State of Alaska
Department of Fish and Game
Sportfish Division

Nomination Form
Fish Distribution Database

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STATE OF ALASKA
FISH & GAME

Region: Arctic

USGS Quad: Harrison Bay B4, B5, A5

Fish Distribution Database Number of Waterway: 330-00-10850 ← 2008

Name of Waterway: Kalikpik River ☑ USGS Name ☐ Local Name

☑ Addition ☐ Deletion ☐ Correction ☐ Backup Information

For Office Use

Nomination #	04 101	A Hots	9/21/04
Revision Year:	2005	Fisheries Scientist	Date 9/21/04
Revision to:	Atlas ____ Catalog ____ Both ok	FDD Project Biologist	Date 7/Jan 04
Revision Code:	A-Z	Drafted	Date 11/28/04

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
Broad Whitefish	1981 (Bendock and Burr 1984)			See Below	☑
Broad Whitefish	Netsch (1977), Hablett (1980)			See Below	☑
					☐
					☐
					☐

p32

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments:

The Kalikpik River is nominated from the upper boundary of catalogged anadromy (red channel on map) to the farthest connected upstream lake with anadromous fish (Lake N77101). The general area of interest is outlined in black on the attached map. Bendock and Burr identified anadromous broad whitefish using the upstream most lake during sampling in 1981. The stream channel to be nominated appears in blue and the lake N77101 is identified on the map. Researchers have also identified Arctic grayling, least cisco, ninespine stickleback, and lake trout in the lake. Two lakes connected to the Kalikpik downstream from lake N77101 are also nominated (identified by blue polygons).

Add new streams & lakes w/ up

Name of Observer (please print): William Morris

Signature: [signature] Date: 11/28/2003

Address: 1300 College Road
Fairbanks, AK 99701

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Fish Distribution Database.

Signature of Area Biologist: [signature]

Name of Area Biologist (please print): John Burr

Revision 04/03

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
136	Ikpikpuk River	August 13	Gr, SSc, NP, LNS
137	Fossil Creek	Jun 30-Jul 2	BWF, Gr, LNS
138	Prince Creek	Jun 30-Jul 2	Gr, NSB, SSc
139	Seabee Creek	June 15	ACi, BWF, RWF, Gr, NSB, LNS, BB
140	Maybe Creek	August 10	Gr
141	Awuna River	June 21	BWF, RWF, Gr, NSB, SSc, LNS
142	Killik River	June 20	RWF, Gr, NSB, SSc, LNS, BB
143	Colville River II	July 25	Gr
144	Aupuk Creek	June 19	Gr, NSB, SSc
145	Colville River II	June 19	BWF, RWF, Lt, Gr, NSB, SSc, LNS, BB
146	Oolamnagavik Creek	June 24	Gr, NSB, SSc
147	Killik River	June 19	RWF, Lt, Gr, NSB, SSc, LNS, BB
148	Mayuasanik Creek	June 19	RWF, Gr, SSc
149	Colville River	July 18	Gr
150	Etivluk River	June 23	RWF, Gr, NSB, SSc, LNS, BB
151	Colville River II	July 19-20	Gr
152	Etivluk River	July 14	Gr
153	Unnamed Creek	August 18-19	Gr

Table 10-2. Continued

1977-STREAMS

Station Number	Name	Survey Date	Species Captured
101	Avak Creek	July 11	No Fish
102	Unnamed	July 13	No Fish
103	Walakpa River	July 12	NSB
104	Sinclair River	July 22	LCi
105	Niklavik Creek	July 14	Gr, NSB
106	Inaru River	July 15	HWF, LCi, Gr, NSB, SSc
107	Meade River delta	July ?	HWF, LCi
108	Meade River	July 15	BWF, HWF, LCi, Gr
109	Ikpikpuk River	July 31	BWF, LCi, Gr, AB
110	Inaru River	July 21	LCi, Gr
111	Alaktak River	July 23	BWF, LCi, Gr
112	Kugrua River	August 5	PS, CS, NSB, SSc, AB
113	Okpiksak River	July 20	BWF, HWF, LCi, Gr, BB
114	Teshekpuk outlet	June 12-19	BWF, HWF, LCi, Gr, NSB, BB
115	Chipp River	August 2	BWF, HWF, LCi, PS, NSB, BB
116	Topagoruk River	August 3	No Fish
117	Fish Creek	August 20	BWF, HWF, LCi, NSB, FSc, AF
118	Kuk River	July 30	LCi, Gr, NSB, FSc
119	Fish Creek	August 12	Gr, SSc

Table 10-2. Continued

311	Kungok River	July 19	CS, PS, LCi
312	Meade River	July 18	No Fish
313	Ikpikpuk River	July 10	Unidentified juveniles
314	Kasegaluk Lagoon	July 19	PS
315	Ivisaruk River	July 20	Gr
316	Chipp River	July 10	LCi
317	Tunalik River	July 23	No Fish
318	Avak inlet	July 24	PS
319	Meade River	July 19	Gr
320	Usuktuk River	July 28	No Fish
321	Topagoruk River	July 13	HWF, Gr, LCi
322	Kuk River	July 17	CS, KS, PS, Gr, FSc
323	Ketik River	July 21	PS
324	Avalik River	July 17	Gr
325	Meade River	July 18	SSc, Gr
326	Oumalik River	July 11	Gr, LCi, HWF
327	Ikpikpuk River	July 10	LCi, BWF
328	Utukok River	July 11	Gr, PS, ACi
329	Avalik River	July 26	Gr
330	Meade River	July 17	HWF, Gr
331	Kokolik River	July 18	PS, Gr
332	Utukok River	July 10	SSc
333	Oumalik River	July 12	HWF, NP, Gr, SSc
334	Ketik River	July 20	No Fish
335	Shaningarok Creek	July 26	Gr

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
336	Kokolik River	July 17	CS, PS, Gr
337	Meade River	July 15	No Fish
338	Meade River	July 15	HWF, Gr
339	Meade River	July 16	Gr
340	Titaluk River	July 12	SSc, Gr
341	Colville River	April 14 March 21	Gr, BWF, RWF, LNS Gr, BB, LNS, NSB
342	Colville River	April 13	Gr, BB, SSc
343	Colville River	April 14	No Fish
344	Kokolik River	July 17	Gr, PS
345	Utukok River	July 8	Gr
346	Kigalik River	July 25	Gr
347	Colville River	March 21	Gr, BWF, LNS, NSB
348	Kokolik River	July 16	No Fish
349	Utukok River	July 7	Gr
350	Meade River	July 16	No Fish
351	Kaksu River	July 16	Gr
352	Kigalik River	July 11	SSc, Gr
353	Kigalik River	July 25	Gr, NP
354	Nuka River	June 20	Gr
355	Colville River	June 20	Gr
356	Colville River	June 20	Gr
357	Kiligwa River	June 19	Gr
358	Kiligwa River	June 19	Gr

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
359	Utukok River	July 5	No Fish
360	Kuna River	June 18	Gr
361	Colville River	June 18	LNS, Gr
362	Colville River	June 18	Gr
363	Ipnavik River	June 21	Gr
364	Kuna River	June 17	Gr
365	Swayback Creek	June 17	Gr
366	Ipnavik River	June 21	Gr
367	Itkillik River	August 12	PS, LCi, RWF, Gr, BWF, HWF
368	Kikiakrorak River	August 11	CS, AC, PS, LCi, Gr, BWF, HWF
369	Kogosukruk River	August 14	HWF, Gr, AC, BWF, PS
370	Colville River	August 13	HWF, BWF, Gr, CS, AC, BB, RWF, LNS, LT
	1978-LAKES		
1	Ikroavik	August 4	ACi, NSB
4	Sungovoak	July 9	LCi, BWF
18	Pittalukruak	July 10 July 22	FSc, BWF, LCi Gr, LCi
25	Itinik	September 21	No Fish
45	Unnamed	July 18	LCi, LT
56	Unnamed	July 16	LCi, LT, BWF
401	Unnamed	July 19	Gr

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
402	Unnamed	July 18	LCi, HWF, BWF
403	Pittalukruak	July 14	LCi, HWF, FSc
404	Unnamed	July 20	No Fish
405	Tokrak	July 18	No Fish
406	Unnamed	July 18	No Fish
407	Unnamed	July 18	No Fish
408	Unnamed	July 18	No Fish

Stream waters in the Colville River drainage are characteristically soft. Total hardness at stream survey locations ranged from 34 ppm to 119 ppm and averaged 75 ppm. Alkalinity ranged from 17 ppm to 103 ppm ($\bar{x}$ 62 ppm), and pH varied between 7 and 8.

Preliminary information on the timing of instream migrations and spawning for several species is presented in figure 10-5. This information is based on net catches at Umiat. Data on the duration of spawning periods are incomplete at this time.

To reflect the physiographic differences in stream morphology and discharge, the mainstem of the Colville River is separated into the following four sections: (1) mouth to Itkillik River, (2) Itkillik River to Killik River, (3) Killik River to Etivluk River, and (4) Etivluk River to headwaters. Most of the survey effort during 1977 was in sections 2 and 3, and in sections 2 and 4 during 1978.

Section 1

Section 1 of the Colville River extends from Harrison Bay up to the confluence with the Itkillik River and consists of the two main channels of the delta. Fishery values for this stretch of the Colville are described by Kogl (1971) and Kogl and Schell (1975).

Section 2

Section 2 of the Colville River extends from the mouth of the Itkillik River to the confluence with the Killik River. Two major tributaries, the Anaktuvuk and Chandler Rivers, enter this section of the Colville. Section 2 of the river flows in a broad valley and is heavily braided; it rises approximately 500 ft in 250 mi (150 m in 400 km). Much of this stretch is bordered by high bluffs on the west and north banks. Potential overwintering habitat is abundant in this section of the Colville, the greatest number of deep holes (to 35 ft or 11 m) occurs along bluffs between the Itkillik and Anaktuvuk Rivers (fig. 10-6). The riverbed at several locations near the Itkillik River appears to lie at or below sea level.

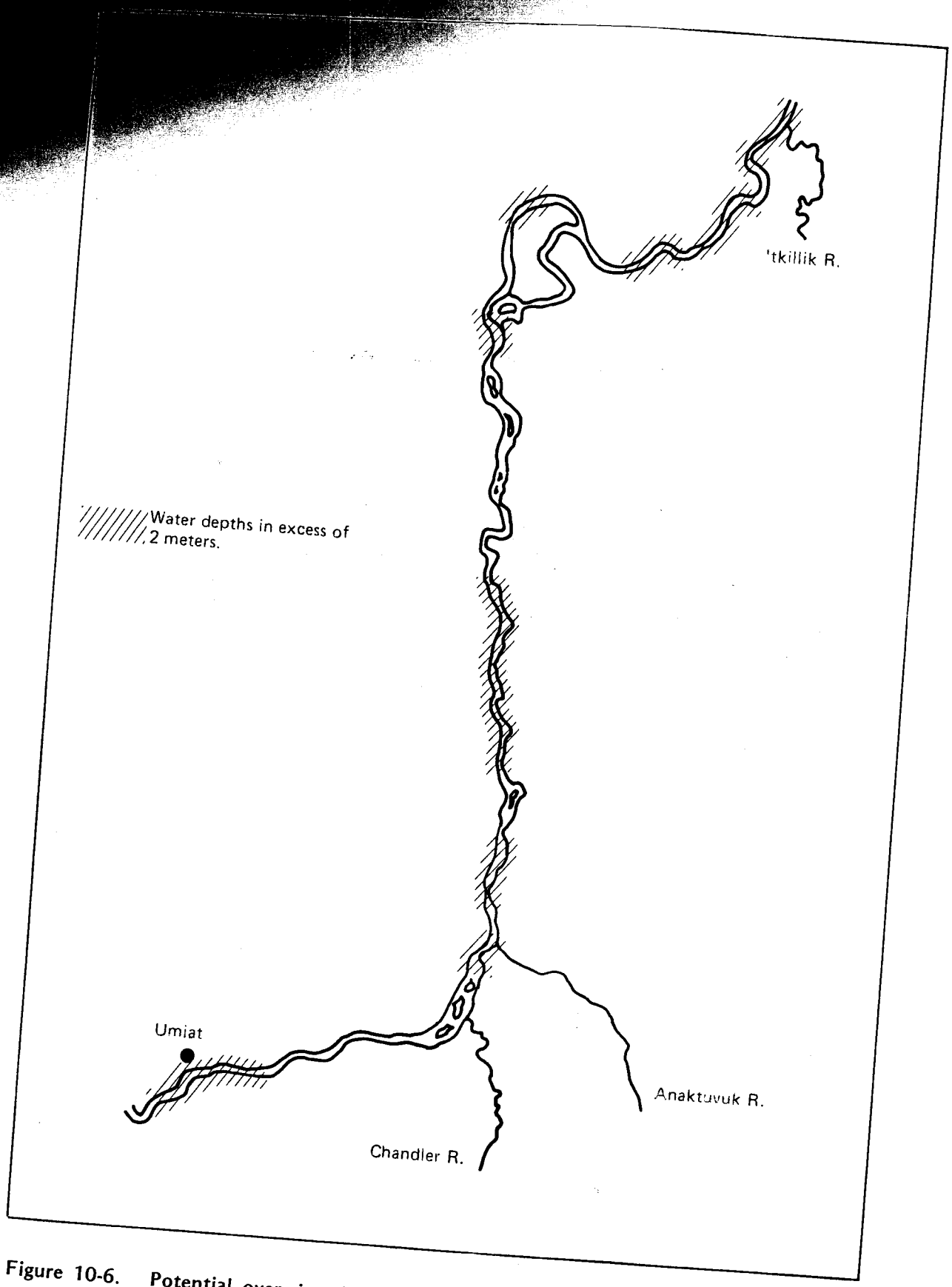

Figure 10-6. Potential overwintering fish habitat in the Colville River between Umiat and the Itkillik River (based on water depths recorded during August 1978)

remainder of Section 4 is an incised channel with few gravel bars and large angular bottom material.

There are four major tributaries that enter Section 4: the Ipnavik, Kuna, Kiligwa and Nuka Rivers. Grayling were the most abundant fish captured and were spawning in the four main tributaries, as well as in the mainstem of the Colville, between June 17 and 21, 1978. The other tributaries that appeared to be suitable summer habitat were Lost Temper, Liberator and Grayling Creeks. A limited amount of overwintering habitat is available throughout this section of the Colville River.

Colville River Winter Sampling

Under-ice netting was conducted in a 90 mi (145 km) reach of the Colville River during October 1977 and March and April of 1978 (fig. 10-7). Nets were checked once or twice daily and measurements of snow depth, ice depth, water depth, water temperature, dissolved oxygen and bottom type (when possible) were recorded at each site (table 10-3). Plastic flagging tape was suspended in the water column to detect any under-ice flow of water. All fish were measured and weighed. Sex was determined by examining gonads, and stomach contents and fullness were noted. A total of 1,476 net hours of fishing yielded a catch of 441 fish or 0.3 fish per hour (table 10-4).

During the month of October 1977, the Colville River at Umiat began freezing and had not completed freezing over its entire length by the end of the month. There was a considerable flow of water both in open areas and under the ice. Ice and snow were not deep, and there was no indication at that time that barriers created by surface ice freezing to the river bottom were present to restrict fish movements.

In March and April 1978, the entire length of the Colville River was ice covered. Snow depths at sampling locations ranged from 10 to 23 in (26-59 cm), and ice depths ranged from 3 to 5 ft (1-1.5 m). Levels of dissolved oxygen were low (1.4 ppm to 4.6 ppm), and there was no discernible flow or current under the ice. There was an abundance of under-ice habitat throughout the area surveyed.

Table 10-3. Physical characteristics of under-ice net sites in the Colville River near Umiat.

Location	Date	Snow Depth (inches)	Ice Depth (inches)	Water Depth (inches)	Water Temp. °C	Dissolved O_2 (ppm)	Bottom Type	Species Present
Umiat Bar	10/16/77	2	4	156	1	N/A	Medium Gravel	GR, RWF, BWF, BB LNS, SSc, NSB
Umiat Bar	3/21/78	23	36	120	1	1.4	Medium gravel	GR, BWF, LNS, NSB
Shivugak Bluff	3/21/78	18	39	192	1	1.6	Rubble	GR, BB, LNS, NSB
Shivugak Bluff	4/13/78	16	37	180	1	2.4	Rubble	GR. BB, SSc
Lower Shivugak Bar	4/14/78	14	42	48	1	2.8	Medium gravel	Did not set net
Uluksrak Bluff	4/14/78	10	62	112	1	2.6	Large gravel	GR, RWF
Prince Cr. Bluff	4/16/78	12	48	144	1	4.6	Large gravel	GR, BWF, RWF, LNS

The species composition of fish inhabiting the Colville River near Umiat remains the same through the year. The dominant fish species captured during the summer of 1977 (grayling, broad whitefish, round whitefish, burbot, longnose suckers, ninespine stickleback and slimy sculpin) were also taken during the three under-ice periods. Humpback whitefish, which migrate upstream past Umiat in August and September, were not taken during the winter netting. The relative abundance of grayling, as evidenced by the catch per unit effort, increased during the winter netting. This probably resulted from wintering fish moving out of summer habitats that freeze to the bottom. Ninespine stickleback and slimy sculpin were taken only as food items from burbot in spring but were observed in shallow water during October. There was a decrease in average length and weight of grayling captured between fall and spring. Mean lengths and weights were 12 in (29.5 cm) and 11 oz (316 g) in October and 11 in (27.1 cm) and 8 oz (229 g) in March. All of the principal species except broad whitefish contained food in their stomachs throughout the sampling periods. Whitefish eggs were the dominant grayling food item during October; however, mayfly and stonefly larvae predominated as grayling food items in March and April.

Burbot spawn in the main reaches of the Colville River during late winter and had completed spawning prior to March test netting. The greatest catches of burbot occurred in areas with rough (rubble or boulder) bottoms.

None of the fish appeared to segregate by species into separate over-wintering locations.

Ipnavik River

The Ipnavik River has a drainage area of 591 mi^2 (1,530 km^2) and length of 74 mi (119 km). The lower river is heavily braided and is accessible by jet boat (during high water) to the confluence of Blankenship Creek. The upper Ipnavik is an incised, single channel stream and provides good summer habitat for grayling. During the time of our survey (June 20-21, 1978), the water was high and turbid. Grayling were the only fish

and were spawning in slow moving water throughout the lower reaches.

Utukok River

The Utukok River flows in a northwesterly direction for approximately 212 mi (341 km) before entering the Arctic Ocean southwest of Icy Cape. Based on the estimated annual flow of 1,380 ft^3 (39 m^3), the Utukok is the ninth largest river on the Arctic Slope of Alaska. The fisheries survey of the Utukok River began on July 5, 1978, at the Driftwood airstrip and was completed on July 12 approximately 25 mi (40 km) from the delta.

Above the confluence of Carbon Creek, the channel of the Utukok alternates between braided stretches about 15 mi (24 km) long and incised stretches that cut through east-west-trending ridges and foothills. Below Carbon Creek, the riverbed becomes a single channel meander with numerous gravel bars and few tributaries that contribute significant amounts of water to the Utukok River. In the foothill reaches of the Utukok River, the riverbed and bars consist of large angular gravel, whereas the braided reaches, as well as the lower river bars, consist of well-sorted fine and medium gravel.

Carbon and Disappointment Creeks were discharging turbid water during the time of the survey, and the Utukok was turbid below Disappointment Creek. Values for hardness in the Utukok River and Carbon Creek were moderately low (68-85 ppm), and pH was slightly basic. Emergent and submergent aquatic vegetation was very sparse throughout the survey. Coleopterans were the only aquatic insects that appeared to be abundant and, along with aerial insects, they were major food items found in grayling stomaches.

Five species of fish were either captured or observed in the Utukok River. Low numbers of grayling were widely distributed throughout the river, and young-of-the-year fry were observed in shallow water. Slimy sculpin were captured in seine nets, and ninespine stickleback were found as food items in grayling. A single Arctic cisco prespawning adult male was captured in the lower river along with grayling and pink salmon. It is likely that some overwintering of fish takes place in the Utukok River, probably below the

distributed throughout the section surveyed and were captured in low to moderate numbers in the upper reaches. Relative abundance cannot be speculated upon in the lower river because pink salmon impaired the net's ability to take other species. Pink salmon were taken in increasing abundance from Avingak Creek down. None were yet spawning. Many young-of-the-year slimy sculpin were observed in river sections with ridges and incised channels. Additionally, one chum salmon was taken below Avingak Creek, one small Arctic char was taken at the lowest river netting, and stickleback were probably present but not captured.

Coastal Plain Stream Surveys

Coastal stream surveys were conducted at 71 locations in an area enclosed by NPR-A boundaries to the north, east, and west and the foothills to the south. Fish were taken in all of the streams surveyed.

Physical habitat and fish species compositions are very similar from river to river and are discussed here collectively to avoid repetitions. These rivers include the Kuk, Meade, and Ikpikpuk Rivers and their tributaries.

Typically, the headwaters occupy the upper one-third of these rivers. They are shallow, less than 2 ft (about 0.6 m) , narrow (50 ft or 15 m wide), and have a rock rubble substrate. The water temperature will be close to that of ambient air by mid-summer. Water color may vary from tea-colored to clear. The banks are lined with willows to 8 ft (about 2.5 m) high. These areas may provide spawning habitat for those species of fish that require a rocky substrate and moving water.

In the mid one-third of the stream, larger pools are present and the substrate largely consists of sand and small gravel. Both emergent and submergent vegetation are common. One of the common emergents is mare's tail (Hippuris tetraphylla). Members of the genus Potamogeton were common submergents. Some of the larger pools could more aptly be called "lakes" since they may be a mile or more (up to 2 km) long and 100 yards (100 m) wide. Water depths may exceed 9 ft (3 m) in pool areas. These pools eventually give way to a wide, (80 yd or about 75 m), shallow, less than 5 ft (1.5 m) river with a shifting sand bottom. The land adjacent to the

Lake Surveys

Lakes that were surveyed ranged in size from 65 to 201,600 acres (26 to 81,600 hectares). The potential for increased sport, commercial and subsistence fishing is low but may increase with improved access or increased development.

Fish surveys were conducted at 20 lakes within the Colville area. Observations were made at 16 additional sites; however, complete surveys were not attempted because water depth or lake size prevented float-plane landings. Most of the lakes not surveyed were considered unsuitable fish habitat and had neither inlets or outlets (table 10-5).

On the coastal plain, 67 lakes were surveyed in 1977 and 1978 (fig. 10-2), of which 21 contained no fish and 29 contained fish other than stickleback. These species included Arctic and least cisco, round, broad and humpback whitefish, lake trout, grayling, slimy sculpin, Alaska blackfish, northern pike, burbot, and a single occurrence of fourhorn sculpin.

Nets were used for sampling at five sites in Teshekpuk Lake on August 17, 1977. Teshekpuk Lake has extensive shoal areas around its perimeter.

Salinity was zero at all five sites. Both alkalinity and total hardness were 102 mg/L, and surface temperatures ranged from 8° to 13°C (47°-55°F). Fish captured included 60 least cisco, 48 broad whitefish, 43 grayling, 4 Arctic cisco, 2 lake trout and 1 humpback whitefish.

Other lake water within the study area is characteristically soft and has low alkalinity and neutral pH. Species diversity is low; and many lakes harbored only one or two species of fish. Old fish dominated the net catches at most of the sites. Table 10-2 shows the species composition of fish in lakes surveyed in NPR-A.

In general, the interrelationships of lake depth, substrate composition and absence or presence of inlets/outlets provide important clues to where fish can be located. Based on collection data, lakes are categorized into eight classes (table 10-6) and are portrayed on figure 10-2. Of the 88

Table 10-6. Classification of 88 lakes surveyed during 1977 and 1978 based on water depth, presence of inlets or outlets, and substrate composition.

Lake Class	Map Symbol	Characteristic*	No. of Lakes	No. w/o Fish	Species Present by Number of Lakes											
					ACi	BWF	HWF	LCi	RWF	AC	LT	GR	NSB	SSc	FSc	AB	NP	BB
1		Shallow, no outlet no spawning substrate	14	12														
2		Deep, no outlet no spawning substrate	9	6													2	
3		Shallow, no outlet with spawning substrate	2	1				1									3	
4		Deep, no outlet with spawning substrate	17	2				3			8	3	4	3	9	3		3 1
5		Shallow, with outlet no spawning substrate	4	1				1		1					1	2		
6		Deep, with outlet no spawning substrate	7	2				1		3						6		
7		Shallow, with outlet with spawning substrate	4	0				1	1	3					1	2		1
8		Deep, with outlet with spawning substrate	23	1		2	5	1	12	3	1	12	15	17	7	-	4	- 2
		TOTALS	80	26		2	12	2	27	6	1	16	21	41	10	1	4	1 2

*Shallow lakes are defined as less than 2 m deep, and deep lakes as 2 m or deeper. Spawning substrate is defined as the presence of sand, gravel or rock.

fish (fig. 10-8). Arctic flounder and rainbow smelt were infrequently captured at coastal stream sites but were not found in lakes, while Alaska blackfish were taken only at lake sites outside of the Colville drainage. Northern pike were captured at one lake and four stream sites in the Meade, Ikpikpuk and Oumalik River systems. Catch compositions of selected fisheries species for 1977-1978 are shown in figure 10-9.

The following is an account of life history data by species:

Lake Trout

Lake trout inhabit the deep, clear lakes found on the coastal plain in the vicinity of or to the south of Teshekpuk Lake, and a small number were captured in the main Colville as far upstream as the Etivluk River (fig. 10-10). No spawning habitat in coastal lakes was observed by field crews, but many fish were immature, suggesting that some lakes support breeding populations.

Total length measurements* of coastal plain lake trout ranged from about 419 to 850 mm (about 16 to 33 in) and averaged about [566 mm (about 22 in) n = 79].

Weight ranged from 548 to 6,980 g (1.2 to 15.5 lb) and averaged 1,667 g [(3.5 lb) n = 70]. Weight/length curves are shown in figure 10-11. The male to female sex ratio of mature trout was 1:3. In the few stomachs that were examined, least cisco, ninespine stickleback and other unidentified small fish were found as food items.

Colville River lake trout ranged in fork length from 355 to 875 mm (about 14 to 34 in) and averaged 558 mm [(about 22 in) n = 45]. Weight ranged from 550 to 9,000 g (about 1.2 to 20 lbs) and averaged 2,151 g (about 24.7 lbs). Ages ranged from 3 to 30+ years (fig. 10-12). The male to female sex ratio was 2.4:1. Fifty-eight percent of the sample consisted of mature fish with redeveloping gonads, 13 percent of which would spawn in the fall of 1977.

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* Measurements were made in metric units and are, therefore, reported in metric with American units secondary.

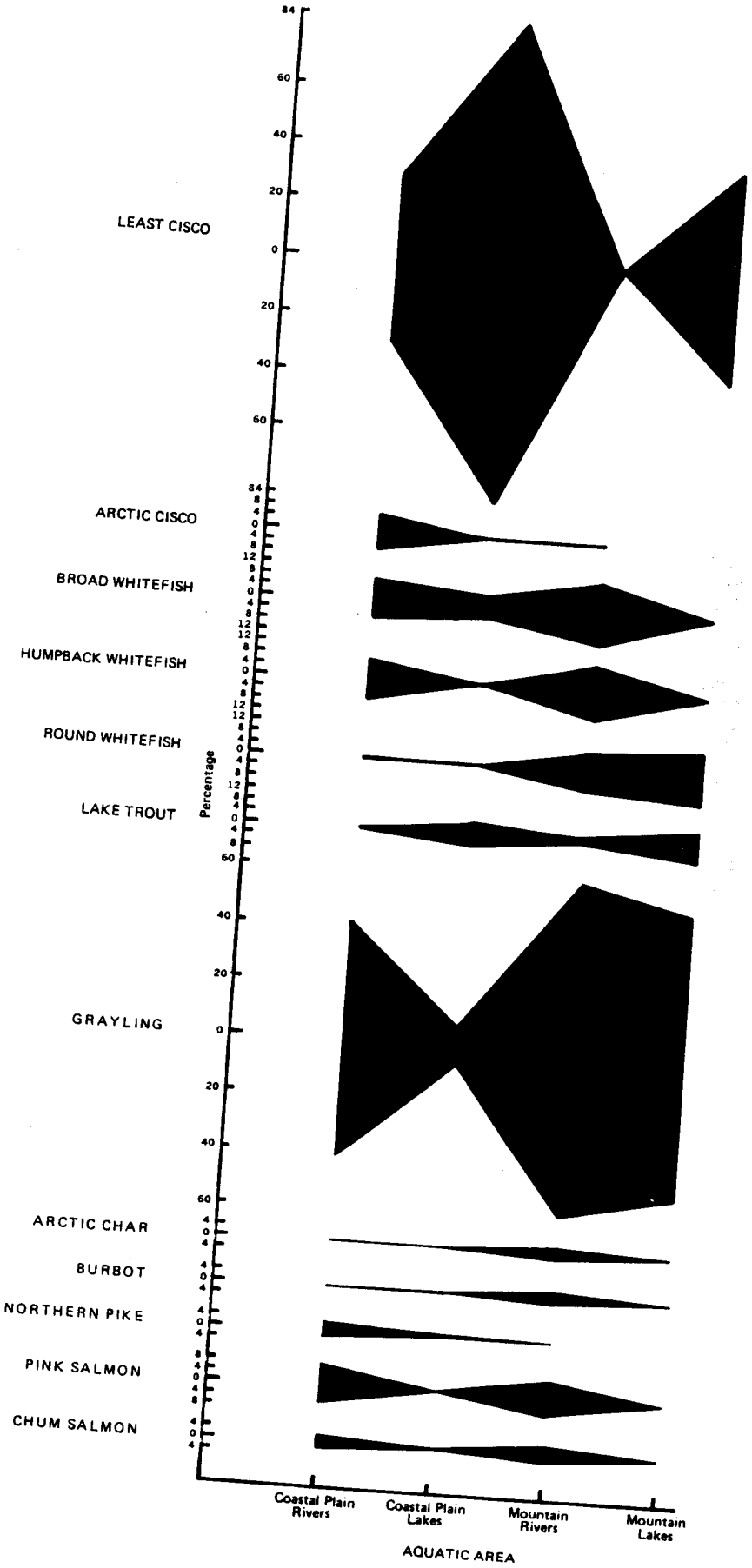

Figure 10-9. Graph showing catch compositions of selected fish species based on all individuals captured in NPR-A during the open water season, 1977-78

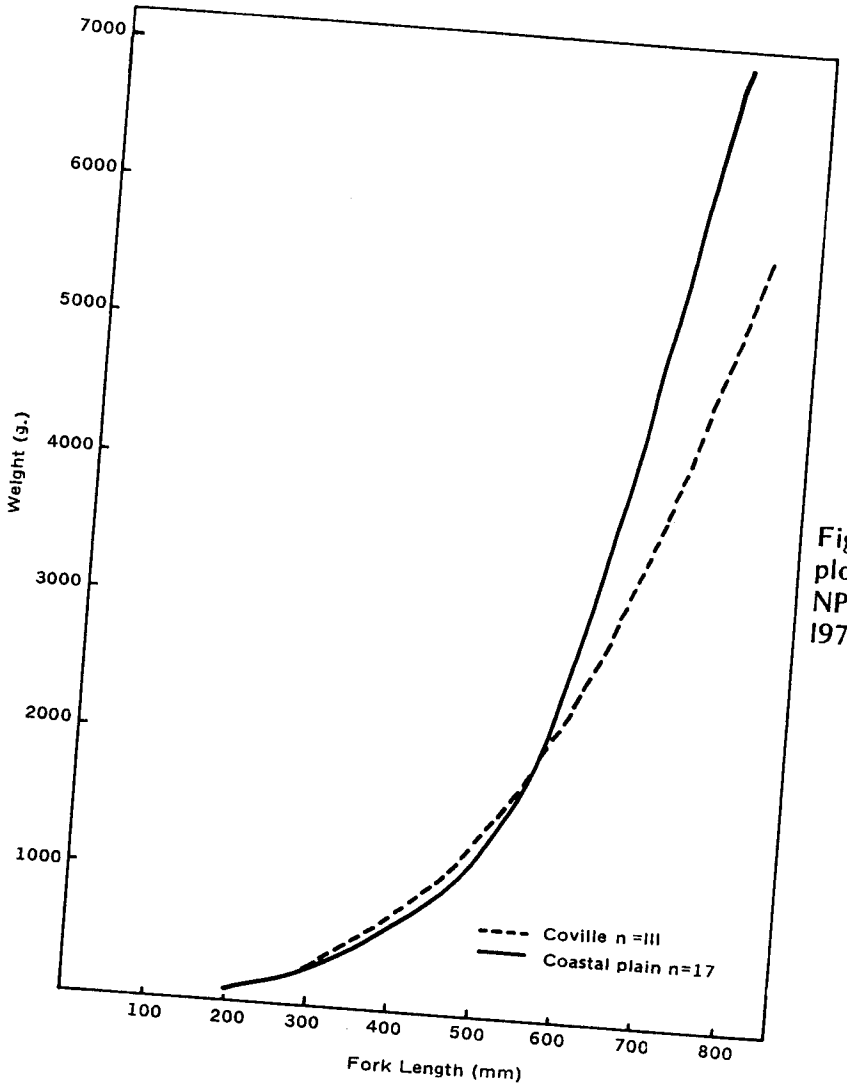

Figure 10-11. Graph showing weight-length plot for lake trout from the coastal plain of NPR-A and the Colville River drainage in 1977

