YUKON DELTA NATIONAL WILDLIFE REFUGE
SUMMARY OF THE NORTH DELTA
BIRD RECONNAISSANCE 1985

by

Cindy Ziobron

November 1985

Key Words:
Yukon Delta NWR
North Delta
Yukon River
Birds
Mammals
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U.S. Fish and Wildlife Service
Yukon Delta National Wildlife Refuge
P.O. Box 346
Bethel, Alaska 99559

and conclusions presented here are preliminary and are not for
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Introduction

The delta region of the Yukon River and its associated coastal mudflats has long been recognized as an important feeding and nesting area for waterfowl and other migratory birds. Yet as recent as 1985, routine bird surveys and inventories have not been a part of the Refuge program due to the expense and difficulties of sampling in this area.

During the summer of 1985 the Envirosphere Company, a division of EBASCO Services Incorporated from Bellevue, Washington, was contracted by the National Oceanic and Atmospheric Administration (NOAA) to begin studies of fisheries resources around the delta mouth. The project was to document species presence and use in specific areas over time.

Logistically and physiographically the north delta is an extremely difficult area to survey. The U.S. Fish & Wildlife Service(USFWS), realizing the means to conduct an opportunistic survey, coordinated efforts with the Envirosphere Company to do bird reconnaisance work around the delta mouth. This report delineates the results of that work conducted between June 15 and July 30, 1985.

Study Area

The study area encompasses approximately 3,000 square miles (Figure 1). Rough boundaries are set at Coffee Point,(east of Kotlik), south to Fish Village, and from Fish Village, west to Kwemeluk Pass,(south of Sheldon's Point). On the western coastal side, the study area continues south to the Black River, a coastal river that drains into the Bering Sea. The general survey area includes areas offshore up to 17 miles, and inland as far as the southern end of Aproka Slough.

The delta itself is basically a large flat alluvial deposit, sustaining a network of streams and sloughs. It is a maze of freshwater ponds and lakes interspersed with meandering streams. Forty to fifty percent of the delta is covered by water. Some lakes and sloughs that are independent of the Yukon River are non-silty, but stained dark brown, while active sloughs are muddy and silty. There is virtually no vertical relief on the delta, nor rocks and gravel. Along the coast, there are vast tidal flats. At low tide they may extend as much as three miles off the northern side, with a tidal change of one vertical meter.

The Yukon River flows more than 2,600 miles before its silt laden waters reach the Bering Sea (USDI, 1974). The mouth is highly segmented into channels, the largest of which is Kwiklauk Pass (South Mouth), approximately one mile wide. For the most part, the Yukon River is deep until it reaches the Bering Sea, where it widens and slows, depositing enormous amounts of sediments at its channel mouths. Annually the river deposits 100 million metric tons of suspended particles and bedload sediment per year. The river flows northward for about the last 150 miles. As it reaches the Bering Sea, the offshore current carries the sediment laden water in a northerly

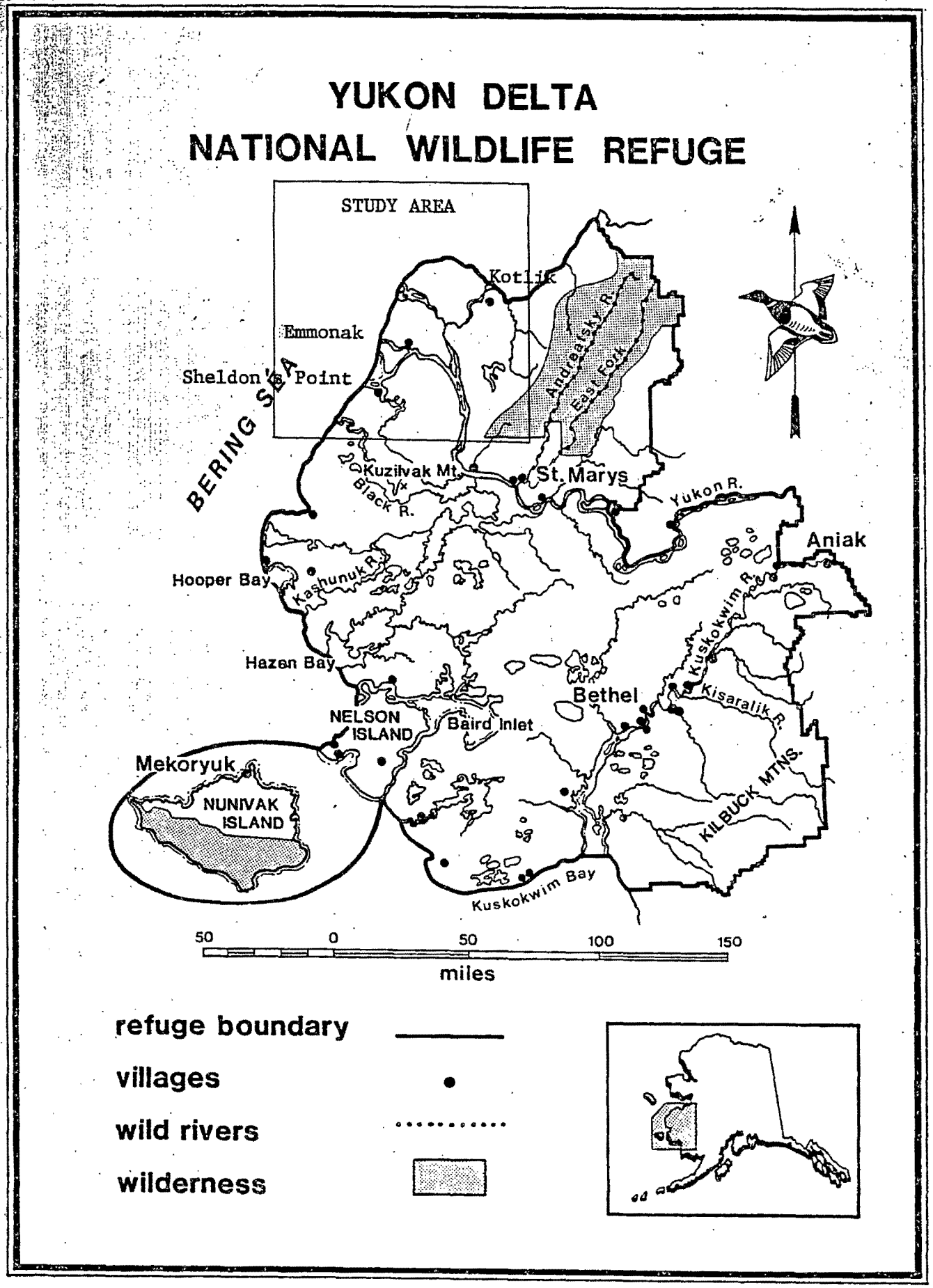

Figure 1. North Delta Study Area in Relation to the Yukon Delta NWR

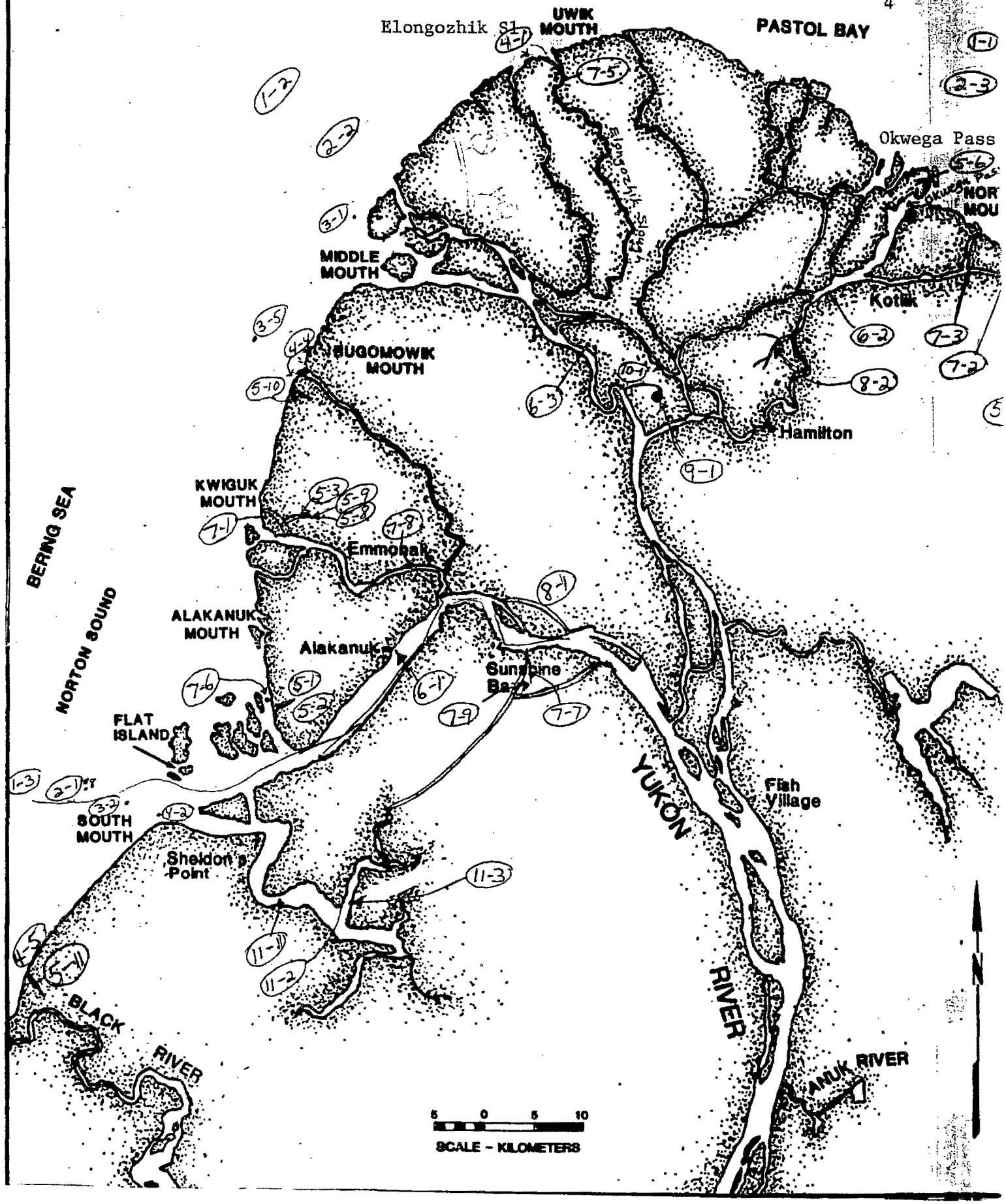

Figure 2. North Delta Study Area 1985 With Corresponding Fish Sample Sites from Appendix A.

direction. The plume of sediments covers more than 4,000 square miles . Here the Yukon River totally dominates Norton Sound for many miles offshore, creating a brown freshwater sea. Visibility is very limited both in the river and offshore, making navigation difficult and time consuming (Rearden, 1979).

The vegetation of the coastal delta is dominated by sedges (Carex sp.) almost exclusively. Many herbacious plants are found, but in relatively low numbers. There are very few shrubs that grow on the outer delta. Occasionally scrub willow (Salix sp.) and gale (Myrica sp.) grow there. As one moves inland, the sloughs are generally lined with willow and alder(Alnus sp.). Further inland, there are occasional stands of cottonwood (Populus balsamifera), but no conifers.

The population of natives on the Yukon-Kuskokwim Delta is the densest anywhere in Alaska (Rearden,et al., 1979). On the north delta, Yupik villages are numerous, and some are relatively large. For centuries the natives have relied on the wealth of varied wildlife resources for subsistence, although fish remains the single most important resource used by delta natives (USDI, 1974).

Methods

Travel and observations were limited to areas where the Envirosphere Company was sampling for fish, either by boat or helicopter. The effort is based on opportunistic sampling. Therefore, the results of this bird inventory are limited. The overall strategy: when, where, and how surveys were conducted, depended totally upon the Envirosphere agenda developed for conducting their concurrent study. For a summary of the Envirosphere sampling stations refer to Appendix A.

The boats used for transportation around the delta were furnished by NOAA. A 26 foot Munson seiner with twin 185 hp. outboards, a 21 foot Boston Whaler with twin 50 hp. outboards, and a 13 foot Zodiac with a single 25 hp. outboard, were used. NOAA also provided a large military UH1H "Huey" helicopter to assist in the field work. In July a steep sided skiff was rented from a resident of Kotlik to use for purse seine tows.

The Envirosphere Company crew and NOAA helicopter pilot and mechanic were based out of Emmonak, Alaska. The crews returned to Emmonak every night; however, they would often leave the boats anchored near the coast and fly out to them the next day, saving time and money. One subcontractor to Envirosphere, Rae Baxter, took the opportunity to set gill and fyke nets from a Zodiac in areas where the larger boats could not travel. When this type of sampling was done, Rae would camp out at the site to monitor net activity. This provided an excellent opportunity to record or photograph bird activity.

Between May 1st and July 15th the helicopter was restricted by USFWS regulation from landing within 15 miles of the coast to prevent disturbance of nesting birds. The helicopter was allowed to drop passengers, supplies and fuel to the boats only at airstrips within the 15 mile zone.

The fish sampling was accomplished using two methods. The time allocation for each sampling technique was two weeks. A synoptic study was undertaken to sample as many types of habitat, in as many areas as possible, to determine general distribution and document species presence. The following two week period was involved in a temporal study which involved sampling a few areas continually to determine the fish usage i.e. when they actually use or move through the areas being sampled. This repeated three times throughout the period from June to September. A total of three synoptic and three temporal studies were alternately completed by the end of the summer.

Approximately eleven types of habitats were sampled: delta front, mid delta platform, inner delta platform, coastal mudflat, tidal slough, major and minor active sloughs, lake, lake outlet, major inactive channel, and minor inactive slough (Appendix D). Mid-channel and offshore sites were sampled by purse seine, while other areas were sampled with gill, fyke, and beach seine nets.

Bird observations were made when the Envirosphere crew did their work. Each day they sampled fish, I traveled with them in their boats around the delta, to make opportunistic bird observations. The results are summarized in the observation section of this paper.

Results

The bird survey was divided into three two week periods which coincided with fish sampling. From June 15 - June 30, the first phase of the synoptic fish study was conducted. Envirosphere traveled to many selected, and varied habitat types around the delta. At this time I traveled mostly with Rae Baxter and camped at the various net locations to observe bird species and nesting. Appendix E is the summary of the results of the nests found during the first phase of the study. Coastal areas in June contained rather high densities of nesting semipalmated and least sandpipers. Dunlin were abundant in areas where peeps were nesting, although no dunlin nests were discovered. Red-necked phalaropes were also abundant, but only two nests were discovered. No nests were observed after June 26, however some of the information can be misleading. Nests most often were found during times when overnight trips were made. There were no overnight trips made after June 26, as Rae left the program. Several flocks of non-breeding birds were observed at the end of June. Many flocks of geese were seen on the coast. A flock of approximately 80 male shovelers was seen in Sunshine Bay, and about 50 non-breeding swans were seen near the mouth of the Pastolik River.

July 1-3, I was at Curlew Lake on another study off the north delta. Upon returning, the Munson motors were in need of repair and the Munson itself was down for a period of ten days while they were being serviced in Anchorage. This lapse in survey time happened during the critical nesting period. By the time motors were replaced and broken in on July 15, two crucial weeks had elapsed, and the bulk of nesting was over.

From July 4 - July 14, the Whaler was used as an alternate source of transportation. Sampling sites and methods needed to be modified for it. No purse seines or long distance trips could be made, because it could not negotiate rough water. The Whaler was very small, hence crowded with four people plus nets and equipment. Envirosphere crew chose to utilize a portion of this two week period to process data and mend nets and equipment. I accompanied them as room permitted.

During this second two week period the temporal aspect of the study was underway. Many areas of the temporal survey were low in habitat variance i.e. most were mid-channel sets and not at any great distance from Emmonak. There were fewer days of observation, compared with the two previous weeks.

The Munson motors were installed and broken in by July 15. The second synoptic survey resumed and travel around the delta continued. During the last two week portion of the bird survey, the delta vegetation was fully green and lush. No birds were observed nesting. It seemed that the total numbers of birds and overall species diversity decreased, although this was not documented by quantitative data. Birds such as eiders, swans, cranes, pintail and sandpipers were more common in flocks. Geese were no longer seen during this period. Female ducks with chicks could often be observed from the helicopter. Tundra swans in particular were easily observed by this method.

