

Kenai Fishery Resources Field Station Interim Project Report Volume I

# REMOTE AND ROADSIDE LAKE STUDY KENAI NATIONAL WILDLIFE REFUGE 1983

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#### INTRODUCTION

Personnel of the U.S. Fish and Wildlife Service, Kenai Fishery Resources Station, conducted fishery surveys on 18 remote and roadside lakes of the Kenai National Wildlife Refuge (NWR) from June 1 to October 7, 1983. Field investigators were J.W. Friedersdorff and W.J. Jakubas.

During preparation of the Kenai NWR Comprehensive Conservation Plan (USFWS 1983), one of the major refuge problems identified was the lack of basic fish and wildlife information. Acquisition of this information to aid refuge management was designated as a first order priority. Consequently, early in 1983, the Refuge Manager requested that the Fishery Resources Program undertake a two-year fishery resource survey of specifically designated refuge lakes.

The objective of the study is to evaluate selected Kenai NWR lakes for their real and potential contribution to recreational fisheries. To achieve this objective, information on fish, plus related water quality, physical characteristics, vegetation, and wildlife were ascertained. Our intent was to survey as many lakes as possible over a short period, while at the same time, providing a reliable picture of the lake's fishery status.

A summary of important information items for 11 of the lakes surveyed in 1983 along with individual lake reports follows. The most reliable way to interpret fishery information in this report is to compare values between lakes; fishery standards have not yet been established for this area of Alaska. This report is intended only as an interim project document. Subjects such as fish life history, detailed comparison of findings, and statistical analysis will be in the final project report. Another 20 lake surveys remain to be accomplished in 1984, and these new data may significantly modify important fishery parameters that characterize fishery resources found in the study lakes.

#### STUDY AREA

The Kenai National Wildlife Refuge is a majestic and diverse land encompassing nearly two million acres. It is located on the Kenai Peninsula with Refuge headquarters, near the center of the refuge, about 55 air miles south of Anchorage. The Kenai Mountains, reaching an elevation of 6,600 feet, occupy the eastern third of the refuge. They are characterized by glaciers, snow, lichen tundra, and alder and willow shrubs. The remaining two-thirds of the refuge is part of the Kenai Lowlands composed of low hills and coastal plain. Boreal spruce-birch forests, coastal marshes, and numerous streams and lakes typify this area.

The refuge contains about 1,500 miles of cold water rivers and streams and 4,600 lakes. Approximately 83% of the lakes are 10 acres or less in surface area, 12% between 11-50 acres, 2% from 51-100 acres, 2% between 101-1,000 acres, and less than 1% over 1,001 acres. Of the total 165,000 acres of refuge lake water, 61% is accounted for by lakes larger than 1,001 acres, 18% 101-1,000 acres, 6% 51-100 acres, 9% 11-50 acres, and 11% of the lake area is 10 acres or smaller (Friedersdorff 1984). Large populations of salmon, trout, and char abound in refuge waters. These fish are important contributors to Alaska sport fishing and the Cook Inlet commercial fishery.

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Water quality parameters were measured on all lakes in deep water during mid-July. Dissolved oxygen and temperature profiles were taken with a YSI 57 Meter. Conductivity was measured with a YSI S-C-T Meter, pH with a Markson 88 Meter and Hach 17F Narrow Range pH Kit. Total hardness and alkalinity were titrated with Hach HA-DT and AL-DT Kits respectively. Total phosphorus and Kjeldahl nitrogren were determined by the Alaska Department of Fish and Game Limnology Laboratory. Water transparency was measured with a 20-centimeter Secchi Disc and water color with a Forel-Ule Color Comparator. Water samples were taken near the surface, at mid-depth, and near the bottom.

Lake maps were traced by pantograph from 1:15,840 scale, 1975 Kenai NWR aerial photographs. Lake depths were determined by a Lowrance 1510 Trueline Recorder or Ross Sportsman 100 Flashing Depthfinder. Bathymetric maps, water volume, and mean depth were computed from lake area and depth data. Lake drainage basins were measured from U.S. Geological Survey 15 minute maps. Factors often correlated with lake productivity, such as Shoreline Development Factor and Morphoedaphic Index were also calculated (Appendices A and B).

Wildlife species sighted during the survey were recorded.

#### FISHERY RESOURCE SUMMARY

#### FISHERIES

Each lake evaluated in this report was classified as to its current sport fish value based on natural game fish abundance and related factors. These classifications, which do not consider the effects of intensive fishery management, are listed in Table 1.

Fish diversity in the lakes consisted of eight species including rainbow trout, Dolly Varden, Arctic char, coho salmon, longnose sucker, threespine stickleback, coastrange and slimy sculpin. Adult rainbow trout, Dolly Varden/ Arctic char, and coho salmon were the important fish for sport angling. Scientific names of these fish, use classes, and fish abbreviations are shown in Table 2.

Rainbow trout were found in five lakes, while Dolly Varden/Arctic char were also found in five. Adult landlocked coho salmon were in three lakes as the result of stocking, and juveniles were present in two additional lakes that were serving as nursery areas for anadromous forms. Threespine stickleback were in all water bodies, sculpin were found in seven lakes, and longnose sucker were present in three lakes. Table 3 gives the fish species found in each lake.

Fish gill net catch-per-unit-effort (CPUE) varied greatly among lakes. In the five lakes that contained rainbow trout, CPUE averaged 0.47 fish per net hour and ranged from a low of 0.04 to a high of 1.40. Dolly Varden/Arctic char had a mean catch rate of 0.09 ranging from 0.01 to 0.18. Adult and juvenile coho salmon, gill netted in five lakes, had a mean CPUE of 0.22 and ranged from 0.01 to 0.97. Longnose sucker averaged 0.33 fish per net hour in three lakes; they were found in relatively large numbers in one lake. Table 4 lists gill net CPUE's for all lakes.

Minnow trap CPUE's appeared to most closely reflect the relative abundance of threespine stickleback. This species was present in all lakes. Stickleback had a mean CPUE of 2.10 fish per trap hour and ranged from a low of 0.15 to a high of 6.32. Catches of juvenile rainbow trout, Dolly Varden/Arctic char, coho salmon, and longnose sucker either confirmed gill net catches or added an additional species to the lake. An unusually high minnow trap CPUE (0.37) of juvenile coho salmon was exhibited in Engineer Lake. This high catch resulted from an Alaska Department of Fish and Game stocking of 49,960 coho fry earlier in the year. Minnow trap CPUE's for all lakes are given in Table 5.

#### PHYSICAL PROPERTIES

Several of the physical parameters we measured influence the species and number of fish inhabiting a lake. Anadromous sockeye and coho salmon can only utilize lakes for spawning and nursery purposes if that lake has a stream capable of providing fish passage to the ocean. The maximum depth and volume of a lake must be sufficient to maintain dissolved oxygen levels that support

# LAKE SPORT FISH VALUE CLASSIFICATION

	Lake Name	•	Potential Sport Fish Value	].
1.	Bottenintnin		Negligible yield sport fishery	
2.	East Finger		Low yield char sport fishery	N.
3.	Engineer	•	Low yield char sport fishery	- Just
4.	Fish	· · · ·	Moderate yield char sport fishery	
5.	Paddle	· · ·	Moderately high yield rainbow trout sport fishery	
6.	Rainbow		Moderate yield rainbow trout sport fishery	
7.	Silver	•	Moderate yield rainbow trout sport fishery	
8.	Sportfish	2	Negligible yield sport fishery	
9.	Trapper Joe		High yield rainbow trout sport fishery	
10.	Upper Jean		Negligible yield sport fishery	
11.	Weed	•	Low yield rainbow trout sport fishery	

1/ This classification is based on the expected fish abundance that would occur under natural conditions and does not consider the effects of intensive fishery management.

Table 1.

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# FISH SCIENTIFIC NAMES

Fis	sh Class	Scientific Name	Abbreviation
Gan	ne Fish		
1.	Rainbow trout	Salmo gairdneri	RBT
2.	Dolly Varden	<u>Salvelinus malma</u>	DOV
3.	Arctic char	<u>Salvelinus</u> alpinus	ARC
4.	Coho salmon	Oncorhynchus kisutch	COS
Nor	-Game Fish		
5.	Longnose Sucker	<u>Catostomus</u> <u>catostomus</u>	LNS
For	age Fish		
6.	Threespine stickleback	<u>Gasterosteus</u> aculeatus	TSB
7.	Slimy sculpin	<u>Cottus cognatus</u>	SLS
3.	Coastrange sculpin	Cottus aleuticus	CRS
9.	Sculpin sp.	<u>Cottus sp</u> .	SCU

# Table 3.

# FISH SPECIES PRESENT IN SURVEYED LAKES KENAI NATIONAL WILDLIFE REFUGE - 1983

	Lake	Fish Species
1.	Bottenintnin	TSB
2.	East Finger	DOV/ARC, LNS, TSB, CRS
3.	Engineer	$\cos^{1/}$ , dov/arc, tsb, crs
4.	Fish	DOV/ARC, TSB, SCU
5.	Paddle	RBT, DOV/ARC, LNS, TSB, CRS
6.	Rainbow	RBT, TSB, SLS, CRS
7.	Silver	RBT, COS, TSB, SLS
8.	Sportfish	cos <sup>1</sup> , tsb
9.	Trapper Joe	RBT, COS, ØOV/ARC, LNS, TSB
10.	Upper Jean	cos <u>l</u> , tsb, sls
11.	Weed	RBT, TSB
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 $\frac{1}{2}$  Stocked fish species

## Table 4.

# LAKE GILL NET FISH CATCH-PER-UNIT-EFFORT // KENAI NATIONAL WILDLIFE REFUGE - 1983

	Lake	RBT	DOV/ARC	COS	LNS	Total CPUE
1.	Bottenintnin	0.00	0.00	0.00	0.00	0.00
2.	East Finger	0.00	0.15	0.00	0.03	0.18
3.	Engineer	0.00	0.01	0.97 <u>2/</u>	0.00	0.98
4.	Fish	0.00	0.18	0.00	0.00	0.18
5.	Paddle	0.50	0.03	0.00	0.10	0.63
6.	Rainbow (6/1)	0.30	0.00	0.00	0.00	0.30
	Rainbow (8/4)	0.42	0.00	0.00	0.00	0.42
	Rainbow (9/28)	) 0.34	0.00	0.00	0.00	0.34
7.	Silver	0.26	0.00	0.02	0.00	0.28
8.	Sportfish	0.00	0.00	0.024	0.00	0.02
9.	Trapper Joe	1.40	0.00	0.01	0.85	2.26
10.	Upper Jean	0.00	0.00	0.07 <u>2/</u>	0.00	0.07
11.	Weed	0.04	0.00	0.00	0.00	0.04
No.	Lakes	5	4	5	3	10
No.	Cases	7	4	5	3	12
Mean	3	0.47	0.09	0.22	0.33	0.48
Star	ndard Deviation	0.44	0.09	0.42	0.46	0.63
Rang	ge	0.04-1.40	0.01-0.18	0.01-0.97	0.03-0.85	0.02-2.26

 $\frac{1}{2}$  Number of fish per net hour  $\frac{2}{2}$  Stocked Fish

# Table 5.

# LAKE MINNOW TRAP CATCH-PER-UNIT-EFFORT $\frac{1}{}$ KENAI NATIONAL WILDLIFE REFUGE - 1983

Lake	RBT	DOV/ARC	COS	LNS	TSB	SCU	Total CPUE
1. Bottenintn	in 0.00	0.00	0.00	0.00	2.54	0.00	2.54
2. East Finger	r 0.00	0.00	0.00	0.00	1.59	0.18	1.77
3. Engineer	0.00	0.00	0.37 <u>2/</u>	0.00	0.15	0.01	0.53
4. Fish	0.00	0.00	0.00	0.00	2.29	0.47	2.76
5. Paddle	0.01	0.00	0.00	<b>~</b> 0.01	0.96	0.08	1.06
6. Rainbow	0.03	0.00	0.00	0.00	2.57	0.00	2.60
(6/1) Rainbow	0.01	0.00	0.00	0.00	1.02	∠0.01	نړ 1.04
(8/4) Rainbow	0.01	0.00	0.00	0.00	3.35	0.01	3.36
(9/28 <u>)</u> 7. Silver	0.01	0.00	0.03	0.00	2.45	<0.01	2.48
8. Sportfish	0.00	0.00	0.00	0.00	1.27	0.00	1.27
9. Trapper Jo	e 0.01	0.03	0.00	0.01	6.32	0.00	6.36
10. Upper Jea	n 0.00	0.00	0.00	0.00	1.13	0.01	1.14
11. Weed	0.02	0.00	0.00	0.00	1.60	0.00	1.62
No. Lakes	5	, ]	2	2	11	7	11
No. Cases	7	]	2	2	13	8	13
Mean	0.01	0.03	0.20	<0.01	2.10	0.10	2.20
Standard Dey.	0.01	<b>-</b>	0.24	· –	1.54	0.16	1.51
Range	0.07-0.03	-	0.03-0.37		0.15-6.32/0	0.01-0.4	7/0.53-6.36

 $\frac{1}{1}$  Number of fish per trap hour

 $\frac{2}{}$  Stocked fish

fish during the winter when dissolved oxygen is used faster through organic decomposition and respiration than it is replaced. Rainbow trout require a spawning stream with sufficient flow and suitable gravel substrate. Lakes with shallow mean depths have greater water volume in the euphotic zone. This allows production of larger quantities of food to support fish populations. Many of these physical characteristics are part of complex controlling mechanisms.

Lakes varied in size from 8 to 286 acres. Maximum depth varied from 8 to 61 feet and mean depth from 2 to 23 feet. Five of the lakes had inlet or outlet streams that we felt were capable of serving as rainbow trout spawning habitat, and three of the lakes had streams that appeared capable of allowing anadromous fish migrations. Table 6 compares major physical properties of the lakes.

#### CHEMICAL PROPERTIES

Certain chemical properties of lake water reflect fertility levels. Key nutrients combine with light radiation and plants to produce food that supports the animal biomass. One of the key chemical properties we used to reflect lake fertility was alkalinity. J.B. Moyle, working with Minnesota lakes, established plant and fish productivity levels based on alkalinity concentrations (MacKenthun and Ingram 1967). Moyle's productivity levels for alkalinity were: 0 to 20 mg/l, low productivity; 20 to 40 mg/l, low to medium productivity, '40 to 90 mg/l, medium to high productivity; and above 90 mg/l, high productivity. Conductivity, which measures the electrical conductivity of water, is another relative measure of lake fertility. Protein formation is affected by the amount of available phosphorus and nitrogen. The Morphoedaphic Index (MEI), shown in Table 7, is an index that combines physical characteristics of lakes (morphology) along with chemical properties which are principally derived from the soil (edaphic). This index was first developed by R.A. Ryder and has been extensively used in Canadian lakes as a quick tool for estimating potential fish productivity (Ryder, et al. 1974).

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In the 11 lakes considered, mean MEI was 23.4. The MEI ranged from 5.5 to 81. Dissolved oxygen spanned a range from 0.3 to 12.6 mg/l, but most of the low oxygen concentrations were found in the lowest levels of the lakes' hypolimnion. Water pH ranged from a low of 6.7 to a high of 7.7, well within the normal tolerance limits of fish. Comparisons of six lake water chemical properties measured during July are in Table 7.

#### VEGETATION AND WILDLIFE

A variety of aquatic vegetation was found growing in the surveyed lakes. Principal families included pondweed, bur reed, sedge, water milfoil, water lily, water plantain, horsetail, crowfoot, quillwort, chara, and sedge. Aquatic vegetation coverage of lake surface areas ranged from three to 92 percent. The number of aquatic species identified in each lake along with the percentage of vegetative coverage are shown in Table 8.

Wildlife sighted during the lake surveys consisted of mammals and birds. Moose, beaver, muskrat, snowshoe hare, coyote, and black bear comprised the six species of mammals identified by sight or sign. There were five classes of birds identified which included waterfowl, gulls/terns, shorebirds, passerines, and raptors. The number of birds and mammals sighted on each lake is given in Table 8. Table 6.

# LAKE PHYSICAL FEATURES KENAI NATIONAL WILDLIFE REFUGE

Lake	Surface Area (Ac.)	Maximum Depth (Ft.)	Mean Depth (Ft.)	Lake Volume (Ac.Ft.)	Water Trans. (Ft.)	Spawning Streams (No.)	Anadromous Streams (No.)
1. Bottenintnin	256	8	2	510	8	0	0
2. East Finger	72	48	23	1,620	27	<u>1/</u> ן	0
3. Engineer	230	17	7.5	1,719	3.9	0	0
4. Fish	66	61	· 22	1,430	30	<u>1/</u> ך	0
5. Paddle	97	41	15	1,485	20	. 1	0
6. Rainbow	150	17	7.3	1,095	7.5	1	1
7. Silver	125	34	12.6	1,660	11	1	]
8. Sportfish	ب 286	60	. 22	6,300	18	<u>ו 1/</u> נ	0
9. Trapper Joe	105	17	4.2	. 440	10	1	T
10. Upper Jean	50	44	19	930	26	0	0
11. Weed	8	39	15	115	12	1	0

 $\frac{1}{2}$  Stream may not support rainbow trout spawning

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# Table 7.

# . LAKE CHEMICAL CHARACTERISTICS KENAI NATIONAL WILDLIFE REFUGE - July, 1983

Lake	D.O. Range (mg/1)	pH C	Specific Conductance @ 25°C	Alkalinity (mg/l)	Total Phosphorùs (ug/l)	Kjeldahl Nitrogen (mg/l)	MEI
1. Bottenintnin	9.9-9.5	6.9	24	7	15.0	0.52	39.3
2. East Finger	10.3-2.0	7.1	37	15	_	-	5.5
3. Engineer	9.8-9.6	7.6	61	25	24.0	0.69	26.9
4. Fish	12.6-0.5	7.2	36	16	7.2	0.31	5.5
5. Paddle	10.6-1.0	7.6	96	41	11.2	0.36	16.7
6. Rainbow	9.7-9.5	7.3	35	15	10.4	0.42	16.0
7. Silver	10.0-0.6	7.3	70	. 29	8.1	0.26	18.2
8. Sportfish	11.4-0.5	7.0	105	47	7.8	0.37	15.6
9. Trapper Joe	9.4-4.2	7.7	104	48	12.0	0.34	81.0
10. Upper Jean	10.9-6.6	7.7	154	72	6.6	0.32	27.1
11. Weed	8.8-0.3	6.7	26	4	10.0	0.44	5.7
No. Lakes		11	11	11	10	10	]]
Mean	-	7.3	68	29	11.2	0.40	23-4
Standard Deviation	—	0.34	42	.21	5.2	0.13	2-18
Range	12.6-0.3	6.7-7.7	24-154	4-72	6.6-24	0.26-0.69	5.5-81

Table 8.

# AQUATIC VEGETATION AND WILDLIFE KENAI NATIONAL WILDLIFE REFUGE - 1983

	Lake	Number Aquatic Species	Percent Lake Coverage	Number Bird Species	Number Mammal Species
].	Bottenintnin	8	92	3	2
2.	East Finger	8	13	10	3
3.	Engineer	6	44	15	4
4.	Fish	10	3	6	3
5.	Paddle	14	47	16	4
6.	Rainbow	8	21	12	2
7.	Silver	11	26	3	2
8.	Sportfish	13	23	11	4
9.	Trapper Joe	9	67	4	2
10.	Upper Jean	7	29	2	2
11.	Weed	<b>7</b>	20	14	3

#### INDIVIDUAL LAKE REPORTS

Detailed reports for 11 lakes follow. In alphabetical order they are: Bottenintnin, East Finger, Engineer, Fish, Paddle, Rainbow, Silver, Sportfish, Trapper Joe, Upper Jean, and Weed Lakes. Detailed information on all biological, chemical, and physical parameters are contained in these reports along with a map depicting lake depths and areas of vegetation. A supplemental report will be provided later in 1984 covering the remaining seven lakes surveyed last year.

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#### BOTTENINTNIN LAKE

#### INTRODUCTION

A fishery survey of Bottenintnin Lake was conducted on September 19-20, 1983. Additional water quality data were gathered on July 21, 1984. Table 1 summarizes Bottenintnin Lake survey findings.

#### PHYSICAL FEATURES

Bottenintnin Lake, in the Kenai River Drainage, is situated in the north central section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 30' and longitude 150° 33'. The lake drainage area appeared to be about 1,500 acres, but it is difficult to define because of the flat topography. This area has been assigned to the Traditional Land Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983). The lake has a surface area of 256 acres, a volume of 510 acre feet, and is at an elevation of about 315 feet. The lake is extremely shallow with a mean depth of 2 feet and maximum depth of 8 feet. (Table 1 and Figure 1).

Lake topography consists mainly of lowland bogs and scattered ridges. Much of the lake's surrounding habitat is emergent and mixed scrub-shrub emergent wetlands. Stands of black spruce and immature paper birch occur along the western shore and on the main peninsula of the lake. The forest areas around the lake were burned by the 1947 fire.

The water level of the lake is maintained by springs, runoff, and bog seepage. There are no inlet or outlet streams. Areas of gravel substrate were present along parts of the northwestern shoreline.

A gravel road, connected to the western end of Skilak Loop Road, provides automobile access to the lake. A large parking lot was the only recreational facility.

#### FISH

Threespine stickleback was the only species of fish captured in the lake. The catch per unit of effort (CPUE) was moderately high at 2.54 stickleback per trap hour (Table 2). Eight gill nets and 20 minnow traps were used to determine fish abundance.

#### AQUATIC VEGETATION

Aquatic vegetation was the heaviest of all 18 lakes surveyed in 1983. Vegetation covered 92 percent of the lake's surface area. Dominant families were water lily, pondweed, sedge, and horsetail. Yellow pond lily and <u>Potamogeton natans</u> grow in dense stands and almost exclusively cover the entire lake. A complete list of species can be found in Table 3 and their accompanying locations in Figure 1.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Wate	er Body Bottenintnin Lake Survey Date(s) <u>9/19-20/83</u>
].	Location: Refuge Kenai NWR T 5N R 7W S 20 Latitude N 60° 30' 50" Longitude W 150° 33' 20" Map. Ref. Kenai C-2
2.	Physical Data:Surface Area256 Ac.Max. Depth8.0 Ft.Mean Depth2.0 Ft.Volume510 Ac. Ft.Water ColorYellow GreenWater Trans8.0 Ft.Drainage Area1,500 Ac.Inlets (cfs)None
	Outlets (cfs) None
	Spawning Habitat No rainbow trout spawning habitat was present.
	Access A gravel access road connects to the western end of Skilak Loop Road.
3.	Water Quality: D.O. 9.9-9.5 mg/l Temp. 19.2-18.9°C Cond. 24 uhmo @ 25°C   pH 6.9 Alk. 7 mg/l Hard. 3 mg/l Phos. 15 ug/l   Kjeldahl N 0.52 mg/l MEI 39.3 SDF 1.56 Pollution None
4.	Fish Species: (Abundance, H/M/L, Introduced)
	Total Species
5.	Management History: ADF&G surveyed the lake in 1960. The State stocked 30,000 coho salmon in 1965 and 38,220 sockeye salmon in 1967. Both fish plants partially or totally failed due to winter kill. Management of the lake was discontinued after 1967.
6.	Current Fishery Status: The lake contains only threespine stickleback. It is subject to game fish winter kill.
7.	Vegetation : Aquatic <u>pondweed (2 Sp.), water lily (1 Sp.), sedges (2 Sp.)</u> horsetail (1 Sp.), gentain (1 Sp.), quillwort (1 Sp.).
	TerrestrialEmergent and scrub-shrub bogs with areas of immature paper birch and black spruce.
8.	Wildlife:Waterfowl (3 Sp.), mammal (2 Sp.).
9.	Recreation: Wildlife yiewing and camping appear to be the only recreational activities. The lake is too shallow to use outboard motors. Facilities
	Survey Crew: Friedersdorff and Jakubas

Figure 1.

# BOTTENINTNIN LAKE



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Table 2.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body Bottenintnin Lake Code No. Survey Date <u>9/19-20/83</u>
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۰ <u></u>	Average			· · · · · · · · · · · · · · · · · · ·		······	- Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
8 Gill Nets	23	1280 1280 1280 1280	1.0 2.0 2.5	-	0 0 0		0.00 0.00 0.00	N/A N/A N/A	N/A N/A N/A
	• .	1280 1280	3.0 4.0		0	-	0.00	N/A N/A	N/A N/A
Total Fish	23	· 6400 ·	A11	-	0	-	0.00	0.00	N/A
20 Minnow Trap	s 23	N/A	N/A	Threespine Stickleback	1172	0-0-1172	2 N/A	N/A	2.54
Total Fish	23	N/A	N/A	All Species	1172	0-0-1172	2 N/A	N/A	2.54

Table 3.

# BOTTENINTNIN LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent	BB	buckbean	<u>Menyanthes trifoliata</u>
Emergent	CR	sedge	<u>Carex rostrata</u>
Emergent	HTF	horsetail	<u>Equisetum fluviatile</u>
Emergent	SR	spike rush	Eleocharis palustris
Floating	YPL	yellow pond lily	Nuphar polysepalum
Floating	PN	pondweed	Potamogeton natans
Submerged	PG	pondweed	Potamogeton gramineus
Submerged	QW	quillwort	Isoetes muricata

# WETLANDS VEGETATION

	ډ	
Class	Symbol	Vegetation Reference
Scrub-shrub	PSS1F	National Wetlands Inventory (Kenai)
Scrub-shrub	PSS4/1B	National Wetlands Inventory (Kenai)
Scrub-shrub	PSS1B	National Wetlands Inventory (Kenai)
Emergent	PEM5F	National Wetlands Inventory (Kenai)
Emergent	PEM5B	National Wetlands Inventory (Kenai)

# TERRESTRIAL VEGETATION

Class	` Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	IB	ìmmature paper birch	<u>Betula papyrifera</u>
Trees	IS	immature spruce	<u>Picea sp.</u>
Trees	MB	mature paper bìrch	Betula papyrifera
Shrubs	A	alder	<u>Alnus sp.</u>
Shrubs	SG	sweet gale	Mirica gale
Shrubs	W	willow	Salix sp.
Below Shrub	CR	sedge	<u>Carex</u> <u>rostrata</u>
Below Shrub	Cunid	sedge	<u>Carex</u> <u>sp.</u>
Below Shrub	MFF	marsh five finger	Potentilla palustris

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#### WATER QUALITY

Water quality data were collected in July and September. Water quality parameters were within acceptable fish tolerance limits. Lake fertility was rated low based on a classification of Minnesota Lakes using alkalinity level as an indicator (MacKenthun and Ingram 1967). The lake's alkalinity of 7 mg/l was the second lowest encountered of 18 lakes surveyed in 1983. Specific conductance, corrected to 25°C, was 24 umhos. Water pH during July was slightly acid at 6.9. Total phosphorus was 15 ug/l and Kjeldahl nitrogen was 0.52 mg/l. Water color was yellow green and transparent to the lake bottom at 8 feet. No sources of water pollution were apparent.

The lake was not thermally stratified. Dissolved oxygen was saturated to slightly super saturated (9.9-9.5 mg/l) through the entire water column. The lake has a Morphoedaphic Index of 39.3 and Shoreline Development Factor of 1.56 (Appendices A and B). Specific water quality data are given in Tables 1, 4 and 5.

#### MANAGEMENT HISTORY

Alaska Department of Fish and Game (ADF&G) surveyed Bottenintnin Lake in 1960 (Kubik and Reynolds 1960) and found only threespine stickleback. In 1964 the State stocked the lake with 30,000 coho salmon and with 38,220 sockeye salmon in 1967. The 1964 plant failed to produce fish while the 1967 plant produced some fish for three consecutive years. Stocking was discontinued after 1967 due to evidence of winter kill (Nelson 1984).

#### WILDLIFE

Three species of waterfowl were seen on the lake along with evidence of muskrat and moose. All species recorded, along with other pertinent data, are listed in Table 6.

#### RECREATIONAL USE

The primary use of this lake area is for wildlife viewing. It also serves as a camping area for recreational activities taking place in other parts of the refuge. Running outboard motors in the lake is difficult due to the dense aguatic vegetation.