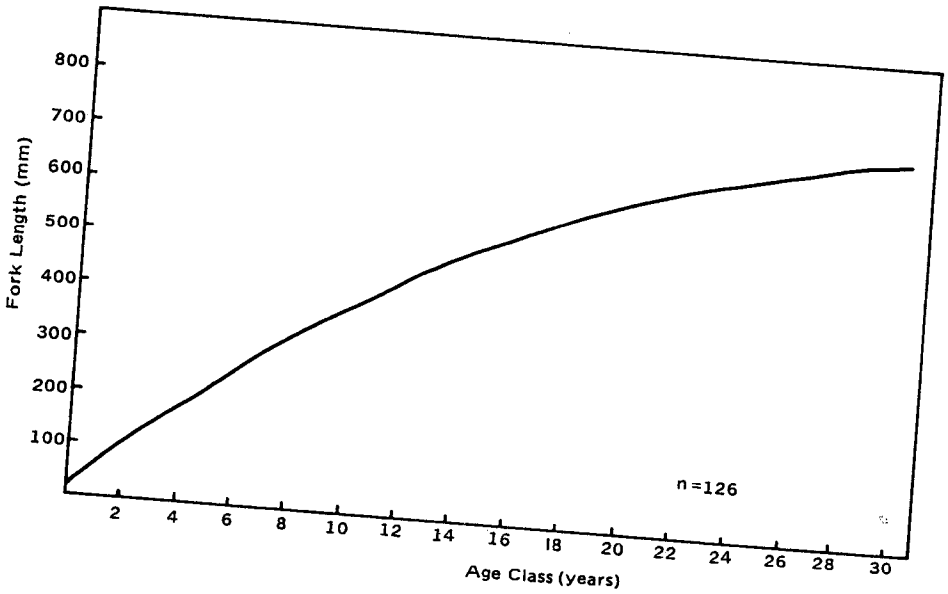

Figure 10-12. Graph showing growth of lake trout captured in the Colville River drainage, 1977

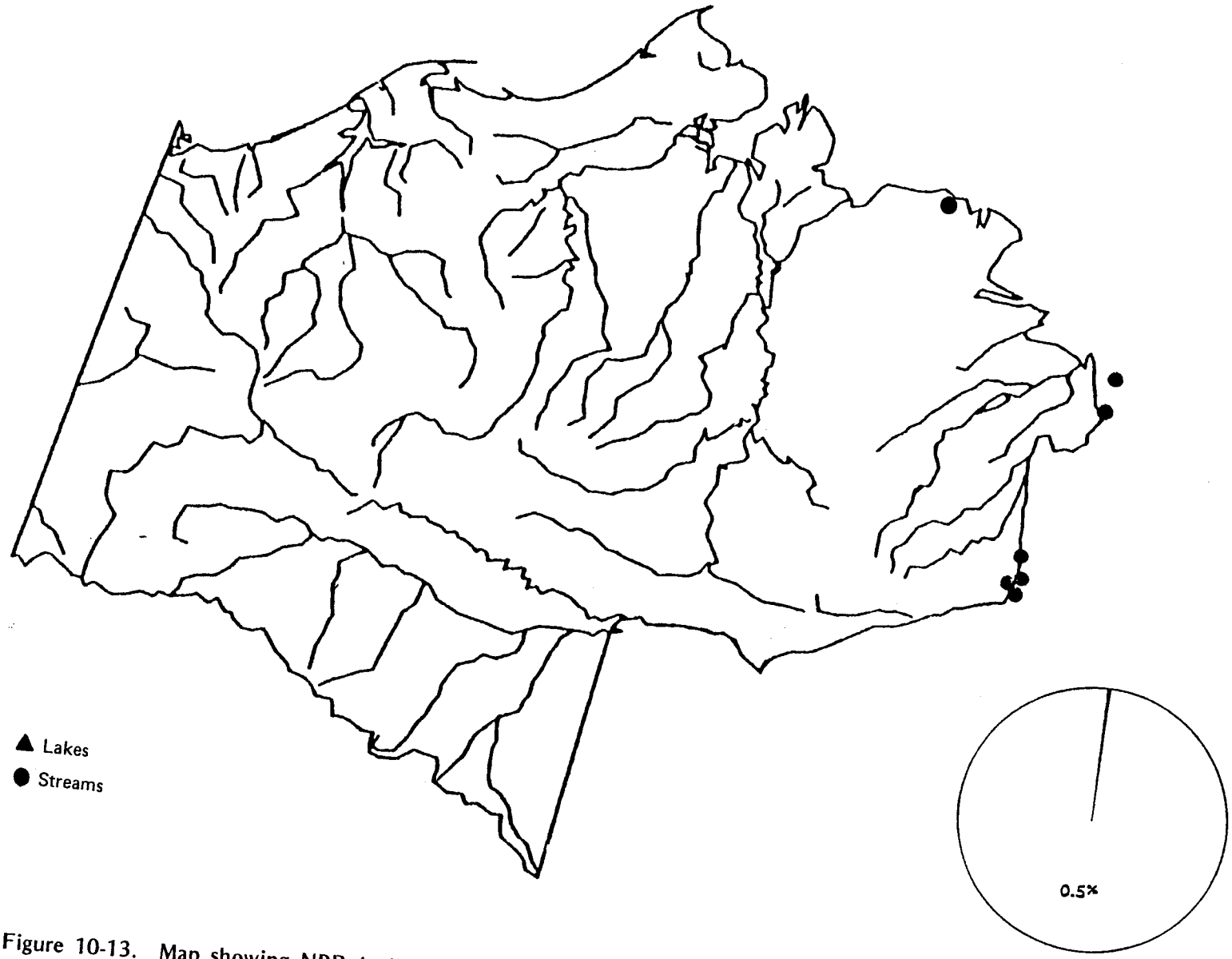

Figure 10-13. Map showing NPR-A distribution and relative abundance of Arctic char to other freshwater fishes in net catches, 1977-1978

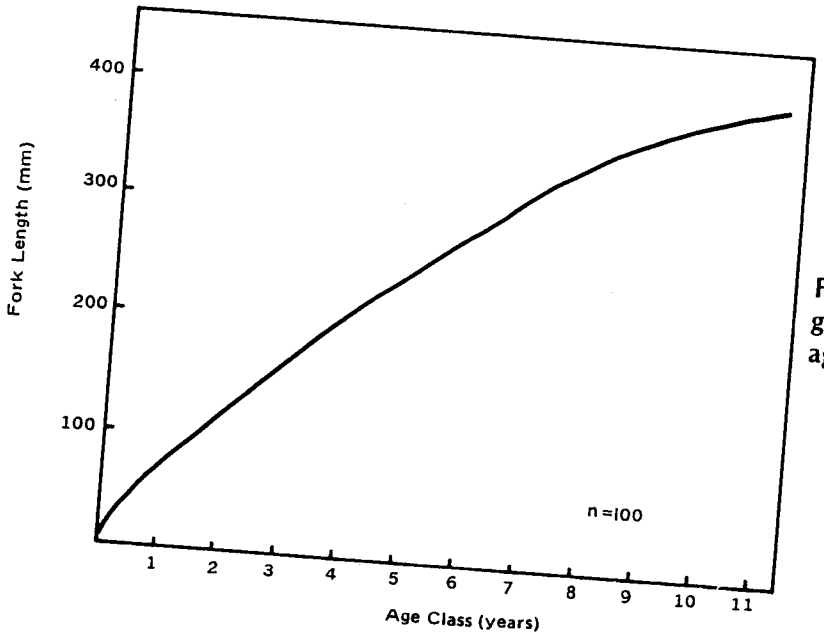

Figure 10-15. Graph showing growth of Ar grayling captured in the Colville River dra age, 1977

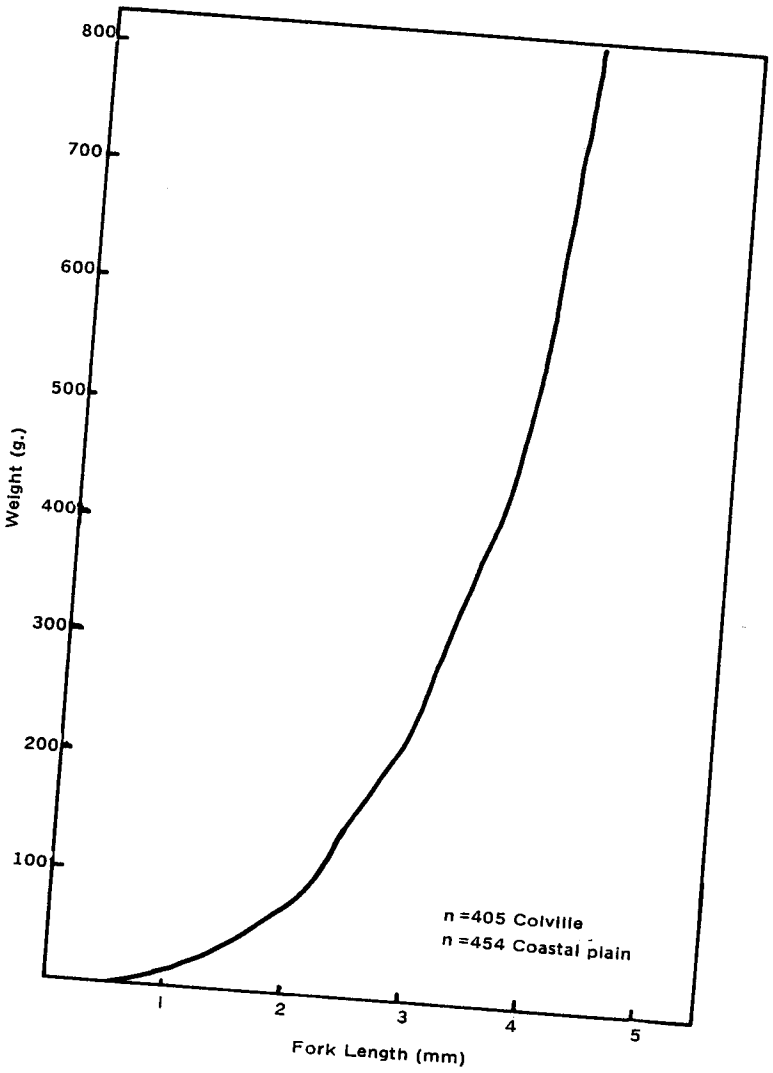

Figure 10-16. Graph showing length-weight plot for Arctic grayling from NPR-A, 1977

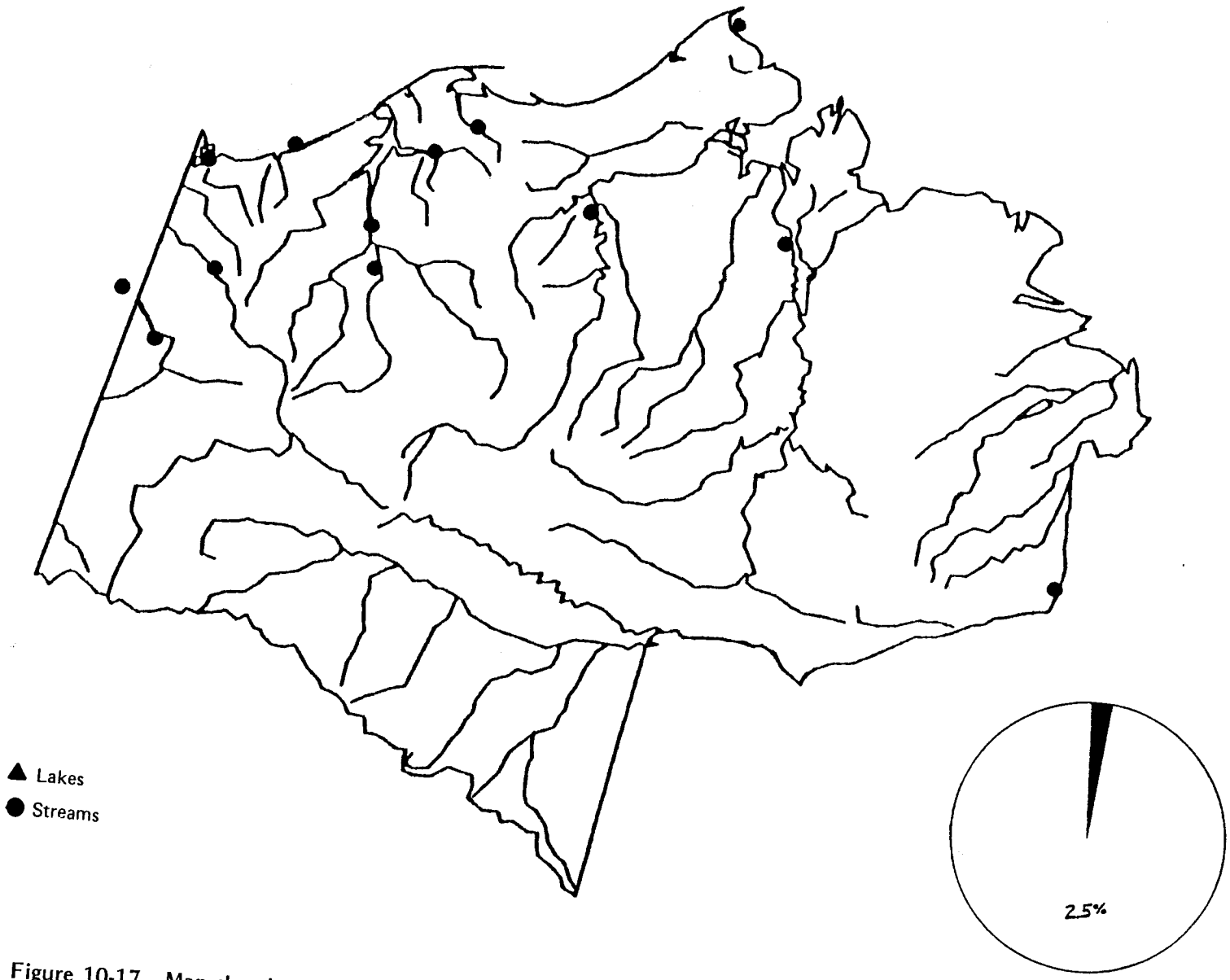

Figure 10-17. Map showing NPR-A distribution and relative abundance of pink salmon to other freshwater fishes in net catches, 1977-1978

near Teshekpuk Lake (fig. 10-19). Small numbers of broad whitefish were captured throughout the summer in the main reaches of the Colville River, and a large spawning run occurs at Umiat in mid-August. Broad whitefish spawning was observed in September 1977 upstream from Umiat. Overflow channels and oxbows that are connected to the Colville River are used extensively by young-of-the-year and immature broad whitefish.

Colville broad whitefish ranged in length from 60 to 662 mm (about 2 to 26 in) and averaged 491 mm [(about 19 in) n = 83]. Weights ranged from 0.5 to 3,800 g (about 0.1 lb to 8.5 lb) and averaged 1,682 g (about 3.8 lb). Weight/length plots are shown in figure 10-20, and Colville age data are plotted in figure 10-21. The male to female sex ratio of 72 broad whitefish was 1:1. Seventy-six percent of the broad whitefish sampled had empty stomachs; food items included snails, aerial insects, chironomid larvae and plankton.

Fifty percent of the coastal plain catch was represented by fingerlings (55-90 mm) for which weight data are incomplete. Of the remaining 50 percent, total lengths ranged from 100 to 604 mm (about 2 to 24 in), averaging 446 m [(about 17 in) n = 57]. Weights for this larger group ranged from 134 to 3,960 g (about 8.3 to 3.7 lb) with an average of 1,176 g (about 2.5 lb). Male to female sex ratio for 30 sexually mature adults was 1:1.1. Stomach contents included dipteran larvae, sand and organic detritus.

Humpback Whitefish

Humpback whitefish range throughout the lower Colville River and delta. Small numbers were captured throughout the summer in streams near the coast east of Barrow, and in Teshekpuk and Pittalukruak Lakes in August (fig. 10-22). Humpback whitefish spawning presumably takes place in the mid and lower Colville River during September and October. Thirty-eight percent of the Colville populations sampled during the run were mature prespawners.

Humpback whitefish ranged in length from 258 to 620 mm (about 10 to 24 in) and averaged 409 mm [(about 16 in) n = 58]. Weights ranged from 170 to

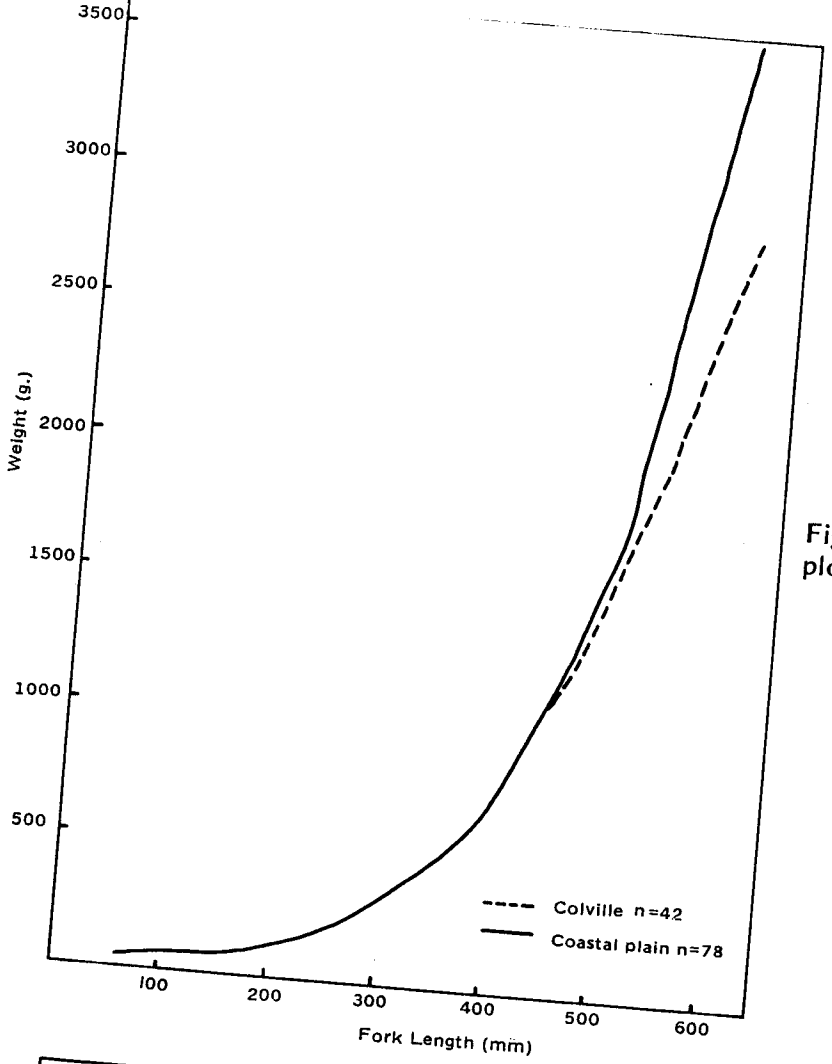

Figure 10-20. Graph showing weight-length plot for broad whitefish from NPR-A, 1977

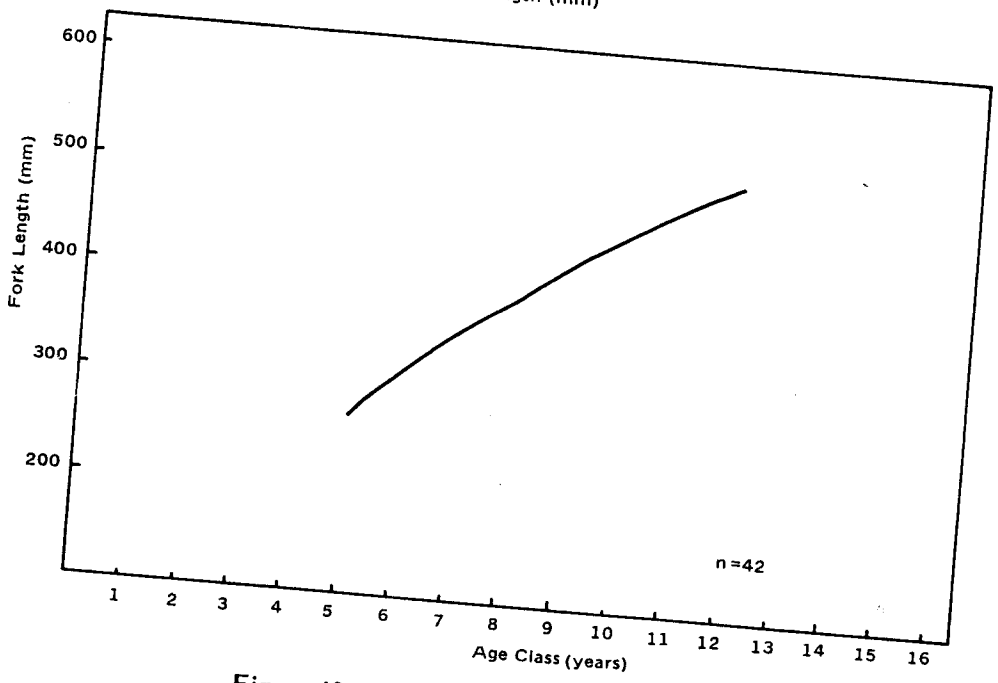

Figure 10-21. Graph showing growth of broad whitefish captured in the Colville River drainage, 1977

1,350 g (about 0.4 to 3 lbs) with an average of 770 g (about 1.6 lb). A weight/length curves is shown in figure 10-23. The male to female sex ratio of 50 fish was 0.9:1. All of the humpback whitefish had empty stomachs.

Coastal plain fish total lengths ranged from 196 to 458 mm (about 8 to 18 in) with an average of 364 mm [(about 14 in) n = 42]. Weights ranged from 59 to 1,060 g (about 0.1 to 2.3 lbs) with an average of 541 g [(about 1.2 lb) n = 39]. Age-length data for 22 specimens are presented in figure 10-24. The male to female sex ratio for 20 sexually mature fish was 1.2:1. No stomach analyses were made.

Round Whitefish

Round whitefish are common in both lakes and streams within the Colville drainage and a few lakes on the eastern coastal plain (fig. 10-25). They are an important forage species in lakes that contain lake trout. Round whitefish taken in lakes were considerably heavier at the same length than fish taken from streams.

Round whitefish from the Colville drainage ranged in length from 38 to 422 mm (about 2 to 15 in) and averaged 266 mm [(about 9 in) n = 172]. Weights ranged from 0.5 to 800 g (about 0.1 to 1.7 lb). Weight/length curve for Colville drainage fish is shown in figure 10-26. The male to female sex ratio of 112 round whitefish was 1.4:1. Thirty-one percent of the sample had empty stomachs. The following food items were taken by round whitefish: snails, bivalves, aerial insects, chironomid larvae, caddis fly larvae and phytoplankton. Age data are shown in figure 10-27.

Least Cisco

More least cisco were captured than any fishery species on NPR-A (fig. 10-8). Resident populations of ciscos inhabit lakes, and both resident and anadromous least cisco are found in the rivers (fig. 10-28). Colville least cisco ranged in length from 138 to 405 mm (about 5 to 16 in) and averaged 240 mm (about 9 in). Weights ranged from 30 to 700 g (about 0.1 to 1.5 lb) and averaged 194 g (about 0.4 lb). The male to female sex ratio of least ciso was 0.5:1. Least cisco food items included snails, aerial insects and zooplankton.

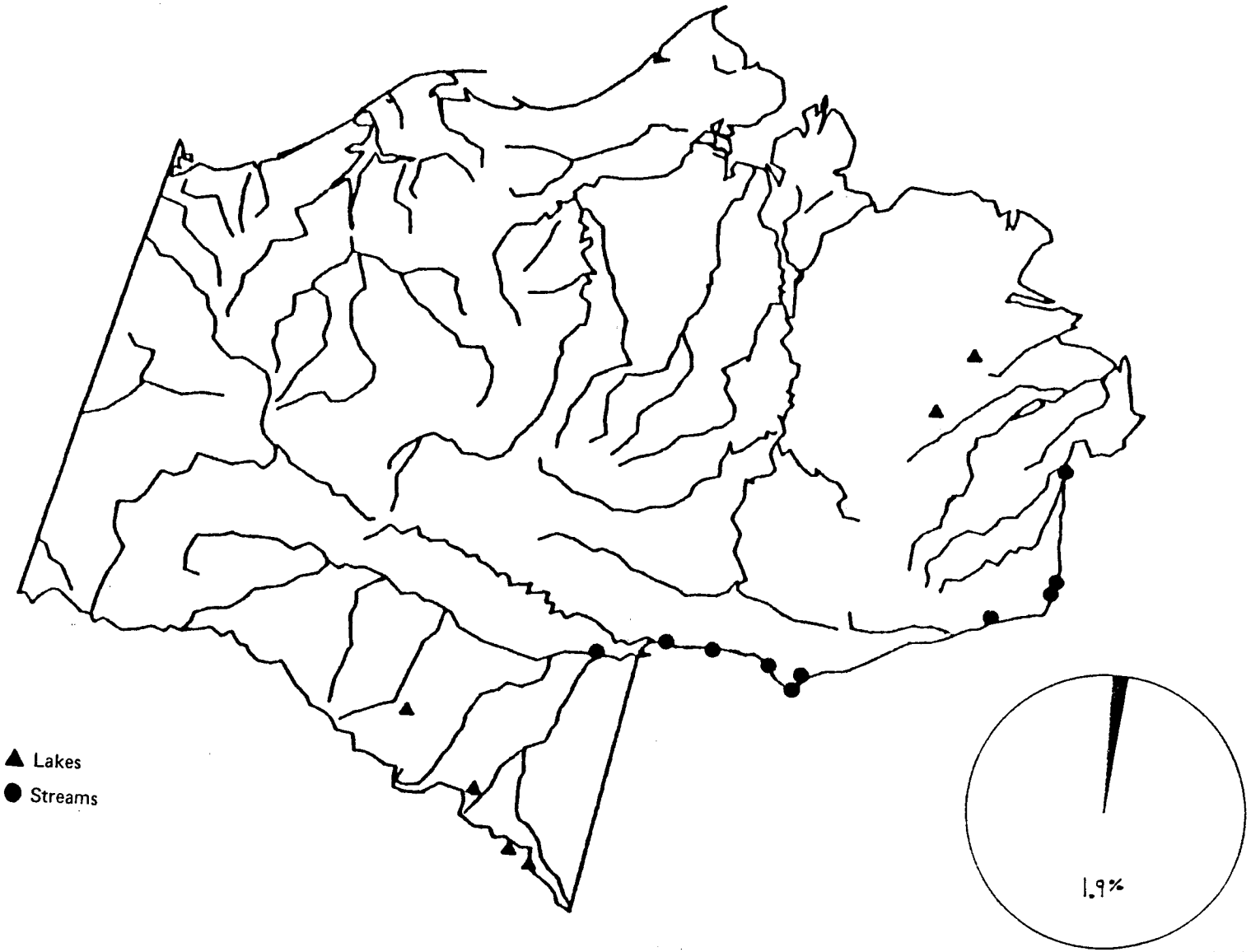

Figure 10-25. Map showing NPR-A distribution and relative abundance of round whitefish to other fresh-water fishes in net catches, 1977-1978

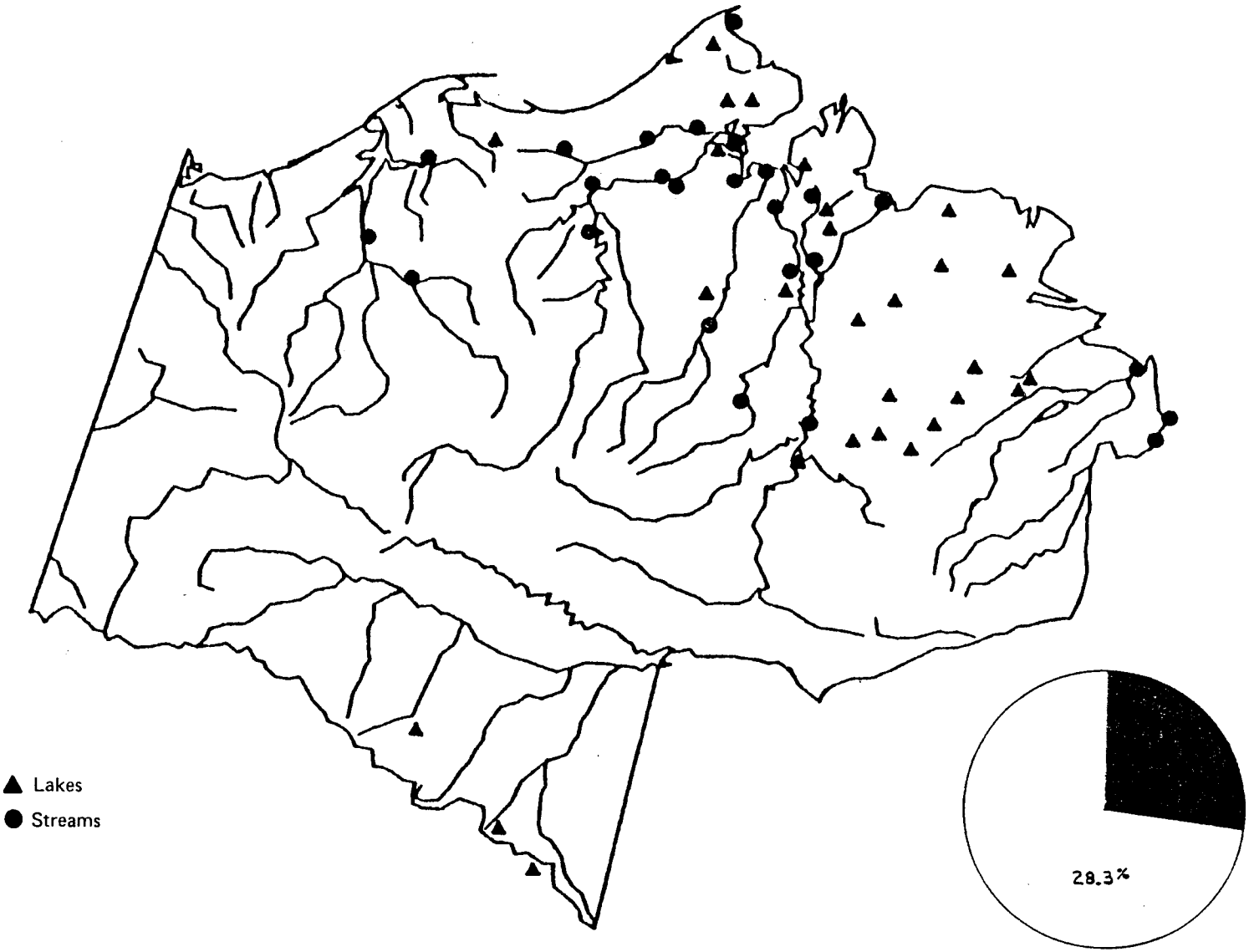

Figure 10-28. Map showing NPR-A distribution and relative abundance of least cisco to other freshwater fishes tin net catches, 1977-1978

