moving Downstream				Fish Moving Upstream			
Sample Month	Mean (fish/day)	Standard Deviation	N	Range	Mean (fish/day)	Standard Deviation	N	Range
June	2.4	1.7	5	0.0-4.2	1.4	1.1	5	0.0-3.0
July	0.0	0.0	3	0.0	0.0	0.0	3	0.0
August	2.3	1.0	3	1.2-3.1	1.5	1.3	3	0.0-2.6

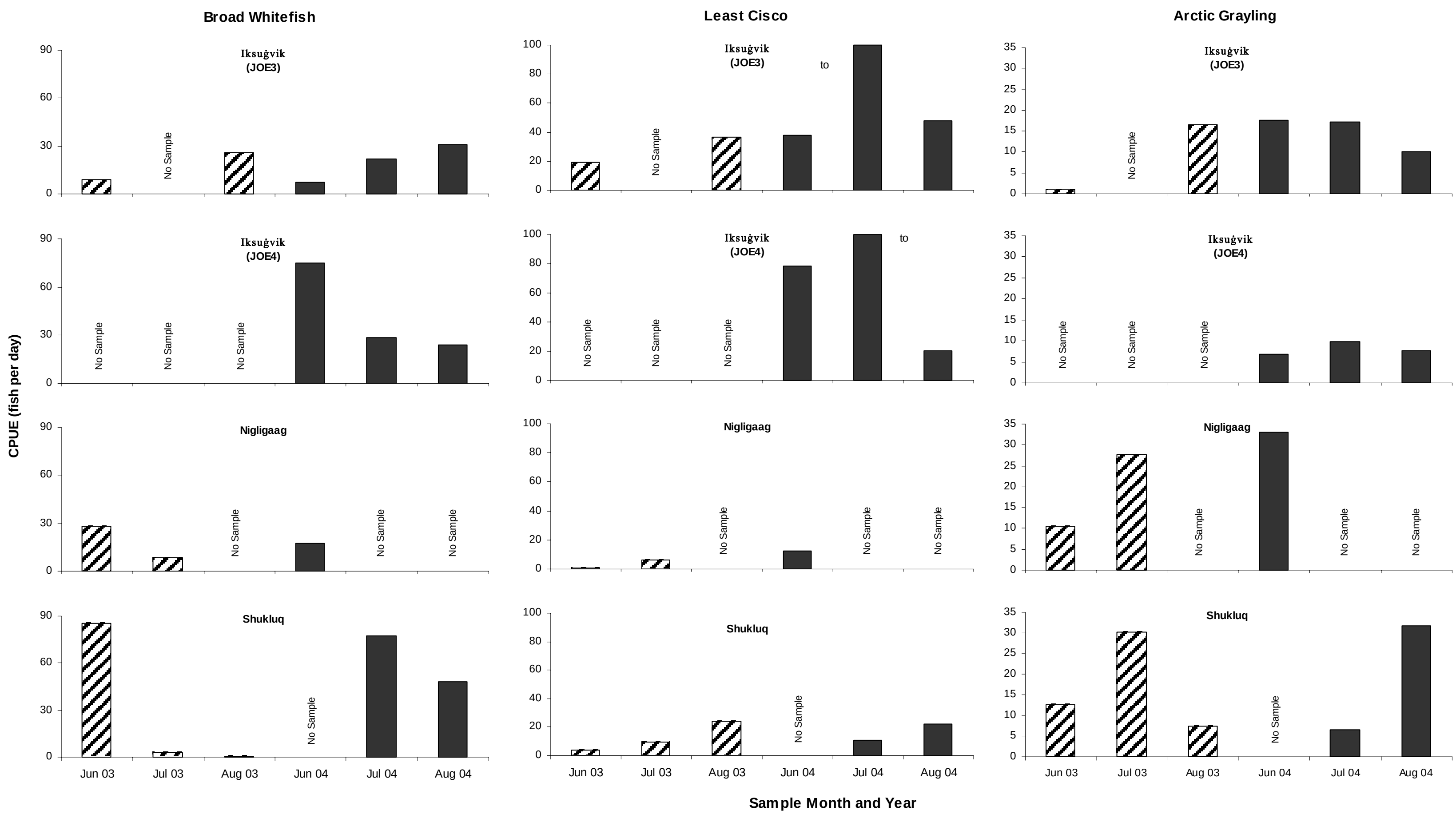

Figure 23. Catch rate, in fish per day, of broad whitefish, least cisco and Arctic grayling at long-term fyke net stations in the Mayuġiaq River sampling area, 2003 - 2004.

Least Cisco. Least cisco was the most abundant species, representing 29% of the catch. They were the only species caught at every fyke net station during every sampling period during 2003-2004, and were also abundant in 2005 (Table 6). Least cisco dominated the catch at stations closer to Teshekpuk Lake, and were a lesser component of the catch at stations away from the lake (Figure 20). They were particularly abundant at Iksuġvik stations (Figure 23).

The dominance of Iksuġvik stations to the least cisco catch is reflected in the length frequencies (Figure 26). Larger fish (longer than 300 mm, 12 inches) were most abundant during June, with few large fish caught in July or August. Conversely, smaller fish were mostly absent during June, with substantial increases in numbers in July and August.

As previously mentioned, least cisco were the dominant species during 1990-1992 sampling at lake shore stations. The mean catch rate during that time period was 336 fish per day, an order of magnitude greater than the 31.2 fish per day observed at lake shore stations in 2005. The high abundance in 1990-1992 as compared to 2005 was across all stations (Figure 24).

Arctic Grayling. Arctic grayling were third in abundance after least cisco and ninespine stickleback, and were consistently caught across 28 of the 29 fyke station/period samples (Table 6). They represented a high proportion of the catch at tributary stations, such as Nigligaak, MTRIB2, Shukluq, SPEC1 and 2, RAD2, and K0501, but were also a large contributor to the catch at outlet stream station MIG01 (Figure 17). In a number of these stations, the catch was low, thus the proportion of catch does not reflect abundance. At long-term stations, Nigligaak and Shukluq showed high abundance of Arctic grayling, with Iksuġvik showing moderate abundance (Figure 23).

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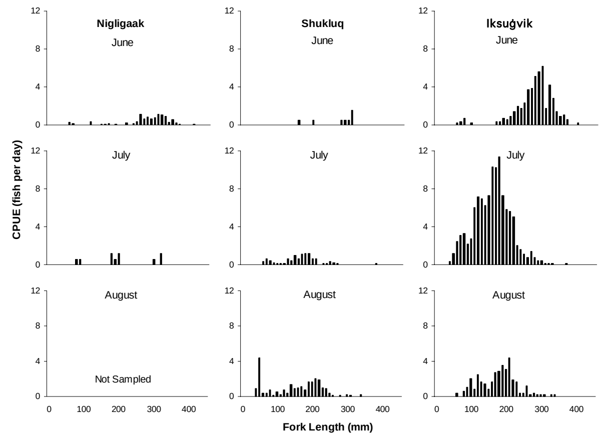

Figure 26. Comparison of least cisco length frequencies by season at long term stations on the Mayuġiaq River, 2003-2004. Catches were mostly large fish in June; most least cisco were caught at Iksuġvik.

In contract to least cisco, Arctic grayling were more abundant during 2005 sampling within Teshekpuk Lake than in 1990-1992. The mean catch rate of 42.3 fish per day in 2005 was over 8 times higher than the 5.2 fish per day in 1990-1992. Much of the difference was caused by high catches at station TL0501 and TL0505 (Figure 24).

Highest abundance of Arctic grayling was in lower Kealok Creek during June 2005. A fyke net set to sample fish moving upstream averaged 620 fish per day on June 18 and 22. Over 95% of these were age 1 and age 2 fish (50-130 mm).

A broad range of sizes were typically present in each sampling period at the long-term stations, however, the largest fish (longer than 375 mm, 15 inches) were present mostly in June following spring spawning (Figure 27).

Burbot. A total of 62 burbot were caught during the 2003-2005 sampling, with fish ranging from 77 to 930 mm (3 to 37 inches). Burbot were caught at 6 stations, but were most abundant at Nigligaak (24 fish caught), Shukluq, and IKP1 (12 fish each). Most of the burbot were large mature fish, although some juveniles were also captured. Based on otolith readings, a 156 mm (6 inch) burbot was estimated to be 3 years old while a 765 mm burbot (30 inches, 6½ pounds) was estimated to be 14 years old.

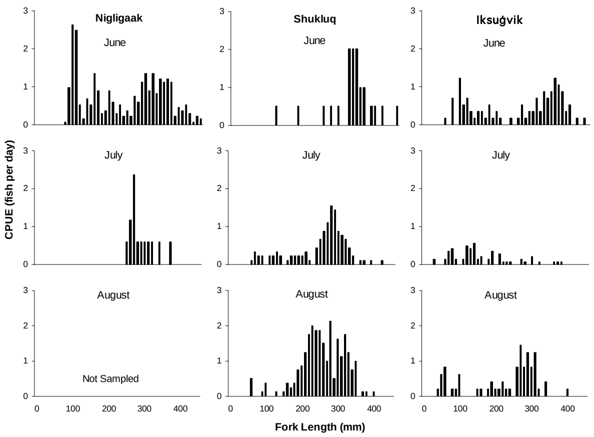

Figure 27. Comparison of Arctic grayling length frequencies by season at long term stations on the Mayuġiaq River, 2003-2004.

Humpback Whitefish. Humpback whitefish catch totaled 45 fish, with most being adults in excess of 340 mm (13 inches). They were widely spread in low numbers, occurring at 9 stations.

Arctic Char. Three Arctic char were captured at Nigligaak in June 2004, ranging in length from 466 to 577 mm (18-23 inches). Two (466 and 532 mm) were tagged and released. The third (577 mm) died from handling stress; it was a female estimated to be 18 years old that had spawned the previous fall.

Northern Pike. Eleven northern pike were captured, with 6 being caught at Nigligaak during June 2004. Pike ranged from 453 to 662 mm (18-26 inches), with 7 being between 610 and 662 mm (24-26 inches). A 495 mm (19½ inch) pike was estimated to be 7 years old.

Movements of Tagged Fish

Anchor Tags. During 2003-2005, a total of 1,799 fish were released with Floy anchor tags from stations in the Teshekpuk Lake study region. Broad whitefish accounted for 74% (1331 tags) of the releases, while an additional 22% (395 tags) were Arctic grayling. While 32 tagged broad whitefish and 62 Arctic grayling were recaptured, most of the recaptures had only been at large for one day before re-entering the fyke nets. If the one-day recaptures are excluded from the analysis, only 13 broad whitefish and 10 Arctic grayling were recaptured (Table 9). One broad whitefish moved from Nigligaak in June 2004 to the southern portion of Teshekpuk Lake in August 2005 (approximately 32 river miles); all of the remaining recaptured broad whitefish were caught at the same station as the initial release. Five of the recaptured Arctic grayling showed inter-station movements, with two moving from Nigligaak to Shukluq (approximately 8 river miles), one moving from Shukluq to Iksuġvik (JOE3) (approximately 3.25 river miles), one from Iksuġvik (JOE4) to Iksuġvik (JOE3) (approximately 0.75 river miles), and one from Nigligaak to TL0505 (approximately 26 river miles).

An additional 6 broad whitefish tags and 1 Arctic grayling tag were returned by fishermen (Table 10). These recoveries also demonstrated movements among the Nigligaak, Shukluq and Iksuġvik stations.

Radio Tags. Radio tags were applied to 94 broad whitefish from 2003 to 2005 to track movements within the system (see companion report: Morris et al. 2006). Ten of these releases were in the Meade River, outside of the general Teshekpuk Lake study area. Relocations through 2004 have been from Teshekpuk Lake proper, the Mayuġiaq River, throughout the Ikpikpuk River, and into the lower Chipp River (Figure 28). Wintering fish were generally split into those that spawned in the Ikpikpuk River and remained near the spawning areas, and those that did not spawn and remained in the Mayuġiaq River, although it appears that some fish may have spawned in the Mayuġiaq River (Figure 28). The region of merged lakes that form the Teshekpuk Lake outlet was the most heavily used wintering area by broad whitefish.

Table 9. Tagged fish recaptured during 2003-2005 Teshekpuk Lake study (does not include 72 fish recaptured after one day at large, complete list in Appendix Table D-1.) (fish moving between stations are highlighted in bold)

Species	Release Station	Release Date	Release Length	Recap Station	Recap Date	Recap Length	Days at Large
Broad whitefish	Nigligaak	Jun 26 03	425	Nigligaak	Jun 28 03	--	2
	Nigligaak	Jun 26 03	417	Nigligaak	Jun 28 03	--	2
	Nigligaak	**Jun 22 04**	**493**	**TLSB2**	**Aug 27 05**	**501**	**431**
	Shukluq	Jun 28 03	439	Shukluq	Jul 27 04	449	395
	Shukluq	Jul 27 03	466	Shukluq	Aug 29 04	479	399
	Shukluq	Jul 27 04	467	Shukluq	Aug 29 04	469	33
	Shukluq	Jul 27 04	482	Shukluq	Aug 30 04	485	34
	Shukluq	Jul 28 04	483	Shukluq	Jul 30 04	482	2
	Shukluq	Jul 28 04	406	Shukluq	Jul 30 04	406	2
	Shukluq	Jul 28 04	351	Shukluq	Jul 31 04	348	3
	Shukluq	Jul 28 04	359	Shukluq	Jul 31 04	358	3
	Shukluq	Jul 28 04	451	Shukluq	Jul 31 04	448	3
	Shukluq	Jul 31 04	342	Shukluq	Aug 30 04	350	30
Burbot	Nigligaak	Jun 20 04	770	Nigligaak	Jun 25 04	770	5
Arctic grayling	**Iksuġvik**	**Jul 28 04**	**306**	**Iksuġvik**	**Aug 31 04**	**315**	**34**
	Nigligaak	Jun 23 04	322	Nigligaak	Jun 25 04	325	2
	Nigligaak	**Jun 21 04**	**315**	**Shukluq**	**Jul 30 04**	**331**	**39**
	Nigligaak	**Jun 22 04**	**321**	**Shukluq**	**Aug 30 04**	**330**	**69**
	Nigligaak	**Jun 21 04**	**430**	**TL0505**	**Jul 29 05**	**431**	**403**
	Shukluq	Jul 28 03	316	Shukluq	Aug 29 04	345	398
	Shukluq	Jul 27 04	320	Shukluq	Aug 29 04	330	33
	Shukluq	**Jun 28 03**	**381**	**Iksuġvik**	**Jun 23 04**	**393**	**361**
	TL0505	Jul 26 05	260	TL0505	Jul 28 05	259	2
	TL0505	Jul 26 05	285	TL0505	Jul 29 05	285	3
Least cisco	KLK01	Jun 20 05	376	KLK01	Jun 23 05	375	3
	KLK01	Jun 21 05	386	KLK01	Jun 23 05	387	2

Table 10. Tagged fish recaptured by fishermen during the 2003-2005 Teshekpuk Lake st

Species	Tag No.	Station Released	Date Released	Station Returned	Date Returned	Days At Large
Broad whitefish	NSB-0027	Nigligaak	6/26/2003	Itta Camp	6/17/2004	357
	NSB-0126	Shugluk	6/27/2003	Itta Camp	6/17/2004	356
	NSB-0429	Iksuġvik	8/24/2003	Itta Camp	6/17/2004	298
	NSB-0721	Nigligaak	6/22/2004	?	8/6/2004	45
	NSB-1107	Iksuġvik	7/28/2004	Savik Camp	8/1/2004	4
	tag missing			Savik Camp	8/6/2004	
Arctic grayling	NSB-0561	Nigligaak	6/21/2004	Savik Camp	7/20/2004	29

Age, Growth and Maturity

One of the main objectives of the 2003-2004 study period was to evaluate the status of broad whitefish, Arctic grayling and least cisco populations at this time to those sampled during the 1990-1992 survey of fish in Teshekpuk Lake (Philo et al. 1993). Evaluation of differences between these two time periods must be done with the knowledge that sampling locations were substantially different, thus any differences in growth may reflect habitat differences, not necessarily temporal changes. The 1990-1992 samples were primarily from within the main body of Teshekpuk Lake while 2003-2004 samples mostly came from tributaries to the Mayuġiaq River.

Broad Whitefish. Broad whitefish caught in 2003-2004 were larger and older than the fish sampled in 1990-1992 (Figures 30 and 31). In 2003-2004, 74% of the captured fish were larger than 300 mm (12 inches), while only 16% of the 1990-1992 fish exceeded this length. Similarly, 36% of the 2003-2004 sampled fish exceeded 14 years of age, while in 1990-1992 only 5% exceeded this age. These differences likely reflect differing habitat use patterns.

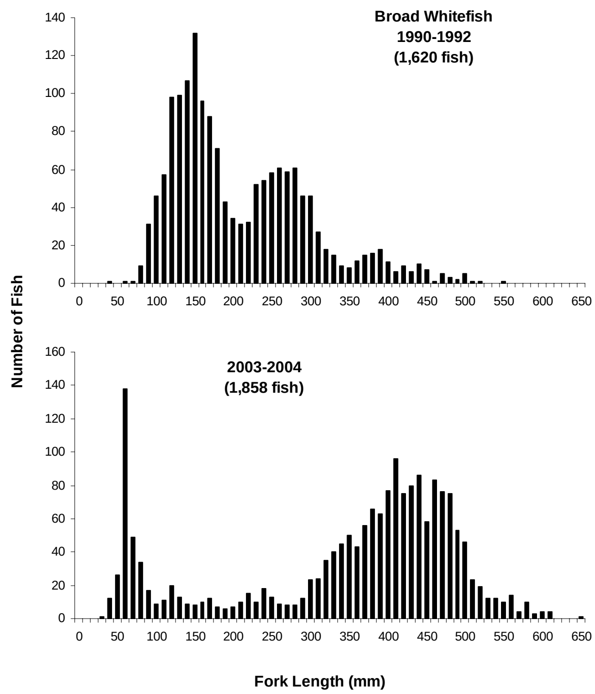

Figure 30. Large broad whitefish were a greater proportion of the catch from the Mayuġiaq River region in 2003-2004 than from Teshekpuk Lake stations in 1990-1992.

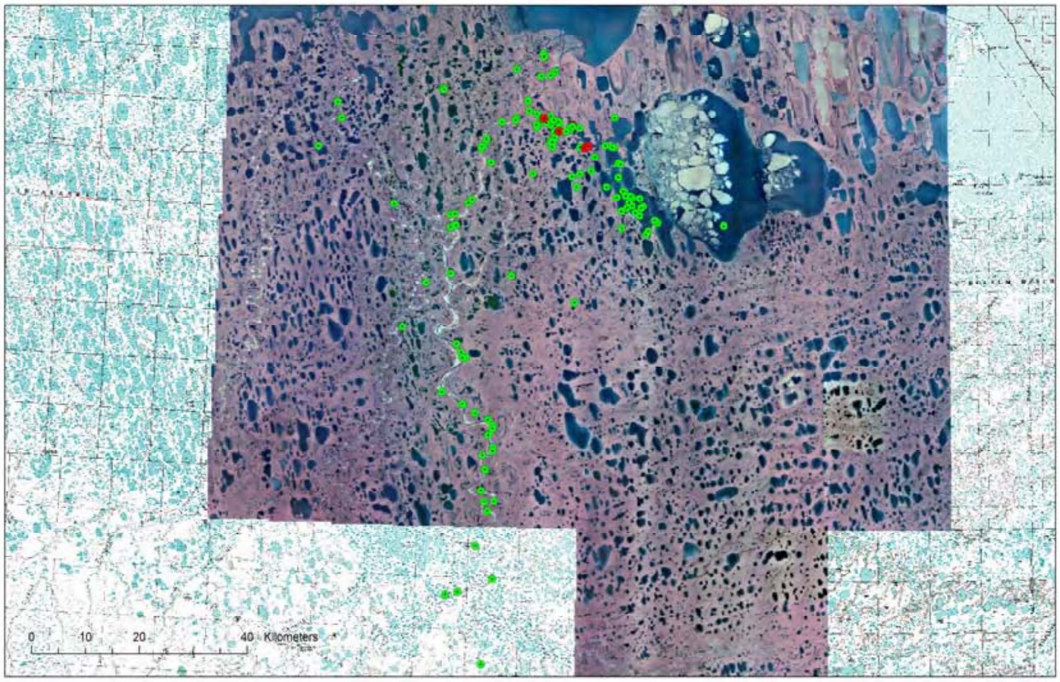

Figure 28. Radio-tagged broad whitefish ,released at the red dots, spread widely through the Teshekpuk Lake region, based on 2003-2004 tag releases.

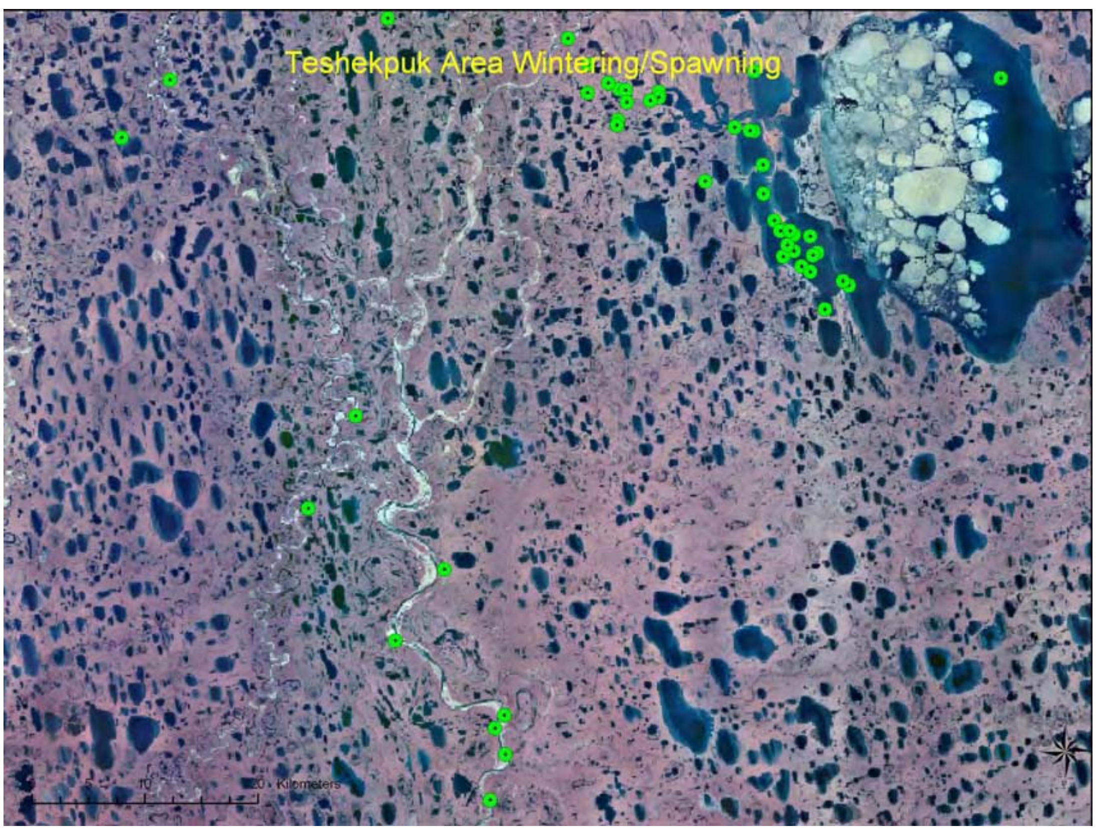

Figure 29. Radio-tagged broad whitefish were detected in wintering areas in the Ikpikpuk and Mayuġiaq rivers, with many at the outlet of Teshekpuk Lake during 2003-2004.