#### FISHERY RESOURCES SUMMARY

Our fishery survey found no game fish and a moderate abundance of threespine stickleback in the lake. Water quality conditions, at the time of the survey, were well within optimum fish tolerance limits. However, the extreme shallow depth of the lake - maximum 8 feet - and the dense aquatic vegetation, make the lake a prime candidate for winter kill. ADF&G confirmed that winter kill had caused the failure of the previous stockings of coho and sockeye salmon. Bottenintnin Lake is considered to haye a negligible sport fish value. Table 4.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyBottenintnin LakeSurvey Date/TimeTotal7-21-83/1000Lake Location (Latitude)N 60° 30' 50"(Longitude)W 150° 33' 20"Code No.Survey CrewCode No.Survey CrewFriedersdorff, JakubasCloud Cover (%)25Wind (mph)StationStation

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (µg/l)
0	19.2	9.9	6.9	21*	7	3	XIV	2.5	15
<u>~</u>	19 0	98				¥			
	10.0	9.5							
<u> </u>	10.9	9.5				· · · · · · · · · · · · · · · · · · ·			
			<u>_</u>			· · · · · · · · · · · · · · · · · · ·			
	- <u>-</u>								· · · · · · · · · · · · · · · · · · ·
					1				
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					· · ·				
*Co	nducti	vity ac	juste	d to 25°C	11s 24 umhos				
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L		_	<u> </u>		·		L	L	1

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Bottom could be seen. Table 5.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water Body Bottenintnin LakeSurvey Date/Time9-20-83/1250Lake Location (Latitude)N 60° 30' 50"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)2Air Temp (°C)9.2Chop (in)1.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (µg/l)
0	7.8	11:1						2.5	
1	7.8	11.2							
2	7.8	11.2							
		3							
	·								
				······································					
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<b>I</b>			+ 1100		Temp - YS	1'57 Meter	: Water	Transpa	rency - 20cm

Remarks: Ec

Equipment used: D.O. & Temp. - YSI 5/ Secchi Disc. Bottom could be seen. ſable 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Wildlife Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyBottenintnin Lake Survey Date/Time9/19-20/83Lake Location (Latitude)N 60° 30' 50" (Longitude)W 150° 33' 20"Code NumberSurvey CrewFriedersdorff, Jakubas

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Surf Scoter Common Merganser 'Common Loon	1 12 3 J+	0-0-1 0-0-12 1-1-1 F	Single Flock Pair/Single	Sight Sight Sight	Water Water
Mammals Furbearers	Muskrat	1	0-0-1	Single	Sight	Water
Big Game	Moose		-	_	Sign	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles Remarks: Rainy, Windy, Cold.

#### EAST FINGER LAKE

#### INTRODUCTION

A fishery survey of East Finger Lake was conducted on June 15-16, 1983. Subsequently, additional water quality data were gathered on July 14, 1983. Table 1 summarizes East Finger Lake survey findings.

#### PHYSICAL FEATURES

East Finger Lake is located on the west central section of the Kenai National Wildlife Refuge (NWR) in the Kenai River drainage at latitude 60° 30' and longitude 150° 52'. Part of the lake has been assigned to the Intensive Land Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983). The lake has a surface area of 72 acres, a volume of 1,620 acre feet, and is at an elevation of about 235 feet. Mean lake depth is 23 feet and maximum depth 48 feet (Table 1 and Figure 1).

The watershed is composed of rolling hills rising to 280 feet above the lake. Approximately 2,000 acres, including South Finger and Quake Lakes, form the East Finger Lake drainage basin. An immature paper birch forest with scattered islands of mature paper birch and white spruce surround the lake. Small emergent to scrub-shrub bogs are located at the north and southeast ends of the lake. Most of the Finger Lakes area was burned in the 1969 fire.

The water regimen of the lake is maintained by runoff and springs. One outflow stream is located at the southwest end of the lake. This stream, which connects to Middle Finger Lake, is shallow with a width varying between three and six feet. About 0.5 cubic feet per second (cfs) of outflow was occurring during the survey. The stream seems capable of permitting fish passage between lakes. Water inflow from South Finger Lake was indicated on USGS Map Kenai C-3, but none was seen at the time of the survey. A small seasonal spring-fed stream on the lake's north end was contributing about 0.2 cfs of inflow. The lake is landlocked from the ocean.

Automobile access to the lake is provided by the Finger Lakes Road. This road was built some years ago by the Atlantic Richfield Company for oil exploration. Public use of the road is currently restricted by a locked gate. Other means of access include airplane or a quarter mile hike from the second gate on Finger Lakes Road. The only recreational facility on the lake is a log cabin located on the northeastern shore.

#### FISH

Fish captured in the lake included Dolly Varden/Arctic char, longnose sucker, threespine stickleback, and coastrange sculpin for a total of four species (Table 2). Dolly Varden/Arctic char and longnose sucker gill net abundances were relatively low with catch per unit of effort (CPUE) of 0.15 and 0.03 respectively, indicating low sport fishing potential. Threespine stickleback had a moderate CPUE of 1.59, and coastrange sculpin had a CPUE of 0.18. Four gill nets and 12 minnow traps were used to determine fish abundance. Seining and electrofishing were employed to obtain maximum species diversity.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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11-t-	m Rody	Fast Finger Lake	Survey Date(s)	6/15-16/83
wate	er bouy	Rofuce Kenai NWR		T <u>ZN R 9W S.33</u>
].	Location: Latitude	N 60° 30'.00" Longitude	W 150° 52' 40"	Map. Ref. <u>Kenaj C-3</u>
2.	Physical [ Volume Drainage / the north	Data: Surface Area <u>72 Ac.</u> 1,620 Ac. Ft. <u>Water Colo</u> Area <u>2,000 Ac.</u> Inle end of the Take:	Max. Depth <u>48 Ft.</u> r <u>Greenish Yellow</u> ts (cfs) <u>There is one</u>	Mean Depth <u>23 Ft.</u> Water Trans <u>27 Ft.</u> spring fed stream at
	Outlets (0 Middle Fi flow was Spawning H	cfs) <u>One outlet stream is at t</u> nger Lake. It was three to si O.5 cfs. Habitat	he southwest end of t x feet wide and shall	he lake flowing to ow. The estimated
	Accéss	Finger Lake Road (currently re	estricted to public tr	<u>affic), airplane, hiking</u>
3.	Water Qua pH 7.1 Kjeldahl	lity: D.O. <u>10.3-2.0 mg/1</u> T Alk. <u>15 mg/1</u> N MEI <u>5.5</u> S	emp. <u>17.5-4.8°C</u> Hard. <u>15 mg/1</u> DF <u>1.89</u> Pollut	Cond.3 <u>7 umhos @ 25°C</u> Phos ionNone
4.	Fish Spec longnose	ies: (Abundance, H/M/L, Intr sucker (L), threespine stickl	oduced) <u>Dolly Varde</u> eback (M), coastrange	n/Arctic char (L), sculpin. Total Species4
5.	Managemen and 1967 0.72 fis of 1.13.	t History: The lake was firs , they found CPUE's of Dolly V h per net hour. A limited 197	t surveyd in 1965 by arden/Arctic char ran 5 survey by the USFWS	ADF&G. Between 1964 ging from 0.19 to yielded a char CPUE
6.	Current F by a CPU sucker ( (CPUE 0.	ishery Status: <u>A low Dolly V</u> E of Q.15 in our 1983 survey. CPUE 0.03), threespine stickle 18). Water fertility was low	arden/Arctic char pop Other fish captured back (CPUE 1.59), and relative to fish prod	ulation was indicated included longnose coastrange sculpin luction.
7.	Vegetatic water 1 Terrestri	on : Aquatic Pondweed (2 Sp ily (1 Sp.), crowfoot (1 Sp.). al Immature paper birch fore	.), horsetail (2 Sp.). st with unburned stand	, water milfoil (2 Sp.), Coverage %13 1s_of_mature_paper
	birch ar	nd white spruce.		
8.	Wildlife: (3 Sp.)	Waterfowl (1 Sp.), shorebi •	rd (] Sp.), passerine	(8 Sp.), mammals
9.	Recreatio	on: Hunting and light fishin	g	
	Facilitie	es There is one refuge log	cabin on the northeas	t side of the lake.
			Jakubas	
	Survey C	rew: rrieuersuorii allo		



# EAST FINGER LAKE



Table 2.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body <u>East Finger Lake</u>Code No. <u>Survey Date 6/15-16-83</u>

		· · · · · · · · · · · · · · · · · · ·					Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
4 Gill Nets	22	640 640	1.0 2.0	Longnose Sucker Longnose Sucker Dolly Varden/A. Char	2 1 6	0-0-2 0-0-1 1-2-3	0.14 0.07 0.43	N/A N/A N/A	N/A N/A N/A
•		640 640 640	2.5 3.0 4.0	Dolly Varden/A. Char Dolly Varden/A. Char	6 1 0	2-1-3 0-0-1 -	0.43 0.07 0.00	N/A N/A N/A	N/A N/A N/A
	22	3200	A11	Longnose Sucker Dolly Varden/A. Char	3 13	0-0-3 3-3-7	0.04 0.19	0.03 0.15	N/A
Total Fish	22	3200	All	All Species	16	3-3-10	0.23	0.18	N/A
12 Minnow Trap	s 24 .	N/A	N/A	Threespine Stickleback Coastrange Sculpin	457 52	0-0-457 0-0-52	N/A N/A	N/A N/A	1.59 0.18
Total Fish	24	N/A	N/A	All Species	509	0-0-509	N/A	N/A	].27
Bag Seine	N/A	N/A	N/A	Threespine Stickleback Coastrange Sculpin	]	0-0-1 0-0-1	N/A N/A	N/A N/A	N/A N/A
Total Fish	N/A	N/A	N/A	All Species	2	0-0-2	N/A	N/A	N/A
Electrofishing	N/A	N/A	N/A	Threespine Stickleback Coastrange Sculpin Longnose Sucker	16 2 1	0-0-16 0-0-2 0-0-1	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
Total Fish	N/A	N/A	N/A	All Species	19	0-0-19	N/A	N/A	N/A

Dolly Varden/Arctic char ranged in size from 9.1 inches (230mm) to 14.0 inches (355mm) fork length. Individual weights were from 0.36 pounds (165 g) to 1.50 pounds (680 g). Condition factors ranged from 0.94 to 1.36 with a mean of 1.09. Longnose sucker ranged in fork length from 4.5 inches (114mm) to 9.1 inches (230mm). See Table 3 for a detailed breakdown of fish weight and condition by fork length class.

#### AQUATIC VEGETATION

Aquatic vegetation was moderate and concentrated around the periphery of the lake, usually not extending beyond 50 feet from the shoreline. Thirteen percent of the lake was covered with vegetation. Dominant families included pondweed, water lily, and sedges. A complete list of species can be found in Table 4. Areas of aquatic vegetation are located in Figure 1.

#### WATER QUALITY

Water quality data were collected in June and July. Measured parameters indicated generally good water conditions for fish. Water fertility for the lake is rated low compared to a classification of Minnesota Lakes (MacKenthun and Ingram 1967) based on alkalinity level. The lake was much lower in alkalinity and conductivity than the 17 other lakes tested in 1983. Specific conductance, corrected to 25°C, was 37 umhos while alkalinity and hardness were both 15 mg/1. Water pH was near neutral at the surface and slightly acid at 20 feet. No sources of water pollution were apparent. Dissolved oxygen concentrations varied from 9.8 mg/l at the surface to 2.0 mg/l near the bottom. Dissolved oxygen concentrations below 36 feet were considered marginal for fish. The much larger volume of well oxygenated water indicates the lake has satisfactory winter under-ice oxygen levels for fish. Water color was greenish yellow with a Secchi disc transparency of 27 feet. The lake had a Morphoedaphic Index of 5.5 and Shoreline Development Factor of 1.89 (Appendices A and B). Specific water quality data are presented in Tables 1, 5, and 6.

#### MANAGEMENT HISTORY

Strickland and Bernhardson (1964) of the Alaska Department of Fish and Game were the first fishery biologists to survey East Finger Lake. During their survey they captured char and suckers. Between 1964 and 1966 the State test netted the lake five times obtaining Dolly Varden/Arctic char CPUE's between 0.19 and 0.72. The Fish and Wildlife Service made a limited gill net survey in 1975 obtaining a char CPUE of 1.13. No specific fishery management measures are known to have been implemented on this lake.

#### WILDLIFE

One pair of common loons were observed moving between East Finger and Middle Finger lakes. Greater yellowlegs were feeding along the lake shoreline and apparently nesting in the immediate area. Eight species of passerine birds and three species of mammals were identified by sight, sign, or sound. All wildlife species recorded along with other pertinent data are listed in Table 7.

## Table 3.

### FISH LENGTH, WEIGHT, AND CONDITION SUMMARY East Finger Lake - 1983

#### Length SD\* Length Length Mean (mm) Range Sample Species Mesh Gear (mm) (mm) No. Size 230 - 400 51 304 2.0 ۴. 7 Dolly Varden/ 4 Gill Nets 304 355 275 - 320 18 5 Arctic char 2.5 ·... 355 - 355 3.0 1 \_

# FISH LENGTH BY MESH SIZE

.

# FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
4 Gill Nets	Dolly Varden/ Arctic char	201 - 250 251 - 300 301 - 350 351 - 400	1 5 5 2	165 259 327 595	21 37 120	165 - 165 240 - 290 285 - 365 510 - 680

# FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
4 Gill Nets	Dolly Varden/ Arctic char	201 - 250 251 - 300 301 - 350 351 - 400	1 5 5 2	1.36 1.07 1.04 1.10	0.09 0.09 0.06	1.36 - 1.36 0.94 - 1.17 0.96 - 1.17 1.06 - 1.14
Totals		A11	13	1.09	0.11	0.94 - 1.36

\*Standard Deviation

Table 4.

# EAST FINGER LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

Class .	Symbol	Common Name	Scientific Name
Emergent Emergent	HTF HTP	horsetail horsetail	<u>Equisetum fluviatile</u> Equisetum palustre
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent	MRs	water milfoil	<u>Myriophyllum sp</u> .
Submergent Submergent Submergent Submergent	MRs <sub>2</sub> PA PP WWC	water milfoil pondweed pondweed -	<u>Myriophyllum sp.</u> Potamogeton alpinus Potamogeton praelongus Ranunculus confervoides

## TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	IB	immature paper birch	<u>Betula papyrifera</u>
Trees	MB	mature paper birch	<u>Betula papyrifera</u>
Trees	MS	mature white spruce	Picea glauca
Shrub	A	alder	<u>Alnus sp.</u>
Shrub	SG	sweet gale	Myrica gale
Below Shrub	CR	sedge	<u>Carex</u> rostrata
Below Shrub	Cunid	sedge	<u>Carex</u> <u>sp</u> .
Below Shrub	G	grass	<u>Gramineae</u>

Table 5.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

Study	Remote & Roadside Lake Study, Kenai NWR, 1983-84	
Water Body	East Finger Lake Survey Date/Time 7-14-83/1000	
Lake Location	n (Latitude) N 60° 30' 00" (Longitude) <u>W 150° 52' 40"</u>	
Code No.	Survey Crew Friedersdorff, Jakubas	
Cloud Cover	(%) Wind (mph) Air Temp (°C) 18 Chop (in)	
Station		

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	p <u>H</u>	Conduct- ivity (u mho)	Tot Alkal (mg	al inity /1)	Total Hardnes (mg/l)	s Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	17.5	9.8	7.1	32*				XIV	7.5	-
1	17.4	9.9					· · · · ·			
2	17.4	9.9								
3	17.2	9.9								
4.	17.1	9.9								
5	15.5	9.9								
6	10.8	10.3	6.9	35	• 15	.0	15.0			
7	9.1	10.0							·	
8	8.0	9.4								
9	6.2	8.2								
10	5.8	7.0								
11	5.2	5.8								
12	5.0	3.8								
12.5	4.8	2.0								
									· · · ·	· · · ·
*	Conduct	divity	adju	ted to s	tandard	25°C	is 37 µn	nhös		
							}			

Remarks:

Equipment used: D.O. & Temp.-YSI 57 meter; Conductivity - YSI SCT-33 meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT.
Table 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyEast Finger LakeSurvey Date/Time6-15-83/1430Lake Location (Latitude)N 60° 30' 00" (Longitude)W 150° 52' 40"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)99Wind (mph) 3Air Temp (°C) 17.0Chop (in) 0.0Station

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	16.0	11.8	7.0	31			XII	8.3	
1	15.5	11.9							
2	15.0	12.0				•			
3	14.8	12.0							
4	14.8	12.1							
5	12.5	12.2		·					
6	11.0	. 12.2							
7	9.0	12.2							
8	7.8	11.0							
9	7.0	10.2							
10	6.0	9.0							
11	5.9	· 7.2							
12	5.5	5.0							
13	5.1	3:5							
14	4.9	. 1.8							
	1								
	<u> </u>		1						
			1 ì						

Remarks:Equipment used: D.O. & Temp.- YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc. Winkler 0, Checked 11.8 mg/l. Table 7.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

Study <u>Remote & Roadside Lake Study, Kepai NWR, 1983-84</u> Water Body <u>East Finger Lake</u> Survey Date/Time<u>6/15-16/83</u> Lake Location (Latitude) <u>N 60° 30' 00"</u> (Longitude)<u>W 150° 52' 40"</u> Code Number <u>Survey Crew</u> Friedersdorff, Jakubas

Animal ·Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfow	v] Common Loon	2	1-1-0	Pair	Sight	Water
Shorebi	rds 🤇 Greater Yellowl	egs 4	1-1-2	Pair	Sight	ΙB
Passeri	nes Rusty Blackbird Song Sparrow White-crowned Spar Blackpoll Warbl Slate-sided Jun Tree Swallow Wilson's Warble Gray Jay	4 Srow Many er Many co – r – r –	1-0-3 0-0-3 - - - - -	Pair/Singl - - - - - - - -	e Sight Sound Sight Sound Sound Sight Sound Sound	IB - - - -
Mammals Big Gam	e Moose	-	-	-	Tracks	_
Furbear	ers Muskrat	-	-	- M	ussel Shells	-
Others	Snowshoe Hare	-	-	_	Cuttings	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles IB=Immature Birch

Remarks: Rusty Blackbird nest with five eggs near shoreline.

#### RECREATIONAL USE

The lake, at the current time, is relatively isolated from the public. Limited sport fishing takes place along with use of the refuge log cabin. During our survey two oil field employees visited the lake. One of the workers stated they occasionally fished the lake from a canoe, but had only limited angling success. Human impact on the lake is minimal. A short vehicle path leads from Finger Lakes Road to the lake, and there is some vegetative disturbance around the cabin site.

#### FISHERY RESOURCE SUMMARY

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Our fishery investigation of East Finger Lake indicated a low population of Dolly Varden/Arctic char (CPUE 0.15). Additional species captured included threespine stickleback, longnose sucker, and coastrange sculpin. Lake water fertility was rated low. Other water quality parameters measured were within acceptable fish tolerance limits. A small outflow stream connecting East Finger and Middle Finger lakes could permit seasonal fish passage. East Finger Lake is considered to have the potential to support a low yield char sport fishery.

#### ENGINEER LAKE

#### INTRODUCTION

A fishery survey of Engineer Lake was conducted on July 27-28, 1983. Survey findings are summarized in Table 1.

#### PHYSICAL FEATURES

Engineer Lake, located in the Kenai River Basin, is situated in the north central section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 28' and longitude 150° 19'. The lake and surrounding area were classified in the Moderate Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983). The lake has a surface area of 230 acres, a volume of 1,719 acre feet, and is at an elevation of 289 feet. The lake is relatively shallow with a mean depth of 7.5 feet and maximum depth of 17 feet. (Table 1 & Figure 1).

The watershed is composed of lowland bogs to hills reaching an elevation of 1,400 feet. Approximately 1,875 acres form the lake's drainage basin. Major habitat types include emergent to scrub-shrub wetlands along the eastern shore, with the remaining shoreline consisting of an immature paper birch-white spruce forest interspersed with black spruce in low lying areas. The surrounding lake area was burned by the 1947 fire.

The water flow regimen of the lake is maintained by spring seepage and runoff. One small outlet stream is located at the east end of the lake. This outlet and the accompanying wetland area, which connects to Hidden Lake, are seasonally saturated and apparently only capable of passing fish during high water conditions. We detected no perceptable flow and the stream terminated in thick vegetation a short distance from Engineer Lake. No inlet streams were found. No suitable rainbow trout stream spawning habitat could be detected. Large areas of gravel and rocky shoreline were found in the northwestern portion of the lake.

Primary access to the lake is by automobile via Skilak Loop Road and a dirt access road. Recreational facilities include a gravel boat ramp, pit toilet, parking lot, and tenting area. The Seven Lakes Trail begins at the campground parking lot and skirts the western edge of the lake.

#### FISH

Fish captured included coho salmon, Dolly Varden/Arctic char, threespine stickleback, and coastrange sculpin. Gill net Catch Per Unit of Effort (CPUE) for sport fish was moderately high at 0.98 fish per net hour (Table 2).

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Mat	Survey Date(s)7/27-28/83
Wal	$\frac{1}{2} = \frac{1}{2} = \frac{1}$
٦.	Location: Refuge Kenai NWR Map. Ref. Kenai B-1
2.	Physical Data: Surface Area 230 Ac. Max. Depth 17.0 Ft. Mean Depth 7.5 Ft.   Volume 1,719 Ac. Ft. Water Color Greenish Brown Water Trans_3.9 Ft.
	Drainage Area 1,875 Ac Inlets (CIS)None
	Outlets (cfs) <u>The lake has one intermittent floodway at the east end connecting</u> to Hidden Lake.
	Some upbitat No stream spawning habitat was found. Some rocky shoals are in
	the western end of the lake.
	Access Skilak Loop Road with a dirt access road to the lake.
	Cond. 61 umho @ 25°C
3.	mater quality. b.o. <u>9.8-5.6 mg/1</u> Hard. <u>22 mg/1</u> Phos. <u>24 ug/1</u>
	Kjeldahl N <u>0.69 mg/lMEI 26.9</u> SDF <u>1.33</u> Pollution <u>None</u>
Δ	Fish Species: (Abundance, H/M/L, Introduced) Dolly Varden/Arctic char (L),
4.	threespine stickleback (L), coho salmon (M-H,I), coastrange sculpin.
	lotal Species_4
E.	Management History: ADF&G initially surveyed the lake in 1960. It was again
5.	surveyed in 1973 and 1974 by USFWS. FWS biologists recommended stocking the lake
	with sport fish. An alternate year cono salmon try stocking program (55,000 -
	50,000) Was (nitiated by Abrag in 1973. A moderatery ingh grand come spece press)
6.	Current Fishery Status: Under the current stocking program, the lake has a
	fluctuate with the stocking rate.
7.	Vegetation : Aquatic Pondweed (3 Sp.), horsetail (1 Sp.), sedges (1 Sp.),
	water lily (1 Sp.). Coverage % 44
	Terrestrial Immature birch-spruce forest with areas of black spruce and emergent
	to scrub-shrub wetlands.
8.	Wildlife: Waterfowl (6 Sp.), shorebirds (2 Sp.), gull (1 Sp.), passerine (4 Sp.),
0.	raptors (2 Sp.), mammals (4 Sp.). Noted wildlife: red-throated loon and Arctic
	100n.
9.	Recreation: Sportfishing, camping, wildlife viewing, hiking, hunting and trapping
	Facilities <u>Parking lot</u> , campground, gravel boat ramp, and pit toilet.
	Survey Crew: Friedersdorff & Jakubas

# Figure 1.

# ENGINEER LAKE

(230 Acres)



Table 2.

1.1

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

Water Bodv	Engineer Lake	Code No.	Survey Date	7/27-28/83

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	Δνομασο						Fi	sh CPUE	•
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex s M-F-U	1000 g.ft.hrs.	Net Hour	Trap Hour
8 Gill Nets	25	1280 1280 1280 1280	1.0 2.0 2.5 3.0	Coho Salmon Coho Salmon Coho Salmon Dolly Varden/A. Char Coho Salmon Dolly Varden/A. Char	7 105 62 1 9 1	5-1-1 25-62-18 23-31-8 0-1-0 3-2-4 0-1-0	0.22 3.28 1.94 0.03 0.28 0.03	N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A
· · · · · · · · · · · · · · · · · · ·		1280	4.0	Coho Salmon	4	0-2-2	0.13	N/A	N/A
By Species	25	6400	A11 	Dolly Varden/A. Char	2	0-2-0	0.01	0.01	N/A
Total Fish	25	6400	A11	All Species	189	56-100-33	3 1.18	0.98	N/A
18 Minnow Traps	25	N/A	N/A	Coho Salmon Threespine Stickleback Coastrange Sculpin	165 69 3	0-0-165 0-0-69 0-0-3	N/A N/A N/A	N/A N/A N/A	0.37 0.15 0.01
Total Fish	25	N/A	N/A	All Species	. 237	0-0-237	N/A	N/A	0.53
Bag Seine T	otal Fish	N/A	N/A	Coho Salmon	41	0-0-41	N/A	N/A	N/A
Electroshocking	]	N/A	N/A	Coho Salmon Threespine Stickleback Coastrange Sculpin	.6 1 1	0-0-6 0-0-1 0-0-1	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
- Total Fish		N/A	N/A	All Species	8	0-0-8	N/A	N/A	N/A

The large number of coho salmon captured (CPUE 0.97) was due to an ongoing ADF&G alternate year fish stocking program. This gill net catch of sport fish translates to potentially moderately high sport angling success. A remnant population of char was indicated by a catch of two adult Dolly Varden/Arctic char. Minnow trap catch was dominated by stocked juvenile coho salmon at a CPUE of 0.37 fish per trap hour. Threespine stickleback and coastrange sculpin were relatively low in abundance.

Coho salmon captured in gill nets and minnow traps ranged in size from 2.4 inches (61mm) to 12.0 inches (305mm) fork length (FL). Their weight ranged from 0.01 pounds (2.9g) to 0.75 pounds (340g). Condition factors (K) ranged from 0.84 to 1.97 with a mean of 1.24 (Table 3). Ages of coho were either zero plus or two plus due to alternate year stocking. No one, three, or four-year-old coho were captured. Growth rates (FL) of stocked coho, back calculated from 24 scale samples, averaged 4.3 inches (108mm) during the first year, 7.1 inches (179mm) during the second year, with an overall growth of 9.9 inches (251mm) for two and one-half years. The two Dolly Varden/Arctic char captured had fork lengths of 15.5 inches (390mm) and 17.9 inches (455mm).

#### AQUATIC VEGETATION

Aquatic vegetation was relatively dense and occupied nearly all areas of the lake. Forty-four percent of the lake was covered with vegetation. Dominant families included pondweed, water lily, horsetail, and sedges. A complete list of species can be found in Table 4. Areas of aquatic yegetation are shown on Figure 1.

#### WATER QUALITY

Water quality data were collected twice during July. All water quality parameters were within acceptable tolerance limits for fish. The lake is of low to medium fertility according to a classification of Minnesota lakes based on alkalinity level (MacKenthun and Ingram 1967). Specific conductance corrected to 25°C was 61 micromhos. Total alkalinity and hardness were slightly below the average of 17 other lakes sampled in 1983. The pH was slightly alkaline. Total phosphorus was 24.0 ug/l and Kjeldahl nitrogen was 0.69 mg/l. No sources of water pollution were apparent. Dissolved oxygen was near maximum to slight supersaturation throughout the entire water column. Thermal stratification of the lake was not present. Water color was greenish-brown with Secchi disc visibility of 3.9 feet. The lake had a Morphoedaphic Index of 26.9 and Shoreline Development Factor of 1.33 (Appendices A & B). Specific water quality data are presented in Tables 1, 5, and 6.

#### MANAGEMENT HISTORY

Engineer Lake was first surveyed in 1960 by the Alaska Department of Fish and Game (ADF&G) (Kubik and Reynolds 1960). A total of ten game fish including rainbow trout, Dolly Varden, and coho salmon were captured in four days of gill netting. The sport fish CPUE was low at 0.05 fish per net hour.

Table 3.

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## FISH LENGTH, WEIGHT, AND CONDITON SUMMARY Engineer Lake, 8/23-24/83

		Mesh		Lei	ngth	Length	Length
Gear	Species	Size (in)	Sample No.	Me(r	ean mm)	SD* (mm)	Range (mm)
8 Gill Nets	Coho Salmon	1.0 2.0	6 103		243 253	13 · 17	225 - 255 205 - 305
		2.5 3.0	58 9 4		262 248 255	19 31 15	210 - 300 200 - 300 240 - 275
18 Minnow Traps		0.125	46	~ 7	0.6	5.9	61 - 84

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
3 Gill Nets & 18 Minnow Traps	Coho Salmon	51 - 100 151 - 200 201 - 250 251 - 300 301 - 350	46 1 82 96 1	4.90 100 173 229 340	1.25 28.6 39.4	2.9 - 8.0 100 - 100 100 - 275 140 - 330 340 - 340

.

FISH CONDITION BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition (K) Mean	Condition SD	Condition Range
8 Gill Nets & 18 Minnow Traps	Coho Salmon	51 - 100 151 - 200 201 - 250 251 - 300 301 - 350	46 1 82 96 1	1.37 1.25 1.23 1.18 1.20	0.11 0.17 0.13	1.11 - 1.86 1.25 - 1.25 0.91 - 1.97 0.84 - 1.45 1.20 - 1.20
	Coho Salmon	A11	226	1.24	0.16	0.84 - 1.97

\*Standard Deviation

Table 4.