The observations, (Appendix B), summarize the areas traveled each day throughout the study period June 15 - July 30. Due to the opportunistic nature of the survey procedure, there was little routine repetition of areas surveyed. Areas traveled from point "A to B" are transect intervals. Each area has an accompanying diagram, so the area observed can be portrayed with more accuracy. These diagrams are included in Appendix D.

No quantitative data were gathered. In some instances numbers were estimated, but it was difficult to tell if the same bird was counted twice, making enumeration of species subjective. Many times we would go through the same area more than once in a day, so it was likely that the more common species i.e. gulls, jaegers, terns and waterfowl were counted more than once. Standard belt transects were not used on the delta as they were impractical in most areas and time did not permit them to be done, as bird inventorying was not a priority to Envirosphere. Quantification was random as quantitative data was not an objective of the bird inventory. Relative estimates were made of one (1),F:few (2-5),S:several (6-10), and N:numerous (10 plus). Some exact counts are shown next to some bird species. Determination of sex was recorded opportunistically.

Table 1 lists the species observed throughout the study period by day. Dates not included in the survey were days when no bird survey was made. Bird data were collected every day a survey was made. A total of seventy three species of birds were identified. All but two species; the canvasback, and the northern goshawk are known to breed in western Alaska. Six species are considered rare according to Armstrong (1983). They are the canvasback, northern goshawk, osprey, merlin, herring gull, and hermit thrush. The sightings of the canvasback and the osprey were made by Rae Baxter and Ron Philippsborn respectively.

Table 1. Species List by Day of Observation, North Delta Bird Survey 1985

Species	June 15	16	17	18	19	20	21	22	23	24	25	26	27	28	30	July 5	8	9	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	29	30
Common Loon		X																												X	X			X	X		
Arctic Loon		X						X	X			X																			X					X	X
Red-throated Loon								X																													
Red-necked Grebe															X	X															X						
Pelagic Cormorant									X																												
Tundra Swan	X	X	X		X	X		X	X	X		X	X			X			X																	X	
Lesser Canada Goose		X				X	X	X				X	X					X	X				X														
Brant												X																									
Emperor Goose	X								X			X																									
Snow Goose						X																															
Mallard												X				X														X							
Northern Pintail	X	X	X	X	X	X	X	X	N	X		X	X				X	X	X	X																X	X
Green-winged Teal		X				X		X	X			X			X				X											X					X	
American Widgeon												X	X																								
Northern Shoveler	X	X	X	X	X	X	X	X	X	X		X	X																X		X						
Greater Scaup	X	X					X																														
Canvasback	X																																				
Oldsquaw		X						X																													
Spectacled Eiders												N																								X	
White-winged Scoter												X																									
Red-breasted Merrganser								X																													
Rough-legged Hawk												X									X															
Northern Harrier				X	X							X			X													X								
Merlin				X																																
Northern Goshawk										X																										
Osprey																	X																			
Lesser Sandhill Crane	X	X		X		X			X			X	X				X											X		X	X				X	
Semipalmated Plover																							X													
Black Turnstone	X		X					X	X								X																			
Common Snipe	X	X													X			X	X												X					
Lesser Yellowlegs														X						X																
Least Sandpiper		X	N		?	N	X	X	N																											
Dunlin	X	X				X	X	X	X			X							X											X						
Semipalmated Sandpiper	X	X	X		?	N	X	?	X																											
Western Sandpiper		X																						X				X		X	X	X	X	X	X	X
Bar-tailed Godwit		X						X	X																				X						X	
Red Phalarope		X																																		
Red-necked Phalarope	X	X				N	X	X	N										X	X	X															

Table 1. (continued)

Species	June 15	16	17	18	19	20	21	22	23	24	25	26	27	28	30	July 5	8	9	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	29	30
Black-bellied Plover		X										X																									
Pomarine Jaeger							X																							X							
Parasitic Jaeger	X	X		X		X	X	X			X	X											X	X		X	X	X	X	X	X			X		X	
Long-tailed Jaeger	X			X		X		X			X						X		X				X	X			X	X			X			X			
Glaucous Gull			X									X																									
Glaucous-winged Gull	X		X		X	X					X	X	X				X		X	X	X	X	X	X		X	X	X	X	X	X	X	X				
Herring Gull					X													X											X							
Mew Gull			X	X	X		X	X		X	X	X					X		X	X	X	X	X		X	X		X	X	X				X			
Black-legged Kittiwake		X					X					X																									
Sabine's Gull												X																									
Arctic Tern	X	X	X	X	X	X	X	X		X	X	X			X		X		X	X			X		X		X		X		X	X	X		X	X
Common Murre										X																											
Great Horned Owl	X*															X				X																	
Tree Swallow				X						X	X			X					X	X								X								
Bank Swallow	X			X	X	X				X	X	X		X					X	X		X							X			X				
Cliff Swallow					X																																
Common Raven	X			X	X	X	X		X		X			X	X		X		X							X	X		X							
Black-capped Chickadee														X	X														X							
American Robin														X																						
Varied Thrush														X				X																		
Gray-cheeked Thrush				X	X	X					X			X	X				X		X		X							X						
Hermit Thrush														X	X				X																	
Arctic Warbler						X																														
Yellow Wagtail				X															X																	
Orange-crowned Warbler																		X																X	X	X
Yellow Warbler				X	X	X	X	X		X	X	X		X	X	X		X										X	X	X		X				
Blackpoll Warbler														X		X																				
Northern Waterthrush												X	X	X	X								X													
Rusty Blackbird										X				X				X											X			X				
Pine Grosbeak														X																						
Common Redpoll	X	X		X	X	N	X	N	X		X	X	X		X				X									X	X	X		X			X	X
Savannah Sparrow	X	X	X			X	X	X	X					X	X	X	X		X									X			X				X	X
Tree Sparrow				X	X																															
White-crowned Sparrow				X	X									X			X																			
Fox Sparrow														X																						
Lapland Longspur	X	X				N	X	X	X			X																								

Key: N nest found ? uncertain on identification X bird sighted * observed between June 8 and 14

Table 2 summarizes the mammals observed on the north delta from June 15 - July 30. Rarely are large game mammal seen on the north delta. Mostly marine mammals are observed. No mammal inventories, such as trapping, were initiated in this study.

Six species of mammals, plus two unidentified seal were noted on the delta. Beaver seemed to be plentiful, as signs of cuttings were noted. No lodges were observed, but beaver could have been living in the banks. Big game animals are rare on the delta. However, in 1984, three polar bear reportedly came ashore near Okwega Pass on the pack ice (B. Okitkun, pers. com.). One was shot, while the other two migrated north. Marine mammals were common. The incoming tide would deposit walrus carcasses near the coast. One such carcass was found near north Kwiguk Pass Mouth. Beluga whales were also reported in the river by local eskimos as far as Emmonak. The two skeletons found at the mouth of Elongozhik Slough appeared to have been shot, drug ashore, and butchered.

Seals were also reported by natives. One seal apparently was eating fish from the coastal fyke net set two and a half miles off the mouth of Bugomawik Slough. It drowned and was removed by a local for food (J. Johnson, pers. com.). Another dead seal was found floating in the North Apoon Pass. No positive species identification was made as it appeared to have been dead for some time.

Table 2. Mammal List, 1985 North Delta Reconnaissance

Name	Date	Area Observed	Comments
Beaver	7/12	Akularak Slough near station 7-9	swimming
Fox	6/22	Camp #3, North Apoon Pass	scat found
Ermine	6/27	Elongozhik Slough near Henry Teeluk's cabin	in summer pelage
Otter	6/28	Akularak Slough near Kwikluak Pass	swimming
Walrus	6/15	tidal slough near, North Kwiguk Pass	dead 3-4 years
Seal	7/21	floating in river near Chapeluk Slough	dead
Seal	7/27	drowned in an offshore coastal fyke net at Bugomowik	removed by local
Beluga	6/27	Elongozhik Slough mouth	two butchered skeletons

Discussion

The greatest species diversity was in areas other than "nesting" areas. Most feeding areas were low and swampy, and had a variety of avifauna. Camp# 2, off Sheldon's Point, in Kwemeluk Pass was one of these areas. It was too wet for nesting birds, but the marsh had a tremendous variety of birds. The mouth of Elongozik Slough was another area that supported a great diversity of waterfowl, cranes and gulls. Large flocks of geese, ducks, and gulls could be seen feeding along the coast. Okwega Pass mouth outer island had a relatively high diversity, and was dry enough for some nesting also.Akularak Slough, which flows into Sunshine Bay supported many different passerines in high densities. Akularak Slough was visited again later in the season and species diversity and numbers had dropped significantly. It was unfortunate that none of the coastal areas were revisited to compare densities and diversity.

The method of observation greatly biased the results. Birds were most often observed from boats on sloughs and rivers. Birds that nested away from sloughs were not observed as much i.e. waterfowl or passerines used areas away from sloughs to nest and rear young. Bird size, color and sex played an important role in the observations. Observations were opportunistic, as boats rarely stopped to observe birds. Therefore, larger birds were more easily spotted from the moving boats or helicopter. White birds were easily picked out as small colorful birds were. Example: Male Yellow warblers were spotted at a much higher frequency than the more drab females, even though a 50/50 ratio probably exists. It is difficult to conclude that less colorful warblers such as Arctic or Orange-crowned warblers were less abundant or just not as readily visible. At another time, a male Pine grosbeak was observed. I would hesitate to say that it would have been observed if it had not been so striking a bird. No female was spotted with it and again one cannot conclude if this was the result of a lack of presence, or a seemingly less colorful bird being overlooked. Many small birds such as kinglets and flycatchers were not observed because time was not allocated to explore scrub willow thickets. Vocalizations would have been a good way to detect birds in dense thickets, but unfortunately I lacked the proficiency. Vocalizations also are impossible to detect from the moving boats.

There was simply not enough "land" time spent observing birds or locating nests. At best, sweeping generalizations and impressions could be made, but no real comparisons to other areas or even the same areas can be substantiated.

The helicopter was used mostly to fly people from Emmonak to Tuchiak, Kotlik, Sheldon's Point, Bugomowik Slough and a slough north of Black River. Occasionally it was used to drop fuel or to pick up people in between. It was not practical to do any kind of census work from the helicopter because it flew at too high an altitude, or at varying altitudes. Birds were difficult to detect and size was difficult to judge. At many times, the passengers were not exactly sure where they were and not always did we have window seats. Upon landing or taking off, the helicopter created winds of up to 80 miles/hour, and made so much noise that it scared birds. For this reason, it was restricted from landing within 15 miles of the coast, until after July 15, when the bulk of the nesting had already taken place. At Bugomowik Slough and the slough north of Black River, most nesting birds had left by the time we

were allowed to fly and land there. At Bugomowik Slough, a female Mallard and Green-winged teal were both raising broods. At Black River, flocks of sandpipers and waterfowl were abundant. The Black River area seemed to support more mollusks, as it was some distance south and away from the direct influence of the sediment deposition at the Yukon River mouths.

Recommendations

1. Clothing - Supply adequate clothing and footwear. A large roomy float coat or mustang suit would be ideal, as long days were spent on boats in the bone chilling weather. Insulated hipboots would also be an asset.

2. Timing - It would be beneficial to start observations at the beginning of June for nesting birds and mid May for birds selecting territories. With an early spring, observation dates may be moved up to one month prior to the 1985 starting date.

3. Binoculars - Smaller power (7X or 8X) would be advisable. Larger 50mm. lenses would be useful, and they do not necessarily need to be light weight i.e. are not backpacked. A quick focus knob would be preferable as it is faster, and with gloves or mittens, more practical.

4. Camping out - Frequent stops are essential for photography. Many birds were scared by boat motors, and the helicopter. They would leave the immediate area, but would return to the area if one waited awhile. Overnight trips would allow observation over a longer period of time, giving a more realistic picture of the areas inhabitants.

5. Separation of fish sampling - Concentration of birds were passed by and nets were often set in areas that were less than optimum for bird nesting/feeding. Had bird observation been the primary objective, different habitats would have been selected for bird observation.

Acknowledgements

I would particularly like to express gratitude to the Envirosphere Company people: Doug Martin, Cliff Whitmus, and Dick Tyler for their great hospitality, very much needed sense of humor, and "dependable" transportation around the delta. Appreciation is extended to Rae Baxter for his useful knowledge of the Yukon-Kuskokwim Delta country and his biological expertise. Much thanks are also due to Ron Philippsborn and Carl Anderson for their patience, and for their tolerance while transporting the crew and their odiferous equipment to and from work sites.

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Appendix A

The location of the fish sample stations are shown in Appendix A. This list contains the date, location, and station number of the areas Envirosphere sampled by purse, seine, or gill nets. Included are fish sample stations that I did not visit, but Rae Baxter did. Stations that Envirosphere sampled, but neither Rae nor myself went to, are not included. Dates are included after stations that were visited, even if no successful fish sample was made, as birds were observed. Example: A purse seine was attempted on offshore station 2-1 on 6/17, but the water was too rough to complete a successful seine. This was counted as a bird survey though, because bird data were collected. The fish sample station numbers are designated by double numbers. The first indicates one of the eleven habitat types, while the second number refers to the chronological order of the sample.

Appendix A

Fish Sample Stations used by Envirosphere Co.

Station	Description	Latitude	Longitude	Date Visited
1-1	Delta front - North Mouth	63 19.74	163 08.21	6/21; 7/22
1-2	Delta front - Middle Mouth	63 08.49	165 05.82	7/26
1-3	Delta front - South Mouth	62 26.16	165 37.32	7/19
2-1	Mid delta - South Mouth	Marker # 8		6/16,17; 7/18
2-2	Mid delta - Middle Mouth	63 08.17	164 48.48	7/26
2-3	Mid delta - North Mouth	63 11.47	163 11.94	7/21,22
3-1	Inner delta - Middle Mouth	63 06.07	164 41.24	6/24; 7/26
3-2	Inner delta - South Mouth	62 31.18	165 11.60	
3-3	Inner delta - North Mouth			
3-4	Inner delta - north of Kwiguk Mouth			7/11
3-5	Inner delta - south of Bugomowik	62 54.20	164 48.10	7/23,24
4-1	Mudflat - west of Elongozhik	63 13 80	164 17.29	6/26
4-2	Mudflat - south of South Mouth	62 31.18	165 10.00	
4-3	Mudflat - north of Kwiguk Mouth			
4-4	Mudflat - south of Bugomowik	62 54.20	164 48.10	7/23,24
4-5	Mudflat - north of Black River			7/29,30
5-1	Tidal slough - off Casey's Channel	62 39.19	164 51.13	
5-3	Tidal slough - north of Kwiguk Mouth			7/8
5-6	Tidal slough - in outer island at Okwega Pass			6/22,23
5-7	Tidal slough - 1st channel east of Apoon Mouth			6/21
5-8	Tidal slough - northwest of Kwiguk Pass			7/9,11
5-9	Tidal slough - same as 5-8			7/9,11
5-10	Tidal slough - south of Bugomowik	62 54.20	164 48.10	7/23,24
5-11	Tidal slough - north of Black River			7/29,30
6-1	Major active dist - Alakanuk Reach	62 40.82	164 36.62	6/17; 7/15,17
6-2	Major active dist - south of Kotlik	62 59.70	163 48.96	6/19; 7/21
6-3	Major active dist - several miles upriver of Seagull Point	62 58.75	164 16.61	7/25
7-1	Minor active - north of Kwiguk Mouth			6/15
7-2	Minor active - at Apoon Mouth	63 02.68	163 24.68	6/20; 7/21
7-3	Minor active - Tatlalinguk Pass	63 02.69	163 31.80	6/20; 7/22
7-5	Minor active - near Elongozhik mouth	63 31.80	164 17.29	6/26
7-7	Minor active - south of Sunshine Bay	62 40.84	164 17.02	6/28
7-8	Minor active - Kwiguk west of Emmonak	62 45.66	164 38.75	7/9
7-9	Minor active - south of Sunshine Bay	62 40.84	164 17.02	7/12
7-10	Minor active - Kwikpakak Slough	63 00.81	164 23.63	7/25
8-1	Minor inactive - north Sunshine Bay	62 43.80	164 19.50	6/19
8-2	Minor inactive - Chapeluk Sl., Apoon	62 59.30	163 52.20	6/19
9-1	Lake - North of big meander, Middle Mouth			7/5,9
10-1	Lake outlet North of big meander,MM.	62 57.10	164 05.90	7/5,9
11-1	Major inactive channel - Kwemeluk Pass			6/16

Appendix B

Observations of Avian Species by Transects

JUNE 15, 1985

(Appendix D-10) Emmonak to Kwiguk Mouth

- parasitic jaeger
- sandhill crane (1)
- greater scaup (pr.)
- northern pintail (2)
- long-tailed jaeger (2)
- lapland longspur (5)
- northern shoveler (1)
- canvasback (1)*
- semipalmated sandpiper (1)*
- red-necked phalarope (1)*