The age-length relationship of broad whitefish caught in 2003-2004 was compared to those caught in 1990-1992 to evaluate the rate of growth between the two time periods. The length of fish in northern regions increases in a linear fashion with age until maturity, at which time growth virtually ceases. This is reflected in the age-length relationship for the entire population (Figure 32). Therefore, the growth comparison was between fish less than the age of maturity. One problem with this approach is that all broad whitefish do not reach maturity at the same age. In the Teshekpuk region, broad whitefish begin to mature at age 8 but full maturity is not reached until about age 16 (Figure 31). Fish up to age 11 were included in this growth comparison, because only 10% of the fish are mature by this age, and maturity rates rise sharply after age 11.

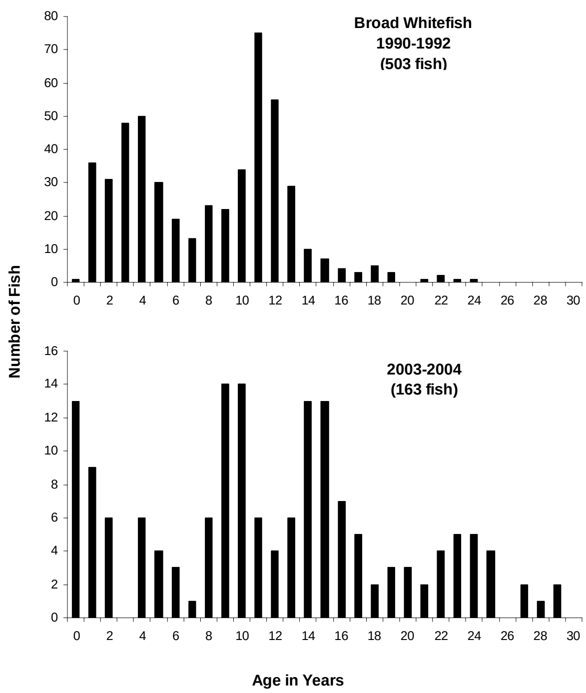

Figure 31. Broad whitefish sampled from the Mayuġiaq River region in 2003-2004 covered a greater range of ages than those sampled from Teshekpuk Lake in 1990-1992.

An analysis of covariance was used to compare the linear relationships that describe growth in the two groups (Figure 33). The difference between the slopes of the lines was highly significant ($p<0.0001$), with the slope describing growth in 2003-2004 being greater than that describing growth in 1990-1992. These results are confounded, however, because data from 1990-1992 include broad whitefish that apparently resided within Teshekpuk Lake and showed slower growth than fish that occupied peripheral habitats, such as tributaries or attached lakes (see Philo et al. 1993). High variability in the length at age data from the 1990-1992 period is likely a result of including fish with a wide variety of growth histories.

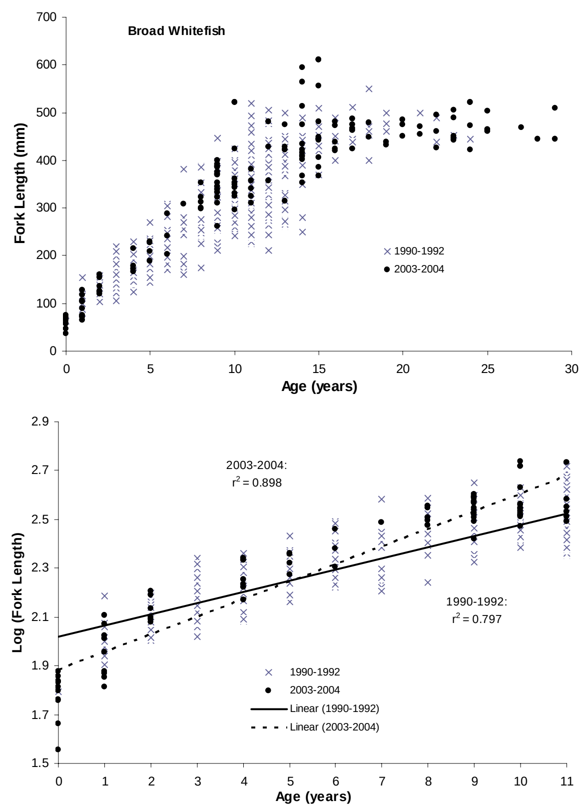

Figure 32. Comparison of age-length relationships of broad whitefish caught in the Teshekpuk Lake region during 1990-1992 and 2003-2004. top = length-at-age data, bottom = comparison of growth rates.

Another way to compare growth differences is to examine length-weight relationships between the two time periods to evaluate differences in weight for a given length. Broad whitefish sampled from fyke net catches in 2003-2004 were divided into 3 length groups (50-275 mm, 276-430 mm, and greater than 430 mm) based on gaps in the length frequency of sampled fish.

Broad whitefish from the 1990-1992 sampling period were divided into the same length groups.

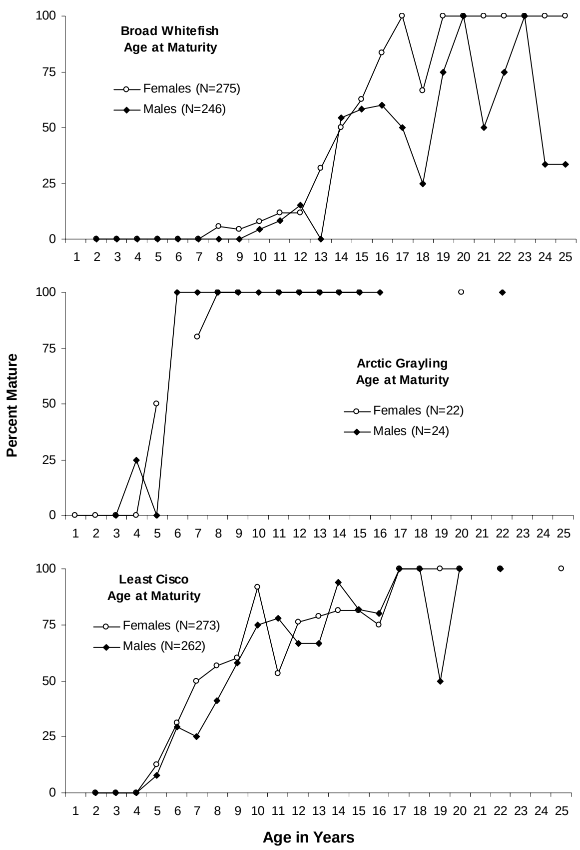

Figure 33. Maturation schedules for broad whitefish, Arctic grayling and least cisco caught in the Teshekpuk Lake region, based on fish caught in 1990-1992 and 2003-2004.

Analysis of covariance was used to evaluate statistical differences between the slope and intercept of the linear relationships based on log-transformed lengths and weights. There was no statistical difference between small (36-175 mm) and medium (276-430 mm) fish in either time period, so data from the two length groups were pooled within each period. For these small to medium fish, comparison between time periods (1990-1992 vs. 2003-2004) indicated no significant difference in slopes of the lines (p=0.063); however, the difference in intercept was highly significant (p<0.00001). Table 11 provides a summary of results from the analysis of covariance for broad whitefish length-weight comparisons.

Table 11. Analysis of covariance results from testing for differences in broad whitefish length-weight relationships between the time periods 1990-1992 and 2003-2004. (values are p values for test between different size groups and time periods; significant differences identified in bold)

Time Period	Size Group	Length Interval (mm)	Test	1990-1992 small	1990-1992 medium	1990-1992 Pooled 50-430	1990-1992 large	2003-2004 small	2003-2004 medium	2003-2004 Pooled 50-430	2003-2004 large
1990-1992	small	50-275	slope	--	0.918	--	--	--	--	--	--
			adj. means[1]	--	0.442	--	--	--	--	--	--
2003-2004	small	50-275	slope	--	--	--	--	--	0.075	--	--
			adj. means[1]	--	--	--	--	--	0.605	--	--
1990-1992	pooled	50-430	slope	--	--	--	**0.003**	--	--	--	--
	(small/medium)		adj. means[1]	--	--	--	0.060	--	--	--	--
2003-2004	pooled	50-430	slope	--	--	0.063	--	--	--	--	**0.0001**
			adj. means[1]	--	--	**0.0000**	--	--	--	--	**0.008**
2003-2004	large	over 430	slope	--	--	--	0.980	--	--	--	--
			adj. means[1]	--	--	--	0.776	--	--	--	--

[1] adjusted mean = test for difference in intercept

When small/medium fish were compared to large fish, there were significant differences between the regression slopes for both 1990-1992 (p=0.003) and 2003-2004 (p=0.0001), which justifies considering the larger fish in a separate analysis. Analysis of covariance between large fish of 1990-1992 vs. 2003-2004 indicated there was no significant difference in either slope (p=0.98) or intercept (p=0.06).

Arctic Grayling. As with broad whitefish, there were substantial differences in the size and age structure of Arctic grayling from the 2003-2004 sampling as compared to the 1990-1992 sampling, however, in this case Arctic grayling from the recent sampling period were smaller than those sampled in 1990-1992 (Figures 33 and 34). In 2003-2004, 13% of the captured fish were larger than 350 mm (14 inches), while 42% of the 1990-1992 fish exceeded this length. Similarly, 15% of the 2003-2004 sampled fish were 10 years old or older, while in 1990-1992 27% exceeded this age.

Arctic grayling in the Teshekpuk study region mature at age 6 (Figure 32) thus the analysis of growth using the age-length relationship used ages 0 to 6 for the analysis of covariance. The difference between slopes of the lines describing Arctic grayling growth in 2003-2004 and in 1990-1992 was marginally significant (p=0.039), with the slope describing growth in

1990-1992 being greater than that describing

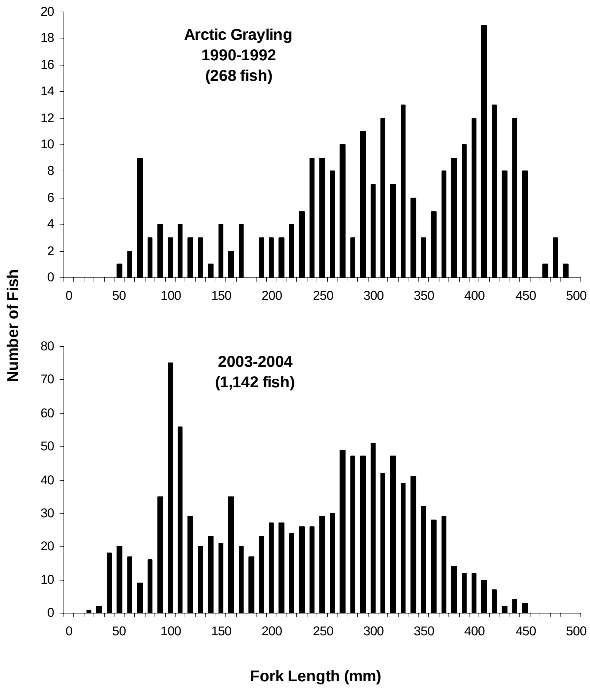

Figure 34. Over 40% of the Arctic grayling sampled from Teshekpuk Lake in 1990-1992 exceeded 350 mm, compared to less than 15% of those from the Mayuġiaq River region in 2003-2004.

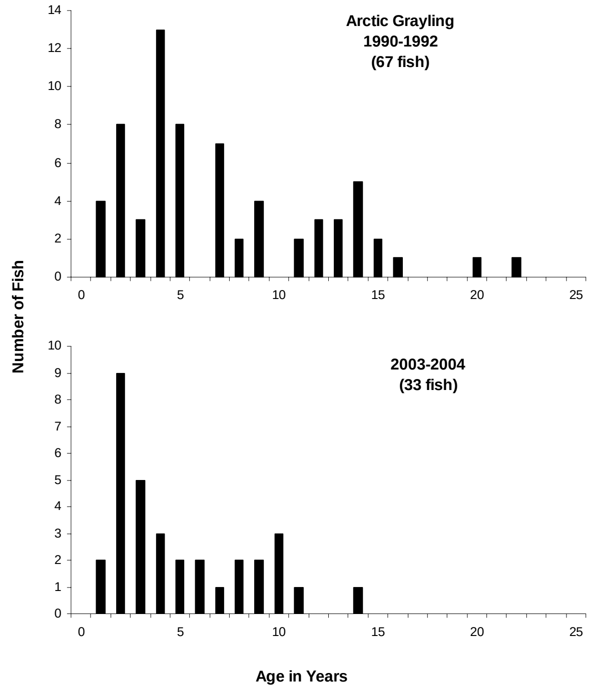

Figure 35. The sample of Arctic grayling from the Mayuġiaq River region in 2003-2004 did not have as many older fish as that from Teshekpuk Lake in 1990-1992.

growth in 1990-1992 being greater than that describing 2003-2004 growth (Figure 36).

Arctic grayling from the 1990-1992 and 2003-2004 sampling periods were divided into two length groups, small fish (50-235 mm) and larger fish (greater than 235 mm), to evaluate length-weight relationships. The length-weight relationship for small (50-235 mm) fish from 2003-2004 was not significantly different from large fish of 2003-2004 (p=0.68), however, the slope of the line describing length-weight of small fish from 1990-1992 was significantly different (p=0.001) than that of large fish for that time period, so the size groups were not pooled within time periods. The test of small fish from 1990-1992 vs. 2003-2004 was not significantly different, nor was the test between large fish from the two time periods. Table 12 provides a summary of the analysis of covariance results for Arctic grayling length-weight comparisons.

Table 12. Analysis of covariance results from testing for differences in length-weight relationships for Arctic grayling and least cisco between the time periods 1990-1992 and 2003-2004. (values are p values for test between different size groups and time periods;significant differences identified in bold)

Species	Time Period	Size Group	Length Interval (mm)	Test	1990-1992 small	1990-1992 medium	1990-1992 large	2003-2004 small	2003-2004 medium	2003-2004 large
Arctic grayling										
	1990-1992	small	50-235	slope	--	--	**0.001**	0.967	--	--
				adj. means[1]	--	--	0.130	0.794	--	--
	1990-1992	large	over 235	slope	--	--	--	--	--	0.307
				adj. means[1]	--	--	--	--	--	0.363
	2003-2004	small	50-235	slope	--	--	--	--	--	0.682
				adj. means[1]	--	--	--	--	--	0.576
Least cisco										
	1990-1992	small	50-149	slope	--	**0.000**	--	0.363	--	--
				adj. means[1]	--	**0.029**	--	0.130	--	--
	1990-1992	medium	150-249	slope	--	--	0.595	--	**0.008**	--
				adj. means[1]	--	--	0.938	--	**0.0000**	--
	1990-1992	large	over 249	slope	--	--	--	--	--	**0.629**
				adj. means[1]	--	--	--	--	--	**0.022**
	2003-2004	small	50-149	slope	--	--	--	--	0.867	--
				adj. means[1]	--	--	--	--	**0.020**	--
	2003-2004	medium	150-249	slope	--	--	--	--	--	**0.017**
				adj. means[1]	--	--	--	--	--	**0.464**

[1] adjusted mean = test for difference in intercept

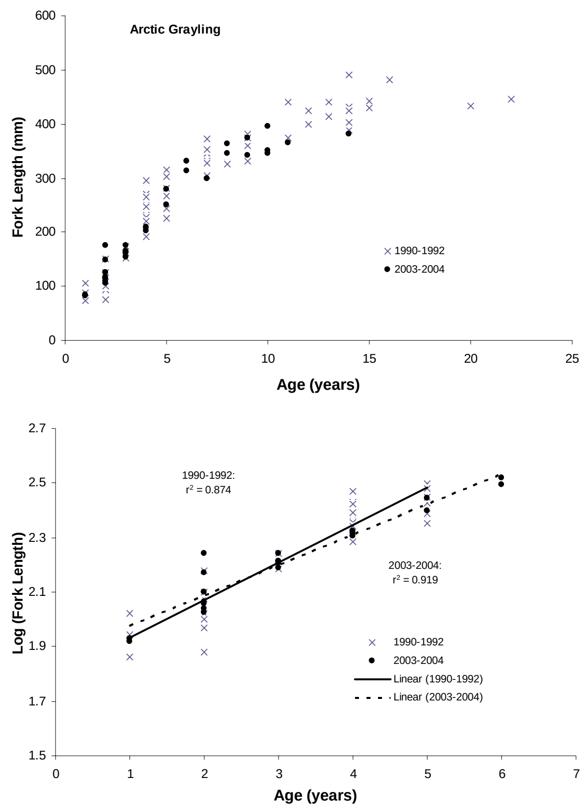

Figure 36. Age-length relationships of Arctic grayling caught in the Teshekpuk Lake region during 1990-1992 and 2003-2004 were similar between both time periods. top = length-at-age data, bottom = comparison of growth rates.

Least Cisco. Least cisco caught in 2003-2004 showed fewer differences from those caught in 1990-1992 than did broad whitefish or Arctic grayling (Figures 37 and 38). While there was a large group of small least cisco from the early period (90-180 mm, 3½ -7 inches), these were mostly a group of lake-resident stunted fish that never grow very large. This is reflected in the age distribution, where least cisco from the early period are older than fish from the 2003-2004 sampling (33% were 10 years or older compared to 19% from the current sampling) despite being smaller.

Least cisco in the Teshekpuk study region mature at age 6 (Figure 24), thus the analysis of growth using the age-length relationship used ages 0 to 6 for the analysis of covariance. The difference between slopes of the lines describing least cisco growth in 2003-2004 and in 1990-1992 was not different (p=0.348), however, the intercepts were significantly different (p<0.0001), indicating parallel lines (Figure 39). Length at a given age was higher in 2003-2004 compared to 1990-1992, but, as in broad whitefish, this was caused by small least cisco residing within Teshekpuk Lake that show stunted growth (see Philo et al. 1993).

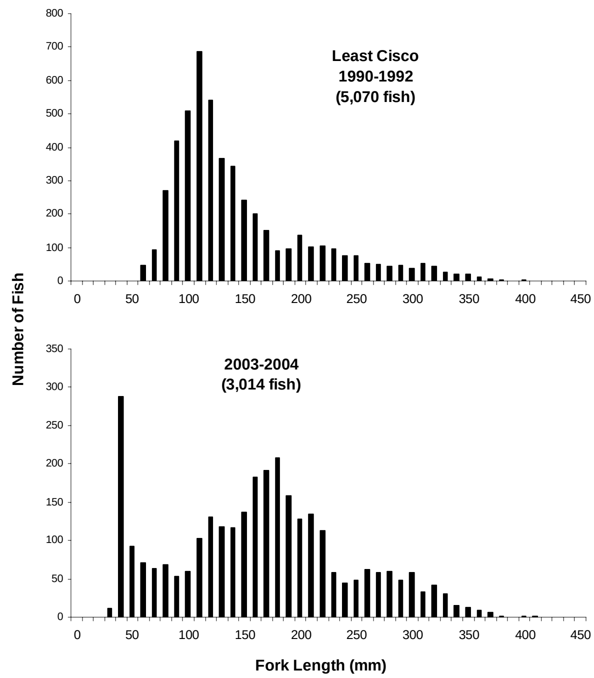

Figure 37. Least cisco sampled from Teshekpuk Lake in 1990-1992 were less than 175 mm; those sampled from the Mayuġiaq River region in 2003-2004 covered a broader range of sizes.

Least cisco from the 1990-1992 and 2003-2004 sampling periods were divided into three length groups, 50-149 mm, 150-249 mm and greater than 249 mm, to evaluate length-weight relationships. The length weight relationships for small (50-149 mm) fish from 2003-2004 was significantly different from the medium fish of 2003-2004 (p=0.02), and those were significantly different from the large fish (greater than 249 mm, p=0.02). Similarly, small (50-149 mm) fish from 1990-1992 were significantly different from the medium fish of 1990-1992 (p<0.0001), while the medium fish were not different from the large fish (p=0.59). As a result, the size groups were not pooled within time periods. When testing between time periods, small fish from 1990-1992

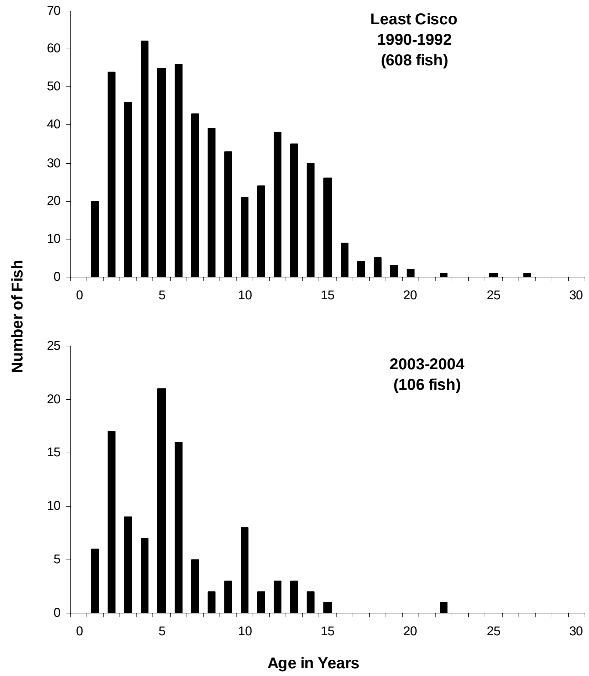

Figure 38. Least cisco sampled from Teshekpuk Lake in 1990-1992 contained a greater portion of older fish than those sampled from the Mayuġiaq River region in 2003-2004.

vs. 2003-2004 were not significantly different, however, both medium and large fish were significantly different between the two time periods. For medium fish, the difference was in slopes, while for large fish the difference was for intercept. Table 11 provides a summary of the analysis of covariance results for least cisco length-weight comparisons.