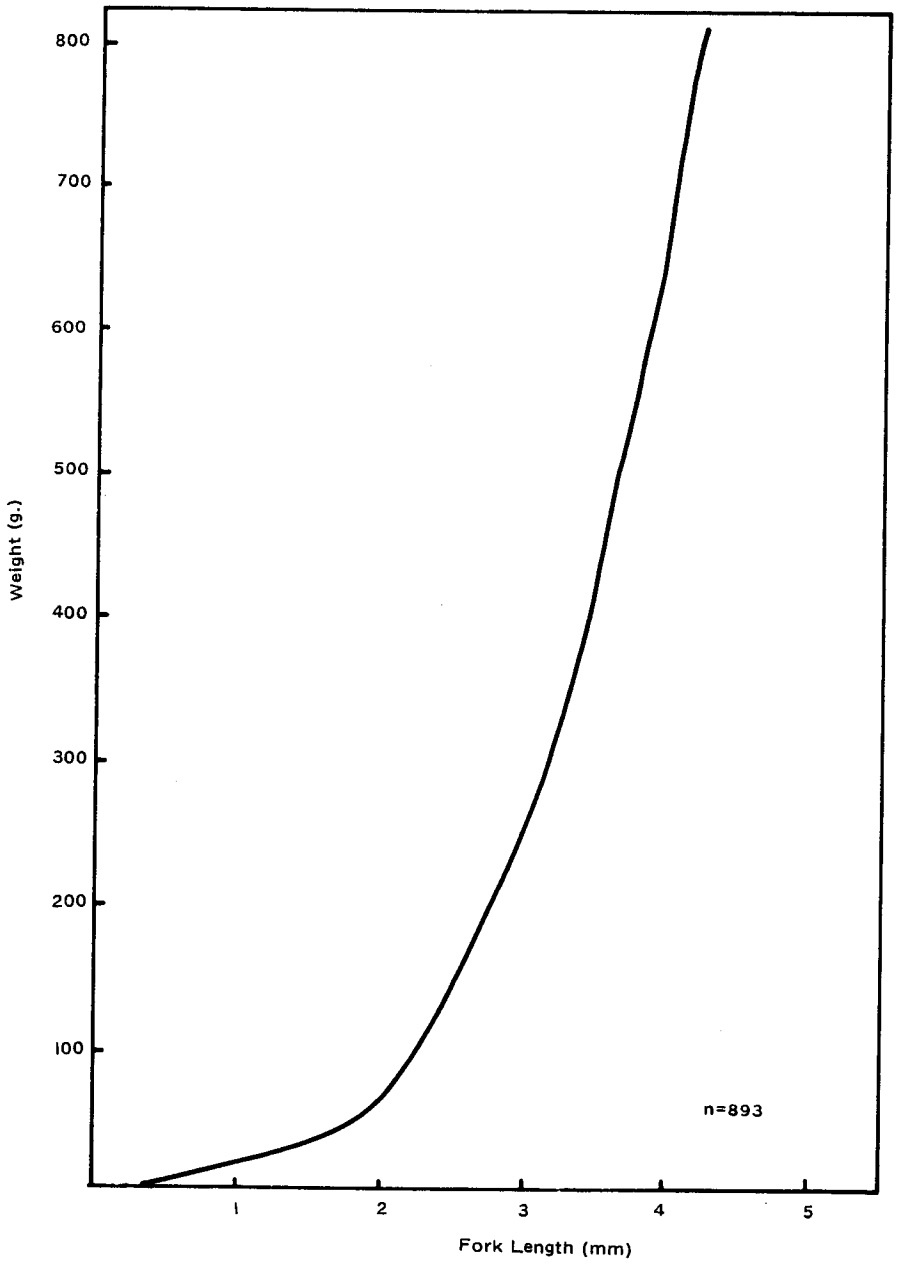

Figure 10-29. Graph showing length-weight plot for least cisco from the coastal plain of NPR-A, 1977

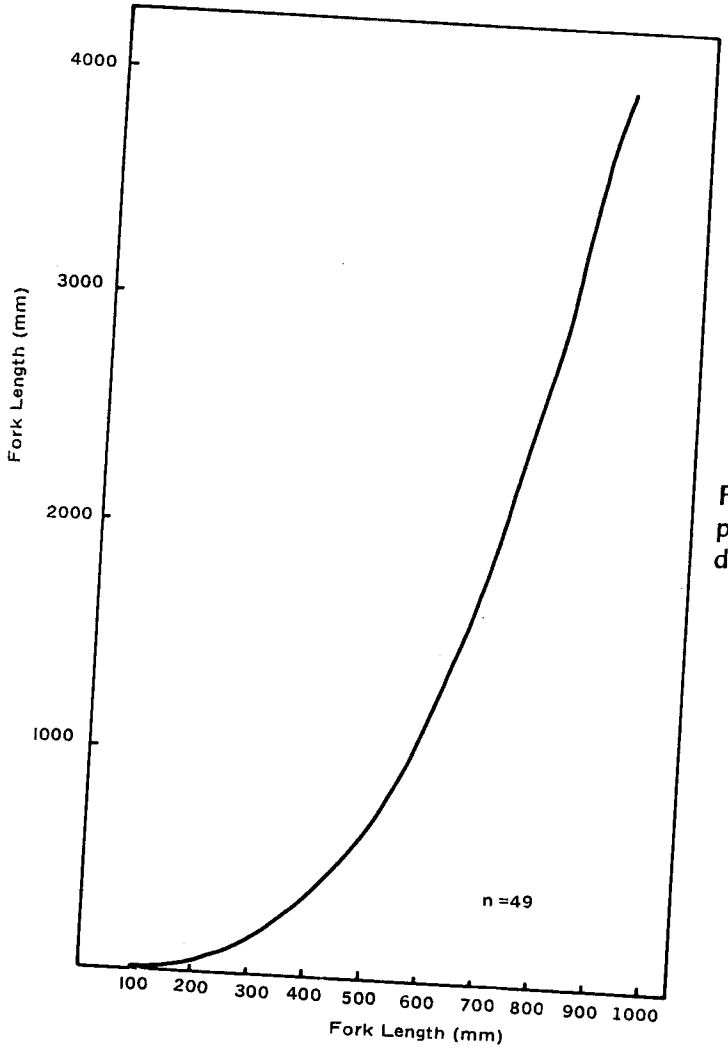

Figure 10-31. Graph showing weight-length plot for burbot from the Colville River drainage, 1977

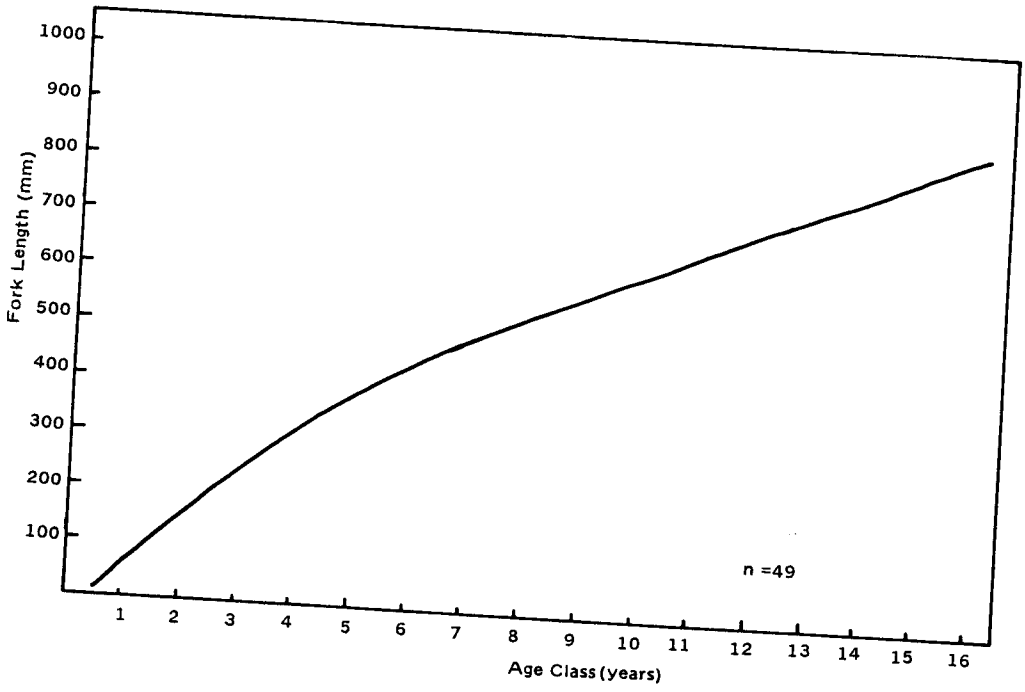

Figure 10-32. Graph showing growth of burbot captured the Colville River drainage, 1977

(about 0.1 to 3 lbs) with an average of 722 g (about 1.5 lb). They were also caught at two additional sites in 1978, but weight/length data were not recorded.

Arctic Cisco

Small catches of Arctic cisco are reported for large rivers near the coast (fig. 10-34). No life history data are available at this time.

Other Species

Longnose suckers were abundant throughout the Colville River and its major tributaries. Spawning took place during June in the main reaches of the Colville as well as in tributary streams. Minor tributaries and overflow channels are important rearing areas for longnose suckers.

Ninespine stickleback are widely distributed throughout the study area and inhabit both lake and stream systems. They are an important forage species for lake trout, char, grayling and burbot. Ninespine stickleback spawning takes place in June. Slimy sculpin are also widely distributed throughout lakes and streams within the study area. Like ninespine sticklebacks, they are an important forage species for larger fish.

Conclusion

The data contained in the previous sections of this report were collected to support land use planning. General discussions about the fisheries resources and recommendations, based in part on this study, are presented in NPR-A Study Report 2, Section 6 (NPR-A Task Force, 1978).

Acknowledgements

Special thanks are given to Terry Bendock for his efforts as project leader of the ADF&G studies, for providing field data, and contributing significantly to the writing and editing of this report. The efforts of N. Netsch and P. Fischer, who directed the U.S. Fish and Wildlife Service field programs in 1977 and 1978, respectively, are appreciated and M. Doxey for

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MATERIALS AND METHODS

Sample Collection and Preparation

Fish samples used for this study were obtained during field survey and inventory work on the NPR-A watersheds by the U.S. Fish and Wildlife Service (USFWS) and the Alaska Department of Fish and Game (ADF&G). Sampling was conducted during the summers of 1977 and 1978. Liver and white muscle samples were removed from each fish collected from various sites on the Reserve immediately after capture. These samples were then frozen for starch-gel electrophoresis. Total length, weight and sex were recorded for each fish used in the study. The most common species collected were least cisco (Coregonus sardinella), Arctic grayling (Thymallus arcticus), broad whitefish (Coregonus nasus), and humpback whitefish (Coregonus pidschian). Gut samples, parasites and miscellaneous lake trout, stickleback and other samples were also taken. Table II-1 lists sampling areas, species sampled and approximate number of fish used for the genetic studies. Sites in this report correspond to those locations in the Fisheries Inventory of NPR-A report by Hablett (Chap. 10).

Electrophoresis

Starch-gel electrophoresis involves the placement of ground tissue subsamples (liver and white muscle, for example) from several fish from a given site on the cut edge of a prepared gel. An electric current is passed through the samples on the gel via a specific buffer solution. The electrically charged proteins in the tissue subsamples migrate through the gel according to the charge on the protein, the strength of the voltage applied, the type of buffer used, and the amount of time the samples are subjected to the current. This study followed the electrophoretic procedures outlined by Utter, Hodgins and Allendorf (1974). The primary buffer systems used were those described by Ridgway, Sherburne and Lewis (1970), and by Clayton and Tretiak (1972).

After a pre-determined number of hours, the gels were cut horizontally into several thin slices. Each slice was stained for a specific enzyme system according to recipes outlined in Shaw and Prassad (1970). The protein

systems surveyed for electrophoretic variation in this study are listed in table II-2.

Statistical Procedures

The gene frequencies of protein phenotypes were derived from a computer program using standard Hardy-Weinberg, Chi-Square and other basic computations. Alleles were designated with letters (A, B, C, C', for example) as opposed to the numbering systems used by some other investigators. The 95 percent confidence intervals may be found in tables II-3 through II-6 in parentheses following the dominant allele. Populations were considered to be significantly different if their 95 percent confidence intervals (C.I.) did not overlap.

RESULTS

Gene frequencies for the fish samples taken from NPR-A are presented in tables II-3 through II-6. These results include those protein systems (MDH, TO and PGM) which were found to be polymorphic and which could be easily resolved with electrophoresis for least cisco and grayling. Of the other protein systems surveyed, PHI, SDH, and AGPDH were polymorphic but not readily interpretable for stock separation on NPR-A. Some of the other enzymes surveyed (see table II-2) were either monomorphic (ADH, IDH, and LDH) or totally uninterpretable due to unknown parameters, and thus were of no use for stock separation.

Least Cisco

Based on gene frequencies for TO (a polymorphic protein most active in liver extract), there do not appear to be significant differences between populations of least cisco in the several sites sampled (table II-3). The BB homozygote was dominant throughout the least cisco populations sampled, while the AA phenotype was not found in any group from NPR-A used for this study. The AB heterozygote was found in very low frequency in populations from sites 4, 18, 23, 25, 26, 108 and 115, and was totally absent in least cisco from sites 6, 44 and 58. Due to the extremely low frequency of the AB type, this phenotype could have been missed during sampling at

Table 11-3. Gene frequencies of TO phenotypes in least cisco populations from NPR-A.

Site	N	TO Phenotypes Observed (Expected) AA	AB	BB	Allele Frequencies A	B (95% C.I.)	Chi-Square	Probability	Degrees of Freedom
4	125	0 (0.08)	6 (6.02)	119 (121.98)	.024	.976 (.933- .922)	0.080	.70	1
6	92	0 (0)	0 (0)	92 (92)	0	1.000 (.960-1.000)	0	1	1
18	40	0 (0.02)	2 (1.96)	38 (38.04)	.025	.975 (.871- .996)	0.200	.80	1
3	28	0 (0.14)	4 (3.69)	24 (24.17)	.071	.929 (.774- .980)	0.167	.50	1
25	29	0 (0)	1 (0.96)	28 (28.01)	.017	.983 (.856- .998)	0.038	.80	1
26	48	0 (0.05)	3 (2.83)	45 (45.17)	.030	.970 (.877- .993)	0.075	.70	1
44	33	0 (0)	0 (0)	33 (33)	0	1.000 (.895-1.000)	0	1	1
58	48	0 (0)	0 (0)	48 (48)	0	1.000 (.925-1.000)	0	1	1
108	44	0 (0.04)	3 (2.90)	41 (41.05)	.034	.966 (.865- .992)	0.043	.80	1
115	41	0 (0.08)	4 (3.81)	37 (37.06)	.049	.951 (.838- .986)	0.089	.70	1
TOTAL	528	0 (0.26)	23 (22.72)	505 (505.02)	.022	.978 (.961- .987)	0.263	.50	1

sites 6, 44 and 58. However, at sites 6 and 58, the sample sizes were relatively large (92 and 48 fish, respectively). It seems unlikely that the AB type could have been excluded from the sample from sites 6 and 58, had it been present in the population. All least cisco populations were in Hardy-Weinberg equilibrium for TO. Figure II-1 presents the expected and observed dimeric, isoenzyme banding patterns for the TO phenotypes in least cisco from NPR-A.

The tetrameric MDH system was found to be polymorphic in liver and white muscle extracts from the least cisco sampled on NPR-A. In a tetrameric protein system the number of possible phenotypes is large, many of which can only be distinguished on an electrophoretic gel by allele dosage differences (light or dark bands dependent upon allelic contributions). For the more complicated MDH system, this present study is concerned with the most electrophoretically mobile form of MDH only (that which migrates fastest towards the positive pole). We have classified the twelve possible phenotypes of the most mobile C form of the three allele system into six readily distinguishable types based on isoenzyme banding pattern differences (fig. II-2). The banding patterns observed following staining of the gel slices are presented in figure II-3.

The gene frequencies of MDH phenotypes in least cisco are presented in table II-4. The CC, CC', CC" and C'C" forms were the only phenotypes found in the least cisco samples. The third allele (C") appeared only in populations from sites 4 and 6. However, due to the low frequency of this third allele and because of the smaller samples collected at sites other than 4 and 6, it is possible that the C" allele was missed during sampling. It should be noted that least cisco from site 4 were significantly different from those from sites 44 and 58, since confidence intervals did not overlap (table II-4). However, when all of the populations were considered together, there were no unique or significantly different populations with a non-overlapping confidence interval among the group.

Grayling

The gene frequencies for grayling TO phenotypes are presented in table II-5. The banding patterns observed and a diagrammatic sketch of an

Table 11-6. Gene frequencies of PGM phenotypes in grayling populations from NPR-A.

Site	N	PGM Phenotypes Observed (Expected) AA	AB	BB	Allele Grequencies A	B	(95% C.I.)	Chi-Square	Probability	Degrees of Freedom
25	23	0 (4.81)	21 (11.41)	2 (6.79)	.457	.543	(.369-.690)	16.247	.01	1
26	22	0 (5.02)	21 (10.98)	1 (5.98)	.478	.522	(.371-.673)	18.316	.01	1
60	81	0 (19.76)	80 (40.50)	1 (20.74)	.494	.506	(.429-.583)	77.073	.01	1
106	46	0 (11.04)	45 (22.95)	1 (11.96)	.490	.510	(.370-.648)	42.27	.01	1
110	19	0 (4.75)	19 (9.50)	0 (4.75)	.500	.500	(.338-.662)	19.000	.01	1
119	30	1 (6.54)	26 (14.94)	3 (8.52)	.467	.533	(.405-.661)	16.457	.01	1
125	26	0 (6.02)	25 (12.98)	1 (7.00)	.481	.519	(.337-.696)	22.294	.01	1
126	56	0 (12.10)	52 (27.85)	4 (16.01)	.465	.535	(.441-.629)	41.958	.01	1
315	23	0 (5.75)	23 (11.50)	0 (5.75)	.500	.500	(.310-.680)	22.98	.01	1
TOTAL	326	1 (75.63)	312 (162.67)	13 (87.37)	.482	.518	(.463-.571)	274.03	.01	1

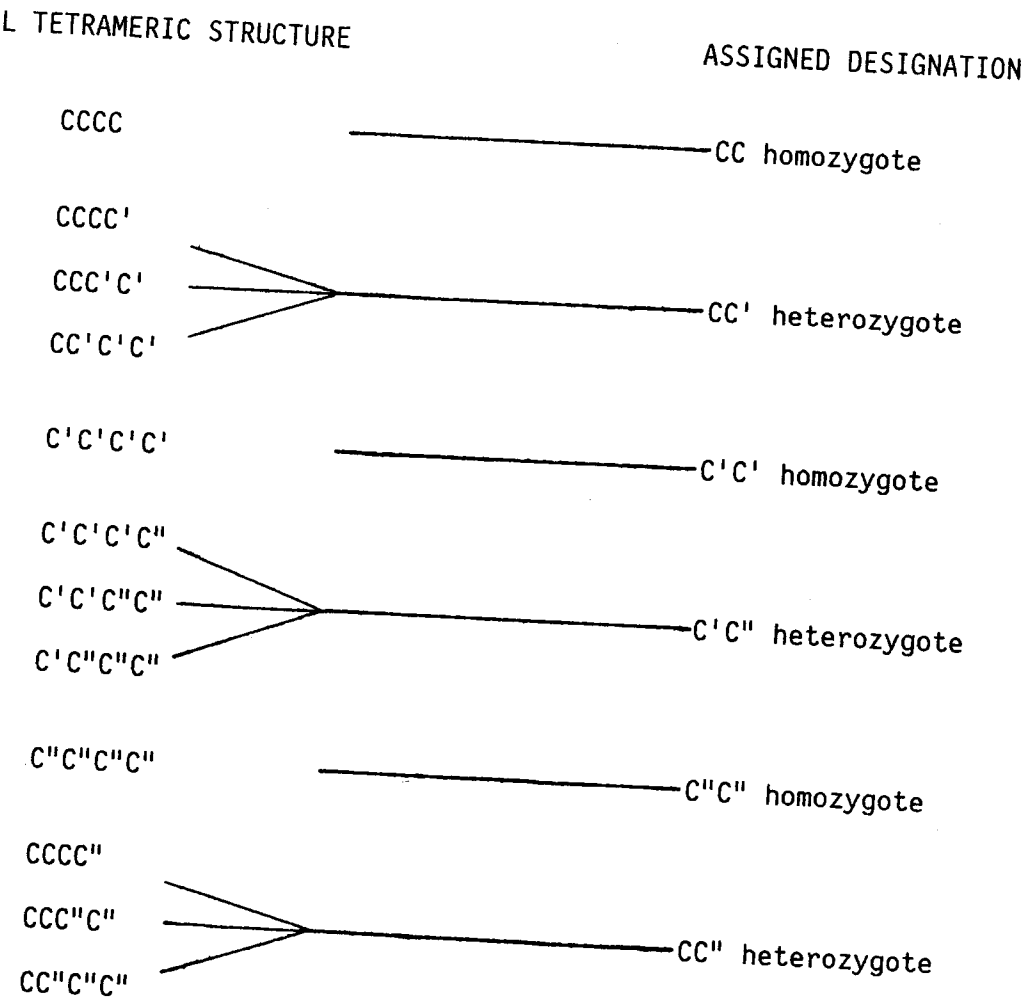


Figure 11-2. The nomenclature used to differentiate the most mobile form of the tetrameric MDH in a 3-allele system for least cisco on NPR-A.

expected banding pattern for a dimeric enzyme are shown in figure II-1.

The A allele was found to be dominant. Only one fish from one site possessed the BB phenotype, while a few of the fish from several sites were heterozygotes (AB). With the exception of Teshekpuk Lake, the 95 percent confidence intervals overlapped at all sites. The Teshekpuk Lake population was found to be significantly different; the majority of fish sampled were heterozygotes (AB). The confidence interval for Teshekpuk Lake grayling does not overlap with grayling from any other NPR-A site.

The gene frequencies for grayling PGM phenotypes are listed in table II-6 and the observed banding patterns are presented in figure II-4. There were no significant differences between the grayling populations sampled for PGM variability on NPR-A. However, there appears to be strong selection for the AB phenotype since the majority of fish sampled were heterozygotes (table II-6).

DISCUSSION

Least Cisco

Least cisco from all sites surveyed were in Hardy-Weinberg equilibrium for TO. Based on TO phenotypes in least cisco, none of the populations appear to be significantly different. The missing AA phenotype is assumed to be lethal or disavantageous at some point in the life cycle, and selection appears to be very heavily in favor of the BB homozygote. The AB heterozygote is missing from three sites (sites 6, 44 and 58), and at a very low frequency in the remainder. Because of the larger sample sizes at sites 6 and 58, the AB phenotype should not have been missed if present in these populations. Because of the absence of the AA phenotype and the low frequency of the AB type, it appears that all the populations are moving towards elimination of the A gene for TO. For TO, all populations have a high probability of being in equilibrium.

Of the ten least cisco populations surveyed for MDH variants, six were in Hardy-Weinberg equilibrium (sites 6, 26, 44, 58, 108 and 115). Absence of the third MDH allele (C") in all but sites 6 and 4 is not surprising due to

its extreme low frequency and the smaller sample size at the other sites. The observed number of CC" heterozygotes is consistently higher than the expected number and is apparently a case of overdominance with selection for the heterozygote. The expected frequency of the C'C' homozygotes is high enough that it should have been detected if it exists in the population. Apparently, selective pressures are eliminating the C'C' phenotype. Absence of the C"C" homozygote in all populations and absence of the CC" and C'C" phenotypes in all but those at sites 6 and 4 is not surprising due to their very low expected frequency. When comparing the 95 percent confidence intervals for the dominant MDH C allele, there appear to be no significantly unique populations of least cisco in the areas sampled. However, cisco from site 4 are genetically different than those from sites 44 and 58 (based on non-overlapping confidence intervals). This difference is related to differing rates of evolution.

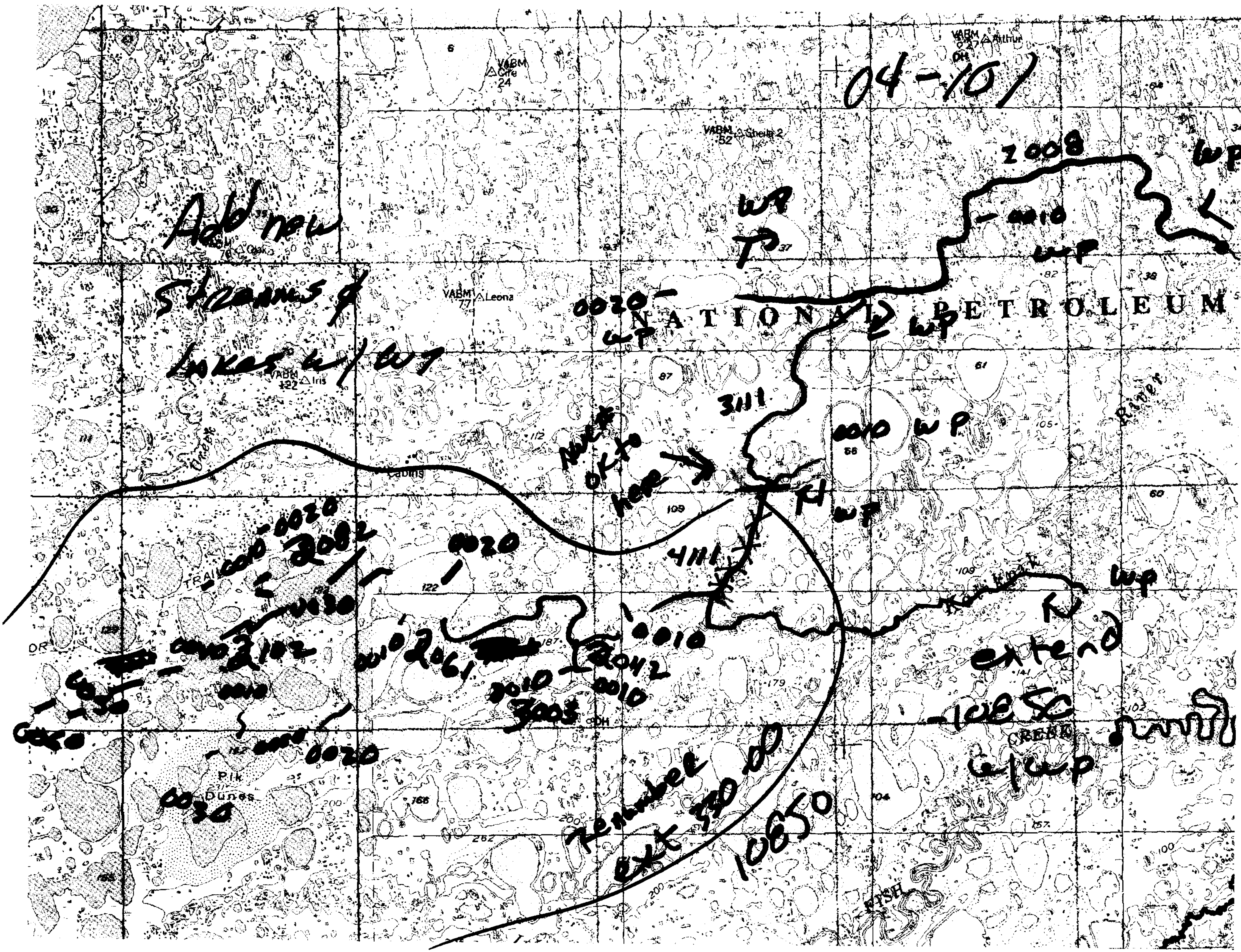
Grayling

TO phenotypes in grayling are just the reverse of that in least cisco, that is, the AA type is highly dominant, whereas the BB homozygote is apparently selected against. However, one BB phenotype was found at site 60. The Teshekpuk Lake grayling population sampled was extremely different for TO from populations at any other sampled site. At Teshekpuk the AB heterozygote was dominant. This is a second instance of overdominance, or selection for the heterozygote, in NPR-A fish populations. Site 126 had significantly more heterozygotes than any other site except 60, but its 95 percent confidence interval still overlapped those of other sites. All sites except 26 were in equilibrium for TO with a high degree of probability.

Very little difference in PGM phenotypes existed between sites. All sites exhibited a high degree of selection for the AB heterozygote while the AA phenotype appeared to be at a strong selective disadvantage (1 fish out of 326). The BB phenotype occurred in very low frequency (13 fish out of 326). None of the populations appear to be in equilibrium.

MANAGEMENT CONSIDERATIONS

Of the several populations of least cisco and grayling sampled, only the



04-101
Add new streams & lakes w/ WP
NATIONAL PETROLEUM
VABM Arthur
VABM Cife 24
VABM Sheila 2 52
VABM 77 Leona
VABM 122 Iris
Cabins
TRAIL
Pik Dunes
CREEK
FISH
2008
0010
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3111
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2102
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Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
65	Howard Pass #1	July 26	No Fish
66	Liberator	August 1	Gr, NSB
67	No Luck	August 2	Gr
68	Recon	August 13	No Fish
69	Swayback	August 12	Gr, NSB
70	W. Smith Mt.	July 27	Gr
71	Kidney Creek	August 21-23	Lt, Gr
72	Query	August 13	No Fish
73	Tukuto	August 6	LCi, RWF, Lt, Gr, SSc
74	Tukuto Crater	August 8	Gr, NSB
75	Lake Betty	August 8-9	BWF, Lt, Gr
76	Unnamed	July 10	Lt
77	Akuliak	August 9	LCi, RWF, Gr
78	Inyorurak Pass	August 9	LCi, Lt, Gr
79	Kikitaliorak	August 11	LCi, RWF, Lt, Gr, SSc
80	Etivluk	August 10-11	RWF, Lt, Gr, SSc

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
23	Unnamed	July 31	BWF, LCi, AB
24	Unnamed	July 21	No Fish
25	Itinik	July 24	LCi, Gr, NSB
26	Teshekpuk	August 17	BWF, HWF, LCi, Lt, Gr
27	Unnamed	August 19	LCi, NSB
28	Unnamed	July 17	No Fish
29	Unnamed	July 17	No Fish
30	Unnamed	August 3	BWF, LCi, Lt, NSB, SSc
31	Unnamed	August 15	NSB
32	Unnamed	July 21	No Fish
33	Unnamed	August 3	NSB
34	Unnamed	August 15	LCi, NSB, AB
35	Unnamed	July 19	NSB
36	Unnamed	July 14	No Fish
37	Unnamed	August 20	BWF, LCi, NSB
38	Unnamed	August 14	LCi, NSB, AB
39	Oil	August 13	NSB
40	Unnamed	July 15	No Fish
41	Takrak	July 14	NSB
42	Unnamed	July 17	NSB
43	Sand Dune	August 19	RWF, Lt, NSB, AB
44	Unnamed	August 12	LCi, Lt, GR, BB

as Seabee, Rainy, and Fossil creeks, as well as all of the major tributaries to the Colville, were utilized by grayling for spawning. Most spawning by grayling was completed by the end of June, at which time large numbers of spent fish were captured near the confluence of minor tributaries with the Colville River. Grayling also utilized the mainstem of the Colville River for spawning, especially above the Etivluk River, and appeared to prefer slow-moving or slack water less than 3 ft (1 m) deep.

Longnose suckers utilize the lower portions of small tributaries, as well as the mainstem of the Colville and major tributaries, for spawning. Spawning ninespine stickleback were captured in slow-moving water in the lower portions of small tributary streams.

The composition of net catches at Umiat throughout July and early August was similar to that following breakup. Arctic char and lake trout were captured infrequently at sites between the Anaktuvuk River and Etivluk River throughout the summer, and three mature Arctic cisco were captured at Umiat in early July 1977.