(Appendix D-10) Inlet near South Kawokhawik Pass

- black turnstone (2)
- northern pintail (3)
- lapland longspur
- dunlin (1)
- semipalmated sandpiper (1)
- parasitic jaeger

(Appendix D-10) Kwiguk Pass Mouth

- raven
- semipalmated sanpiper
- tundra swans (2)
- northern pintail (3)
- Arctic tern
- common redpoll
- dunlin (1)
- lapland longspur (11)
- bank swallow (1)
- long-tailed jaeger

(Appendix D-10) Camp # 1, North Kwiguk Pass (sta. 1)

- dunlin (2)
- emperor goose (2)
- common snipe(vocal)
- common redpoll (1)
- savanah sparrow
- semipalmated sandpiper(nesting)
- glaucous-winged gulls (2)

JUNE 16, 1985

(Appendix D-14) Kwiguk Pass Mouth to South Mouth

- loons (common?) (2)
- black-legged kittiwakes (2)
- tundra swans (2)

(Appendix D-5) Kwemeluk Pass, Camp# 2 (sta. 11-1)

- semipalmated sandpiper
- red-necked phalarope (4)
- red phalarope (1)
- norther shoveler (pr.)
- northern pintail (pr.)
- oldsquaw (pr.)
- green-winged teal (pr.)
- Arctic loon
- sandhill crane
- greater scaup
- western sandpiper (1)
- black-bellied plover(3A/1J)
- bar-tailed godwit (5)
- snipe(vocal)
- dunlin
- savannah sparrow
- Arctic tern
- parastic jaeger
- lesser Canada goose
- common redpoll
- least sandpiper

JUNE 17, 1985

(Appendix D-7) Kwemeluk Pass to Flat Island

tundra swans (5)	black turnstone
Arctic tern	northern pintail
northern shoveler	semipalmated sandpiper
least sandpiper(nesting)	

(Appendix D-7) Flat Island

Arctic tern	black turnstone(nesting pair)
savannah sparrow	least or semipalmated sandpiper

(Appendix D-12) Offshore So. Mouth Marker# 8 (sta. 2-1)to Alakanuk (sta. 6-1) to Emmonak

mew gulls	glaucous-winged gulls
Arctic tern	glaucous gull

JUNE 18, 1985

(Appendix D-14) Emmonak to Kotlik via Aproka Sl. & Apoon Pass (Kwiguk to Aproka)

mew gull	common redpoll
white-crowned sparrow	gray-cheeked thrush
tree swallow	bank swallow

Aproka Slough

bank swallow (N)	northern shoveler (3)
Arctic tern	common raven

(Apoon & Middle Mouth Jct. to Kotlik)

mew gull	northern shoveler
parasitic jaeger	long-tailed jaeger
Arctic tern	bank swallow
mew gull	sandhill crane
northern shoveler	northern pintail

Kotlik

common raven	tree swallow

Kotlik to Apoon Mouth, return to Kotlik

mew gull	Arctic tern
northern shoveler	northern pintail

(Appendix D-2) Kotlik Airstrip

northern shoveler(1)	tree sparrow (1)
common redpoll(N)	yellow warbler (1)
northern harrier (3)	yellow wagtail(1)*
merlin(female,mobbing northern harrier) (1)	

JUNE 19, 1985

(Appendix D-2) Kotlik slough and airstrip

common redpoll	glaucous-winged gull
white-crowned sparrow*	northern pintail
northern harrier	northern shoveler
common raven	herring gull
gray-cheeked thrush(vocal)	sandpiper sp?
tree sparrow	bank swallow
tundra swan	cliff swallow(1)*
Arctic tern	mew gull

(Appendix D-8) Apoon Pass to Chapeluk Sl. (sta. 8-2),(6-2) Okwega Pass to Kotlik

common redpolls	tree sparrow
gray-cheeked thrush	tundra swan
herring gull	sandpiper sp?

JUNE 20, 1985

Helicopter Flight to Kotlik

tundra swans (50) Pastolik River mouth
large gulls (3) Pastolik River and Pastoliak River

(Appendix D-1) Kotlik to Tatlaklinguk Pass(sta. 7-3) and Kvichvauk Sl., North Apoon

gray-cheeked thrushes (2)	common redpoll (F)
snow goose (1)	

(Appendix D-1) North Apoon Pass

common redpoll (nest) pr.	dunlin
parasitic jaeger	lapland longspur (nest) pr.
long tailed-jaeger	least sandpiper (nest) pr.
yellow warbler(1)	Arctic warbler (Myrica sp.) (1)

(Appendix D-1) North Apoon Pass, Camp# 3 (sta. 7-2)

sandhill crane	common raven
Arctic tern	northern shoveler
northern pintail (N)	red-necked phalarope (nest)
savannah sparrow	bank swallow
green-winged teal	least/semipalmated sandpiper (nest)

JUNE 21, 1985

(Appendix D-1)Camp# 3

Arctic tern	northern pintail
common redpolls (nest)	northern shoveler
red-necked phalarope(nest)	lapland longspur (nest)

Camp #3 (continued)

greater scaup	mew gull
parasitic jaeger	yellow warbler
savannah sparrow	pomarine jaeger(1)* 17 miles out
common ravens (vocal)	black-legged kittiwake(1)* 17 miles out
lesser Canada geese	dunlin
least sandpiper (nest)	

JUNE 22, 1985

(Appendix D-1)Camp# 3

oldsquaw(1)	red-necked phalarope
least sandpiper	

(Appendix D-2) North Apoon to Okwega Mouth via Okwega West Side

Arctic tern	northern shoveler (25 mostly males)
northern pintail	black turnstone
red-necked phalarope	tundra swan (25)
longed-tailed jaeger	parasitic jaeger
green-winged teal	common redpolls
yellow warbler	

(Appendix D-2) Okwega Pass Mouth Inner Island, Camp# 4 (sta. 5-6)

dunlin(F)	savannah sparrow
northern pintails (25)	least/semipalmated sandpipers
northern shoveler	black turnstone(F)
bar-tailed godwit	Arctic tern
mew gull	lesser Canada geese
lapland longspur	abandoned goose nest
red-throated loon (1)	red-breasted merganser (pr.)
Arctic loon (1)	common redpolls (nest)

JUNE 23, 1985

(Appendix D-2) Okwega Pass, Outer Island

northern shoveler (25)	northern pintail (25-2 nests)
tundra swans (2)	semipalmated sandpiper(F)
black turnstone(F)	dunlin (1)
common redpoll(F)	emperor goose (1)
pelagic cormorants (pr.)	lapland longspur(S)
bar-taied godwit (F)	northern phalarope (nest) (N)
Arctic loon (2)	savannah sparrow(S)
green-winged teal (pr.)	lesser Canada geese (N)
sandhill crane(N)	least sandpiper (nest with 4 chicks)

JUNE 24, 1985

(Appendix D-2) Okwega Mouth to Kotlik via Okwega Pass

northern shoveler (N)	tundra swans (N)

(Appendix D-9) Tuchiak Village

goshawk (1)	rusty blackbird (4)
common raven	yellow warbler (1)

(Appendix D-4) Tuchiak to Kawanak Mouth (sta. 3-1) to Tuchiak

Arctic tern	mew gull
northern pintail	bank swallow
common murre (1)*	tree swallow

JUNE 25,1985

(Appendix D-10) Emmonak Local, Kwiguk Pass

mew gull	gray-cheeked thrush (vocal)
common raven	long-tailed jaeger
glaucous-winged gull	parasitic jaeger (Lt. & Dk. phase)

Tuchiak to Kawanah Mouth to Tuchiak

yellow warbler (1)	common redpolls
bank swallow	tree swallows
parasitic jaeger	glaucous-winged gull
Artcic tern	

JUNE 26, 1985

(Appendix D-13) Tuchiak to Elongozhik Slough Mouth

American widgeon (2 pr.)	bank swallow (N)
Arctic tern	rough-legged hawk (1)
yellow warbler	northern pintail (N)
tundra swans (N)	lesser Canada geese (N)
northern harrier (1)	white-winged scoter (1)
sandhill crane (N)	common redpoll
gulls (100 at mouth)	northern waterthrush (1)

(Appendix D-3) Elongozhik Slough, Camp# 6 (sta. 4-1, and 7-5)

brant (N)	northern shoveler (N)
lesser Canada geese (N)	gulls (N)
Arctic tern	tundra swans (N)
Artic loon	black-legged kittiwake (3)
Sabine's gull (2)	spectacled eiders (2 pr. nesting)
green-winged teal	northern pintail (N)
lapland longspur	black-bellied plover (4)
parasitic jaeger (1 dk.)	mallards (pr.)
eiders sp? (3 females)	emperor geese (pr.)

JUNE 27, 1985

(Appendix D-13) Elongozhik Slough Mouth to 15 miles upstream

common redpoll	northern pintail (N)
lesser Canada geese (N)	northern shoveler (N)
sandhill crane	tundra swan (N)
American widgeon (pr.)	northern waterthrush
glaucous-winged gull (N)	

JUNE 28, 1985

(Appendix D-6) Emmonak to Sunshine Bay via Akularak Slough (sta. 7-7)

northern waterthrush (5)	gray-cheeked thrush (N)
hermit thrush (F)	bank swallow (100's)
rusty blackbird (5)	lesser yellowlegs (1)
varied thrush (3)	white-crowned sparrow (1)
American robin (1)	fox sparrow (1)
pine grosbeak (1)	black-capped chickadee (F)
blackpoll warbler (1)	savannah sparrow
yellow yarbler (1)	

(Appendix D-6) Sunshine Bay

glaucous-winged gull (N)	mew gull (N)
parasitic jaeger	tree swallow (N)
bank swallow (N)	northern pintail
northern shoveler(80 males)	

(Appendix D-14) Alakanuk Slough

varied thrush (vocal)	bank swallow
common raven	tree swallow
American robin (1)	

JUNE 30, 1985

Emmonak Local

yellow warbler	northern harrier(F)
savannah sparrow(S)	black-capped chickadee(F)
common redpoll	green-winged teal
red-necked grebe (pr.)	snipe (1)
Arctic tern	northern waterthrush(F)
common raven	gray-cheeked thrush(S)
hermit thrush (1)	common Loon (pr.)
flycatcher/kinglet sp? (1)	

JULY 5, 1985

(Appendix D-9) Lake outlet 1/2 mile below, to Lake (sta. 10-1)

blackpoll warbler	yellow warbler
great horned owl (2 pale form)	

Lake (sta. 9-1)

mallard (1)	savannah sparrow
red-necked grebes (pr.)	tundra swan (2)
osprey (1)	

JULY 8, 1985

Helicopter Flight

glaucous-winged gull	mew gull
Arctic tern	common raven
sandhill crane	

JULY 9, 1985

(Appendix D-10) Emmonak to North Kwiguk Mouth stopping at (sta. 5-8,5-9)

long-tailed jaeger	Arctic tern
red-necked phalarope	glaucous-winged gull
savannah sparrow	common raven
sandhill crane	

(Appendix D-10) Kwiguk Mouth to West of Emmonak (sta. 7-8)

northern pintail (10)	white-crowned sparrow
black turnstone (1)	mew gull
glaucous-winged gull	herring gull (1)
Arctic tern	

Lake Slough (sta. 9-1)

lesser Canada geese (2)	yellow warbler
northern pintail	rusty blackbird
common snipe(vocal)	varied thrush(vocal)
orange-crowned warbler (1)	

JULY 11, 1985

Emmonak to (sta. 5-8)

long-tailed jaeger	tundra swans
mew gull	glaucous-winged gull

Station 5-8

common snipe (3)	savannah sparrow
red-necked phalarope (4)	common redpoll
gray-cheeked thrush(vocal)	

Kwiguk Pass to Coast, offshore to Emmonak

hermit thrush	common raven
green-winged teal	dunlin
tree swallow	northern pintail
mew gull	glaucous-winged gull
Artic tern	gray-cheeked thrush
Canada goose	bank swallow
yellow wagtail(1)	tundra swan

JULY 12, 1985

Emmonak to Sunshine Bay to Akularak Slough

glaucous-winged gull	mew gull
Arctic tern	northern pintails

Hook seine Sta.# 7-7, 7-9

lesser yellowlegs (1)	red-necked phalarope (2)
bank swallow (hundreds)	great horned owl(1-pale form)
tree swallow (N)	rough-legged hawk (1)

great horned owl or rough-legged hawk (1)

JULY 13, 1985

Emmonak Airport Local to Tank Farm

mew gull	glaucous-winged gull
gray-cheeked thrush	

JULY 14, 1985

(Appendix D-10) Emmonak to Anuzukanuk Slough to Emmonak

bank swallow	mew gull
gray-cheeked thrush	

JULY 15, 1985

(Appendix D-14) Emmonak to Alakanuk Reach (sta. 6-1) to Emmonak

jaeger	gulls

Kotlik to Emmonak via Aproka Slough

Arctic tern	lesser Canada geese (2)
Mew gull	northern waterthrush (1)
glaucous-winged gull	semipalmated plover (1)
gray-cheeked thrush	

JULY 16, 1985

Emmonak Local

glaucous-winged gull	parasitic jaeger
western sandpiper (1)	long-tailed jaeger

JULY 17, 1985

Emmonak to Alakanuk Reach (sta. 6-1)

mew gull	Arctic tern

JULY 18, 1985

Emmonak to South Mouth offshore bouy# 9.

common raven (3)	mew gull
glaucous-winged gull	gulls

No birds beyond bouy# 6, 4.5 miles out

Sheldon's Point

common raven	parasitic jaeger
Arctic tern	gulls

JULY 19, 1985

Emmonak to Sheldon's Point

long-tailed jaeger	glaucous-winged gull

(Appendix D-12) Offshore South Mouth beyond Bouy# 7 Seven Miles 14 miles out (sta. 1-3)

glaucous-winged gull (2)	parasitic jaegers (2)
cormorants or loons?	eiders sp?

Sheldon's Point

common raven (8)	Arctic tern (3)
glaucous-winged gull	

Sheldon's Point to Emmonak

glaucous-winged gull	Arctic tern

JULY 20, 1985

Emmonak Local

savannah sparrow	glaucous-winged gull
long-tailed jaeger	mew gull
parasitic jaeger	tree swallow
common redpoll	yellow warbler(vocal)

JULY 21, 1985

Emmonak to Kotlik via Aproka Sl. & Apoon Pass & Kwiklauk Pass

mew gulls	Arctic tern
glaucous-winged gull	

Aproka Slough

sandpiper sp?	bank swallow
common raven (2)	northern shoveler (2)
sandhill crane (5 pr.)	