Prey Abundance Patterns

Three sampling methods were used to characterize the prey available to fish in the region: 1) Petite Ponar dredge, 2) sweep net, and 3) plankton net. Each gear type samples a different portion of the habitat. The Petite Ponar dredge collects mud and sand from the bottom along with any vegetation growing on the bottom. The sweep net is used to sample invertebrates within vegetation beds and invertebrates swimming in the water column near the beds. The zooplankton net catches small aquatic invertebrates living within the water column. A complete listing of sample results is included in

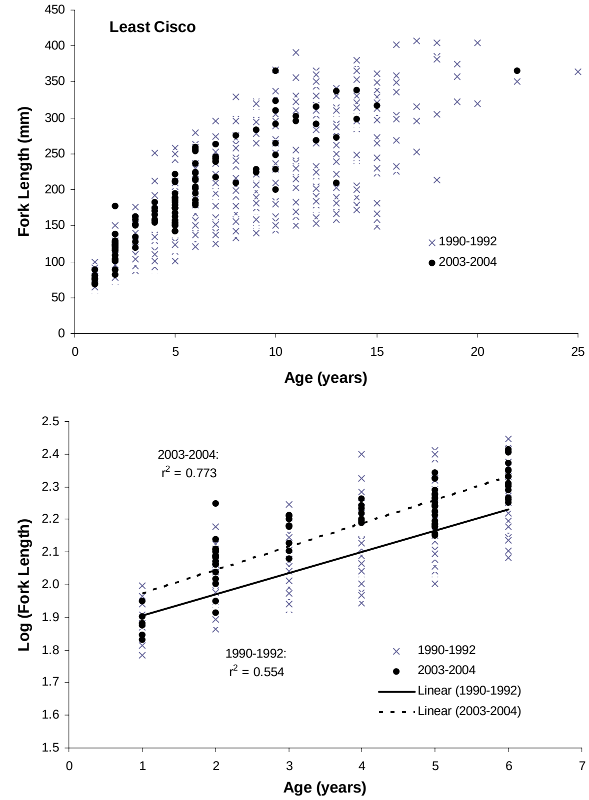

Figure 39. Comparison of age-length relationships of least cisco caught in the Teshekpuk Lake region during 1990-1992 and 2003-2004. top = length-at-age data, bottom = comparison of growth rates.

Appendix G.

Chironomid larvae (the young of gnats) were the dominant form caught by Ponar dredge at Nigligaak, Shukluq, and Iksuġvik (Table 13). In contrast, an amphipod was the most abundant form at the Mayuġiaq sampling station and small clams were abundant at one of the stations in Teshekpuk Lake. Chironomids were also abundant in sweep net samples at Nigligaak and Iksuġvik, while snails were dominant at Shukluq. Pelagic copepods tended to dominate the plankton net samples.

Table 13. Summary of abundance data for invertebrate samples collected in 2004 in the Teshekpuk Lake region.

Sample type	Sample location	Station	Sample date	Total abundance	Number of families	Dominant family	% contribution of dominant family
Petite Ponar							
	Nigligaak	MTRIB1	Jun 23	450	4	Chironomidae	92
			Jul 28	293	2	Chironomidae	83
			Aug 28	464	4	Chironomidae	63
	Mayuġiaq R. above Nigligaak	MIG02	Jun 23	1350	3	Pontoporeiida	93
			Jul 28	807	6	Pontoporeiida	93
			Aug 28	1021	4	Pontoporeiida	95
	Shukluq	MTRIB3	Jul 28	207	5	Chironomidae	62
	Iksuġvik	JOE4	Jun 24	350	4	Chironomidae	65
			Jul 28	1393	5	Chironomidae	90
			Aug 28	186	4	Chironomidae	58
	Teshekpuk Lake	TL003	Jul 28	114	2	Oligochaetes	62
		TL005	Jul 28	250	4	Pisidiidae	60
Sweep Net							
	Nigligaak	MTRIB1	Jun 25	238	9	Planorbidae	38
			Jul 28	460	8	Chironomidae	62
			Aug 28	504	10	Chironomidae	57
	Shukluq	MTRIB3	Jul 28	175	6	Valvatidae	76
	Iksuġvik	JOE4	Jun 25	279	7	Chironomidae	61
			Jul 28	53	7	Chironomidae	28
			Aug 28	410	8	Chironomidae	76
	Teshekpuk Lake	TL005	Jul 28	920	8	Chironomidae	31
Zooplankton net							
	Nigligaak	MTRIB1	Jun 23	59	3	Diaptomidae	64
			Jul 28	38	4	Cyclopidae	55
	Mayuġiaq R. above Nigligaak	MIG02	Jun 23	98	6	Bosminidae	49
			Jul 28	237	5	Diaptomidae	84
	Shukluq	MTRIB3	Jul 28	23	4	Cyclopidae	48
	Iksuġvik	JOE4	Jun 24	420	5	more than one	62
			Jul 28	63	3	Diaptomidae	97

Ponar Dredge. Petite Ponar samples showed little diversity, with one taxon usually dominating the results from each station, although was variation in which taxon was dominant. Samples from Nigligaak, Shukluq, and Iksuġvik were similar, being dominated by chironimids (as mentioned above), with snails and worms being present in lesser amounts (Figure 40). Clams, snails and worms were abundant in a sample from Teshekpuk Lake, while an amphipod species dominated samples form the Mayuġiaq River. The patterns were similar through the summer.

Sweep Net. In contrast to Ponar samples, sweep net samples tended to be more diverse, with two or three taxa being abundant at most stations (Figure 41). Samples from Nigligaak and Iksuġvik were most similar, being dominated by chironimids, followed by snails and caddis flies.

Samples from Shugluk were dominated by snails, followed by chironomids. Snails and chironomids were also abundant in a sample from Teshekpuk Lake, but a fair number of copepods were also present.

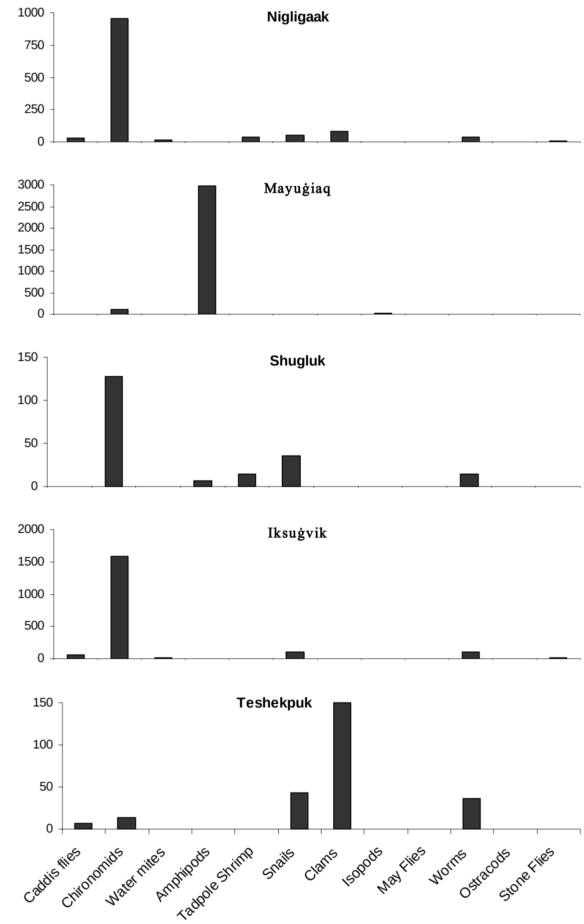

Figure 49. Potential fish prey showed considerable variation at stations in the Teshekpuk Lake study area, based on 2004 Ponar dredge samples.

Zooplankton. Copepod nauplii (young stages) were the most abundant taxon identified, being especially abundant at Iksuġvik in June. Two genera, *Arctodiaptomous* and *Bosmina*, were common in the samples during June, while two other genera, *Leptodiaptomus* and *Cyclops*, were abundant in July.

Feeding Patterns

Broad Whitefish. Stomachs were obtained from 19 broad whitefish during 2004, with 9 from June sampling and 10 from July. A complete list of prey items identified by fish is

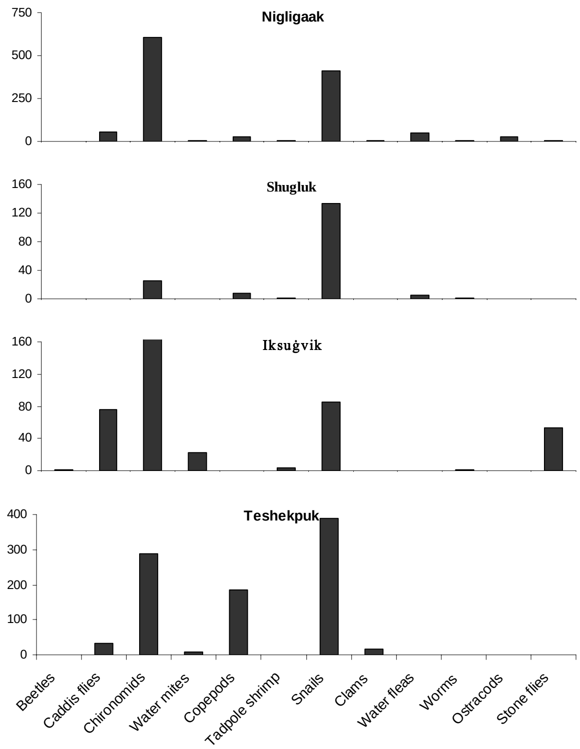

Figure 41. Chironomids and snails dominated potential fish prey at stations in the Teshekpuk Lake study area, based on 2004 sweep net samples.

provided in Appendix C. Typical food items are illustrated in Figure 12 in the Methods section. A total of 2,265 prey items from 11 identified taxonomic groups were identified from broad whitefish stomachs (see Appendix Table C-1). Snails were the most abundant prey category followed by chironomids (midge larvae) (Table 12). Snails consisted of two types: *Amnicola* sp. and *Gyraulus* sp., the latter of which was the predominant food organism. Snails and chironomids were the most abundant prey items in broad whitefish at all sampled stations during each sampling period (Figure 42). The amount of prey in sampled stomachs was higher at Iksuġvik stations than at Nigligaak and Shukluq.

Arctic Grayling. Stomachs were obtained from 9 Arctic grayling during 2004, with 3 from June sampling and 6 from July. As with broad whitefish, a complete list of prey items identified by fish is provided in Appendix C. A total of 610 prey items from 20 identified taxonomic groups were identified from Arctic grayling stomachs (see Appendix Table C-2). Diets of Arctic grayling were highly variable. At Nigligaak in June, chironomids were the most abundant prey item, but amphipods and Simuliidae (black fly larvae) were also abundant (Table 12, Figure 43). At Shukluq and SK-01 during July, fish, including ninespine stickleback, were a main prey item, although caddis flies were also eaten.

Diets of Arctic grayling were much more diverse than those observed in broad whitefish (Figure 44). Feeding patterns in broad whitefish were similar among individual fish and among stations, while there was substantial variability among feeding intensity of individual Arctic grayling. For example, one grayling caught at Nigligaak in June contained 262 prey items representing 15 taxonomic groups.

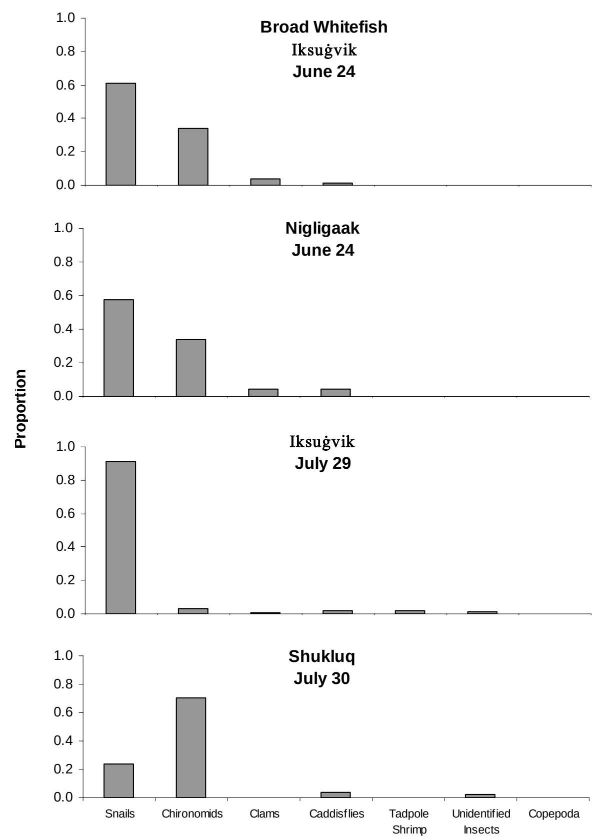

Figure 42. Chironomids and snails were dominant food items for broad whitefish captured at stations associated with the Mayuġiaq River, 2004.

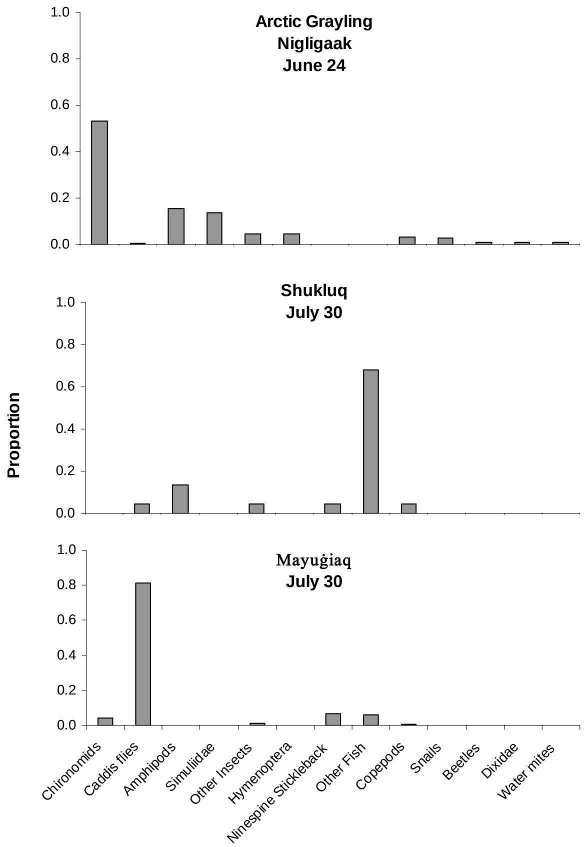

Figure 43. A highly diverse diet was observed in Arctic grayling captured at stations associated with the Mayuġiaq River, 2004.

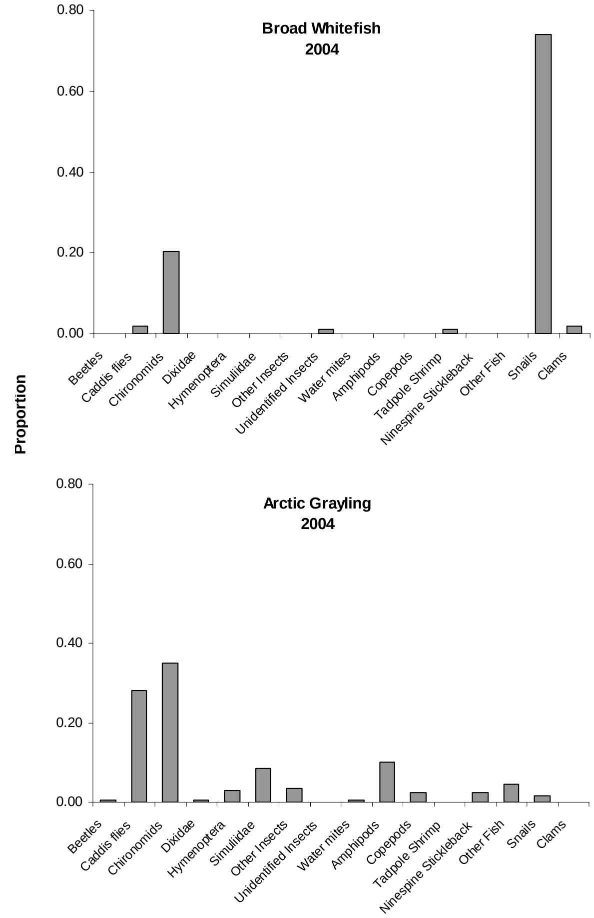

Figure 44. Comparison of diets in broad whitefish and Arctic grayling captured in habitats associated with the Mayuġiaq River, 2004.

DISCUSSION

Availability of Wintering Habitat

The analysis of potential wintering areas provided an estimate that over 200 mi^2 of habitat deeper than 7 feet are present in the main basin of Teshekpuk Lake, and that large relict lake basins that form the outlet of the lake provide an additional 21.5 mi^2 of potential wintering habitat deeper than 7 feet. To provide this number some perspective, there have been surveys conducted on lakes of the Arctic Coastal Plain since the 1970's for various studies. To date, 820 lakes have been surveyed for depth and area, of which 527 lakes were deeper than 7 feet (L.L. Moulton, unpublished data). These 520 lakes cover a combined surface area of 217 mi^2. If it is assumed that the mean proportion of area covered by water deeper than 7 feet is 0.352 (calculated for 143 lakes with detailed bathymetry, all deeper than 7 feet), then the total wintering area for the 527 lakes surveyed to date is only 76.4 mi^2, or about 34% of the wintering habitat available from Teshekpuk Lake and its outlet region.

Results from radio-tagged broad whitefish confirmed that the outlet region of Teshekpuk Lake is the most heavily used wintering area within the system, with few broad whitefish using the main basins of Teshekpuk Lake for wintering.

Comparison of Growth in 2003-2004 to 1990-1992

Age-length relationships from broad whitefish, least cisco and Arctic grayling for the periods 1990-1992 and 2003-2004 were examined to evaluate differences in growth rate between the two time periods. There were substantial differences in the sampled broad whitefish and least cisco populations that were likely a result of the different habitats being sampled in the two time periods, thus the analyses for these two species were compromised. The problem arose because the 1990-1992 sampling was focused on sampling within Teshekpuk Lake proper while the 2003-2004 sampling was in tributary systems along the Mayuġiaq River. Philo et al. (1993) documented groups of stunted, apparently lake-resident, least cisco and broad whitefish, which confound the age-length relationships. These individuals were not present in the habitats sampled during 2003-2004. There were no such problems with Arctic grayling, thus the growth analysis for this species is likely valid. There were no differences identified in Arctic grayling growth rates between the two periods. At this time, there is no evidence for detectable changes in fish growth or condition that can be attributed to climate change.

Fish Habitat Use

It is well established that heat is a scarce resource in the arctic and that, when possible, fish will seek out warmer habitats to feed and grow (Craig 1984, 1989). This is especially true when fish are dispersing from wintering areas to begin feeding after the long period of winter fasting. Warmer habitats will have higher primary productivity, which can lead to abundant prey populations. In the Teshekpuk Lake study area, water temperatures at the sampled tributary stations were 2°C higher than those at the outlet stream stations on the Mayuġiaq River during June of both 2003 and 2004. As a result, fish appeared to congregate in these warmer lateral habitats, leading to high catch rates of feeding broad whitefish, least cisco and Arctic grayling. These high concentrations of fish apparently attracted predatory fish, such as northern pike and burbot.

The warm, lateral habitats typified by the tributary mouths at Nigligaak, Shukluq, and Iksuġvik, contained extensive vegetation beds. These beds supported high densities of chironomids and snails, in contrast to the main channel of the Mayuġiaq River, which supported mostly amphipods. Chironomids and snails proved to be the predominant prey for broad whitefish, which may explain the high catches of this species at these 3 locations.

Another factor that appears to increase the value of specific tributaries is the abundance of connected lake habitat. The two streams feeding into the Mayuġiaq River at Iksuġvik and Nigligaak contain extensive lake habitat in their watersheds, with approximately 32% of the watershed covered by lakes in each. The third productive system discharging at Shugluk contains over 20% coverage by lakes in its watershed. In contrast, the drainage basin of second tributary to the Mayuġiaq River (MTRIB2) connected lakes represent around 7% of its basin, with no on-channel lakes. This tributary was sampled near its mouth in June 2003 and 2004, but catches were low (broad whitefish = 3.8 fish per day in 2003) and the site was abandoned. At the same time, broad whitefish catches at Nigligaak were 28.3 fish per day, and at Shugluk were 85.7 fish per day. The abundance of lake habitat within a basin, and on-channel lakes in particular, appear to greatly enhance the value as fish habitat.

While warmer temperatures can increase the value of feeding habitats, summer temperatures can be too high. Tundra streams and shallow lakes warm rapidly and can reach in excess of 20°C (68°F) in late June through July (Moulton 2005). Morris (2003) notes that fish in tundra streams become stressed when handled at temperatures above 16.5°C (62°F) and at 18°C (64.5°F), broad whitefish died when being removed from the net.

Fish Movements

While almost 1,800 fish tagged with anchor tags were released, only 24 were recaptured after being at liberty for more than 1 day, and only 13 were at large longer than a week. Part of the reason for the low recapture rate is the low recapture effort in the region – the study fyke nets were only fished for short periods during the summer and fish tagged were typically too small to be caught by mesh sizes used in the subsistence fisheries in the region. Nevertheless, a few patterns were notable. There were 6 long-term recaptures from 1,325 tagged broad whitefish, all except 1 at the same station as the release. The exception was a 32-mile movement from the lower Mayuġiaq River into the southwest portion of Teshekpuk Lake. Conversely, there were 7 long-term recaptures from 404 tagged Arctic grayling, 5 of which moved between stations. It is possible that broad whitefish move out of the immediate area along the Mayuġiaq River after being tagged, while Arctic grayling tend to make more restricted movements.

This extreme difference in recapture rates over the relatively short term of the study is indicative of the very different life histories of these two species in the region. Broad whitefish tend to use a much larger portion of the region-wide drainages than do Arctic grayling, most likely related to spawning migrations to the upper Ikpikpuk River for broad whitefish. Broad whitefish may also have a higher propensity to return to feeding areas that were successful in previous years while Arctic grayling will use a broader range of habitats, but generally within a smaller geographic area. Spring spawning events may also have affected the recapture location of Arctic grayling depending on the temporal proximity of recapture to the spawning event.

Radio-tagged fish moved widely within the Teshekpuk Lake/Ikpikpuk River system. Fish moving into the upper Ikpikpuk region tended to be fish heading for spawning areas, while fish remaining in the Mayuġiaq River tended to be non-spawning fish, although there were exceptions to these general patterns. Greater detail on movements of radio-tagged fish are provided in a separate report (Morris et al. 2006).