## ENGINEER LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

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		4	•
Class	Symbol	Common Name	Scientific Name
Emergent Emergent	HTF SR	horsetail spike rush	<u>Equisetum fluviatile</u> Eleocharis palustris
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent Submergent Submergent	PG PR PP*	-	Potamogeton gramineus Potamogeton perfoliatus Potamogeton praelongus

## WETLAND VEGETATION

Class	Symbol	Vegetation Reference
Scrub-§hrub	PSS4/1B	National Wetlands Inventory (Kenai)
Scrub-Shrub	PSS1	National Wetlands Inventory (Kenai)
Emergent	PEM5	National Wetlands Inventory (Kenai)

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees Trees Trees Trees	BS IB IS MS	black spruce immature birch (<20') immature spruce (<20') mature spruce (>20')	<u>Picea mariana</u> <u>Betula papyrifera</u> <u>Picea glauca</u> <u>Picea glauca</u>
Shrubs	SG	sweet gale	Myrica gale
Below Shrub		None Noted	

\*Needs to be re-confirmed

Table 5

2.2

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

StudyRemote & Roadside LakeStudyKenaiNWR, 1983-84Water BodyEngineer LakeSurvey Date/Time7-21-83/0830Lake Location (Latitude)N60°28' 45"(Longitude)W 150° 19' 15"Code No.SurveySurveyFriedersdorff, JakuhasCloud Cover (%)5Wind (mph)1-5Air Temp (°C)15.0Chop (in)Station11111

Sample Depth (m)	Water Temp. (°C)	D.O.	рH	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (µg/l)
0	17.9	9.8	7.6	53*	25	22	<u> </u>	1.2	24
1	17.8	9.8							
2	17.7	9.8,							
3	17.5	9.6		•					
4	17.0	9.6'			-				· · · · · · · · · · · · · · · · · · ·
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	<u> </u> <u>'</u>	1	1	· · · · · · · · · · · · · · · · · · ·					
*Cond	uctivi	ty adi	usted	to standa	rd 25°C tem	lerature is	61 µmł	os	
		1							

Remarks: Equipment used: D.O. & Temp.- YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Marson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 2D cm Secchi disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

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Study Remote & Roadside Lake Study, Kenai NWR, 1983-84	<u>`</u>
Water Body Engineer Lake Survey Date/Time 7-27-83/1500	
Lake Location (Latitude) N 60° 28' 45" (Longitude) W 150° 19' 15"	
Code No Survey Crew Friedersdorff, Jakubas	
claud Cover (9) 15 Wind (mph) 2-10 Air Temp (°C) 21.5 Chop (in) 3.0	)

Sample Depth (m)	Water Temp. (°C)	`D.O. (mg/l)	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)·	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (mg/l)
	18.2	9.9							
1	17.2	10.0							
2	17.0	10.0							
3	16.8	9.9		•					
4	16.8	8.8.							
								•	
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Remarks:

Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency 20 cm Secchi disc. The Take was sampled again by the Fish and Wildlife Service in 1973 and 1974. The CPUE in 1973 was 0.09 fish per net hour for four Dolly Varden and one rainbow trout and 0.04 in 1974 (Bailey 1974) for three Dolly Varden. Limnological measurements in 1974 indicated good dissolved oxygen levels in both the winter and summer. Other water quality parameters were found to be within favorable fish tolerance limits. Following the 1974 and 1975 FWS surveys, the Fish and Wildlife Service recommended the Take be stocked with sport fish to improve public angling opportunity (Bailey and Nelson 1974; Crateau 1975).

In 1975 the ADF&G initiated a fish management program consisting of alternate year, coho salmon fry stocking. Fry numbers stocked to date are: 1975 (34,400), 1977 (34,350), 1979 (34,250), 1981 (45,000), and 1983 (49,960). All the earlier coho plants were of Seward origin; the 1983 coho fry were from Crooked Creek and were incubated at the Trail Lakes Hatchery. Since 1976 the lake has been test netted by the State annually to determine the fishery status. Results have yielded high CPUE's, often exceeding 1.00 fish per net hour, for stocked coho. Growth rates for these coho have been considered good.

#### WILDLIFE

Engineer Lake and its surrounding habitat support a variety of wildlife, the most prevalent being waterfowl and shorebirds. White-winged scoter, Barrow's goldeneye, and mew gulls were observed rearing young. Pairs of Arctic and red-throated loons were also observed. Four other species of waterfowl and shorebirds were noted along with four species of passerines, and two species of raptors.

The lake's dense stands of horsetail, extensive bog, large amount of pondweed, and large number of juvenile salmon furnish cover, breeding habitat, and food sources which are attractants for the relatively high numbers of waterfowl and shorebirds found around the lake.

Mammals observed were typical for this area and included moose, coyote, muskrat, and snowshoe hare. All wildlife species recorded along with other pertinent data are listed in Table 7.

#### RECREATIONAL USE

Recreational uses of the Engineer Lake area include sport fishing, camping, hiking, wildlife viewing, hunting, and trapping. During July 27-28, we observed an average of ten automobiles (half were campers) parked overnight and a greater number of short-term day visits. Most fish were hooked from boats in the northern half of the lake. A good half day catch for a party of two appeared to be about 10 coho. This lake is believed to be a favorite summer and winter fishing lake. No accurate data are available on total yearly fishing pressure. Table 7.

## KENAL FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Wildlife Data Sheet

.

Study	Remote	e & Roadside	Lake St	udy, K	<u>enai NW</u>	R, 1983-	-84		
Watar	Body Fr	ngineer Lake	Surve	ey Date	e/Time	7-27-	-83		
Mater	ocation	(latitude) N	60° 28'	~45"	(Longi	tude) W	150°	191	15"
Lake L Codo N	lumbar	Survey	Crew	Fried	ersdorf	f, Jakul	as		
Loue n	(UIIIDE)	Jurrey	0101						

Animal Class	Common Name N	lumber	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Barrow's Goldeneye White-winged Scoter Common Merganser Red-throated Loon Red-necked Grebe Arctic Loon	4 J 7 J+ 5 2 6 2	0-0-4 0-2-5 0-0-5 0-0-2 0-0-6 1-1-0	Flock Brood Single Single Single Pair	Sight Sight Sight Sight Sight Sight	Water Water Water Water Water Water
Shorebirds	Red-necked Phalarope Sandpiper Unid.	e 2 7	· 0-0-2 0-0-7	Single Flock	Sight Sight	HT F YPL
Gulls	Mew Gull	8 J+	0-0-8	Rookery	Sight	IB
Passerines	Gray Jay Common Raven Savannah Sparrow Tree Swallow	  		- - -	Sight Sight Sound Sight	IB IB IB IB
Raptors	Great Horned Owl Red-tailed Hawk	1 1	0-0-1 0-0-1	Single Single	Sight Sight	IB IB
Mammals Big Game	Moose	3 J+	0-1-2	Cow/Calf	Sight	Bog
Furbearers	Coyote Muskrat	- 1	- F 0-0-1	amily Group Single	p Sound Sight	_ Water
Others	Snowshoe Hare	1	0-0-1	Single	Sight	IB

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles IB=Immature Birch; YPL=Yellow Pond Lily; HTF=Horsetail Human impact around the camping area appeared heavy. Grass and brush have been trampled, trees cut for firewood, and people were not utilizing the pit toilet. Litter accumulation around the campground was high.

#### FISHERY RESOURCE SUMMARY

Engineer Lake, prior to 1975, was a poor sport fishery with limited numbers of rainbow trout, Dolly Varden, and coho salmon as evidenced by the extremely low fish CPUE from test gill netting. The few sport fish captured are believed to have originated from Hidden Lake immigrating through the intermittent waterway during high water. No stream areas adjacent to the lake, capable of supporting rainbow trout spawning, could be found. With the advent of the State stocking program, large numbers of coho salmon have provided an active sport fishery.

Lake water fertility is slightly below the average of other refuge lakes we tested in 1983. Dissolved oxygen levels are evidently sufficient to sustain fish during critical winter periods since no fish kills have been reported. Coho salmon growth rates were good averaging about 3.7 inches per year. The CPUE of juyenile coho exceeded that of threespine stickleback showing highly successful interspecies competition between sport and forage species. Without continuation of the current fish stocking program, the lake will undoubtedly revert to historic low game fish populations. Engineer Lake is considered to have the potential to support only a low yield char sport fishery without special management. Under the current stocking program, the lake provides a moderately high yield put-grow and take coho salmon sport fishery.

#### INTRODUCTION

A fishery survey of Fish Lake was conducted on July 6-7, 1983. Additional water quality data were gathered on July 13, 1983. Table 1 summarizes Fish Lake survey findings.

#### PHYSICAL FEATURES

Fish Lake is located in the northcentral section of the Kenai National Wildlife Refuge.(NWR) in the Swanson River drainage at latitude 60° 43' and longitude 150° 43'. This area was classified as wilderness by the Alaska National Interest Lands Conservation Act of 1980. The lake has a surface area of 66 acres, a volume of 1,430 acre feet, and is at an elevation of about 200 feet. Mean depth is 22 feet and maximum depth 61 feet (Table 1 and Figure 1).

The lake's drainge area of about 280 acres is characterized by rolling hills, rising to 100 feet above the lake, and lowland bogs. A mature white spruce-paper birch forest dominates the west and north sides of the lake, while the east side consists mainly of black spruce with scattered paper birch. Small wetlands occur around the periphery of the lake with a relatively large wetland at the southern end.

Ihe water flow regimen of the lake is maintained by runoff, bog seepage, and springs. One small outlet stream is located at the south end of the lake. No perceptable flow was detected, and the stream ended in thick vegetation a short distance from the lake. The lake has no rainbow trout stream spawning habitat. U.S. Geological Survey Map Kenai C-2 (1951 Series) shows the lake to be landlocked from the ocean.

Swan Lake Road provides automobile access to the lake. Recreational facilities include two camping sites with parking spaces, picnic tables, fire pits, plus an outhouse. A 250-foot long path leads downhill to the lake.

#### FISH

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Dolly Varden/Arctic char, threespine stickleback, and sculpin were present in the lake (Table 2). Gill nets captured 17 Dolly Varden/Arctic char yielding a catch per unit of effort (CPUE) of 0.18 fish per net hour. This would provide moderate sport angling potential. Threespine stickleback taken in minnow traps were found to be moderately abundant at CPUE 2.29 fish per trap hour, and sculpin had a CPUE of 0.47. Four gill nets and 12 minnow traps were used to determine fish abundance.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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11	- Rody	Fish Lake		Survey	Date(s) _	7/6-7/83	
Wate	er Bouy		enai NWR		Т	7N R 8W	S_ <u>5</u>
].	Location: R LatitudeN	etuge 1 60° 43' 30"	Longitude	W 150° 43'	30" M	ap. Ref. <u>K</u> e	nai C-2
2.	Physical Dat Volume 1,43 Drainage Are at the north	a: Surface An <u>30 Ac. Ft.</u> a 280 Ac. n end of the la	rea <u>66</u> Ac. Water Color Inlet Ke discharging	Max. Depth <u>Medium Gr</u> s (cfs) <u>An</u> 1-5 cfs; we	<u>61 Ft.</u> een ADF&G surv did not f	Mean Dept Water Tra <u>vey reported</u> ind this st	h <u>22 Et</u> ns <u>30 Et.</u> an inlet ream
	Outlets (cfs had no perce	) <u>There is o</u> ptable flow.	ne small outle	t.stream_at_	the southe	rn end of th	e lake, it
	Spawning Hab	itat There	was no rainbow	trout spawn	ing habita	t	
	Accèss	Swan Lake Road.					
3.	Water Qualit pH 7.2 Kjeldahl N (	<u>y</u> : D.O. <u>12.6</u> Alk. D.31 mg/1 MEI	5-0.5 mg/l Te 16 mg/l 5.5 SE	mp. <u>17.5-4.</u> Hard. <u>11 n</u> DF <u>1.41</u>	8 mg/l ng/l Pollutio	Cond. <u>36 ur</u> Phos. <u>7.</u> n None	nhos @ 25°( 2 ug/1
4.	Fish Species threespine	: (Abundance stick]eback (M	, H/M/L, <u>I</u> ntro ), sculpin_sp.	oduced) <u>Do</u>	lly Varden,	/Arctic char Total Spec	(M), ies3
5.	Management H ADF&G. The	listory: <u>A</u> y found Arctic	fishery surve char to be lo	y of the lak w in abundan	e was cond ce.	ucted in 196	]_by
6.	Current Fish (CPUE 0.18) also preser quality is	nery Status: of Dolly Vard it. Fishing pr within accepta	The lake curre en/Arctic char essure is beli ble fish toler	ntly contain . Threespin eved to be l ance levels.	s a low to e stickleb ight to mo	moderate po mack and scul derate, and	pulation pin are water
			;	•		· · ·	
7.	Vegetation horsetail (1 Sp.), c Terrestrial wetlands.	: Aquatic [ (1 So.), water hara, gentain Mature white	Pondweed (1 Sp. milfoil (1 Sp. (1 Sp.). e spruce-paper	), quillwort ), crowfoot birch, black	: (1 Sp.), (1 Sp.), t Co < spruce, 6	water lily our reed (1 s overage % emergent_and	(1 Sp.), <u>Sp.), arum</u> 3 scrub=shr
8.	Wildlife:	Waterfowl (1	Sp.), passerin	e (5 Sp.), ma	ammals (3	<u>Sp.).</u>	
9.	Recreation:	Wildlife yiew	ing, hunting,	fishing, and	camping.		
	lacilities one outhou	Two automobil se.	e parking spac	es, two picn	ic tables,	two fire pi	ts, and
	Survey Crew	Frie	dersdorff, Jak	ubas			



Table 2.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

. Water Body	Fish Lake	Code No.	Survey Dat	e 7/6-7/83
			v	

	Average	_	<u>, ,</u>				Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	- Net Hour	Trap Hour
4 Gill Nets	24	640 640 640 640 640	1.0 2.0 2.5 3.0 4.0	Dolly Varden/Arctic ( Dolly Varden/Arctic ( Dolly Varden/Arctic (	0 Char 10 Char 3 Char 4 0		0.00 0.13 0.04 0.05 0.00	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
Total Fish	24	3200	A11	All Species	17	10-4-3	0.22	0.18	N/A
12 Minnow Traps	3 23	N/A	N/A	Threespine Sticklebac Sculpin Sp.	ck 632 130	0-0-632 0-0-130	N/A N/A	N/A. N/A	2.29 0.47
Total Fish	23	N/A.	N/A	All Species	762	0-0-762	N/A	N/A	2.76
Otter Trawl	N/A	N/A	N/A	Threespine Sticklebad	ck 13	0-0-13	N/A	N/A	N/A

Dolly Varden/Arctic char ranged in size from 10.0 inches (255mm) to 17.5 inches (445mm) fork length. Weight was from 0.35 pounds (160 g) to 2.1 pounds (975 g). Condition factors ranged from 0.81 to 1.16 with a mean of 1.07. Table 3 gives a breakdown of Dolly Varden/Arctic char weight and condition by fork length class.

#### AQUATIC VEGETATION

Aquatic vegetation coverage of Fish Lake was three percent, the lowest of the 18 lakes surveyed in 1983. Although vegetation occurred along much of the shoreline, it was often too sparse to provide good fish cover. Dominant plant families included pondweed, water lily, quillwort, and horsetail. Our depth recorder indicated submerged trees in the northwest corner of the lake. A complete list of species can be found in Table 4 with locations in Figure 1.

#### WATER QUALITY

Water quality data were collected twice in July. Limnological conditions were generally acceptable for fish. Lake fertility was low based on a classification of Minnesota Lakes using alkalinity level as an indicator (MacKenthun and Ingram 1967). The alkalinity, at 16 mg/l, was below the average value found in the 18 lakes sampled in 1983. Specific conductance, corrected to 25°C, was 36 umhos. Water pH was near neutral. Total phosphorus was 7.2 ug/l, and Kjeldahl nitrogen was 0.31 mg/l. No sources of water pollution were present.

The lake was thermally stratified between 16 and 20 feet. Dissolved oxygen (Do) concentrations were satisfactory for fish (12.6 - 6.0 mg/l) in the lake's epilimnion and upper part of the hypolimnion down to about 45 feet. Below 45 feet Do levels were poor to lethal (3.5. - 0.5 mg/l) for fish. The greater volume of well oxygenated water in the epilimnion indicates that winter Do concentrations are probably adequate for fish. The Morphoedaphic Index for the lake was 5.5 and the Shoreline Development Factor was 1.41 (Appendices A and B). Specific water quality data are in Tables 1, 5, and 6.

#### MANAGEMENT HISTORY

The Alaska Department of Fish and Game (ADF&G) surveyed Fish Lake in 1961 (Kubik and Christian 1961). They captured only Arctic char for a CPUE of 0.05 fish per net hour. The biologists also indicated a small inlet on the north end of the lake was discharging between 1 - 5 cubic feet per second (we did not find this stream). No other specific fishery management work is known to have been implemented on the lake.

#### WILDLIFE

A single adult common loon was rearing one chick on the lake. Five species of passerine birds were observed along with three species of mammals. All species recorded, along with other pertinent data, are listed in Table 7.

## FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Fish Lake-1983

#### Length Length Length SD\* Range (mm) Sample Mean Species Mesh Gear (mm) (mm) Size No. 272 17 255 - 315 Dolly Varden/ Arctic char 10 2.0 4 Gill Nets 320 - 435 362 64 3 4 2.5 40 355 - 445 3-88 3.0

# FISH LENGTH BY MESH SIZE

FISH WEIGHT BY LENGTH CLASS

Gear	Species I	_ength Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
4 Gill Nets	Dolly Varden/ Arctic char	251 - 300 301 - 350 351 - 400 401 - 450	9 3 1 1	180 372 625 975	23 45 - -	160 - 230 325 - 415 625 - 625 975 - 975

# FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class · (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
4 Gill Nets	Dolly Varden/ Arctic char	251 - 300 301 - 350 351 - 400 401 - 450	9 3 1 1	1.04 1.11 1.14 1.11	0.10 0.06 - -	0.81 - 1.14 1.04 - 1.16 1.14 - 1.14 1.11 - 1.11
Totals	·	A11	14	1.07	0.09	0.81 - 1.16

52

Table 4.

# FISH LAKE ASSOCIATED VEGETATION

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# AQUATIC VEGETATION

<del>:</del> Class	Symbol	Common Name	Scientific Name
Emergent Emergent Emergent Emergent	BB HTF MT WC	buckbean horsetail mare's tail wild calla	Menyanthes trifoliata Equisetum fluviatile Hippuris vulgaris Calla palustris
Floating Floating	BR YPL	bur reed yellow pond lily	<u>Sparganium angustilfolium</u> <u>Nuphar polysepalum</u>
Submergent Submergent Submergent Submergent	CH PG QW WWC	muskgrass pondweed quillwort	<u>Chara sp.</u> Potamogeton gramineus Isoetes muricata Ranunculus confervoides
	,š		

## WETLANDS VEGETATION

Class	Symbol	Vegetation Reference
Emergent	PEM5B	National Wetlands Inventory (Kenai)
Scrub-Shrub	PSS1B	National Wetlands Inventory (Kenai

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Froes	MB	mature paper birch	<u>Betula papyrifera</u>
Frues	MS	mature white spruce	Picea glauca
Shrubs	A	alder	<u>Alnus sp.</u>
Shrubs	AS	Alaska spiraea	Spiraea beauverdiana
Shrubs	SG	sweet gale	Myrica gale
Below Shrub	CG	cotton grass	<u>Eriophorum sp.</u>
Below Shrub	Cunid	sedge	<u>Carex sp.</u>
Below Shrub	CR	sedge	<u>Carex rostrata</u>
Below Shrub	MFF	marsh five finger	<u>Potentilla palustris</u>
Below Shrub	WF	wild flag	Iris setosa

Table 5.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

### Water Analysis Data Sheet

Study	Remo	te & Roadside	Lake S	Study,	Kenai NWR,	1983-8	4	
Water	Body	Fish Lake		Sur	vey Date/T	ime 7	-13-83/1000	
Lake L	ocation	(Latitude) N	60° 43	3' 30"	(Longit	ude) <u>W </u> ]	<u>50° 43' 30"</u>	
Code N	10.	Survey (	Crew	Fried	lersdorff,	Jakubas		

Cloud C Station	Cover (S	%)	W	ind (mph)	Air	Temp (°C)_	<u>19.5</u> C	hop (in)	
Sample	Water			Conduct-	Total	Total		Water	Tota]
Depth (m)	Temp. (°C)	.D.O. (mg/1)	рН )	ivity (u mho)	Alkalinity (mg/l)	Hardness (mg/1)	Water Color	Trans. (m)	Phosphate (ug/1)
0	17.5	10.8	7.2	37*			VIII	9.0	7.2
1	17.4	10.9							
2	17.2	10.9				i i	· ·	-	
3	17.1	11.0		. ,					
4	17.0	11.0							
5	16.5	.11.3							
6	11.8	12.6							
7	9.5	12.6	<i>(</i>			÷			
8	8.0	12.1							
9	7.0	11.5		31	16	11,	}		
10	6.4	10.2							
11	6.0	9.6							
12	5.5	8.6							
13	5.2	6:0							
14	5.0	3.5							
15	5.0	3.3							
16	4.9	1.0							
17	4.9	0.6							
18	4.8	0.5	,						
	*Cor	ductiv	fity a	djusted to	25°C is 36	umhos			

Remarks: Equipment used: D.O. & Temp.- YSI 57 Meter; Conductivity - YSI SCT-33 meter; pH-Hach 17F & Markson 88 Meter; Water Colorp Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AD-DT; Hardness - Hach HA-DT.

## Table 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

Study	Remote & Roadside Lake Study, Kenai NWR, 1983-84
Water	Body Fish Lake Survey Date/Time 7-7-83/1330
lake l	ocation (Latitude) N 60° 43' 30" (Longitude) W 150° 43' 30"
Code I	Survey Crew Friedersdorff, Jakubas
Cloud	Cover (%) 75 Wind (mph) 5-10 Air Temp (°C) 20 Chop (in) 1-3.0
Statio	on

` · .

Sample	Water			Conduct-	Total	Total	۱	Water	Total
Depth	Temp.	D.O.	рН	ivity	Alkalinity	Hardness (mg/1)	Water	(m)	rnospnate (ug/l)
(m)	<u>(°C)</u>	(mg/l	<u></u>	<u>(u mno)</u>	<u>(IIIg/ I)</u>		00101		<u> </u>
0	18.0	10.6	7.3				IIIV	8.5	
]	18.0	10.6							
2	18.0	10.8		•					
3	17.9	10.8							
4	17.8	11.0			 				
5	14.0	12.2							
6	10.6	12.4							
7	8.5	12.2							
8	7.2	12.1							
9	6.2	11.6							
10	6.0	11.0							
11	5.1	10.2							-
12	5.0	9.2	- · ·						
13	4.9	7.4							
14	4.6	6.6							
15	4.5	4.6							
16	4.2	3.4							
17	4.2	2.0	1						
18	4.2	0.8							
		1							

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency- 20 cm Secchi Disc. Table 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

.

Studv	Remote & Roadside Lake Study, Kenai NWR, 1983-84	. `
Water	Body Fish Lake Survey Date/Time 7-7-83/1330	
Lake L	ocation (Latitude) N 60° 43' 30" (Longitude) <u>W 150° 43' 30"</u>	
Code N	o. Survey Crew Friedersdorff, Jakubas	
Cloud	Cover (%) 75 Wind (mph) 5-10 Air Temp (°C) 20 Chop (in) 1-3.0	
Statio	)m	

Sample	Water	· • • • • • • • • • • • • • • • • • • •		Conduct-	Total	Total		Water	Total
Depth	Temp.	D.O.	pH	ivity	Alkalinity	Hardness	Water	Trans.	Phosphate (
(m)	<u>(°C)</u>	(mg/1	)1	(u mho)	(mg/l)	(ing/1)	LOIOT		<u>(1,6,1)</u>
0	18.0	10.6	7.3				VIII	8.5	
1	18.0	10.6							
2	18.0	10.8							
3	17.9	10,48	4					•	
4	17.8	11.0	•						
5	14.0	12.2							
6	10.6	12.4							·
7	8.5	12.2							
8	7.2	12.1							
9	6.2	11.6							
10	6.0	11.0							
11	5.1	10.2							-
12	5.0	9.2							
13	4.9	7:4					}		
14	4.6	6.6							
15	4.5	4.6							
16	4.2	3.4							
17	4.2	2.0	1						
18	4.2	0.8					·		
				1					

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency- 20 cm Secchi Disc Table 7.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Wildlife Data Sheet

.

Study	Remot	e &	Roadside	Lake	Study,	Kenai	NWR,	1983-	-84	· · · ·	
Unton.	Pody	Fick	Lake	SI	irvey D	ate/Tin	ne	7-6-8	33		
Water	Bouy	<u>FISI</u>	LANC		421 201	(1.01	aitu	H Lot	50°	43	30"
Lake l	_ocation	(La1	titude) <u>N</u>	60-	43 30		iy i cu				
Code 1	Number	-	Survey	Cre	w Frie	edersdo	rtt,	Jakuba	1S		
Code I	vumber		JUIVEY	010							

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Common Loon	2 J+	0-1-1	Brood	Sight	Water
Passerine	s Alder Flycatcher Swanson's Thrush Yellow-rumped Warble Black-capped Chickad Slate-sided Junco	4 - ee - -	-		Sound Sound Sound Sound Sound	
Mammals Big Game	Moose	1	-	Single	Sight	-
Furbearer	rs Muskrat	-	-	-	Mussel Shells	-
Others ·	Snowshoe Hare	-	-	_	Cuttings	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles

Remarks:

#### RECREATIONAL USE

During the summer, the camping area is frequently used by refuge visitors. No records exist on lake sport fishing pressure, but we believe it to be light to moderate. No data exists to substantiate this estimate. Other uses of the lake include wildlife viewing and hunting. Human impact around the camping area appears heavy. Many paper birch trees had bark removed above head height, well worn foot paths lead from the camping area to the lake, bushes had been cut to make additional camping area, and the outhouse had been vandalized by gunfire.

#### FISHERY RESOURCE SUMMARY

Our fishery investigation of Fish Lake indicates a moderate population (CPUE 0.18) of Dolly Varden/Arctic char. A previous survey in 1961 by the ADF&G indicated a lower abundance of char. Threespine stickleback numbers were moderate (CPUE 2.29), while sculpin, with a CPUE of 0.47, constituted the remaining fish species in the lake. No rainbow trout spawning habitat was present. Lake fertility was relatively low. Other water quality parameters were within acceptable fish tolerance limits. Fish Lake is-considered to have the potential to support a moderate yield char sport fishery.

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#### INTRODUCTION

A fishery survey of Paddle Lake was conducted on June 28-29, 1983. Additional water quality data were collected on July 12, 1983. Table 1 summarizes Paddle Lake survey findings.

#### PHYSICAL FEATURES

Paddle Lake is located in the Swanson River drainage in the northcentral section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 46' and longitude 150° 31'. This area was designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. The lake has a surface area of 97 acres, a volume of 1,485 acre feet, and is at an elevation of approximately 225 feet. The lake's mean depth is 15 feet and maximum depth 41 feet (Table 1 and Figure 1).

Paddle Lake has a watershed of approximately 1,200 acres which is characterized by low rolling hills. Predominant vegetation consists of immature paper birch that is regenerating from the 1947 burn. Scattered stands of mature birch and white spruce, which were not killed in the fire, are found around the lake, along with black spruce near the shoreline and in low lying areas. Three small scrub-shrub to emergent wetlands are at the north and south ends of the lake.

Lake water level is maintained by stream flow, springs, and runoff. Two intermittent inflow streams, one from Yugok Lake at the south end and one from a four-lake complex at the north end, have been reported to contribute water to the lake. Neither stream was evident during our survey, and no visible inflow could be detected. An outlet stream at the northwest tip of the lake flowing to Lure Lake was clearly defined. This stream was between eight and 12 feet wide and up to a foot deep. The substrate was mostly covered with organic debris and silt. Floating and emergent aquatic vegetation was growing in the stream bed; outflow was estimated at 3 cubic feet per second. This stream is believed to provide the rainbow trout spawning habitat for the lake. According to U.S. Geological Survey map Kenai D-2, the lake is landlocked from the ocean.

Automobile access yia Swan Lake Road leads to a parking lot on a bluff overlooking the lake. Camping sites, a sign out station for the canoe trails, and a bulletin board are part of the facility. From the parking lot a quarter mile downhill trail leads to the lake.