Apoon Pass and offshore 3 miles offshore

sandhill crane (5)	glaucous-winged gull
Arctic terns on barrel markers (3)	

Hook seine Sta. 7-2.

mew gull	sandpiper sp?
northern harrier	

Apoon at Chapeluk Slough (sta. 6-2)

long-tailed jaeger (5)	mew gull
glaucous-winged gull	

Kvichvauk Slough North Apoon

common raven	yellow warbler
rusty blackbird	

JULY 22, 1985

(Appendix D-13) Kotlik offshore NW of Stebbins 14 miles out (sta. 1-1,2-3)

glaucous-wing gull	parasitic jaeger
scoter sp? (1)	pomarine jaeger

Tatlalinguk Pass Hook Seine (sta. 7-3)

mew gull	yellow warbler
common redpoll	

JULY 23, 1985

Emmonak Cemetery.

yellow warbler (1)	common redpoll (S)
common loon(vocal)	

(Appendix D-11) Bugomowik Slough (sta. 3-5, 4-4, 5-10)

bar-tailed godwit (3)	savannah sparrow (2)
sandhill cranes (11)	green-winged teal (1female,3chicks)
dunlin	parasitic jaeger (3 calling on ground)
glaucous-winged gull	Arctic loon (pr.)
red-necked grebe (1)	mallard (1female w/chicks)

JULY 24, 1985

Kotlik Airstrip

Arctic tern	common snipe(vocal)
common redpoll	western sandpiper (6)

(Appendix D-14) Kotlik to M. Mouth via Aproka Sl. & Dunukchavak Sl. to Tuchiak.

glaucous-winged gull	sandhill crane (pr.)
long-tailed jaeger	northern shoveler (pr.)
yellow warbler	rusty blackbird
gray-cheeked thrush (3)	

Bugomowik Mouth (sta. 3-5, 4-4, 5-10)

savannah sparrows	Glaucous-winged gull
loons sp? (2)	juvenile glaucous-winged gull, broke wing in fyke net and was destroyed

JULY 25, 1985

Tuchiak to Middle Mouth (sta. 6-3)

bank swallow	glaucous-winged gulls
Arctic tern	

Kwikpikak Slough

Arctic tern	glaucous-winged gulls

7/26 - Emmonak

western sandpiper (10)

Tuchiak to Middle Mouth Offshore (sta. 3-1)

northern pintail (1)	Arctic tern

Four miles Offshore (sta. 1-2)

common loon (1)	long-tailed jaeger
loon sp.	Arctic tern

Ten Miles Offshore (sta. 2-2)

Arctic tern	mew gull
parasitic jaeger	

JULY 27, 1985

Emmonak Local

common loon (2)	western sandpiper (10)
orange-crowned warbler (1female w/2 fledglings)	

JULY 29, 1985

(Appendix D-12) Slough North of Black River (sta. 4-5, 5-11)

northern pintail (25)	western sandpiper (20)
common redpoll	glaucous-winged gull
Arctic loons (4)	savannah sparrow
parasitic jaeger	

JULY 30, 1985

Slough North of Black River (sta. 4-5, 5-11)

bar-tailed godwit (2)	western sandpiper (12)
Arctic tern (1)	savannah sparrow
northern pintail (5)	common redpoll

Helicopter flight: Emmonak to Black River

sandhill crane (100)	tundra swan (50adults/young)
spectacled eiders (50 males)	western sandpipers (10)

Key:

*	observed by Rae Baxter	**	observed by Ron Phillipsborn
F	few (2 - 5)	S	several (6 - 10)
N	numerous (10 plus)	pr	pair
A	adult	J	juvenile

Appendix C

Descriptions of Infrequent Sightings

Species were widely distributed over several habitat types. Observation was somewhat biased by the mode of transporation i.e. species were observed from boats mostly; therefore sightings were more commonly made around sloughs, lakes, rivers, and the coast. Species that were less abundant or were infrequently observed are noted below. Designation of abundance is rather subjective because many habitat types were not thoroughly investigated.

Red-throated Loon - One adult was observed swimming in a tidal slough near station 5-6 at 10:00 pm. on June 22 near the inner island at Okwega Pass.

Pelagic Cormorant - Pair flying north on coastal side of outer island at Okwega Pass, 1:00 pm. on June 23.

Brant - Brant were numerous, along with Lesser Canada Geese, on sedge flats east of the mouth of Elongozhik Slough. This appeared to be a waterfowl feeding area.

Snow Goose - One adult was swimming in the sedges on the side of North Apoon Pass. It appeared to be injured and did not flush. Observed 5:15 on June 20.

Emperor Goose - One flying between inner and outer island at Okwega Pass the evening of June 23. One observed near a tidal slough North of Kwiguk Pass Mouth at 9:00 pm. on June 15. One pair flying near Elongozhik Slough mudflat station 4-1 on June 26.

American Widgeon - Two pair were flushed along Elongozhik Slough on June 26, and one pair was flushed along the slough on July 27.

Canvasback - One was spotted by Rae Baxter near the mouth of Kwiguk Pass on June 15.

Greater Scaup - One pair was spotted on Kwiguk Pass on June 15. One was at the marsh behind camp# 2 at Kwemeluk Pass at 11:30 pm. on June 16. One landed in a marsh behind camp# 3 at North Apoon Pass on June 21.

Oldsquaw - A pair was observed on June 16 at Kwemeluk Pass. One was observed from camp# 3 flying north on Apoon Pass at 9:30 am. on June 22.

Spectacled Eiders - Two pair were in two adjacent shallow ponds east of the mouth of Elongozhik Slough. One female appeared to be sitting on a nest while her mate swam nearby. The other pair was swimming around and feeding in their pond. Observed 10:00 pm. east of station 4-1 on June 26.

White-winged Scoter - Flushed near mouth of Elongozhik Slough on June 26.

Red-breasted Merganser - One pair was feeding near the gill net at station 5-6. Each caught one fish (sp?) and then hauled out to preen. Observed at 9:00 pm. on June 22.

Rough-legged Hawk - One was flying over Elongozhik Slough on June 27. Another was flushed from a slough near station 7-9 at 10:30 pm. on July 12.

Merlin - One adult female observed mobbing a Marshawk above Kotlik airstrip on June 18 at 8:00 pm.

Northern Goshawk - One was observed flying on the east side of the Tuchiak abandoned village site at 2:15 pm. an June 23.

Osprey - A sighting was made by Ron Philippsborn while flying a helicopter to lake sta. 9-1 on July 5. This sighting is uncertain.

Semipalmated Plover - Two adults were spotted with one chick at the St. Mary's airstrip on July 13. The first delta sighting was made at the junction of Apakshau Slough and Apoon Pass on July 15. It was feeding on a mud bar at the mouth of Apakshau Slough.

Lesser Yellowlegs - Two sightings were made of the same bird on July 12 at 8:00 pm. and on June 28 at 3:00 pm. near station 7-7 and 7-9. Both times the bird was sitting on a branch and calling loudly. On the second occassion it displayed continual wing flashing and calling while the hook seine was being towed, approximately twenty minutes. Station 7-7 was across the slough from the bird, while station 7-9 was on the same side of the slough as the bird, and assumed to be very close to its nest.

Least/Semipalmated Sandpipers - These two Charadriformes were extremely difficult to distinguish. Leg color is the main criteria used, however on the delta, mud coated on the legs of both species made color impossible to differentiate. Bill size and shape were not useful in separating the species. the row of light feathers above the scapulars was helpful in separating the Least, however the immature and late summer plummages have more rufous color and are similar in appearance to the Western sandpiper. Only one Western sandpiper was observed on the delta, at Kwemeluk Pass on July 17, until flocks migrated through towards the end of July.

Red Phalarope - One was observed near station 11-1 in a marsh at 11:15 pm. on June 17.

Black-bellied Plover - Three adults and one juvenile or winter plummage bird were observed feeding in wet area near station 11-1 in Kwemeluk Pass, at 11:30 pm. on June 17. On June 26, four adults were seen on a sedge flat near station 4-1 at the mouth of Elongozhik Slough.

Pomarine Jaeger - These birds were observed only on the delta front approximately 14 to 17 miles offshore. Rae Baxter observed one off North Mouth on June 21, and others were observed off South Mouth on July 19.

Glaucous Gull - Sightings were combined with that of Glaucous-winged Gulls due to the fact that they hybridize and also they are hard to distinguish in large flocks.

Herring Gull - Sighting was made west of Emmonak on Kwiguk Pass at station 7-8 on July 9. One was sighted on North Apoon Pass off Chapeluk Slough on June 19.

Black-legged Kittiwake - On June 16, two kittiwakes were spotted on Kwiguk Pass. Rae Baxter observed one 17 miles off of North Mouth on June 22, while three more were observed along the coast at the mouth of Elongozhik Slough at station 4-1 on June 26.

Sabine's Gull - Two flew over head near coastal mudflat near station 4-1 on Elongozhik Slough at 6:00 pm. on June 26.

Common Murre - Rae Baxter observed one west of Nunatuk Island in Kwawanuk Channel on June 24.

Great Horned Owl - Rae Baxter spotted one near station 7-6 on Casey's Channel mid-June. Two adult pale forms were flushed separately from willows along the lake outlet station 10-1 at 12:30 on July 5. One adult pale form was flushed from a slough near station 7-9 at 10:30 pm. on July 12.

Cliff Swallow - Observed by Baxter,on June 19 at slough off Kotlick airstrip.

American Robin - Flew over Akularak Slough at 2:00 pm. on June 28.

Varied Thrush - One was observed in willow lined bank along Akularak Slough. At least one other was heard in this area on June 28. One was heard on July 9 at the lake outlet, station 10-1 east of Choolunawick.

Arctic Warbler - One observed North Apoon Pass at 5:00 pm. on June 20 in a low shrub.

Yellow Wagtail - One was observed by Rae Baxter near the Kotlik airstrip on June 18. One was observed in the willows on Kwiguk Pass on July 11.

Orange-crowned Warbler - Seen in willows along the lake slough station 10-1 on July 9. One female and two fledglings were first noticed in willows in front of Peverall's house in Emmonak on July 27. The female was catching mosquitoes off the windows of the house.

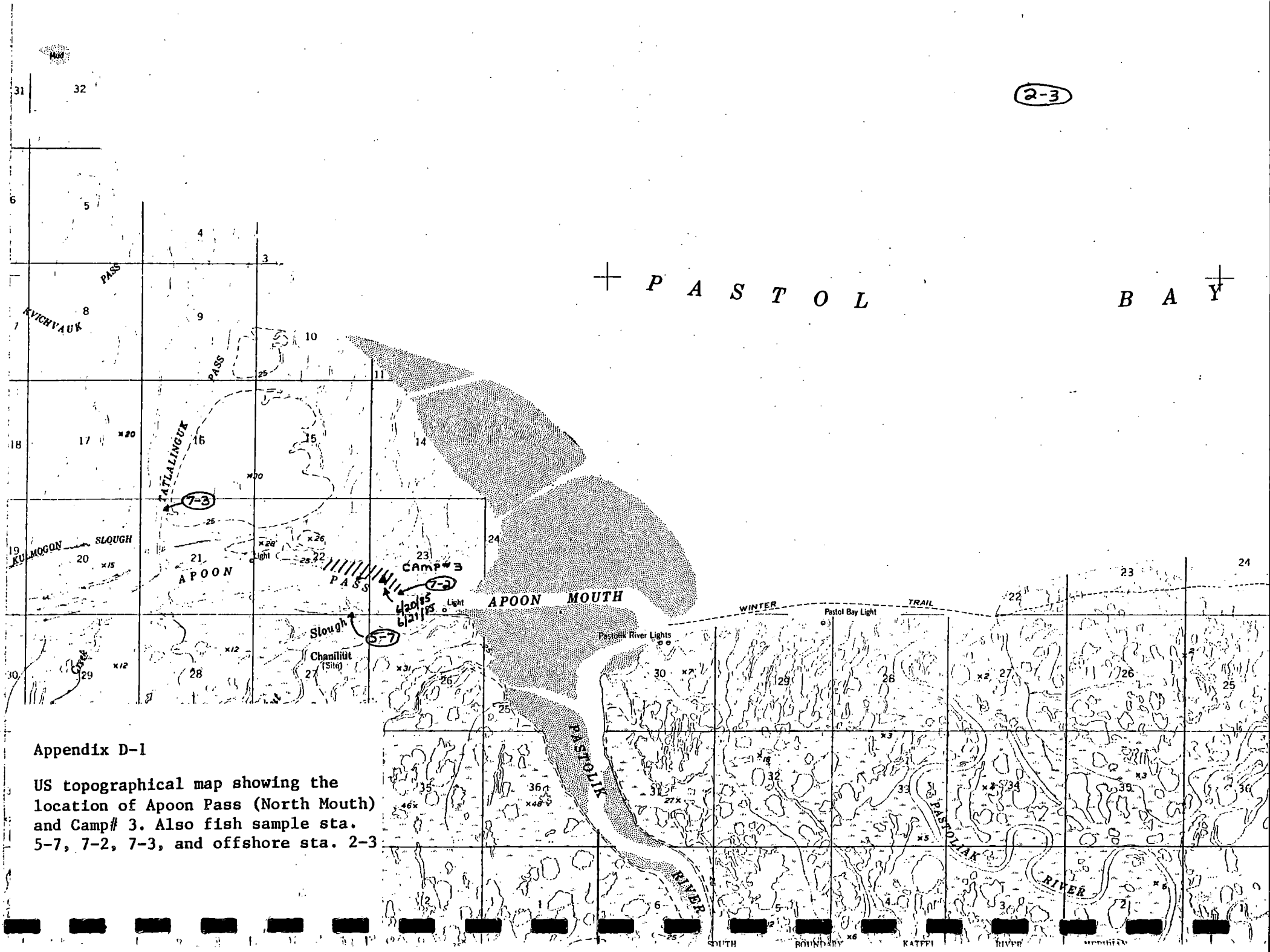
Blackpoll Warbler - One observed in willows on Akularak Slough on June 28. One observed in willows on Lake Outlet Slough sta. 10-1 on July 7th.

Pine Grosbeak - A male was spotted on a willow along Akularak Slough. It was passed very quickly by the Munson at 1:00 pm. on June 28.

Fox Sparrow - One was feeding on a mudflat near Akularak Slough on June 28.