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APPENDIX A

Water chemistry from stations in the Teshekpuk Lake study area, 2003-2005

Appendix Table A-1. Water chemistry parameters measured at each station sampled during the 2003 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	Turbidity (NTU)
IKP1	6/24/2003	11.7	10.7	98.2	120.2	13.6
	6/25/2003	10.7	10.8	98.3	122.7	
	6/26/2003	12.2	11.4	103.8	118.5	10.7
IKP2	6/23/2003	10.1	11.2	97.3	216.1	9.8
	6/24/2003	9.1	11.4	98.2	219.0	11.3
	6/25/2003	9.1	11.4	98.2	219.0	
IKP3	6/23/2003	12.2	11.4	103.8	118.5	10.7
IKP4	6/23/2003	12.2	11.4	103.8	118.5	9.8
Joe 01	7/22/2003	17.2	8.9	98.6	230.2	0.8
	7/23/2003	14.0	8.6	83.0	234.2	1.0
	7/24/2003	13.0	9.3	88.0	230.5	1.0
	7/25/2003	11.5	9.7	89.0	221.9	0.8
Joe 02	7/24/2003	12.9	8.0	77.4	232.3	1.0
	7/25/2003	11.6	7.8	71.9	233.2	1.8
Joe 03	7/26/2003	8.8	7.9	68.6	221.1	1.0
	7/27/2003	7.6	11.0	92.1	235.9	1.0
	8/24/2003	5.8	10.9	88.1	246.3	0.8
	8/25/2003	4.8	12.5	97.2	242.6	0.5
MIG1	6/25/2003	7.8	12.4	101.0	255.0	
	6/26/2003	8.3	11.7	99.4	288.4	2.7
MTRIB1	6/26/2003	9.8	10.9	97.1	178.0	0.5
	6/27/2003	10.4	10.4	93.7	184.6	0.3
	6/28/2003	10.2	10.3	91.0	190.6	1.9
	7/26/2003	9.3	10.8	92.1	213.7	0.9
	7/27/2003	8.7	11.0	96.6	214.2	0.9
MTRIB2	6/26/2003	10.8	11.6	104.6	132.8	0.9
	6/27/2003	9.4	11.8	101.9	133.2	0.7
	6/28/2003	8.6	11.5	99.0	134.5	0.6
MTRIB3	6/26/2003	14.3	9.4	93.6	225.5	
	6/27/2003	8.3	9.2	79.2	202.6	1.6
	6/28/2003	9.2	9.9	86.0	206.5	1.5
	7/23/2003	13.8	4.5	43.8	169.7	5.0
	7/27/2003	9.2	10.8	94.3	215.5	5.3
	7/28/2003	7.3	10.9	90.8	209.1	
	8/24/2003	6.0	12.1	96.8	219.7	4.1
Neg 02	7/22/2003	no data	4.1	41.7		6.0
TG 01	7/24/2003	9.5	9.9	86.4	104.4	2.9
TL 01	7/25/2003	11.2	9.3	83.9	199.8	2.6

Appendix Table A-2. Water chemistry parameters measured at each station sampled during the 2004 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)
JOE3	6/19/2004	9.7	12.32	100.0	231.3	7.88	4.70
	6/20/2004	12.1	12.08	99.5	213.8	7.67	4.58
	6/21/2004	8.9	11.44	98.7	203.6	7.80	3.30
	6/22/2004	9.8	11.95	98.8	210.9	7.70	2.75
	6/23/2004	10.4	10.12	92.9	211.9	7.64	2.34
	8/30/2004	6.0	11.80	97.1	227.1	7.65	0.44
	8/31/2004	7.4	11.15	98.4	237.3	7.87	0.65
	8/31/2004	7.4	11.15	98.4	237.3	7.87	0.65
JOE4	6/24/2004	11.4	11.32	98.4	219.9	7.71	2.16
	6/25/2004	9.5	10.82	94.3	219.5	7.63	2.27
	7/27/2004	14.6	9.31	91.7	195.7	8.06	0.90
	7/28/2004	11.7	9.94	92.0	198.5	8.03	0.85
	7/29/2004	10.3	10.41	92.8	197.2	8.03	0.85
	7/30/2004	9.6	11.04	97.0	201.0	7.96	0.90
	7/31/2004	8.2	11.21	95.5	200.3	7.93	2.00
	8/28/2004	6.1	11.85	95.2	223.6	7.39	0.55
	8/29/2004	7.3	12.30	96.8	227.1	7.98	0.75
	8/29/2004	7.3	12.30	96.8	227.1	7.98	0.75
M0216	6/24/2004	4.9	11.98	93.8	84.7	7.24	6.55
MIG02	6/19/2004	10.3	11.14	99.8	176.0		
	6/20/2004	10.8	11.83	100.0	181.0	7.60	8.10
	6/21/2004	10.5	11.24	100.0	188.0	7.66	8.30
	6/22/2004	9.0	11.75	99.7	178.9	7.62	7.27
	6/23/2004	9.0	11.07	97.2	208.2	7.76	5.50
	6/24/2004					7.75	4.79
	6/25/2004	9.8	10.01	88.1	180.4	7.65	5.33
	7/26/2004	16.4	8.89	93.0	210.2		
	7/28/2004	11.6	10.80	99.6	216.5	7.91	4.50
MIG03	7/30/2004	9.3	11.09	97.1	231.0	7.88	9.60
MTRIB1	6/19/2004	13.3	9.37	89.6	140.0	7.43	3.90

Appendix Table A-2. Water chemistry parameters measured at each station sampled during the 2004 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)
MTRIB1	6/20/2004	14.0	8.98	87.5	140.5	7.45	3.20
	6/21/2004	12.8	8.25	85.0	133.1	7.31	3.30
	6/22/2004	11.7	9.38	86.7	134.5	7.39	2.56
	6/23/2004	12.4	10.30	96.5	130.0	7.41	2.58
	6/24/2004	13.9	9.05	88.2	128.0	7.44	2.17
	6/25/2004	13.0	10.10	95.6	129.6	7.40	2.09
	7/26/2004	18.6	8.25	88.9	167.5	7.97	1.70
	7/28/2004	12.4	9.91	93.1	175.0	7.85	1.90
MTRIB2	6/19/2004	12.6	9.68	91.1	141.5	7.42	3.20
	6/20/2004	13.8	9.32	89.9	144.8	8.17	3.05
MTRIB3	7/26/2004	17.9	8.96	94.6	202.6	8.16	1.60
	7/27/2004	14.7	9.83	97.0	201.6	7.90	1.40
	7/28/2004	12.1	10.69	99.2	206.9	8.11	1.70
	7/29/2004	10.1	10.76	95.5	212.5	7.97	2.10
	7/30/2004	8.6	10.67	91.6	214.0	7.82	1.80
	7/30/2004	9.2	10.62	93.0	212.7	7.70	2.90
	7/31/2004	7.1	11.21	92.5	189.8	7.53	4.40
	8/28/2004						2.90
	8/29/2004	6.4	9.80	78.0	224.1	7.40	3.20
	8/30/2004	5.4	10.84	83.7	220.3	7.19	2.74
	8/31/2004	6.4	10.63	86.6	221.8		2.62
NEG 02	6/19/2004	9.6	12.32	100.0	167.5		
	6/20/2004	11.7	12.28	100.0	195.5		
RAD1	6/21/2004	13.7	9.79		92.0	7.35	
	6/22/2004	12.3	10.10		94.0	7.39	2.99
RAD2	6/24/2004	11.6	10.50		84.0	7.47	3.18
	6/25/2004	11.2	10.34	94.3	90.7	7.37	2.43
SK-01	7/26/2004	17.8	8.66	91.1	192.1	8.20	1.30
	7/28/2004	11.7	10.42	96.3	192.0	8.08	3.10
	7/29/2004	10.2	11.31	99.6	199.6	8.02	4.00
	7/31/2004	7.6	11.52	96.1	207.4	7.96	5.40

Appendix Table A-2. Water chemistry parameters measured at each station sampled during the 2004 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)
SPEC1	6/21/2004	11.7	10.00		101.0	7.12	
	6/22/2004	9.8	10.80		101.0	7.41	3.05
SPEC2	6/24/2004	11.2	10.50		94.0	7.59	2.44
	6/25/2004	10.4	10.77	96.6	105.3	7.34	2.19

Appendix Table A-3. Water chemistry parameters measured at each station sampled during the 2005 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)
ETL05	6/24/2005	5.0	--	--	145.8	7.66	6.09
K0501	6/17/2005	6.2	--	--	89.6	--	--
	6/18/2005	3.3	--	--	92.4	--	--
	6/18/2005	6.6	12.20	99.8	89.9	7.35	8.39
	6/20/2005	9.4	--	--	104.0	7.80	5.11
	6/21/2005	9.1	--	--	103.3	--	--
	6/22/2005	6.3	--	--	102.5	8.05	3.99
KLK01	6/18/2005	4.4	--	--	55.9	7.49	1.25
	6/19/2005	4.6	12.53	99.3	55.2	8.07	0.91
	6/20/2005	4.8	12.47	95.8	42.7	7.33	1.90
	6/21/2005	6.3	--	--	88.7	7.97	0.45
KLK02	6/19/2005	4.7	12.66	98.5	87.9	7.93	7.67
	6/20/2005	5.1	--	--	100.5	7.67	4.44
	6/21/2005	4.8	--	--	136.1	8.18	2.62
	6/23/2005	4.6	--	--	89.6	8.26	4.95
KLK03	6/21/2005	9.3	--	--	--	7.65	1.91
	6/22/2005	5.2	--	--	103.6	7.61	2.07
MD0501	8/22/2005	8.1	11.72	--	175.7	--	--
R0501	6/18/2005	3.6	--	--	100.3	7.58	1.71
	6/19/2005	2.4	12.45	95.3	101.3	7.61	1.73
	6/20/2005	3.4	12.65	94.5	100.8	7.37	1.90
	6/21/2005	3.4	--	--	99.1	7.68	1.89
TL0503	7/24/2005	12.2	--	--	181.9	7.80	1.98
	7/25/2005	11.3	--	--	184.6	7.88	1.69
	7/26/2005	8.7	--	--	166.4	7.86	0.94
	7/27/2005	9.3	--	--	142.8	7.85	1.31
	7/28/2005	9.2	--	--	197.2	7.78	1.21
	7/29/2005	7.4	--	--	191.0	7.74	2.53
TL0504	7/24/2005	9.6	--	--	190.1	--	--
	7/25/2005	7.3	--	--	163.6	7.71	1.10
	7/26/2005	3.8	--	--	157.0	7.71	1.10
	7/27/2005	4.8	--	--	185.3	7.81	1.24

Appendix Table A-3. Water chemistry parameters measured at each station sampled during the 2005 Teshekpuk Lake fish survey.

Station	Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat.)	Specific Conductance (microS/cm)	pH	Turbidity (NTU)
TL0505	7/24/2005	12.0	--	--	179.7	--	--
	7/26/2005	9.2	--	--	181.9	7.59	1.10
	7/27/2005	7.2	--	--	184.1	7.42	0.86
	7/28/2005	7.6	--	--	184.5	7.54	0.87
	7/29/2005	7.4	--	--	185.1	7.74	0.64
TL0506	7/27/2005	8.2	--	--	147.2	7.84	1.05
	7/28/2005	7.2	--	--	186.5	7.74	0.97
	7/29/2005	6.8	--	--	185.6	7.96	1.03
TL0501	6/24/2005	8.3	--	--	97.8	7.73	4.72
TLSB1	8/25/2005	5.2	11.86	--	200.2	7.46	7.76
	8/26/2005	6.5	11.31	--	182.8	8.02	1.66
	8/29/2005	5.5	11.89	--	226.1	8.05	15.90
TLSB2	8/26/2005	4.4	11.05	--	195.2	7.85	1.60
	8/27/2005	6.4	11.43	--	196.2	8.09	1.23
	8/29/2005	5.2	12.70	--	209.7	7.83	13.20
TLSB3	8/26/2005	4.3	11.92	--	186.6	7.85	13.40
	8/27/2005	6.7	11.64	--	214.2	7.81	15.00

APPENDIX B

Catches of fish by day and station in the Teshekpuk Lake study area, 2003-2005

Appendix Table B-1. Effort in hours at each station sampled in the Teshekpuk Lake study region, 2003.

Fyke Nets

	Station										
Date	IKP1	IKP2	MIG01	Joe 01	Joe 02	Joe 03	MTRIB1	MTRIB2	MTRIB3	Neg 02	TL 01
Jun 20 03											
Jun 21 03											
Jun 22 03											
Jun 23 03		21.5									
Jun 24 03	26.2	21.6									
Jun 25 03	24.3	24.3	24.0								
Jun 26 03	89.1		21.2				18.6	21.1	7.7		
Jun 27 03							27.6	20.7	16.3		
Jun 28 03							19.9	21.3	23.6		
Jun 29 03											
Jul 21 03											
Jul 22 03				19.5						16.9	
Jul 23 03				23.6	22.7				22.8		
Jul 24 03				32.4	32.4						
Jul 25 03				16.7	17.0						25.1
Jul 26 03						20.8	17.8				
Jul 27 03						22.3	22.8		16.9		
Jul 28 03									19.7		
Jul 29 03											
Jul 30 03											
Jul 31 03											
Aug 23 03											
Aug 24 03						22.8			28.7		
Aug 25 03						22.1					
Aug 26 03											
Aug 27 03											
Aug 28 03											
Aug 29 03											
Aug 30 03											
Aug 31 03											
Total Hrs:	139.6	67.4	45.2	92.3	72.2	87.8	106.7	63.1	135.8	16.9	25.1

Gill Nets and Trammel Nets

Gear	Station	Date	Effort (hours)
Gill Nets			
	SK-01	Jul 21 03	10.5
	TG 01	Jul 24 03	3.2
Trammel Net			
	IKP3	Jun 23 03	3.2
	IKP4	Jun 23 03	2.9

Appendix Table B-2. Effort in hours at each station sampled in the Teshekpuk Lake study region, 2004.

Fyke Nets

	Station											
	JOE3	JOE4		MTRIB1		MTRIB2	MTRIB3		RAD1	RAD2	SPEC1	SPEC2
Date		D/S	U/S	D/S	U/S		D/S	U/S				
Jun 20	25.1			24.0		23.5						
Jun 21	27.1			24.0	26.2							
Jun 22	23.8			19.6	23.7				24.3		24.2	
Jun 23	21.2			19.8	20.3							
Jun 24		22.5		21.6	24.1							
Jun 25		16.4		23.1	26.7					24.8		26.3
Jun 26												
Jun 27												
Jun 28												
Jun 29												
Jul 27	19.5						21.0	20.3				
Jul 28		21.1	22.4				23.6	25.6				
Jul 29		22.7					18.8					
Jul 30		23.6					23.2					
Jul 31		25.1					26.2					
Aug 29		28.1					23.6	25.9				
Aug 30	17.3						27.5	27.4				
Aug 31	25.6						20.3	18.7				
Total Hrs:	159.6	159.4	22.4	132.0	120.9	23.5	184.1	117.9	24.3	24.8	24.2	26.3

D/S = net set to catch fish moving downstream
U/S = net set to catch fish moving upstream

Gill Nets

Gear	Station	Date	Effort (hours)
Multi-mesh			
	JOE4	Jun 24	0.4
	JOE5	Jul 29	1.0
	JOE5	Jul 30	3.2
	MTRIB1	Jun 24	1.9
	MTRIB3	Jul 30	4.5
5 inch mesh			
	ETESH	Aug 30	unknown
	IKP1	Aug 31	unknown
5.5 inch mesh			
	SK-01	Jul 27	23.5
	JOE5	Jul 30	15.5
	MIG03	Jul 31	20.0

Appendix Table B-3. Effort in hours at each station sampled in the Teshekpuk Lake study region, 2005.

Fyke Nets

	Station											
	K0501		KLK01		KLK02	KLK03	R0501		ETL05	TL0501	TL0503	TL0504
Date	DS	US	DS	US	US	US	DS	US				
Jun 18	21.3	22.2										
Jun 19							21.2	22.2				
Jun 20			22.3	22.0	21.6		23.7	23.7				
Jun 21			23.4	24.5	23.2		24.8	25.0				
Jun 22		20.0				22.1						
Jun 23			46.6	45.8	47.7							
Jun 24									19.3	21.9		
Jul 24											21.5	
Jul 25											21.2	19.3
Jul 26											21.0	25.1
Jul 27											23.5	24.8
Jul 28											22.5	
Jul 29											23.8	
Aug 22												
Aug 23												
Aug 24												
Aug 25												
Aug 26												
Aug 27												
Aug 29												
Total Hrs:	21.3	42.2	92.3	92.3	92.4	22.1	69.7	70.8	19.3	21.9	133.4	69.2

Fyke Nets

	Station									
	TL0505		TL0506	MD0501		TLSB1	TLSB2		TLSB3	
Date	DS	US		DS	US		DS	US		Total
Jun 18										43.5
Jun 19										43.3
Jun 20										113.2
Jun 21										120.9
Jun 22										42.1
Jun 23										140.1
Jun 24										41.3
Jul 24										21.5
Jul 25										40.4
Jul 26	23.5	24.2								93.8
Jul 27	24.6	23.1								96.0
Jul 28	23.3	23.3	22.7							91.8
Jul 29	23.9	24.1	23.7							95.5
Aug 22				23.3	23.5					46.8
Aug 23										0.0
Aug 24										0.0
Aug 25										0.0
Aug 26						18.9				18.9
Aug 27						28.3	22.8	22.9	30.2	104.3
Aug 29						47.8	46.5	46.3		140.6
Total Hrs:	95.3	94.7	46.4	23.3	23.5	95.0	69.3	69.2	30.2	1,293.9

D/S = net set to catch fish moving downstream
U/S = net set to catch fish moving upstream

Appendix Table B-3. Effort in hours at each station sampled in the Teshekpuk Lake study region, 2005.

Gill Nets

	Station							
Date	KLK01	IKGN01	TL0507	NAL01	TG0500	TG0501	TG0502	Total
Jun 18	3.2							3.2
Jul 26		3.0						3.0
Jul 27								0.0
Jul 28			18.5					18.5
Jul 29			7.0					7.0
Nov 7							21.0	21.0
Nov 8					23.3	23.8	23.7	70.9
Nov 9					24.8	24.7	24.7	74.1
Nov 10				17.2	19.7	24.8		61.7
Nov 11				23.8				23.8
Total Hrs:	3.2	3.0	25.5	41.0	67.8	73.3	69.4	283.2

Appendix Table B-4. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2003.

IKP1 (Fyke Net)

Species	6/24/03	6/25/03	6/26/03	Total
Broad whitefish	7	2	26	35
Burbot	3	7	2	12
Arctic grayling	3		18	21
Humpback whitefish	1	3		4
Least cisco	9	9	31	49
Ninespine stickleback			1	1
Slimy sculpin			1	1
Effort (hrs)	26.2	24.3	89.1	139.6

IKP2 (Fyke Net)

Species	6/23/03	6/24/03	6/25/03	Total
Broad whitefish	1	1	1	3
Burbot			1	1
Arctic grayling	2			2
Humpback whitefish	2			2
Least cisco	2	3	1	6
Effort (hrs)	21.5	21.6	24.3	67.4

Joe 01 (Fyke Net)

Species	7/22/03	7/23/03	7/24/03	7/25/03	Total
Broad whitefish	3	3		3	9
Arctic grayling	8	1	9	2	20
Least cisco	100	35	41	18	194
Effort (hrs)	19.5	23.6	32.4	16.7	92.3

Joe 02 (Fyke Net)

Species	7/23/03	7/24/03	7/25/03	Total
Broad whitefish	5			5
Arctic grayling	3		1	4
Least cisco	40	119	10	169
Effort (hrs)	22.7	32.4	17.0	72.2

Joe 03 (Fyke Net)

Species	7/26/03	7/27/03	8/24/03	8/25/03	Total
Broad whitefish	8	8	34	14	64
Arctic grayling	1	1	7	24	33
Least cisco	7	37	55	13	112
Slimy sculpin				1	1
Effort (hrs)	20.8	22.3	22.8	22.1	87.8

Appendix Table B-4. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2003.

MIG1 (Fyke Net)

Species	6/25/03	6/26/03	Total
Arctic grayling	5	0	5
Least cisco	1	0	1
Effort (hrs)	24.0	21.2	45.2

MTRIB1 (Fyke Net)

Species	6/26/03	6/27/03	6/28/03	7/26/03	7/27/03	Total
Broad whitefish	41	25	12	30	17	125
Burbot		2	2			4
Arctic grayling	11	11	7	5	9	43
Least cisco	1			5	5	11
Effort (hrs)	18.6	27.6	19.9	17.8	22.8	106.7

MTRIB2 (Fyke Net)

Species	6/26/03	6/27/03	6/28/03	Total
Broad whitefish	5	3	2	10
Arctic grayling	10	18	9	37
Least cisco	1		1	2
Effort (hrs)	21.1	20.7	21.3	63.1

MTRIB3 (Fyke Net)

Species	6/26/03	6/27/03	6/28/03	7/23/03	7/27/03	7/28/03	8/24/03	Total
Broad whitefish	27	105	38		5	2	2	179
Alaska blackfish	1							1
Burbot		1						1
Arctic grayling	2	3	20	1	7	67	15	115
Humpback whitefish	1	2	2					5
Least cisco	1	4	3	11	7	5	49	80
Northern pike		2	1					3
Effort (hrs)	7.7	16.3	23.6	22.8	16.9	19.7	28.7	135.8

Neg 02 (Fyke Net)

Species	7/22/03
Broad whitefish	1
Least cisco	20
Effort (hrs)	16.9

TL0301 (Fyke Net)

Species	7/25/03
Broad whitefish	23
Arctic grayling	8
Least cisco	49
Effort (hrs)	25.1

Appendix Table B-5. Number of fish caught by day at each gill net and trammel net station sampled in the Teshekpuk Lake study region, 2003.

SK-01 (Gill Net)

Species	7/21/03
Broad whitefish	5
Effort (hrs)	10.5

TG0301 (Gill Net)

Species	7/24/03
Least cisco	2
Effort (hrs)	3.2

IKP3 (Trammel Net)

Species	6/23/03
Broad whitefish	1
Bering cisco	2
Humpback whitefish	1
Least cisco	4
Effort (hrs)	3.2

IKP4 (Trammel Net)

Species	6/23/03
Broad whitefish	2
Humpback whitefish	2
Least cisco	6
Effort (hrs)	2.9

Appendix Table B-6. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2004.

FYKE NETS

JOE3 Species	Jun 20	Jun 21	Jun 22	Jun 23	Jul 27	Aug 30	Aug 31
Broad whitefish	5	5	15	5	18	32	23
Humpback whitefish		1		2			
Bering cisco	1						
Least cisco	77	32	16	29	392	33	52
Arctic grayling	19	29	8	15	14	7	11
Burbot							2
Slimy sculpin	1						
Threespine stickleback					1		
Ninespine stickleback	1	1			9		178
Effort (hrs):	25.1	27.1	23.8	21.2	19.5	17.3	25.6

JOE4	Jun 24	Jun 25	Jul 28		Jul 29	Jul 30	Jul 31	
Species	D/S	D/S	D/S	U/S	D/S	D/S	D/S	Aug 29
Broad whitefish	7	107	74	30	10	12	11	28
Humpback whitefish		2						
Least cisco	7	120	200	379	79	116	36	24
Arctic grayling		11	3	30	7	7	0	9
Burbot								3
Threespine stickleback					3	2	0	
Ninespine stickleback				12	13	0	0	2
Effort (hrs):	22.5	16.4	21.1	22.4	22.7	23.6	25.1	28.1

Appendix Table B-6. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2004.

FYKE NETS

MTRIB1	Jun 20	Jun 21		Jun 22		Jun 23		Jun 24		Jun 25		
Species	D/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	Total
Arctic char	1			2								3
Broad whitefish	20	51	5	45	3	20	3	15	7	1	9	179
Humpback whitefish	1	5		6		4				1		17
Least cisco	5	38	10	22	4	20	6	6	4	5	13	133
Arctic grayling	10	25	88	54	25	22	41	14	30	6	29	344
Burbot	2	3	1	3	2	1	1		3	4		20
Northern pike		2			1	2						5
Ninespine stickleback						1					1	2
Alaska blackfish							1					1
Effort (hrs):	24.0	24.0	26.2	19.6	23.7	19.8	20.3	21.6	24.1	23.1	26.7	252.9

MTRIB2	
Species	Jun 20
Arctic grayling	64
Least cisco	2
Ninespine stickleback	9
Effort (hrs):	23.5

MTRIB3	Jul 27		Jul 28					Aug 29		Aug 30		Aug 31	
Species	D/S	U/S	D/S	U/S	Jul 29	Jul 30	Jul 31	D/S	U/S	D/S	U/S	D/S	U/S
Broad whitefish	147	12	136	42	77	29	70	58	6	139	4	78	2
Humpback whitefish	2	1	1		0	1	1						
Least cisco	11	6	11	9	18	12	6	27	14	16	10	56	8
Arctic grayling	6	10	10	4	3	9	1	28	24	38	10	80	10
Burbot								3	2	3		1	2
Northern pike	1												
Threespine stickleback	0			1	2		3						
Ninespine stickleback	3	50		23	3								
Effort (hrs):	21.0	20.3	23.6	25.6	18.8	23.2	26.2	23.6	25.9	27.5	27.4	20.3	18.7

Appendix Table B-6. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2004.