#### FISH

Rainbow trout, Dolly Yarden/Arctic char, longnose sucker, threespine stickleback, and coastrange sculpin were verified during the survey for a total of five fish species (Table 2). Rainbow trout was the dominant game fish in the lake exhibiting a moderately high gill net abundance. The catch per unit of

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Mate	Survey Date(s) 9/28-29/83
Walt J	Location: Refuge Kenai NWR T <u>8N R</u> .7W S.21
1.	Latitude <u>N 60° 46' 10"</u> Longitude <u>W 150° 31' 40"</u> Map. Ref. <u>Kenai D-2</u>
2.	Physical Data:Surface Area97 Ac.Max. Depth41 Ft.Mean Depth15 Ft.Volume1,485 Ac. Ft.Water ColorGreen YellowWater Trans20 Ft.Drainage Area1,200 Ac.Inlets(cfs)There are two intermittent inlets-one from Yugok Lake at the south end and one from Dog Lake at the north end.Bothstreams were not clearly defined and no water flow was detected.Outlets (cfs)One outlet is at the north end of the lake flowing into Lure Lake.This stream was clearly defined, being 8-12 feet wide, 1 foot deep, and with thesubstrate covered with silt and organic debris.Floating and emergent aquatics wereSpawning HabitatThe outlet stream is believed to/growing in the stream beprovide rainbow trout spawning habitat.AccessAutomobile access is via Swan Lake Road.
3.	Water Quality: D.O. 10.6-1.0 mg/l Temp. 17.0-4.2°C Cond. 96 umhos @ 25°C   pH 7.6 Alk. 41 mg/l Hard. 46 mg/l Phos. 11.2 ug/l   Kjeldahl N 0.36 mg/l MEI 16.7 SDF 2.66 Pollution None
4.	Fish Species: (Abundance, H/M/L, Introduced) <u>Rainbow trout (M-H), Dolly</u> Varden/Arctic char (L), longnose sucker (L), threespine stickleback (M), coastrange sculpin. Total Species 5
5.	Management History: The lake was surveyed in 1965 by the ADF&G. They found moderate abundances of Arctic char and rainbow trout, a low abundance of longnose sucker, and one coho salmon.
6.	Current Fishery Status: Rainbow trout are the dominant game fish (CPUE 0.50) alon with a low abundance of Dolly Varden/Arctic char (CPUE 0.03). Water quality conditions are within normal fish tolerance limits and fishing pressure is believed to be high, but short term.
7:	Vegetation : Aquatic <u>Pondweed (4 Sp.), water lily (2 Sp.), horsetail (1 Sp.),</u> water milfoil (1 Sp.), bur reed (2 Sp.), musk grass. Coverage % <u>45.6</u> Terrestrial <u>Predominately immature paper birch regenerating from the 1947 burn</u> with scattered stands of mature birch and white spruce.
8.	Wildlife: <u>Raptor (1 Sp.), waterfowl (1 Sp.), tern (1 Sp.), passerine (12 Sp.),</u> mammals (4 Sp.). Wildlife of note: bald eagle and beaver.
9.	Recreation: Canoeing, fishing, wildlife viewing, hunting, camping. The lake is one launch point for the Swanson River Canoe Route, part of the National Recreation Facilities <u>Parking lot</u> , bulletin board showing canoe system trail. /Trail System.

Survey Crew:

Friedersdorff, Jakubas



Table 2.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Page 1 of 2

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## Summary Fish Catch and Effort Data

.Water Body	Paddle Lake	Code No.	Survey Date	6/28-29/83	
					_

•	Average	· · · · · · · · · · · · · · · · · · ·					Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
4 Gill Nets	26	640	1.0	Longnose Sucker	1	0-0-1	0.06	N/A	N/A
	20	640	2.0	Longnose Sucker	1	0-0-1	0.06	N/A	N/A
· • .				Rainbow Trout	30	5-16-9	1.80	N/A	N/A
				Dolly Varden/A. Char	3	2-1-0	0.18	N/A	.N/A
		640	2.5	Longnose Sucker	4	0-0-4	0.24	N/A	· N/A
				Rainbow Trout	16	6-8-2	0.96	N/A	N/A
		640	· 3.0	Rainbow Trout	4 ·	1-2-1	0.24	N/A	N/A
				Longnose Sucker	2	0-0-2	0.12	N/A	N/A
		640	4.0	Rainbow Trout	2	0-0-2	0.12	N/A	N/A
				Longnose Sucker	2	0-0-2	0.12	<u>N/A</u>	N/A
	26	3200	A11	Rainbow Trout	52	12-26-14	0.63	0.50	N/A
• • •	20	0200	ATT	Longnose Sucker	10	0-0-10	0.12	0.10	N/A
			A11	Dolly Varden/A. Char	3	2-1-0	0.04	0.03	N/A
Total Fish	26	3200	. A11	All Species	65	14-27-24	0.78	0.63	N/A
10 Minnow Tunna		N / A	Ν / Λ	Throespine Stickleback	289	0-0-289	 Ν / Δ	N/A	0.96
iz minnow iraps	20	M/M	щA	Longnose Sucker	1	0-0-1	NZA	N/A	< 0.01
				Rainbow Trout	4	0-0-4	N/A	N/A	0.01
	, <b>M</b>			Coastrange Sculpin	25	0-0-25	N/A .	N/A	0.08
Total Fish	25	.N/A	N/A	All Species	319	0-0-319	N/A	N/A	1.06
Rag Seine	N / A	N/A	 N/A	Threespine Stickleback	7	0-0-7	N/A	N/A	N/A
Dug serie	ηγη	11/11		Coastrange Sculpin	1	0-0-1	N/A	N/A	N/A
– Total Fish	N/A	N/A	N/A	All Species	8	0-0-8	N/A	N/A	N/A

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Table	2. (Cont	inued)	KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE Summary Fish Catch and Effort Data				Page 2 of 2				
	Wate	r Body <u>Pa</u>	addle Lake	Code No	Survey Date	6/28-29	9/83				
Gear	Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size . (In.)	Fish Species	Total Eish Number	Sex M-F-U	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour		
Electroshocking	J N/A	N/A	N/A	Threespine Stickleba Coastrange Sculpin	ck 28 1 27	0-0-28 0-0-27	N/A N/A	N/A N/A	N/A N/A		
Total Fish	N/A	N/A	N/A	All Species	55	0-0-55	N/A	N/A	N/A		

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effort (CPUE) was 0.50 fish per net hour. Dolly Varden/Arctic char and longnose sucker were low in abundance with respective CPUE's of 0.03 and 0.10. A moderate abundance of threespine stickleback was indicated by a minnow trap CPUE of 0.96 along with rainbow trout juveniles (CPUE 0.01), longnose sucker juveniles (CPUE 0.01), and coastrange sculpin (CPUE 0.08). The presence of young trout indicates recent successful spawning and recruitment of younger year classes to the fish population. Four gill nets and 12 minnow traps were used to determine fish abundance. Electrofishing and seining were employed to test for maximum species diversity.

Rainbow trout captured in gill nets ranged in size from 9.1 inches (230 mm) to 17.3 inches (440 mm). Their weight was from 0.3 pounds (130 g) to 2.4 pounds (1,080 g). Condition factors ranged from 0.75 to 1.40 with a mean of 1.15. Paddle Lake rainbow trout exhibited an annual average growth rate of 2.2 inches (57 mm). Table 3 lists a breakdown of rainbow trout weight and condition by fork length class. Table 4 shows age and growth of rainbow trout back calculated from 22 scale samples. The Dolly Varden/Arctic char ranged from 11.2 inches (285mm) to 12.4 inches (315mm) fork length. Longnose suckers were mostly large being from 17.7 inches (450mm) to 18.5 inches (470mm) fork length.

#### AQUATIC VEGETATION

Aquatic Vegetation was moderate to heavy and largely confined to shallow lake areas and along shore. Dominant families included pondweed, water lily, and bur reed. Aquatic vegetation covered approximately 47 percent of the lake area. A complete list of species identified is in Table 5 with location of major species in Figure 1.

#### WATER QUALITY

The principal water quality survey was accomplished in July with a few parameters being tested in June during fish sampling. Most water parameters were well within acceptable fish limits except for dissolved oxygen (Do) concentrations in the lowest depths of the lake. Water fertility is rated medium based on a classification of Minnesota lakes using the alkalinity level as an indicator (MacKenthun and Ingram 1967). The lake's alkalinity of 41 mg/l was slightly above the average of 18 lakes surveyed in 1983. Specific conductance, corrected to 25° C, was 96 umhos. Water pH was slightly alkaline at 7.6 on the surface and slightly acid, being 6.6 at 30 feet. Total phosphorus was 11.2 ug/l and Kjeldahl nitrogen was 0.36 mg/l. Water color was greenish yellow with a Secchi disc transparency to 20 feet. No sources of water pollution were present.

The lake was thermally stratified between 10 and 23 feet with a surface temperature of 63°F declining to 40°F near the lake's deepest point. Dissolved oxygen ranged from 9.9 mg/l (slight supersaturation) at the surface to 1.0 mg/l (five percent normal atmospheric saturation) at 30 feet. Satisfactory Do concentrations were available to fish in the upper 26 feet of the lake, while less satisfactory to critical concentrations were found below that level. The lake had a Morphoedaphic Index of 16.7 and Shoreline Development Factor of 2.66. Specific water quality data are in Tables 1, 6, and 7. Table 3.

## FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Paddle Lake - 1983

Gear	Species	Mesh Size (in)	Sample No.	Length Mean (mm)	Length SD* (mm)	Length • Range (mm)
4 Gill Nets	Rainbow Trout	2.0 2.5 . 3.0 4.0	28 15 4 1	282 322 350 370	45 36 72 -	230 - 425 275 - 405 290 - 440 370 - 370

## FISH LENGTH BY MESH SIZE

## FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
4 Gill Nets	Rainbow Trout	201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	6 21 11 5 3	158 246 401 630 802	15 49 78 91 - 294	130 - 170 170 - 325 300 - 550 510 - 740 495 - 1080

# FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
4 Gill Nets	Rainbow Trout	201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	6 21 11 5 3	1.17 1.14 1.17 1.22 1.03	0.17 0.07 0.10 0.14 0.26	0.94 - 1.40 1.03 - 1.30 1.01 - 1.34 1.01 - 1.39 0.75 - 1.27
Tot	tals	A11	46	1.15	0.12	0.75 - 1.40

\*Standard Deviation

## AGE-GROWTH\* OF RAINBOW TROUT PADDLE LAKE, 1983

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Year	No	Fork	Length	(FL) In	Milli TV	meters V	at Ann	ulus For VII	mation VIII	Capture
01433	110.	<u> </u>	<u>_</u>				· · ·	7 ± 1	• · · · · ·	1 ⊑
1980	. 5	70	134	197						239
1979	3	58	125	183	239					293
1978	10	44	95	158	221	291				344
1977	3	45	92	141	197	240	306			353
1976	0									
1975	1	41	85	135	203	271	339	345	382	440
Total	No.	22.	<sup>#</sup> 22	22	17	14	4	1	1	
Ave. 1	FL, (mm	<u>)</u> 52	107	163	219	279	314	345	382	
Aye. J	FL (in	) 2.1	4.2	6.4	8.6	11.0	12.4	13.6	15.0	

\*Not corrected for length at scale formation.

Table 5.

# PADDLE LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent	BB	buck bean	<u>Menyanthes</u> trifoliata
Emergent	HFT	horsetail	Equisetum fluviatile
Floating	BR	bur reed	<u>Sparganium</u> angustilfolium
Floating	Brm	bur reed	<u>Sparganium</u> minimum
Floating	DWL	dwarf water lily	<u>Nymphae</u> tetragona
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent	Mrs	water milfoil	<u>Myriophyllum sp.</u>
Submergent	CH	musk grass	<u>Chara sp.</u>
Submergent	Pfo	pondweed	<u>Potamogeton foliosus</u>
Submergent	PG	pondweed	<u>Potamogeton gramienus</u>
Submergent	PL	pondweed	<u>Potamogeton filiformis</u>
Submergent	PR	pondweed	<u>Potamogeton perfoliatus</u>

# TERRESTRIAL VEGETATION

r		• •	;·
Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	IB	immature paper birch	Betula papyrifera
Trees	MB	mature paper birch	Betula papyrifera
Trees	IS	immature spruce	Picea glauca
Trees	MS	mature spruce	Picea glauca
Shrub	A	alder	<u>Alnus sp.</u>
Shrub	SG	sweet gale	Myrica gale
Below Shrub	G	grass	<u>Gramineae</u>
Below Shrub	WC	wild calla	<u>Calla palustris</u>
Below Shrub	WF	white flag	Iris setosa
Table 6.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

Studv	Remote & Roadside Lake Study, Kenai NWR, 1983-84
Water Ī	Body Paddle Lake Survey Date/Time 7-12-83/1030
Lake L	cation (Latitude) N 60° 46' 10" (Longitude) W 150° 31' 40"
Code No	Survey Crew Friedersdorff, Jakubas
Cloud (	Cover (%) 100 Wind (mph) 1-5 Air Temp (°C) 13.0 Chop (in) 1.0
Statio	

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Colør	Water Trans. (m)	Total Phosphate (ug/l)
0	17.0	9.9	7.6	81*	4]	46	XII	6.1	11.2
1	16.9	9.9							
2	16.9	9.9							
3	16.8	9.9	i						
4	14.0	10.6							
5	9.5	10.4		79.	42	47			
6	7.5	9.2			· .			1	
7	6.2	7.2							
8	5.9	5.8							
9	5.1	4.0							
10	4.8	1.8	6.6	88				•	
11	4.2	1.0							
*Co	nducti	ity co	rrect	ed to 25°(	is 96 umho	ς			
					·				
		1	<b> </b>			l			
					·	· ·			
						<u> </u>			

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 7.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyPaddle LakeSurvey Date/Time6-29-83/1400Lake Location (Latitude)N 60° 46' 10"(Longitude)W 150° 31' 40"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)1-2Air Temp (°C)15.0Chop (in)0.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	17.5	12.8	7.4	75			XII	5.5	
1	17.5	12.4			· · · · ·				
2	17.5	12.2							
3	17.5	12.2				4			
4	12.5	14.2							· · · · · · · · · · · · · · · · · · ·
5	8.2	13.0					· · · · · · · · · · · · · · · · · · ·		
6	6.8	10.8							
. 7	6.0	8.2							
8	5.5	5.2						·	
9	5.0	3.3							
10	4.5	0.8							
11	4.2	0.8							
		1					[		
							<b>•</b>		
			1			<u> </u>		l	

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Light Rain.

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#### MANAGEMENT HISTORY

A fishery survey of Paddle Lake was carried out in 1965 by the Alaska Department of Fish and Game (Watsjold and Olson 1965). They netted rainbow trout, Arctic char, longnose sucker, and one coho salmon (a species we did not find) for respective catch per hour figures of 0.27, 0.42, 0.04, and 0.01. The Fish and Wildlife Service completed three limited sport angler checks in 1965 finding hook and line rainbow catch rates between 0.19 and 11.2 fish per hour. No other specific fishery management measures are known to have been implemented on the lake.

#### WILDLIFE

A relatively large number of wildlife species were found on Paddle Lake. Raptors included a bald eagle searching for food and a great horned owl. Two pair of loons, one pair with two chicks, plus Arctic terns were seen on the lake. Twelve species of passerine birds were identified. A beaver lodge, that appeared inactive, was located in the northeast end of the lake. Although no beaver were seen, a few fresh cuttings indicated that beaver were using the lake. Three other mammals were identified. All wildlife species recorded are listed in Table 8.

#### RECREATIONAL USE

Paddle Lake is one of the refuge launching sites for the Swanson River Canoe Route which has been designated as part of the National Recreation Trail System. The area is heavily used during the summer with over 3,500 canoe trips being made yearly. We believe this creates rather heavy, but short term fishing use of the lake. Other uses include wildlife viewing, small and large game hunting, and camping. The parking lot and adjacent areas contain a bulletin board and canoe sign out station, several picnic tables, and fire pits. The canoe trail and surrounding area show heavy wear. Trees are damaged, picnic tables and signs abused, and brush has been cleared by visitors for additional camping area.

#### FISHERY RESOURCE SUMMARY

Our investigation indicated that rainbow trout was the dominant game fish in the lake. Its abundance was moderately high at a CPUE of 0.50 fish per net hour. Ayerage growth rate for rainbow trout was 2.2 inches per year. Low numbers of Dolly Varden/Arctic char (CPUE 0.03) and longnose sucker (CPUE 0.10) also populated the lake. Threespine stickleback were moderate in abundance (CPUE 0.96) and a few coastrange sculpin were captured. Paddle Lake was slightly above average in fertility. Other water quality parameters were generally within satisfactory limits for fish. The lake is believed to receive rather heavy, short term fishing pressure as a result of being part of the canoe system. Table 8.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

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Study	/ Remot	e & Roadside	Lake	Study,	Kenai Nŀ	VR, 1983	3-84		
Water	Body Pa	ddle Lake	Sur	vey Dat	ce/Time	6-28-8	33		
lako	location	(latitude) N	60° 4	6'10"	(Longi	tude) W	150°	31	40"
Code	Number	Survey	Crew	Fried	ersdorf	f, Jakut	bas		
obuc	nuniber								

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Common Loon	6 J+	2-2-2 F	Pair/Brood	Sight	Water
Terns	Arctic Tern	1	0-0-1	Single	Sight	-
Passerine	Swanson's Thrush Gray-cheeked Thru Rusty Blackbird White-crowned Sparr Black-capped Chicka Yellow-rumped Warbl Slate-sided Junco Song Sparrow Northern Waterthrus Tree Swallow American Robin	sh – Maný ow – dee – er – h – h –		-	Sound Sound Sound Sound Sound Sound Sound Sight Sound Sound Sound	
Raptors	Bald Eagle Great Horned Owl	] ]	0-0-1 0-0-1	Single Single	Sight Sound	Flight MB
Mammals Big Game	Moose	]	-	Single	Sight	· -
Furbeare	rs Beaver Muskrat	-	0-0-1	- Single	Cuttings Mussel Shells	-
Others	Snowshoe Hare	1	0-0-1	Single	Sight	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch Remarks: Fresh beaver cuttings seen, but lodge appears to be inactive. A 1965 Alaska Department of Fish and Game (ADF&G) survey found one coho salmon. It was either illegally stocked or raises the possibility of an unmapped seasonal water route to the Swanson River. Their finding of a relatively high CPUE for Dolly Varden/Arctic char indicates a population shift from char to a higher proportion of rainbow trout has taken place since the original ADF&G survey. Paddle Lake is believed to have the potential to support a moderately high yield rainbow trout and low yield char sport fishery.

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RAINBOW LAKE

#### INTRODUCTION

Fishery surveys on Rainbow Lake, which served as a control lake, were conducted three times during the year on June 1-2, August 4-5, and September 28-29, 1983. Additional water quality data were gathered on July 12, 1983. Table 1 summarizes Rainbow Lake survey findings.

#### PHYSICAL FEATURES

Rainbow Lake is located in the northcentral section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 43' and longitude 150° 48'. The lake's drainage basin of around 510 acres is part of the larger Swanson River Drainage. Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983) classifies the lake in the Intensive Land Management Category. The lake has a surface area of 150 acres, a volume of 1,095 acre feet, and is at an elevation of 208 feet. The lake is relatively shallow with a mean depth of 7.3 feet and maximum depth of 17 feet. (Table 1 and Figure 1).

Lake topography consists of gently rolling hills covered by a mature paper birch-white spruce mixed forest. Alder and sweet gale occur along much of the shoreline. An emergent bog is on the south end of the lake and a scrub-shrub bog on the north end. Swanson River Road runs adjacent to the west side of the lake.

Lake water level is maintained by streams, runoff, springs, and bog seepage. A small seasonal inlet stream enters the lake on the southwest shore. Although it contained water, no flow was occurring. An outlet stream, on the west side of the lake, passes under the Swanson River Road through a steel culvert. According to U.S. Geological Survey Map Kenai C-3, the stream flows about two miles to the Swanson River. Near the lake, the outlet stream varies between six and 12 feet in width and a few inches to two feet in depth. Aquatic vegetation was abundant in the stream with organic debris and silt covering much of the bottom; small patches of gravel were associated with turbulent currents. Flow was estimated at 1.5 cubic feet per second (cfs) during June. The bottom of the road culvert appeared to be in line with the stream substrate and did not dam water. Stream habitat appeared to be poor for rainbow trout spawning in the immediate vicinity of the lake. Large expanses of gravel were present in shoal areas of the lake.

Swanson River Road provides direct automobile access to the lake. Recreational facilities include multiple camping sites, parking areas, a water well, outhouse, and a boat ramp.

#### FISH

Rainbow trout are the only game fish species in Rainbow Lake. Gill net catch per unit of efforts (CPUE) for rainbow trout during the three fish surveys

Table l.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Wat	er Body Rainbow Lake Survey Date(s)9/28_29/83
].	Location: Refuge Kenai NWR T <u>7N</u> R <u>9W</u> S 2 Latitude N 60° 43' 15" Longitude <u>W 150° 48' 20</u> " Map. Ref. <u>Kenai C-3</u>
2.	Physical Data:Surface Area150 Ac.Max. Depth17 Ft.Mean Depth7.3 Et.Volume1,095 Ac. Ft.Water ColorYellow GreenWater Trans7.5 Ft.Drainage Area510 Ac.Inlets (cfs)There is one small, seasonallyintermittent stream located on the southwest shore.It had no water flow at thetime of the survey.Outlets (cfs)There is one stream on the west side of the lake flowing about twomiles to Swanson River.Its flow was about 1.5 cfs during June.
	Spawning Habitat _ The outlet stream is a low quality rainbow trout spawning habitat.
	Access Automobile via Swanson River Road.
3.	Water Quality: D.O. 9.5-9.7 mg/l       Temp. 17.0-16.5°C       Cond. 35 umhos @ 25°(         pH 7.3       Alk. 15 mg/l       Hard. 13 mg/l       Phos. 10.4 ug/l         Kjeldahl N 0.42 mg/l       MEI 16.0       SDF 1.55       Pollution       None
4.	Fish Species: (Abundance, H/M/L, Introduced) Rainbow trout (M), threespine stickleback (M-H), slimy sculpin, coastrange sculpin. Total Species 4
5.	Management History: ADF&G surveyed the lake in 1960 finding a low abundance of rainbow trout. An FWS survey in 1974 also found low trout abundance. The lake may have at one time supported sockeye salmon spawning.
6.	Current Fishery Status: <u>Rainbow trout are the only game fish in the lake with gill</u> net CPUE's ranging from 0.30-0.42 fish per net hour. The lake also contains a moderate to high abundance of threespine stickleback and low number of slimy and coastrange sculpin. Water quality conditions were within fish tolerance limits.
7:	Vegetation : Aquatic       Pondweed (1 Sp.), water lily (2 Sp.), horsetail (1 Sp.),         bur reed (1 Sp.), gentain (1 Sp.).       Coverage % 21         Terrestrial       Predominately mature paper birch-white spruce mixed forest. Alder and sweet gale are along much of the shoreline.
8.	Wildlife: <u>Waterfowl (2 Sp.), shorebirds (2 Sp.), gulls/terns (2 Sp.), raptor (1 Sp.), passerine (5 Sp.), mammals (2 Sp.).</u> Wildlife of note included osprey, Arctic tern, and common loon.
9.	Recreation: <u>Camping, fishing, wildlife viewing and hunting</u> .
	Facilities <u>Multiple campsites, water well, boat ramp, picnic tables, grills</u> and outhouse.

Survey Crew: Friedersdorff and Jakubas



were 0.30 in June, 0.42 in August, and 0.34 fish per net hour in September. These abundance levels should provide moderate angling success. Minnow traps captured juvenile rainbow trout, slimy and coastrange sculpin and a moderate to high abundance of threespine stickleback. Tables 2, 3, and 4). The presence of juvenile trout indicated successful spawning is taking place and younger year classes are recruiting to the fishery. During each fishery survey, six gill nets and 14 minnow traps were employed to determine fish abundance.

Rainbow trout captured in gill nets and minnow traps ranged in size from 3.5 inches (89mm) to 17.3 inches (440mm). Their weight ranged from 0.02 pounds (8.8 g) to 2.4 pounds (1,100 g). Condition factors varied from 0.66 to 1.98 with a mean of 1.38. Rainbow Lake trout had an average annual growth rate of 2.9 inches (74mm). Their ages ranged from one to six years showing a good age structure and implying successful spawning is occurring every year. Table 5 gives a breakdown of rainbow trout weight and condition by fork length class. Table 6 shows age-growth of rainbow trout back calculated from 29 scale samples.

#### AQUATIC VEGETATION

Aquatic vegetation was moderate and largely confined to shallow areas near the lake shore. Dominant plant families included pondweed, water lily, horsetail, and bur reed. Aquatic vegetation covered approximately 21 percent of the lake. A complete list of species is in Table 7 with plant locations in Figure 1.

#### WATER QUALITY

The principal water quality survey of Rainbow Lake was accomplished in July. Dissolved oxygen (Do) profiles were taken during other surveys. Rainbow Lake water quality parameters were within acceptable fish tolerance limits. Water fertility was rated low based on a classification of Minnesota Lakes using alkalinity leyel as an indicator (MacKenthun and Ingram 1967). The lake's alkalinity of 15 mg/l was below the average of the 18 lakes surveyed in 1983. Specific conductance, corrected to 25°C, was 35 umhos/cm. Water pH was near neutral. Total phosphorus was 10.4 ug/l and Kjeldahl nitrogen was 0.42 mg/l. Water color was yellow green with a Secchi disc transparency of 7.5 feet.

No thermal stratification of the lake occurred during our surveys (Tables 8, 9, 10, and 11). Dissolved oxygen levels in the lake were near normal atmospheric saturation except during the June survey when the lower six feet of the lake had Do concentrations of 4.5 mg/l (45 percent of normal saturation). The lake had a Morphoedaphic Index of 16.0 and Shoreline Development Factor of 1.55.