A large run of mature humpback whitefish and immature and mature broad whitefish occurred at Umiat the third week of August 1977, and peak numbers of fish were captured in the last days of the month. Humpback and broad whitefish spawning presumably occurs during September throughout the Colville River to a distance upstream from Umiat. Two spent broad whitefish were captured at Umiat during the second week of September, at which time water temperatures were between 5° and 8°C (41° and 46°F).

A total of 64 pink and 29 chum salmon was captured in the Colville River between the Itkillik River and Umiat during 1978. Pink salmon were spawning near the Itkillik River on August 11 and at Umiat on August 19. Chum salmon were still moving upstream past Umiat on August 19 and were not yet ripe.

Table 10-2 presents species composition of stream survey locations in the Colville River drainage. Species diversity and availability of overwintering habitat in the Colville River decreases in an upstream direction.

Table 10-1. List of fish species collected in 1977 and 1978.

Common Name	Scientific Name	Abbreviation
Family Salmonidae		
Arctic cisco	Coregonus autumnalis	ACi
Broad whitefish	Coregonus nasus	BWF
Humpback whitefish	Coregonus pidchian	HWF
Least cisco	Coregonus sardinella	LCi
Pink salmon	Oncorhynchus gorbuscha	PS
Chum salmon	Oncorhynchus keta	CS
Chinook salmon	Oncorhynchus tshawytscha	KS
Round whitefish	Prosopium cylindraceum	RWF
Arctic char	Salvelinus alpinus	AC
Lake trout	Salvelinus namaycush	LT
Arctic grayling	Thymallus arcticus	GR
Family Osmeridae		
Rainbow smelt	Osmerus mordax	RSm
Family Gasterosteidae		
Ninespine stickleback	Pungitius pungitius	NSB
Family Cottidae		
Slimy sculpin	Cottus cognatus	SSc
Fourhorn sculpin	Myoxocephalus quadricornis	FSc
Family Umbridae		
Alaska blackfish	Dallia pectoralis	AB
Family Esocidae		
Northern pike	Esox lucius	NP
Family Catostomidae		
Longnose sucker	Catostomus catostomus	LS
Family Gadidae		
Burbot	Lota lota	BB
Family Pleuronectidae		
Arctic flounder	Liopsetta glacialis	AF

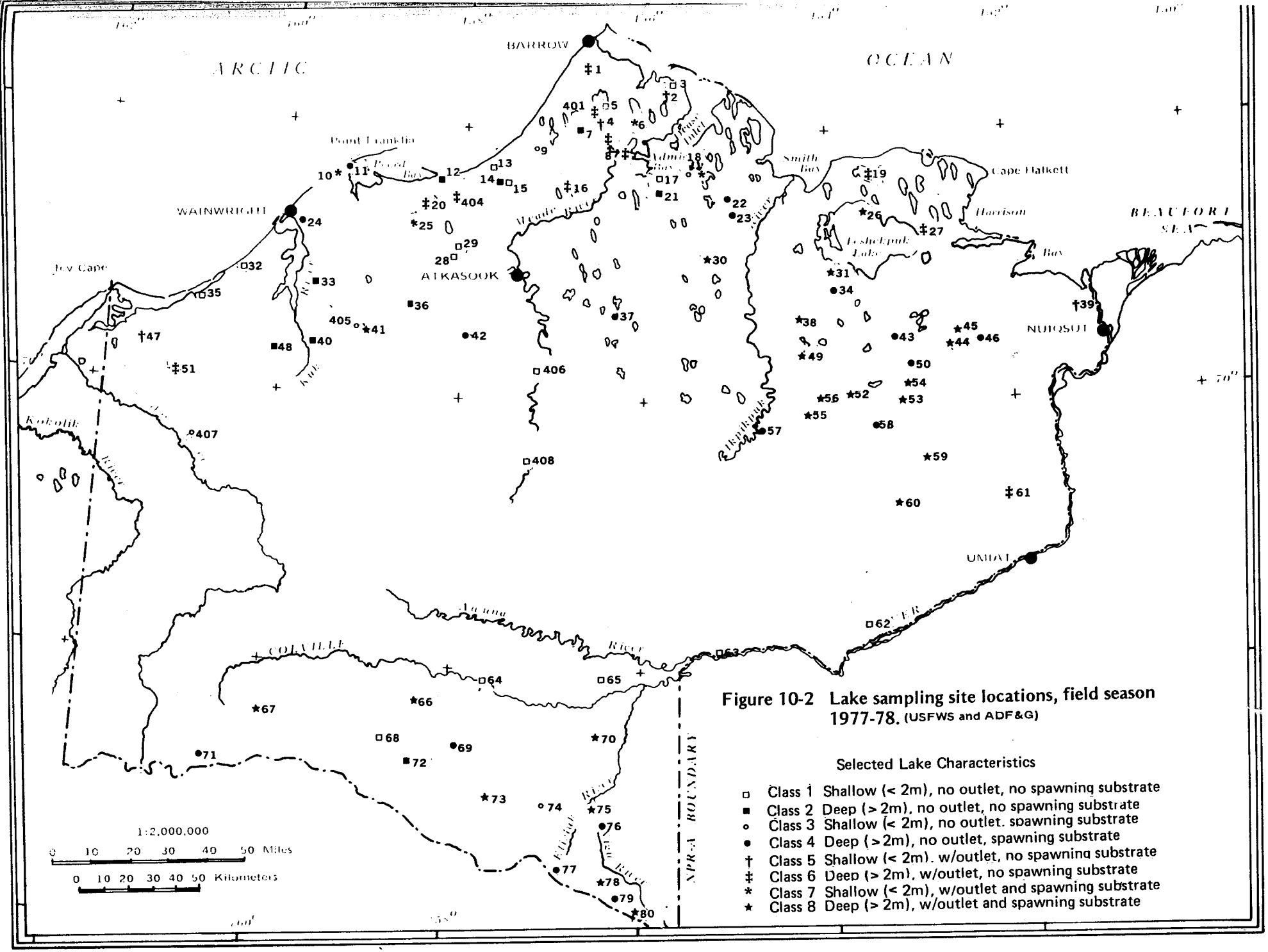

Figure 10-2 Lake sampling site locations, field season 1977-78. (USFWS and ADF&G)

Selected Lake Characteristics

- □ Class 1 Shallow (< 2m), no outlet, no spawning substrate
- ■ Class 2 Deep (> 2m), no outlet, no spawning substrate
- ○ Class 3 Shallow (< 2m), no outlet, spawning substrate
- ● Class 4 Deep (> 2m), no outlet, spawning substrate
- † Class 5 Shallow (< 2m), w/outlet, no spawning substrate
- ‡ Class 6 Deep (> 2m), w/outlet, no spawning substrate
- * Class 7 Shallow (< 2m), w/outlet and spawning substrate
- ★ Class 8 Deep (> 2m), w/outlet and spawning substrate

On the Colville River, an ice auger with a 10 in (25.6 cm) bit was used to drill through winter ice. Monofilament graduated mesh sinking gill nets or individual panels from these nets were used to capture fish under the ice. Burbot were captured using large single hooks attached to lines set through the ice.

Fish collected by USFWS field personnel were measured for total length (sometimes fork) and most were weighed. Scales were taken from selected fish, and stomachs of a small number of specimens were examined. The sex of mature fishes was determined in the laboratory, and liver and white muscle samples were removed from individual fishes retained for genetic studies.

Fish samples taken by ADF&G were preserved in 10 percent formalin or frozen and sent to Fairbanks for further laboratory analysis. All samples were grouped by date and location. Small fish were weighed to the nearest gram on a triple beam balance. Fish over 500 g were weighed on a Chatillon spring scale. Fork lengths were measured to the nearest millimeter, and sex and stage of maturity were determined by examining gonads. A binocular microscope was used to determine ages of Arctic char, lake trout and burbot from otoliths wetted in zylene. All other fish were aged by reading scales. Scales were cleaned and impressed on 20 mil acetate sheets. A Bruning 200 microprojector was used to read the scales. Lengths at the end of each year of life for several species were back calculated using the direct proportion formula. Estimates of stomach fullness and contents were made in the field. Fecundity was determined by displacing a volume of water with a known quantity of eggs. The total number of eggs was then calculated using the quantity of water displaced by the entire ova mass.

Physical, chemical and biological data were recorded for each sampling site using standard survey forms in the field. These have been entered into the USFWS computer system and may be accessed for statistical analysis and graphic displays, through the Alaska Information Management System, U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503.

Stations were entered on 1:500,000 maps beginning with northern townships

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STATE OF ALASKA
FISH & GAME

State of Alaska
Department of Fish and Game
Sportfish Division

Nomination Form
Fish Distribution Database

Region: Arctic

USGS Quad: Harrison Bay B4, B5, A5

Fish Distribution Database Number of Waterway: 330-00-10850 ← 2008

Name of Waterway: Kalikpik River ☑ USGS Name ☐ Local Name

☑ Addition ☐ Deletion ☐ Correction ☐ Backup Information

For Office Use

Nomination #	04 101	A Hots	9/21/04
Revision Year:	2005	Fisheries Scientist	Date
Revision to:	Atlas ____ Catalog ____ Both ✓	FDD Project Biologist	7/Jan 04 Date
Revision Code:	A-Z	Drafted	11/22/04 Date

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
Broad Whitefish	1981 (Bendock and Burr 1984)			See Below	☑
Broad Whitefish	Netsch (1977), Hablett (1980)			See Below	☑
					☐
					☐
					☐

P32

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments:

The Kalikpik River is nominated from the upper boundary of catalogged anadromy (red channel on map) to the farthest connected upstream lake with anadromous fish (Lake N77101). The general area of interest is outlined in black on the attached map. Bendock and Burr identified anadromous broad whitefish using the upstream most lake during sampling in 1981. The stream channel to be nominated appears in blue and the lake N77101 is identified on the map. Researchers have also identified Arctic grayling, least cisco, ninespine stickleback, and lake trout in the lake. Two lakes connected to the Kalikpik downstream from lake N77101 are also nominated (identified by blue polygons).

Add new streams & lakes w/ up

Name of Observer (please print): William Morris

Signature: [signature] Date: 11/28/2003

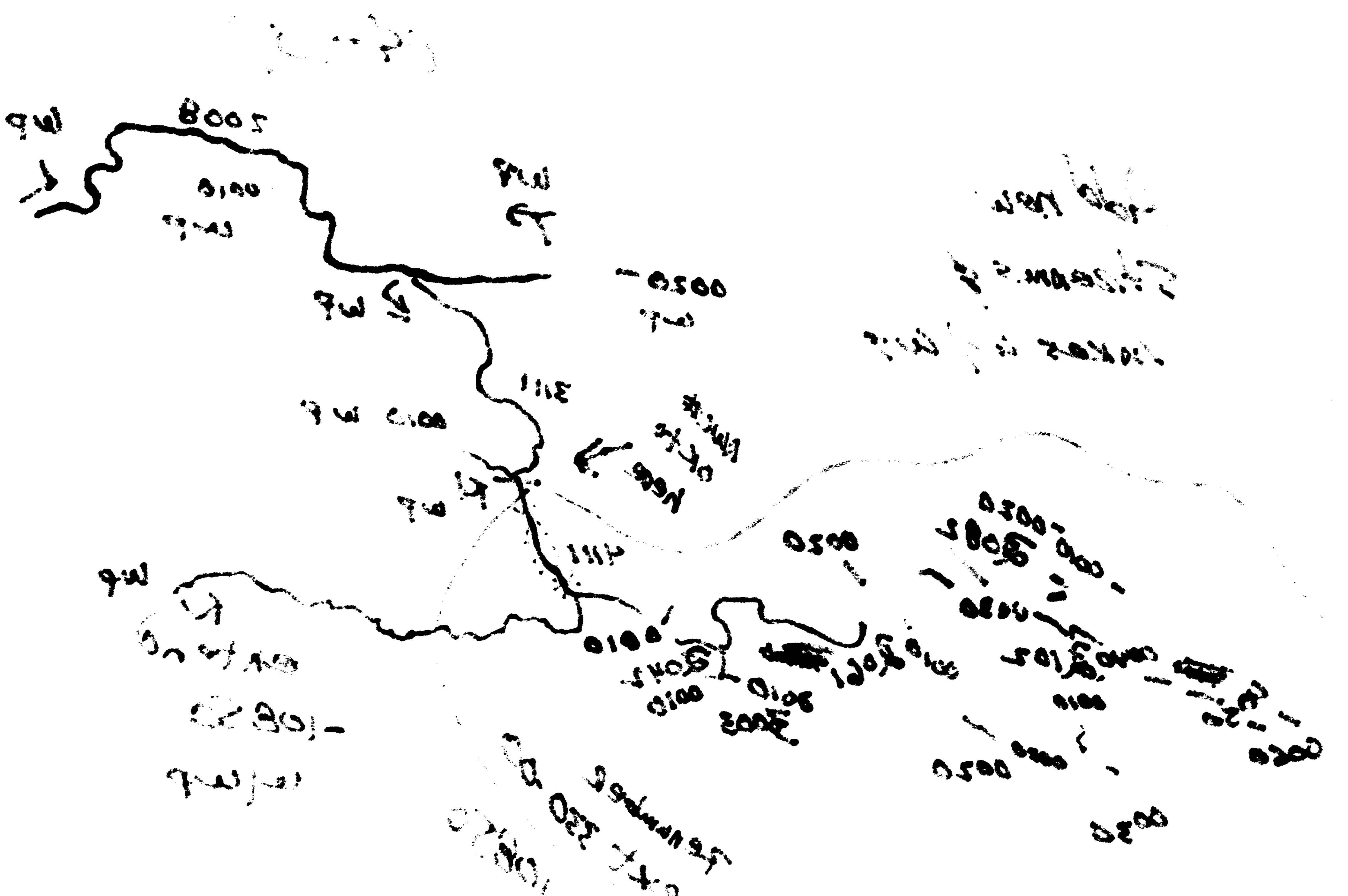
Address: 1300 College Road
Fairbanks, AK 99701

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Fish Distribution Database.

Signature of Area Biologist: [signature]

Name of Area Biologist (please print): John Burr

Revision 04/03


2008

Teshekpuk Lake grayling population appears to be unique at this time. However, in the event that stock enhancement or rehabilitation of either least cisco or grayling is ever contemplated for NPR-A, one very obvious fact stands out: both species have genotypes that appear to be less fit for the natural environment. Thus, any potential donor stocks for enhancement should be genetically screened for compatability prior to any rehabilitation.

ACKNOWLEDGEMENTS

This study is part of a cooperative effort between various biologists and departments within the U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, and Bureau of Land Management. The authors wish to thank Norval Netsch, Ed Crateau, Gary Love, Don Hales, Paul Fisher and Terry Bendock and their technicians for logistical and sampling assistance. The authors also wish to thank Jack Dean, Buddy Jensen, and Kevin Ryan for the samples and assistance provided in the field. The help of Dave Wangaard is especially appreciated during field collections and laboratory analyses.

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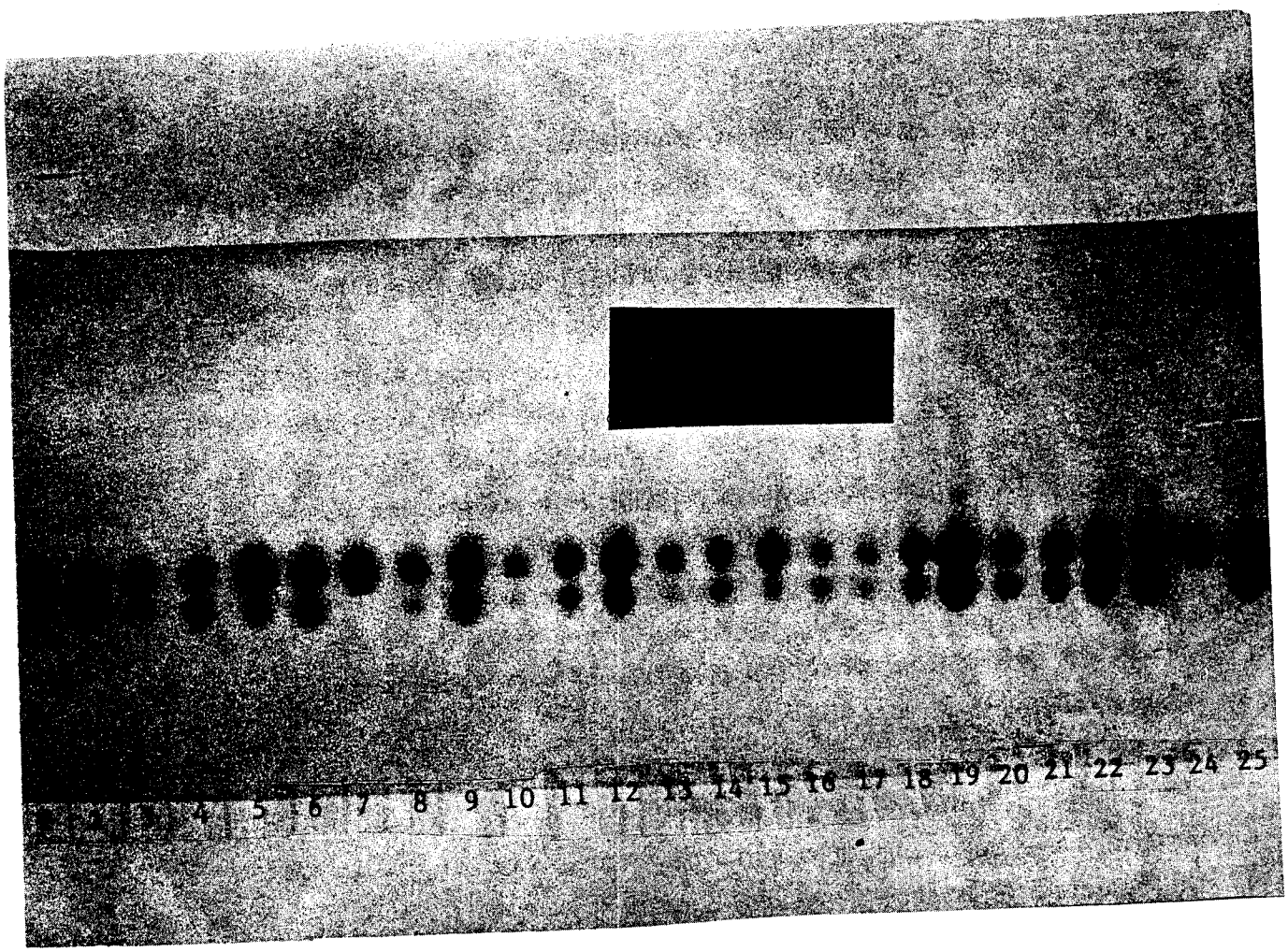
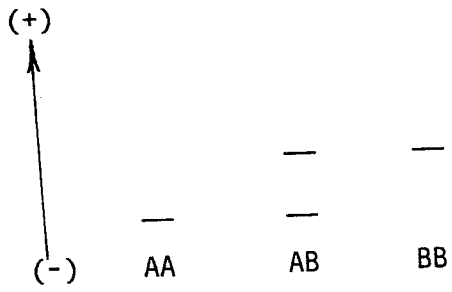


Figure 11-4. Observed PGM phenotypes in grayling from site 126 (Judy Creek). From left, BB homozygotes (fish 7 and 24) and AB heterozygotes (remaining fish). Only one grayling from all of the collecting sites exhibited the AA phenotype.

The sketch below shows the expected phenotypes in a monomeric protein.



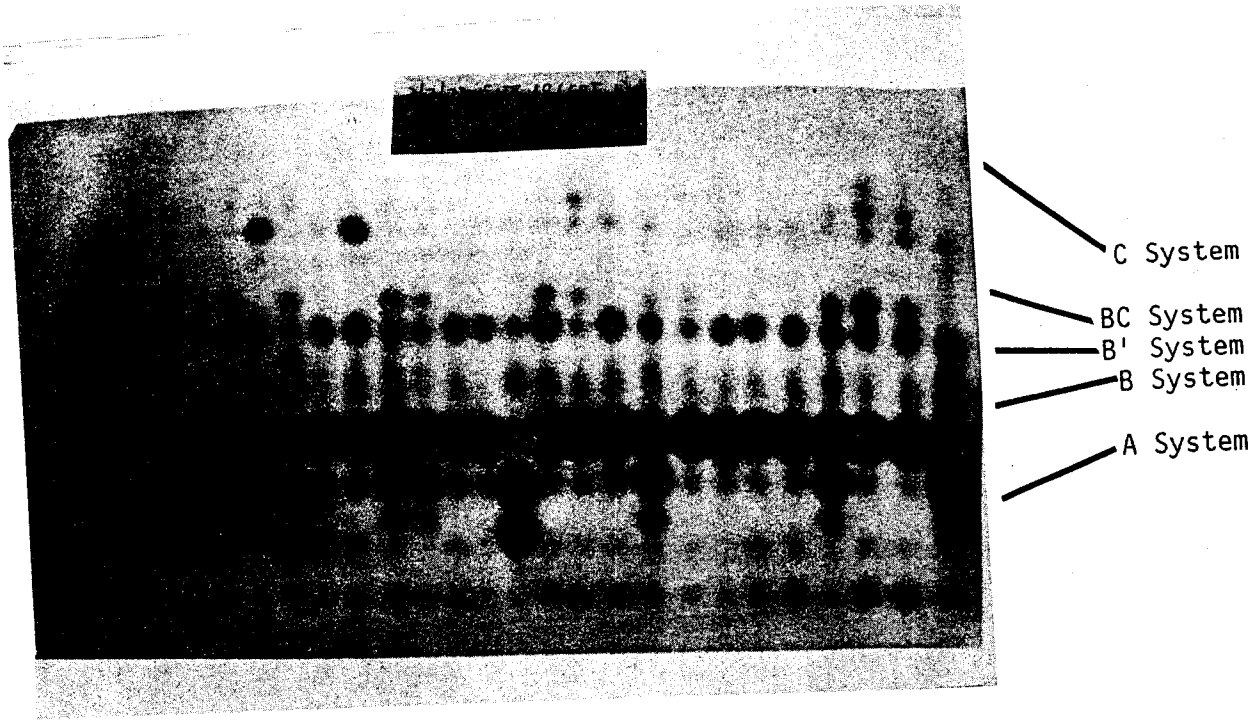
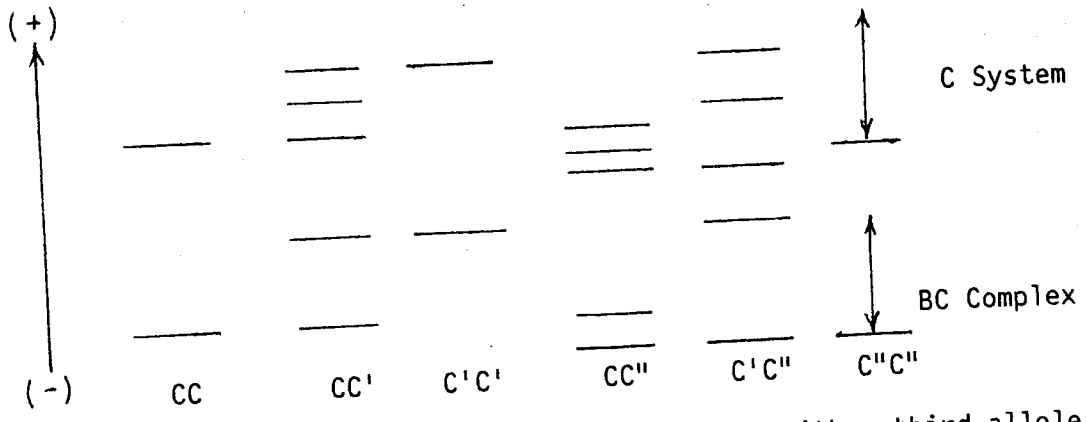


Figure 11-3. The observed MDH phenotype variants for least cisco from Site 6, Tusikvoak Lake. From left to right, CC" heterozygotes (fish 8, 11, and 28), CC homozygotes (fish 3, 8, 10, 14, 15, 16, 19, 22, 23, and 24) and CC' heterozygotes (remaining fish). The C'C" phenotypes was found in one instance but not in this population. C'C' and C'C" homozygotes were never observed in our samples.



Expected phenotypes in a tetrameric protein with a third allele (C system only).

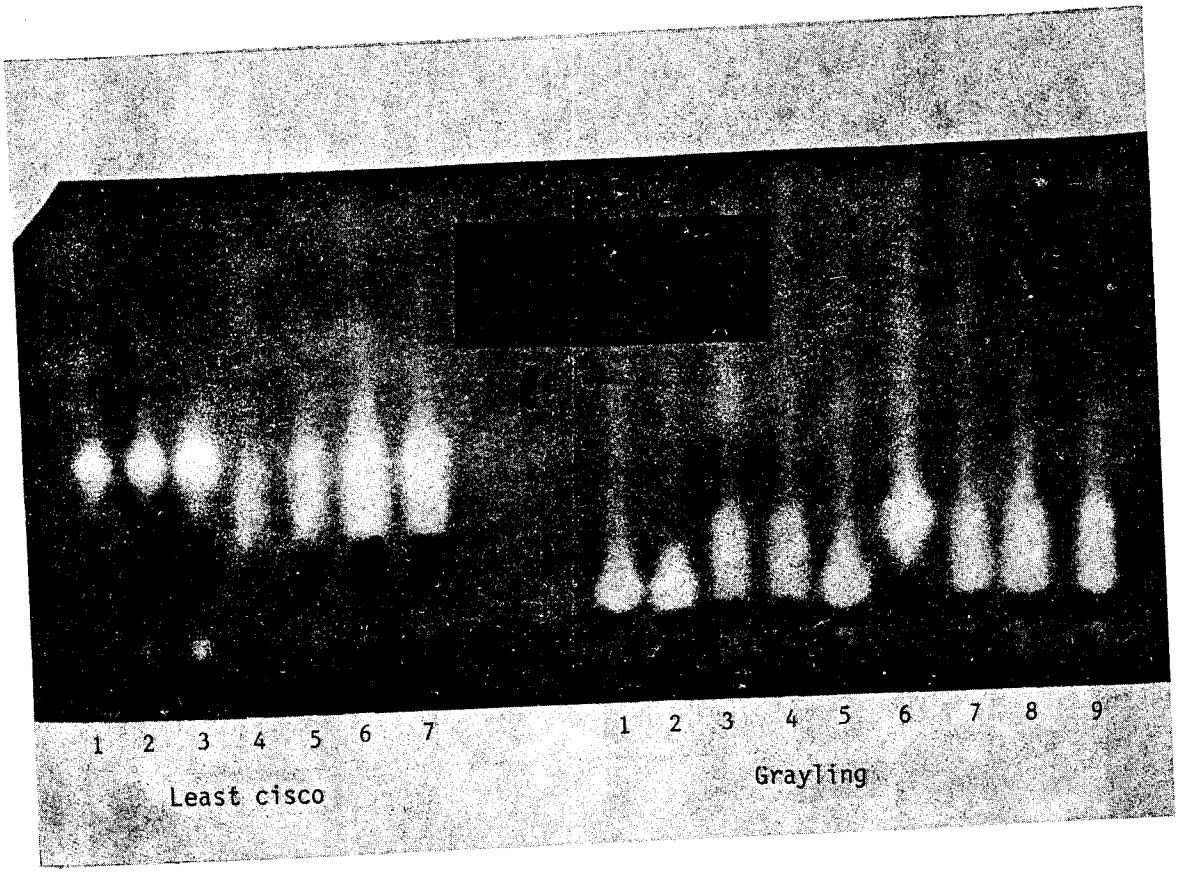


Figure 11-1. The observed banding pattern of the dimeric TO phenotypes for least cisco and grayling. From left, least cisco 1, 2, and 3 are BB homozygotes, while 4, 5, 6, and 7 are AB heterozygotes. No AA homozygotes were found in any of the least cisco populations sampled. The second group of banding patterns are from grayling. From left to right fish 1, 2, and 5 are AA homozygotes, fish 6 is a BB homozygote, while fish 3, 4, 7, 8, and 9 are AB heterozygotes. The dark bands accompanying the TO migration are probably ADH.

The sketch below shows the expected banding pattern for phenotypes of a dimeric protein.

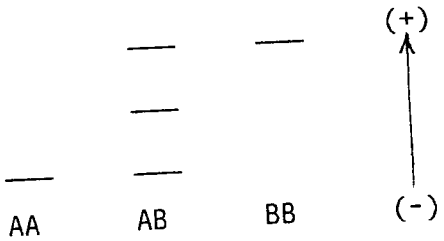


Table 11-5. Gene frequencies of TO phenotypes in grayling populations from NPR-A.

Site	N	TO Phenotypes Observed (Expected) AA	AB	BB	Allele Frequencies A	(95% C.I.)	B	Chi-Square	Probability	Degrees of Freedom
25	23	24 (20.10)	3 (2.81)	0 (.11)	.935	(.863-1.000)	.065	0.014	.90	1
26	36	2 (10.04)	34 (17.93)	0 (8.03)	.528	(.414- .646)	.472	28.878	.01	1
60	81	76 (75.09)	4 (5.75)	1 (.08)	.963	(.935- .991)	.037	0.546	.40	1
106	46	46 (46.00)	0 (0)	0 (0)	1	(.922-1.000)	0	1	1	1
110	19	16 (16.11)	3 (2.77)	0 (.11)	.921	(.834-1.000)	.079	0.019	.80	1
119	29	23 (23.35)	6 (5.37)	0 (.32)	.897	(.817- .977)	.103	0.080	.70	1
125	26	24 (24.02)	2 (1.95)	0 (.05)	.961	(.908-1.000)	.039	0.060	.80	1
126	56	42 (42.90)	14 (12.26)	0 (.90)	.875	(.812- .938)	.125	0.265	.50	1
315	23	23 (23.00)	0 (0)	0 (0)	1	(.856-1.000)	0	1	1	1
TOTAL	339	272 (273.91)	66 (61.36)	1 (3.39)	.899	(.862- .926)	.101	2.047	.1	1

Table 11-4. Gene frequencies of MDH phenotypes in least cisco populations from NPR-A.

Site	N	MDH Phenotypes Observed (Expected) CC	CC'	C'C'	CC"	C'C"	C"C"	Allele Frequencies C (95% C.I.)	C'	C"	Chi-Square	Probability	Degrees of Freedom
4	125	36 (51.25)	88 (57.00)	0 (15.88)	0 (0.63)	1 (.38)	0 (.002)	.640 (.580-.700)	.356	.004	38.922	.01	4
6	53	23 (27.24)	27 (19.40)	0 (3.45)	3 (2.12)	0 (.85)	0 (.05)	.717 (.630-.804)	.255	.028	8.353	.05	4
18	40	12 (16.92)	28 (18.20)	0 (4.88)	0 (0)	0 (0)	0 (0)	.650 (.544-.756)	.350	0	11.588	.01	1
23	30	9 (13.26)	21 (13.38)	0 (3.36)	0 (0)	0 (0)	0 (0)	.665 (.543-.787)	.335	0	7.436	.01	1
25	28	7 (10.95)	0 (13.13)	0 (3.95)	0 (0)	0 (0)	0 (0)	.625 (.495-.755)	.375	0	10.087	.01	1
26	40	22 (24.02)	18 (13.95)	0 (2.02)	0 (0)	0 (0)	0 (0)	.775 (.625-.877)	.225	0	3.666	.05	1
44	33	27 (27.19)	6 (5.51)	0 (0.26)	0 (0)	0 (0)	0 (0)	.908 (.762-.967)	.092	0	0.301	.50	1
58	48	38 (38.45)	10 (8.98)	0 (0.53)	0 (0)	0 (0)	0 (0)	.895 (.777-.954)	.105	0	0.648	.30	1
108	44	22 (24.77)	22 (16.50)	0 (2.73)	0 (0)	0 (0)	0 (0)	.750 (.658-.842)	.250	0	4.873	.03	1
115	41	17 (20.58)	24 (17.06)	0 (3.53)	0 (0)	0 (0)	0 (0)	.708 (.608-.808)	.293	0	6.978	.01	1
TOTAL	482	213 (250.54)	265 (191.06)	0 (36.44)	3 (2.70)	1 (1.06)	0 (.008)	.721 (.679-.759)	.275	.004	69.657	.01	4

Table 11-2. Protein systems surveyed with starch-gel electrophoresis.