FYKE NETS

RAD1

Species	Jun 22
Broad whitefish	1
Arctic grayling	28
Humpback whitefish	1
Least cisco	338
Ninespine stickleback	5
Slimy sculpin	3
Effort (hrs):	24.3

RAD2

Species	Jun 25
Alaska blackfish	1
Arctic grayling	8
Least cisco	2
Ninespine stickleback	20
Effort (hrs):	24.8

SPEC1

Species	Jun 22
Broad whitefish	1
Arctic grayling	7
Least cisco	7
Ninespine stickleback	37
Slimy sculpin	3
Effort (hrs):	24.2

SPEC2

Species	Jun 25
Broad whitefish	2
Arctic grayling	6
Least cisco	10
Effort (hrs):	26.3

Appendix Table B-7. Number of fish caught by day at each gill net station sampled in the Teshekpuk Lake study region, 2004.

GILL NETS

SK-01	5.5 inch
Species	Jul 27
Broad whitefish	1
Effort (hrs):	23.5

JOE4	Multi-mesh
Species	Jun 24
Broad whitefish	7
Arctic grayling	
Humpback whitefish	
Least cisco	
Effort (hrs):	0.4

JOE5	Multi-mesh		5.5 inch	
Species	Jul 29	Jul 30	Jul 30	Total
Broad whitefish	1	4	1	6
Northern pike	1			1
Effort (hrs):	1.0	3.2	15.5	19.7

MTRIB1	Multi-mesh
Species	Jun 24
Broad whitefish	4
Arctic grayling	5
Humpback whitefish	1
Northern pike	1
Effort (hrs):	1.9

MTRIB3	Multi-mesh
Species	Jul 30
Broad whitefish	5
Arctic grayling	3
Humpback whitefish	1
Effort (hrs):	4.5

MIG03	5.5 inch
Species	Jul 31
Broad whitefish	4
Burbot	1
Pink salmon	6
Effort (hrs):	20.0

ETESH	5 inch
Species	Aug 30
Broad whitefish	5
Effort (hrs):	unknwn

IKP1	5 inch
Species	Aug 31
Broad whitefish	1
Effort (hrs):	unknwn

Appendix Table B-8. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2005.

FYKE NETS

	K0501			KLK01						KLK02		
	Jun 18		Jun 22	Jun 20		Jun 21		Jun 23		Jun 20	Jun 21	Jun 23
Species	DS	US	US	DS	US	DS	US	DS	US	US	US	US
Broad whitefish												
Humpback whitefish												
Bering cisco												
Least cisco				2	3	7	3	4	6			
Round whitefish				1	2	1	3	1				
Arctic grayling	4	531	553	1		2	1	2		7	2	23
Lake trout					1			1				
Pink salmon												
Burbot				1	2		2					
Slimy sculpin		2						1				
Ninespine stickleback		10	5	275	1	490	8	160	5			
Effort (hrs):	21.3	22.2	20.0	22.25	22.0	23.4	24.5	46.6	45.8	21.6	23.2	47.7

FYKE NETS

	KLK03	MD0501		R0501						ETL05	TL0501
	Jun 22	Aug 22		Jun 19		Jun 20		Jun 21		Jun 24	Jun 24
Species	US	DS	US	DS	US	DS	US	DS	US	lake set	lake set
Broad whitefish	1	17	20								61
Humpback whitefish		8	6								
Bering cisco											
Least cisco		332	104							8	48
Round whitefish											
Arctic grayling	127		4				1		2	1	196
Lake trout											
Pink salmon		1									
Burbot											
Slimy sculpin											
Ninespine stickleback	281	1	19							255	750
Effort (hrs):	22.1	23.3	23.5	21.2	22.2	23.7	23.7	24.8	25.0	19.3	21.9

Appendix Table B-8. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2005.

FYKE NETS

	TL0503						TL0504		
	Jul 24	Jul 25	Jul 26	Jul 27	Jul 28	Jul 29	Jul 25	Jul 26	Jul 27
Species	lake set	lake set	lake set	lake set	lake set	lake set	lake set	lake set	lake set
Broad whitefish	8	34	19	24	7	4	20	17	6
Humpback whitefish									
Bering cisco									
Least cisco	45	90	52	17	16	5	45	73	7
Round whitefish									
Arctic grayling	51	24	31	12	6	1	9	23	2
Lake trout									
Pink salmon									
Burbot									
Slimy sculpin									
Ninespine stickleback	800	250	31	9	48	9	0	29	7
Effort (hrs):	21.5	21.2	21.0	23.5	22.5	23.8	19.3	25.1	24.8

FYKE NETS

	TL0505								TL0506		TLSB1		
	Jul 26		Jul 27		Jul 28		Jul 29		Jul 28	Jul 29	Aug 26	Aug 27	Aug 29
Species	DS	US	DS	US	DS	US	DS	US	lake set	lake set	lake set	lake set	lake set
Broad whitefish	8	28	18	7	12	3	4		6	2	1	9	6
Humpback whitefish													
Bering cisco													
Least cisco	19	131	28	46	37	12	24	47	37	4	7	45	15
Round whitefish													
Arctic grayling	114	144	61	49	29	24	27	27	9	25	6	6	5
Lake trout													
Pink salmon													
Burbot				1	1						1		
Slimy sculpin													
Ninespine stickleback	0	0	12			0	0	0	9	5		3	
Effort (hrs):	23.5	24.2	24.6	23.1	23.3	23.3	23.9	24.1	22.7	23.7	18.9	28.3	47.8

Appendix Table B-8. Number of fish caught by day at each fyke net station sampled in the Teshekpuk Lake study region, 2005.

FYKE NETS

	TLSB2				TLSB3
	Aug 27		Aug 29		Aug 27
Species	DS	US	DS	US	lake set
Broad whitefish	131		121	1	3
Humpback whitefish					
Bering cisco					
Least cisco	4	2	45	2	25
Round whitefish					
Arctic grayling	6		11	10	3
Lake trout					
Pink salmon					
Burbot					
Slimy sculpin					
Ninespine stickleback					2
Effort (hrs):	22.8	22.9	46.5	46.3	30.2

Appendix Table B-9. Number of fish caught by day at each gill net station sampled in the Teshekpuk Lake study region, 2005.

GILL NETS

IKGN01	5.5 inch
Species	Jul 26
Broad whitefish	5
Humpback whitefish	2
Effort (hrs):	23.5

TG0500	Multi-mesh			
Species	Nov 8	Nov 9	Nov 10	Total
Lake trout	0	2	1	3
Effort (hrs):	23.3	24.8	19.7	67.8

TG0501	Multi-mesh			
Species	Nov 8	Nov 9	Nov 10	Total
Lake trout	0	0	0	0
Effort (hrs):	23.8	24.7	24.8	73.3

TG0502	Multi-mesh			
Species	Nov 7	Nov 8	Nov 9	Total
Lake trout			3	3
Broad whitefish		1		1
Humpback whitefish			1	1
Least cisco	29	29	12	70
Effort (hrs):	21.0	23.7	24.7	69.4

APPENDIX C

Stomach contents of fish in the Teshekpuk Lake study area, 2003-2004

Appendix Table C-1. Stomach contents of broad whitefish sampled during 2004 from habitats associated with the Miguakiak(Mayuġiaq) River.

Species:	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF	BDWF
Station:	JOE4	JOE4	JOE4	JOE4	JOE4	JOE4	JOE4	JOE5	JOE5	JOE5	JOE5	JOE5	MTRIB1	MTRIB1	MTRIB3	MTRIB3	MTRIB3	MTRIB3	MTRIB3
Date:	Jun 24	Jun 24	Jun 24	Jun 24	Jun 24	Jun 24	Jun 24	Jul 29	Jul 29	Jul 29	Jul 29	Jul 30	Jun 24	Jun 24	Jul 30	Jul 30	Jul 30	Jul 30	Jul 30
Fork Length (mm):	428	420	443	475	506	495	504	521	484	462	460	510	481	595	472	405	480	486	556
Taxa Identifiers Fish Number:	**062**	**063**	**064**	**065**	**066**	**067**	**068**	**159**	**190**	**191**	**192**	**193**	**060**	**061**	**232**	**234**	**237**	**238**	**239**
Trichoptera (caddisflies)																			
Brachycentridae (larva)					1				17			1					2		
Limnephilidae (larva)	6			3	1		1	1	1				3				3		
Coleoptera (beetles)																			
Carabidae																			
Thalassotrechus sp.																			
Haliplidae																			
Brychius sp.																			
Dytiscidae																			
Laccophilus sp.																			
Staphylinidae																			
Omaliinae (adult)																			
Other																			
Unidentified																			
Hymenoptera (ants)																			
Ichneumonidae (adult)																			
Unidentified																			
Diptera (true flies)																			
Chironomidae																			
Orthocladiinae																			
Orthocladius sp. (larva)				5	6										3	15			
Orthocladius sp. (pupa)																			
Psectrocladius sp. (larva)																			
Chironominae																			
Chironomus sp. (pupa)																			
Cryptochironomus sp. (larva)	4	27	52	41	10	7	2			3	18		8	2		22	1		1
Dicrotendipes sp. (larva)																			
Parachironomus sp. (larva)	29	36	18	9	2	16	6			5	10		13		2	20	6	16	1
Paracladopelma sp. (larva)		44																	
Dixidae																			
Unidentified																			
Simuliidae																			
Gymnopais sp. (adult)																			
Metacnephia sp. (adult)																			
Parasimulium sp. (larva)																			
Unidentified (adult)																			
Other (insects)																			
Unidentified				1						16	1						3		
Notostraca (tadpole shrimps)																			
Lepidurus lemmoni										24	1								
Copepoda (copepods)																			
Unidentified (immature)							2												
Amphipoda																			
Gammarus lacustris																			
Hydracarina (water mites)																			
Hydrachna sp.																			
Gastropoda (snails)																			
Hydrobiidae																			
Amnicola sp.	16		12	9	3	2			6		3		38				8		
Planorbidae																			
Gyraulus sp.	62	2	94	10	327	13	16	288	360	184	24	176	1		14		1		6
Unidentified																			
Pelecypoda (clams)																			
Sphaerium sp.	2	7	22			1	1			1		5	3						
Fish																			
Burbot																			
Nninespine stickleback																			
Unidentified																			
Total Number of Organisms	119	116	198	78	350	39	28	289	384	233	57	182	66	2	19	57	24	16	8
Total Number of Distinct Taxa	6	5	5	6	7	5	6	2	4	5	5	3	6	1	3	3	6	1	3

Appendix Table C-2. Stomach contents of Arctic grayling, humpback whitefish and northern pike sampled during 2004 from habitats associated with the Miguakiak (Mayuġiaq) River.

Species:	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	HBWF	PIKE
Station:	MTRIB1	MTRIB1	MTRIB1	MTRIB3	MTRIB3	SK-01	SK-01	SK-01	SK-01	MTRIB1	MTRIB1
Date:	Jun 24	Jun 24	Jun 24	Jul 30	Jul 30	Jul 30	Jul 30	Jul 30	Jul 30	Jun 24	Jun 24
Fork Length (mm):	396	363	375	382	331	342	345	366	313	384	610
Taxa Identifiers / Fish Number:	**056**	**057**	**058**	**235**	**236**	**214**	**215**	**216**	**217**	**059**	**055**
Trichoptera (caddisflies)											
Brachycentridae (larva)					1	164					
Limnephilidae (larva)		1	1			2		2			2
Coleoptera (beetles)											
Carabidae											
Thalassotrechus sp.	1	1									
Haliplidae											
Brychius sp.			1								
Dytiscidae											
Laccophilus sp.											3
Staphylinidae											
Omaliinae (adult)			1								
Other											
Unidentified											1
Hymenoptera (ants)											
Ichneumonidae (adult)	3	3	3								
Unidentified	2	3	3								
Diptera (true flies)											
Chironomidae											
Orthocladiinae											
Orthocladius sp. (larva)											
Orthocladius sp. (pupa)		1	10								
Psectrocladius sp. (larva)			17								
Chironominae											
Chironomus sp. (pupa)		2									
Cryptochironomus sp. (larva)											
Dicrotendipes sp. (larva)			61								
Parachironomus sp. (larva)	7	13	92				1	2	6	6	
Paracladopelma sp. (larva)											
Dixidae											
Unidentified			3								
Simuliidae											
Gymnopais sp. (adult)			2								
Metacnephia sp. (adult)	1		1								
Parasimulium sp. (larva)		1	45								
Unidentified (adult)			2								
Other (insects)											
Unidentified	7		11		1		1		1		
Notostraca (tadpole shrimps)											
Lepidurus lemmoni											
Copepoda (copepods)											
Unidentified (immature)	7	3	2		1		1				
Amphipoda											
Gammarus lacustris	27	32			3						
Hydracarina (water mites)											
Hydrachna sp.			3								
Gastropoda (snails)											
Hydrobiidae											
Amnicola sp.	2	4	2								
Planorbidae											
Gyraulus sp.										29	
Unidentified			2								
Pelecypoda (clams)											
Sphaerium sp.											
Fish											
Burbot											5
Nninespine stickleback				1			1	13			
Unidentified				15			5	6	2		
Total Number of Organisms	57	64	262	16	6	166	9	23	9	35	11
Total Number of Distinct Taxa	7	10	15	1	3	2	3	3	2	2	3

APPENDIX D

Data on tagged fish in the Teshekpuk Lake study area, 2003-2005

Appendix Table D-1. Tagged fish recaptured during 2003-2005 Teshekpuk Lake study.

Species	Tag No.	Release Station	Release Date	Release Length	Recap Station	Recap Date	Recap Length	Days at Large
Broad whitefish	NSB-1107	JOE4	7/28/2004	475	SAVIK	8/1/2004		4
	NSB-1449	JOE4	8/29/2004	443	JOE3	8/30/2004	445	1
	NSB-0036	MTRIB1	6/26/2003	472	MTRIB1	6/27/2003		1
	NSB-0051	MTRIB1	6/26/2003	459	MTRIB1	6/27/2003		1
	NSB-0058	MTRIB1	6/26/2003	494	MTRIB1	6/27/2003		1
	NSB-0060	MTRIB1	6/26/2003	486	MTRIB1	6/27/2003		1
	NSB-0030	MTRIB1	6/26/2003	425	MTRIB1	6/28/2003		2
	NSB-0054	MTRIB1	6/26/2003	417	MTRIB1	6/28/2003		2
	NSB-0240	MTRIB1	6/27/2003	410	MTRIB1	6/28/2003		1
	NSB-0245	MTRIB1	6/27/2003	448	MTRIB1	6/28/2003		1
	NSB-0599	MTRIB1	6/21/2004	493	MTRIB1	6/22/2004	491	1
	NSB-0619	MTRIB1	6/21/2004	438	MTRIB1	6/22/2004	440	1
	NSB-0744	MTRIB1	6/22/2004	487	MTRIB1	6/23/2004	487	1
	NSB-0779	MTRIB1	6/22/2004	505	MTRIB1	6/23/2004	506	1
	NSB-0772	MTRIB1	6/22/2004	493	TLSB2	8/27/2005	501	431
	NSB-0675	MTRIB1	6/23/2004	415	MTRIB1	6/24/2004	415	1
	NSB-0679	MTRIB1	6/23/2004	455	MTRIB1	6/24/2004	460	1
	NSB-0190	MTRIB3	6/27/2003	398	MTRIB3	6/28/2003		1
	NSB-0460	MTRIB3	6/28/2003	439	MTRIB3	7/27/2004	449	395
	NSB-0392	MTRIB3	7/27/2003	466	MTRIB3	8/29/2004	479	399
	NSB-0995	MTRIB3	7/27/2004	447	MTRIB3	7/28/2004	447	1
	NSB-1266	MTRIB3	7/27/2004	467	MTRIB3	8/29/2004	469	33
	NSB-1012	MTRIB3	7/27/2004	482	MTRIB3	8/30/2004	485	34
	NSB-1221	MTRIB3	7/28/2004	483	MTRIB3	7/30/2004	482	2
	NSB-1296	MTRIB3	7/28/2004	406	MTRIB3	7/30/2004	406	2
	NSB-0938	MTRIB3	7/28/2004	351	MTRIB3	7/31/2004	348	3
	NSB-1188	MTRIB3	7/28/2004	359	MTRIB3	7/31/2004	358	3
	NSB-1213	MTRIB3	7/28/2004	451	MTRIB3	7/31/2004	448	3
	NSB-1358	MTRIB3	7/31/2004	342	MTRIB3	8/30/2004	350	30
	NSB-1547	MTRIB3	8/30/2004	472	MTRIB3	8/31/2004	473	1
	NSB-1782	TL0505	7/27/2005	483	TL0505	7/28/2005	484	1
	NSB-1787	TL0505	7/27/2005	460	TL0505	7/28/2005	462	1
Burbot	NSB-0915	MTRIB1	6/20/2004	770	MTRIB1	6/25/2004	770	5
	NSB-0746	MTRIB1	6/22/2004	661	MTRIB1	6/23/2004	666	1
	NSB-0817	MTRIB1	6/24/2004	730	MTRIB1	6/25/2004	724	1
	NSB-1788	TL0505	7/27/2005	595	TL0505	7/28/2005	595	1
Arctic grayling	NSB-0634	JOE3	6/21/2004	356	JOE3	6/22/2004	357	1
	NSB-1090	JOE4	7/28/2004	306	JOE3	8/31/2004	315	34
	NSB-0606	MTRIB1	6/21/2004	331	MTRIB1	6/22/2004	332	1
	NSB-0609	MTRIB1	6/21/2004	363	MTRIB1	6/22/2004	362	1
	NSB-0614	MTRIB1	6/21/2004	450	MTRIB1	6/22/2004	451	1

Appendix Table D-1. Tagged fish recaptured during 2003-2005 Teshekpuk Lake study.

Species	Tag No.	Release Station	Release Date	Release Length	Recap Station	Recap Date	Recap Length	Days at Large
Arctic grayling	NSB-0616	MTRIB1	6/21/2004	320	MTRIB1	6/22/2004	319	1
	NSB-0623	MTRIB1	6/21/2004	303	MTRIB1	6/22/2004	300	1
	NSB-0625	MTRIB1	6/21/2004	302	MTRIB1	6/22/2004	303	1
	NSB-0628	MTRIB1	6/21/2004	424	MTRIB1	6/22/2004	424	1
	NSB-0629	MTRIB1	6/21/2004	309	MTRIB1	6/22/2004	308	1
	NSB-0631	MTRIB1	6/21/2004	412	MTRIB1	6/22/2004	413	1
	NSB-0561	MTRIB1	6/21/2004	404	SAVIK	7/21/2004		30
	NSB-0570	MTRIB1	6/21/2004	315	MTRIB3	7/30/2004	331	39
	NSB-0620	MTRIB1	6/21/2004	430	TL005	7/29/2005	431	403
	NSB-0734	MTRIB1	6/22/2004	361	MTRIB1	6/23/2004	361	1
	NSB-0735	MTRIB1	6/22/2004	404	MTRIB1	6/23/2004	403	1
	NSB-0739	MTRIB1	6/22/2004	325	MTRIB1	6/23/2004	323	1
	NSB-0741	MTRIB1	6/22/2004	418	MTRIB1	6/23/2004	415	1
	NSB-0745	MTRIB1	6/22/2004	376	MTRIB1	6/23/2004	373	1
	NSB-0748	MTRIB1	6/22/2004	317	MTRIB1	6/23/2004	315	1
	NSB-0750	MTRIB1	6/22/2004	372	MTRIB1	6/23/2004	372	1
	NSB-0776	MTRIB1	6/22/2004	399	MTRIB1	6/23/2004	395	1
	NSB-0777	MTRIB1	6/22/2004	360	MTRIB1	6/23/2004	358	1
	NSB-0743	MTRIB1	6/22/2004	321	MTRIB3	8/30/2004	330	69
	NSB-0666	MTRIB1	6/23/2004	348	MTRIB1	6/24/2004	346	1
	NSB-0668	MTRIB1	6/23/2004	395	MTRIB1	6/24/2004	393	1
	NSB-0669	MTRIB1	6/23/2004	324	MTRIB1	6/24/2004	323	1
	NSB-0670	MTRIB1	6/23/2004	390	MTRIB1	6/24/2004	390	1
	NSB-0676	MTRIB1	6/23/2004	305	MTRIB1	6/24/2004	305	1
	NSB-0678	MTRIB1	6/23/2004	442	MTRIB1	6/24/2004	444	1
	NSB-0797	MTRIB1	6/23/2004	300	MTRIB1	6/24/2004	301	1
	NSB-0799	MTRIB1	6/23/2004	322	MTRIB1	6/25/2004	325	2
	NSB-0669	MTRIB1	6/24/2004	323	MTRIB1	6/25/2004	322	1
	NSB-0806	MTRIB1	6/24/2004	376	MTRIB1	6/25/2004	374	1
	NSB-0279	MTRIB3	6/28/2003	381	JOE3	6/23/2004	393	361
	NSB-0412	MTRIB3	7/28/2003	316	MTRIB3	8/29/2004	345	398
	NSB-0978	MTRIB3	7/27/2004	320	MTRIB3	8/29/2004	330	33
	NSB-1542	MTRIB3	8/30/2004	306	MTRIB3	8/31/2004	308	1
	NSB-1544	MTRIB3	8/30/2004	359	MTRIB3	8/31/2004	359	1
	NSB-1545	MTRIB3	8/30/2004	326	MTRIB3	8/31/2004	324	1
	NSB-1546	MTRIB3	8/30/2004	309	MTRIB3	8/31/2004	309	1
	NSB-1749	TL0503	7/25/2005	365	TL0503	7/26/2005	365	1
	NSB-1760	TL0505	7/26/2005	290	TL0505	7/27/2005	290	1
	NSB-1761	TL0505	7/26/2005	286	TL0505	7/27/2005	285	1
	NSB-1762	TL0505	7/26/2005	285	TL0505	7/27/2005	286	1
	NSB-1763	TL0505	7/26/2005	308	TL0505	7/27/2005	309	1
	NSB-1764	TL0505	7/26/2005	360	TL0505	7/27/2005	361	1
	NSB-1767	TL0505	7/26/2005	389	TL0505	7/27/2005	389	1
	NSB-1768	TL0505	7/26/2005	260	TL0505	7/27/2005	259	1
	NSB-1751	TL0505	7/26/2005	260	TL0505	7/28/2005	259	2
	NSB-1758	TL0505	7/26/2005	285	TL0505	7/29/2005	285	3

Appendix Table D-1. Tagged fish recaptured during 2003-2005 Teshekpuk Lake study.