#### MANAGEMENT HISTORY

The first survey of Rainbow Lake was conducted in 1960 by the Alaska Department of Fish and Game (Kubik and Reynolds 1960). Rainbow trout was the only game fish and yielded a gill net abundance of 0.2 fish per hour. They further reported sockeye salmon had formerly spawned in the lake, but did not document their source of information. Two creel censuses by the State in 1964 Table 2.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

	Water Body _	Rainbow Lake	Code No	Survey Date	6/1-2/83
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	Average						Fi	sh CPUE	•
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
6 Gill Nets	26	960 960 960 960 960 960	1.0 2.0 2.5 3.0 4.0	Rainbow Trout Rainbow Trout Rainbow Trout	0 30 12 5 0	- 8-11-11 1-6-7 0-3-2 -	0.00 1.20 0.48 0.20 0.00	N/A N/A N/A N/A N/A	N/A N/A N/A N/A
Total Fish	26	4800	. A11	All Species	47	9-20-18	0.38	0.30	N/A
14 Minnow Trap	s 23	N/A	N/A	Threespine Stickleback Rainbow Trout	829 9	0-0-829 0-0-9	N/A N/A	N/A N/A	2.57
Total Fish	23	N/A	N/A	All Species	838	0-0-838	N/A	N/A	2.60

Table 3.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

	. Wate	r Body <u>Rai</u>	nbow Lake	eCode No	Survey Date	8/4-5/83		•	
Gear	Average Fishing Time	Amount Gear	Mesh Size	Fish Species	Total Fish	Sex	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour
6 Gill Nets	(hrs.) 25	(Sq.Ft.) 960 960 960 960	(In.) 1.0 2.0 2.5 3.0	Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	Number 4 27 20 11	M-F-U 0-0-4 11-9-7 10-9-1 7-2-2	0.17 1.13 0.83 0.46	N/A N/A N/A N/A	N/A N/A N/A N/A
Total Fish	25	4800		All Species	63	29-20-14	0.53	0.42	N/A
14 Minnow Trap	s 26	N/A	N/A	Threespine Stickleback Rainbow Trout Sculpin Sp.	372 5 1	0-0-372 0-0-5 0-0-1	N/A N/A N/A	N/A N/A N/A	1.02 0.01 ∠0.01
Total Fish	26	N/A	N/A	All Species	. 378	0-0-378	N/A	N/A	1.04

Table 4.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

	•	. Wate	er Body <u>F</u>	<u>lainbow Lake</u>	Code NoS	Survey Date	9/28-29	/83		
		Average					· · · · · · · · · · · · · · · · · · ·	Fi	sh CPUE	
G	ear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
6	Gill Nets	24	960 960 960 960 960	1.0 2.0 2.5 3.0 4.0	Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	0 21 14 11 3	- 7-1-13 4-2-8 1-6-4 2-0-1	0.00 0.91 0.61 0.48 0.13	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
י. ר	otal Fish	24	4800	A11	All Species	49	14-9-26	0.43	0.34	N/A
11 1 1 1 7Ω	4 Minnow Traps	5 23	N/A	·N/A	Threespine Sticklebac Slimy Sculpin Coastrange Sculpin Rainbow Trout	ck 1079 1 1 2	0-0-1079 0-0-1 0-0-1 0-0-2	P N/A N/A N/A N/A	N/A N/A N/A N/A	3.35 0.01 0.01 0.01 0.01
.]	otal Fish	23	N/A	N/A	All Species	1083	0-0-1083	N/A	N/A	3.36

## Table 5.

## FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Rainbow Lake - 8/4-5/83

Gear	Species	Mesh Size (in)	Sample No.		Length Mean (mm)	Length SD*· (mm)	Length Range (mm)
C Cill Nota	Dainhau Thout	1 0	<u></u> э	<u> </u>	157	36	125 105
b GIII Nets	Rainbow Trout	2.0	25		297	54	210 - 375
		2.5	20	****	340	53	225 - 440
		3.0	10		367	32	320 - 410
14 Minnow Tra	(pS	0.125	5		103	9.2	89 - 112

## FISH LENGTH BY MESH SIZE

## FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets 14 Minnow Tra	Rainbow Trout aps	$51 - 100 \\ 101 - 150 \\ 201 - 250 \\ 251 - 300 \\ 301 - 350 \\ 351 - 400 \\ 401 - 450 \\ \end{cases}$	2 4 6 11 12 16 5	11.1 20.8 166 316 467 717 975	3.2 7.1 57 79 77 82 117	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

## FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
6 Gill Nets 14 Minnow Tra	Rainbow Trout aps	51 - 100 101 - 150 201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	2 4 6 11 12 16 5	1.29 1.26 1.35 1.41 1.38 1.43 1.43 1.31	0.06 0.10 0.21 0.20 0.12 0.11 0.06	1.25 - 1.33 0.89 - 1.64 0.66 - 1.98 1.11 - 1.75 1.23 - 1.53 1.26 - 1.66 1.25 - 1.38
Totals		A11	56	1.38	0.20	0.66 - 1.98

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\*Standard Deviation

# AGE-GRANTH OF RAIMBOWTICH

RAINBOW LANCE 1933

BACK-GALCULATED FORK-LENGTHS-(MILLIMETERS) AT ANNULAS FORMATION\*

	Number					Age	e of	Fish	·					
Year Class	of Fish	1	2	3	4	5	6	7	8	9	10	11	12	Capture FL
1982 1981 1980 1979 7978 1978 1977 1976 1974 1973	- 4 - 4 - 4 - 5 - 7 - 2	24 37 61 36 31 37 37 35 37	90 122 78 88 71 76 63 65 63	178 138 136 112 135 113 110 110	204 189 160 170 152 163 157	245 205 205	202 (28) (28) (29) (29) (29) (29) (29) (29) (29) (29	2 44   2 44   2 4 2   2 4 2   2 4 2   2 4 2	244 244 244	+10 HID	451	· · ·		89 114 150 24-+ 276 230 344 344 344 344 344 344 344 344 344 3
Number of Fis	h 25	25	34	ĊĊ	) i	5	i l	: <u>)</u>	5	3	2			
Grand Mean (1	mm )	40	81	130	185		1	1 390	5(4	1 +11	4-51			
Grand <u>Mean (</u>	in)	1.6	3,2	5.1	7.1	9.0		<u>) 12</u>	<u>.) iq.</u>	S. Val.	111	\$		
Annual Increm	Growth ent (in)													

(ne growthe 1,795 10/4/

\*Not corrected for length at scale formation

Table 6.

Table 7.

## RAINBOW LAKE ASSOCIATED VEGETATION

## AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent Emergent Emergent Emergent	BB CR HTF MFF	buckbean - horsetail marsh fivefinger	<u>Menyanthes trifoliata</u> <u>Carex rostrata</u> Equisetum fluviatile Potentilla palustris
Floating Floating Floating	BR DWL YPL	bur reed dwarf water lily yellow pond lily	Sparganium angustilfolium Nymphaea tetragona Nuphar polysepalum
Submergent	PG	pondweed	Potamogeton gramineus

## WETLANDS VEGETATION

с. ,

Class	Symbol	Vegetation Reference				
Emergent	5EM5B	National Wetlands Inventory (Kenai)				
Scrub-shrub	PSS4/1B	National Wetlands Inventory (Kenai)				

## TERRESTRIAL VEGETATION

Class	Şymbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	MB	mature paper birch	Betula papyrifera
Trees	IB	immature paper birch	Betula papyrifera
Trees	MS	mature white spruce	Picea glauca
Shrubs	A	alder	<u>Alnus sp.</u>
Shrubs	SG	sweet gale	Myrica gale
Below Shrub	CG	cotton grass	<u>Eriuphorum sp.</u>
Below Shrub	Cunid	sedge	<u>Carex sp.</u>
Below Shrub	G	grass	Gramineae

Table 8.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyRainbow LakeSurvey Date/Time 6-2-83/0915Lake Location (Latitude)N 60° 43' 15"(Longitude)Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)10Wind (mph)15Air Temp (°C)11.0Chop (in)2.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0 .	13.0	13.4	7.1	30			XIV_	2.3	
1	13.0	10.2		30					
2	12.9	7.2	•	31					
3	12.8	6.2		31					
4	12.8	5.4		31					
5	12.4	4.9		31					
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Remarks: Equipment Used: D.O. & Temp. - YSI 54A Meter; Conductivity- YSI SCT 33 Meter; pH - Hach 17F; Water Color - Forel-Ule Scale; Water Transparency -20 cm Secchi Disc. Table 9.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyRainbow LakeSurvey Date/Time12-83/1500Lake Location (Latitude)N 60° 43' 15"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)1-5Air Temp (°C)15.0Chop (in)1.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Colør	Water Trans. (m)	Total Phosphate (ug/l)
0	17.0	9.5	7.3	30*			XV	2.5	10.4
1	16.9	.9.7							
2	16.9	9.7					•		
3	16.9	9.7	7.2	34	15	13			
4	16.8	9.7							
5	16.5	9.7							
			, ,						
							[		
*Co	nductiv	ity ac	juste	d to 25°C	is 35 umhos	•			
			1						
	· · · ·		1			}			
			+						
			1.				•		

Remarks: Equipment Used: D.O. & Temp. - YSI 57 Meter; Conductivity - YSI SCT-33
Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale,
Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT;
Hardness - Hach HA-DT.

Table 10.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyRainbow LakeSurvey Date/TimeBodyRainbow LakeSurvey Date/TimeLake Location (Latitude)N 60° 43' 15"(Longitude)W 150° 48' 20"Code No.Survey CrewCode No.Survey CrewFriedersdorff, JakubasCloud Cover (%) 100Wind (mph) 5-15Air Temp (°C) 14.5Chop (in)6.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Colør	Water Trans. (m)	Total Phosphate (ug/l)
0	19.5	10.0						2.3	
1	19.5	9.8							
2	19.4	9.6							
3	19.2	9.6							
4	18.5	9.5							
4.5	18.2	8.0							
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Remarks: Equipment Used: D.O. & Temp. - YSI 57 Meter; Water Transparency 20 cm Secchi disc. Table 11.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyRainbow LakeSurvey Date/Time9-28-83/1300Lake Location (Latitude)N 60° 43' 15"(Longitude)Worker No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)5-10Air Temp (°C)4.0Chop (in)6.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Colør	Water Trans. (m)	Total Phosphate (üg/l)
0	5.2	12.8						3.0	
1	5.2	12.6							
2	5.2	12.6							
3	5.2	12:5	,						
4	5.2	12.4							
5	5.2	11.1							
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		1							
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		1							
			11						
			1						
	  -		1						
		1							

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency 20 cm Secchi Disc., Light Rain. found catch rates of trout to be between 0.4 and 0.8 fish per hour. In 1972, Curtis and Havens sampled the lake capturing four rainbow trout in three gill nets fished overnight for a CPUE of 0.06 fish per hour. An under ice oxygen profile on April 26, 1979, found Do levels ranging from 11.0 mg/l at the surface to 4.5 mg/l near the bottom. In 1974 the Fish and Wildlife Service accomplished a fishery survey of the lake capturing only one rainbow trout for a CPUE of 0.02 fish per net hour. No stocking, chemical treatment, or other management measures are known to have been implemented on the lake.

#### WILDLIFE

During the survey period June to September, the lake harbored a variety of wildlife. A pair of osprey were seen feeding on the lake and appeared to be nesting nearby. Common loons, gulls, green-winged teal, and Arctic tern, in addition to five species of passerines, were seen or heard. Muskrat were seen and moose sign was evident. All wildlife species recorded along with other pertinent data are in Table 12.

#### RECREATIONAL USE

Recreational uses of Rainbow Lake include camping, wildlife viewing, fishing and hunting. Relatively heavy camping occurs during the summer, especially on weekends and holidays. We observed one or more campers each time we visited the lake. Campers repeatedly questioned us about what fish were in the lake and how to fish for them. The only successful angler we met fished from a boat. No accurate data are available on yearly fishing pressure.

Human impact around the camp area was evident. Brush had been cleared and many trees cut for firewood. The campground is highly desirable because of its location, the facilities provided, and the attractive view of the lake.

#### FISHERY RESOURCES SUMMARY

Our three fishery surveys indicated that rainbow trout was the only game fish inhabiting the lake. Trout abundance was moderate ranging between a CPUE of 0.30 and 0.42 fish per net hour. Average growth rate of rainbow trout was 2.9 inches per year. Threespine stickleback were moderate to high in abundance, and coastrange and slimy sculpin were also captured. Rainbow Lake is low in fertility. Other water quality parameters appeared to be within satisfactory tolerance limits for fish, including winter dissolved oxygen concentrations.

Previous surveys by the Alaska Department of Fish and Game and the Fish and Wildlife Service found much lower abundances of rainbow trout. At some time in the past, the lake may have supported a spawning population of sockeye salmon. Evidently, in recent years, the outlet stream to Swanson River has not been used by anadromous fish. The lake is believed to receive only light to moderate fishing pressure at the current time. Rainbow Lake is considered to have the potential to support a moderate yield rainbow trout sport fishery. Table 12.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyRainbow LakeSurvey Date/Time 6/1-2/83, 8/4-5/83, 9/28-29/83Lake Location (Latitude)N60° 43' 15"(Longitude) W 150° 48' 20"Code NumberSurvey CrewFriedersdorff, Jakubas

An C1	imal ass	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds	Waterfowl	Green-winged Teal Common Loon	] 3 J+	0-0-1 1-1-1	Single Pair/Brood	Sight Sight	Flight Water
	Shorebirds	Lesser Yellowlegs Sandpiper Unid.	, ] 3 ]+	1-1-1 0-0-1	Pair/Brood Single	Sight Sight	Sedge Sedge
	Gulls/Terns	Arctic Tern Gull Unid.	. 1 3	0-0-1 0-0-3	Single Single	Sight Sight	Flight Flight/Water
	Passerines	Yellow-rumped Warble White-crowned Sparro Swanson's Thrush Ruby-crowned Kingle Slate∺sided Junco	er Many bw Many Many t Many Many	-		Sound Sound Sound Sound Sound	MS,MB MS,MB MS,MB MS,MB MS,MB
	Raptors	Osprey	2	1-1-0	Pair	Sight	Flight,MS,ME
Mamm	als Big Game	Moose	-	-	-	Cutting	s –
	Furbearers	Muskrat	-	-	-	Sight	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; MS=Mature Spruce Remarks:

#### SILVER LAKE

#### INTRODUCTION

A fishery survey of Silver Lake was conducted on August 30-31, 1983. Additional water quality data were gathered on July 21, 1983. Survey findings for Silver Lake are summarized in Table 1.

#### PHYSICAL FEATURES

Silver Lake is a tributary of the Kenai River via the West Fork of the Moose River. The lake is located at latitude 60° 30' and longitude 150° 47'. The lake and surrounding area were classified in the Traditional Management Use Category under Alternative "C" of the draft Kenai National Wildlife Refuge (NWR) Comprehensive Conservation Plan (USFWS 1983). Silver Lake has a surface area of 132 acres, a volume of 1,660 acre feet and is at an elevation of 230 feet. The mean depth is 12.6 feet and the maximum depth is 34 feet (Table 1 and Figure 1). We were unable to survey the bay on the northeastern end of the lake. A previous survey indicated this bay was shallow with only a small area greater than 10 feet deep. The lake's mean depth would probably decrease to 10 or 11 feet if sounding data for this bay had been included in our calculations.

The watershed includes approximately 3,400 acres of bogs, ponds, lakes, and low hills reaching an elevation of 517 feet. Mosquito Lake and 21 other unnamed ponds and lakes lie within the Silver Lake watershed. The major terrestrial habitat types consist of a mature black spruce forest adjacent to the lake and mature white spruce-birch mix on drier upland areas.

Lake water level is maintained by two small inlet streams which flow into the west and southwest end of Silver Lake. One of the streams drains an unnamed lake to the west and had a small flow estimated at less than 0.25 cubic feet per second at the time of survey. The other stream drains Mosquito Lake and had no perceptable flow. A small outlet stream is at the northeast end of the lake and flows to Camp Island Lake, the West Fork Moose River, and the Kenai River. The outlet tributary is, at some point downstream, believed to provide trout spawning habitat for the lake's rainbow trout population. Rocky substrate shoal areas around the northeastern bay may provide char spawning habitat.

Access to Silver Lake is by a one-mile foot trail from mile 7.7 of the Swanson River Road. The lake has no public use facilities.

#### FISH

Fish captured in the lake included rainbow trout, coho salmon, threespine stickleback, and slimy sculpin. Rainbow trout taken in gill nets had a moderate catch per unit of effort (CPUE) of 0.26 while coho salmon had a

Table l.

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# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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11-1-	Survey Date(s) 8/30-31/83
Wate	Location: Refuge <u>Kenai NWR</u> <u>T 6N R 9W S 2</u> Map. Ref. Kenai C-3
2.	LatitudeN 60° 30' 45"LongitudeW 150 47 40Hup: HerePhysical Data:Surface Area 132 Ac.Max. Depth 34 Ft.Mean Depth 12.6 Ft.Volume1,660 Ac. Ft.Water ColorDark yellow greenWater Trans 11 Ft.Drainage Area3,400 Ac.Inlets (cfs)One inlet on the west end of thelake, draining an unnamed lake, had a flow of 0.25 cfs.The second inlet drainingMosquitoLake had no perceptable flow.Outlets (cfs)The outlet stream flows to Camp Island Lake and then into the Mooseand Kenai Rivers.
	Spawning Habitat No stream spawning habitat was observed. The outlet stream, at some point, is believed to provide rainbow trout spawning habitat. Access A 1 mile hike from Swanson River Road, airplane.
3.	Water Quality:       D.O.       10.0-0.6 mg/l       Temp.       19.0-7.0°C       Cond.       70 umhos @ 25°         pH       7.3       Alk.       29 mg/l       Hard.       30 mg/l       Phos.       8.1 ug/l         Kjeldahl N       0.26 mg/l       MEI       18.2       SDF       1.78       Pollution       None
4.	Fish Species: (Abundance, H/M/L, Introduced) <u>Rainbow trout (M), coho salmon (L),</u> threespine stickleback (M), slimy sculpin Total Species_4
5.	Management History: The lake was surveyed by the ADF&G in 1965. They captured 34 rainbow trout, 6 coho salmon, and one Dolly Varden/Arctic char in three overnight gill net sets. In 1975 the FWS gill netted the lake taking rainbow trout at a CPUE of 0.12 and coho salmon at CPUE 0.16 fish per net hour. No management measures are known to have been implemented on the lake.
6.	Current Fishery Status: We found this lake to support a moderate population of rainbow trout (CPUE 0.26). Several trout age classes were present indicating recruitment is occurring. The lake serves as a nursery area for juvenile coho salmon. Water fertility was low to moderate with other water quality parameters within acceptable fish tolerance limits.
7.	Vegetation : Aquatic <u>Water lily (2 Sp.), pond weed (3 Sp.)</u> .
	Coverage % 26 Terrestrial The surrounding habitat is primarily mature black spruce forest with several major lowland bogs. The bogs were classified as scrub-shrub to emergent wetlands.
8.	Wildlife: Mammals (2 Sp.), waterfowl.
9.	Recreation:Walk-in fishing, wildlife viewing, hunting.
	Facilities <u>None</u>
	Survey Crew: Friedersdorff, Dean

Survey Crew:

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CPUE of 0.02 fish per net hour (Table 2). All the coho salmon were juveniles. Minnow trap catches were dominated by threespine stickleback at a moderately high CPUE of 2.45 fish per trap hour. Other minnow trapped species included coho salmon, rainbow trout, and slimy sculpin. A total of six gill nets and 14 minnow traps were used to measure fish abundance. Seining was accomplished to capture additional fish.

Rainbow trout taken in gill nets and minnow traps ranged in fork length from 4.3 inches (109mm) to 17.9 inches (455mm). Their weight ranged from 0.03 pounds (14.3 g) to 2.9 pounds (1295 g). Condition Factors (K) ranged from 1.08 to 1.68 with a mean of 1.33. Ages of rainbow trout varied from two to seven years. Growth rates of the rainbow trout back calculated from 28 scale samples, indicated trout had a mean growth rate of 2.3 inches per year.

Coho salmon captured in gill nets and minnow traps had fork lengths from 3.2 inches (82mm) to 5.1 inches (130mm) with weights varying from <0.01 pounds (7.7 g) to 0.07 pounds (32.5 g). The coho salmon were one and two years old. Table 3 gives a summary of fish weights and condition factors by fork length class, and Table 4 shows age-growth data of rainbow trout.

#### AQUATIC VEGETATION

Aquatic plants were abundant in the shallow northwestern bay of the lake and only moderately abundant elsewhere. Yellow pond lily and the pondweed <u>Potamogeton natans</u> were the dominant aquatic plants. Other aquatic plant families present included bur reed, horsetail, water milfoil, and sedges. Approximately 26 percent of the lake was covered with aquatic vegetation. A list of plant species identified at the lake is in Table 5. Locations of aquatic plants are in Figure 1.

#### WATER QUALITY

Water fertility of Silver Lake is rated low to medium using a classification of Minnesota Lakes (MacKenthun and Ingram 1967) based on alkalinity level. The lake was low in alkalinity and also lower in conductivity than the mean of 17 other lakes surveyed in 1983. Specific conductance, corrected to 25°C, was 70 umhos. The pH was slightly alkaline with a value of 7.3. Dissolved oxygen concentrations varied from 10.0 mg/l at the surface to 0.6 mg/l at the bottom. Oxygen concentrations were adequate for fish to a depth of approximately 20 feet and stressful to lethal below that depth. Water color was dark yellow green with a water transparency of 11 feet. The lake had a Morphoedaphic Index of 18.2 and Shoreline Development Factor of 1.78 (Appendices A and B). Specific water quality data are in Tables 1, 6, and 7.

#### MANAGEMENT HISTORY

Silver Lake was first surveyed by the Alaska Department of Fish and Game in 1965. They captured 34 rainbow trout, six coho salmon, and one Dolly Varden/Arctic char in three overnight gill net sets. A second survey by Table 2.

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# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

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	•	'		
Wator Rody	Silvor Lako	Code No	Survey Date	8/30-31/83
nacei bouy	JIIVEL LAKE		Jurycy Ducc	0/00 01/00

· · · · · · · · · · · · · · · · · · ·	Average					· · · · · · ·	Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear - (Sg.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
6 Gill Nets	24	960 960 960 960 960 960	1.0 2.0 2.5 3.0 4.0	Coho Salmon Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	3 14 7 15 1	0-0-3 7-6-1 3-3-1 2-9-4 0-0-1	0.13 0.61 0.30 0.65 0.04	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
By Species	24	4800	A11 A11	Rainbow Trout Coho Salmon	37	12-18-7 0-0-3	0.32	0.26 0.02	N/A N/A
	24	4800	A11	All Species ,	40	12-18-10	0.35	0.28	N/A
14 Minnow`Traps	23	N/A	N/A	Coho Salmon Threespine Stickleback Slimy Sculpin Rainbow Trout	8 788 1 3	0-0-8 0-0-788 0-0-1 0-0-3	N/A N/A N/A N/A	N/A N/A N/A N/A	0.03 2.45 ≺0.01 0.01
Total Fish	23	N/A	N/A	All Species	800	0-0-800	N/A	N/A	248
Seine		N/A	N/A	Threespine Stickleback Coho Salmon Rainbow Trout Slimy Sculpin	270 2 1 16	0-0-270 0-0-2 0-0-1 0-0-16	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A
Total Fish		N/A	N/A	All Species	289	0-0-289	N/A	N/A	N/A

# Table 3. FISH LENGTH, WEIGHT, AND CONDITION SUMMARY SILVER LAKE - 1983

Gear	Species	Mesh Size	Sample No.	Length Mean (mm)	Length SD* (mm)	Length Range (mm)
6 Gill Nets & 14 Minnow Traps	Rainbow Trout Coho Salmon	2.0 2.5 3.0 0.125 1.0 0.125	13 6 12 2 3 10	304 368 380 112 115 101	79 72 55 3.5 13 16	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

## FISH LENGTH BY MESH SIZE

## FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets	Rainbow	101-150	2	16	2.3	14.3-17.6
& 14 Mjnnow Trans	Irout	201-250	5 6	271	41 15	125-230
i i upo		301-350	5	444	27	405-475
		351-400	5	766	121	630-960
		401-450	9	950	131	805-1165
	7	451-500	2	1,230	92	1165-1295
	Coho Salm	10n 51-100	5	9	1.4	7.7-10.6
	•	101-150	8	22	6.0	13.6-32.5

## FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
6 Gill Net: & 14 Minnov Traps	s Rainbow x Trout , Coho Salmon	101-150 201-250 251-300 301-350 351-400 401-450 451-500 51-100 101-150	25659258	1.15 1.42 1.32 1.31 1.39 1.29 1.31 1.33 1.39	0.06 0.14 0.11 0.09 0.17 0.16 0.09 0.06 0.11	1.10-1.19 1.26-1.62 1.12-1.45 1.20-1.44 1.25-1.68 1.08-1.52 1.24-1.37 1.27-1.40 1.22-1.56
Totals	Rainbow Trou Coho Salmon	t A11 A11	34 13	1.33 1.37	0.14 0.09	1.08-1.68 1.22-1.56

\*Standard Deviation

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Table 4.

## AGE-GROWTH\* OF RAINBOW TROUT SILVER LAKE - 1983

Year Class	No.	Fork L I	ength (FL) II.	) <u>In M</u> III	illimeter IV	rs at Ai V	nnulus I VI	Formation VII	Capture FL
				· · · · ·					
1982	2	51				. 4			107
1981	]	65	150						215
1980	5	58	123	195					273
1979	5	46	99	170	234				311
1978	5	. 37	83	150	224	304			. 374
1977	8	40	80	139	203	269	337		410
1976	2	36 ,	72	133	200	273	323	390	455
Total	1 No.	28	26	25	15	10	2	1	
Av. F	FL (mm	) 45	95	158	216	281	334	390	
Av. B	FL (in	) 1.8	3.7	6.2	8.5	11.0	13.1	15.4	

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\*Not corrected for length at scale formation

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Table 5.

## • SILVER LAKE ASSOCIATED VEGETATION

## AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent	Blr	bulrush	<u>Scirpus validus</u>
Emergent	HFT	horsetail	Equisetum fluviatile
Emergent	MT	mare's tail	Hippuris vulgaris
Floating	BR	bur reed	Sparganium angustilfolium
Floating	DWL	dwarf water lily	Nymphae tetragona
Floating	PN	pondweed	Potamogeton natans
Floating	YPL	yellow pond lily	Nuphar polyesepalum
Submergent	MRs	water milfoil	<u>Myriophyllum sp.</u>
Submergent	PG	pondweed	<u>Potamogeton gramienus</u>
Submergent	PL	-	<u>Potamogeton filiformis</u>
Submergent	PP,	-	<u>Potamogeton parelongus</u>

#### WETLAND VEGETATION

Class	Symbol Vegetation Reference					
Emergent	PEM5F	National Wetlands Inventory (Kenai)				
Scrub-shrub	P554/1B	National Wetlands Inventory (Kenai)				

## TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	IB	immature paper birch	Betula papyrifera
Trees	MB	mature paper birch	Betula papyrifera
Scrub-shrub	ŞG	sweet gale	Myrica gale
Below Shrub	Cunid	sedge	<u>Carex sp</u> .
Below Shrub	G	grass	Gramineae

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Table 6.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

StudyRemote and Roadside Lake Study, Kenai NWR, 1983-84Water BodySilver LakeSurvey Date/TimeTake Location (Latitude)N 60° 38' 45"(Longitude)W 150° 47' 40"Code No.Survey CrewFriedersdorff, DeanCloud Cover (%)90Wind (mph)Station1

Sample Depth (m)	Water Temp. (°C)	<sup>.</sup> D.O. (mg/1.	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans: (m)	Total Phosphate (ug/l)
0	19.0	10.0	7.3	62*	29	30	XVI	3.5	8.1
1	18.7	10.0							·
2	18.2	10.0							
3	18.0	i0.0							
4	17.5	10.0							
5	14.0	9.6	7.1	.60					•
6	10.0	6.6							
7	8.5	4.2							· .
8	8.0	3.0			 	· .			
9	7.2	1.6				]			
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*0	onducti	vity c	prrec	ted to 25°	C temperatu	e is 70 u	nhos.		
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	1	1							•
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Remarks:

Equipment used: D.O. & Temp.- YSI 57 meter; Conductivity - YSI \$CT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

StudyRemote and Roadside Lake Study, Kenai NWR, 1983-84Water BodySilver LakeSurvey Date/Time8-30-83/1430Lake Location (Latitude)N 60° 38' 45"(Longitude)W 150° 47' 40"Code No.Survey CrewFriedersdorff, DeanCloud Cover (%)90Wind (mph)15-25Air Temp (°C)12.2Chop (in)12.0

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Sample Depth . (m)	Water Temp.	D.O.	pH	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans: (m)	Total Phosphate (ug/l)
0	15.0	10.0						3.0	
1	15.0	10.0							
2	15.0	9.8	5						
3	15.0	9.7		•					·
4	15.0	9.7							
·5	14.9	9.7		· .					·
6	14.0	9.2				•			
7	10.9	4.7				<u> </u>	·		· · · · · · · · · · · · · · · · · · ·
8	8.2	0.7				· .			
9	7.0	0.5				 			
								· .	
	<u> </u>	1							
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							<u> </u>	<u> </u>	

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency 20 cm Secchi disc. Wind, water movement, and boat movement caused probe to drift.

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the Fish and Wildlife Service in 1975, using two gill nets, produced a catch of 11 rainbow trout (CPUE 0.12) and 15 coho salmon (CPUE 0.16). The rainbow trout ranged in fork length from 7.1 inches (180 mm) to 20.1 inches (525 mm) with a mean of 14.6 inches (371mm). Coho salmon had mean, minimum, and maximum fork lengths of 6.6 inches (168 mm), 5.9 inches (150 mm), and 7.1 inches (180 mm) respectively. No specific management measures are known to have been implemented on the lake.

#### WILDLIFE

Four species of aquatic birds were seen on the lake in addition to three moose. Two of the moose were bulls. Birds were not prevalent because of high winds. All wildlife species recorded along with other pertinent data are listed in Table 8.

#### RECREATIONAL USE

This lake is estimated to receive only light fishing from hikers. No anglers were observed during our survey, and there was little evidence of public use around the lake. Our survey was completed the day before the start of moose hunting season. On the flight out, we observed about 50 cars and campers directly south of the lake along Swanson River Road. It was evident the lake would receive hunting pressure.

#### FISHERY RESOURCE SUMMARY

Our fishery survey indicated the lake had a moderate population of rainbow trout (CPUE 0.28). Recruitment of younger rainbow trout age classes is occurring, but suitable spawning habitat within close distance of the lake appears to be limiting trout population levels. The lake has an anadromous outlet stream connecting to the ocean, and the lake serves as a nursery area for juvenile coho salmon. Other species present included threespine stickleback and slimy sculpin. Char were taken in the survey conducted in 1965. None were taken during this survey. Lake water fertility was low to moderate. Other water quality parameters were within acceptable fish tolerance limits. Silver Lake is considered to have the potential to support a moderate yield rainbow trout sport fishery. Table 8.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodySilver LakeSurvey Date/TimeAgencies8/30-31/83Lake Location (Latitude)N 60° 38' 45"Code NumberSurvey CrewFriedersdorff, Dean

· Animal Class	Common . Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Scoter Unid. Unid. Duck Common Loon	1 1 3	0-0-1 0-0-1 0-0-3	Single Single Single	Sight Sight Sight	Flying Flying Water
Shorebirds	Greater Yellowlegs	3	0-0-3	Single	Sight	- Marsh
Mammals Big Game	Moose	3	2-1-0	Single	Sight	-
Furbearers	Muskrat	0	-	- 1	Mussel Shel	ls -

## M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles

Remarks:

KS: One inactive beaver lodge is located in the small northern subbasin of the lake. It could not be reached for close examination. The weather was cool and extremely windy which probably reduced bird activity on and surrounding the lake.