PROTEIN	COMMENT
Tetrazolium oxidase (TO)	Polymorphic. Optimal resolution.
Malate dehydrogenase (MDH)	Polymorphic. Optimal resolution.
Phosphogulcomutase (PGM)	Polymorphic. Optimal resolution.
Lactate dehydrogenase (LDH)	Monomorphic. Optimal resolution.
Isocitrate dehydrogenase (IDH)	Monomorphic. Optimal resolution.
Sorbitol dehydrogenase (SDH)	Polymorphic. Poor resolution.
Phosphohexoisomerase (PHI)	Polymorphic. Poor resolution.
-glycerophosphate dehydrogenase (AGPDH)	Polymorphic. Fair resolution.
Alcohol dehydrogenase (ADH)	Monomorphic. Fair resolution.
Creatine kinase (CK)	Variability unknown. Poor resolution.
Esterase (EST)	Variability unknown. Poor resolution.
Glucose 6-phosphate dehydrogenase (G6PDH)	Variability unknown. Poor resolution.
Malic enzyme (ME)	Variability unknown. Poor resolution.
6-phosphogulconate dehydrogenase (6PGDH)	Variability unknown. Poor resolution.
Phosphomanoisomerase (PMI)	Variability unknown. Poor resolution.

Table 11-1. Sites, species and number of fish used for genetic studies.

Site No.	Site Name	Species	Approximate No.
4	Sungovoak Lake	Least Cisco	125
6	Tusikvoak Lake	Least Cisco	92
18	Pittalukruak Lake	Least Cisco	40
23	unnamed lake	Least Cisco	30
25	Lake Itinik	Arctic Grayling	23
		Least Cisco	29
26	Teshekpuk Lake	Arctic Grayling	36
		Least Cisco	40
		Broad Whitefish	42
44	unnamed lake	Least Cisco	33
58	unnamed lake	Least Cisco	48
60	Square Lake	Arctic Grayling	81
106	Inaru River	Arctic Grayling	46
108	Meade River	Least Cisco	44
110	Inaru River	Arctic Grayling	19
115	Chipp River	Humpback Whitefish	10
		Broad Whitefish	15
		Least Cisco	41
119	Fish Creek	Arctic Grayling	30
125	Kaolak River	Arctic Grayling	26
126	Judy Creek	Arctic Grayling	56
132	Colville River	Humpback Whitefish	46
		Broad Whitefish	25
		Round Whitefish	32
315	Ivisaruk River	Arctic Grayling	23

CHAPTER 11

GENETIC STUDIES OF FRESHWATER FISHES ON NATIONAL PETROLEUM RESERVE IN ALASKA

Carl V. Burger and Richard L. Wilmot
U.S. Fish and Wildlife Service

INTRODUCTION

Genetic studies of fish on the National Petroleum Reserve in Alaska (NPR-A) were initiated because land-use planners have no data base from which to evaluate the relative benefits of alternative land-use practices, or to evaluate the impact of energy development on fishery resources, which may be genetically unique. This study is designed to provide basic information regarding genetic variation within and between fish populations on the Reserve.

Classical taxonometric studies to separate fish stocks have been hampered by environmental influences on meristic characters during fish development. These effects have prevented investigators from specifying whether observed differences were genetic or environmental. With the recent use of starch-gel electrophoresis, the occurrence and frequencies of enzyme variants have been found to differ between and among groups of fish. Many of these variants have been shown to be heritable. Since enzymes and proteins are products of genes, any detectable electrophoretic enzyme variation provides biologists with a tool to estimate gene frequencies in groups of fishes. The frequencies can be used to test hypotheses concerning the breeding structure of a species. Also, the degree of genetic similarity within a species can be determined over a given geographic area to determine if reproductively isolated groups of fish are present. The objectives of the NPR-A genetic studies are to determine for land-use planners the degree of genetic similarity among and between fishes on NPR-A, and to determine whether unique and/or reproductively isolated stocks exist.

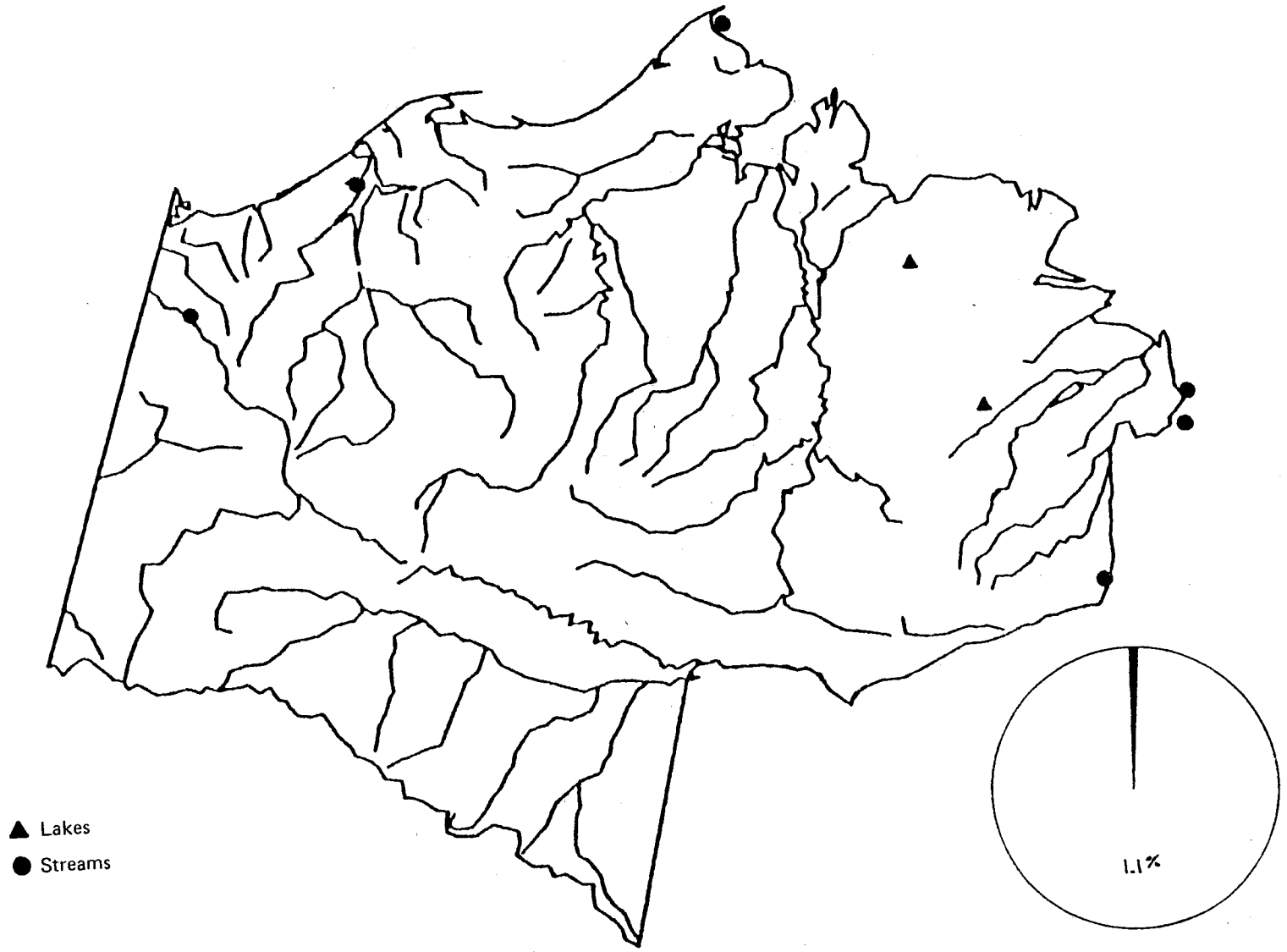


Figure 10-34. Map showing NPR-A distribution and relative abundance of Arctic cisco to other freshwater fishes in net catches, 1977-1978

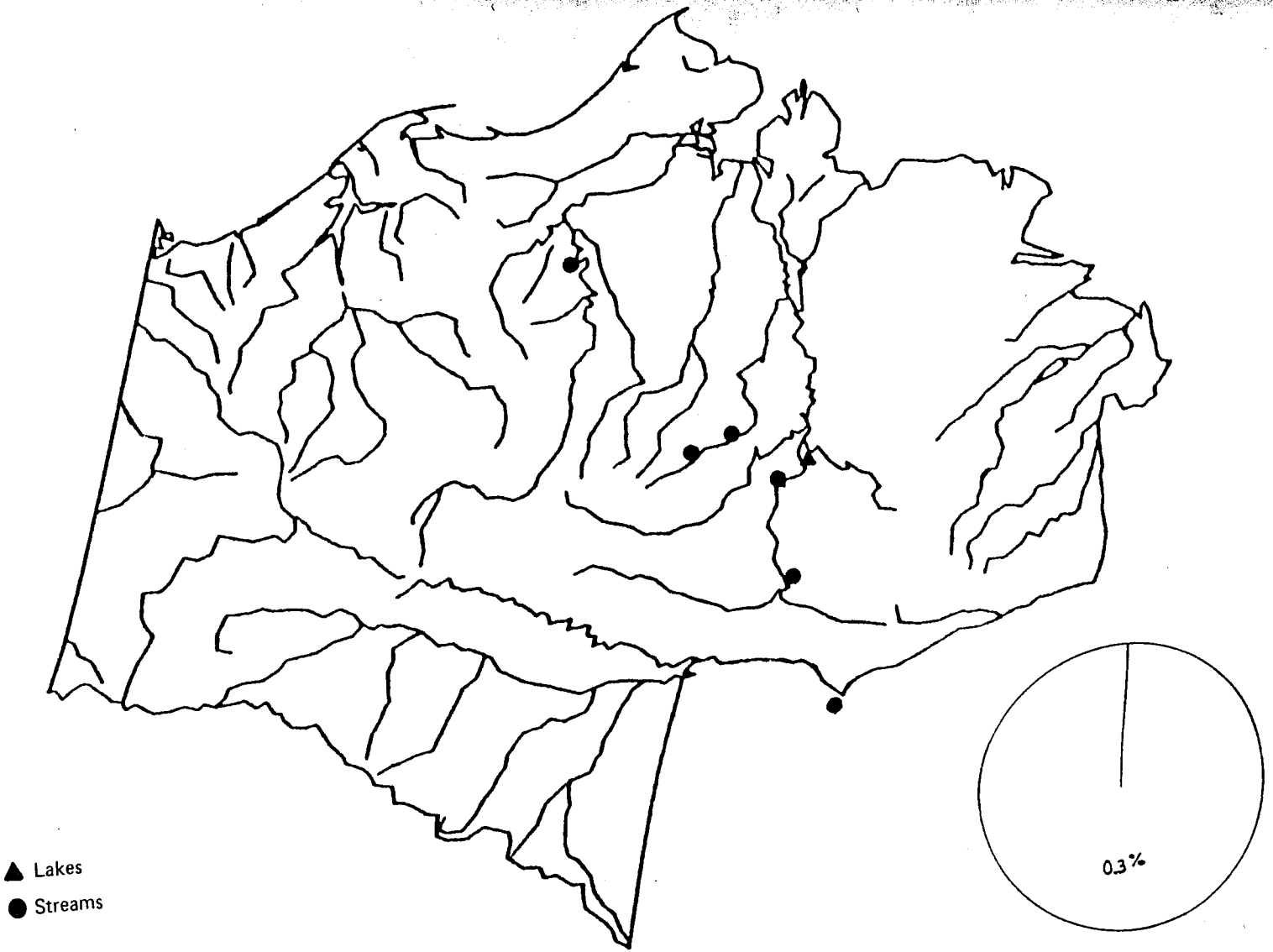
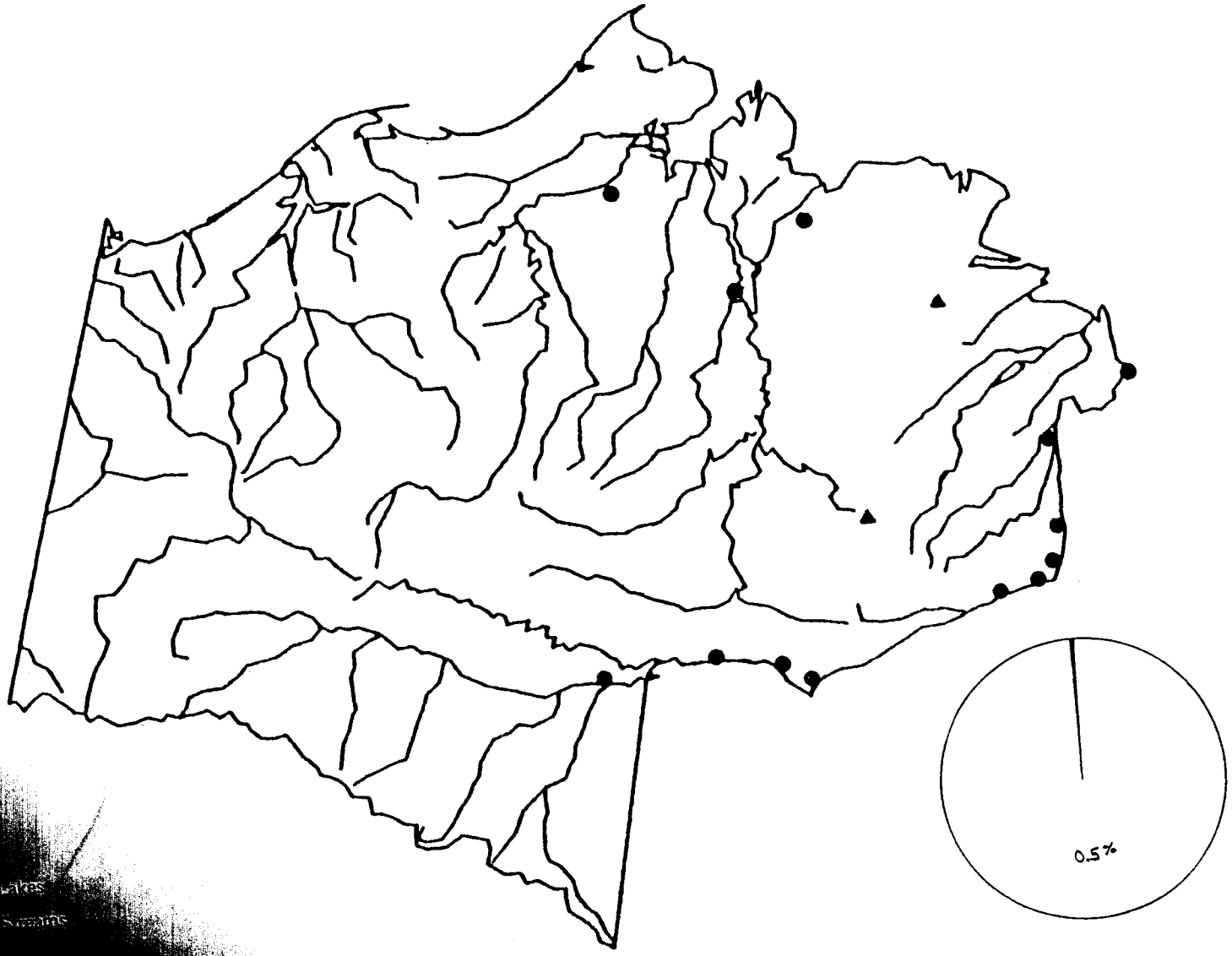


Figure 10-33. Map showing NPR-A distribution and relative abundance of northern pike to other freshwater fishes in net catches, 1977-1978



...owing NPR-A distribution and relative abundance of burbot to other freshwater
...net catches, 1977-1978

At the coastal plain sites, young fish ranging in total length from 29 to 99 mm (about 1 to 4 in) were not weighed (n = 779). Total lengths of fishes from 100 mm to 505 mm (about 4 to 20 in) averaged 316 mm [(about 12 in) n = 716]. Their weights ranged from 5 to 1,420 g (about 0.1 to 3.2 lbs) and averaged 289 g (about 0.6 lb). Weight/length curve for coastal plain fishes is shown in figure 10-29.

The sex ratio for 547 adult fish (male to female) was 1:1.5. Food items found in descending order of preference were dipteran larvae, copepods, dipteran adults, cladocerans and ninespine stickleback.

Burbot

Burbot range throughout the Colville River and its tributaries and are found in small numbers in the coastal plain streams and lakes (fig. 10-30). Most burbot were found in the middle and lower reaches of the Colville River. Burbot also inhabit lakes in the mountain region, but presumably were not captured at several sites because they are not readily caught by gill net which was the principal sampling gear. Burbot ranged in length from 55 to 915 mm (about 2 to 36 in) and averaged 658 mm (about 26 in). Weights ranged from 1.6 to 4,000 g (about 0.1 to 8.8 lbs) and averaged 1,724 g [(about 3.8 lb) n = 27]. Weight/length data are presented in figure 10-31, and growth plots are shown in figure 10-32. Seven percent of the burbot captured were immature, 39 percent had developing gonads and 54 percent were mature with redeveloping gonads. The male to female sex ratio of 27 burbot was 0.4:1.

Burbot are predominately piscivorous. Of 27 stomachs examined, 15 percent were empty and the remainder averaged one-fourth full. The following food items were taken in descending order of abundance: slimy sculpin, ninespine stickleback, round whitefish, grayling, caddis fly larvae and snails.

Northern Pike

Nine northern pike were captured at one lake and two streams (fig. 10-33). They ranged in total length from 118 to 80[illegible] in) with an average of 486 mm (about 19 in) and weighed

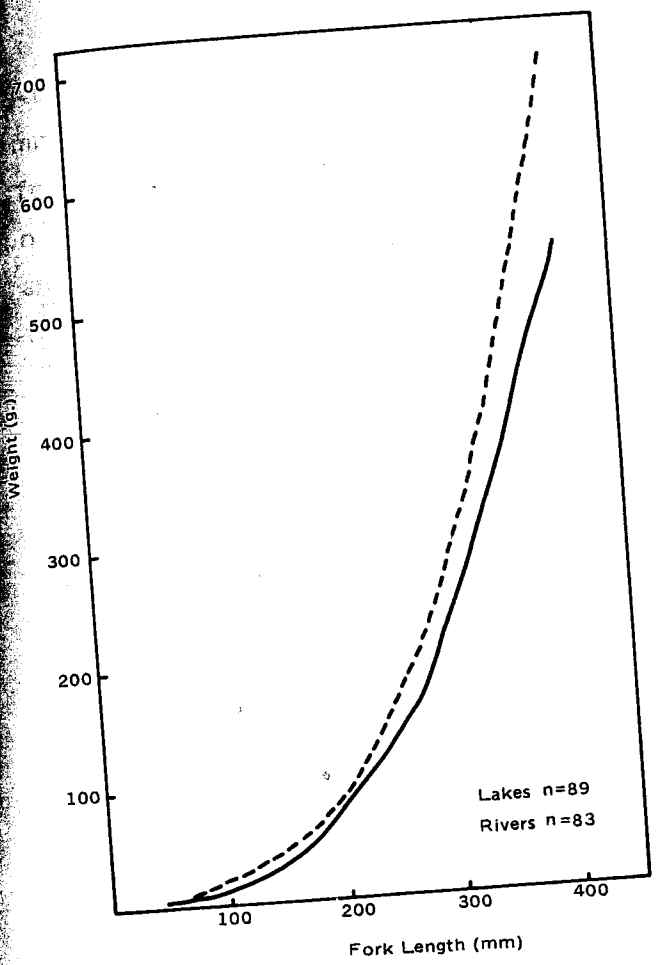


Figure 10-26. Graph showing length-weight plot for round whitefish from the Colville River, 1977

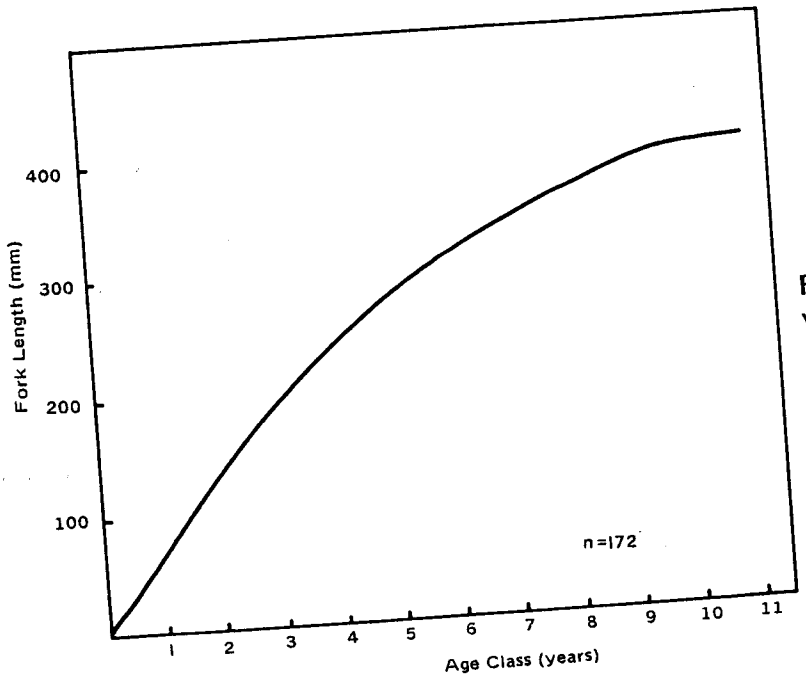


Figure 10-27. Graph showing growth of round whitefish the Colville River drainage, 1977

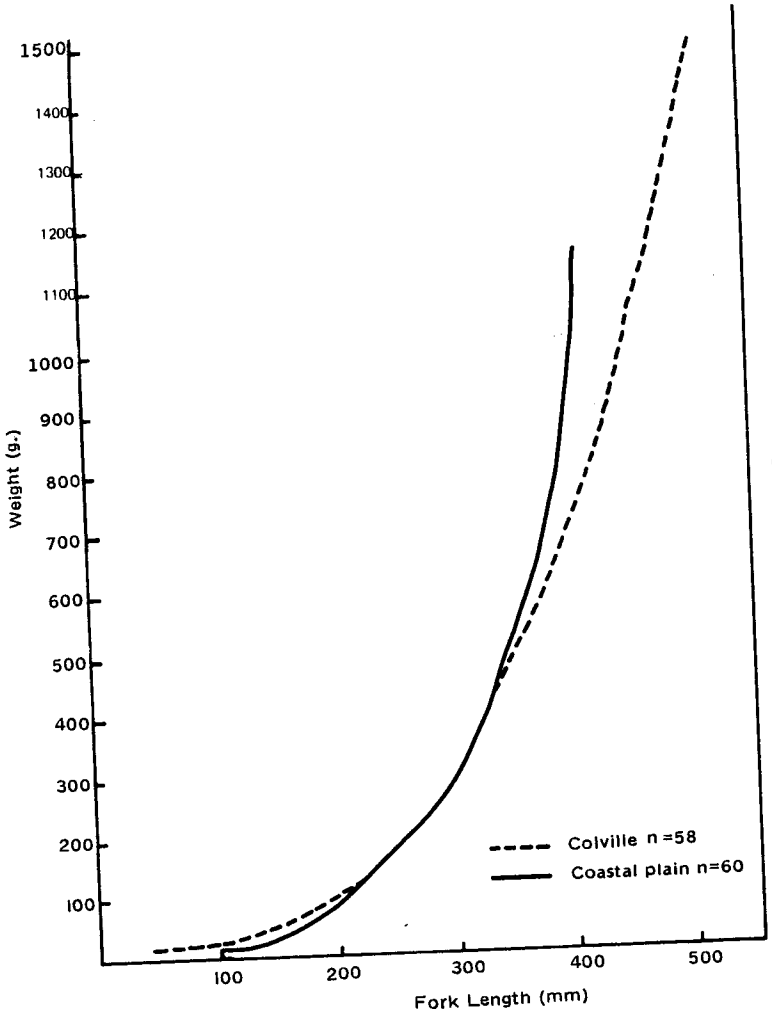


Figure 10-23. Graph showing length-weight plot for humpback whitefish from NPR-A 1977

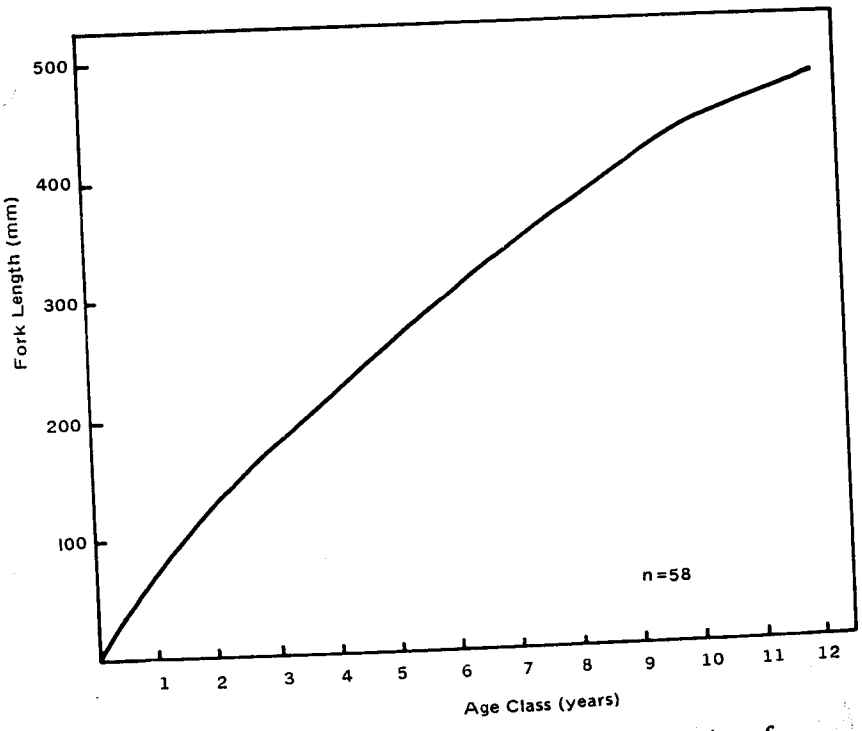


Figure 10-24. Graph showing growth of humpback whitefish captured in the Colville River drainage, 1977

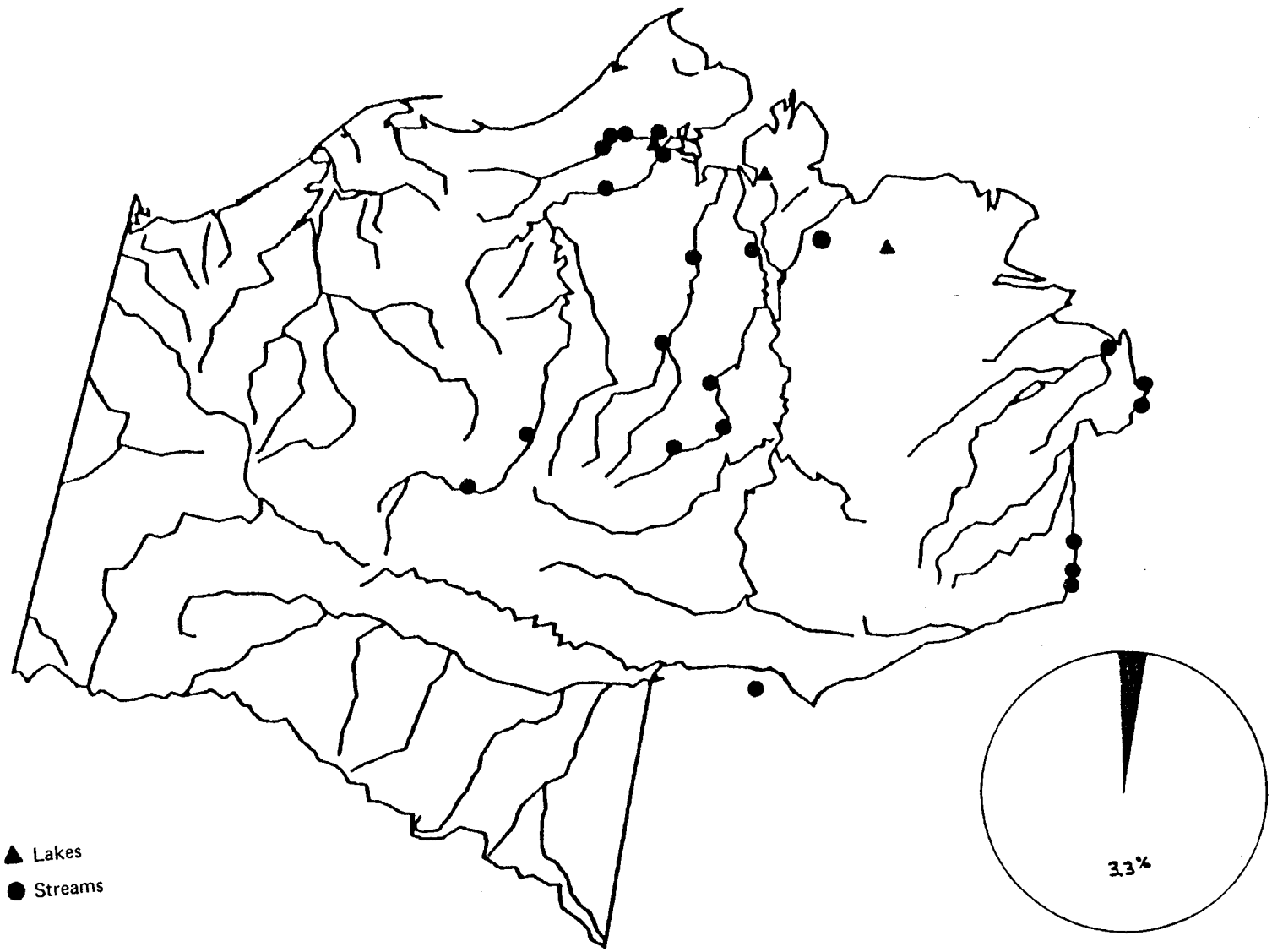


Figure 10-22. Map showing NPR-A distribution and relative abundance of humpback whitefish to other freshwater fishes in net catches, 1977-1978

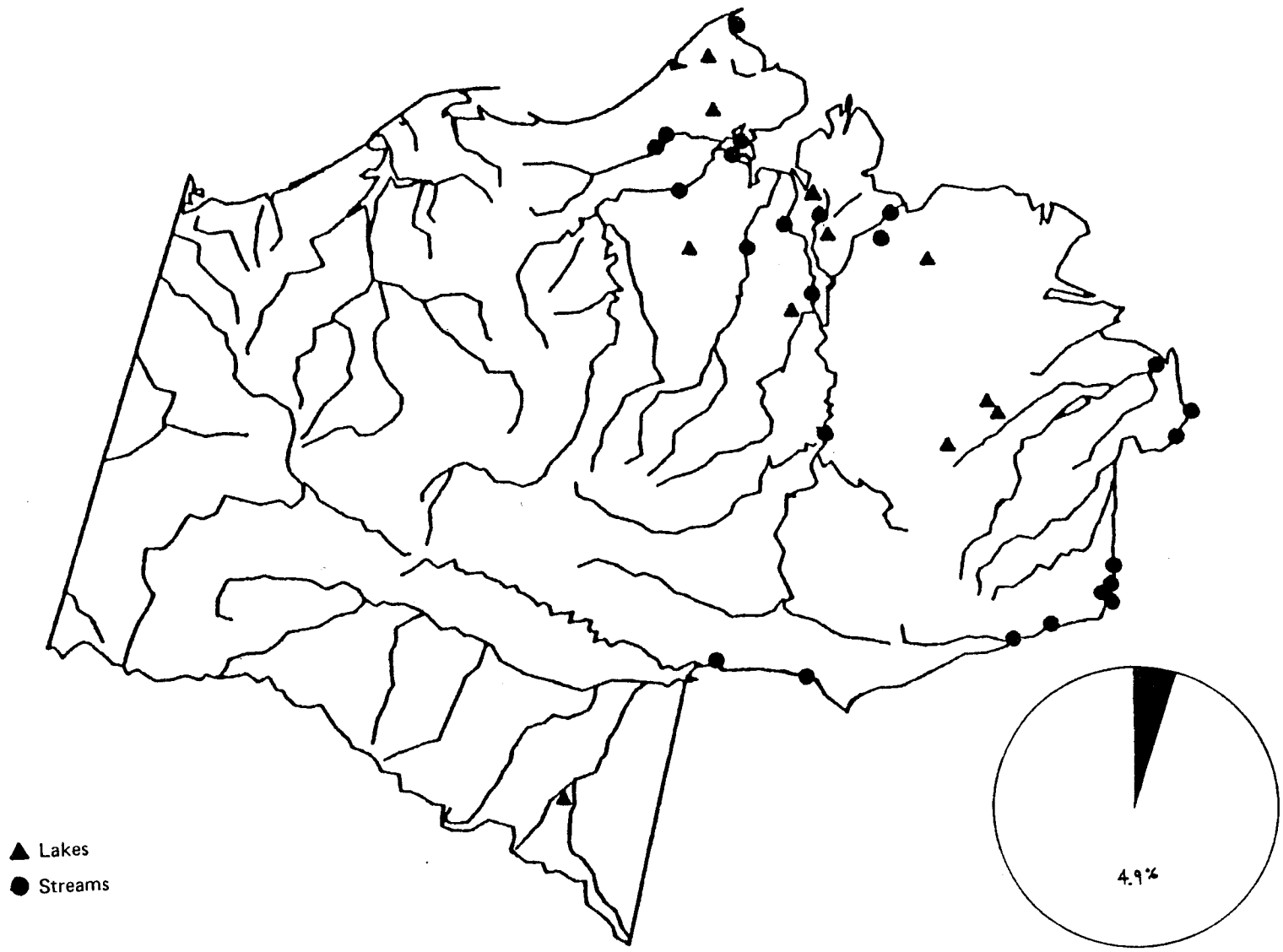


Figure 10-19. Map showing NPR-A distribution and relative abundance of broad whitefish to other freshwater fishes in net catches, 1977-1978