Species	Tag No.	Release Station	Release Date	Release Length	Recap Station	Recap Date	Recap Length	Days at Large
Arctic grayling	NSB-1760	TL0505	7/27/2005	290	TL0505	7/28/2005	370	1
	NSB-1774	TL0505	7/27/2005	390	TL0505	7/28/2005	391	1
	NSB-1775	TL0505	7/27/2005	291	TL0505	7/28/2005	293	1
	NSB-1776	TL0505	7/27/2005	346	TL0505	7/28/2005	347	1
	NSB-1777	TL0505	7/27/2005	379	TL0505	7/28/2005	380	1
	NSB-1779	TL0505	7/27/2005	355	TL0505	7/28/2005	358	1
	NSB-1781	TL0505	7/27/2005	383	TL0505	7/28/2005	385	1
	NSB-1785	TL0505	7/27/2005	356	TL0505	7/28/2005	357	1
	NSB-1786	TL0505	7/27/2005	506	TL0505	7/28/2005	503	1
	NSB-1559	TL0505	7/28/2005	345	TL0505	7/29/2005	346	1
	NSB-1560	TL0505	7/28/2005	434	TL0505	7/29/2005	434	1
Least cisco	NSB-1704	KLK01	6/20/2005	376	KLK01	6/23/2005	375	3
	NSB-1710	KLK01	6/21/2005	386	KLK01	6/23/2005	387	2

APPENDIX E

Length frequencies of fish by day and station in the Teshekpuk Lake study area, 2003-2005

Appendix Table E-1. Lengths of Arctic char caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
MTRIB1	FN	6/20/2004	DS	532
MTRIB1	FN	6/22/2004	DS	577
MTRIB1	FN	6/22/2004	DS	466

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Direction:

DS = moving downstream
US = moving upstream

Appendix Table E-2. Lengths of Bering cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Fork Length (mm)
IKP3	TR	6/23/2003	170
IKP3	TR	6/23/2003	220
JOE3	FN	6/20/2004	285

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Direction:

DS = moving downstream
US = moving upstream

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples (DS = moving downstream, US = moving upstream)

Fork Length (mm)	2003 IKP1 Jun 23	2003 IKP1 Jun 24	2003 IKP1 Jun 25	2003 IKP2 Jun 23	2003 IKP2 Jun 24	2003 IKP2 Jun 25	2003 JOE1 Jul 22	2003 JOE1 Jul 23	2003 JOE1 Jul 24	2003 JOE1 Jul 25	2003 JOE2 Jul 23	2003 JOE2 Jul 25	2003 JOE3 Jul 26	2003 JOE3 Jul 27	2003 JOE3 Aug 24	2003 JOE3 Aug 25
0																
10																
20																
30																
40																
50	3	2		1	1											
60	14	4				1								1		
70	5	1														
80	3		1													
90	1		1													
100																1
110																1
120											1	1		1		
130													1			
140															1	
150															1	1
160							1		1						1	
170							1		1		1					
180															1	
190							1				1					
200																
210																
220							1	1								
230																
240																
250																
260																
270																
280																
290															1	1
300															1	
310																
320																
330							1		1						1	
340														2	1	
350																1
360							1		1							
370															1	
380													1		1	
390							1		1				1		2	
400							1		1				1		1	
410							2		1		1		1		1	
420															1	
430							1	1					1		1	
440							1		1						1	1
450															1	1
460							1			1	1		1		3	1
470							1		1						3	2
480							1	1							5	2
490							1							1	4	1
500														2	1	1
510																
520							1			1				1		
530													1			
540																
550																
560							1			1						
570																
580																
590																
600																
610																
620																
630																
640																
650																
Total:	26	7	2	1	1	1	18	3	9	3	5	1	8	8	34	14

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples (DS = moving downstream, US = moving upstream)

Fork Length (mm)	2004 JOE3 Jun 20	2004 JOE3 Jun 21	2004 JOE3 Jun 22	2004 JOE3 Jun 23	2004 JOE3 Jul 27	2004 JOE3 Aug 30	2004 JOE3 Aug 31	2004 JOE4 Jun 24	2004 JOE4 Jun 25	2004 JOE4 Jul 28 DS	2004 JOE4 Jul 28 US	2004 JOE4 Jul 29	2004 JOE4 Jul 30	2004 JOE4 Jul 31	2004 JOE4 Aug 29	2003 MTRIB1 Jun 26
0																
10																
20																
30											1					
40					3						4	3	2			
50					2							3		3		
60					3	2				1	7	1	2	2		
70			3	1	1	3	1				2	2		1	1	
80						7	1							1	1	
90			1			1	3						1	2		
100						2					1		1			
110					1	1				3			1			
120					1	5	4			1			1			
130					2	2	1			1	1					
140						1	2									
150						1	4						1			
160						1										
170						1	2						1			
180							1			2	2					
190																
200					2		1									
210											1					
220					1		2									
230					1						1					
240																
250							1									
260													1			
270						1					1					
280					1											
290									1							
300									1	1		1				
310									1		1					
320	1			1					2	1						
330	1								1	1					1	
340				1					2	2						
350		1	1							1	1				1	1
360		1							3	1						
370									11	3					1	
380			3						6	3	2				2	
390	1		2	1				1	10	4	1				1	1
400			2					1	11	4					2	3
410			2					1	14	3						6
420		1	1						10	4	1				2	4
430		1		1				3	7	6				1	2	
440						1			2	5					4	4
450	1								5	1	2				3	2
460									3	3				1	3	
470									3	3					3	5
480						1			2	6	1					3
490									1	1					1	5
500	1					1				4						4
510						1			3	1						
520										1						
530										2						2
540										3			1			1
550									2	1						
560									3							
570									2							
580		1							1							
590																
600								1								
610										1						
620																
630																
640																
650																
Total:	5	5	15	5	18	32	23	7	107	74	30	10	12	11	28	41

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples

Fork	2003	2003	2003	2003	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004
Fork	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1	MTRIB1
Length	Jun 27	Jun 28	Jul 26	Jul 27	Jun 20	Jun 21	Jun 21	Jun 22	Jun 22	Jun 23	Jun 23	Jun 24	Jun 24	Jun 25
(mm)						DS	US	DS	US	DS	US	DS	US	DS
0														
10														
20														
30														
40														
50														
60										1				
70					1					1				
80						1	1					1		
90														
100														
110														
120														
130														
140														
150														
160														
170				1										
180				1										
190														
200														
210														
220														
230														
240														
250														
260			1	1										
270			1											
280														
290														
300	1		1	1									1	
310			2			1								
320					1	1								
330					1			1						
340														
350						1				1				
360					1	1								
370			1			3		2		1				
380								3						
390			1		1			2		1				
400	2			2	1	2								
410	2		2		2	4	1	3		3	1	2	2	
420	2	2				2		1		1		2		
430	2	1	1	1	1	4	1	3		1		2		
440	2		1	2		3		2					1	
450		1	3		1	4					1			
460	1		5	2	2	2		4		1		2		
470	1	1	5	1		3		6		1			1	
480	1	1	1		1	3		2	1	3				1
490	1		2	1		3	1	5		1	1	1		
500			3	3	1	2		1	1	2		1	1	
510	1	1				4		3				1		
520	2			1		1		1	1	2				
530					1	2		1						
540					1			1						
550					2	1		1				1		
560	2					3	1	1						
570					1									
580	1	1						1				1	1	
590														
600														
610					1			1						
620														
630														
640														
650														
Total:	21	8	30	17	20	51	5	45	3	20	3	14	7	1

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples

Fork Length (mm)	2004 MTRIB1 Jun 25 US	2003 MTRIB2 Jun 26	2003 MTRIB2 Jun 27	2003 MTRIB2 Jun 28	2003 MTRIB3 Jun 26	2003 MTRIB3 Jun 27	2003 MTRIB3 Jun 28	2003 MTRIB3 Jul 27	2003 MTRIB3 Jul 28	2003 MTRIB3 Aug 24	2004 MTRIB3 Jul 27 DS	2004 MTRIB3 Jul 27 US	2004 MTRIB3 Jul 28 DS	2004 MTRIB3 Jul 28 US
0														
10														
20														
30														
40														
50		1						1				1		2
60		2								1		6		22
70	2							1			1			8
80	1	1					1					1		1
90	1													
100									1					
110														
120														
130												1		
140														
150														
160											1			
170														
180														
190														
200														
210														
220													1	
230														
240											1			
250														
260														
270													2	
280									1					
290														
300											2			
310											2			
320						2					7		1	
330	1										4		5	
340					1	2		1			2		7	1
350					2	1					8		7	
360						3	1				9		6	1
370					3	1					13		8	
380	2				1	4	1	1		1	8		13	2
390					1	8	2				7		7	
400					1	7	1				9		12	
410		1	1		4	10					10		10	1
420	1		1		2	7	2				6		8	1
430				1	2	4	1				8	1	6	
440					1	10	3				11		14	2
450					2	6	3				7		5	
460			1			11	6	1			9	1	3	1
470					1	6	2				8		6	
480					2	8	6				4		6	
490				1	3	2	3				6		2	
500					1	6	2				1		2	
510						2	1				1	1		
520						2	1				1		3	
530						1					1			
540						1							2	
550														
560							1							
570														
580														
590						1								
600														
610	1													
620														
630														
640														
650														
Total:	9	5	3	2	27	105	37	5	2	2	147	12	136	42

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples

Fork Length (mm)	2004 MTRIB3 Jul 29	2004 MTRIB3 Jul 30	2004 MTRIB3 Jul 31	2004 MTRIB3 Aug 29 DS	2004 MTRIB3 Aug 29 US	2004 MTRIB3 Aug 30 DS	2004 MTRIB3 Aug 30 US	2004 MTRIB3 Aug 31 DS	2004 MTRIB3 Aug 31 US	2003 NEG 02 Jul 22	2004 RAD1 Jun 22	2004 SPEC1 Jun 22	2004 SPEC2 Jun 25	2003 TL0301 Jul 25
0														
10														
20														
30														
40														
50	6													
60	52	10						1		1				3
70	5	2			1	1								5
80					2		2				1			7
90						3	1	2						
100		1				1								1
110			1						1					2
120	3	1												1
130		2				1								1
140				2		1		1						1
150														
160				1	1			3						1
170	1							4						
180														
190	1							3						
200						2		2						
210	1	1			1			6						
220	1			3		1		5						
230				1				6						1
240				3		2		12						
250				3		3		6						
260				1		2		3						
270								3						
280	1			1		2		2						
290		1				3		3				1	1	
300				1		8		4						
310			2			13		2						
320		1	1	1		11		3						
330		1	2	3		15								
340	1		4	6	1	10		1						
350		2	5	4		11		1						
360	1		3	2		6		1						
370				2		4		1						
380			5	1		4		1						
390			4	2		1								
400		2	4	2		5								
410	1		2			3								
420	1		7	1		2								
430		1	7	4		3			1					
440	1		4	6		3								
450		2	5	2										
460			4	2		6								
470			3	3		3	1	2						
480		1	3			6								
490			2			2								
500		1		1										
510			1			1								
520														
530													1	
540														
550														
560	1													
570														
580														
590														
600														
610														
620														
630														
640														
650														
Total:	77	29	69	58	6	139	4	78	2	1	1	1	2	23

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples

Fork Length (mm)	2005 KLK03 Jun 22 US	2005 TL0501 Jun 24 lake set	2005 TL0503 Jul 24 lake set	2005 TL0503 Jul 25 lake set	2005 TL0503 Jul 26 lake set	2005 TL0503 Jul 27 lake set	2005 TL0503 Jul 28 lake set	2005 TL0503 Jul 29 lake set	2005 TL0504 Jul 25 lake set	2005 TL0504 Jul 26 lake set	2005 TL0504 Jul 27 lake set	2005 TL0505 Jul 26 DS	2005 TL0505 Jul 26 US	2005 TL0505 Jul 27 DS	2005 TL0505 Jul 27 US
0															
10															
20															
30															
40															
50															
60		2						1							
70		9	1	2											
80	1	23		4	2	1		1	2			1			1
90		14		8	4	2	3		1	3		3	6	6	2
100		4	1	4	5	4	1	2	1	1	1	2	13	5	1
110		1		1	1	2			1				1		
120		1							1	1	1		2	1	
130		1			1	1				2	1				
140					1				2	1			4	1	
150				2	3	1	1		2	2					
160											1				
170							1			1					
180				4		1	1		2	2	1	1			
190										1					
200									2	2	1				
210															
220									1						
230									1						
240		1		1					2						
250													1	1	
260															
270		1							1						
280													1		
290															
300									1						
310															
320		1													1
330			2												
340			2			2									
350															
360			1												
370						2									
380				1		1				1		1			
390															
400				1		2									
410			1			1									
420		1		1											
430				2										1	
440				1		1								1	
450															
460					1	1									1
470		1		1		1									
480					1									1	1
490		1		1		1									
500														1	
510															
520															
530															
540															
550															
560															
570															
580															
590															
600															
610															
620															
630															
640															
650															
Total:	1	61	8	34	19	24	7	4	20	17	6	8	28	18	7

Appendix Table E-3. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net Samples

Fork Length (mm)	2005 TL0505 Jul 28 US	2005 TL0505 Jul 28 DS	2005 TL0505 Jul 29 DS	2005 TL0506 Jul 28 lake set	2005 TL0506 Jul 29 lake set	2005 TLSB1 Aug 26 lake set	2005 TLSB1 Aug 27 lake set	2005 TLSB1 Aug 29 lake set	2005 TLSB2 Aug 27 DS	2005 TLSB2 Aug 29 US	2005 TLSB2 Aug 29 DS	2005 TLSB3 Aug 27 lake set	2005 MD0501 Aug 22 DS	2005 MD0501 Aug 22 US
0														
10														
20														
30														
40								2			1			
50						1		2						
60							2	1			1			
70														
80												1		
90		2		1										
100	2	1	2		1		2					1		
110	1						1	1					1	
120							2				2		2	
130											1		3	1
140				1							1			1
150							1					1	3	
160													2	
170				1									1	1
180														
190													1	
200														
210														
220														
230														
240														
250					1									
260											1			
270														
280			1											
290														
300														
310		1					1				2			
320		1												
330											2			
340											1			
350									2		5			
360									5		3			
370		1	2						6		6		1	
380				1					9		7			2
390									6		4			1
400		1							13		8			
410			1						8		3			
420									13		7			2
430									14		6			2
440		2							11		5			1
450			1						9		10			1
460		1		1					17		11			1
470									10	1	10			1
480		1							10		5			1
490				1					3		7			
500									4		5			1
510									5		3			
520									1		1			
530		1									1			
540											1			
550														1
560														
570														
580														
590														
600														
610														
620														
630														
640														
650														
Total:	3	12	7	6	2	1	9	6	146	1	120	3	14	17

Appendix Table E-4. Length frequency of broad whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

	2003	2003	2004	2004	2004	2004	2004	2004	2003	2004	2005	2005
Fork	IKP3	IKP4	ETESH	IKP1	JOE4	JOE5	JOE5	MIG02	SK01	SK01	IKGN01	TG0502
Length	Jun 23	Jun 23	Aug 30	Aug 31	Jun 24	Jul 29	Jul 30	Jul 31	Jul 21	Jul 27	Jul 26	Nov 08
(mm)	TR	TR	GN	GN	GN	GN	GNS	GNS	GNS	GNS		lake set
0												
10												
20												
30												
40												
50												
60		1										
70												
80												
90												
100												
110												
120												1
130												
140												
150												
160												
170												
180												
190												
200												
210												
220												
230												
240												
250												
260												
270												
280												
290												
300												
310												
320			1									
330			1									
340												
350												
360			2									
370			1									
380	1											
390												
400												
410												
420					2							
430												
440					1							
450												
460						2						
470					1						1	
480						1					1	
490					1						1	
500				1	2							
510							1				1	
520						1						
530												
540								2				
550									1		1	
560												
570									1			
580								1	1	1		
590									1			
600		1						1				
610												
620												
630												
640												
650									1			
Total:	1	2	5	1	7	4	1	4	5	1	5	1

Appendix Table E-5. Length frequency of Alaska blackfish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fork Length (mm)	2004 MTRIB1 Jun 23	2003 MTRIB3 Jun 26	2004 RAD2 Jun 25
0			
10			
20			
30			
40			
50			
60			
70			
80			
90			
100			
110	1		
120			1
130			
140			
150			
160		1	
170			
180			
190			
200			
210			
220			
230			
240			
250			
Total:	1	1	1

Appendix Table E-6. Lengths of burbot caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
IKP1	FN	6/23/2003		640
IKP1	FN	6/23/2003		650
IKP1	FN	6/24/2003		645
IKP1	FN	6/24/2003		695
IKP1	FN	6/24/2003		720
IKP1	FN	6/25/2003		520
IKP1	FN	6/25/2003		570
IKP1	FN	6/25/2003		660
IKP1	FN	6/25/2003		700
IKP1	FN	6/25/2003		720
IKP1	FN	6/25/2003		760
IKP1	FN	6/25/2003		790
IKP2	FN	6/25/2003		77
JOE3	FN	8/31/2004	DS	310
JOE3	FN	8/31/2004		670
JOE4	FN	8/29/2004	US	589
JOE4	FN	8/29/2004	US	730
JOE4	FN	8/29/2004	DS	739
MTRIB1	FN	6/27/2003		740
MTRIB1	FN	6/27/2003		930
MTRIB1	FN	6/28/2003		655
MTRIB1	FN	6/28/2003		750
MTRIB1	FN	6/20/2004	DS	770
MTRIB1	FN	6/21/2004	DS	600
MTRIB1	FN	6/21/2004	US	762
MTRIB1	FN	6/21/2004	DS	775
MTRIB1	FN	6/21/2004	DS	790
MTRIB1	FN	6/22/2004	US	661
MTRIB1	FN	6/22/2004	DS	679
MTRIB1	FN	6/22/2004	DS	740
MTRIB1	FN	6/22/2004	DS	760
MTRIB1	FN	6/22/2004	US	765
MTRIB1	FN	6/23/2004	DS	666
MTRIB1	FN	6/23/2004	US	707
MTRIB1	FN	6/24/2004	US	152
MTRIB1	FN	6/24/2004	US	411
MTRIB1	FN	6/24/2004	US	730
MTRIB1	FN	6/25/2004	DS	157
MTRIB1	FN	6/25/2004	DS	724
MTRIB1	FN	6/25/2004	DS	763
MTRIB1	FN	6/25/2004	DS	770
MTRIB3	FN	6/27/2003		600
MTRIB3	FN	8/29/2004	DS	274
MTRIB3	FN	8/29/2004	US	565
MTRIB3	FN	8/29/2004	DS	569
MTRIB3	FN	8/29/2004	US	664
MTRIB3	FN	8/29/2004	DS	689
MTRIB3	FN	8/30/2004		80
MTRIB3	FN	8/30/2004		90
MTRIB3	FN	8/30/2004		580
MTRIB3	FN	8/30/2004		725
MTRIB3	FN	8/31/2004	DS	95
MTRIB3	FN	8/31/2004	US	95
MTRIB3	FN	8/31/2004	US	378
MIG02	GNS	7/31/2004		765

Station	Gear	Date	Direction	Fork Length (mm)
KLK01	FN	6/20/2005	US	625
KLK01	FN	6/21/2005	US	588
KLK01	FN	6/21/2005	US	653
TL0505	FN	7/27/2005	US	595
TL0505	FN	7/28/2005	DS	595
TLSB1	FN	8/26/2005		378
TLSB1	FN	8/29/2005		724
DANLE	HL	11/12/2005		917
DANLE	HL	11/12/2005		854
DANLE	HL	11/12/2005		635

Gear:
- FN = fyke net
- GN = multimesh gill net
- GNS = large mesh subsistence gill net
- HL = hook and line
- TR = trammel net

Direction:
- DS = moving downstream
- US = moving upstream

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

	Gill Nets		**Fyke Nets**												
	2004	2004	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2004	2004
Fork	MTRIB1	MTRIB3	IKP1	IKP1	IKP2	JOE1	JOE1	JOE1	JOE2	JOE3	JOE3	JOE3	JOE3	JOE3	JOE3
Length (mm)	Jun 24	Jul 30	Jun 23	Jun 24	Jun 23	Jul 22	Jul 23	Jul 25	Jul 23	Jul 26	Jul 27	Aug 24	Aug 25	Jun 20	Jun 21
0															
10															
20															
30															
40															
50															
60						1		1	1						
70									1						
80						1								1	1
90			3	1				1					1		
100			5	1											4
110			1												3
120			1												1
130						1									1
140															1
150															2
160			1			1									1
170															
180						1							1		1
190															1
200						2									
210													1		
220					1								1		
230															
240															1
250															
260												1	2		1
270											1	1	5	1	
280										1		1	2	1	
290			1									1	4	1	1
300													4		1
310													3	2	1
320							1					1			
330		1												2	1
340		1	3									2		2	
350			1	1										1	2
360	1													2	2
370	1		1						1					2	1
380		1	1											3	
390	1				1										1
400															1
410															
420														1	
430															
440															
450															
460															
470															
480															
490															
500															
Total:	3	3	18	3	2	7	1	2	3	1	1	7	24	19	29

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Nets																
	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2003	2003	2003	2003
Fork	JOE3	JOE3	JOE3	JOE3	JOE3	JOE4	JOE4	JOE4	JOE4	JOE4	JOE4	JOE4	MIG01	MTRIB1	MTRIB1	MTRIB1
Length	Jun 22	Jun 23	Jul 27	Aug 30	Aug 31	Jun 25	Jul 28	Jul 28	Jul 29	Jul 30	Aug 29	Aug 29	Jun 25	Jun 26	Jun 27	Jun 28
(mm)						DS	DS	US	DS	DS	DS	US				
0																
10																
20																
30									1	1						
40											1					
50				1	2											
60				2	2											
70									3	1						
80	1		3		1		1	1		1						
90									1					3		
100	1	2		3												
110			1					1						1		
120	1	2	3				2	2								
130			3					3								
140			1					5	1	1				1		
150				1				1	1					1		
160			1					2				1				
170	1															
180						1		2								
190								4		1		2				
200												1				
210		1	1					2		1				1	1	
220								1				1				
230								1			1					
240			1								1		1		1	
250													1			1
260											1					
270				1		2		1					1	1	1	1
280					1											
290					1									1	1	1
300		1						2		1				1		
310		1			3										1	
320		1				1									1	
330	1					1									1	
340		1				1								1	2	1
350	1					1										2
360	2	1						1							1	
370		2				1							2		1	
380		1				1		1								
390		1														
400		1			1	1										
410																1
420																
430																
440						1										
450																
460																
470																
480																
490																
500																
Total:	8	15	14	8	11	11	3	30	7	7	4	5	5	11	11	7