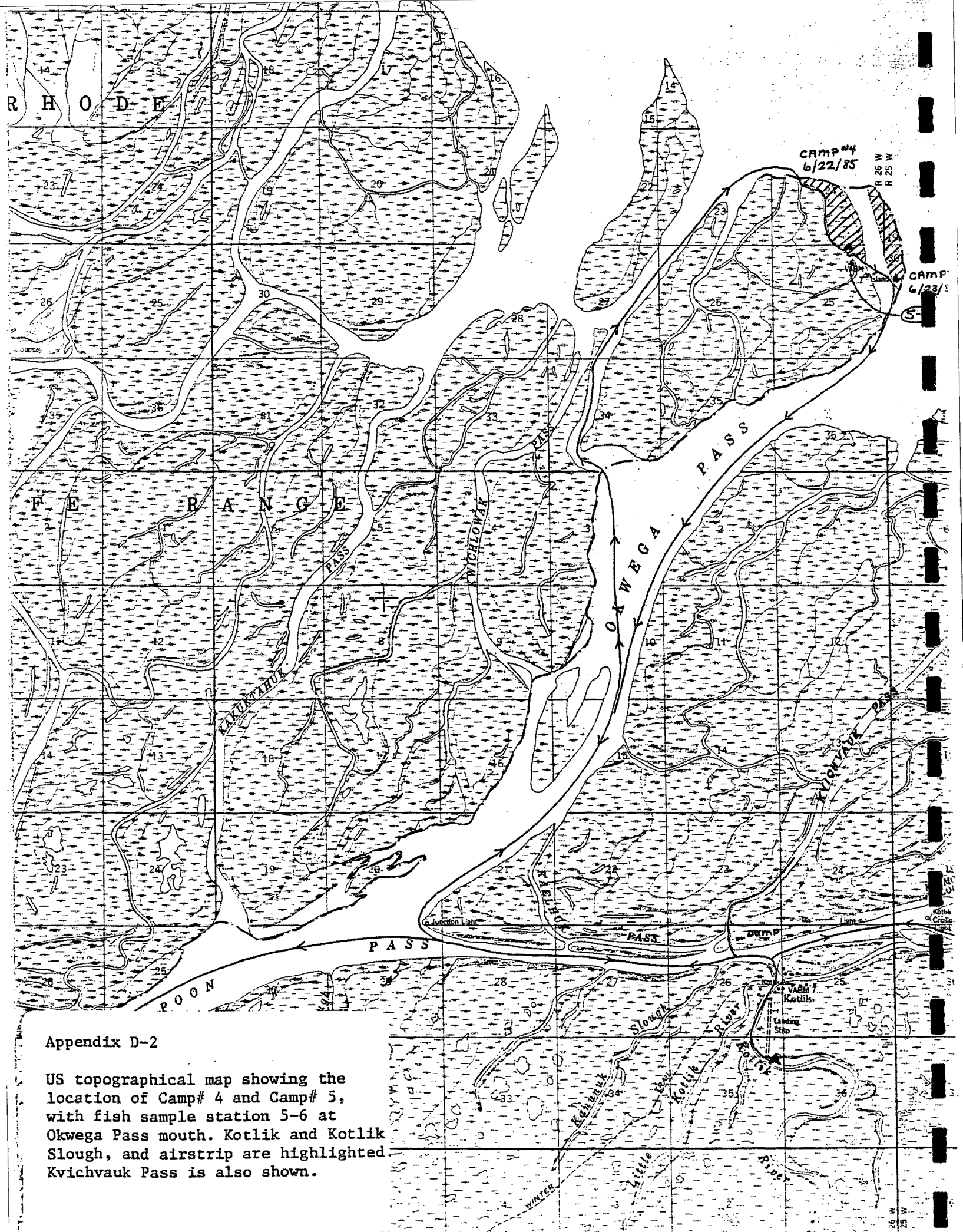
Appendix D

List Of USGS Topographic Maps Used For 1985 North Delta Survey



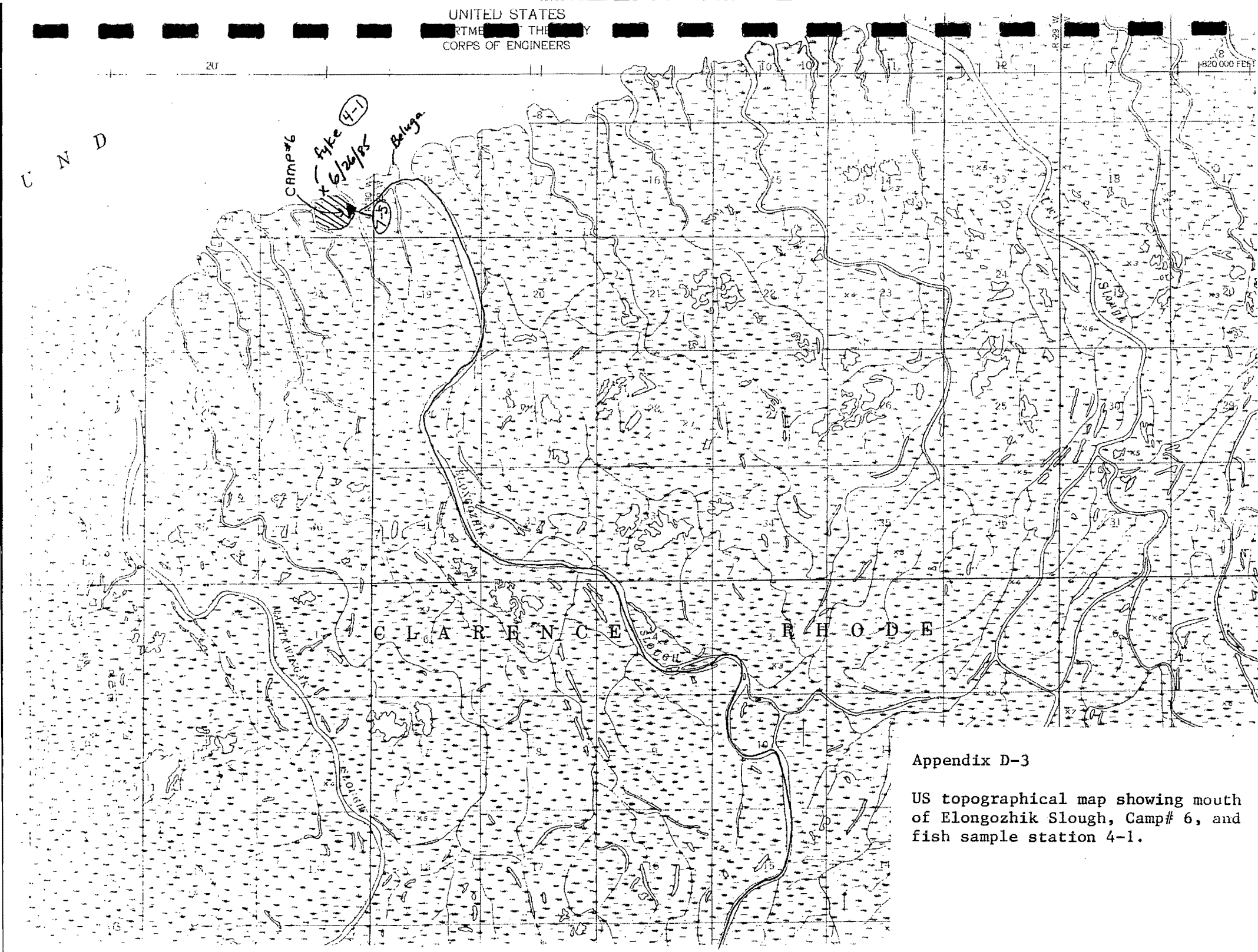
Appendix D-1

US topographical map showing the location of Apoon Pass (North Mouth) and Camp# 3. Also fish sample sta. 5-7, 7-2, 7-3, and offshore sta. 2-3



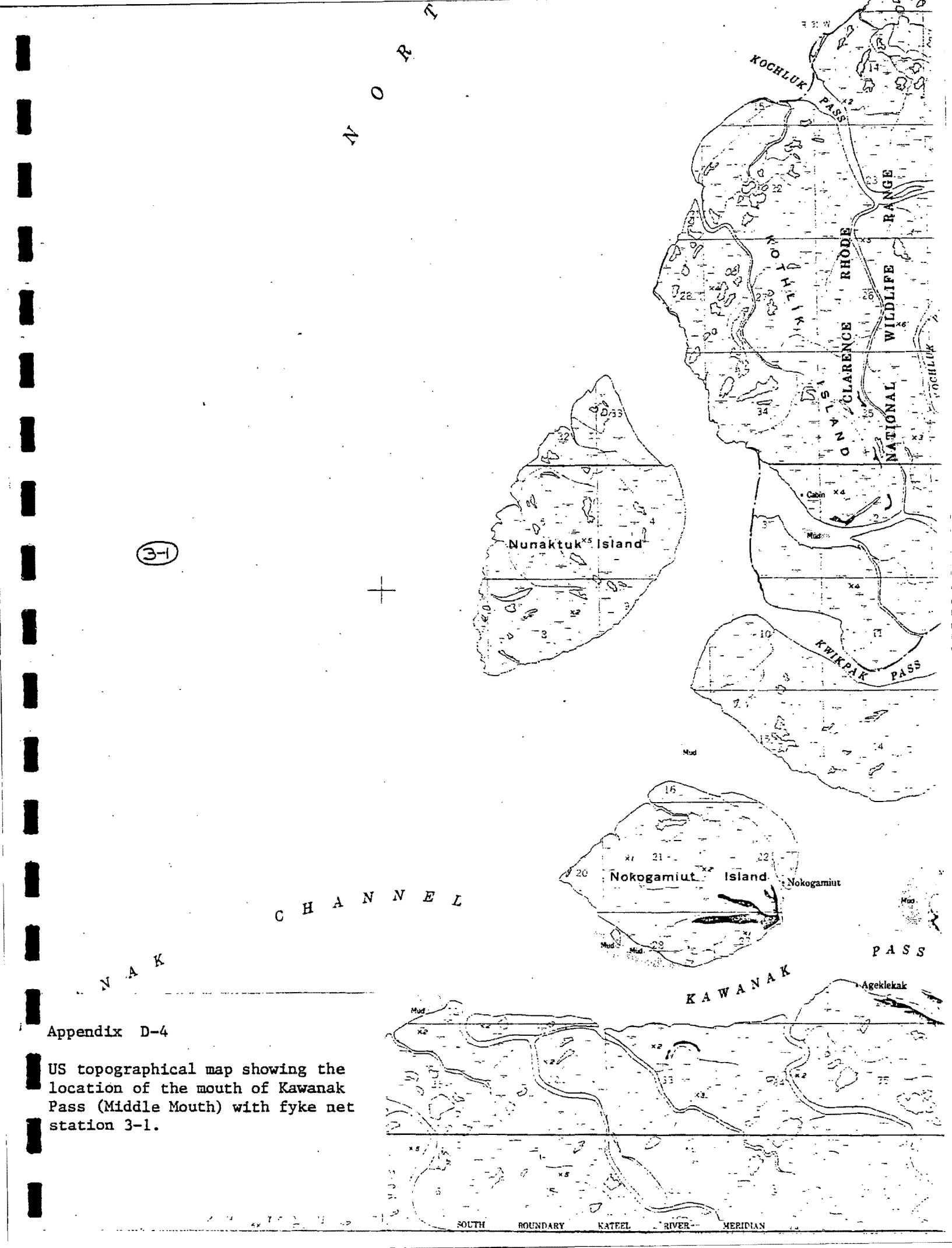
Appendix D-2

US topographical map showing the location of Camp# 4 and Camp# 5, with fish sample station 5-6 at Okwega Pass mouth. Kotlik and Kotlik Slough, and airstrip are highlighted. Kvichvauk Pass is also shown.



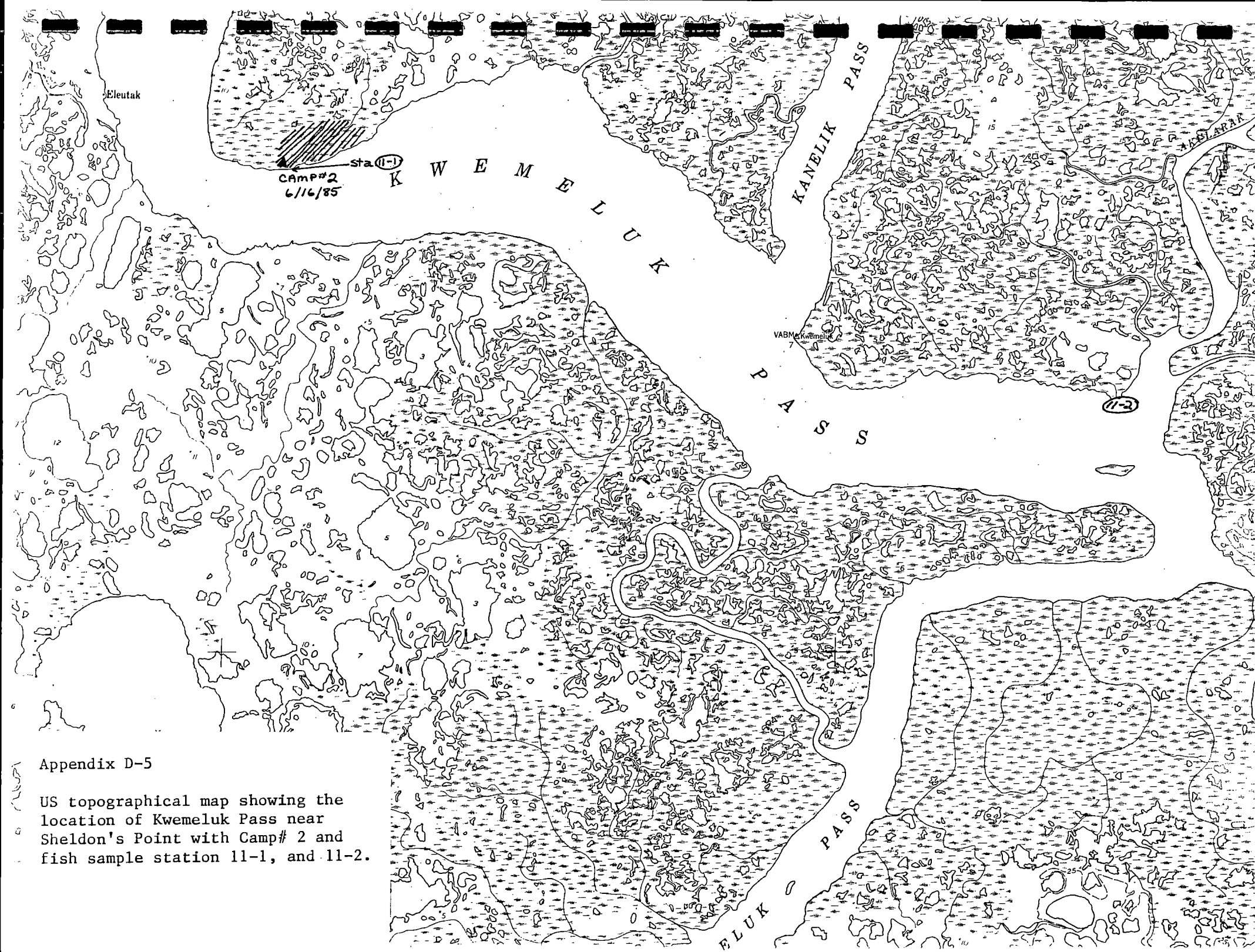
Appendix D-3

US topographical map showing mouth of Elongozhik Slough, Camp# 6, and fish sample station 4-1.



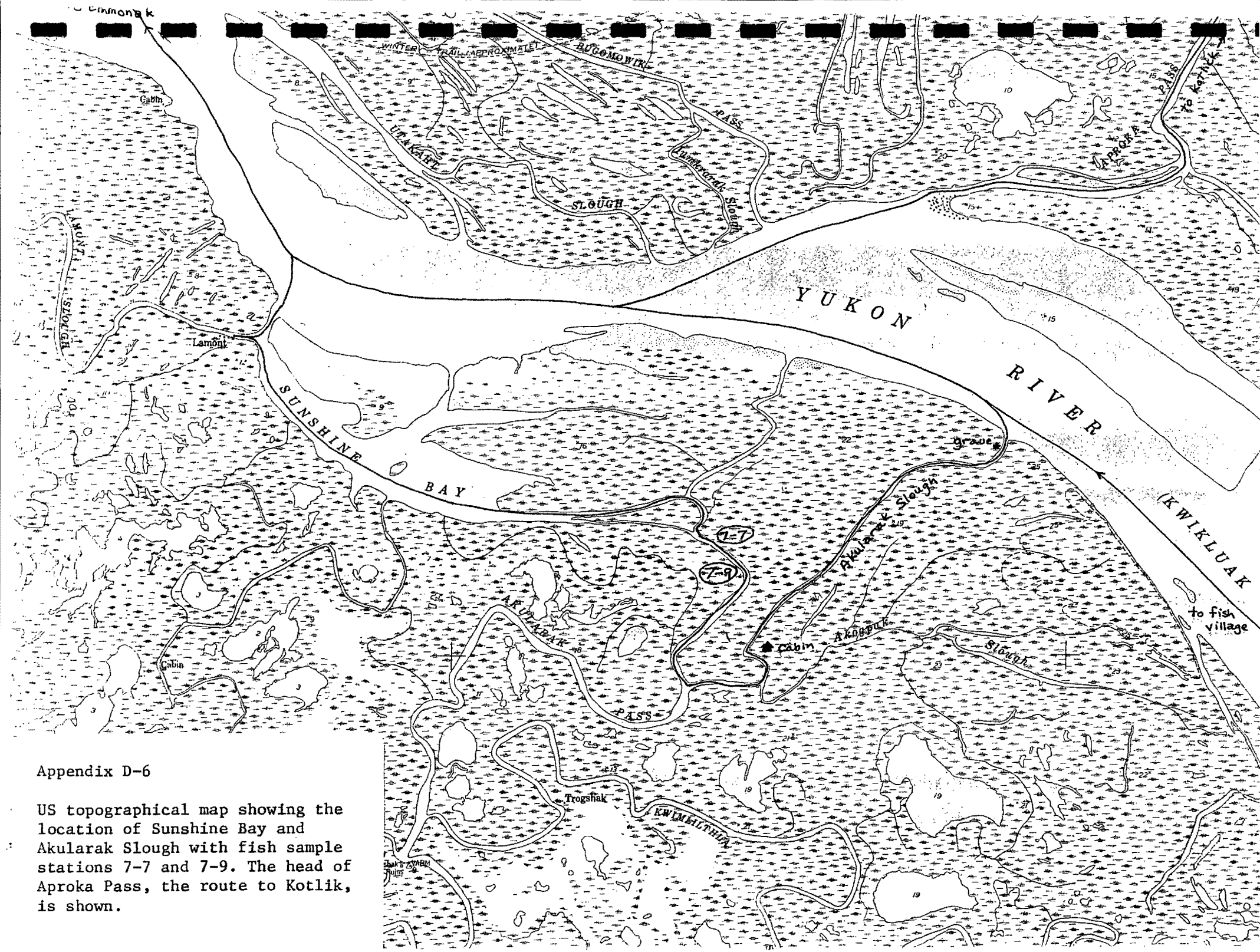
Appendix D-4

US topographical map showing the location of the mouth of Kawanak Pass (Middle Mouth) with fyke net station 3-1.