#### SPORTFISH LAKE

#### INTRODUCTION

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A fishery survey of Sportfish Lake was conducted on August 15-16, 1983. Table 1 summarizes survey findings.

#### PHYSICAL FEATURES

Sportfish Lake is located in the northern section of the Kenai National Wildlife Refuge (NWR) in the Pincher Creek drainage, at latitude 60° 51' and longitude 150° 17'. This area has been assigned to the Minimal Land Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Plan (USFWS 1983). The lake has a surface area of 286 acres, a volume of 6,300 acre feet, and is at an elevation of 190 feet. Mean depth is 22 feet and maximum depth is 60 feet. (Table 1 and Figure 1).

The watershed is composed of gently rolling hills interspersed with lowland bogs. Approximately 1,360 acres form the lake's drainage basin. The eastern side of the lake is covered by a mature white spruce-paper birch forest which was burned by the 1915-1920 fire. Remaining portions of the lake are surrounded by a black spruce forest, with a mature white spruce-paper birch mix becoming dominant further from the lake. Several small emergent to scrub-shrub wetlands occur along the shoreline.

Water flow regimen of the lake is maintained by one small inflow stream at the northwestern end, one small outlet at the northern end, springs, and runoff. Vegetation choked the inlet stream, and no perceptable flow could be detected. The outlet stream, which connects to another nearby unnamed lake, was shallow, intermittent and blocked by an old beaver dam. Although the lake's water level was about one foot below the dam crest, a slight amount of seepage was occurring through the dam to the stream. The stream water level was too shallow to support adult trout, but it could possibly serve as marginal trout spawning habitat under higher flow conditions. Our survey revealed that an outlet stream, formerly located in the eastern part of the lake, no longer exists. Sportfish Lake previously flowed into Two Island Lake and Turnagain Arm via Pincher Creek (U.S. Geological Survey map-Kenai D-1, Alaska, 1951 Series). The lake and tributaries are now landlocked and have no access to the ocean.

Primary access to the lake is by airplane. Alaska Bush Carriers have held a Refuge Special Use Permit for the lake since 1967. They built a semipermanent tent camp for the convenience of their sport fishing clients. There are no other recreational facilities.

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## U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Wat	er Body Sportfish LakeSurvey Date(s) <u>8/15-16/83</u>
1.	Location: Refuge Kenai NWR T 9N R 6W S 23 Latitude N 60° 51' 35" Longitude W 150° 17' 00" Map. Ref. Kenai D-1
2.	Physical Data:Surface Area286 Ac.Max. Depth60 Ft.Mean Depth22 Ft.Volume6,300 Ac. FtWater ColorMedium GreenWater Trans18 Ft.Drainage Area1,360 Ac.Inlets (cfs)One small stream with neglighbleflow in the northwest part of the lake.
	Outlets (cfs)One intermittent stream is at the north end of the lake. An old beaver dam blocks flow except during high water periods.
	Spawning HabitatThe outlet stream may serve as a small, marginal trout spawning area during high flow periods
3.	Water Quality: D.O.       11.4-0.5 mg/l       Temp.       18.7-5.5°C       Cond.       105 umho @ 25°C         pH       7.0       Alk.       47 mg/l       Hard.       48 mg/l       Phos.       7.8 ug/l         Kjeldahl N       0.37 mg/l,       MEI       15.6       SDF       1.55       Pollution       None
4.	Fish Species: (Abundance, H/M/L, Introduced) <u>threespine stickleback (M), coho</u> salmon (L,I)
5.	Management History: The lake was formerly known as a rainbow trout sport fishery. This fishery was reported declining in the early 1970's. We theorize the lake's most important migratory and spawning tributary was destroyed by the 1964 earthquake, and this caused a significant decline in rainbow trout stocks.
6.	Current Fishery Status: We found no rainbow trout during our survey. Three adult coho salmon (survivors of a suspected illegal stocking) were captured. The lake appears suitable as sport fish rearing habitat, but has only one small intermittent stream that is of questionable value for trout spawning.
7.	<pre>Vegetation : Aquaticsedges (2 Sp.), water milfoil (2 Sp.), bur reed (2 Sp.),</pre>
8.	Wildlife: <u>Waterfowl (6 Sp.)</u> , raptors (1 Sp.), passerine (4 Sp.), mammals (4 Sp.)
9.	Recreation: Former fly-in tent camp fishery, wildlife viewing.
	Facilities Semi-permanent wall tent and pit toilet.

Survey Crew: Friedersdorff, Jakubas

## SPORTFISH LAKE


Fish captured included three coho salmon and numerous threespine stickleback. Gill net catch per unit of effort (CPUE) for coho was extremely low at 0.02 fish per net hour (Table 2). We believe the coho salmon are the survivors of an unauthorized stocking of juveniles since there are no streams to permit anadromous fish migration from the ocean. The low gill net catch of game fish translates into extremely low sport angling success. Minnow traps took only threespine stickleback at a moderate CPUE of 1.27 fish per trap hour. A total of eight gill nets and 19 minnow traps were used to determine fish abundance. A seine was used for additional fish sampling.

Coho salmon captured in gill nets ranged in size from 16.7 inches (425mm) to 18.5 inches (470mm) fork length (FL). Their weight ranged from 2.40 pounds (1,090g) to 3.63 pounds (1,650g). Condition factors (K) ranged from 1.24 to 1.45 with a mean of 1.34. Ages of the three coho were all four years plus summer growth. Fork lengths of stocked coho, back calculated from three scale samples, averaged 1.7 inches (42mm), 3.3 inches (84mm), 8.4 inches (213mm), 13.0 inches (331mm), respectively for the first four years of life. Growth through August of the fifth year averaged 17.5 inches (445mm). The mean coho growth rate was 3.4 inches (87mm) per year. A geometric regression depicting coho growth is shown in Figure 2.

#### AQUATIC VEGETATION -

Aquatic vegetation was moderate and concentrated in shallow areas around the western and southern periphery of the lake. Twenty-three percent of the lake was covered with vegetation. Dominant families included sedges, pondweed, and water lily. Most noteworthy was the extensive areas of bull rush along the western and southern shores. Also of interest were the large areas of <u>Potamogeton robbinsii</u> which is listed as "evidently rare" in Alaska by Welsh (1974) and Hulte'n (1974). A complete list of species can be found in Table 3. Areas of aquatic vegetation are located on Figure 1.

#### WATER QUALITY

Most water quality data were collected during July with an additional dissolved oxygen profile taken in August. All water quality parameters were within acceptable tolerance limits for fish. The lake is moderately fertile according to a classification of Minnesota lakes (MacKenthun and Ingram 1967) based on alkalinity level, and was above the average fertility level of 17 other lakes sampled in 1983. Specific conductance, corrected to 25°C, was 105 micromhos. Total alkalinity and hardness were relatively high compared to other local waters. Water pH was neutral. Total phosphorus was 7.8 ug/l and Kjeldahl nitrogen was 0.37 mg/l. No sources of water pollution were apparent. Dissolved oxygen ranged from 11.4 mg/1 at 23 feet to 0.8 mg/1 below 36 feet. Most of the lake water volume had dissolved oxygen levels ranging from slightly super saturated to around 90 percent saturation. Dissolved oxygen in the 36 to 60 foot depth stratum, the stagnant portion of the hypolimnion, was less than 5 percent of normal atmospheric saturation. Thermal stratification of the lake occurred between 26 and 30 feet. Water color was medium green with Secchi disc water transparency of 18.0 feet. The lake had a Morphoedaphic Index of 15.6 and Shoreline Development Factor of 1.55 (Appendices A and B). Specific water quality data are presented in Tables 1, 4, and 5.

#### FISH

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body <u>Sportfish Lake</u> Code	NoSurvey	Date <u>8/15-16/83</u>
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1	Average					· · · ·	Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
8 Gill Nets	24 	1280 1280 1280 1280 1280 1280	1.0 2.0 2.5 3.0 4.0	Coho Salmon - - -	3 0 0 0	2-1-0	0.00 0.10 0.00 0.00 0.00	N/A N/A N/A N/A . N/A	N/A N/A N/A N/A N/A
Total Fish	24	6400	A11	All Species	. 3	2-1-0	0.02	0.02	N/A
19 Minnow Traps	25	N/A	N/A	Threespine Stickleback	603	0-0-603	N/A	N/A	1.27
Total Fish	25	N/A	N/A	All Species	603	0-0-603	N/A	N/A	1.27
Seine	N/A	N/A	N/A	Threespine Stickleback	20	0-0-20	N/A	N/A	N/A



# Table 3.

# SPORTFISH LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent Emergent Emergent	Blr MT SR	bulrush mare's tail spike rush	<u>Scirpus</u> validus <u>Hippuris vulgaris</u> Eleocharis palustris r
Floating Floating Floating Floating	BR BRm ST YPL	bur reed bur reed arrowhead yellow pond lily	<u>Sparganium</u> angustilfolium <u>Sparganium</u> minimum <u>Sagittaria</u> cuneata <u>Nuphar polysepalum</u>
Submergent Submergent Submergent Submergent Submergent	MR PG PL PR PRID QW	water milfoil - - quillwort	Myriophyllum spicatum Potamogeton gramineus Potamogeton filiformis Potamogeton perfoliatus Potamogeton robbinsii Isoetes muricata

# WETLANDS VEGETATION

Class	Symbol .	•	Ve	getation [	Reference	
Scrub-Shrub	PSS1B	•	National	Wetlands	Inventory	(Kenai)
Emergent	PEM5		National	Wetlands	Inventory	(Kenai)

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	MB	mature paper birch	Betula papyrifera
Trees.	MS	mature white spruce	Picea glauca
Shrubs	sg	sweet gale	Myrica gale
Shrubs	A	alder	Alnus sp.
Below Shrub	G	grass	Gramineae

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Table 4.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84	
Water Body Sportfish Lake Survey Date/Time 7-20-83/1110	
Lake Location (Latitude) N 60° 51' 35" (Longitude) W 150° 17' 00"	
Code No: Survey Crew Friedersdorff, Jakubas	
Cloud Cover (%) Wind (mph) Air Temp (°C) <u>15</u> Chop (in)	
Station	

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (µg/1)
0	18.7	9.8	7.0	92*			Х	, 5.5	7.8
· ]	18.6	10.2		· ·					
2	18.5	10.2							
3	18.5	10,3							
4	18.2	10.3							
5	18.0	10.3		. ·					
6	16.0	10.8		92 · ·	47	48			·
7	13.0	11.4			· · ·				
8	11.5	11.3	-						
9	10.0	7.6							
10.	8.2	7.2		•					
il	6.8	0.8							
.12	6.0	0.6				:			
13	5.5	0.5							·
		•						· .	·
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		•					•		
	•							· · · · · · · · · · · · · · · · · · ·	
*Cond	luctivi	ty adj	usted	to standa	rd 25°C is	05 µmhos	•	•	
•		· .							

Remarks: Equipment used: D.O. & Temp.- YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 5.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84	
Water Body .Sportfish Lake Survey Date/Time 8-15-83/1330	
Lake Location (Latitude) N 60° 51' 35" (Longitude) W 150° 17' 00"	
Code No. Survey Crew Friedersdorff, Jakubas	_
Cloud Cover (%) 90 Wind (mph) 3 Air Temp (°C) 13 Chop (in) 1.0	
Station	

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1.	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (µg/l)
0	17.0	10.7	· .			•	•	.4.0	·
1	17.0	10.4					•		
2	17.0	10.4				•	•	·	
3	17.0	10.4							
4	17.0	10.4							
5	16.9	10.4		•					
6	16.9	10.4			•		•	;	
7	16.0	10.4			•				
8	12.2	10.2						•	
9	10.0	10.4			_	-			
10	7.9	1.5							
11	6.9	0.5							
12	6.0	.0.5	1.						
13	5.5	0.5	1						
14	5.1	0.5	ŀ						
15	5.0	0.4	· .						
16	. 50	0.3.		· · ·					
	·	1							
		1	1		•		·		
				·			· · ·	· · · ·	

Remarks: Equipment Used: D.O. & Temp.- YSI 57 Meter; Water Transparency - 20cm Secchi Disc.

#### MANAGEMENT HISTORY

The Fish and Wildlife Service (Nelson and Crateau 1972) conducted two limited gill net surveys of Sportfish Lake in September, 1972. Survey records indicate one rainbow trout was captured on 9-11-72 in one gill net fished for 25 hours, and three rainbow trout were taken on 9-26-72 with one gill net fished for 51 hours. This sampling resulted in extremely low CPUE's of 0.04 and 0.06 fish per net hour respectively. Biologists further indicated that the rainbow trout fishery was in decline. No specific fishery management measures are known to have been implemented on this lake.

#### WILDLIFE

Common loons and warblers appeared to use the lake and its surrounding habitat as a staging area for fall migration. Eleven loons were seen on the lake and flocks of warblers were observed on the island. Surf scoters were the only waterfowl observed with young. A coyote family was heard on two consecutive nights northeast of the lake, and scat was found in the area. Several abandoned lodges and two old dams indicated the lake once supported a population of beaver. A total of six species of waterfowl, four species of passerines, one raptor, and four species of mammals were seen. No rare wildlife species are known to use the lake. All wildlife species recorded along with other pertinent data are listed in Table 6.

#### RECREATIONAL USE

Alaska Bush Carriers have had a fly-in tent camp on Sportfish Lake for 15 years. The camp consists of a semi-permanent wall tent, pit toilet, and boats. Kenai NWR records indicate recent Alaska Bush Carrier sport fishing use of the lake amounted to only four person days in the past three years. Representatives of Alaska Bush Carriers indicated that angling success for rainbow trout on the lake was good in the 1960's. Around 1969 to 1970 the sport fishery began to decline. By the late 1970's and early 1980's rainbow trout catch rates were negligible.

Human impact on the lake is minimal. A small area has been cleared for the tent and paths worn to the pit toilet. Some dead trees have been cut for firewood. Other habitat around the lake is in a wild state. The permittee's wall tent was in deteriorating condition.

#### FISHERY RESOURCE SUMMARY

Sportfish Lake was historically known to support a good rainbow trout population. In the early 1970's, the trout fishing was reported declining. Our 1983 survey found only three coho salmon and a moderate abundance of threespine stickleback; we believe the coho salmon were illegally stocked. This survey verified the low trout population. Lack of suitable stream spawning habitat is judged to be the key factor responsible for the rainbow trout decline. We theorize the lake's most important migratory and spawning tributary was destroyed by the 1964 earthquake. Table 6.

#### KENAI FISHERY RESOURCES STATION ALASKA\_FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Wildlife Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84

Water	Bodý S	portfish Lake	Surve	y Date/	'Time 8-	16-83			
Lake	Locatior	n (Latitude) N	60° 51'	35" (	Longitu	de)W	150°	17.	00"
Code	Number _	Survey	Crew	Frieder	rsdorff,	Jaku	bas		

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds						
Waterfow]	Surf Scoter White-winged Scoter Unid. Duck Common Loon Red-necked Grebe Common Merganser	3 J 1 11 11 1	0-0-3 0-0-1 0-0-11 - 0-0-1	Brood Single Single Flock Single	Sight Sight Sight Sight Sound Sight	Water Water Water Water
Passerines	Yellow-rumped Warble Wilson's Warbler Black-capped Chickac Gray Jay	er Many J 3 lee 1 1	0-0-3 0-0-1 0-0-1	Flock - Single Single	Sight Sight Sight Sight	MB,MS MB,MS MB,MS MB,MS
Raptors	Great Horned Owl	. ]	0-0-1		Sound	MB,MS
Mammals	· · ·					
Big Game	Moose Black Bear	1 -	0-1-0 -	Single -	Sight Feces	MB,MS -
Furbearers	Muskrat	-	-	• -	Mussel Shells	-
	Coyote	<b></b>	_	Family Group	Sound	- - ·
					•	•

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; MB=Mature Spruce Remarks: Hole in gill net was possibly cut by a beaver. No sign of lodge, animal or cuttings. Lake water fertility was moderate, and other water quality parameters were within acceptable fish tolerance limits. The large number of threespine stickleback and good growth rate of the coho salmon, at around 3.4 inches per year, indicate the lake is suitable as fish rearing habitat. Without intensive fishery management, the lake will continue to have a low population or complete loss of rainbow trout. Sportfish Lake is believed to have a negligible sport fish value.

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#### INTRODUCTION

A fishery survey of Trapper Joe Lake was conducted on September 15-16, 1983. Additional water quality data were gathered on July 20, 1983. Table 1 summarizes Trapper Joe Lake survey findings.

#### PHYSICAL FEATURES

Trapper Joe Lake, part of the Chickaloon River Drainage, is located in the northeastern section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 45' and longitude 150° 04'. This area has been assigned to the Moderate Land Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Plan (USFWS 1983). The lake has a surface area of 105 acres, a volume of 440 acre feet, and is at an elevation of 298 feet. Most of the lake is extremely shallow. Mean depth is 4.2 feet and maximum depth is 17 feet (Table 1 and Figure 1).

The watershed is composed of rolling hills to the west, mountain foothills to the east, and lowland bogs to the north and south. A mature white sprucepaper birch forest covers the western hills. Low areas to the east and north are dominated by black spruce. The northern and southern wetlands are emergent and scrub-shrub class. Approximately 3,700 acres form the lake's drainage basin.

The waterflow regimen of the lake is maintained by runoff, springs, bog seepage, and stream flow. An inlet stream, three to five feet wide, is located at the south end of the lake. This stream appears to be perennial, although, little flow could be detected. The outlet, located at the northern end of the lake, was slightly larger, but quickly became shallow with only small channels meandering through clumps of aquatic vegetation. U.S. Geological Survey Map D-1 (Alaska, 1951 series) indicates the outlet stream is tributary to the Chickaloon River which, in turn, connects to the ocean. Areas of rock and grayel are found along the southwestern edge of the lake. Although we found no rainbow trout spawning habitat near the confluence of the outlet, we believe this stream provides for rainbow trout reproduction, as well as, a seasonal migration route to the ocean.

Access to the lake is primarily by airplane. It can also be reached by a short hike from the oil pipeline service road which connects to Mystery Creek Road and the Sterling Highway. Recreational facilities include a refuge log cabin and a semi-permanent tent camp belonging to Alaska North Flying Service.

#### FISH

Fish taken during our 1983 survey included relatively large numbers of rainbow trout, longnose sucker, and threespine stickleback, plus low numbers of Dolly Varden/Arctic char, and coho salmon (Table 2). Gill net catch per

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# U.S. FİSH AND WİLDLIFE SERVICE Lake Survey Summary .

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Wate	er Body Trapper Joe Lake		Survey	Date(s) _	9/15-16/83	
].	Location: Refuge Kenai NW Latitude N 60° 45′ 40″ Lon	R gitude	W 150° 04'	30" T	<u>5N R 5W</u> ap. Ref. <u>Kena</u>	<u>S_21</u> 11 D-1
2.	Physical Data:Surface Area1Volume440 Ac. Ft.WateDrainage Area3,700 Ac.end of the lake.No perceptable	05 Ac. M r Color Inlėts flow coul	ax. Depth Brownish (cfs) <u>One</u> d be detec:	17 Ft. Green inlet stre ted.	Mean Depth Water Trans eam is at the	<u>4.2 Ft.</u> 10 Ft southern
	Outlets (cfs) <u>One outlet stream</u> <u>perceptable flow could be detecte</u> <u>direction. This outlet is part of</u> Spawning Habitat <u>Although no r</u> <u>outlet stream is believed to prov</u> Access <u>Airplane and a short h</u>	is at the d, aquation f the Chion ainbow tr ide adequ ike from	northern e c vegetatic ckaloon Riv out spawnin ate spawnin the oil pin	end of the on was lear ver Drainag ng habitat ng area. peline roag	lake. Althou ing in a down was detected, l are the mear	gh no stream the ns of
3.	Water Quality: D.O.       9.5-4.2 mg/         pH       7.7       Alk.       48 mg/l         Kjeldahl N       0.34 mg/l       MEI       81.0	<u>'1</u> Temp H ) SDF	<u>9.4-4.</u> ard. <u>49 m</u> 1.48	2°C g/l _ Pollution	Cond. <u>104 @</u> Phos <u>12 ug</u> nNone	25°C J/1
4.	Fish Species: (Abundance, H/M/L longnose sucker (H), Dolly Varder	, <u>I</u> ntrodu n/Arctic c	ced) <u>Rain</u> har (L), t	bow trout hreespine	(H), coho salı stickleback (I Total Specie	mon (L), H) s5
5.	Management History: The lake wa population of rainbow trout and No management measures have been	s surveyed low under institute	l in May 19 ice dissol ed on the 1	77 by the ved oxygen ake.	FWS with a hi levels indic	gh ated.
6.	Current Fishery Status: <u>A high</u> (CPUE 1.40) in addition to juven	fall rain ile Dolly	<u>nbow trout</u> Varden and	population coho saln	n was indicate non.	
7.	<u>Vegetation</u> : Aquatic <u>Pondweed</u> <u>water lily (] Sp.), bur reed (]</u> Terrestrial <u>Spruce-birch mixed</u> in low areas to the east and not	(3 Sp.), w Sp.), cro Porest on rth, wetla	ater milfo wfoot (1 S the wester nds north	il (2 Sp.) p.). Co n hills, b and south	, horsetail ( verage % <u>67</u> lack spruce fo of the lake.	orest
8.	Wildlife: Waterfowl (1 Sp.), pa	sserine (:	3 Sp.), fur	bearers (1	Sp.), big ga	me (1 Sp.
9.	Recreation: Fishing, hunting, w Alaska North Flying Service. Facilities <u>KNWR cabin, semi</u>	ildlife y: -permanen	iewing. Sp t tent.	pecial Use	Permit held b	У 
	Survey Crew: Friedersdo	orff and J	akubas			



# TRAPPER JOE LAKE



unit of effort (CPUE) for rainbow trout was high at 1.40. Some of the trout are believed to utilize stream habitat during the warmer months and overwinter in the lake. Further study would be necessary to verify this hypothesis. During the fall, the high CPUE of rainbow trout would provide high angling potential. Presence of two intermediate size coho salmon (CPUE 0.01) indicates the lake outlet stream provides periodic access to the ocean. A total of six gill nets and 14 minnow traps were used to determine fish abundance.

Rainbow trout captured in gill nets and minnow traps ranged in size from 4.4 inches (111mm) to 16.7 inches (425mm) Fork Length (FL). Their weight went from 0.06 pounds (25.0g) to 2.0 pounds (885g). Condition factors (K) ranged from 1.07 to 1.74 with a mean of 1.29 (Table 3). The two coho salmon juveniles were 10.6 inches (270mm) and 8.5 inches (215mm) long. Rainbow trout ranged in age from two to seven years. Rainbow trout growth averaged 2.2 inches (57mm) per year. "Age-growth" data calculated from 19 rainbow trout scale samples is given in Table 4. Longnose suckers captured were generally large. A subsample ranged in fork length from 9.3 inches (235mm) to 10.6 inches (270mm). One juvenile longnose sucker was captured in the minnow traps.

#### AQUATIC VEGETATION

Aquatic plants grew in dense mats over most of the lake bottom. Sixtyseven percent of the lake was covered with vegetation. Major families included pondweed and water lily. <u>Potamogeton robbinsii</u>, listed as "evidently rare" in Alaska by Welsh (1974) and Hulte'n (1974) was the predominant species. A complete list of species is in Table 5 with areas of occurrence in Figure 1.

#### WATER QUALITY

Water quality data were collected once in July with an additional oxygen profile taken in September. The lake had medium to high fertility using a classification of Minnesota Lakes based on Alkalinity level (MacKenthun and Ingram 1967). It was slightly above the average fertility of 17 other lakes sampled in 1983. Specific conductance, corrected to 25°C, was 104 umhos. The pH was slightly alkaline at 7.7 while phosphorus was 12 ug/1 and Kjeldahl nitrogren 0.34 mg/1. In July the lake was not thermally stratified, although water temperature decreased from 18.8°C at the surface to 15.0°C near the bottom. Dissolved oxygen ranged from 9.4 mg/1 at the surface (approximately 100 percent of normal atmospheric saturation) to 4.2 mg/1 near the bottom (43 percent saturated). These oxygen levels range from excellent to marginal for salmonids. Water color was brownish green with a Secchi disc water transparency of 10 feet. The lake had a Morphoedaphic Index of 81.0 and Shoreline Development Factor of 1.48 (Appendices A and B). Specific water quality data are presented in Tables 1, 6, and 7.

#### MANAGEMENT HISTORY

The Fish and Wildlife Service (Love 1977) surveyed Trapper Joe Lake in May, 1977. One gill net took 22 rainbow trout. This equaled a moderately high CPUE of 0.92 fish per net hour. Another 22 suckers and one Dolly Varden

Table 2.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water	Body	<u>    Trapper    </u>	Joe	<u>Lake</u> Code	No	Survey	Date	9/15-16/83
-------	------	------------------------	-----	------------------	----	--------	------	------------

	Average						Fi	sh CPUE	•
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
6 Gill Nets .	25	960	1.0	Rainbow Trout	. 11	2-2-7	0.46	N/A	N/A
•••		960 <sup>.</sup>	1.0	Longnose Sucker	6	0-0-6	0.25	N/A	N/A
•		960	2.0	Rainbow Trout	85	24-31-3	0 3.54	N/A	N/A
		960	2.0	Longnose Sucker	8	0-0-8	0.33	N/A	N/A
. •	1	960	2.0	Coho Salmon	]	0-1-0	0.04	N/A	N/A
•		960	2.5	Rainbow Trout	58	12-32-1	4 2.42	N/A	N/A
1		960	2.5	Longnose Sucker	18	0-1-17	0.75	N/A	N/A
•		960	2.5	Coho Salmon '	٦	1-0-0	0.04	N/A	N/A
		960	3.0	Rainbow Trout	47	13-23-1	1 1.96	N/A	N/A
	•	960	3.0	Longnose Sucker	49	0-0-49	2.04	N/A	N/A
	•	960	4.0	Rainbow Trout	9	2-3-4	0.38	N/A	N/A
•		960	4.0	Longnose Sucker	46	0-0-46	1.92	N/A	N/A
By Species	25	4800	A11	Rainbow Trout	210	53-91-6	6 1.75	1.40	N/A
<b>U</b>				Coho Salmon	2	1-1-0	0.02	0.01	N/A
'				Longnose Sucker	127	0-1-12	6 1.05	0.85	N/A
Total Fish		4800	A11 .	All Species	339	45-93-1	92 2.83	2.26	N/A
14 Minnow Traps	23	. N/A	N/A	Threespine Stickleback	2034	0-0-203	4 N/A	N/A	6.32
				Rainbow Trout	2	0-0-2	N/A	N/A	.0.01
•	•••••	· · · * · · · · · · ·	•	Dolly Varden/Arctic Char	10	Q-0-10	N/A	N/A	0.03
· · · ·	• . • . • • • • • •			Longnose Sucker	.]	0-0-1	N/A	N/A	< 0.01
Total Fish	23	N/A	N/A	All Species	2047	0-0-204	47 N/A	N/A	636

unit of effort (CPUE) for rainbow trout was high at 1.40. Some of the trout are believed to utilize stream habitat during the warmer months using the lake for overwintering. Further study would be necessary to verify this hypothesis. During the fall, the high CPUE of rainbow trout would provide high angling potential. Presence of two juvenile coho salmon (CPUE 0.01) indicates the lake serves as an anadromous fish nursery area, and substantiates that the outlet stream provides periodic access to the ocean. A total of six gill nets and 14 minnow traps were used to determine fish abundance.

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#### MANAGEMENT HISTORY

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# Table 3.

# FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Trapper Joe Lake, 1983

FISH LENGTH BY MESH SIZE

Gear	Species	Mesh Size (in)	Sample No.	Length Mean (mm)	 Length SD* (mm)	Length Range (mm)
6.Gill Nets	Rainbow Trout	1.0 2.0 2.5	6 68 48 27	279 274 316	126 52 46	$   \begin{array}{r}     111 - 375 \\     190 - 400 \\     240 - 400 \\     270 - 410   \end{array} $
14 Minnow Traps		3.0 4.0 0.125	51	321 130	 - 28 71 0	250 - 410 250 - 425 130 - 130

# FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets & 14 Minnow Traps	Rainbow Trout	101 - 150 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	2 1 18 23 21 23 3	26.2 115 175 269 451 623 862	1.6 - 31 44 60 60 20	25.0 - 27.3 - 115 - 235 205 - 335 360 - 560 525 - 760 850 - 885

FISH CONDITION (K) BY LENGTH CLASS

Gear Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
6 Gill Nets Rainbow Trout & 14 Minnow Traps	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	2 1 18 23 21 23 3	1.19 1.68 1.38 1.29 1.27 1.23 1.20	0.07 0.16 0.10 0.10 0.07 0.05	1.14 - 1.24 - 1.16 - 1.74 1.08 - 1.48 1.12 - 1.50 1.07 - 1.33 1.15 - 1.23
Totals	A11	91	1.29	0.13	1.07 - 1.74

\*Standard Deviation

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Table 4.