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Nets

Fork Length (mm)	2003 MTRIB1 Jul 26	2003 MTRIB1 Jul 27	2004 MTRIB1 Jun 20 DS	2004 MTRIB1 Jun 21 DS	2004 MTRIB1 Jun 21 US	2004 MTRIB1 Jun 22 DS	2004 MTRIB1 Jun 22 US	2004 MTRIB1 Jun 23 DS	2004 MTRIB1 Jun 23 US	2004 MTRIB1 Jun 24 DS	2004 MTRIB1 Jun 24 US	2004 MTRIB1 Jun 25 DS	2004 MTRIB1 Jun 25 US	2003 MTRIB2 Jun 26
0														
10														
20														
30														
40														
50														
60														2
70														
80					1									
90			1		8								1	2
100			1	3	17				5		2	1	6	1
110			1	4	15	2	1		4		3		2	
120					3				2	1	1			
130					1					1				
140					2	2			3		1			1
150					2	2		1	1					1
160			1		4	2	1	2	5	2	1			
170				1	3	2			2	1	1	1	1	
180					3			1						
190					1	1					1	1	1	
200					2	6		2	2					
210			1	1		1	1	1			1			
220								1			2	1		
230				1			1		1	1	2		1	
240				1			1							
250		1			1	1			1	1				
260	2					3								
270		4		1	1	1			2		2			1
280		1		1	1	2	1						3	
290	1			1	2	2	1		1	1	1		3	
300		1			5	7		1	2	1	1			
310	1		1	1		4	2	1			1		1	1
320		1	1	1	2	1	3	3	1	1			4	
330				2	3	2	1				1	1		1
340	1			2	1	2	1		2	1	2		1	
350			1	1		2	1	1	2		3		2	
360					4	4	2	2			1		2	
370		1		1		1	4	3	1		3	1		
380				1		1							1	
390							1	1	2	2				
400			1	1	1		1	1						
410					2	1	1	1	1					
420			1		1	1	1							
430					1									
440				1					1	1				
450					1	1								
460														
470														
480														
490														
500														
Total:	5	9	10	25	88	54	25	22	41	14	30	6	29	10

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Nets

Fork Length (mm)	2003 MTRIB2 Jun 27	2003 MTRIB2 Jun 28	2004 MTRIB2 Jun 20 DS	2003 MTRIB3 Jun 26	2003 MTRIB3 Jun 27	2003 MTRIB3 Jun 28	2003 MTRIB3 Jul 23	2003 MTRIB3 Jul 27	2003 MTRIB3 Jul 28	2003 MTRIB3 Aug 24	2004 MTRIB3 Jul 27 DS	2004 MTRIB3 Jul 27 US	2004 MTRIB3 Jul 28 DS	2004 MTRIB3 Jul 28 US
0														
10														
20		1												
30														
40														
50	3													
60	3						1							
70														2
80								1				1		
90	1		8							1		1		
100			18							2				
110			12						1					
120			6		1							1		
130		1	1						1	1		2		
140			2											1
150	2	1	3											
160	1	1	4							1			1	
170	1		2								1			
180	1					1			2					
190			2						1					
200	2		1						1					
210									1			1	1	
220			1								1			
230	1									1				
240									1		1			
250					1				6					
260									7	2				
270	1			1				1	9					
280									12	2			2	
290		1	2			1		1	10			2		
300								1	4	2			1	1
310			1					1	3	1	1		2	
320				1		3		1	2		1	1	1	
330	1	2				4			3	1	1			
340		1			1	3							1	
350						2								
360						2						1		
370									1					
380			1			1								
390						1		1						
400										1				
410		1				1								
420	1												1	
430														
440														
450						1								
460														
470														
480														
490														
500														
Total:	18	9	64	2	3	20	1	7	65	15	6	10	10	4

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fork Length (mm)	2004 MTRIB3 Jul 29 DS	2004 MTRIB3 Jul 30 DS	2004 MTRIB3 Jul 31 DS	2004 MTRIB3 Aug 29 DS	2004 MTRIB3 Aug 29 US	2004 MTRIB3 Aug 30 DS	2004 MTRIB3 Aug 30 US	2004 MTRIB3 Aug 31 DS	2004 MTRIB3 Aug 31 US	2004 RAD1 Jun 22	2004 RAD2 Jun 25	2004 SPEC1 Jun 22	2004 SPEC2 Jun 25	2003 TL0301 Jul 25
0														
10														
20														
30														
40										12	1	4		
50										9	5			
60									4					
70	1										1			
80														2
90		1									1			
100									1	1			1	
110		1								2		1		
120	1									1				
130										1			1	2
140	1													
150				1								1		
160								2						
170		1						2						
180								3						
190		1				1	1	3	1					
200			1	1	2			4						
210						2		7	1					
220				3	1	1		9						
230				1		2	1	10	1					
240		2		3	2	1		8	1					
250				1		1	1	12						
260		1		2		1	1	6						
270				1		4		2	1				1	
280				2	4	4	1	4						1
290				1		1		2						1
300		1			2	4	3	2		1				1
310				2	1	4		1						1
320				3	3	5	1	2						
330				4	3	2								
340		1		2	1	3				1				
350					4	2	1	1						
360														
370					1									
380				1										
390														
400												1	1	
410													1	
420														
430													1	
440														
450														
460														
470														
480														
490														
500														
Total:	3	9	1	28	24	38	10	80	10	28	8	7	6	8

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fork Length (mm)	2005 K0501 Jun 18 DS	2005 K0501 Jun 18 US	2005 K0501 Jun 22 US	2005 KLK01 Jun 20 DS	2005 KLK01 Jun 21 DS	2005 KLK01 Jun 21 US	2005 KLK01 Jun 23 DS	2005 KLK02 Jun 20 US	2005 KLK02 Jun 21 US	2005 KLK02 Jun 23 US	2005 KLK03 Jun 22 US	2005 R0501 Jun 20 US	2005 R0501 Jun 21 US	2005 ETL05 Jun 24 lake set	2005 TL0501 Jun 24 lake set
0															
10															
20			1												
30															
40											1				5
50		12	10								39				19
60	2	152	40	1	1	1	1			2	57				45
70	1	178	31				1			9	16				41
80		58	7							5	5				11
90		26	4					1		1	2				6
100	1	33	10					1		2	3				6
110		29	4					1		2	1				14
120		12	6												5
130		3	3								1				6
140		2	1						1						1
150		5	1												4
160		2							1	1	1				
170		5						2		1					1
180		4	2					1							2
190		3													1
200		1													
210		2													1
220															2
230															2
240															1
250															3
260		1												1	
270															1
280															
290															
300															2
310		1													
320															5
330													1		2
340															
350					1										
360													1		4
370											1				1
380												1			1
390															1
400															
410															
420															1
430															
440															2
450															
460															
470															
480															
490															
500															
Total:	4	529	120	1	2	1	2	6	2	23	127	1	2	1	196

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fork Length (mm)	2005 TL0503 Jul 24 lake set	2005 TL0503 Jul 25 lake set	2005 TL0503 Jul 26 lake set	2005 TL0503 Jul 27 lake set	2005 TL0503 Jul 28 lake set	2005 TL0503 Jul 29 lake set	2005 TL0504 Jul 25 lake set	2005 TL0504 Jul 26 lake set	2005 TL0504 Jul 27 lake set	2005 TL0505 Jul 26 DS	2005 TL0505 Jul 26 US	2005 TL0505 Jul 27 DS	2005 TL0505 Jul 27 US	2005 TL0505 Jul 28 DS	2005 TL0505 Jul 28 US
0															
10															
20															
30															
40															
50							1		1						
60	17	4	10	1	2			8		32	20	8		2	2
70	20	7	9	3	1		2	7		34	60	22	8	3	4
80	2	4	4					1		14	17	11	4	3	2
90	2	2	1		2		1	1		3	6	1	3		2
100	1	3		1			1	1		2	3		4	4	
110	1			1				1		4	2	1	1	1	2
120	2	1	2					1	1	1	6	1	1		
130	1									3	2		1	1	
140				1						2	1		2		
150	1		1	1			1			2	1		1		3
160							1			2	1		1	1	1
170							1	1		2	2		2		
180	1						1			2	4		4	1	1
190		1			1			1		1	2	1	1		1
200			1					1		1	2				1
210			1							1	2	1	1		
220													1		
230		1		1							1	1			1
240											1	1		1	
250										1		1			2
260										1	2	1	2		
270				1							1		1		
280										1	4	2			
290										1	1	1	2	2	
300											1	2			
310															
320										1					
330										1		1			
340													1	1	1
350													2	4	
360		1	1	1						1	1	2			
370												1	2	1	
380	3										1	1	1	2	
390													2	1	
400			1							1					
410															
420				1											
430															1
440															
450															
460						1									
470															
480												1			
490															
500													1	1	
Total:	51	24	31	12	6	1	9	23	2	114	144	61	49	29	24

Appendix Table E-7. Length frequency of Arctic grayling caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fork Length (mm)	2005 TL0505 Jul 29 DS	2005 TL0505 Jul 29 US	2005 TL0506 Jul 28 lake set	2005 TL0506 Jul 29 lake set	2005 TLSB1 Aug 26 lake set	2005 TLSB1 Aug 27 lake set	2005 TLSB1 Aug 29 lake set	2005 TLSB2 Aug 27 DS	2005 TLSB2 Aug 29 DS	2005 TLSB2 Aug 29 US	2005 TLSB3 Aug 27 lake set	2005 MD0501 Aug 22 US
0												
10												
20												
30												
40					1		1				1	
50	1		2	1								
60	5	1	4	6								
70	6	8		12			1					
80	3	7	2	4	2	1	1		1	1		
90	1	1						1		3		
100		1								1		
110			1	1								1
120		2										
130	1											
140					1					1		
150	1	1										
160												
170	1	1							1			
180	1					1						
190	1	1										
200				1			1					
210		2										1
220						1						
230												
240						1			1			
250												
260												1
270												
280	1					1			1			
290												
300										1		
310									1			
320					1							
330								1	1			
340	3						1		2	1		
350	1							2	1			
360							1		1			
370		1								1	1	
380					1		1					
390									1	1		
400						1		1				
410								1				
420		1										
430	1											
440												
450												
460												
470											1	
480												
490												
500												
Total:	27	27	9	25	6	6	7	6	11	10	3	3

Appendix Table E-8. Length frequency of humpback whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

	Gill Net				**Trammel Net**		**Fyke Net**							
Fork Length (mm)	2004 MTRIB1 Jun 24	2004 MTRIB3 Jul 30	2005 TG0502 Nov 09	2005 IKGN01 Jul 26	2003 IKP3 Jun 23	2003 IKP4 Jun 23	2003 IKP1 Jun 24	2003 IKP1 Jun 25	2003 IKP2 Jun 23	2004 JOE3 Jun 21	2004 JOE3 Jun 23	2004 JOE4 Jun 25 DS	2004 MTRIB1 Jun 20 DS	2004 MTRIB1 Jun 21 DS
0														
10														
20														
30														
40														
50						1		1						
60								1	1					
70														
80														
90														
100														
110														
120														
130														
140														
150														
160														
170														
180								1						
190														
200														
210														
220					1	1								
230														
240														
250														
260														
270														
280														
290														
300														
310														
320														
330														
340							1							1
350														
360												1		1
370													1	
380	1	1							1					2
390											1	1		
400			1	1										
410														
420				1										
430										1	1			1
440														
450														
460														
470														
480														
490														
500														
Total:	1	1	1	2	1	2	1	3	2	1	2	2	1	5

Appendix Table E-8. Length frequency of humpback whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2004 MTRIB1 Jun 22 DS	2004 MTRIB1 Jun 23 DS	2004 MTRIB1 Jun 25 DS	2003 MTRIB3 Jun 26	2003 MTRIB3 Jun 27	2003 MTRIB3 Jun 28	2004 MTRIB3 Jul 27 DS	2004 MTRIB3 Jul 27 US	2004 MTRIB3 Jul 28 DS	2004 MTRIB3 Jul 30 DS	2004 MTRIB3 Jul 31 DS	2005 MD0501 Aug 22 DS	2005 MD0501 Aug 22 US
0													
10													
20													
30													
40													
50													
60													
70													
80													
90													
100													
110													
120													
130												1	
140													
150													
160													
170													
180													
190													
200													
210													
220													
230													
240													
250													
260													
270													
280													
290													
300													1
310													
320													
330												1	
340		1											
350		1				1						2	1
360	2			1								1	2
370	2		1		2	1	1						1
380		1								1			
390		1										1	
400	2								1				
410								1					1
420													
430											1		
440								1					
450													
460													
470													
480													
490													
500													
Total:	6	4	1	1	2	2	1	2	1	1	1	6	6

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

	Trammel Net		**Fyke Net**													
Fork Length (mm)	2003 IKP3 Jun 23	2003 IKP4 Jun 23	2003 IKP1 Jun 23	2003 IKP1 Jun 24	2003 IKP1 Jun 25	2003 IKP2 Jun 23	2003 IKP2 Jun 24	2003 IKP2 Jun 25	2003 JOE1 Jul 22	2003 JOE1 Jul 23	2003 JOE1 Jul 24	2003 JOE1 Jul 25	2003 JOE2 Jul 23	2003 JOE2 Jul 24	2003 JOE2 Jul 25	2003 JOE3 Jul 26
0																
10																
20																
30																
40																
50			10	2	2											
60			14	3	1	1		1								
70			2	2	1											
80																
90			1													
100					1											
110			1	1		1			1							
120									1			1		3		
130									4	1				2		1
140					1				4	1	3	1	1	1	1	
150									15	1	3	2		11		
160									30	1	11	2	3	14	1	
170									20	6	7	4	2	30	1	2
180	1				1				11	5	4	3	9	20	2	3
190					1					3	1	1	2	5		
200			1						2	1	1	1	5	4		
210									3	2	2	1	1	4	1	
220		2			1				5	2	4	1	3	8		
230										1	1		4	7		
240										4	2			4		
250		2								2			4	3		
260	1	1					1		1	1	1			3	2	
270	2	1							4	2	1	1	2	3		1
280			2						1	2	1		1	3		
290													2			
300							1						1	3		
310				1											1	
320														1		
330																
340																
350							1									
360																
370															1	
380																
390																
400																
410																
420																
430																
440																
450																
460																
470																
480																
490																
500																
Total:	4	6	31	9	9	2	3	1	102	35	42	18	40	129	10	7

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2003 JOE3 Jul 27	2003 JOE3 Aug 24	2003 JOE3 Aug 25	2004 JOE3 Jun 20	2004 JOE3 Jun 21	2004 JOE3 Jun 22	2004 JOE3 Jun 23	2004 JOE3 Jul 27	2004 JOE3 Aug 30	2004 JOE3 Aug 31 DS	2004 JOE4 Jun 24 DS	2004 JOE4 Jun 25 DS	2004 JOE4 Jul 28 DS	2004 JOE4 Jul 28 US	2004 JOE4 Jul 29 DS	2004 JOE4 Jul 30 DS
0																
10																
20																
30																
40								3							1	1
50								2							11	3
60						1		6	1					2	15	8
70						2		11					2		15	5
80	1	2		1		3		15	1				3		15	9
90		2						13	2				6	2	5	2
100	1	2	2	1				23	1	5			2	3	5	4
110								56	1	2			8	9	3	7
120		1						56	4	5			14	12	5	7
130		1						37	1	6			14	28	2	9
140	1	2						32	1				14	21		9
150		2						27	1	1			16	22		7
160	1	1	1					24	1	5			20	36		2
170	4	6					1	13	2	3		1	14	33		9
180	2	3	3					26	2	6		2	30	34	2	10
190	1	8	1					18	2	2		4	26	40		7
200	6	6						8	2	5		3	6	43		5
210		5	1	1		1	2	10	6	7		1	11	41		4
220	3	2		1	1		1	8	3	2		5	6	29		2
230	6	3		2	2		2	2	2	2		5		5		3
240	4	1		3	3	1	1	1				2	2	5		1
250	1	2		5	3	2	1	1				2	2	3		
260	1	2	3	6	4	1	2			1		8		2		
270	2		1	9	2	1	3					7		4		
280	2	1		12	4		3		1		1	9	1			
290				14	1		5				3	9	3	1		
300		1		9	5	1	2				2	16		2		
310			1		3	1	1					5				1
320				5	2	1	2					14				1
330	1	1		1	1	1	2					11	1			
340		1		3								5				
350				1								4				
360				2							1	3				
370							1					2		1		
380																
390																
400												1				
410																
420																
430																
440																
450																
460																
470																
480																
490																
500																
Total:	37	55	13	76	31	16	29	392	34	52	7	119	200	378	79	116

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2004 JOE4 Jul 31 DS	2004 JOE4 Aug 29 DS	2004 JOE4 Aug 29 US	2003 MIG01 Jun 25	2003 MTRIB1 Jun 26	2003 MTRIB1 Jul 26	2003 MTRIB1 Jul 27	2004 MTRIB1 Jun 20 DS	2004 MTRIB1 Jun 21 DS	2004 MTRIB1 Jun 21 US	2004 MTRIB1 Jun 22 DS	2004 MTRIB1 Jun 22 US	2004 MTRIB1 Jun 23 DS	2004 MTRIB1 Jun 23 US	2004 MTRIB1 Jun 24 DS
0															
10															
20															
30															
40															
50	1														
60	4	1							1		1		2		
70	11												2		
80	4					1									
90	3	1				1									
100	1														
110	3	1													
120	3	1	1							1	1		1	1	1
130	1														
140			4												
150									1						
160	2									1					
170	1		2						1				1		
180	1					1	1								
190			4				1								
200	1		2				2								
210			2												
220			2	1						1			1		
230			1												
240			1						1				1		
250											3				
260									5	2	3		4	1	
270								1	4		2				
280									6		2		2		1
290			1						5				2		
300						1			4		1	1			
310					1			1	5		1		2	2	
320						1	1	1	2	2	4		1		1
330								1	2	1	1	1	1	1	1
340									1		1				1
350								1			1	1		1	
360										2	1				
370												1			
380															
390															
400															
410															1
420															
430															
440															
450															
460															
470															
480															
490															
500															
Total:	36	4	20	1	1	5	5	5	38	10	22	4	20	6	6

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2004 MTRIB1 Jun 24 US	2004 MTRIB1 Jun 25 DS	2004 MTRIB1 Jun 25 US	2003 MTRIB2 Jun 26	2003 MTRIB2 Jun 28	2004 MTRIB2 Jun 20 DS	2003 MTRIB3 Jun 26	2003 MTRIB3 Jun 27	2003 MTRIB3 Jun 28	2003 MTRIB3 Jul 23	2003 MTRIB3 Jul 27	2003 MTRIB3 Jul 28	2003 MTRIB3 Aug 24	2004 MTRIB3 Jul 27 DS
0														
10														
20														
30														
40													7	
50													35	
60											1		3	
70						1								
80														
90														
100														
110														
120					1					1			1	
130												1		1
140										1	1		2	
150										2				1
160									1	2		1		
170				1						1	1	1		1
180										2		1		2
190	1									1	2		1	2
200									1	1		1		2
210														
220														
230														
240														1
250		1	1											1
260						1					1		1	
270			1											
280							1							
290	1							1						
300		1	3					1						
310		1	2					2	1					
320	1	1	1											
330		1	2											
340			1											
350	1		2											
360														
370														
380											1			
390														
400														
410														
420														
430														
440														
450														
460														
470														
480														
490														
500														
Total:	4	5	13	1	1	2	1	4	3	11	7	5	50	11

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2004 MTRIB3 Jul 27 US	2004 MTRIB3 Jul 28 DS	2004 MTRIB3 Jul 28 US	2004 MTRIB3 Jul 29 DS	2004 MTRIB3 Jul 30 DS	2004 MTRIB3 Jul 31 DS	2004 MTRIB3 Aug 29 DS	2004 MTRIB3 Aug 29 US	2004 MTRIB3 Aug 30 DS	2004 MTRIB3 Aug 30 US	2004 MTRIB3 Aug 31 DS	2004 MTRIB3 Aug 31 US	2003 NEG 02 Jul 22	2004 RAD1 Jun 22
0														
10														
20														
30														12
40														276
50														24
60			1		1									2
70			1	3		2	1				2		1	
80			3	1			2		4				1	2
90	1			1							1		1	8
100	1								2		2			3
110				1					1			1		4
120							1	1			1	2		1
130			1	1	1	1	1	1	1					
140					2		1	4		1	3			
150			1	3	2		2		2	1	2		5	
160	1	1		1			2	1	1	1	1	2	4	
170	1	1		4			1	2	2	2	2		5	
180		1		1	2	2			1		5		1	2
190	1	4		1			4	1			7		2	1
200			1		1		6		3		3	1		
210		3		1	1	1	1		1	1	13			1
220							2	2	5		5	1		
230	1						2		2	2	2			
240							1		1		5			
250		1			1				2	1				1
260					1									
270			1											
280											1			1
290														
300										1	1			
310								1						
320														
330														
340								1				1		
350														
360														
370														
380														
390														
400														
410														
420														
430														
440														
450														
460														
470														
480														
490														
500														
Total:	6	11	9	18	12	6	27	14	28	10	56	8	20	338

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2004 RAD2 Jun 25	2004 SPEC1 Jun 22	2004 SPEC2 Jun 25	2003 TL0301 Jul 25	2005 KLK01 Jun 20 DS	2005 KLK01 Jun 20 US	2005 KLK01 Jun 21 DS	2005 KLK01 Jun 21 US	2005 KLK01 Jun 23 DS	2005 KLK01 Jun 23 US	2005 ETL05 Jun 24 lake set	2005 TL0501 Jun 24 lake set	2005 TL0503 Jul 24 lake set	2005 TL0503 Jul 25 lake set
0														
10														
20														
30														
40											1	2		1
50	1		1					1			3	6	10	36
60			1		1	1	2		3	1	1	2	11	23
70										1		11	11	11
80								1				3	8	4
90				3		2						9	1	2
100												7	1	
110				2								2	1	4
120				3										3
130				2			1							1
140				5								1		1
150		1		6								1		2
160		1		6								1	1	
170		1		3										
180				6			1			1				
190		1	2											
200		1	1	2										1
210	1	1	1	2										
220		1	1	1										
230				1										
240											1			
250				3										
260				2							1			1
270			2	1							1			
280			1											
290														
300				1										
310												1	1	
320														
330														
340												1		
350							1							
360														
370					1					2				
380							1			1				
390														
400														
410							1					1		
420														
430														
440									1					
450														
460														
470														
480														
490														
500														
Total:	2	7	10	49	2	3	7	2	4	6	8	48	45	90

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2005 TL0503 Jul 26 lake set	2005 TL0503 Jul 27 lake set	2005 TL0503 Jul 28 lake set	2005 TL0503 Jul 29 lake set	2005 TL0504 Jul 25 lake set	2005 TL0504 Jul 26 lake set	2005 TL0504 Jul 27 lake set	2005 TL0505 Jul 26 DS	2005 TL0505 Jul 26 US	2005 TL0505 Jul 27 DS	2005 TL0505 Jul 27 US	2005 TL0505 Jul 28 DS	2005 TL0505 Jul 28 US	2005 TL0505 Jul 29 DS
0														
10														
20														
30														
40						2						1		
50	4	1	1	1		14	1							
60	11	1	11	3		6		1	1					
70	8		1		6	4		3	1					
80	6	1			6	5	1	2	6	2				1
90	3				1	2		1	5	2		1		1
100	4				1				12	2		2	1	2
110	1	1		1	1	1		2	11	2		3	1	2
120	2	2			5	1		3	15	5		2		1
130		1			3	1		1	13	1	1	5		1
140					4	7		2	13	3	2	2	1	2
150	1	2			1	3		1	3		2	2	2	1
160	1	2			1	4			8	3	5	2		
170	2	2			4	5			9		3			2
180			1		1	3			4	1	2		1	1
190	1		2		1	4	1	1	6	2	5	2		
200	4	1			3	5			7		9	1		
210	1				3	1			11	1	3	1	1	
220	1	1			1	1		1			5		3	2
230	1				1	1		1	2		3	2	1	1
240		1			1	1	3		1	1	1	2		
250					1				2		1			1
260							1				1			
270	1	1				2				2		3	1	2
280												2		
290												1		1
300											1	1		1
310									1		1			1
320											1	2		
330														1
340														
350										1				
360														
370														
380														
390														
400														
410														
420														
430														
440														
450														
460														
470														
480														
490														
500														
Total:	52	17	16	5	45	73	7	19	131	28	46	37	12	24

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Fyke Net

Fork Length (mm)	2005 TL0505 Jul 29 US	2005 TL0506 Jul 28 lake set	2005 TL0506 Jul 29 lake set	2005 TLSB1 Aug 26 lake set	2005 TLSB1 Aug 27 lake set	2005 TLSB1 Aug 29 lake set	2005 TLSB2 Aug 27 DS	2005 TLSB2 Aug 27 US	2005 TLSB2 Aug 29 DS	2005 TLSB2 Aug 29 US	2005 TLSB3 Aug 27 lake set	2005 MD0501 Aug 22 DS	2005 MD0501 Aug 22 US
0													
10													
20													
30													
40						1							
50		10	1			1						1	
60		18											
70		6			1						1		
80											3	2	1
90				1	2						1	1	1
100						1	1		1			3	1
110						1			1	1	1	13	6
120	1	1			1				2	1		5	11
130	1				5				2		1	3	2
140				1	6	2			1		4	1	4
150	2				4				2		4	3	1
160	3				5	1			2		2	6	4
170	4	1	2	2	8						2	5	2
180	5				5	1		1			1	3	2
190	9	1			4	1			2		2	5	1
200	7			1	1				4				
210	1		1	1	1						3		
220	5								1			4	2
230	3				1				2			3	1
240	4			1	1				1			10	7
250	1							1	1			20	3
260									3			24	1
270									1			18	9
280									5			17	1
290	1								4			33	5
300							3		2			33	1
310												11	3
320									1			8	
330													
340									2			1	
350													
360													
370													
380													
390													
400													
410													
420													
430													
440													
450													
460													
470													
480													
490													
500													
Total:	47	37	4	7	45	9	4	2	40	2	25	233	69

Appendix Table E-9. Length frequency of least cisco caught in fish sampling at Teshekpuk Lake, 2003-2005.