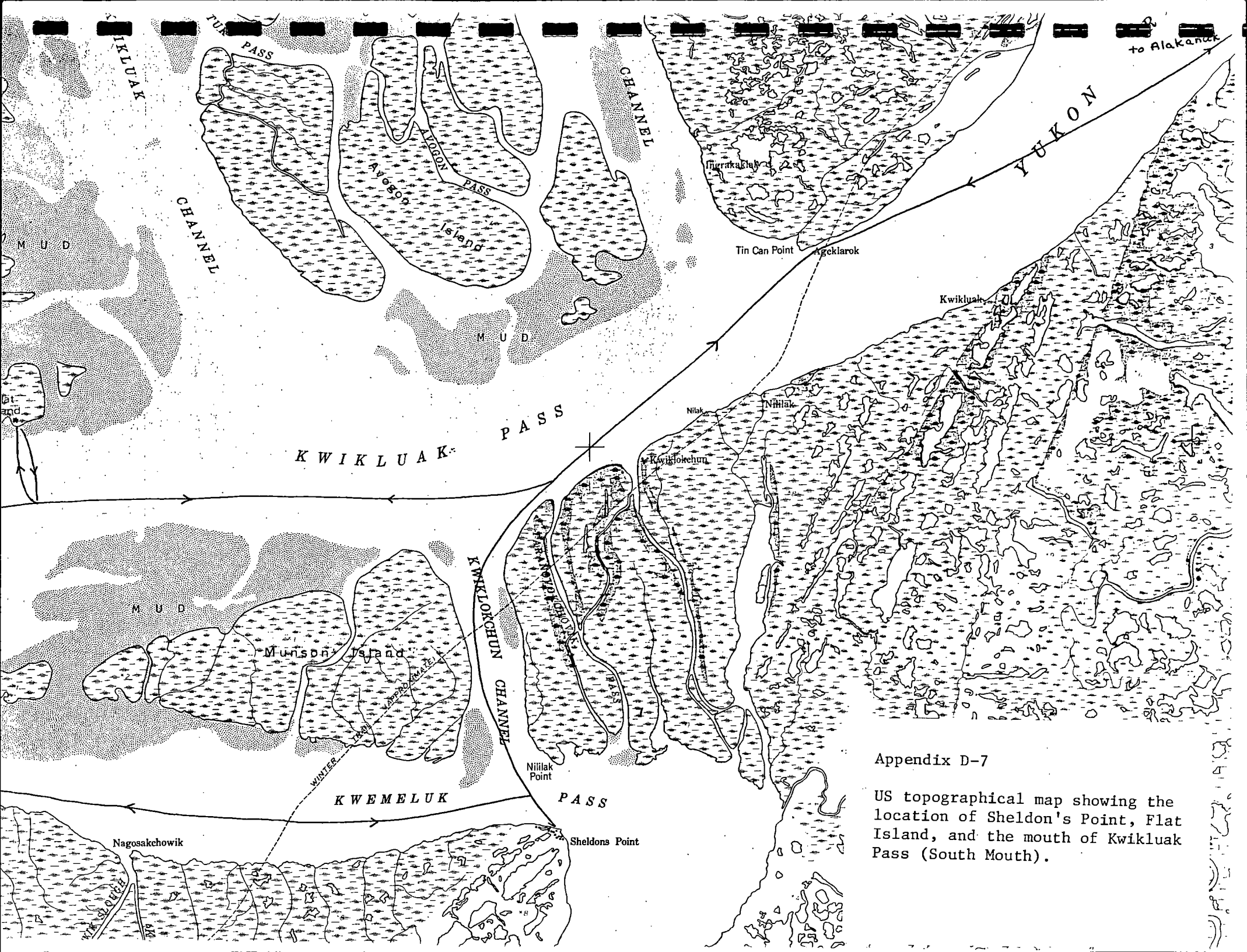
Appendix D-5

US topographical map showing the location of Kwemeluk Pass near Sheldon's Point with Camp# 2 and fish sample station 11-1, and 11-2.



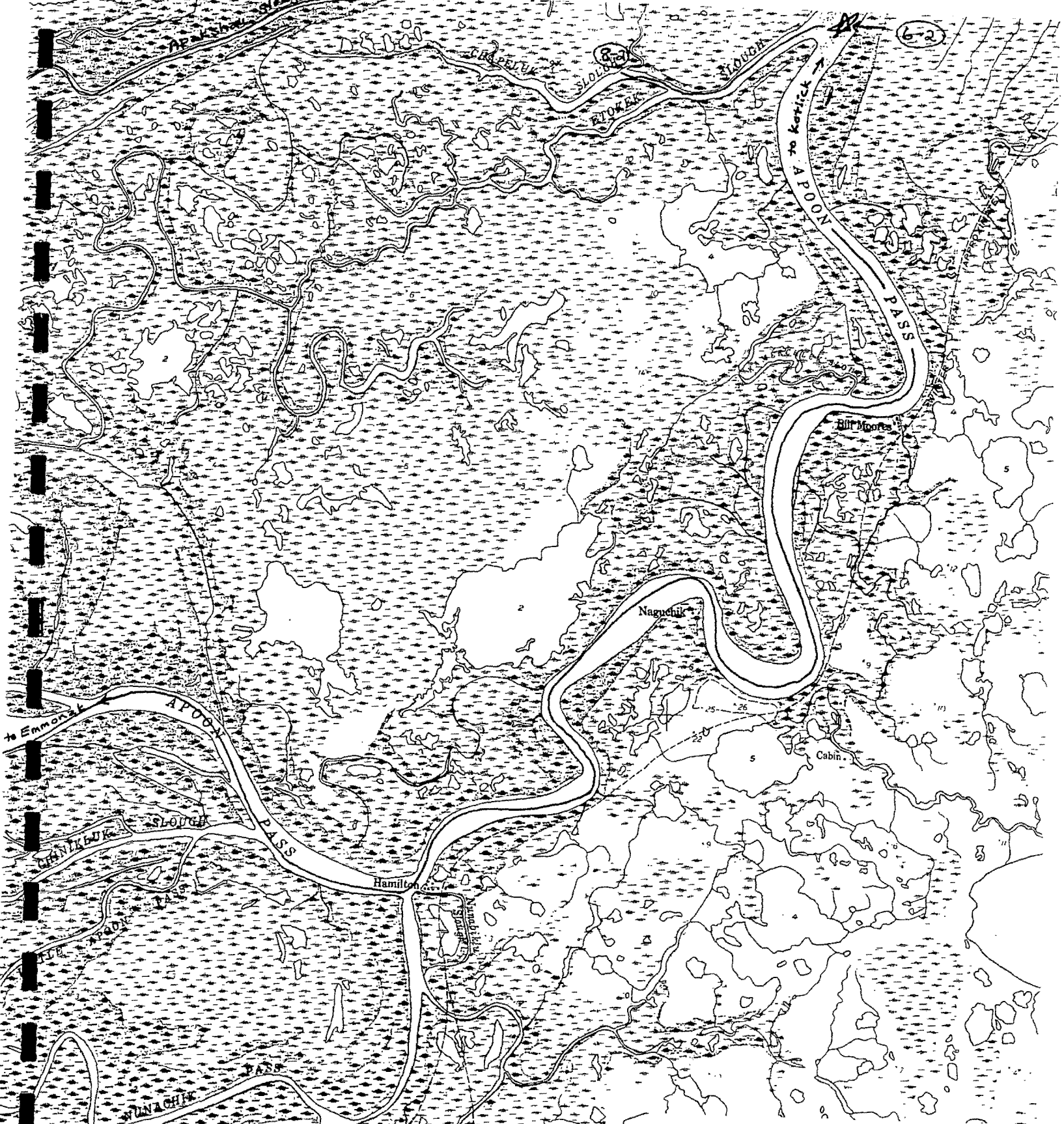
Appendix D-6

US topographical map showing the location of Sunshine Bay and Akularak Slough with fish sample stations 7-7 and 7-9. The head of Aproka Pass, the route to Kotlik, is shown.



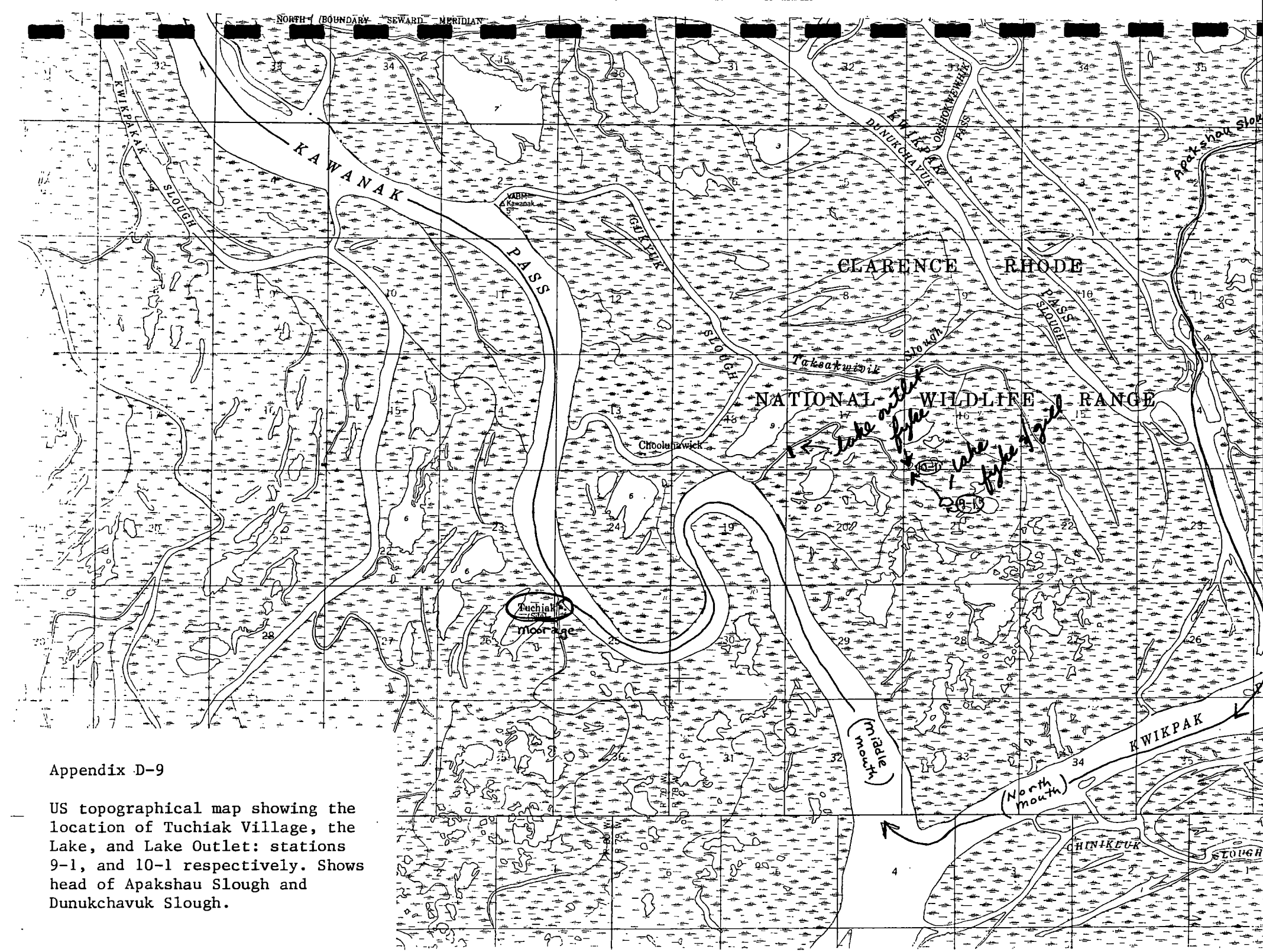
Appendix D-7

US topographical map showing the location of Sheldon's Point, Flat Island, and the mouth of Kwikluak Pass (South Mouth).



Appendix D-8

US topagraphical map showing the location of Chapeluk Slough and fish sample stations 6-2, and 7-4. Apakshau Slough is just north of Chapeluk Slough.

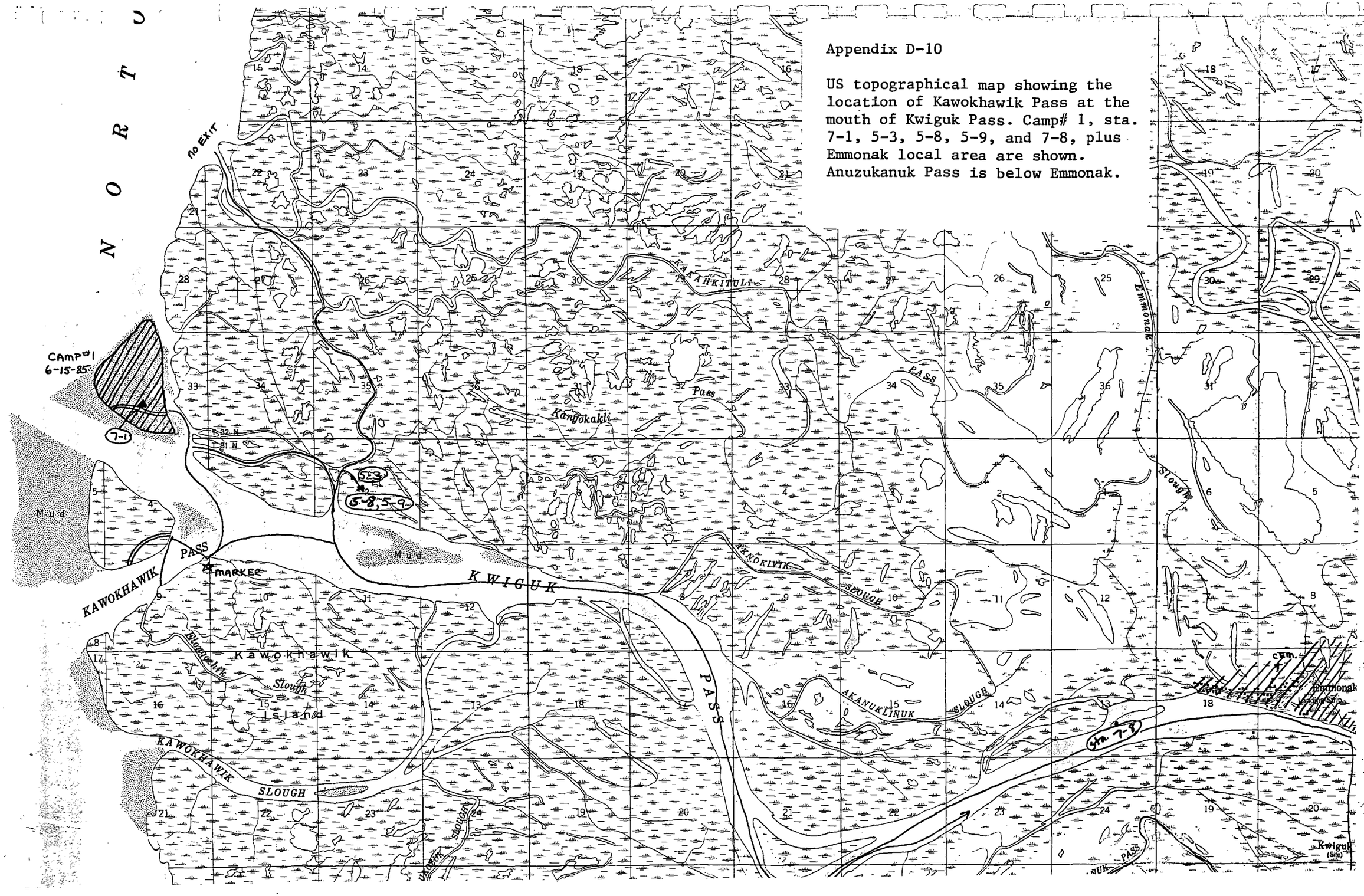


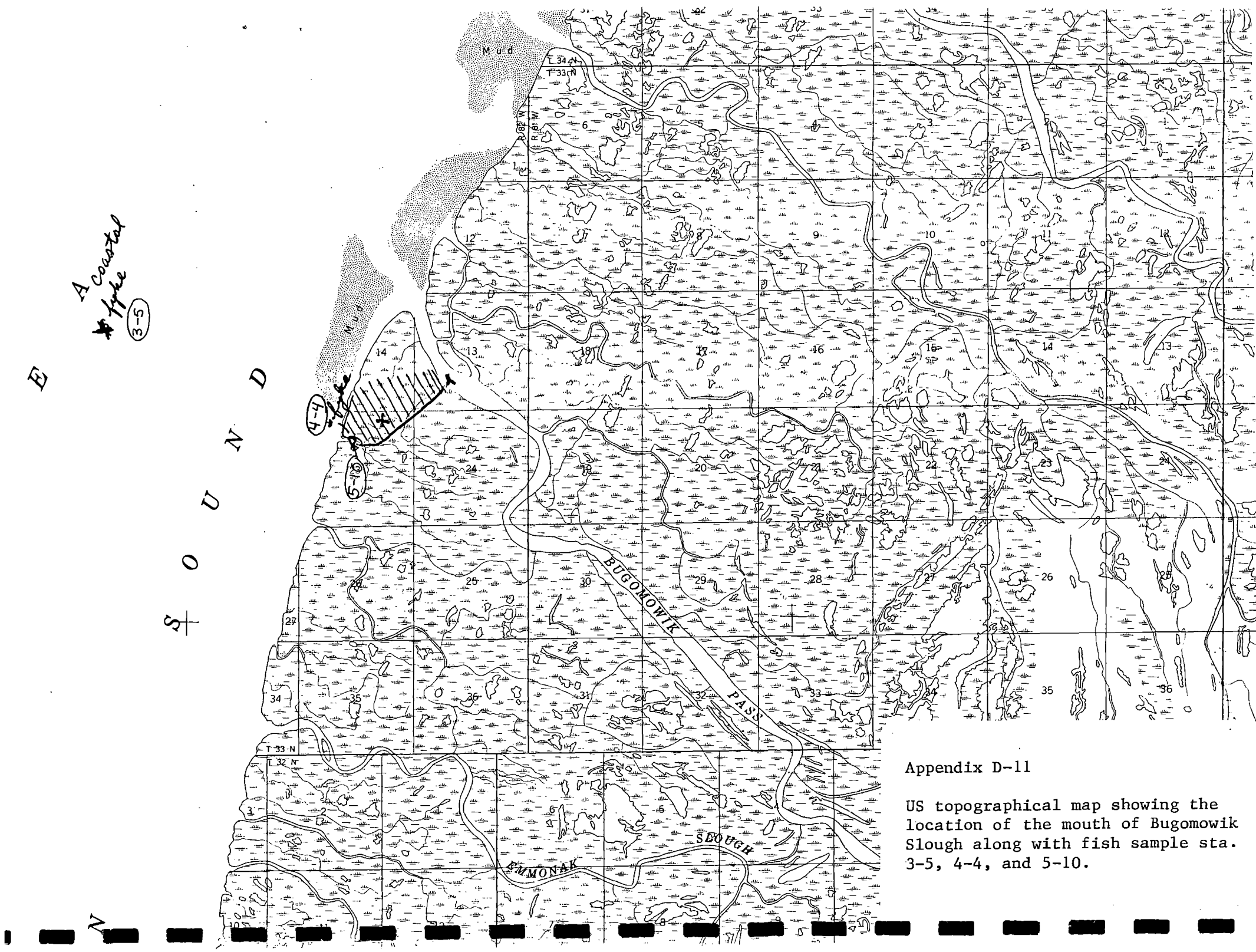
Appendix D-9

US topographical map showing the location of Tuchiak Village, the Lake, and Lake Outlet: stations 9-1, and 10-1 respectively. Shows head of Apakshau Slough and Dunukchavuk Slough.