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# AGE-GROWTH OF RAINBOW TROUT Trapper Joe Lake, 1983

YEAR CLASS	NO.	FORK I	LENGTH II	(FL) IN III	MILLIMET IV	ERS AT	ANNULUS VI	FORMATION VII	CAPTURE FL
1981	. ]	63	133	•		· · · · ·		<u></u>	190
1980	5	53	103	165	• .				234
1979	4	46	106	179	245			1	313
1978	3	58	110	168	218	287		· -	352
1977	5	49	89	149	214	283	338		. 389
1976 <sup>.</sup>	1	40	79	128	199	275	354	398	421
Total N	0.	19	19	18	13	9	. 6	]	
Av. FL	(mm)	51	. 101	162	223	283	341	398	
Av. FL	(in)	2.0	4.0	6.4	. 8.8	11.1	13.4	15.7	

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Table 5.

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# TRAPPER JOE LAKE ASSOCIATED VEGETATION

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# AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent	HTF	horsetail	<u>Equisetum fluviatile</u>
Emergent	MT	mare's tail	Hippuris vulgaris
Floating	BR	bur reed	<u>Sparganium angustilfoilum</u>
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent Submergent Submergent Submergent Submergent	MR PG PP PRb WWC	water milfoil pondweed pondweed pondweed	Myriophyllum spicatum Potamogeton gramineus Potamogeton praelongus Potamogeton robbinsi Ranunculus confervoides

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	MB	mature paper birch	Betula papyrifera
Trees	MS	mature white spruce	Picea glauca
Shrubs	A	alder	<u>Alnus sp.</u>
Shrubs	SG	sweet gale	Myrica gale
Below Shrub	BB	buck bean	<u>Menyanthes trifoliata</u>
Below Shrub	Cunid	sedge	<u>Carex sp.</u>
Below Shrub	CR	sedge	<u>Carex rostrata</u>
Below Shrub	G	grass	<u>Gramineae</u>

Table 6.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyTrapper Joe LakeSurvey Date/TimeTraper Joe LakeSurvey Date/Time7-20-83/0930Lake Location (Latitude)N 60°.45' 40"(Longitude)W 150° 04' 30"Ode No.Survey CrewCode No.Survey CrewFriedersdorff, JakubasCloud Cover (%)95Wind (mph)OAir Temp (°C)16.5 Chop (in)OStationStationStation

Sample Depth (m).	Water Temp (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (µg/l)
0	18.8	9.4	7.7	92 *	48	49	XV	3.0	12
1	18.5	9.5							
2	18.1	9.4	·						
3	17.5	9.2			•••				
4	ʻ16.0	6.8		•			-		
5	15.0	4.2		:					÷
				•••		•			
						•			
	•	-							
· ·									
				•					
* Conc	luctivi	ty cor	recte	d to 25°C	temperature	is 104 µm	hos	•	
							·.		
			-					•	

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Marson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 7.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyTrapper Joe LakeSurvey Date/Time9-15-83/1330Lake Location (Latitude)N 60° 45' 40"(Longitude)W 150° 04' 30"Code No.Survey Crew ' Friedersdorff, JakubasCloud Cover (%)5Wind (mph)OAir Temp (°C)8.0Station

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (¤g/l)
0	10.5	11:0			•	•		5.0	
1	10.2	10.9			•				-
2	10.2	10.8							
3	10.0	10.8							•
4	· 9.6	10.6	•	-					
5	9.5	10.6					-		
								•	
·				···		•			
								· ·	
		: .							
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Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency 20 cm Secchi disc. were also captured. During February, 1973, Fish and Wildlife Service biologists returned taking an under ice dissolved oxygen (Do) profile. They found Do levels ranging from 3.4 mg/l at two feet (24 percent of normal atmospheric saturation) to 0.2 mg/l at 12 feet (less than one percent saturation). These oxygen concentrations are extremely low to critical for trout. However, rainbow trout were confirmed to be overwintering in the lake at the time of sampling despite the low dissolved oxygen levels. No specific fishery management measures are known to have been implemented on this lake.

#### WILDLIFE

Trapper Joe Lake and its streams have historically supported a nesting pair of trumpeter swans (Jakubas 1983). No swans were seen during the survey, probably due to the time of the year.

An active beaver lodge with nearby underwater food cache was found along the southwest side of the lake. A total of one species of waterfowl, three species of passerines, and two species of mammals were seen. All wildlife species along with other pertinent data are listed in Table 8.

#### RECREATIONAL USE,

Recreational use of Trapper Joe Lake includes fishing, hunting, and wildlife viewing. We believe the lake is mostly used by fly-in anglers and hunters. Alaska North Flying Service has held a Special Use Permit for a semi-permanent tent camp since 1977. Alaska North personnel indicated the lake provides good angling for moderate size rainbow trout throughout most of the year. There are no current records on visitor use, but we believe use to be low.

The Alaska North wall tent was in great disrepair at the time of our survey. In contrast, the refuge log cabin, which has an old wood stove and bunks, was in good condition. One plane attempted to land on the lake during our survey, but yeered off when the pilot saw the cabin was occupied.

#### FISHERY RESOURCE SUMMARY

Our fishery investigation indicated Trapper Joe Lake has a high abundance of rainbow trout with a gill net CPUE of 1.40 trout per net hour. In addition, a high abundance of longnose sucker and low abundances of juvenile Dolly Varden/Arctic char and coho salmon were also found. The lake also contains a few intermediate size coho salmon. Trapper Joe Lake is considered to-have-the-potential to-support a high yield rainbow trout sport fishery.

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Table 8.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyTrapper Joe LakeSurvey Date/Time9/15-16/83Lake Location (Latitude)N 60° 45' 40" (Longitude)W 150° 04' 30"Code NumberSurvey CrewFriedersdorff, Jakubas

Animal ·Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds Waterfowl	Common Loon	2	0-0-2	Pair	Sight	Flight
Passerine	Ġray Jay Black-billed Magpie Common Raven	2 1 1	0-0-2 0-0-1 0-0-1	Single Single Single	Sight Sight Sight	MB,BS Flight Flight
Mammals Furbearers	Beaver	-	-	_	Lodge Sight	Water
Big Game	Moose	. ]			Sight	Bog

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; BS=Black Spruce Remarks: One active beaver lodge in southwest section of lake. Weather partly cloudy, freezing at night.

#### UPPER JEAN LAKE

#### INTRODUCTION

A fishery survey of Upper Jean Lake was conducted on July 28-29, 1983. Additional water quality data were obtained on July 25. Table 1 summarizes survey findings.

#### PHYSICAL FEATURES

Upper Jean Lake is located in the northeastern section of the Kenai National Wildlife Refuge (NWR) in the Kenai River drainage, at latitude 60° 31' and longitude 150° 12'. The lake and surrounding area were designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. The lake has a surface area of 50 acres, a volume of 930 acre feet, and is at an elevation of 497 feet. The lake is relatively deep with a mean depth of 19 feet and maximum depth of 44 feet. (Table 1 and Figure 1).

The watershed is composed of steep mountain foothills with approximately 560 acres forming the lake's drainage basin. Black spruce dominates the southwest side of the lake while a white spruce-paper birch-cottonwood mosaic covers the remainder of the shoreline. Vegetation on the steeper hills consists of dwarf shrubs and alpine plant species, intermixed with areas of bare rock.

Waterflow regimen of the lake is maintained by springs and runoff. An outlet stream, indicated to be at the east end of the lake (U.S. Geological Survey Map, Kenai C-1, 1951 Series), does not exist. No lake tributaries were found and there is no suitable habitat for rainbow trout spawning. Large areas of boulders along with limited gravel were in the northern half of the lake along the shore.

Automobile access to the lake is available over a short dirt access road from the Sterling Highway. There are no recreational facilities.

#### FISH

Fish captured included coho salmon, threespine stickleback, and slimy sculpin. Gill net catch per unit of effort (CPUE) for coho was extremely low at 0.07 fish per net hour (Table 2). The coho salmon are survivors from a previous 1979 stocking by the Alaska Department of Fish and Game (ADF&G). This low gill net catch translates to extremely low angling potential. Minnow trap CPUE for stickleback was moderate at 1.13 fish per trap hour. A total of two gill nets and 10 minnow traps were used to determine fish abundance.

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# Table 1. U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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11- +	Survey Date(s) 7/28-29/83
wat	er Body FN D 5W S 18
1.	Location: Refuge Kenai NWR Map. Ref. Kenai C-1
2.	Physical Data:Surface Area50 Ac.Max. Depth44 Ft.Mean Depth19 Ft.Volume930 Ac. Ft.Water ColorDark GreenWater Trans26 Ft.Drainage Area560 Ac.Inlets (cfs)None
	Outlots (cfs) None
	Spawning Habitat No stream spawning habitat for rannow trout was processed
	Access Dirt access road from the Sterling Highway.
3.	Water Quality: D.O.       10.9-6.6 mg/l       Temp.       16.5-8.0°C       Cond.       154 @ 25°C         pH       7.7       Alk.       72 mg/l       Hard.       73 mg/l       Phos.       6.6 ug/l         Kjeldahl N       0.32 mg/l       MEI       27.1       SDF       1.56       Pollution       None
	Eil Granies: (Abundance H/M/L Introduced) Threespine stickleback (M),
4.	Fish Species. (Abundance, $n/n/2$ , $n/2$ ,
5.	Management History: The lake historically supported threespine stickleback and slimy sculpin. In 1962 the ADF&G began a stocking program planting coho salmon,
	sockeye salmon, and rainbow trout fry during various years. These rish running
	a sport fishery for anglers.
6.	Current Fishery Status: At the time of survey, only threespine stickleback, slimy
	ADF&G 1979 stocking; there were large and exhibted a good growth rate. A total
	of 10,960 rainbow trout fry were stocked in late August, 1983. Under the current
	fishery
7.	Vegetation : Aquatic <u>Musk grass, sedges (2 Sp.), pondweed (2 Sp.), buckwheat</u>
	(I Sp.), and crowfoot (I Sp.). Coverage % 29
	Terrestrial <u>Black spruce, mature white spruce-paper birch-black cottonwood complex</u> dwarf shrubs, alpine plant species.
8.	Wildlife: Waterfowl (1 Sp.), shorebirds (1 Sp.), mammals (2 Sp.),
9.	Recreation: Sportfishing, camping, wildlife viewing, hunting.
	Facilities\$mall unimproved parking area and dirt boat ramp.
	Survey Crew: Friedersdorff and Jakubas



# Table 2.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body <u>Upper Jean Lake</u> Code No.\_\_\_\_\_Survey Date <u>7/28-29/83</u>

· · · · · · · · · · · · · · · · · · ·	Average	· · · · · · · · · · · · · · · · · · ·		, <u></u> ,,,,,,,,			Fi	sh CPUE	
Gear	Fishing Time (hrs.)	Amount Gear (Sg.Ft.)	Mesh Size (In.)	Fish Species.	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
2 Gill Nets	23	320 320 320 320 320 320	1.0 2.0 2.5 3.0 4.0	Coho Salmon Coho Salmon Coho Salmon	0 1 1 1 0	0-1-0 0-1-0 1-0-0	0.00 0.14 0.14 0.14 0.00	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
Total Fish	23	1600	A11	Coho Salmon	3	1-2-0	0.08	0.07	N/A
10 Minnow Trap	s 24	N/A	N/A	Threespine Stickleback Slimy Sculpin	272 2	0-0-272 0-0-2	2 . N/A . N/A	N/A N/A	1.13 0.01
Total Fish	24.	N/A	N/A	All Species	274 ·	0-0-274	4 N/A ·	N/A	1.14

Coho salmon captured in gill nets ranged in size from 12.2 inches (310mm) to 19.1 inches (485mm) fork length. Their weight ranged from 0.82 pounds (370 g) to 3.63 pounds (1,650 g). Condition factors (K) ranged from 1.24 to 1.45 with a mean of 1.34. Age of the coho salmon was four years plus summer growth. Fork lengths of the stocked coho, back calculated from three scale samples averaged 2.8 inches (73mm), 5.7 inches (145mm), 9.1 inches (230mm), and 11.7 inches (298mm) through the first four years of life respectively with additional summer growth to 15.5 inches (393 mm). The mean annual growth rate was 3.0 inches (77mm).

#### AQUATIC VEGETATION

Aquatic vegetation was moderate and concentrated along the southern and eastern shorelines. Twenty-nine percent of the lake was covered with vegetation. Families present included muskgrass, sedges, buckwheat, pondweed, and crowfoot. Chara was by far the dominant species, and occurred in dense mats. A complete list of species can be found in Table 3. Areas of aquatic vegetation are shown in Figure 1.

#### WATER QUALITY

Water quality data were collected twice in July. All water quality parameters were within acceptable tolerance limits for fish. The lake has medium to high fertility according to a classification of Minnesota lakes by J.B. Moyle which he based on alkalinity level (MacKenthun and Ingram 1967). Specific conductance, corrected to 25°C, was 154 micromhos. Water pH was slightly alkaline at 7.7. Total alkalinity and hardness were near the highest sampled from 18' refuge lakes in 1983. Total phosphorus was 6.6 ug/l and Kjeldahl Nitrogen 0.32 mg/l. Dissolved oxygen ranged from 10.9 mg/1 at the surface to 6.6 mg/1 at 39 feet. This represents slight supersaturation of dissolved oxygen to about 55 percent of normal atmospheric saturation which is satisfactory for most fish. Thermal stratification of the lake occurred between 23 and 26 feet. Water color was dark green with a Secchi disc visibility of 26 feet. The lake had a Morphoedaphic Index of 27.1 and Shoreline Development Factor of 1.56 (Appendices A & B). Specific water quality data are presented in Tables 1, 4, and 5.

#### MANAGEMENT HISTORY

The lake was first surveyed in 1960 by the Alaska Department of Fish and Game (Kubik and Reynolds 1960). A few rainbow trout were captured, which biologists indicated had been stocked by a private individual. Threespine stickleback and sculpin were the only native species prior to stocking. The State began a fish stocking program in 1962. Over the years, fry have been stocked by the State as follows: 1962 (13,500 rainbow trout), 1963 (6,600 rainbow trout), 1965 (1,150 sockeye salmon), 1966 (34,670 sockeye salmon), 1967 (9,020 sockeye salmon), 1969 (11,500 coho salmon), 1973 (11,500 coho salmon), 1975 (11,500 coho salmon, 1977 (75,000 sockeye salmon), 1979

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# UPPER JEAN LAKE ASSOCIATED VEGETATION

Class .	Symbol	Common Name	Scientific Name		
Emergent	SR	spike rush	<u>Eleocharis palustris</u>		
Emergent	CR	-	Carex rostrata		
Floating	SW	smartweed	Polygonum amphibium		
Submergent	CH	muskgrass	<u>Chara sp.</u>		
Submergent	PG	-	Potamogeton gramineus		
Submergent	PL	-	Potamogeton filiformis		
Submergent	WWC	-	Ranunculus confervoides		

# AQUATIC VEGETATION

.

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees Trees Trees Trees	BS CW MB MS	black spruce cottonwood mature paper birch mature white spruce	<u>Picea mariana</u> <u>Populus balsamifera</u> <u>Betula papyrifera</u> <u>Picea glaúca</u>
Shrubs	Å	alder	<u>Alnus</u> <u>sp.</u>

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (μg/l)
0	.16.5	10.9	7.7	129*				8.0	6.6
1	16.5	10.9					• •	· · · · · · · · · · · · · · · · · · ·	
2	16.3	10.9							
3	16.3	10.9	-						
4	16.3	10.9							•
5	16.3	10.9.							
6	16.3	10.9	•	130	• 72	73		· •	
7	16.2	10.9	·						
8	13.9	10.2						· .	
9	10.8	10.8				•			
10	9.2	10.2							
11	8.8	8.6							
12	8.0	6.6				· .			
		:							
					· ·				
		1							
*Co	nducti	vity a	djust	ed to stan	dard 25°C i	154 µmho	<u>в</u>	;	
	·				•				
				·			•		
· .		•			•				

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 5.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyUpper Jean LakeSurvey Date/TimeTotal7-27-83/1600LakeLocation (Latitude)N 60° 31' 40"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)99Wind (mph)O-1Air Temp (°C)16.0StationStation

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (mg/l)
0	17.2	10.5					. <u> </u>	8,0	
. 1	17.1	10.5							
2 .	17.1	10.6							
3	17.1	10.6		·	·				
4	17.1	10.5	•	· · · · ·					
5	17.0	10.6							
6	16.8	10.6						·	
7	16.1	10.2			· .			· · · · · · · · · · · · · · · · · · ·	
8	14.0	10.2		<u> </u>					
9	10.2	10.4				•			
10	9.9	10.2							
11	9.0	9.4							
12	8.2	3,6							
13	8.0	2.5							
		1							
				•					
			<u> </u>						

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency - 20cm Secchi Disc. (9,060 coho salmon), and 1983 (10,960 rainbow trout). The recent trout stocking was of Swanson River origin, and fish were incubated at the Elmendorf State Fish Hatchery. ADF&G test netting over the last 15 years has often yielded gill net catch rates exceeding CPUE's of 1.00 fish per net hour. Sampling by University of Alaska personnel in the summer of 1983 yielded a few small sockeye operKokanee salmon. These states are stated to be

#### WILDLIFE

Upper Jean Lake was known to support beaver until the last few years (Bailey 1983). Our survey found two inactive beaver lodges and no recent food cuttings. Beavers were not seen. A pair of common loons, which had nested on the lake, were raising one chick. Few species of wildlife occurred around the lake with only one species of waterfowl, one species of shorebird, and two species of mammals observed. All wildlife species recorded along with other pertinent data are listed in Table 6.

#### RECREATIONAL USE

Recreational uses of Upper Jean Lake include fishing, plus limited wildlife viewing, camping, and hunting. A dirt access road located at the base of Mystery Hills runs from the Sterling Highway to the lake. The campsite is merely a user generated expansion of the access road. No records are available on sport fishing use. Visitors were not present during our survey.

#### FISHERY RESOURCE SUMMARY

Upper Jean Lake historically supported a native population of threespine stickleback and slimy sculpin. The lake is landlocked and has no tributary streams to support natural trout spawning. Since 1962, the ADF&G has managed the lake by stocking coho salmon, sockeye salmon, or rainbow trout in various years to provide sport fishing.

Our survey found a moderate abundance of stickleback, a low number of coho salmon (which were survivors from a 1979 stocking), and slimy sculpin. The coho salmon we captured exhibited a mean growth rate of 3.0 inches annually. Upper Jean Lake was among the most fertile lakes sampled in 1983, and water quality conditions are optimal for fish. The lake has proved capable of providing a good put-grow and take sport fishery for salmon and trout. Some sockeye or Kokanee salmon were documented in the lake in 1983 by University of Alaska fish researchers. The lake is expected to revert to historic forage fish populations if the State fish stocking program is discontinued. Under the current stocking program, the lake will provide a moderate to high yield put-grow and take sport fishery. Without continued management, Upper Jean Lake is considered to have negligable sport fishery value.

#### Table 6.-

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyUpper Jean Lake Survey Date/Time7-27-83Lake Location (Latitude)N 60° 31' 40" (Longitude)W 150° 12' 35"Code NumberSurvey CrewFriedersdorff, Jakubas

Anima ·Class	al S	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds W	laterfowl	Common Loon	3 J+	]-]-]	Brood	Sight	Water
S	horebirds,	Lesser Yellowlegs	1	0-0-1	Single	Sight	Shore
Mamma] B	s ig Game	Moose	-	-	_	Tracks	 
0	thers	Snowshoe Hare	-	· _	֥ _	Cuttings	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles
Remarks: Old beaver activity noted. No beaver at present.

#### INTRODUCTION

A fishery survey of Weed Lake was conducted on June 16-17, 1983. Additional water quality data were gathered on July 14, 1983. Table 1 summarizes Weed Lake survey results.

#### PHYSICAL FEATURES

Weed Lake is located in the northcentral section of the Kenai National Wildlife Refuge (NWR) in the Swanson River drainage at latitude 60° 41' and longitude 150° 52'. The lake area was placed in the Intensive Land Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983). The lake has a surface area of 8 acres, a volume of 115 acre feet, and is at an elevation of approximately 275 feet. Mean lake depth is 15 feet and maximum depth is 39 feet (Table 1 and Figure 1).

Weed Lake has a watershed of approximately 180 acres which consists of flatlands and lowland bogs. The lake area was on the fringe of the 1947 burn. A dense, mature, black spruce-paper birch forest exists on the northern shore, while the remainder of the surrounding forested land is composed of immature birch and spruce. Two emergent and scrub-shrub bogs are located on the northeastern and southern shores. The Swanson River Road crosses just below the west end of the lake.

The water regimen of the lake is apparently maintained by springs, runoff, and bog seepage. A small outlet stream, at the west end of the lake, flows under Swanson River Road through a steel culvert. Culvert placement was in line with the natural stream bottom and permitted free flow of stream water. The stream averaged three feet in width, a few inches deep, and was interlaced with emergent vegetation. Stream flow was about 0.5 cubic feet per second (CFS). Small patches of gravel formed part of the stream substrate. Trout spawning habitat appeared to be marginal in the immediate vicinity of the lake. U.S. Geological Survey maps indicate the lake is landlocked from the ocean.

Swanson River Road and a small roadside automobile pullcover provide direct access to the lake. A marked canoe portage to the Drake Lake-Skookam Lake trail is at the eastern tip of the lake. There are no other recreational facilities.

#### FISH

Two adult rainbow trout were taken in gill nets for a catch per unit of effort (CPUE) of 0.04 fish per net hour. One additional juvenile rainbow was captured in a minnow trap (CPUE 0.02). This catch represents a low

Table 1. U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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11	Survey Date(s)6/16-17/83
Wate	$\frac{1}{2} \frac{1}{2} \frac{1}$
1.	Location: Refuge <u>Kenai NWR</u> Latitude <u>N 60° 41' 30"</u> Longitude <u>W 150° 52' 35"</u> Map. Ref. <u>Kenai C-3</u>
2.	Physical Data:Surface Area8 Ac.Max. Depth39 Ft.Mean Depth15 Ft.Volume.115 Ac. Ft.Water ColorGreen BrownWater Trans12 Ft.Drainage Area180 Ac.Inlets (cfs)None
	Outlets (cfs) One small outlet is at the west end of the lake. It is shallow and weed choked and was flowing about 0.50 cfs at the time of survey. Portions of the outlet stream have a gravel bottom. Spawning Habitat The small outlet stream appears extremely marginal as rainbow trout spawning habitat. Access
3.	Water Quality: D.O.       8.8-0.3 mg/l       Temp.       19.2-4.0°C       Cond.       26 umhos @ 25°C         pH       6.7       Alk.       4 mg/l       Hard.       4 mg/l       Phos.       10 ug/l         Kjeldahl·N       0.44 mg/l       MEI       5.7       SDF       1.77       Pollution       None
4.	Fish Species: (Abundance, H/M/L, Introduced) <u>Rainbow trout (L). threespine</u> stickleback (M)
5.	Management History: There is no previous management history
6.	Current Fishery Status: The lake contains a low, self sustaining population of rainbow trout (CPUE 0.04) and threespine stickleback.
. •	
7.	Vegetation : Aquatic <u>Pondweed (2 Sp.), gentain (1 Sp.), rose family (1 Sp.),</u> horsetail (1 Sp.), water lily (1 Sp.), bur reed (1 Sp.). Coverage % <u>20</u> Terrestrial <u>Mature black spruce-paper birch forest, immature spruce-birch</u> forest, two emergent/scrub-shrub bogs.
8.	Wildlife: Waterfowl (2 Sp.), passerine (12 Sp.), mammals (3 Sp.). Waterfowl of note: sandhill crane.
9.	Recreation: Fishing, wildlife viewing, canoeing, and hiking.
:	Facilities <u>Parking pullover next to the lake, canne portage</u>
	Survey Crew: Friedersdorff, Jakubas



trout population that could provide only limited angling potential. Threespine stickleback yielded a moderate CPUE of 1.60 (Table 2). Two gill nets and five minnow traps were used to determine fish abundance. Seining and electrofishing were also employed to broaden the sampling effort.

The two adult rainbow trout were 11.8 inches (300mm) and 12.0 inches (305mm) fork length. Their weights were 0.68 pounds (300 g) and 0.75 pounds (340 g) respectively. Condition factors were 1.15 and 1.20 for an average of 1.18. Both fish were four years old plus summer growth. Average fork length back calculated from scale samples was 2.2 inches (57mm), 3.8 inches (96mm), 6.3 inches (160mm), and 9.0 inches (229mm) through the fourth winter with additional summer growth to 11.9 inches (303mm). Fish growth averaged 2.3 inches (59mm) per year.

#### AQUATIC VEGETATION

Aquatic vegetation covered 20 percent of the lake. Dominant families included water lily, pondweed, and horsetail. A complete list of species can be found in Table 3 along with their locations in Figure 1.

#### WATER QUALITY

Water quality data were collected once in June and again in July. Parameters measured indicated generally satisfactory conditions for fish. The water was rated extremely low in fertility using a classification of Minnesota Lakes (MacKenthun and Ingram 1967) based on alkalinity level. Alkalinity and hardness were the lowest recorded for all 18 lakes surveyd in 1983. Specific conductance, corrected to 25°C, was 26 umhos. Water pH was slightly acid at the surface. The lake became thermally stratified between seven and ten feet deep. No sources of water pollution were present. Dissolved oxygen (Do) ranged between 8.8 mg/l at the surface to 0.3 mg/l near the bottom. Dissolved oxygen concentrations were satisfactory (around 95 percent of normal atmospheric saturation) for fish in the epilimnion while Do concentrations lethal to fish (less than one percent of atmospheric saturation) were present near the lake bottom in the stagnant hypolimnion. The lake had a Morphoedaphic Index of 5.7 and Shoreline Development Factor of 1.77 (Appendices A and B). Specific water quality data are presented in Tables 1, 4, and 5.

#### MANAGEMENT HISTORY

No previous fishery investigations have been conducted on Weed Lake, and no fishery management measures are known to have been applied to the lake.

#### WILDLIFE

A pair of sandhill cranes were seen in the southern bog, as well as, a pair of lesser scaup on the lake. Many birds were observed around the lake with 12 species of passerines being identified by sight or sound. Mammals
Table 2.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Summary Fish Catch and Effort Data

		er Body <u>We</u>	ed_Lake	Code NoSur	rvey Date	6/16-17/	83		
· ·		•						• .	<u></u>
Gear _	Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour
2 Gill Nets	23	320 320 320 320 320 320	1.0 2.0 2.5 3.0 4.0	Rainbow Trout Rainbow Trout -	. 0 1 1 0 0	0-0-1 0-0-1	0.00 0:14 0.14 0.00 0.00	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
Total Fish	23	1600	A11	All Species	2	0-0-2	0.05	0.04	N/A
5 Minnow Traps	23	N/A	N/A	Threespine Stickleback Rainbow Trout	184 2	0-0-184 0-0-2	N/A N/A	N/A N/A	1.60 0.02
Total Fish	23	N/A	N/A	All Species	186	0-0-186	5 N/A	N/A	1.62
Seine	•	N/A	N/A	Threespine Stickleback	125	0-0-125	5 N/A	N/A	N/A
Electroshocking	g	N/A	N/A	Threespine Stickleback	74	0-0-74	N/A	N/A	ĨN/Α

Table 3.

## WEED LAKE ASSOCIATED VEGETATION

## AQUATIC VEGETATION

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Class	Symbol	Common Name	Scientific Name
Emergent	BB	buckbean	<u>Menyanthes trifoliata</u>
Emergent	. HTF	horsetail	<u>Equisetum fluviatile</u>
Emergent	MFF	marsh fivefinger	Potentilla palustris
Floating	Brm	bur reed	<u>Sparganium mimimum</u>
Floating	PN	pondweed	Potamogeton natans
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent	PG	pondweed	Potamogeton gramineus

## WETLANDS VEGETATION

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Class	Symbol	Vegetation Reference					
Emergent	PEM5B	National Wetlands Inventory (Kenai)					
Scrub-shrub	PSS1B	National Wetlands Inventory (Kenai)					

## TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	IB	immature paper birch	Betula papyrifera
Trees	MB	mature paper birch	Betula papyrifera
Shrubs	DB <sup>®</sup>	dwarf birch	<u>Betula nana</u>
Shrubs	SG	sweet gale	Myrica gale
Shrubs	W	willow	Salix sp.
Below Shrub	CG	cotton grass	<u>Eriophorum sp</u> .
Below Shrub	Cunid	sedge	<u>Carex sp</u> .