Gill Net

Fork Length (mm)	2005 TG0502 Nov 07 lake set	2005 TG0502 Nov 08 lake set	2005 TG0502 Nov 09 lake set
0			
10			
20			
30			
40			
50			
60			
70			
80			
90			
100			
110			
120	1	1	1
130		1	1
140	4	3	
150	15	9	2
160	1	5	4
170	2	3	3
180	2	2	
190	1		
200	1	1	1
210		1	
220			
230			
240			
250			
260			
270			
280			
290			
300			
310			
320			
330			
340			
350			
360			
370			
380			
390			
400			
410			
420			
430			
440			
450			
460			
470			
480			
490			
500			
Total:	27	26	12

Appendix Table E-10. Lengths of lake trout caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
KLK01	FN	6/20/2005	US	685
KLK01	FN	6/23/2005	DS	600
TL0507	GN	7/28/2005		755
TL0507	GN	7/28/2005		775
TL0507	GN	7/28/2005		820
TL0507	GN	7/29/2005		780
TG0500	GN	11/9/2005		860
TG0500	GN	11/9/2005		926
TG0500	GN	11/10/2005		750
TG0502	GN	11/9/2005		698
TG0502	GN	11/9/2005		628
TG0502	GN	11/9/2005		812

Gear:

FN = fyke net
GN = multimesh gill net

Appendix Table E-11. Lengths of northern pike caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
JOE5	GN	7/29/2004		495
MTRIB1	GN	6/24/2004		610
MTRIB1	FN	6/21/2004	DS	453
MTRIB1	FN	6/21/2004	DS	624
MTRIB1	FN	6/22/2004	US	624
MTRIB1	FN	6/23/2004	DS	510
MTRIB1	FN	6/23/2004	DS	620
MTRIB3	FN	6/27/2003		531
MTRIB3	FN	6/27/2003		612
MTRIB3	FN	6/28/2003		650
MTRIB3	FN	7/27/2004	DS	662

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Direction:

DS = moving downstream
US = moving upstream

Appendix Table E-12. Lengths of pink salmon caught in fish sampling during the Teshekpuk Lake study, 2003-2005.

Station	Gear	Date	Fork Length (mm)
MIG02	GNS	7/31/2004	450
MIG02	GNS	7/31/2004	476
MIG02	GNS	7/31/2004	488
MIG02	GNS	7/31/2004	505
MIG02	GNS	7/31/2004	515
MIG02	GNS	7/31/2004	546
MD0501	FN	8/22/2005	416

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Appendix Table E-13. Lengths of round whitefish caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
KLK01	FN	6/20/2005	US	420
KLK01	FN	6/20/2005	US	407
KLK01	FN	6/20/2005	DS	443
KLK01	FN	6/21/2005	DS	482
KLK01	FN	6/21/2005	US	460
KLK01	FN	6/21/2005	US	426
KLK01	FN	6/21/2005	US	446
KLK01	FN	6/23/2005	DS	446

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Direction:

DS = moving downstream
US = moving upstream

Appendix Table E-14. Lengths of slimy sculpin caught in fish sampling at Teshekpuk Lake, 2003-2005.

Station	Gear	Date	Direction	Fork Length (mm)
IKP1	FN	6/23/2003		69
JOE3	FN	8/25/2003		110
JOE3	FN	6/20/2004		112
RAD1	FN	6/22/2004		36
RAD1	FN	6/22/2004		41
RAD1	FN	6/22/2004		50
SPEC1	FN	6/22/2004		43
SPEC1	FN	6/22/2004		61
SPEC1	FN	6/22/2004		80
K0501	FN	6/18/2005	US	108
K0501	FN	6/18/2005	US	92
KLK01	FN	6/23/2005	DS	100

Gear:

FN = fyke net
GN = multimesh gill net
GNS = large mesh subsistence gill net
TR = trammel net

Appendix Table E-15. Lengths of threespine stickleback caught in fish sampling at Teshekpuk Lake, 2003-2005.

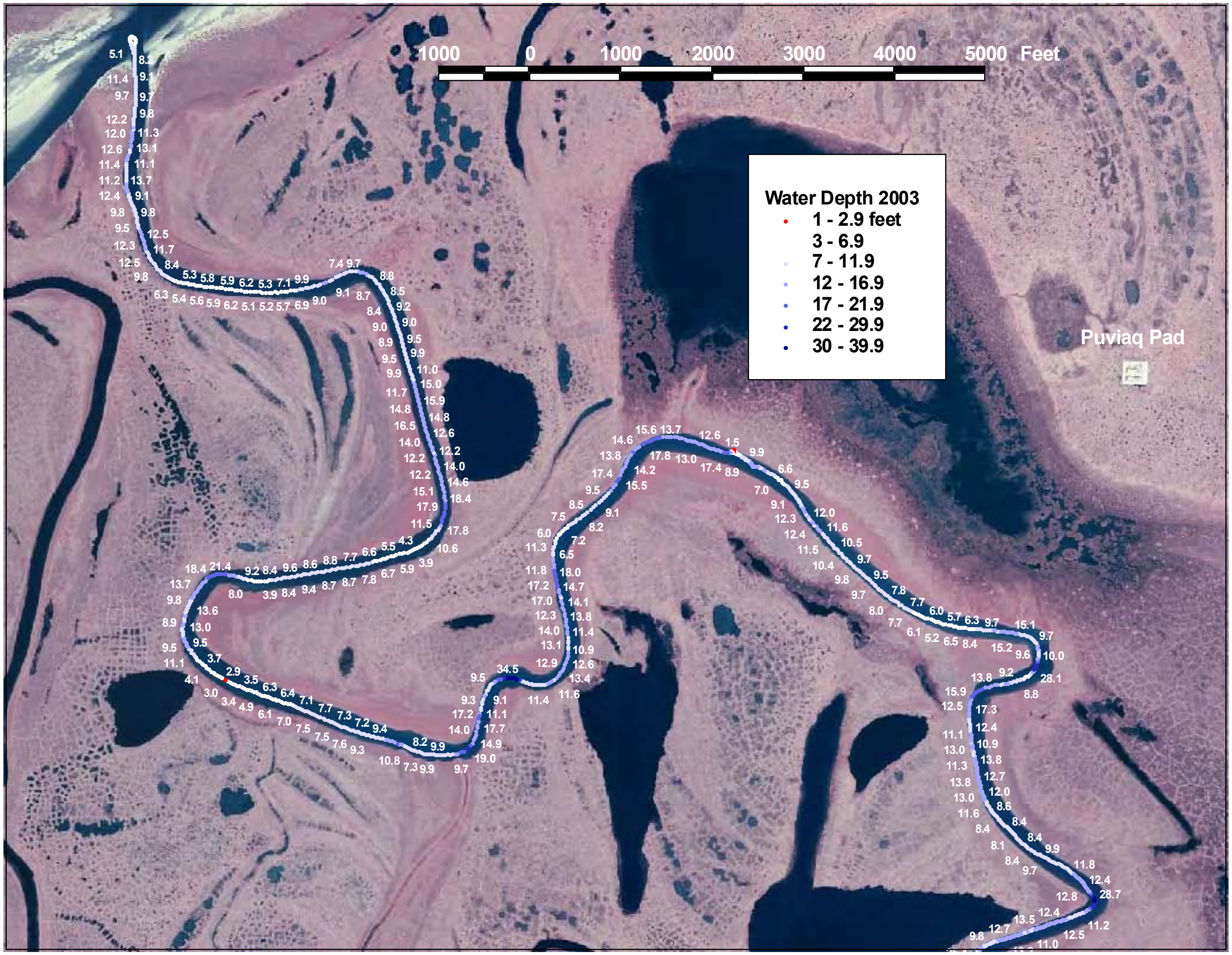
Station	Gear	Date	Direction	Fork Length (mm)
JOE3	FN	7/27/2004		81
JOE4	FN	7/29/2004	DS	74
JOE4	FN	7/29/2004	DS	89
JOE4	FN	7/30/2004	DS	78
JOE4	FN	7/30/2004	DS	79
MTRIB3	FN	7/28/2004	US	77
MTRIB3	FN	7/29/2004	DS	79
MTRIB3	FN	7/29/2004	DS	85
MTRIB3	FN	7/31/2004	DS	72
MTRIB3	FN	7/31/2004	DS	74
MTRIB3	FN	7/31/2004	DS	80

Gear:
- FN = fyke net
- GN = multimesh gill net
- GNS = large mesh subsistence gill net
- TR = trammel net

Direction:
- DS = moving downstream
- US = moving upstream

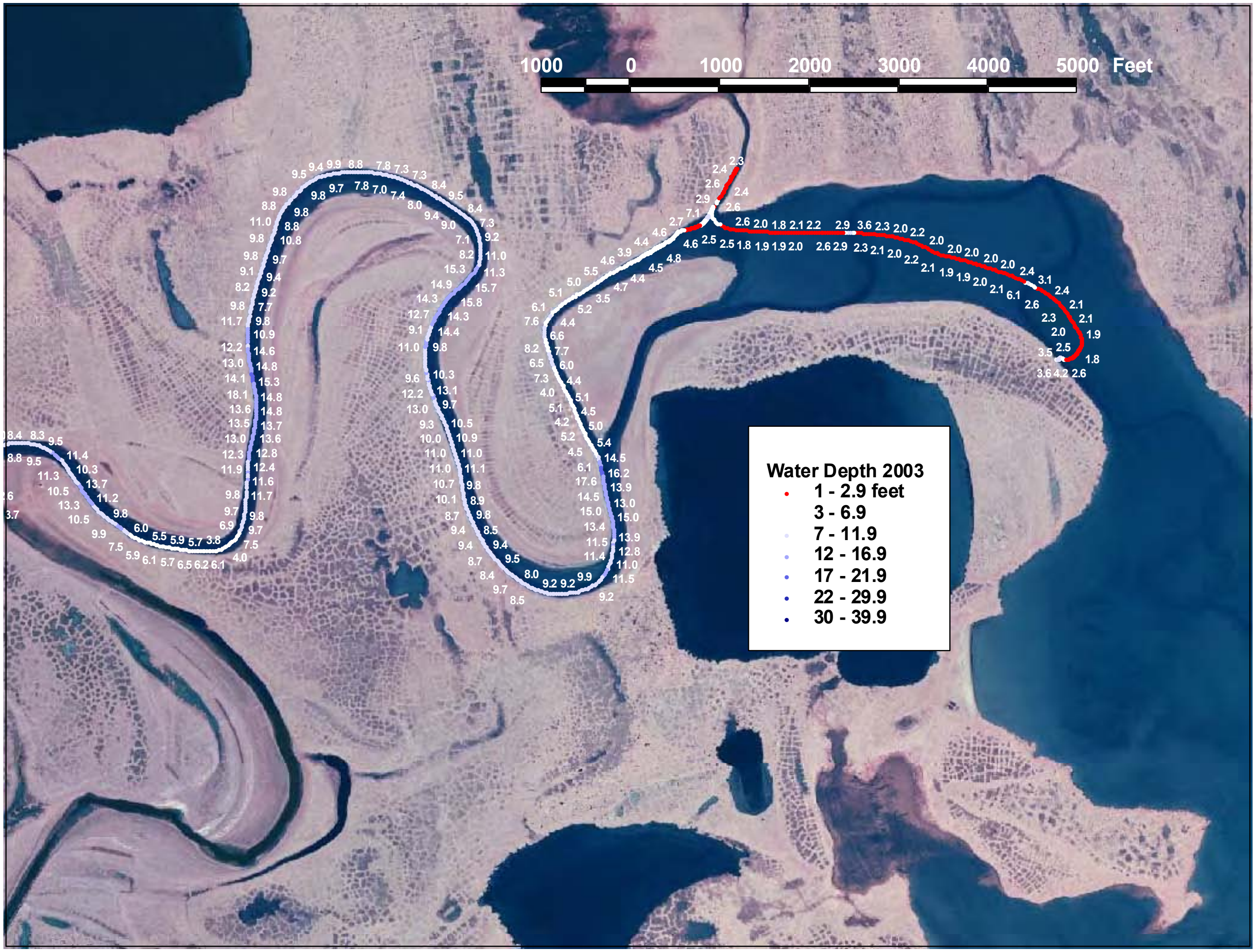
APPENDIX F

Bathymetry data from surveys in the Teshekpuk Lake study area



Appendix Figure F-1. Results of depth survey conducted June 27, 2003 in lower Miguakiak (Mayuġiaq) River.

Appendix Figure F-2. Results of depth survey conducted June 27, 2003 in mid Miguakiak (Mayuġiaq) River.



Appendix Figure F-3. Results of depth survey conducted June 27, 2003 in upper Miguakiak (Mayuġiaq) River.

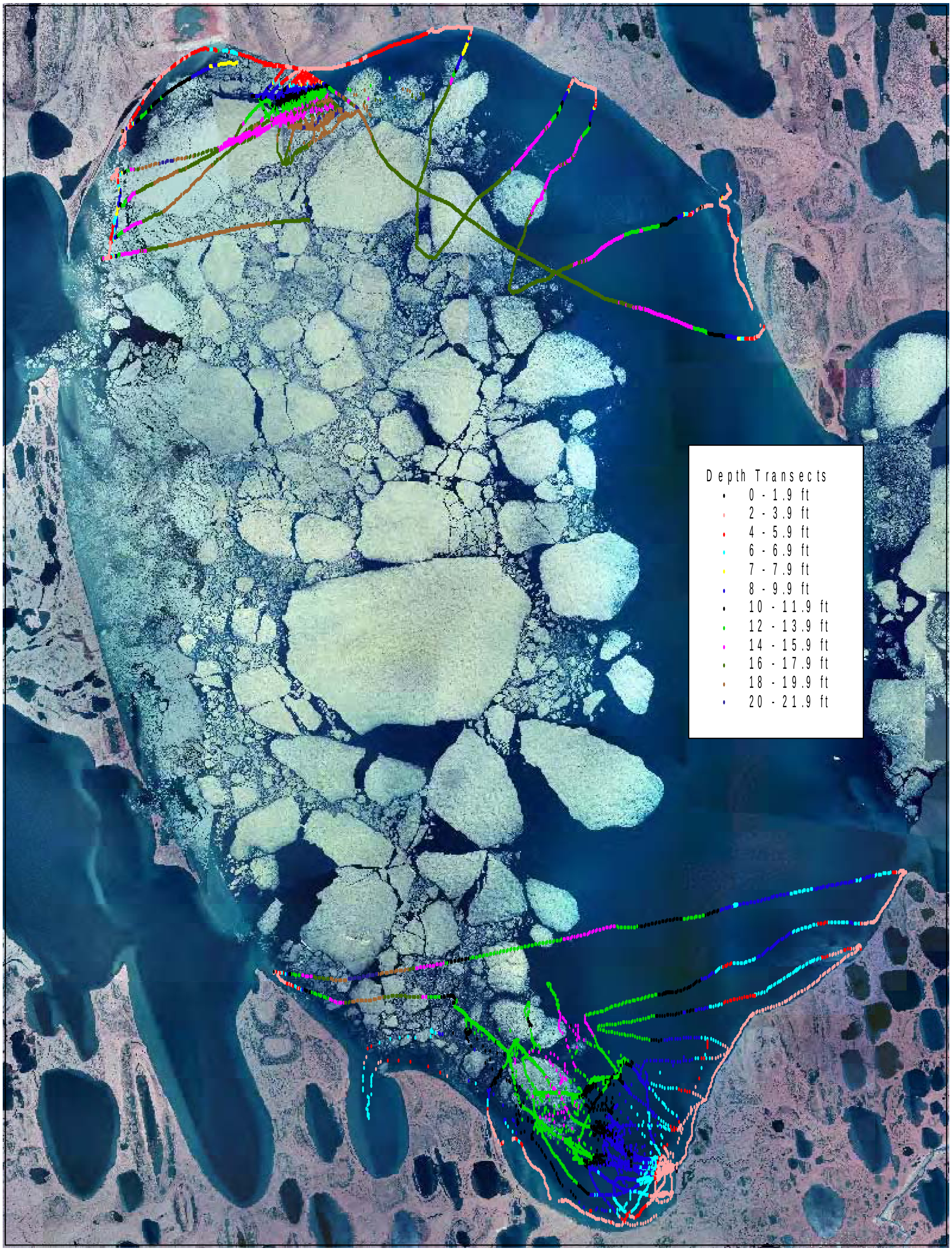


Figure F-4. Depth transects measured at Teshekpuk Lake in 2006 (southern portion of basin) and 2007 (northern portion of basin).

APPENDIX G

Invertebrate data from Ponar dredge, sweep net and zooplankton sampling in the Teshekpuk Lake study area

Appendix Table G-1. Taxa identifed from sampling with a Petite Ponar at Teshekpuk area stations during 2004.

	Nigligaak				Mayuġiaq				Iksuġvik				Shugluk	Teshekpuk
	Jun 23	Jul 28	Aug 28	Total	Jun 23	Jul 28	Aug 28	Total	Jun 24	Jul 28	Aug 28	Total	Jul 28	Jul 28
Caddis flies	7		21	28		7		7		50	7	57		7
Chironomids	421	243	293	957	71	21	28	120	228	1250	108	1586	128	14
Water mites	7		7	14						14	7	21		
Amphipods					1257	757	971	2985					7	
Copepods													7	
Tadpole Shrimp		36		36									14	
Snails			50	50					43	21	43	107	36	43
Clams			79	79	7			7						150
Water fleas										21		21		
Isopods						14	14	28						
May Flies					7			7						
Oligochaete Worms	7	14	14	35					64	21	7	92	14	36
Ostracods										7		7		
Polychaete Worms											14	14		
Springtails														
Stone Flies	7			7	7			7	14	7		21		
Number of Organisms	449	293	464	1206	1349	799	1013	3161	349	1391	186	1926	206	250
Number of Taxa	4	3	6	7	4	4	3	6	3	7	6	8	6	5

Appendix Table G-2. Taxa identifed from sampling with a sweep net at Teshekpuk area stations during 2004.

	Nigligaak				Iksuġvik				Shugluk	Teshekpuk
	Jun 23	Jul 28	Aug 28	Total	Jun 24	Jul 28	Aug 28	Total	Jul 28	Jul 28
Beetles	2			2	1			1		
Caddis flies	51	5	2	58	43	17	16	76		33
Chironomids	32	283	288	603	169	15	313	497	25	288
Clams			3	3						16
Copepod		20	8	28					8	186
Flies					1			1		
Hydroids									2	
Ostracods		29		29						
Snails	144	90	177	411	2	11	72	85	133	389
Springtails	1		2	3	1			1		
Stone flies					42	6	5	53		
Tadpole shrimp	3	1		4		1	2	3	1	
Water fleas		30	20	50					5	
Water mites	5	1		6	20	2	1	23		8
Worms			4	4			1	1	1	
Number of Organisms	238	459	504	1201	279	52	410	741	175	920
Number of Taxa	7	8	7	11	8	6	6	9	6	6

Appendix Table G-3. Taxa identifed from sampling with a zooplankton net at Teshekpuk area stations during 2004.

	Nigligaak			Mayuġiaq			Shugluk	Iksuġvik		
	Jun 23	Jul 28	Total	Jun 23	Jul 28	Total	Jul 28	Jun 24	Jul 28	Total
Arctodiaptomus oregonensis	38		38	4		4		4		4
Bosmina longirostris				48		48		31		31
Chydorus sp.	7		7	1		1		1		1
Copepod Nauplii				42		42		368		368
Cyclops sp.	6	21	27	1	15	16	11	3	1	4
Dapnia pulex				1		1		5		5
Eurycercus sp.		9	9		3	3	6			
Harpacticoid								7		7
Hydatophylax sp.					3	3				
Hydroids									1	1
Leptodiaptomus sicilis		5	5		198	198	1		61	61
Monoporeia affinis				1	18	19				
Ostracod	8		8					1		1
Valvata lewisi		1	1				1			
Worms		2	2				4			
Number of Organisms	59	38	97	98	237	335	23	420	63	483
Number of Taxa	4	4	7	7	5	10	4	8	3	10