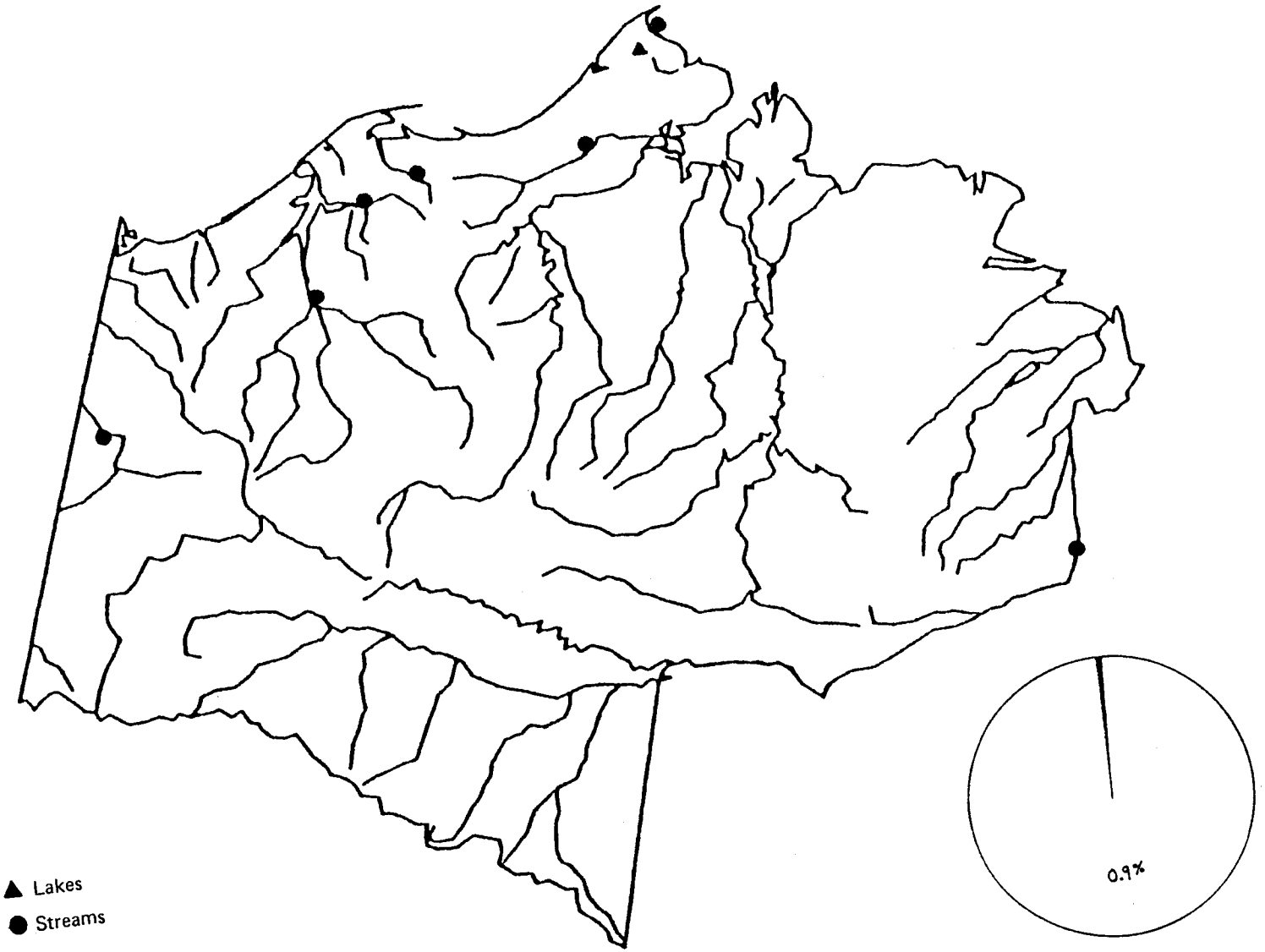


Figure 10-18. Map showing NPR-A distribution and relative abundance of chum salmon to other freshwater fishes in net catches, 1977-1978

Grayling ranged in weight from less than 1 to 1,040 g (about 0.1 to 2.3 lb) with an average of 322 g [(0.7 lb) n = 322]. Immature fish accounted for 49 percent of the catch, and the male to female sex ratio of 198 adults was 1:1. Weight/length relationships are shown in figure 10-16.

Throughout the study area, grayling were opportunistic feeders. Of total stomachs examined an average stomach was half full. The following food items were found in descending order of abundance: caddis fly larvae, chironomid larvae, terrestrial and aquatic beetles, aerial insects, snails, bivalves, amphipods and ninespine stickleback.

Salmon

Small runs of pink and chum salmon ascend the Colville River as far as Umiat (figs. 10-17,10-18). Sixty-four pink salmon and 29 chum salmon were captured during the first two weeks of August 1978 between the Itkillik River and Umiat. One chinook salmon was captured in the Kuk River drainage in July 1978. All of the pink salmon were in spawning condition. They averaged 503 mm (about 20 in) in length (mid-eye to fork) and 1,575 g (about 3.5 lb) in weight.

Pink and chum salmon were captured in the Kuk River in August 1977 and July 1978. Additional pinks were collected from the Utukok, Kokolik, Chipp and Meade Rivers, and chums were taken in the Kokolik and Inaru. All of the fish captured were spawning adults. Seventy-nine pink salmon ranged in total length from 464 to 590 mm (about 18 to 23 in) and average 502 mm or (about 22 in). Weight ranged from 900 to 2,130 g (about 2 to 4.6 lb) with an average of 1,518 g (about 3.5 lb). Twenty-five chum salmon ranged in total length from 430 to 743 mm (about 17 to 29 in) and averaged 650 g (about 25 in). Weight ranged from 2,300-4,130 g (about 5.1 to 9.1 lb) with an average of 3,048 g (about 6.6 lb). The sex ratio of males to females was 1:1.

Broad Whitefish

Broad whitefish range throughout the Colville River drainage, and small numbers were found at stream and lake sites on the coastal plain

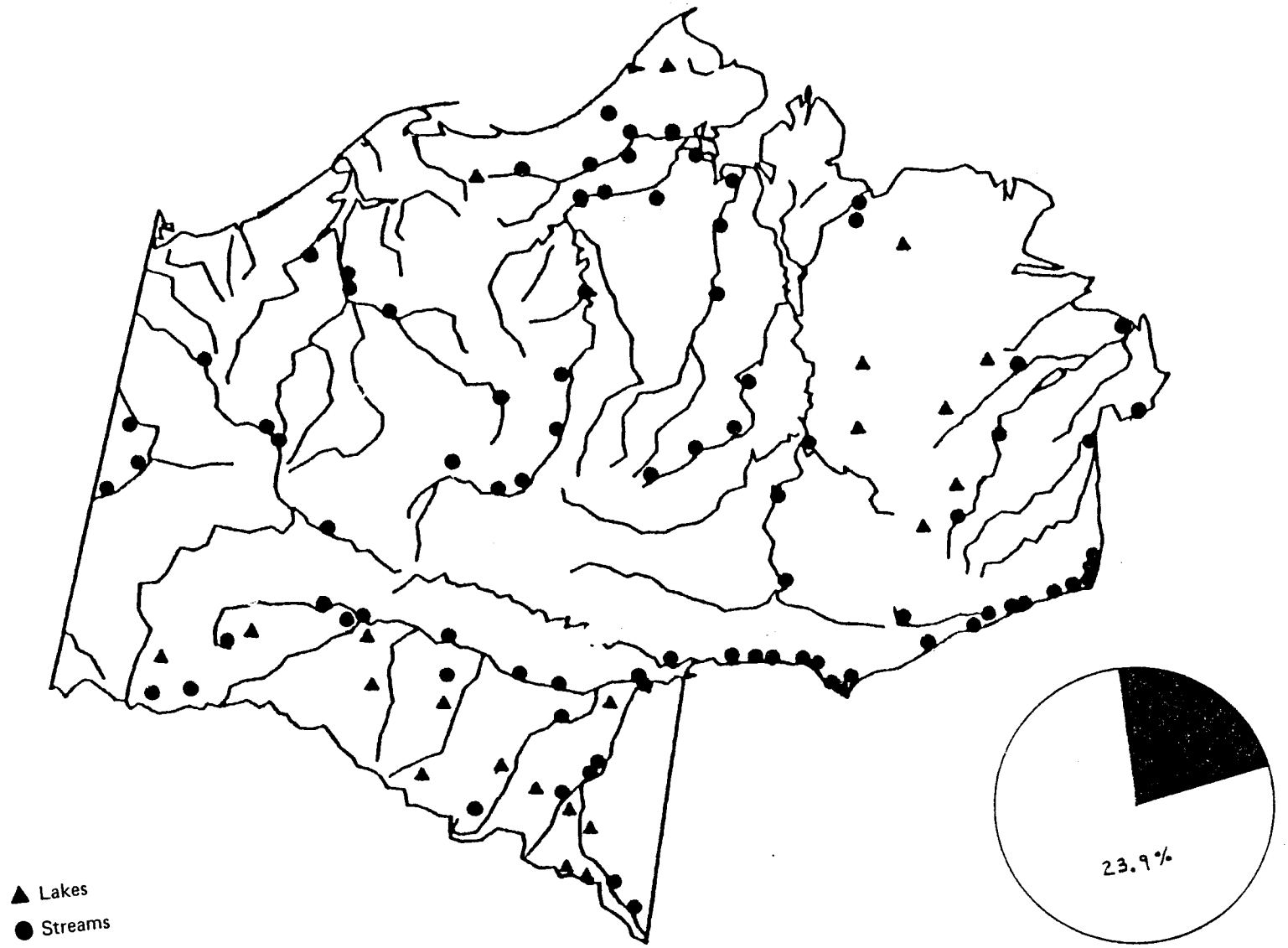


Figure 10-14. Map showing NPR-A distribution and relative abundance of Arctic grayling to other freshwater fishes in net catches, 1977-1978

Fifty-one percent of the Colville drainage lake trout stomachs examined were empty. Of those stomachs that contained food, the following items in descending order of frequency were found: least cisco, snails, aerial insects, round whitefish, slimy sculpin and voles.

Arctic Char

Small numbers of Arctic char range throughout the Colville River drainage (fig. 10-13). Few Arctic char were captured in the Colville River upstream from Umiat, and they were absent from all of the lakes surveyed within the study area. Most Arctic char were captured near the Colville River confluences with the Anaktuvuk and Chandler rivers, and it appears that a small run of anadromous char enters the Chandler and Anaktuvuk rivers in mid-August.

Fourteen anadromous Arctic char were captured between the Anaktuvuk River mouth and Umiat. Char ranged in length from 354 to 587 mm (about 14 to 23 in) and weighed from 410 to 2,200 g (about 8 to 4.9 lb). All but one were female. All of the char sampled had empty stomachs.

Grayling

Arctic grayling are the most abundant and widespread fish species within the Colville drainage, inhabiting both lake and stream areas (fig. 10-14). Fork lengths ranged from 46 to 470 mm (about 2 to 18 in) and averaged 311 mm [(about 12 in) n = 122]. Age data are shown in figure 10-15. Colville grayling ranged in weight from 1.0 to 1,300 g (about 0.1 to 1.9 lb) and averaged 465 g (about 1 lb). Immature grayling accounted for 10 percent of the total catch. Developing fish accounted for 30 percent of the catch, and mature fish with redeveloping gonads accounted for 60 percent of the catch. The male to female sex ratio of 118 grayling was 0.5:1.

Moderate numbers of grayling are found throughout the lakes and streams of the coastal plain. Larger numbers of adults and young were captured at the river sites, and spawning grayling were often found at the outlets of large lakes. Total length measurements at those sites ranged from 25 to 497 mm (about 1 to 19 in) and averaged 303 mm [(about 12 in) n = 298].

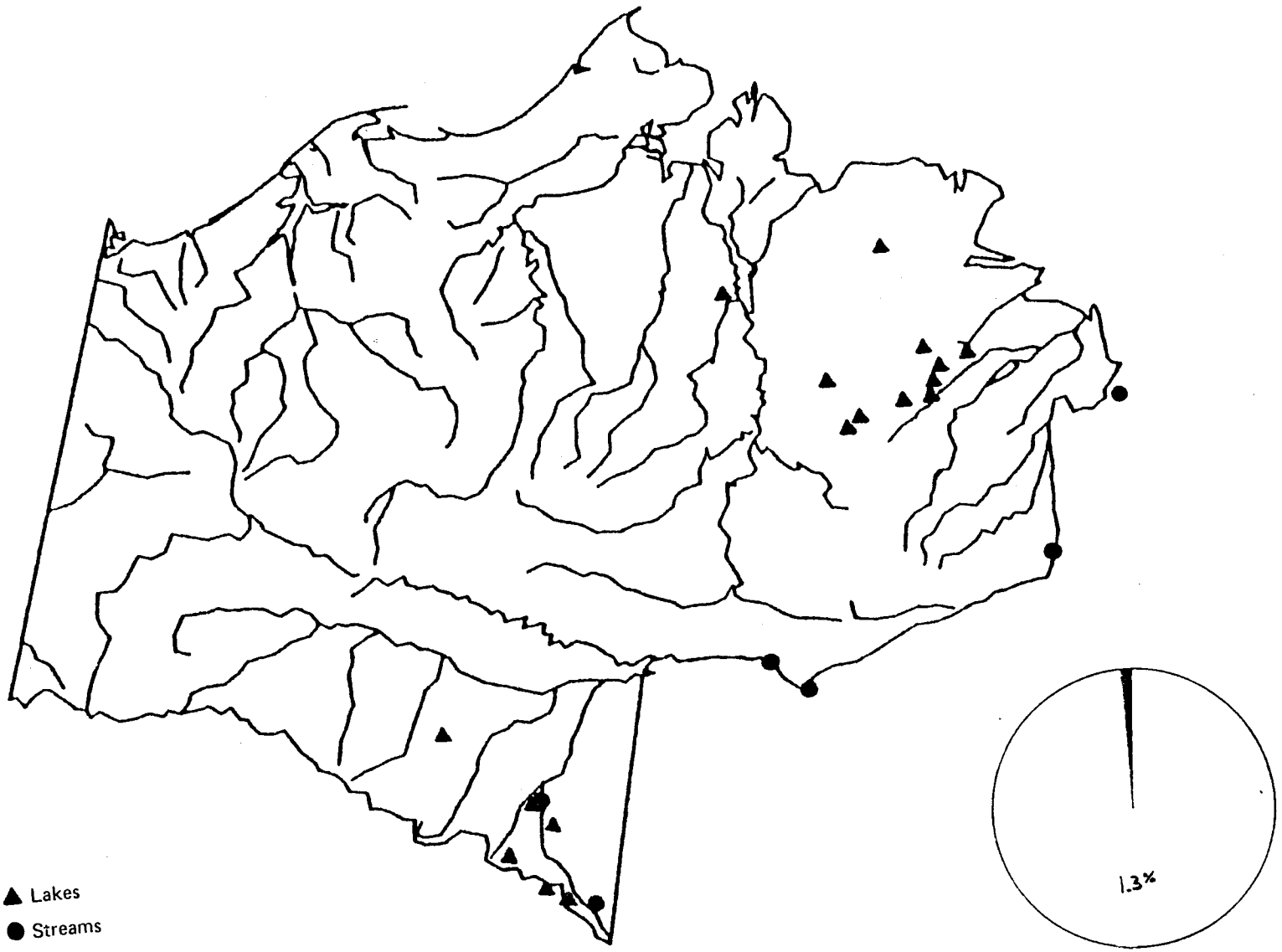


Figure 10-10. Map showing NPR-A distribution and relative abundance of lake trout to other freshwater fishes in net catches, 1977-1978

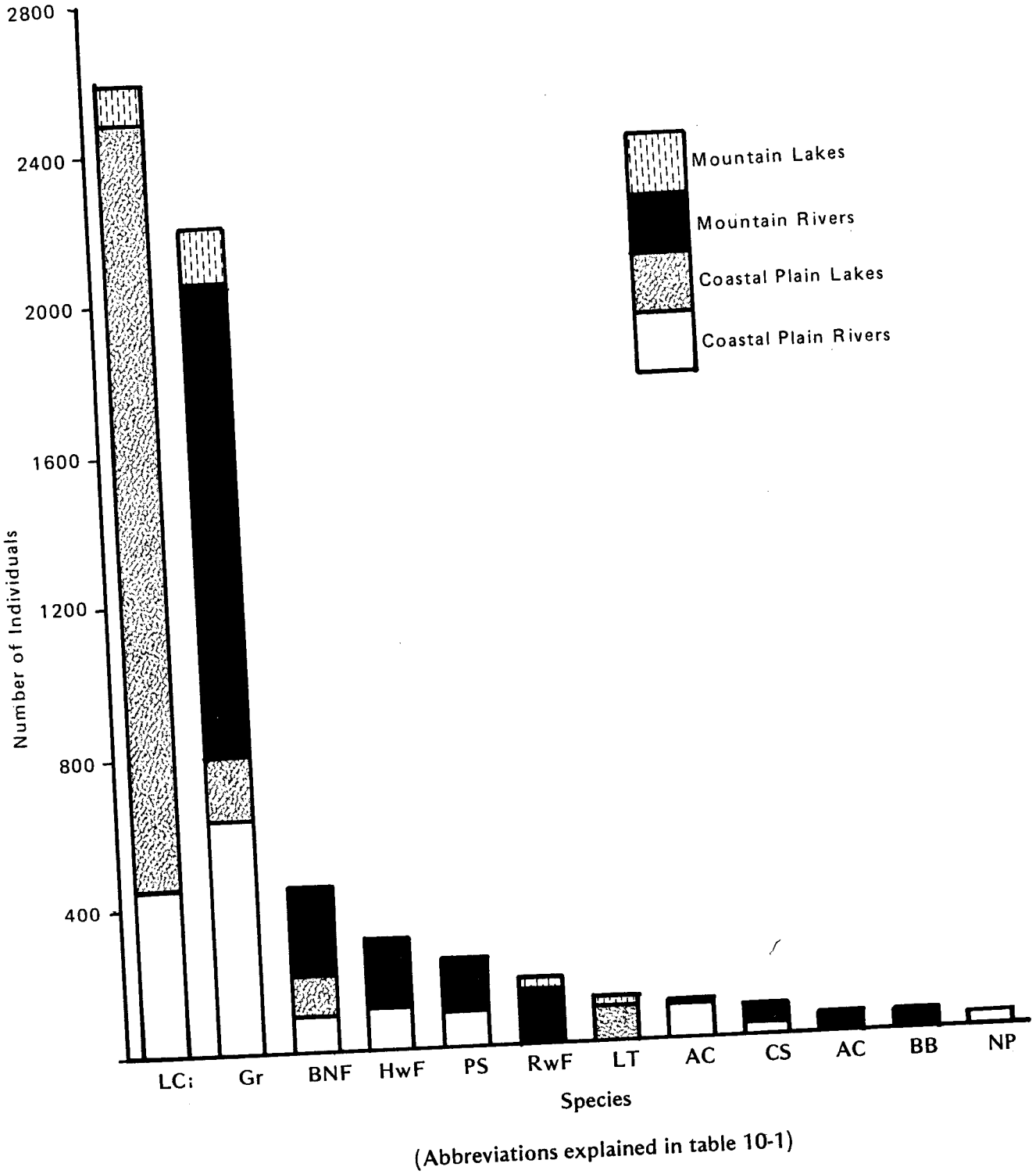


Figure 10-8. Graph showing number of individuals from selected fish species captured in NPR-A during the open water season, 1977-1978

lakes sampled, 31 contained no fish. Forty-two sites had organic mud or fine sand substrates and 46 had no outlet or inlet. Shallow lakes with spawning substrates that had an inlet or outlet usually contained several species of fish, thus supporting the concept that shallow water does not limit habitat use during the open water season if escapement is possible prior to freeze-up.

Lakes not less than 6 ft (2 m) deep and having suitable spawning substrates appeared to support the larger and most diverse populations on the basis of our samples. Of 43 lakes in this class, 39 contained fish. Lakes ranging in depth from 6 - 66 ft (2 - 21 m) and having outlets contained all but two of the 14 species found during the lake surveys (fourhorn sculpin and northern pike). Lakes ranging from 9 - 23 ft (3 -7 m) deep, without outlets, may contain resident populations of lake trout, Alaska blackfish, and northern pike.

The sampling period for the lake surveys must also be considered. Forty-six sites were sampled from July 9-29, 1977 and 1978, during which 26 contained no fish and only nine contained fishes other than ninespine stickleback. This is contrasted to the remaining 42 sites sampled between July 31 and August 20 in 1977, of which three contained no fish and 34 contained fish other than ninespine stickleback. No inferences are drawn concerning periodicity at this time; we only wish to identify potential biases in the 1977-1978 sampling program. Since fish move from lake to stream and vice versa during distinct periods for spawning and feeding, it is possible that fish moved into areas in August after they were surveyed in July. Dates of sampling are shown in table 10-2.

Life History Information

Twenty species of fish were captured from the Colville River Drainage, the coastal plain and foothills of NPR-A. Arctic char, which were found in the Colville drainage, were not captured outside of that system, except for one small specimen captured in the Kokolik River immediately outside of NPR-A.

Ninespine stickleback is the most widespread species in the coastal study area, followed in decreasing order by least cisco, grayling and broad white-

Table 10-5. NPR-A lakes surveyed but not sampled in 1977 due to shallow water and lack of inlets and outlets. All of these sites were considered to be marginal or unsuitable fish habitat.

Site No.	Name	North Latitude	West Longitude
1	Puddin Lake	69°23'	153°27'
2	Maybe Lake	69°18'	153°26'
3	Unnamed	69°12'	153°15'
4	Issygok Lake	68°03'	155°44'
5	Unnamed	68°39'	155°48'
6	Unnamed	69°01'	158°23'
7	Unnamed	69°08'	158°23'
8	Unnamed	68°33'	156°03'
9	Unnamed	68°31'	156°23'
10	Unnamed	68°29'	156°21'
11	Unnamed	68°16'	156°23'
12	Nigitun Lake	68°13'	156°53'
13	Battery Lake	68°40'	156°58'
14	Unnamed	68°43'	157°30'
15	Unnamed	68°47'	158°32'
16	Migrant Lake	68°49'	158°58'

rivers has less relief and stream gradient is lower than areas upstream. Fish appear to use this part of the rivers for migration. Water temperature is within a few degrees of the ambient air temperature, and flow is greater than in the upper rivers.

In the lower one-third of the rivers, meanders are more common. Here, willows are short, 1 ft (0.3 m) or less, and the shoreline vegetation is composed primarily of sphagnum moss. Large extensive sandbars and dunes are common on the inside curves of the meanders, and steep banks higher than 31 ft (10 m) occur on the outside curves. The river bottom is largely shifting sand, and water flows are greater than upriver. Grayling and humpback whitefish are common throughout these sections, although not in large numbers.

River deltas also have shifting sand bottoms. Here, little vertical relief is noticed for the rise is approximately 3 ft (1 m) from the water surface to the top of the bank. During the open water season flows are swift, and water color has a milky appearance due to a large load of fine sediment.

During the 1978 survey period fish were abundant in lower portion of rivers. Least cisco and broad whitefish dominated the catches, and grayling and humpback whitefish were common. Fourhorn sculpin were also captured here.

Grayling were found throughout the coastal plain, but with a greater frequency in upper stream sections in the eastern half of the reservation. Sculpin were captured frequently and were usually associated with a sandy to rock substrate in cool flowing waters. Least cisco were the most common fish, being taken most often from the lower sections of larger streams. Other whitefish (broad and humpback) were found in Beaufort Sea drainages, commonly in lower watercourse areas. Pink and chum salmon were found principally in Kuk River tributaries, pink salmon were collected in the Chipp and Meade Rivers, and chum in the Inaru River. Other significant but numerically minor captures included burbot, northern pike, chinook salmon and longnose suckers. Arctic flounder and rainbow smelt were taken at the mouth of two streams in brackish water. Fourhorn sculpin were found at five sites in coastal proximate waters varying in salinity from 0 to 3.2 g/L.

confluence of Carbon Creek. Tributaries to the Utukok, other than Carbon Creek, appear to be poor or unsuitable habitat for the fish species present.

Kokolik River

The Kokolik River flows in a northerly and westerly direction for approximately 185 mi (298 km). It originates in the western Brooks Range and enters the Chukchi Sea of the Arctic Ocean at Point Lay. The Kokolik is the twelfth largest stream on the North Slope, with an average annual estimated flow of 1,175 ft^3/s (33 m^3/s).

The fisheries survey of the Kokolik River began on July 13, 1978, at a point approximately 10 mi (16 km) north of Kokolik Lake, and was completed on July 20 approximately 35 river mi (56 km) from the coast.

Above Avingak Creek, the Kokolik flows alternately through a series of small valleys and three sets of ridges and hills. Braided channels are relatively less frequent here than in other North Slope rivers. The gravel bars in the valleys consist of large, angular stones at the upper ends grading to large gravel where the river enters the next section of incised channels and ridges. In the incised channels, the riverbed consists of large, angular rubble and boulders, many of which protrude at low water. The river flows over several low bedrock ledges, which are usually evidenced by a line of broken rock extending across the stream. Downstream from Avingak Creek, the river meanders through flat tundra to the coast. Gravel size gets progressively smaller, and there are many long, shallow straight stretches of water.

The greatest water depth was observed in the incised channels of the upper reaches, where some pools against rock faces were up to 16 ft (4.9 m) deep. Water depths in the lower reaches and in the upper valleys rarely exceeded 7 ft (about 2 m) where measured. The water was a transparent green during the survey period, and for a short time it became turbid green in response to local thundershowers. There was very little aquatic vegetation except for algal slime on rocks in the incised channels. Water beetles and stonefly larvae were abundant in some stretches of the river.

Five species of fish were captured or observed in the river. Grayling were

captured and were spawning throughout the lower river. There appears to be no suitable overwintering habitat in the Ipnavik River.

Kuna River

The Kuna River is approximately 50 mi (80 km) in length and drains 753 mi^2 (1,950 km^2). It is accessible by jet boat to its confluence with Swayback Creek. Riverbed material is large and angular above Swayback Creek and consists of well-sorted medium gravel in the lower reaches. Shallow pools and riffles are common. During the time of our survey (June 17-19, 1978), the Kuna was high and slightly turbid. Grayling were the only fish captured, and they were spawning throughout the lower river. There appears to be no suitable overwintering habitat in the Kuna River.

Kiligwa River

The Kiligwa River is 47 mi (76 km) long and drains 575 mi^2 (1,489 km^2). The mouth and lower 2 mi (3 km) of the Kiligwa are braided. The remainder of the Kiligwa is incised and bordered by low cliffs. The river cuts down to bedrock at several locations and few gravel bars exist along the main channel above the lower 2 mi (3 km). The Kiligwa is accessible by jet boat up to the confluence of Jubilee Creek. During the survey there was an airstrip and several cat trains (G.S.I.) on the east bank near the mouth and an old exploration camp (Brady) approximately 8 mi (13 km) upstream on the west bank. Grayling were the only fish captured during June 19-20, 1978. There are holes up to 15 ft (5 m) deep along cutbanks in the lower river; however, the Kiligwa is probably poor or unsuitable overwintering habitat.

Nuka River

The Nuka River is 47 mi (76 km) long and drains 607 mi^2 (1,572 km^2). It is the uppermost located tributary to the Colville and was discharging more water than the upper Colville at the rivers' confluence during the time of our survey (June 20, 1978). The Nuka River has a single incised channel in the lower reaches and few gravel bars that were composed of large, angular material. Grayling were the only fish captured in the Nuka River

Table 10-4. Numbers of principal fish species captured in the Colville River during fall and spring of 1977 and 1978.

Species	Numbers of Fish Captured		
	October	March-April	Total
Grayling	187	169	356
Broad Whitefish	25	7	32
Round Whitefish	15	3	18
Burbot	12	9	21
Longnose sucker	2	12	14
Total	241	200	441

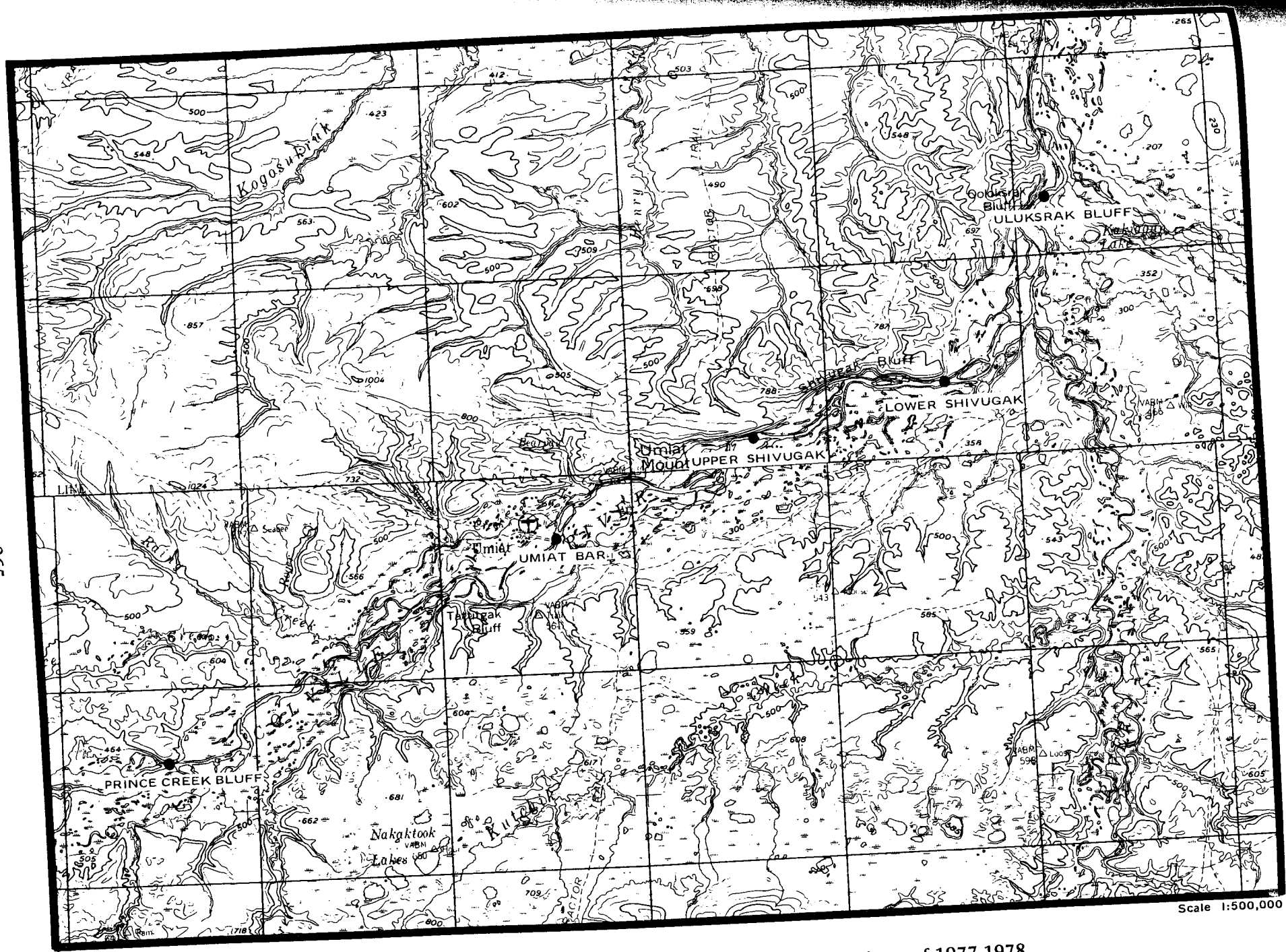


Figure 10-7. Colville River under-ice netting sites sampled during winter of 1977-1978

All of the species captured appear to spawn, rear, and overwinter in this reach of the Colville or its tributaries. The Anaktuvuk and Chandler rivers have several springs where considerable aufeis forms in their upper reaches, and both rivers support small runs of anadromous Arctic char. Few Arctic char were captured in the Colville above the confluence with the Chandler River. Most of the spawning pink salmon appear to have a wider distribution and spawn throughout the main river up to Umiat and possibly some distance beyond. Other tributaries draining into Section 2 of the Colville that are important summer fish habitat include the Kikiakrorak and Kogosukruk Rivers and Seabee, Rainy, Prince, Fossil and Ninuluk Creeks.