Appendix D-10

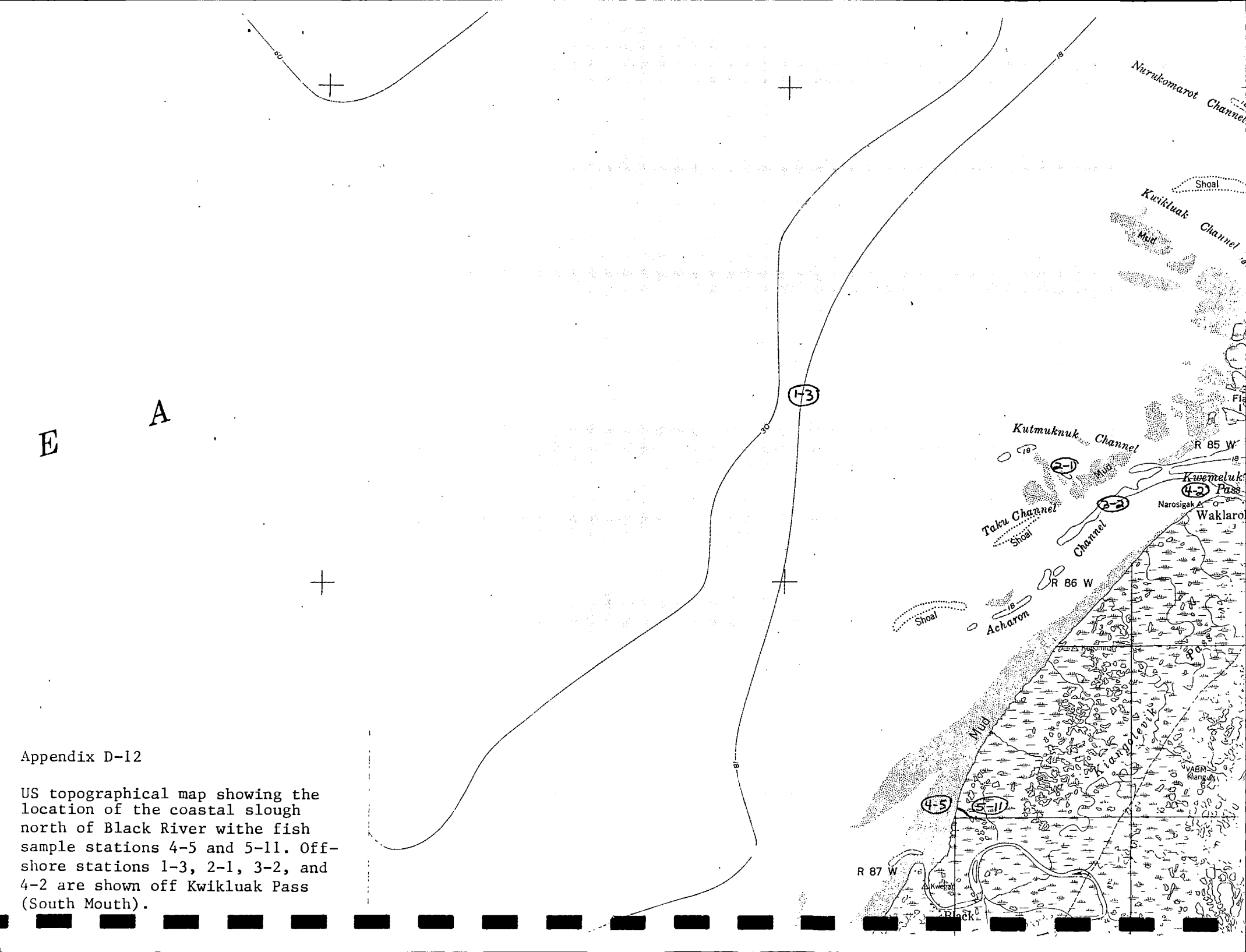
US topographical map showing the location of Kawokhawik Pass at the mouth of Kwiguk Pass. Camp# 1, sta. 7-1, 5-3, 5-8, 5-9, and 7-8, plus Emmonak local area are shown. Anuzukanuk Pass is below Emmonak.





Appendix D-11

US topographical map showing the location of the mouth of Bugomowik Slough along with fish sample sta. 3-5, 4-4, and 5-10.

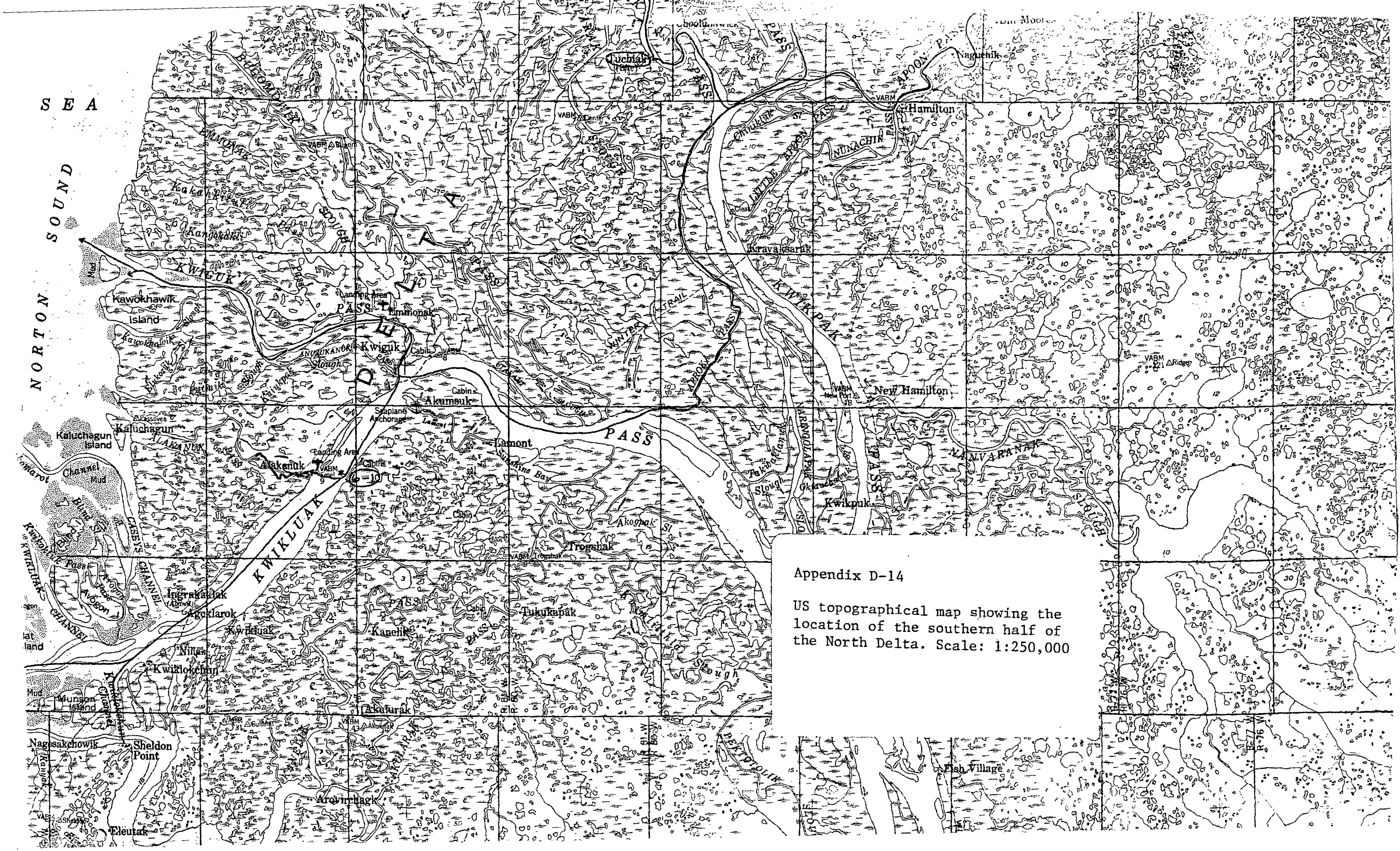


Appendix D-12

US topographical map showing the location of the coastal slough north of Black River withe fish sample stations 4-5 and 5-11. Off-shore stations 1-3, 2-1, 3-2, and 4-2 are shown off Kwikluak Pass (South Mouth).

Appendix D-13

US topographical map sh
location of the norther
the North Delta. Scale =



Appendix D-14

US topographical map showing the location of the southern half of the North Delta. Scale: 1:250,000

Appendix E

Summary of Nests Found

Species	Date	Area	Number of Eggs	Comment
Least Sandpiper	6/17	Flat Island	3	Ground
Common Redpoll	6/20	N. Apoon	3	Willow
Northern Phalarope	6/20	N. Apoon	4	Ground
Lapland Longspur	6/20	N. Apoon	3	Ground
Least/Semipalmated Sandpiper*	6/20	N. Apoon	2,3,3,3,4,5	Ground
Common Redpoll	6/22	Okwege Inner Island	3	Willow
Goose sp*	6/22	Okwega Inner Island	X	Inundated
Northern Phalarope	6/23	Okwega Outer Island	4	Ground
Northern Pintail	6/23	Okwega Outer Island	8	Ground
Northern Pintail	6/23	Okwega Outer Island	6	Ground
Least Sandpiper	6/23	Okwega Outer Island	4 chicks	Ground
Spectacled Eiders	6/23	Elongozhik Slough	2 nests	Marsh

* species identification uncertain

Appendix F

Project Setbacks

1. Weather - High winds along the coast often delayed or made it impossible to keep on schedule. Offshore purse seines were delayed by rough water. Rain made it difficult to watch birds, as moisture would condense on binocular lenses.

2. Equipment - Inadequate/Breakdowns
   A. Whaler - Cronic starter problems/fuel line problems.
      Whaler transom had inadequate freeboard for offshore tows.
   B. Munson - Both 185 hp. motors were destroyed after 300 hrs. of use.
      Servicing and replacement with 175 hp. motors took ten days.
      Servicing lower units on motors, involved problems, as the Munson needed to be hauled out of the water.
      Power tilt on new 175s broke after installation and break in.
   C. Skiff - Needed tow bar built for towing Munson on purse seines
      Welding required oxygen. First oxygen bottle sent was empty and another needed to be ordered.
   D. Helicopter - Was restricted by the 15 mile coastal landing limitation.
      Turbine was plugged by mosquitoes and over heated - needed to be flushed for several days.

3. Observations
   10X power binoculars too large to hold still.
   Water was too rough for holding binoculars steady on boats.
   Boats would rarely stop for bird identification.
   Dust (dried silt) got in between lenses, and coated binoculars.

4. Equipment Loss
   Anchors for fyke nets lost in shipment/added delay in setting nets.
   Anchors lost offshore Bugomowik, and was not recovered.
   Fyke net lost offshore Bugomowik, and was not recovered.
5. Travel - Spontaneous i.e. planned at the moment. No advanced schedule was available to plan overnight trips. Travel was extremely difficult and time consuming due to sandbars navigation, tides, and equipment breakdowns.
7. Procurement of fuel and adequate equipment was time consuming and costly.

Appendix G

Description of Habitats at Camp Areas on the North Delta

Kwiguk Pass - This area consisted of coastal sedge flats disected by tidal sloughs. Vegetation was brown in early June. The area was dry enough for nesting sandpipers. Peeps and Dunlin were abundant.

Kwemeluk Pass - This area was characterized by sedge flats along a major inactive distributary. Vegetation was brown in June. The habitat was diverse. Along the shore the land was dry enough to set up a tent, but further inland it was very wet. Standing water was present and was intermixed with deeper "ponds". surrounded by taller sedges and rushes. This area appeared to be an important feeding area for birds as many different species were present.

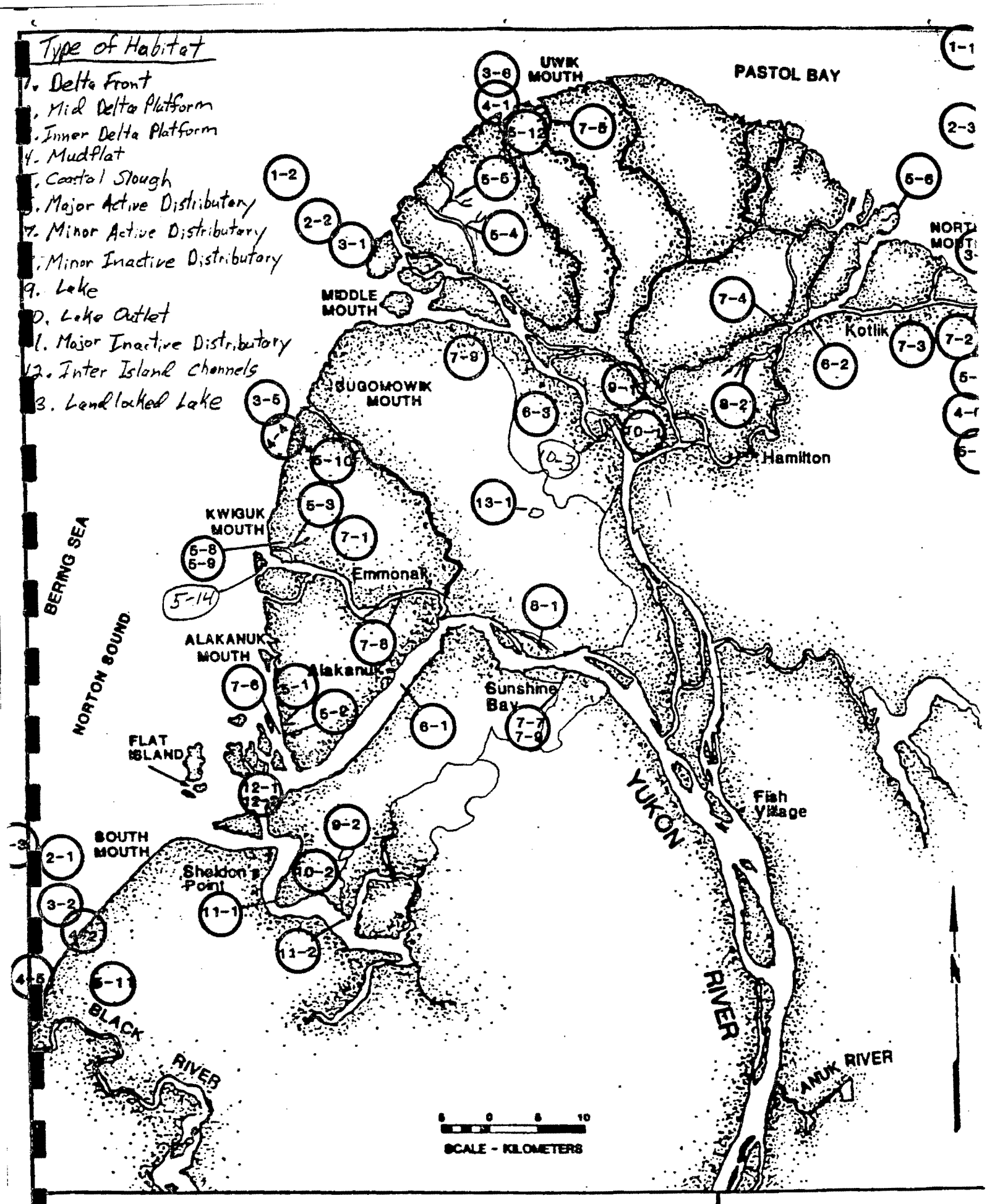
North Apoon Pass - This area was charaterized by mixed sedge, herbacious plants and dwarf shrubs. Vegetation was brown, while shrubs were begining to bud. This area was drier and more elevated from the tide line. A marsh was behind the camp and patches of willow, sweet gale, and birch were relatively abundant. Least and Semipalmated Sandpipers were found nesting here, as well as Northern Phalaropes.