There were no subsistence, commercial or sport fishermen observed in Section 2 during the river trips (July 1977, August 1978); however, there was evidence of past fish camps at three locations on the Colville below the Kikiakrorak River.

Section 3

Section 3 of the Colville River extends approximately 195 mi (314 km) from the Killik to the Etivluk River. This section of the Colville is a single channel meander with numerous oxbows, lakes and ponds in a relatively narrow valley. It is bounded by foothills to the south and Knifeblade Ridge to the north and has three major tributaries (Oolamnagavik, Kurupa and Awuna Rivers). Gravel bars are numerous in Section 3; however, deep pools providing overwintering habitat are not as abundant as in Section 2. Grayling and longnose sucker were the most widespread species captured in Section 3. Least and Arctic cisco were not captured in this section, and all sampling was conducted too early in the year to determine the presence or absence of salmon.

Section 4

Section 4 is the Colville River above the confluence of the Etivluk River. The lower part of this section (Etivluk to Ipnavik Rivers) is heavily braided with bottom material of sand and medium size gravel. The middle section (Ipnavik to Kuna Rivers) is a single channel meander that flows through a broad valley with many connected sloughs and oxbow lakes. The

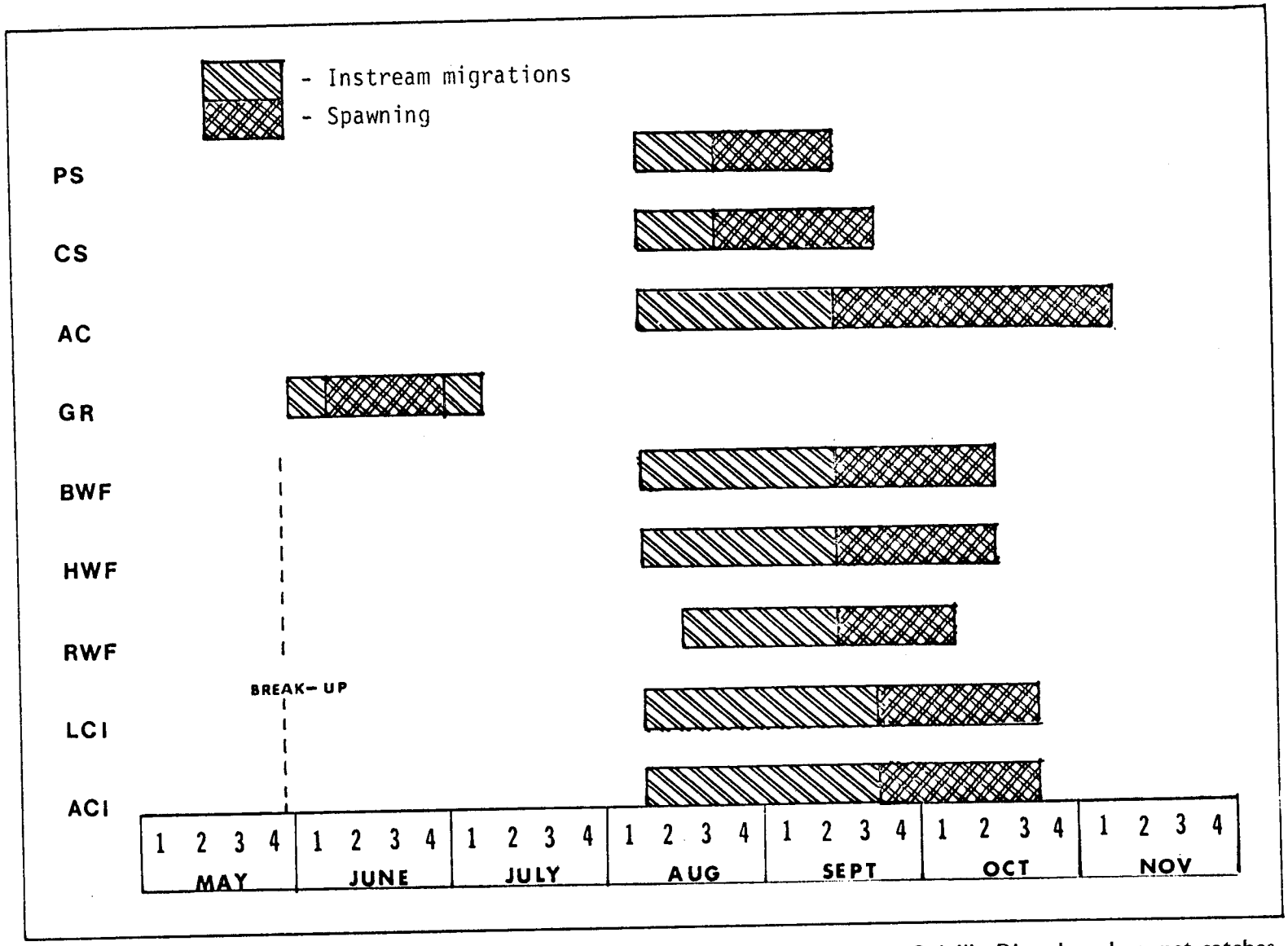


Figure 10-5. Preliminary migration timing and spawning of principal species in the Colville River based on net catches at Umiat during 1977. Information on the timing of whitefish spawning is incomplete at this time.

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
359	Utukok River	July 5	No Fish
360	Kuna River	June 18	Gr
361	Colville River	June 18	LNS, Gr
362	Colville River	June 18	Gr
363	Ipnavik River	June 21	Gr
364	Kuna River	June 17	Gr
365	Swayback Creek	June 17	Gr
366	Ipnavik River	June 21	Gr
367	Itkillik River	August 12	PS, LCi, RWF, Gr, BWF, HWF
368	Kikiakrorak River	August 11	CS, AC, PS, LCi, Gr, BWF, HWF
369	Kogosukruk River	August 14	HWF, Gr, AC, BWF, PS
370	Colville River	August 13	HWF, BWF, Gr, CS, AC, BB, RWF, LNS, LT
	1978-LAKES		
1	Ikroavik	August 4	ACi, NSB
4	Sungovoak	July 9	LCi, BWF
18	Pittalukruak	July 10 July 22	FSc, BWF, LCi Gr, LCi
25	Itinik	September 21	No Fish
45	Unnamed	July 18	LCi, LT
56	Unnamed	July 16	LCi, LT, BWF
401	Unnamed	July 19	Gr

Table 10-2. Continued

1977-STREAMS

Station Number	Name	Survey Date	Species Captured
154	Nucleus Creek	August 20	Gr
155	Etivluk River	July 13	Gr
156	Betty Lake inlet	August 7-9	Lt, Gr
157	Betty Lake outlet	August 7	No Fish
158	Ipnavik River	August 25	Gr
159	Unnamed	August 9	No Fish
160	Etivlik Lake outlet	August 10	Gr, SSc

1978-STREAMS

Station Number	Name	Survey Date	Species Captured
112	Kugrua River	August 7	PS, CS, LCi, FSc
300	Inaru River	July 19	Gr, LCi, BWF, HWF
301	Smith River	August 1	AC, LCi
302	Inaru River	July 25	Gr, BWF, HWF, CS
303	Topagoruk River	July 14	LCi, HWF, Gr
304	Inaru River	July 20	Gr
305	Meade River	July 26	HWF, LCi, Gr
306	Chipp River	July 10	LCi, BWF
307	Kungok River	July 20	No Fish
308	Meade River	July 20	Gr, LCi
309	Topagoruk River	July 13	Gr, HWF, BWF
310	Kuk River	July 21	ACi, AF

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
120	Ublutuoch River	August 13	Gr, NSB, SSc
121	Avak inlet	July 18	RSM, NSB, SSc
122	Avak River	July 18	NSB
123	Avalik River	July 30	LCi, Gr, NSB, SSc
124	Utukok River	July 19	NSB, SSc
125	Kaolak River	July 30	Gr, NSB, SSc
126	Judy Creek	August 11	Gr, SSc
127	Kogosukruk Creek	July 9	RWF, AC, Gr, NSB, SSc, LS, BB
128	Oumalik River	August 16	HWF, Gr, NSB, SSc, NP
129	Ikpikpuk & Price Rivers	August 15	Gr, SSc
130	Judy Creek	August 9	Gr, NSB
131	Utukok River	July 19	Gr, NSB, SSC
132	Colville River II	June 14	BWF, RWF, AC, Gr, SSc, LS, BB
133	Anaktuvuk River	August 22-24	BWF, RWF, AC, Lt, Gr, SSc, LS
		July 9	BWF, RWF, AC, Lt, Gr, SSc, LS
134	Colville River II	August 22-25	BWF, HWF, PS, CS, RWF, AC, Gr, LS
135	Chandler River I	June 12	BWF, HWF, AC, Gr
		August 24	RWF, AC, Gr, SSc, LS, BB

Volume 25 Study G-I

STATE OF ALASKA
Bill Sheffield, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF ARCTIC AREA WATERS

By

Terrence N. Bendock and John Burr

ALASKA DEPARTMENT OF FISH AND GAME
Don W. Collinsworth
Commissioner

SPORT FISH DIVISION
Richard Logan, Director

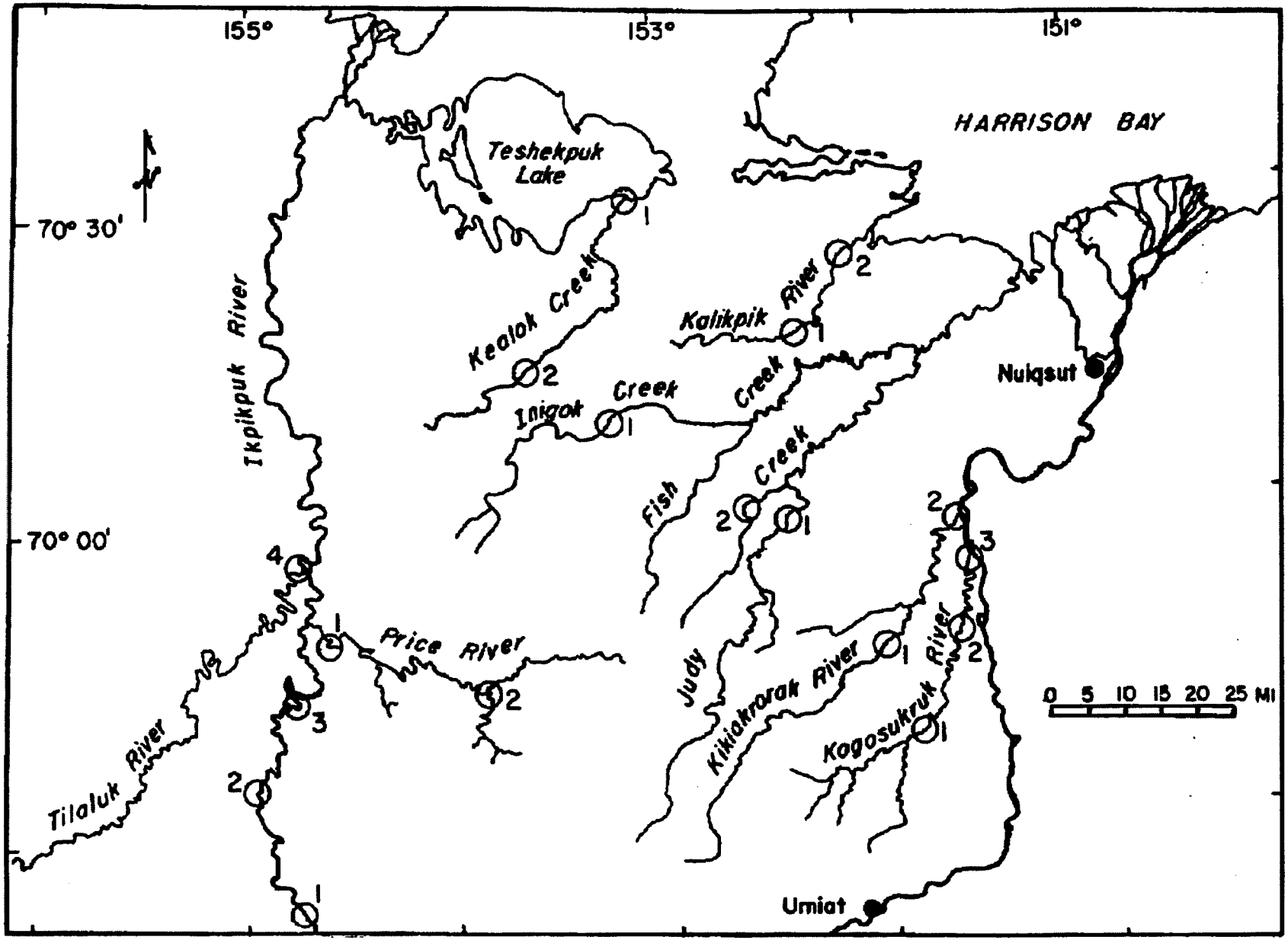
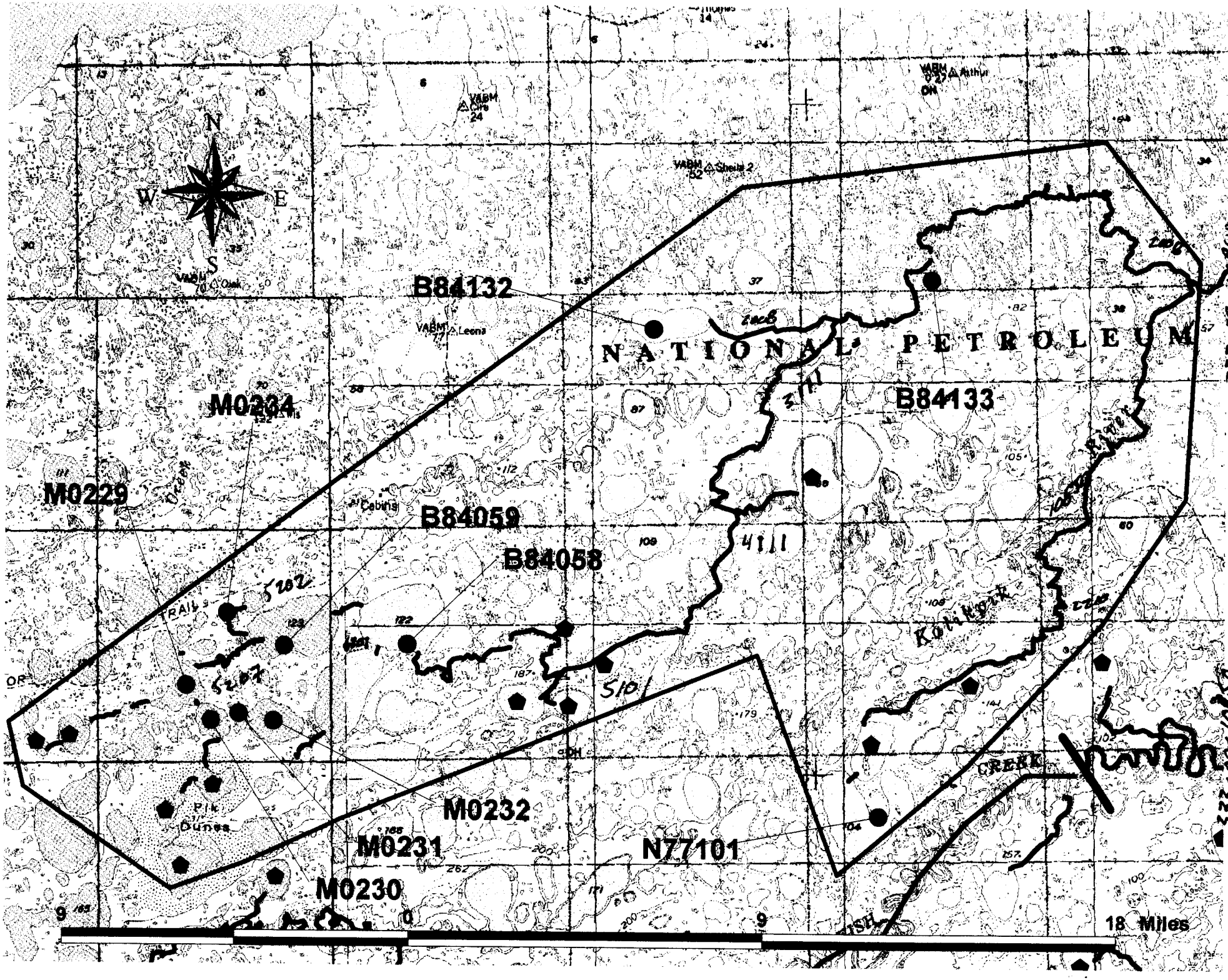


Figure 11. Central Coastal Plain of North Slope showing locations of stream sampling sites.

Table 10. Location, width, depth, pH and species present at coastal plain stream survey sites, 1983.

Stream Site	Location	Approx. Width (ft)	Maximum Depth (ft)	pH	Species Present
Ikpikpuk R. #1	69° 33' N, 154° 44'W	...	...	8.0	GR, NP, SSC, NSB
Ikpikpuk R. #2	69° 36' N, 154° 56'W	150	10	8.0	BB, GR, HWF, LNS, NP
Ikpikpuk R. #3	69° 44' N, 154° 45'W	175	5	8.0	BB, GR, HWF, LNS, NP
Ikpikpuk R. #4	69° 57' N, 154° 43'W	250	15	8.0	AL, BB, BWF, GR, HWF, LCI, NP, NSB
Price R. #1	69° 50' N, 154° 37'W	60	12	8.0	BWF, GR, HWF, LCI
Price R. #2	69° 45' N, 153° 51'W	80	10	8.0	BWF, GR, HWF, LCI
Kealok Cr. #1	70° 31' N, 153° 10'W	50	6	8.0	GR
Kealok Cr. #2	70° 16' N, 153° 35'W	50	4	8.0	GR, LCI
Kalikpik R. #1	70° 17' N, 152° 21'W	40	5	8.0	GR
Kalikpik R. #2	70° 26' N, 152° 05'W	60	6	8.0	BWF, GR, LCI, RWF
Inigok Cr	70° 10' N, 153° 13'W	80	7	8.0	BWF, GR, RWF
Judy Creek #1	70° 00' N, 152° 25'W	15	5	8.5	RWF
Judy Creek #2	70° 02' N, 152° 35'W	16	4	8.0	BWF
Kikiakrorak R. #1	69° 48' N, 152° 00'W	15	2	8.5	Y. O. Y. GR captured, SSC observed
Kikiakrorak R. #2*	70° 00' N, 151° 36'W	150	4	...	BWF, CS, GR, HWF, LCI, PS
Kogosukruk R. #1	69° 39' N, 151° 50'W	60	25	8.5	GR, LCI, LNS, RWF
Kogosukruk R. #2	69° 45' N, 151° 42'W	75	3	8.5	SSC
Kogosukruk R. #3*	69° 56' N, 151° 35'W	125	5	...	BB, GR, LNS, NSB, RWF, SSC

* From previous surveying work (Bendock, 1979).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M0234
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B84058
M0232
M0231
N77101
M0230
18 Miles

JD Johnson

From: William Morris [william_morris@dnr.state.ak.us]
Sent: Wednesday, June 02, 2004 8:51 AM
To: j_johnson@fishgame.state.ak.us
Subject: RE: nominations

The upstream most lakes on the Kalikpik contain anadromous broad whitefish (and a bunch of other fish), they reach the lakes by swimming up the West Fork Kalikpik from Harrison Bay. Let me know if I did not address the question issue.

Thanks,

Bill

-----Original Message-----
From: JD Johnson [mailto:j_johnson@fishgame.state.ak.us]
Sent: Wednesday, June 02, 2004 7:41 AM
To: William Morris (E-mail)
Subject: nominations

Bill

I'm working my way thru your Kalikpik River noms

I managed to find whitefish data in Bendock and Burr 1984 that supports the extension of the Kalikpik River for whitefish but not as far as nominated I've requested copies of the Netsch and Hablett reports

I've looked thru the references you cited w/the nomination for the West Fork of the Kalikpik River (excluding Netsch and Hablett reports) and have not been able to find any data relating to Kalikpik River.

Any additional info you could provide would be appreciated

J. Johnson
Alaska Department of Fish and Game
FDD Project Biologist
333 Raspberry Rd
Anchorage, AK 99518
907-267-2337 office
907-267-2464 FAX
j_johnson@fishgame.state.ak.us

PRELIMINARY REPORT - COASTAL PLAIN OF NATIONAL PETROLEUM RESERVE - ALASKA

by NORVAL NFTSCH, ET AL 1977

U.S. FISH AND WILDLIFE SERVICE
NPR-A FISHERY RECONNAISSANCE
STREAM AND LAKE SUMMARY

NAME Fish Creek FWS SITE NO. 92 LAT N 70°22' LONG W 151°17'

MAP REFERENCE Harrison Bay T 12N R 3E S 24
T ____ R ____ S ____
T ____ R ____ S ____

MAIN DRAINAGE Fish Creek ELEVATION 1.5 - 6.1 M

__ LAKE: LENGTH ____ KM AREA ____ HA MAXIMUM DEPTH ____ M

OUTLET: __ NONE __ UNDETERMINED __ PRESENT WITH UNDEFINED CHANNEL

__ PRESENT WITH DEFINED CHANNEL:
WIDTH ____ M DEPTH ____ M DISCHARGE ____ M^3/SEC

X STREAM: POOL WIDTH 121.9 (Max) M POOL DEPTH 2.8(Max) M RIFFLE WIDTH * M

RIFFLE DEPTH * M DISCHARGE 2.8* M^3/SEC

SHORELINE Sand banks SUBSTRATE Fine sand

AQUATIC VEGETATION None observed

WATER QUALITY:

TEMP	CONDUCTIVITY	SALINITY	SECCHI	PH	DO
14 °C	5,600 MHO	3.2 0/00	.75 M	8.7	10 PPM

FISH:

CAPTURE EFFORT:

ELECTRO-FISHING	ANGLING	NET HOURS	TRAP HOURS	SEINE HAULS
--- SEC	.75 HRS	12	36	6

SPECIES	NUMBER	LENGTH RANGE	WEIGHT RANGE
NST	1	40 mm	---
FSc	20	27 - 185 mm	<1 - 60 gm
BWF	62	55 - 318 mm	<1 - 266 gm
HWF	2	233 - 236 mm	82 - 111 gm
LCi	72	49 - 274 mm	<1 - 167 gm
AF	7	20 - 29 mm	---

FISH OBSERVED BUT NOT CAPTURED None

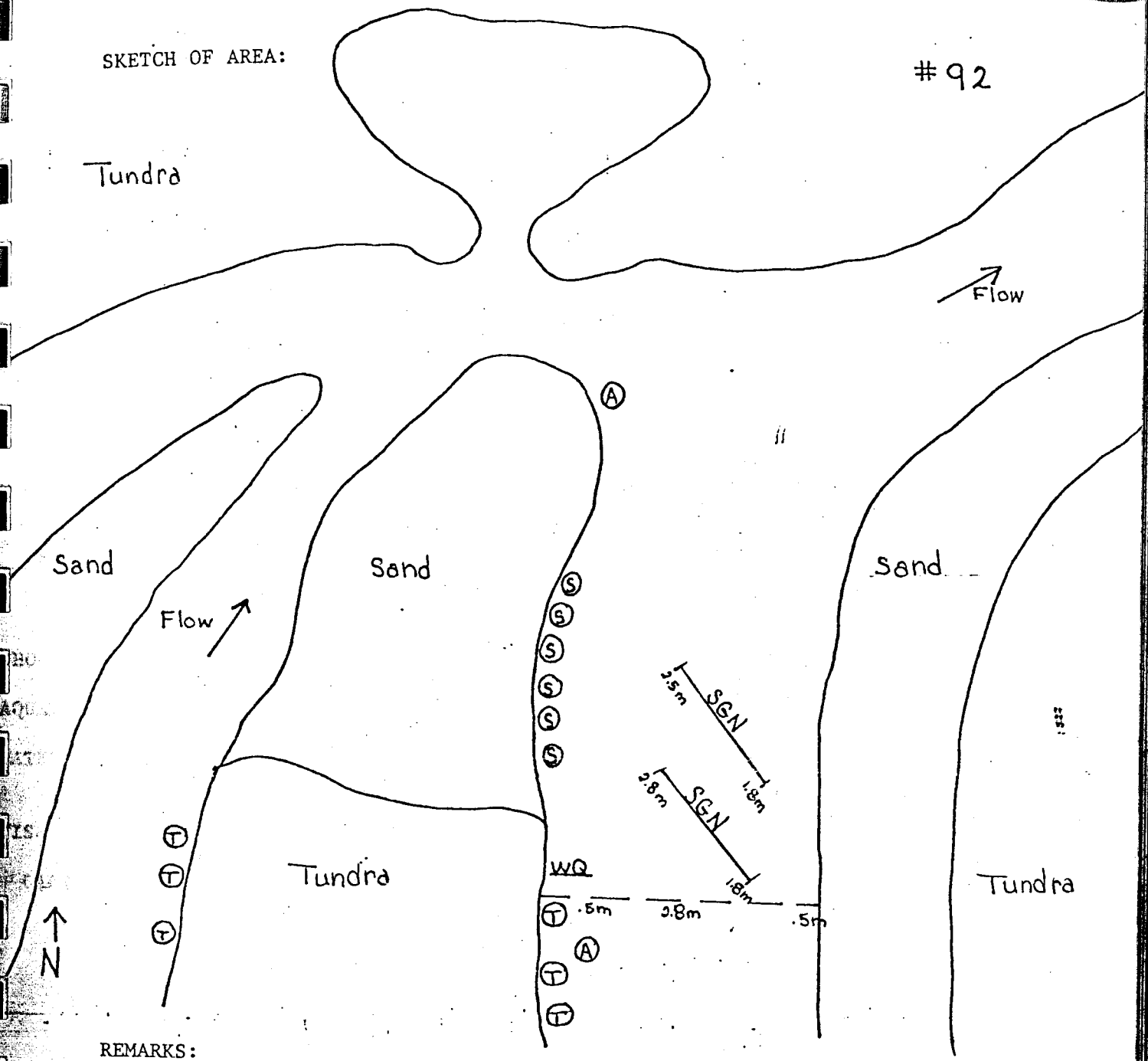
DATA COLLECTED BY B. Jensen, K. Kuletz DATE 20 August 1977

(CONTINUED ON BACK)

*REFER TO REMARKS SECTION (NEXT PAGE)

SKETCH OF AREA:

#92



REMARKS:

Discharge data obtained from USGS.

No riffles were present.

A native camp is located approximately one mile downstream from this site.

U.S. FISH AND WILDLIFE SERVICE
NPR-A FISHERY RECONNAISSANCE
STREAM AND LAKE SUMMARY

NAME Fish Creek FWS SITE NO. 100 LAT N 70°13' LONG W 152°22'

MAP REFERENCE Harrison Bay T 10N R 2W S 22
T ____ R ____ S ____
T ____ R ____ S ____

MAIN DRAINAGE Fish Creek ELEVATION 30.5 M

__ LAKE: LENGTH ____ KM AREA ____ HA MAXIMUM DEPTH ____ M

OUTLET: __ NONE __ UNDETERMINED __ PRESENT WITH UNDEFINED CHANNEL

__ PRESENT WITH DEFINED CHANNEL:
WIDTH ____ M DEPTH ____ M DISCHARGE ____ M^3/SEC

X STREAM: POOL WIDTH 9.4 (Max) M (Est) POOL DEPTH 2.1 (Max) M RIFFLE WIDTH -- M
RIFFLE DEPTH -- M DISCHARGE 3.2* M^3/SEC

SHORELINE Cut banks, sand SUBSTRATE Fine sand, some detritus

AQUATIC VEGETATION None observed

WATER QUALITY:

TEMP	CONDUCTIVITY	SALINITY	SECCHI	PH	DO
7.2°C	113 MHO	0 0/00	-- M	8	12 PPM

FISH:

CAPTURE EFFORT:

ELECTRO-FISHING	ANGLING	NET HOURS	TRAP HOURS	SEINE HAULS
--- SEC	7 HRS	6	36	6

SPECIES	NUMBER	LENGTH RANGE	WEIGHT RANGE
GR	30	46 - 457 mm	< 5 - 830 gm
SSc	1	50 mm	< 1 gm

FISH OBSERVED BUT NOT CAPTURED None

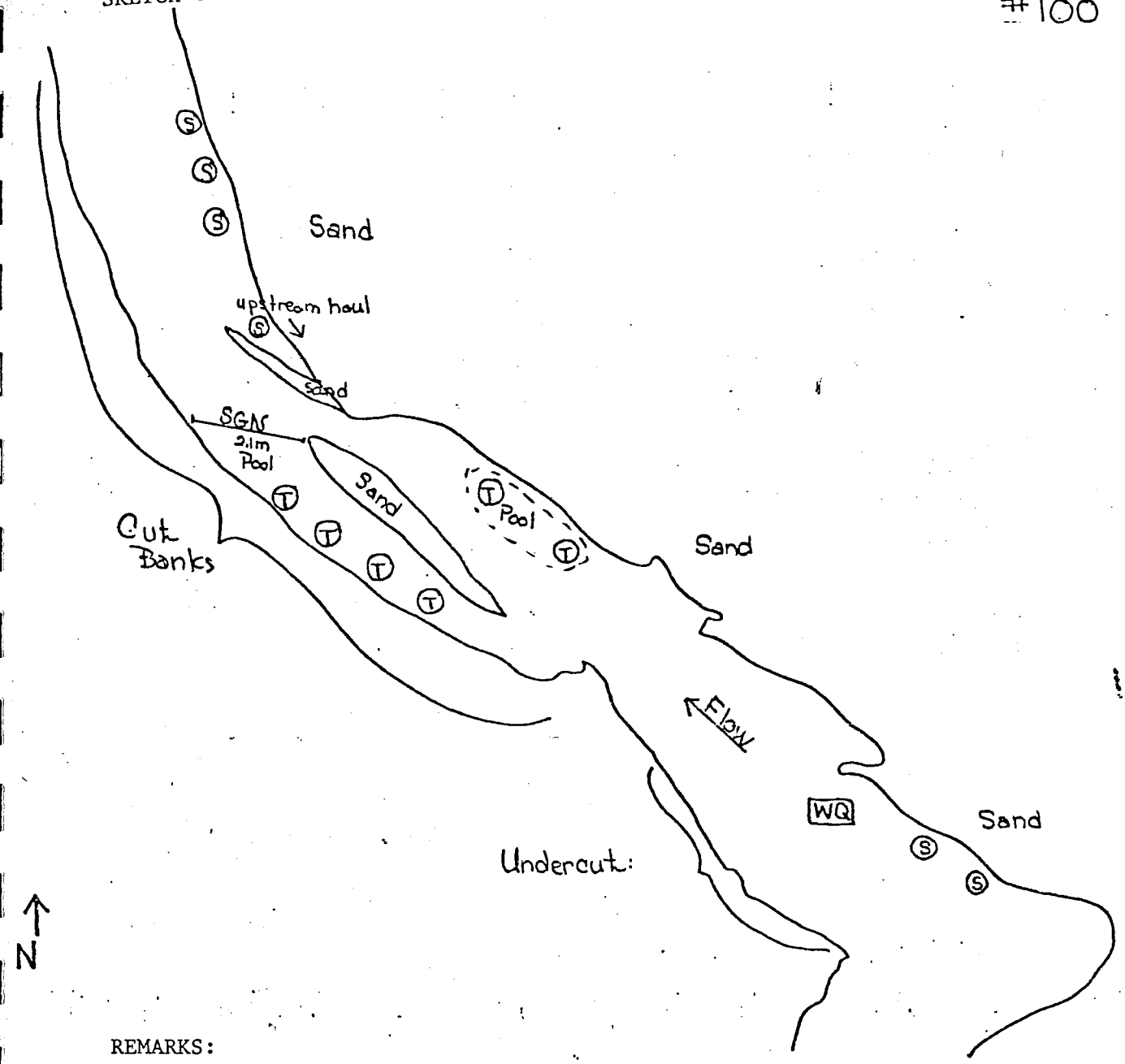
DATA COLLECTED BY N. Swanton, C. Berger DATE 12 August 1977

(CONTINUED ON BACK)

*REFER TO REMARKS SECTION (NEXT PAGE)

SKETCH OF AREA:

#100



REMARKS:

Discharge data obtained from USGS.

Angling occured all along the stretch of stream illustrated in the sketch.

U.S. FISH AND WILDLIFE SERVICE
NPR-A FISHERY RECONNAISSANCE
STREAM AND LAKE SUMMARY

NAME Judy Creek FWS SITE NO. 103 LAT N 70°03' LONG W 152°26'

MAP REFERENCE Harrison Bay T 8N R 2W S 8
T ___ R ___ S ___
T ___ R ___ S ___

MAIN DRAINAGE Fish Creek ELEVATION 22.9 M

__ LAKE: LENGTH ___ KM AREA ___ HA MAXIMUM DEPTH ___ M

OUTLET: __ NONE __ UNDETERMINED __ PRESENT WITH UNDEFINED CHANNEL

__ PRESENT WITH DEFINED CHANNEL:
WIDTH ___ M DEPTH ___ M DISCHARGE ___ M^3/SEC

X STREAM: POOL WIDTH 5.0 (Avg) M POOL DEPTH 1.8 (Avg) M RIFFLE WIDTH -- M

RIFFLE DEPTH .25 (Avg) M DISCHARGE .71* M^3/SEC

SHORELINE Sand SUBSTRATE Fine sand, gravel in one spot

AQUATIC VEGETATION None observed

WATER QUALITY:

TEMP	CONDUCTIVITY	SALINITY	SECCHI	PH	DO
13°C	138 MHO	0 0/00	2.3 M	8.6	11 PPM

FISH:

CAPTURE EFFORT:

ELECTRO-FISHING	ANGLING	NET HOURS	TRAP HOURS	SEINE HAULS
---	SEC 4 HRS	4	28	6

SPECIES	NUMBER	LENGTH RANGE	WEIGHT RANGE
SSc	2	59 - 64 mm	2 - 3 gm
GR	66	42 - 404 mm	<1 - 599 gm

FISH OBSERVED BUT NOT CAPTURED None

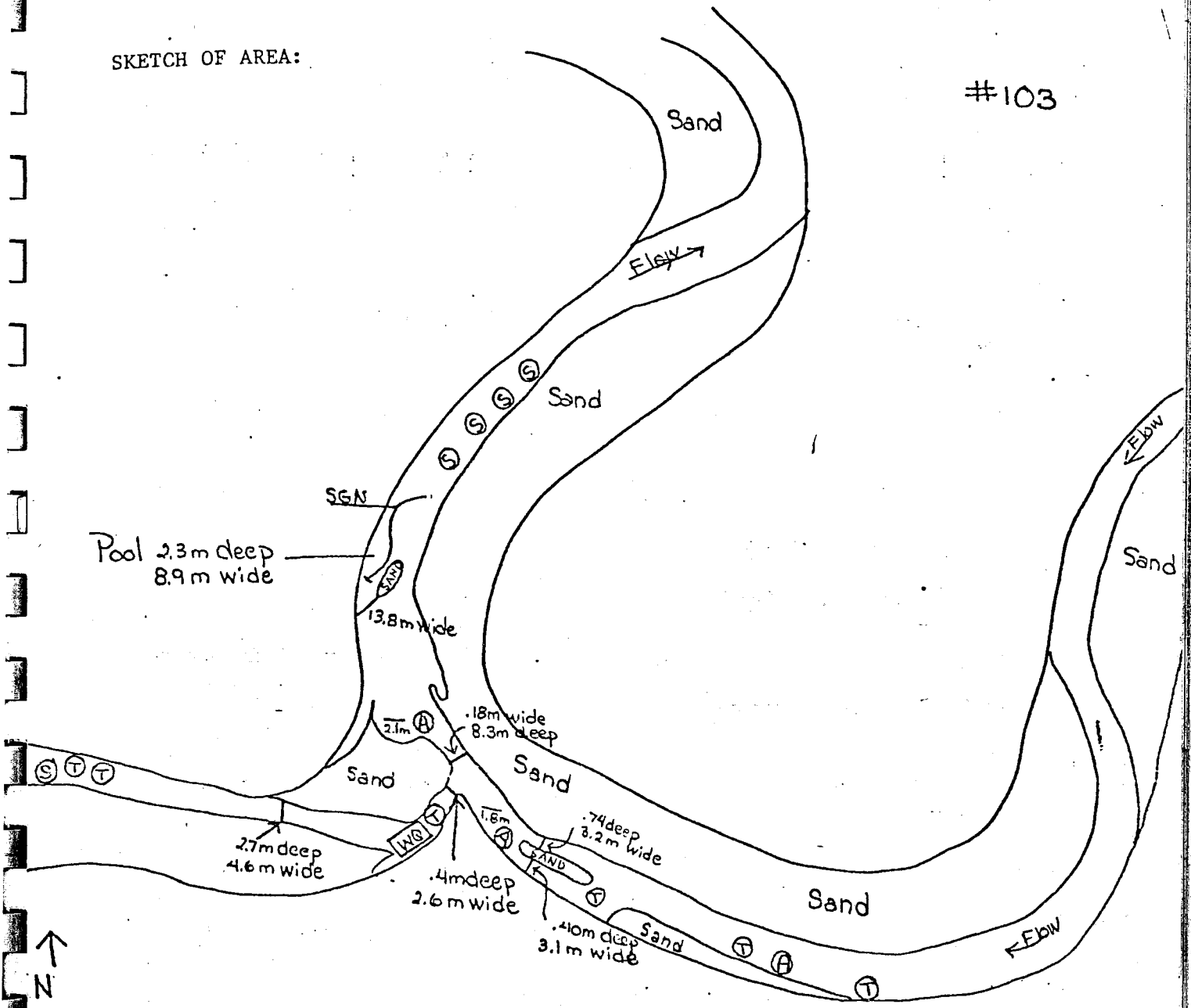
DATA COLLECTED BY B. Jensen, N. Swanton, E. Rudolfs DATE 11 August 1977

(CONTINUED ON BACK)

REFER TO REMARKS SECTION (NEXT PAGE)

SKETCH OF AREA:

#103



REMARKS:

Discharge date obtained from USGS.

U.S. FISH AND WILDLIFE SERVICE
NPR-A FISHERY RECONNAISSANCE
STREAM AND LAKE SUMMARY

NAME Judy Creek FWS SITE NO. 105 LAT N 69°39' LONG W 152°57'

MAP REFERENCE Umiat T 4N R 4W S 32
T ____ R ____ S ____
T ____ R ____ S ____

MAIN DRAINAGE Fish Creek ELEVATION 91.4 M

__ LAKE: LENGTH ____ KM AREA ____ HA MAXIMUM DEPTH ____ M

OUTLET: __ NONE __ UNDETERMINED __ PRESENT WITH UNDEFINED CHANNEL

__ PRESENT WITH DEFINED CHANNEL:
WIDTH ____ M DEPTH ____ M DISCHARGE ____ M^3/SEC

X STREAM: POOL WIDTH 6.1 (Max) M POOL DEPTH 2.1 (Max) M RIFFLE WIDTH --- M

RIFFLE DEPTH .1 (Max) M DISCHARGE 0* M^3/SEC

SHORELINE Cut banks 6.1 M high (Est) SUBSTRATE Fine sand

AQUATIC VEGETATION Some present - not identified

WATER QUALITY:	TEMP	CONDUCTIVITY	SALINITY	SECCHI	PH	DO
FISH:	18°C	200 MHO	-- 0/00	.7 M	9	11 PPM

CAPTURE EFFORT:	ELECTRO-FISHING	ANGLING	NET HOURS	TRAP HOURS	SEINE HAULS
	---	SEC -- HRS	6	36	6

SPECIES	NUMBER	LENGTH RANGE	WEIGHT RANGE
NST	16	54 - 78 mm	.8 gm (Avg indiv)
GR	8	56 - 168 mm	1 - 33 gm

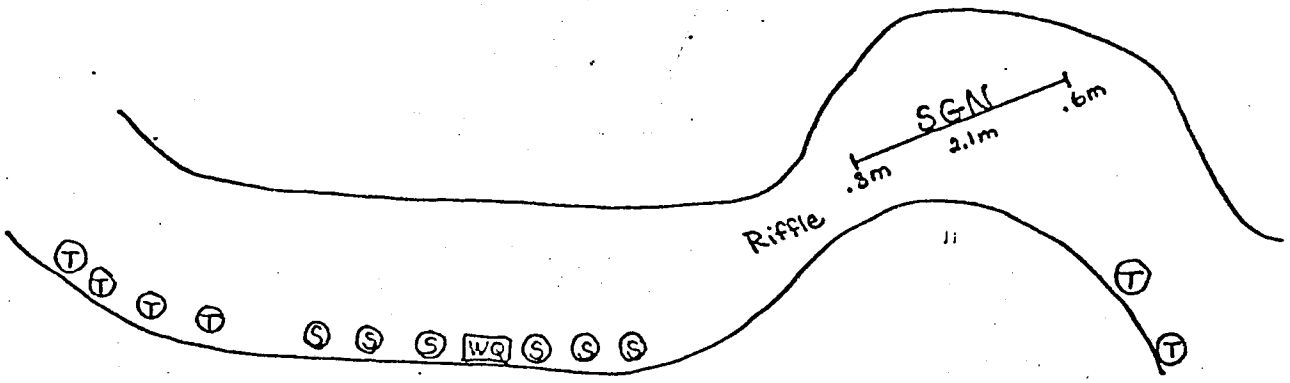
FISH OBSERVED BUT NOT CAPTURED None

DATA COLLECTED BY K. Ryan, L. Steinberg DATE 9 August 1977

(CONTINUED ON BACK)

SKETCH OF AREA:

#105



N

REMARKS:

Discharge data obtained from USGS.

Animals observed: red fox

Birds observed: willow ptarmigan (50 est)

REMARKS SECTION (NEXT PAGE)

Volume 2

STUDIES OF SELECTED WILDLIFE & FISH & THEIR USE OF HABITATS ON & ADJACENT TO NPR-A 1977-1978

U.S. Department of the Interior

National Petroleum Reserve in Alaska 105(c)

Field Study 3

CHAPTER 10

FISH INVENTORIES CONDUCTED WITHIN THE NATIONAL PETROLEUM RESERVE ON THE NORTH SLOPE OF ALASKA, 1977-78

by

Thomas R. Hablett, U.S. Fish and Wildlife Service

INTRODUCTION

In June 1977, the U.S. Fish and Wildlife Service (USFWS) began a twoyear fisheries investigation of the lakes and watercourses on the National Petroleum Reserve in Alaska (NPR-A). Field studies for genetic information were conducted by the FWS National Fisheries Research Center (Chapter 11 herein). The USFWS collected inventory data on the coastal plain, and the Alaska Department of Fish and Game (ADF&G) on the Colville River and its tributaries and other mountain rivers (fig. 10-1). Prior to the 1977 field season, fisheries information on NPR-A was minimal. Therefore, the objectives of the study were to:

1. Determine fish species composition and relative abundance.

2. Determine migration pattern and timing.

3. Determine age-growth relationships and other aspects of life history.

4. Identify critical habitat, including spawning and overwintering areas.

5. Describe genetic variation within and between populations of selected fish species.

The major study effort used Umiat and Barrow as bases of operation during the open water seasons of 1977 and 1978. Seasonal scope was added by under-ice assessments during the winter of 1977-78, primarily on the Colville River.

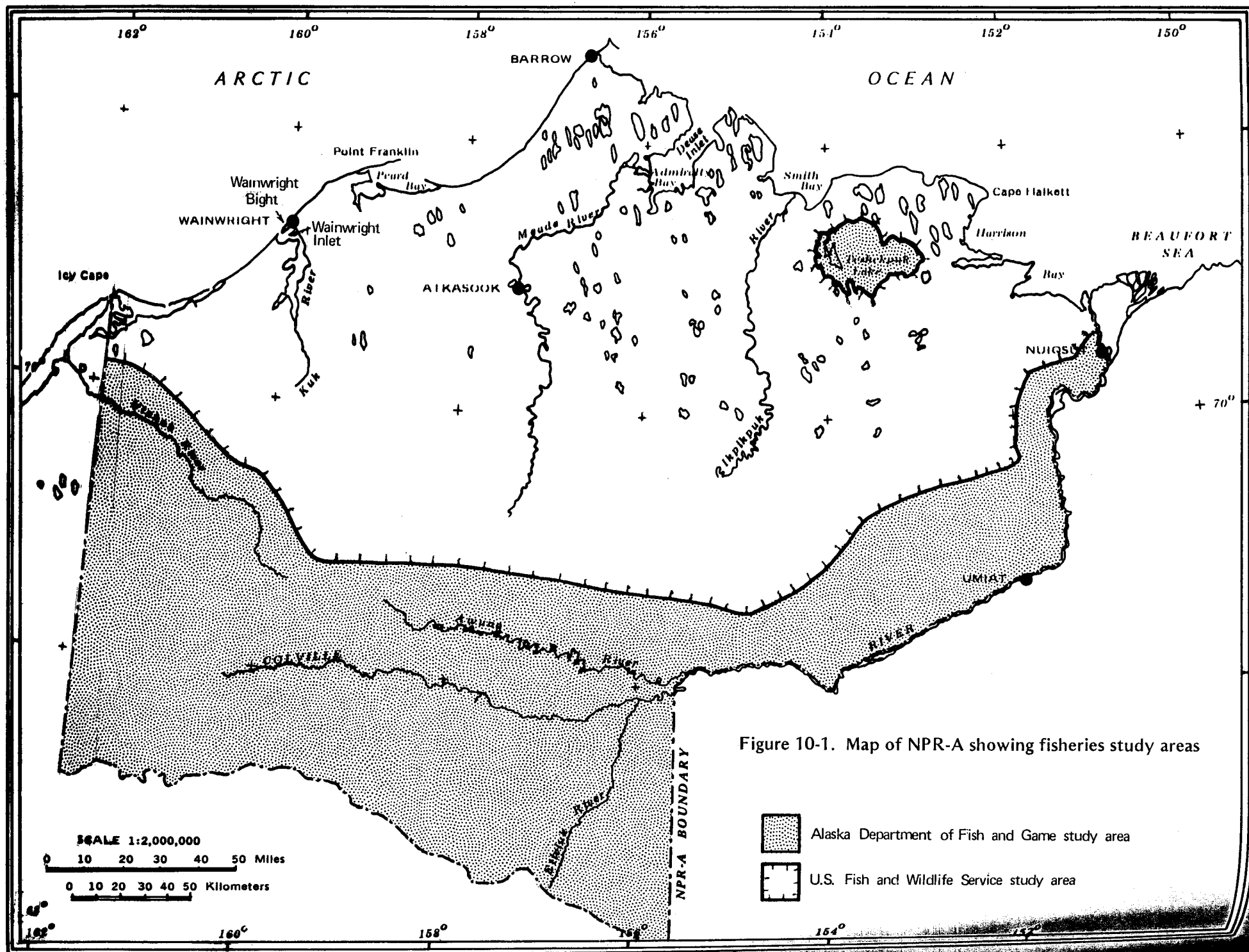


Figure 10-1. Map of NPR-A showing fisheries study areas

STUDY AREA

Lakes

On the coastal plain, the most conspicuous hydrologic feature is the vast expanse of lakes. Three categories of lakes were noted throughout the study and are described in Selkregg (1975) as glacial, thaw, and overflow channels or oxbows. Representative lakes of NPR-A were selected using the criteria of geographical location, depth and area, presence of outlets and inlets, and proximity to saltwater. These lakes range in size from 315 mi^2 (816 km^2) Teshekpuk Lake to small potholes. Most NPR-A lakes are less than 6 ft (about 2 m) deep and often freeze to the bottom by late winter. However, many lakes deeper than 6 ft (about 2 m) are reported for the eastern coastal plain of NPR-A by Holmquist (1975), and USFWS 1977-78 data describes lake depths ranging from 2 to 65 ft (about 0.5 - 21 m).

Rivers

Rivers and streams on NPR-A are generally shallow and markedly seasonal in their flow characteristics. Streamflow begins with breakup in early June, starting in the headwaters and proceeding downstream to the cooler coastal plain. Freeze-up usually begins in September so that the ice-free period is about three months. Peak flows usually result from snow melt; flow diminishes in mountain and tundra streams by midsummer (Sloan, 1976). Many tributaries become discontinuous during midsummer, but extreme fluctuations of both discharge and turbidity in response to precipitation are common during the open water season. Beaded streams are found throughout the study area and provide migration corridors for fish during periods of high water; however, most become isolated during summer months and are of limited habitat value to the fishery.

Beginning in September and continuing through the winter months, the rivers and streams freeze, and flows are reduced or stopped. By March, ice thickness is several feet and only deep pools contain water, thereby limiting wintering habitat to a few isolated pockets (Sloan, 1976).

METHODS

Parallel sampling programs were conducted by USFWS and ADF&G during the 1977-1978 field seasons. However, differences in study areas and objectives somewhat altered methods and equipment used by the two field groups.

Amphibious, float, fixed-wing aircraft and helicopters were used to transport field crews and equipment between lakes and streams. Rafts and kayaks were used to conduct some lake surveys and float several rivers. A river boat powered by outboard motors equipped with jet units was used to survey sections of Colville drainage.

Physiographic data and positions were derived from U.S. Geological Survey 1:63,500 and 1:250,000 maps.

Water chemistry data were obtained using Hach Field Kits.* Depths were sounded by hand line or fathometer. Standard Secchi discs were used to determine clarity and hydrometers to determine salinity.

Multifilament graduated mesh sinking or floating gill nets measuring 125 ft x 6 ft and consisting of five 25-foot panels of 1/2-in through 2 1/2-in mesh were used to capture fish.** Other sampling gear included 4 ft x 25 ft beach seines, 1/2 in x 6 ft x 25 ft multifilament gill nets, minnow traps, dipnets and backpack electroshockers. Hook and line sampling was used to capture fish as time allowed, and baited hooks were sometimes left overnight to capture burbot. A standard net night was considered 12 hours.

Angling data from Heritage Conservation and Recreation Service (HCRS) field crews, and additional net sampling by U.S. Geological Survey (USGS) on the Miguakiak River and USFWS crew on the Meade River Delta are included in this report.

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* The use of brand names in this report is for identification only and does not imply endorsement by the agency.

** Metric equivalent measures for these nets are: 38.1 m x 1.8 m with 1.3 cm to 6.4 cm mesh for the graduated gill net; 1.2 m x 7.6 m beach seines; and 1.8 m x 7.6 m gill nets with 1.3 cm mesh.

plotting across to the right. Lake stations for 1977 number 1-80; 1977 rivers and streams 101-160; 1978 rivers and streams 300-370; and 1978 lakes 401-408. Stations surveyed in 1978 that were previously numbered have retained their original designation.

A report of the genetic studies appears separately as Chapter II of this report.

RESULTS

A total of 20 species representing 9 families was collected within the study area (table 10-1). A list of lakes and streams surveyed, fish species captured and site numbers (referred to on figs. 10-2 and 10-3) is presented in table 10-2. A total of 220 sites was sampled, of which 88 were lakes and 132 were streams. Thirty-five sites yielded no fish (fig. 10-4). Several sites initially visited in 1977 were resampled in 1978. Descriptive accounts of the streams and lakes surveyed are the subject of this section.

Colville River

The Colville River, the largest river flowing to the north coast of Alaska, is approximately 430 mi (690 km) long and drains 24,000 mi^2 (62,160 km^2). The study area includes the mainstem of the Colville River and headwater tributaries west of 156°W longitude.

Tributaries originating within the drainage contain coarse alluvial sands and gravel and are rapid runoff streams that are heavily braided and confined to relatively narrow river valleys.

Breakup began in the Brooks Range in early May and occurred at Umiat on May 31, 1977, and June 1, 1978. The Colville River was ice-free by June 10, at which time net catches near Umiat consisted of grayling, round whitefish, broad whitefish, burbot, ninespine stickleback, slimy sculpin and longnose suckers. Water level dropped rapidly and temperature rose sharply following breakup. Grayling, longnose suckers and ninespine stickleback began spawning in the third week of June in 5°-8°C (41°-46°F) water. Small tributaries that became discontinuous late in the season such

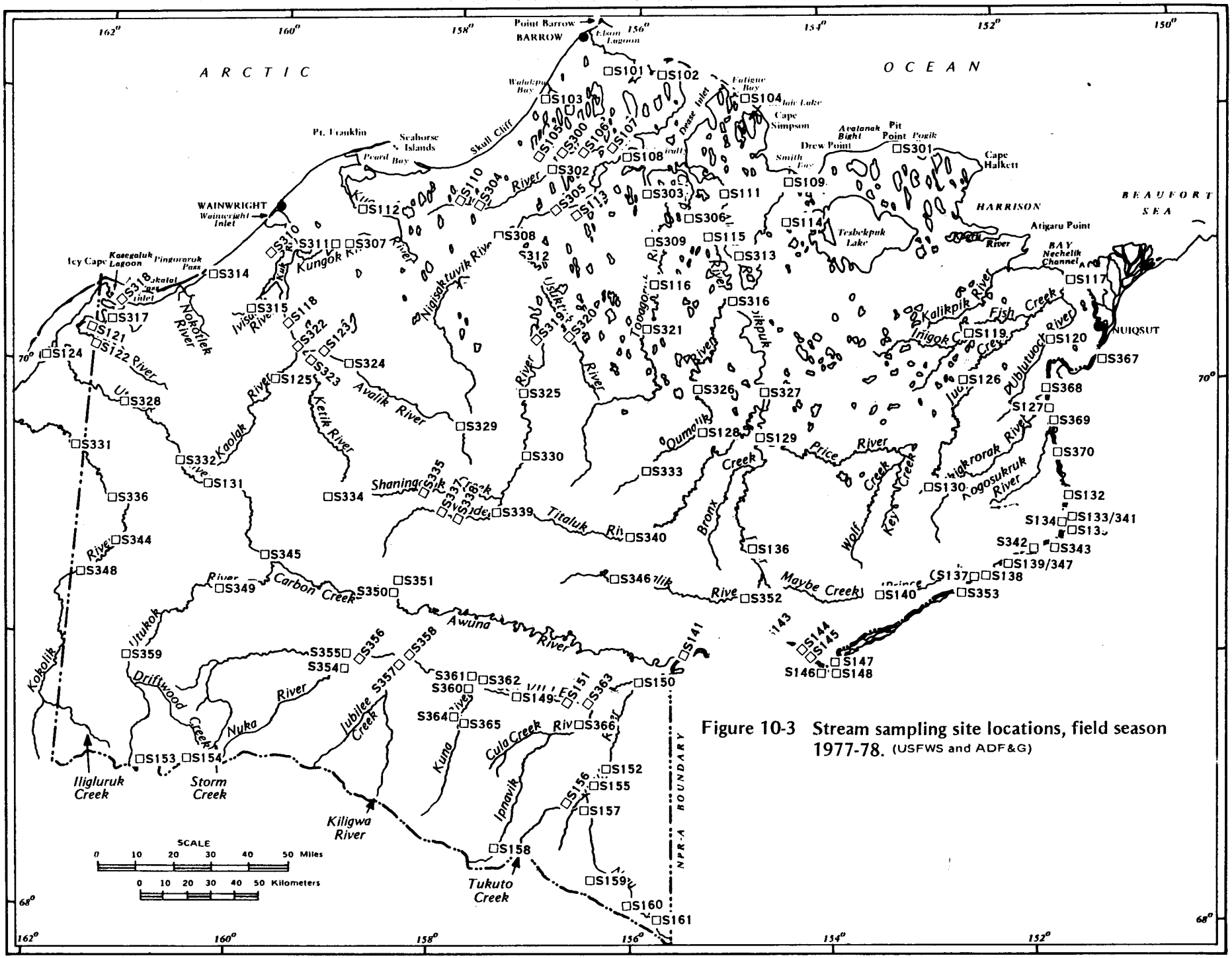

Figure 10-3 Stream sampling site locations, field season 1977-78. (USFWS and ADF&G)

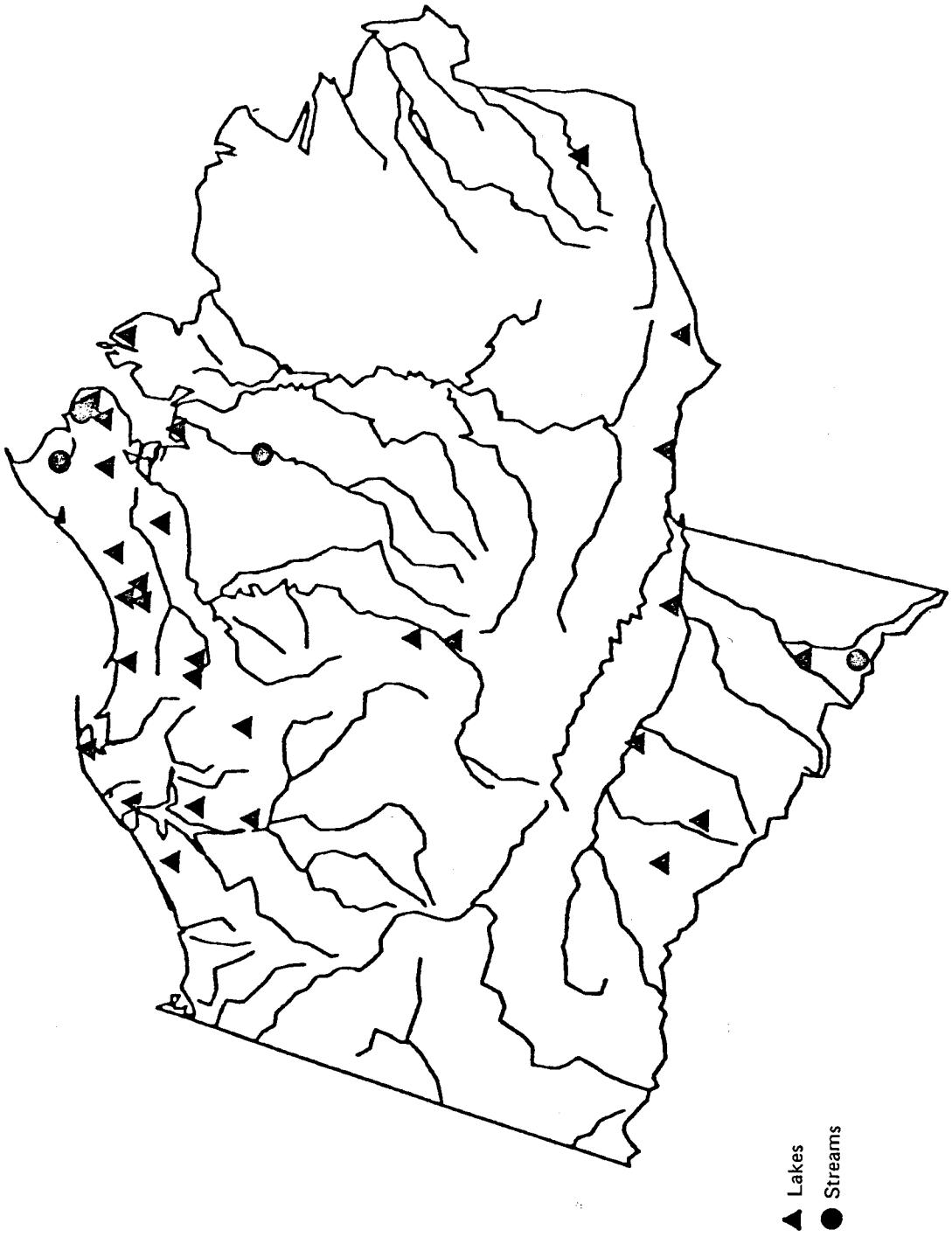
Lakes
Streams

Table 10-2. List of lakes and streams surveyed on NPR-A during 1977-78. [Name abbreviations given in table 10-1.]

1977-LAKES

Station Number	Name	Survey Date	Species Captured
1	Ikroavik	July 25	NSB
2	Sinclair	July 29	No Fish
3	Unnamed	July 12	No Fish
4	Sungovoak	July 12	BWF, LCi, Gr
5	Unnamed	July 11	No Fish
6	Tusikvoak	July 29	LCi, NSB
7	Evrulivik	July 25	NSB
8	Ekalgruak	July 10	NSB
9	Tractor	July 27	No Fish
10	Unnamed	August 5	NSB
11	Unnamed	August 5	No Fish
12	Unnamed	July 22	NSB
13	Unnamed	July 24	No Fish
14	Unnamed	July 27	No Fish
15	Unnamed	July 24	No Fish
16	Unnamed	July 27	No Fish
17	Unnamed	July 13	No Fish
18	Pittalukruak	July 31	HWF, LCi, BWF
19	Okalik	August 17	LCi, NSB
20	Tuvak	July 23	NSB
21	Unnamed	July 13	NSB
22	Unnamed	July 23	LCi, NSB

Table 10-2. Continued

Station Number	Name	Survey Date	Species Captured
45	Unnamed	August 14	LCi, Lt, Gr, BB
46	Unnamed	August 11	NSB
47	Sikolik	July 18	NSB
48	Unnamed	July 21	NSB
49	Ahyagat	August 11	LCi, Lt, Gr, NSB
50	Unnamed	August 10	BWF, LCi, Lt, NSB
51	Unnamed	July 9	NSB
52	Unnamed	August 19	BWF, LCi, RWF, Lt, NSB
53	Unnamed	August 17	ACi, LCi, Lt, NSB, SSc
54	Unnamed	August 17	BWF, Lt, Gr, NSB
55	Unnamed	August 16	LCi, Lt, Gr, NSB
56	Unnamed	August 16	LCi, Lt, NSB
57	Unnamed	August 15	LCi, NSB
58	Unnamed	August 10	LCi, NSB
59	Unnamed	August 10	Gr, NSB
60	Square	July 12-13 August 9	Gr, NSB Gr, NSB
61	Dogbone	July 14	No Fish
62	Ikpikpuk #1	July 26	No Fish
63	Ikpikpuk #2	July 26	No Fish
64	Green	July 27	No Fish