Okwega Pass Islands - The inner island was very wet and only one Common Redpoll nest was found in a willow shrub. The island was almost entirely sedge flat with one clump of willows. One inudated goose nest was discovered. The outer island was somewhat drier and had a few more shrubs. Parts were marshy and supported feeding Pintails, Teal, Black-bellied Plovers, Bar-tailed Godwits, and Sandhill Cranes. Nests of Semipalmated and Least Sandpipers, Northern Phalaropes, and Northern Pintails were found. The area between the islands was exposed at low tide. The abundant sedges and rushes growing there provided excellent food for many cranes, geese, ducks and shorebirds observed feeding there.

Elongozhik Slough - This area was very low coastal sedge flats. Most of the area was too wet for nesting, but large flocks of waterfowl, gulls, and cranes were seen feeding along with relatively large numbers of other shorebirds. Two pairs of Spectacled Eiders were observed nesting further inland near a small pond. The exposed tidal flat extended for up to three miles in this area of the delta.

Bugomowik Slough - This area was low coastal sedge flats. It was visited late in the nesting season. Few species were observed here. Female Green-winged Teal and Mallards were observed with young chicks. Sandhill cranes, Long-tailed Jaegers, and Glaucous-winged Gulls were common here.

Black River - This area was visited the end of July. Flocks of ducks were observed feeding a mile offshore on the mudflats. Closer to shore, flocks of Western Sandpipers were feeding on the mudflats. Bivalves were abundant in this area and were assumed to provide food for foraging birds.



LOCATION OF SAMPLE SITES FOR THE 1985 SUMMER SURVEY OF THE YUKON RIVER DELTA

Figure 1

envirosphere company

OPERATIONS SUMMARY FOR THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Personnel

The 1985 field season of the Yukon Delta fisheries study extended from June 3rd through September 22nd, (i.e. 112 days). During this period 4 personnel from Envirosphere Company, and 6 individual subcontractors provided 368 man days of labor (Table 1). All personnel, except Mr. Cordell, that were originally identified for this study, worked during the 1985 field season. Mr. Harrison of the University of Washington, was substituted because Mr. Cordell became unavailable at the time of the study.

Chronological Summary of Activities

A chronological summary of activities during the 1985 field season is shown in Table 2. The sample program began much later than expected as a result of the late time of flooding and ice out in the lower river. This initial delay plus the time required to get the project up to full speed inhibited our ability to identify the beginning of the juvenile salmon outmigration and eliminated the early portion of the continuous survey program. Consequently, the first synoptic survey which began on June 16th marked the beginning of the field sample program. Sampling continued through September 17th, (i.e., 94 days), and included two more synoptic surveys during July and September. The three synoptic surveys required 40 days to complete. Therefore, continuous surveys were conducted during the remaining 54 days. During the latter period, the amount of time available for purse seine was significantly reduced (lost 33 days) as a result of an engine breakdown and reassignment of the Munson boat to the oceanographic program.

TABLE 1

PERSONNEL, TIME OF WORK, AND NUMBER OF DAYS WORKED
DURING THE 1985 FIELD SEASON[1/] OF THE YUKON DELTA FISHERIES STUDY

Personnel	Affiliation	Field Period	Number of Days Worked
D. Martin	Envirosphere	6/9-7/1; 8/8-8/19; 9/3-9/7	39
C. Whitmus	Envirosphere	6/28-7/29	30
V. Pantalone	Envirosphere	6/24-8/17	55
D. Glass	Envirosphere	8/16-8/31	16
R. Tyler	Independent	6/3-7/5; 7/17-8/5; 9/5-9/20	68
R. Baxter	Independent	6/4-6/29	26
M. Stevenson	Kinnetics Lab	6/7-6/22; 9/3-9/22	36
R. Harrison	Univ. of Wash.	7/1-9/20	81
J. Johnson	Emmonak Local	8/10-9/13 (intermittent)	12
R. Grotefendt	Independent	6/16-6/20	5
			368

1/ The 1985 field season was 112 days (i.e. 6/3 - 9/22).

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Table 2. Chronological Summary of Activities During the 1985 Field Season of The Yukon Delta Study

Period	Activity
June 3, 4	Crew and gear assembled at St. Mary's
June 5-7	Mobilization to Emmonak delayed by flooding and ice in the the lower river
June 8	Boats and equipment moved from St. Mary's to Emmonak
June 9-10	Equipment assembled and field camp organized
June 11-15	Reconnaissance of area, installation of five STP meters, and test sampling with fishing gear
June 16-28	First Synoptic Survey of delta
June 29 - July 3	Continuous survey (i.e., sample stations in South Mouth region)
July 4-14	Munson boat out of service due to engine replacement. Continuous survey continued but sampling limited by helicopter landing restriction
July 15-27	Second Synoptic Survey
July 28	Service Munson boat
July 29 - August 8	Munson boat assigned to Oceanographic study. Sample lake outlets and coastal habitats by helicopter
August 9-16	Purse seine all stations in synoptic survey
August 17 - Sept. 3	Munson boat assigned to Oceanographic study (August 17-August 29). Continuous survey continued, however, helicopter travel and sampling limited by poor weather
September 4-5	Third Synoptic Survey
September 6-8	Shutdown for major repair of purse seine
September 9-17	Third Synoptic Survey continued and three STD meters retrieved
September 18-22	Demobilize and store most gear in Emmonak. Provide logistical support to EG&G for SCUBA recovery of remaining STD meters
September 28	STD meter retrieved by EG&G divers, one meter lost

Sample Program

Fish were collected from 53 stations (Figure 1) that were representative of 13 different types of habitat on the Yukon Delta (Table 3). A number of sample gears were tested and many of the proposed sample methods were modified in order to effectively sample the diversity of habitats (Table 4). The 450 feet purse seine was found to be very effective for sampling the delta front, mid-delta and major distributary habitats where the water was greater than 20 feet deep. Juvenile salmonids and non-salmonids as small as 30 mm were frequently caught with this net. The purse seine operation was much safer and more efficient with a crew of four people, even though three people could complete the job. The shallow inner delta platform was sampled with a double bodied fyke net which was very effective when the net remained in operation. Problems were encountered, however, when debris clogged the nets and strong currents caused the nets to rip or break loose from their anchor. These nets were often set from a Zodiac because of the difficulty of reaching the inner delta habitats with the Munson boat. Consequently, the number of sets was often limited by poor weather which inhibited helicopter and Zodiac operations along the coast. Single body fykes with the lead attached to the shore were very effective in mudflat and lake habitats. However, large numbers of fish caught in the mudflats were often killed when the nets became dewatered during low tide. Coastal sloughs and lake outlet streams were sampled with two single body fyke nets that were sewn together in a "Z" configuration. This net modification enabled us to sample fish that were moving both directions in a tidal channel and to continuously sample one lake outlet stream. A 75 foot beach seine was tested in the coastal sloughs and was found to be less effective and more labor intensive than the tidal nets. Minor active distributaries were successfully sampled with a 150 foot beach seine that was anchored to the shore and held open against the current with a boat. This procedure caught many juvenile salmon in channels that were too shallow or narrow to be sampled with the purse seine. Gill nets were very effective for catching larger fish in inactive distributaries, lakes, and lake outlet channels.

TABLE 3

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude	Longitude
1-1	Delta front - North Mouth	63 19.74	163 08.21
1-2	Delta front - Middle Mouth	63 08.49	165 05.82
1-3	Delta front - South Mouth	62 26.16	165 37.32
2-1	Mid delta - South Mouth	62 30.06	165 15.84
2-2	Mid delta - Middle Mouth	63 08.17	164 48.48
2-3	Mid delta - North Mouth	63 11.47	163 11.94
3-1	Inner delta - Middle Mouth	63 06.07	164 41.24
3-2	Inner delta - south of South Mouth	62 31.18	165 11.60
3-3	Inner delta - East of Pastolik River	63 04.73	163 15.28
3-4	Inner delta - north Kwiguk Mouth	NOT SAMPLED	
3-5	Inner delta - south of Bugomowik	62 54.20	164 48.10
3-6	Inner delta - west of Elongozhik	63 18.50	164 17.00
3-7	Inner delta - Black River	NOT SAMPLED	
4-1	Mudflat - west of Elongozhik	63 18.50	164 17.00
4-2	Mudflat - south of South Mouth	62 31.18	165 10.00
4-3	Mudflat - north of Kwiguk Mouth	NOT SAMPLED	
4-4	Mudflat - south of Bugomowik	62 54.20	164 48.10
4-5	Mudflat - Black River	62 26.50	165 16.90
4-6	Mudflat - East of Pastolik River	63 01.70	163 15.80
5-1	Tidal slough - off Casey's Channel	62 39.19	164 51.13
5-2	Tidal slough - off Casey's Channel	NEAR 5-1	
5-3	Tidal slough - north of Kwikuk Mouth	62 50.50	164 49.00
5-4	Tidal slough - trib to Kochluk Pass, Mid	63 05.80	164 29.00
5-5	Tidal slough - trib to Kochluk Pass, Mid	63 05.80	164 29.00
5-6	Tidal slough - in outer island at Okwega Pass	63 07.00	164 32.00

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TABLE 3 (Continued)

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude	Longitude
5-7	Tidal slough - 1st channel east of Apoon Mouth	63 02.00	163 22.00
5-8	Tidal slough - northwest of Kwiguk Pass	62 48.00	164 47.00
5-9	Tidal slough - same as 5-8	62 48.00	164 47.00
5-10	Tidal slough - south of Bugomowik	62 54.20	164 48.10
5-11	Tidal slough - Black River	62 26.50	165 16.90
5-12	Tidal slough - West of Elongozhik	63 18.30	164 17.00
5-13	Tidal slough - East of Pastolik River	63 01.70	163 15.80
6-1	Major active dist - near Alakanuk	62 40.82	164 36.62
6-2	Major active dist - South of Kotlik	62 59.70	163 48.96
6-3	Major active - several miles upriver of Sea Gull Point	62 58.75	164 16.61
7-1	Minor active - North of Kwiguk Mouth	62 50.50	164 49.00
7-2	Minor active - at Apoon Mouth	63 02.68	163 24.68
7-3	Minor active - Tatlinguk Pass, NE of Kotlik	63 02.69	163 31.80
7-4	Minor active - Apakshaw jct., east of Kotlik	63 01.28	163 50.86
7-5	Minor active - Near Elongozhik Mouth	63 13.80	164 17.29
7-6	Minor active - In Casey's Channel	62 39.29	164 51.18
7-7	Minor active - East of Sunshine Bay	62 40.84	164 17.02
7-8	Minor active - Kwiguk, west of Emmonak	62 45.66	164 38.75
7-9	Minor active - SE of Sunshine Bay	1 MILE SOUTH OF 7-7	
7-10	Minor active - Kwikpakak Slough	63 00.81	164 23.63
8-1	Minor inactive - Utakaht Slough	62 43.80	164 19.50
8-2	Minor inactive - Chapeluk Slough, Apoon	63 59.30	163 52.20

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TABLE 3 (Continued)

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude	Longitude
9-1	Lake - Two miles east of Choolunawick	62 56.50	164 04.40
9-2	Lake - north of Kwemeluk Pass, west of Kanelik Pass	62 20.20	164 43.90
10-1	Lake outlet - One and one-half miles east of Choolunawick	62 57.10	164 05.90
10-2	Lake outlet - north of Kwemeluk Pass, west of Kanelik Pass	62 30.20	164 44.20
11-1	Major inactive channel - SE of Sheldon's Point	62 28.00	164 50.00
11-2	Major inactive channel - Kwemeluk/Kanelik Jct.	62 27.00	164 41.00
12-1	Interisland channel - north of South Mouth, east of Flat Island	62 36.80	164 51.80
12-2	Interisland channel - same as above	62 36.80	164 51.80
13-1	Landlocked lake - NE of Emmonak, west of Kravaksarak	62 51.80	164 23.30

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TABLE 4

NUMBER OF SAMPLES COLLECTED BY HABITAT TYPE DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY (PRELIMARY DATA SUMMARY)

Habitat	Purse Seine	Double Fyke Net	Single Fyke Net	Beach Seine	Tidal Net	Hook Seine	Gill Net	Outlet Net	Total
Delta Front	13								13
Mid-Delta Platform	20								20
Inner-Delta Platform		6							6
Mudflat			19						19
Tidal Slough			3	5	34		3		45
Major Active Distributary	30					2			32
Minor Active Distributary			2			50			52
Major Inactive Distributary			1				2		3
Minor Inactive Distributary			3				2		5
Lake Outlet Stream			2				1	34	37
Lake With Outlet			5				3		8
Landlocked Lake			1				1		2
Interisland Channel			1				1		2
All	63	6	37	5	34	52	13	34	244

Recommendations/Comments

In order to identify the run timing of the juvenile salmon outmigration, it will be necessary to begin sample operations prior to the time of ice out in the lower river. This could be accomplished by sampling in the Yukon River near St. Mary's which is usually free of ice for several days to more than a week before ice out in the lower river. Sample effort should also be concentrated at fewer stations and with more emphasis on major distributory and coastal habitats.

Purse seine operations in the mid delta and delta front were often limited by water conditions unsuitable for the Boston Whaler. The low transom on this craft was not high enough to prevent small waves from washing over the stern. The whaler also had an inoperative fuel tank and leaks in the hull, both of which hampered the field operations. Consequently, the whaler is not recommended for the second year study. Instead a boat with a high transom and a semi-V bottom should be utilized for the seine skiff. The herring skiff which was leased from Mr. Al Wasuli (Kotlik) had adequate freeboard and was a suitable craft for operations offshore. However, this boat had a flat bottom and was very difficult to manuever when towing the purse seine.

The Munson boat with its semi-V hull and high powered outboards was well suited for operations, both within and outside of the delta. However, several problems were encountered that need to be rectified before the second field season.

- The tall davit was not strong enough to withstand the power capabilities of the hydraulic capstan. As a result, the davit was broken two times. The davit was repaired each time it was broken, however, it has been weakened and needs to be replaced. A stronger davit with support braces and a stronger mounting bracket is needed.

- The 100 gallon fuel capacity was insufficient for average daily operations. Spare 55 gallon drums were carried on the Munson or in the seine skiff in order to provide fuel. This procedure utilized deck space, was cumbersome, labor intensive, and dangerous. An additional 30-50 gallons of fuel capacity on the Munson would eliminate this problem most of the time. Space for a third fuel tank is available either below deck or on deck immediately forward of the cabin. A rectangular tank located immediately below and to the port side of the capstan could be installed with the least cost.

- The anchor for the Munson was lost in the mud and could not be retrieved. Therefore a new anchor (20 lbs) with 20 feet of heavy chain will be needed.

- The trouble sensor system on the port engine is inoperative and needs to be repaired. Both engines also need to be serviced.

- The windshield wiper motor needs to be mounted at the top of the window because the wiper blade is too short to clear the upper portion of the window, where viewing is really needed.

Helicopter support was an invaluable service for the summer field program. Transportation of fuel, supplies and people enabled the sampling of many locations that would have been very difficult had the helicopter not been available. The only problem with the helicopter operation was the long distance between the helicopter and the locations of the equipment storage and boats. Much time was wasted hauling equipment back and forth with a small three wheeler between these locations. A landing spot located closer to the waterfront would eliminate this problem. The large un-used area located east of the Emmonak Coop fish processing plant is suggested as a potential landing location for the second field season.

Fuel Cache

Fuel was cached at remote locations for a few days during the synoptic surveys. The fuel and fuel drums were removed and no fuel remains cached.