Table 4.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

	• • •	·
Study Remote & Roadside Lake	Study, Kenai NWR, 1983-84	
Water Body Weed Lake	Survey Date/Time 7-14-83/1315	
Lake Location (Latitude) N 60°.	.41'30" (Longitude) W 150°52'35"	
Code No. Survey Crew	Friedersdorff, Jakubas	
Cloud Cover (%) 15 Wind (mp	oh) 1-2 Air Temp (°C) 18.5 Chop (in) 2.0	
Station		

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Temp.	<b>D O</b>							<b>.</b>
	D.U.	ŢЪ́	ivity	Alkalinity	Hardness	Water	Trans.	Phosphate
(°C)	(mg/1	<u>}</u>	(u mho)	(mg/l)	(mg/1) ·	Lolor	(m)	· (ug/1)
19.2	8.8	6.7	23*			XVIII	3.5	10
18.0	8.6							
17.2	8.6							
13.6	8.5							· · · · · · · · · · · · · · · · · · ·
7.0	5.5							
5.5	.4.7							
4.8	3.9			• 4.2	4.0			
4.1	3.3		-					
4.0	0.9							
4.0	0.6							
4.0	0.3					<u> </u>		
4.0	0.3		55			· ·		
		•	•				·.	
	·					· ·		
				•				
nductivi	ty adju	sted	to standa	rd 25°C is i	6 umhos.		•	
	1							
							· .	
								·
	19.2 19.2 18.0 17.2 13.6 7.0 5.5 4.8 4.1 4.0 4.0 4.0 4.0 4.0 4.0	19.2       8.8         18.0       8.6         17.2       8.6         13.6       8.5         7.0       5.5         5.5       4.7         4.8       3.9         4.1       3.3         4.0       0.9         4.0       0.3         4.0       0.3	19.2       8.8       6.7         18.0       8.6       17.2       8.6         17.2       8.6       13.6       8.5         7.0       5.5       5.5       4.7         4.8       3.9       6.0         4.1       3.3       4.0       0.9         4.0       0.6       4.0       0.3         4.0       0.3       -       -         4.0       0.3       -       -         nductivity adjusted       -       -       -	19.2       8.8       6.7       23*         18.0       8.6	19.2       8.8       6.7       23*         18.0       8.6	19.2       8.8       6.7       23*         18.0       8.6	19.2       8.8       6.7       23*       XVIII         18.0       8.6	19.2       8.8 $6.7$ $23^*$ XVIII $3.5$ 18.0       8.6

Remarks: Equipment used: D.O. & Temp.-YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 5.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Water Analysis Data Sheet

itudy Remote & Roadside Lake Study, Kenai NWR, 1983-84	
later Body Weed Lake Survey Date/Time 6-17-83/1130	
ake Location (Latitude) N 60° 41′ 30" (Longitude) W 150° 52′ 35"	
ode No. Survey Crew Friedersdorff, Jakubas	
loud Cover (%) 0 Wind (mph) 5 Air Temp (°C) 17 Chop (in) 2.0	
tation	

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	р <u>Н</u> )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	15.8	13:4	6.7	19			XVII	3.1	
]	15.1	. 13.6		•			•.		
2	15.0	13.0							
3	11.0	13.3							
4	7.0	9.5							
5	5.5	9.2			· ·			,	
6	5.0	8.6		•					
7	4.8	8.3						•	
8	4.3	6.8							
9	4.0	4.5		· .					
10	4.0	3.8							
11	4.0	3.8							
	·							1	
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			· .	•					
			· .		· · · · · · · · · · · · · · · · · · ·				
							•	• •	

Remarks: Equipment used: D.O. & Temp.- YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc: Winkler 0<sub>2</sub> checked 13.6 mg/1. indicated in the area included moose, muskrat, and snowshoe hare. All wildlife species recorded along with other pertinent data are listed in Table 6.

#### RECREATIONAL USE

The lake is located adjacent to Swanson River Road. A pull over parking area is situated next to the lake. A canoe portage connects the east end of the lake to the Drake Lake-Skookam Lake Trail. Our sport fishing success averaged about four fish per hour. We believe this small lake goes mostly unnoticed by refuge visitors; foot paths by the lake indicate some fishing takes place. No data on angling pressure is available.

#### FISHERY RESOURCE SUMMARY

Weed Lake survey results indicate the lake currently supports a low population density of rainbow trout (CPUE 0.04), plus a moderate population of threespine stickleback (CPUE 1.60). The lake is low in fertility. Dissolved oxygen concentrations were satisfactory in the upper 13 feet of the lake. The small outflow stream was judged to be marginal for rainbow trout spawning in the immediate vicinity of the lake. Weed Lake is considered to have the potential to support a low yield rainbow trout sport fishery.

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Table 6.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Wildlife Data Sheet

Study	Remot	e & Roadside	e Lake S	tudy, K	<u>enai NWI</u>	₹ <b>,</b> 198	<u>3-84</u>		
Water	Body Wee	d Lake	Surv	ey Date	/Time	6/16	5-17/8	33	
lake	Location	(latitude)N	60° 41'	30"	(Longit	ude)W	150°	52'	35"
Code	Number	Survey	Crew	Friede	rsdorff	Jaku	ibas		
UUUU									

Animal Class	Common Name N	lumber	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Rinds	· · · ·					
Waterfowl	Lesser Scaup Sandhill Crane	2	1-1-0 0-0-2	Pair Pair	Sight . Sight	Water Bog
Passerines	Yellow-rumped Warbler Varied Thrush Blackpoll Warbler Savannah Sparrow Alder Flycatcher White-crowned Sparrow Song Sparrow Rusty Blackbird Olive-sided Flycatche Gray Jay Slate-sided Junco American Robin	1 Many 1 Many Many 3 1 r - -	0-0-1	Single - - Single - - - - - - - -	Sound Sight Sound Sound Sound Sight Sound Sound Sound Sound	BS BS Bog - Bog MB,BS Shoreline - BS -
Mammals Big Game	Moose	-	_	-	Tracks	-
Furbearers	s Muskrat	-	-	-	Mussel Shell	ls –
Others	Snowshoe Hare	-	÷	-	Sight	· _

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; BS=Black Spruce Remarks:

## PREPARED BY:

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<u>8-17-84</u> Date

*§-17-84* Date

# SUBMITTED BY:

Project Leader

<u> 141</u> V/SY Date

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#### APPENDIX A

#### FISHERY MATHEMATICAL FORMULAE

- 1. Gill Net CPUE Number of Fish per Net Hour: CPUE = F/(N x T), where F = number of fish (species), N = number of nets, and T = fishing time (average) in hours.
- 2. Gill Net CPUE Number of Fish per 1000 Square Feet Hours: CPUE = F/(1000 Nsf x T), where F = number of fish (species), 1000 Nfs = thousand square feet of net, and T = fishing time (average) in hours.
- 3. Minnow Trap CPUE = Number of Fish per Trap Hour: CPUE = F/(TN x T), where F = number of fish (species), TN = number of traps, and T = fishing time (average) in hours.
- 4. Fish Condition K = The Relative Plumpness of Fish:  $K = W \times 10^5/L^3$ , where W = individual fish weight in grams, and L = individual fish length (fork length, total length, etc.) in mm.
- 5. Lake Volume LV Amount of Water in Lake:  $LV = \Sigma SV$ , where SV = strata yolume.
- 6. Strata Volume SV the Amount of Water in a Vertical Lake Strata: SV =  $h/3(A1+A2+\sqrt{A1 \times A2})$ , where h = vertical depth of lake contour stratum, A1 = surface area of upper lake contour, and A2 = surface area of lower lake contour.
- 7. Shoreline Development Factor SDF The Degree the Lake Shoreline Deviates From a Perfect Circle: SDF = S/2  $\sqrt{a\pi}$ , where S = length of shoreline, and a = surface area of lake.
- 8. Morphoedaphic Index MEI A Relative Measure of Lake Productivity: MEI = C/MD, where C = lake conductivity in micromhos at 25°C, and MD = lake mean depth (meters).
- 9. Mean Depth The Mean Depth of the Lake: MD = LV/SA, where LV = lake yolume, and SA = lake surface area.

#### APPENDIX B

#### GLOSSARY OF TECHNICAL TERMS

Acre Foot - 43,560 cubic feet of water.

- Alkalinity The acid combining or buffering capacity of a solution. Bicarbonate ions constitute almost all the alkalinity in local waters.
- Anadromous Fish A fish species that spawns in fresh water while attaining most of its growth as an ocean resident.
- Annulus A mark on a fish scale that is formed once a year. The mark is used to tell the fish's age.

Biomass - The total amount of living matter in a lake.

- Catch-per-unit-effort (CPUE) In fisheries, the number of fish captured per unit of time and amount of gear effort. See Relative Abundance.
- Conductivity Specific conductance is the measure of a water's capacity to conduct electrical current. It is normally expressed in micromhos per square centimeter.
- Creel Census a canvass of anglers to gather data or their fishing effort and catch.
- Cover A part of the environment, living or dead, utilized by fish for cover, resting, feeding, or spawning.

Detritus - Dead organic material.

Dissolved Oxygen (Do) - A commonly employed measure of water quality relating to the amount of elemental oxygen in solution. Ideal Do for cold water fish is above 6.0 mg/l, problems can occur between 6.0 and 3.0 mg/l, and below 3.0 mg/l conditions are stressful. Salmonids have been known to survive in Do levels as low as 1.5 mg/l under extreme cold water conditions.

Epilimnion - The upper, warmer portion of a lake thermally stratified from lower colder water layers.

- Euphotic Zone The upper, well-lighted zone of a lake where photosynthesis occurs.
- Fertility In fisheries, a water body having nutrients in proper amounts to promote plant and animal growth when other factors are favorable.

Food Chain - A series of feeding relationships between organisms.

Forage Fish - Usually smaller fish that are food for larger fish.

Game Fish - Fish species that are highly prized by anglers for sport. Examples include rainbow trout and salmon.

- Hardness The total calcium and magnesium ion concentration in water normally expressed in mg/l calcium carbonate.
- Hypolimnion The deeper colder part of a lake thermally stratified from the shallower and warmer upper layers.
- Kjeldahl Nitrogen All organic nitrogen plus ammonia in water. Nitrogen is a key nutrient and sometimes a limiting factor.
- Lake Size 1 to 99 acres small, 100 to 499 acres moderate, 500 to 999 acres large.

Limnology - The study of freshwater lakes.

Morphoedaphic Index - A relative measure of potential lake fish productivity based on morphological and chemical factors.

Morphology - In geology, the study of land form.

- Non-game Fish A fish species not sought after by anglers. A local example is the longnose sucker.
- Nursery In fisheries, that part of a stream, lake, or ocean where young fish congregate during early growth stages.
- Nutrient A substance necessary for the normal growth and development of an organism.
- Oligotrophic A body of water which lacks appreciable nutrients, minerals, or organisms.

Parameter - A quantity that specifies a characteristic.

- pH The negative logarithm of the hydrogen ion concentration expressed in gram equivalents. A pH 7 is approximately neutral, a lower pH means increasing acidity, a higher pH value increasing alkalinity.
- Phosphorous A key element necessary for the growth of plant and animal tissue. It is often a limiting factor.
- Productivity Yield in the general sense of fish harvest, or in more specialized usage, the annual production of food organisms.
- Recruitment The younger fish that each year are added to the portion of the fishery population vulnerable to harvest.
- Relative Abundance In this study a term used to denote the comparative numbers of fish captured by gill nets or minnow traps over specific time periods.

Shoreline Development Factor - A mathematical term that describes lake shoreline irregularity.

Substrate - Materials making up the bottom of a stream or lake.

Thermal Stratification - Separation of lake waters due to density gradients caused by differences in water temperature.

Thermocline - A layer of water lying between upper warmer and lower colder water layers. It is characterized by temperature changes of at least one degree Centigrade per meter depth.

Winter Kill - Death of fish due to low dissolved oxygen levels. This occurs in lakes where utilized oxygen cannot be replaced as rapidly as it is being used. The cause of low oxygen is due to ice and snow that blocks light preventing photosynthesis and sealing the water from atmospheric gas exchange.



## Kenai Fishery Resources Field Station Interim Project Report Volume II

## REMOTE AND ROADSIDE LAKE STUDY KENAI NATIONAL WILDLIFE REFUGE 1983

3.

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September 18, 1984

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Figure 1. Proposed and the on Love Still Lucation Migh,

#### INTRODUCTION

Personnel of the U.S. Fish and Wildlife Service, Kenai Fishery Resources Station, conducted fishery surveys on 18 remote and roadside lakes of the Kenai National Wildlife Refuge (NWR) from June 1 to October 7, 1983. Field investigators were J.W. Friedersdorff and W.J. Jakubas.

The objective of the Remote and Roadside Lake Study is to evaluate selected Kenai NWR lakes for their real and potential contribution to recreational fisheries. Information on fish, water quality, physical characteristics, yegetation, and wildlife were collected to achieve this objective.

Volume I (Friedersdorff and Jakubas 1984) of this project report contains data and summary information for 11 of the 18 lakes surveyed in 1983. This report, Volume II, evaluates the fishery potential of the remaining seven lakes. Study findings will be subject to modification when results of approximately 20 additional lakes to be surveyed in 1984 are added to the data base.

#### METHODS

#### FISHERY RESOURCE SUMMARY

The seven lakes evaluated in this report were classified as to sport fish value based on their natural game fish abundance and related factors. These sport fish classifications are listed in Table 1.

Fish diversity in the lakes consisted of ten species including rainbow trout, coho salmon, sockeye, (kokanee) salmon, Dolly Varden, Arctic char, longnose sucker, threespine stickleback, ninespine stickleback, slimy sculpin, and coastrange sculpin. Common fish names, scientific names, classes, and fish abbreviations are in Table 2.

In the seven lakes surveyed, rainbow trout were captured in six, sockeye (kokanee) salmon in two, juvenile coho salmon in two, longnose sucker in two, char in two, threespine stickleback in all seven, ninespine stickleback in one, slimy sculpin in three, and coastrange sculpin in one. Table 3 shows fish species captured in each lake.



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	LAKE NAME	PÓTENTIAL SPORT FISH VALUE
12.	Beaver	Moderately high yield rainbow trout sport fishery and come source house protection
13.	Bedlam Y.Suurt	High yield rainbow trout and low yield sockeye/{(kokanee)) salmon sport fishery.
14.	Bird	Moderately high yield rainbow trout sport fishery.
15.	Dolly Varden	Moderate the high yield char and low yield rainbow trout sport fishery.
16.	Neckshorta	Moderate yield rainbow trout sport fishery.
17.	Rock	Moderate yield sockeye (kokanee) salmon sport fishery.
18.	Two Island	High yield rainbow trout sport fishery,

1/ This classification is based on the expected fish abundance that would occur under natural conditions. Table 2.

Fish	Class	Scientific Name	Abbreviation
Game	Fish		
٦.	Rainbow trout	Salmo gairdneri	RBT
2.	Dolly Varden	Salvelinus malma	DOV
3.	Arctic char	Salvelinus alpinus	ARC
4.	Coho salmon	Oncorhynchus kisutch	COS
5. Non-(	Sockeye salmon Kokanee salmon Kusuur Sasesa Game Fish	Oncorhynchus nerka Onconhynchus: nerka	' SOS
6.	Longnose sucker	<u>Catostomus</u> catostomus	LNS
Forag	ge Fish	•	I
7.	Threespine stickleb	ack <u>Gasterosteus</u> aculeatus	TSB
8.	Nînespine stickleba	ck <u>Pungitius pungitius</u>	NSB
9.	Slimy sculpin	<u>Cottus</u> cognatus	SLS
10.	Coastrange sculpin	<u>Cottus</u> <u>aleuticus</u>	CRS
	Sculpin sp.	<u>Cottus</u> <u>sp</u> .	SCU
	•		•

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## FISH SPECIES PRESENT IN SURVEYED LAKES KENAI NATIONAL WILDLIFE REFUGE - 1983 Table 3.

	LAKE		•	FISH SPECIES
12.	Beaver			RBT, COS <sup>1</sup> /,LLNS, TSB
13.	Bedlam	· · ·		RBT, SOS <sup>2/</sup> , TSB, SLS
14.	Bird			RBT, TSB, SLS
15.	Dolly Varden			DOV/ARC <sup><u>3/</u>, RBT, TSB, CRS</sup>
16.	Neckshorta			RBT, TSB
17.	Rock			SOS <sup>2</sup> , LNS, TSB, SLS
18.	Two Island			RBT, COS <sup>1</sup> , TSB, NSB, DOV

Juvenile fish Maya beskékaneessalmon Restant Survey a statement Previously determined by ADF&G as Arctic char

1/ 2/ 3/

Gill net catch per unit effort (CPUE) for each fish species varied between lakes. The highest 1983 rainbow trout CPUE of 1.45 fish per net hour was found in Two Island and Bedlam lakes. Char had the highest abundance (CPUE 0.81) in Dolly Varden Lake. Beaver and Bedlam lakes serve as nursery areas for juvenile anadromous coho salmon, Sockeye, which were possibly kokanee salmon, were found in Bedlam and Rock lakes. Tables 4 and 5 list gill net and minnow trap CPUE's for the seven lakes surveyed.

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Interpretation of char CPUE's must be handled with precaution. Dolly Varden Lake CPUE's of char (Table 4) varied significantly between the three surveys over the 1983 field season. Char catches were much higher in the early spring and late fall than during mid-summer. The lower summer char CPUE seemed to be the result of char being less active during the middle of the summer and remaining in the deeper, cooler water (see Dolly Varden Lake detailed report). These results indicate consideration must be given to seasonal and habitat conditions, particularly water temperature, in evaluating char CPUE in lakes. In contrast, we found rainbow trout CPUE's from the three surveys of Rainbow Lake to be much more uniform (See Rainbow Lake detailed report). This suggests that rainbow trout CPUE's throughout the June to September field season tend to be more uniformly accurate than char CPUE's.

## PHYSICAL PROPERTIES

A number of lake physical characteristics, which individually or in combination with other features influence fish diversity and abundance. were measured. Spawning streams are critical for the presence of rainbow trout. High rainbow trout populations are normally present if a spawning stream is directly adjacent to the lake and of high spawning quality. Such is the case for Beaver, Bedlam, Bird, and Two Island lakes. Rainbow trout abundance is usually lower if a perennial or seasonal stream is present which only provides passage to distant spawning habitat. Dolly Varden lake is an example of a seasonally high water stream and Neckshorta Lake appears to be an example of high water fish passage that occurs only in extremely high water years. Stream spawning habitat must be available to the lake for trout populations to be present. Arctic char are capable of spawning in lakes lacking tribuatry streams provided suitable spawning gravel exists in the lake. Dolly Varden Lake is an example of this situation. Char also appear to inhabit deep lakes where large quantities of cool water are present during summer months.

The seven lakes surveyed varied in size from 120 to 425 acres. Maximum depth varied from 14 to 95 feet while mean depth was from 4.6 to 31 feet. All seven lakes appeared to have either perennial, seasonally intermittent, or streams that are present only during high water. Four of the lakes had streams that clearly provided anadromous fish passage to Cook Inlet. Table 6 compares physical characteristics of the lakes.

# Table 4.

LAKE GILL NET CATCH-PER-UNIT-EFFORT $\frac{1}{}$ KENAI NATIONAL WILDLIFE REFUGE - 1983

							•
	LAKE	. RBT	DOV/ARC	COS	SOS	LNS	Total CPUE
12.	Beaver	0.76	0.00	0.05	0.00	1.69	2.49/50
13.	Bedlam	1.45	0.00	0.00	0.02	0.00	1.4817
14.	Bird	0.88	0.00	0.00	0.00	0.00	0.88
15.	Dolly Varden (6/7)	0.01	0.51	0.00	0.00	0.00	0.52
	Dolly Varden (8/2)	0.04	0.09	0.00	0.00	0.00	0.13
	Dolly Varden (9/26)	0.03	0.81	0.00	0.00,	0.00	0.84
16.	، Neckshorta	0.50	0.00	0.00	0.00	0.00	0.50
17.	Rock	0.00	0.00	0.00	0.21	0.26	0.48 7
18.	Two Island	1.45	0.00	0.15	0.00	0.00	1.59%
No.	Lakes	7	7	. 7	7	7	7
No.	Cases	9	9	9	9	9	9
Meai	า	0.57	0.16	0.02	0.03	0.22	0.99
Stai	ndard Deviation	0.60	0.30	0.05	0.07	0.56	0.74
Ran	ge	0.00- 1.45	0.00-	0.00- 0.15	0.00- 0.21	0.00- 1.69	0.13- 2. <b>49</b> 50

1/ Number of fish per net hour

# Table 5.

# LAKE MINNOW TRAP CATCH-PER-UNIT-EFFORT $\frac{1}{}$ KENAI NATIONAL WILDLIFE REFUGE - 1983

	Lake ,	RBT	DOV/ARC	COS	LNS	TSB	NSB	SCU	Total CPUE
12.	Beaver	0.02	0.00	0.04	<b>∢</b> 0.01	2.66	0.00	0.00	2.72
13.	Bedlam	0.03	0.00	0.00	0.00	2.58	0.00	0.00	2.61
14.	Bird	40.01	0.00	0.00	0.00	1.95	0.00	0.00	1.95
15.	Dolly Varden	<u>(6/7)</u> 0.00	0.00	0.00	0.00	0.57	0.00	0.22	0.80/ 7
	Dolly Varden	<u>(</u> 8/2) 0.00	0.00	0.00	0.00	0.04	0.00	0.35	0.39
	Dolly Varden	<u>(</u> 9/26)0.00	0.00	0.00	0.00	0.09	· <b>-</b> 0.00	0.48	0.56
16.	Neckshorta	0.00	0.00	0.00	0.00	1.07	0.00	0.00	1.07
17.	Rock	0.00	0.00	0.00	0.00	1.29	0.00	0.01	1.30
18.	Two Island	0.02	∠0.01	0.01	0.00	2.81	<0.01	0.0Ò	2.84
No.	Lakes	7	7	7	7	7	7	7	7
No.	Cases	9	9	9	9	9	9	9	9
Mea	n	0.01	∠0.01	0.01	<0.01	1.45	<b>4</b> 0.01	0.12	1.58
Sta	ndard Deyiation	0.01	-	0.01	-	1.10	-	0.19	0.97
Ran	ge .	0.00- 0.03	0.00- <0.01	0.00- 0.04	0.00- <0.0	0.04- 1 2.81	0.00- <b>&lt;</b> 0.01	0.00- 0.48	0.39- 2.84

1/ Number of fish per trap hour

## LAKE PHYSICAL FEATURES KENAI NATIONAL WILDLIFE REFUGE - 1983

, L	ake	Surface Area (Ac)	Maximum Depth (Ft.)	Mean Depth (Ft.)	Lake Volume (Ac.Ft.)	Water Trans. (Ft.)	Spawning Streams (No.)	Anadromous Streams (No.)
} 12.	Beaver	425	14	4.6	1,970	3.6	1	
13.	Bed]am	150	27	12.7	1,900	15	1 . :	
14.	Bird	203	27	16.9	3,420	11.5	1	0
1 <sub>15.</sub>	Dolly Varden	242	95	31	7,540	43	1 <u>1</u> /	0
 16.	Neckshorta	123	27	11	1,300	16	01/	0
17.	Rock	330	, 53	27	1,100	16	ן <u>1</u> /	<u>ן 1</u> /
18.	Two Island	120	25	13.3	1,500	10	1	1

,

1/ Stream fish passage may be present during periods of high water

#### CHEMICAL PROPERTIES

Chemical properties of water often reflect its suitability for fish survival and growth. Alkalinity, phosphorus, nitrogen, and conductivity are interrelated indices of lake fertility. The pH affects the fertility as well as spawning success. Dissolved oxygen levels of greater than 6.0 mg/1 are considered desirable for cold water fish such as trout and char. We interpreted lake productivity using J.B. Moyle's classification based on water alkalinity level (MacKenthun and Ingram 1967). We also calculated a Morphoedaphic Index (MEI) for each lake.

In the seven lakes surveyed MEI ranged from 3.6 to 77.3. Alkalinity varied from 17 to 89 mg/l. Waters were slightly alkaline with pH's from 7.1 to 7.7. Dissolved oxygen concentrations varied from 0.5 to 13.2 mg/l. Although low oxygen levels were found, they were largely confined to the lower depths of the lakes and did not appear to represent a significant fishery problem. A comparison of lake chemical properties measured during July is in Table 7.

#### VEGETATION AND WILDLIFE

Major types of aquatic vegetation representing 15 families and 34 species were found in the seven surveyed lakes. The principal families included pondweed, water lily, water milfoil, and sedge.

Over the season, there was a noticeable difference in the variety of plant species and percent of vegetation coverage found at each lake. Much of the vegetation was dormant or just emerging in June and was not fully developed until late July. Therefore, lakes surveyed in June and early July may not reflect the full abundance of aquatic plant species that would be present later in the year. The percent of aquatic vegetation coverage would be lower for early surveys compared to surveys later in the season. Table 8 lists the number of aquatic plant species identified for each lake and the percent of aquatic vegetation coverage. Table 9 cross indexes aquatic plant families to scientific and common names.

Wildlife sighted during the surveys consisted of mammals and birds. The mammals included moose, beaver, muskrat, bats, bear, squirrel, and hare. Five classes of birds were seen including raptors, waterfowl, gulls, passerines, and terns. The number of bird and mammal species sighted at each lake is in Table 8. Table 7.

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## LAKE CHEMICAL CHARACTERISTICS KENAI NATIONAL WILDLIFE REFUGE - JULY, 1983

	Lake	D.O. Range (mg/l)	рН	Specific Conductance @ 25°C	Alkalinity (mg/l)	Total Phosphorus (µg/l)	Kjeldahl Nitrogen (mg/l)	MEI
12.	Beaver	9.5 - 8.0	7.6	109	49~	36	0.51	77.3
13.	Bedlam	9.6 - 0.8	7.7	129	59	15	0.36	33.4
14.	Bird	9.7 - 1.6	7.4	99	39	14	0.34	19.3
15.	Dolly Varden	13.2 - 4.3	7.1	34	17	6 ·	0.19	3.6
16.	Neckshorta	10.0 - 1.5	7.3	66	31	18	0.34	6=2 1517
17.	Rock	11.6 - 0.5	7.6	98	44	9	0.52	. 11.7
18.	Two Island	9.7 - 0.7	7.5	177	89	22	0.41	13:3 43,7
No.		- 7	7	7	7	. 7	7	7
Mear	. · 1	- ·	7=5 -	102	47	17	0.38	23-55 2.5, 9
Star	ndard Deviati	on –	0.21 -	45.4	23	9.9	0.11	2577
Ranç	je	0.5 - 13.2	7.1-7.7	34-177	17-89	6-36	0.19-0.52	3.6-77.3

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# Table 8.

## AQUATIC VEGETATION AND WILDLIFE KENAI NATIONAL WILDLIFE REFUGE - 1983

	Lake	Number Aquatic Species	Percent Lake Coverage	 Number Bird Species	Number Mamma <u>l</u> Species	
12. 13.	Beaver Bedlam	9 16	28 38	 8 8		
14.	Bird	18	27	8	4	
15.	Dolly Varden	11	10	13	2	
16.	Neckshorta	14	53	2	3	
17.	Rock	9	4	10	. 2	
18.	Two Island	18	25	 15	 1	

# AQUATIC PLANT FAMILIES AND SPECIES

	Family	Common Name	Scientific Name
1.	Buckwheat	water smartweed	Polygonum amphibium
2.	Bur Reed	bur reed.	Sparganium angustifolium
3.	Crowfoot	crowfoot	Ranunculus confervoides
4.	Duckweed	duckweed star duckweed	Lemna <u>minor</u> Lemna trisulca
5.	Gentain	buck bean	<u>Menyanthes</u> trifoliata
6.	Hornwort	hornwort	Certatophyllum demersum
7.	Horsetail	horsetail	<u>Equisetum</u> <u>fluviatile</u> Equisetum <u>palustre</u>
8.	Muskgrass	chara	<u>Chara</u> sp.
9.	Pondweed	pondweed pondweed pondweed pondweed pondweed pondweed pondweed pondweed pondweed	Potamogeton Potamogetonberchtoldi friesii gramineus gramineusPotamogeton Potamogetonfriesii gramineus filiformis parelongus perfoliatusPotamogeton Potamogeton Potamogetonparelongus perfoliatus alpinus zosterifolius
10.	Primrose	tufted loostrife	Lysimachina thyrsiflora
11.	Quillwort	quillwort	<u>Isoetes</u> <u>muricata</u>
12.	Sedge	spike rush bulrush sedge sedge sedge sedge	<u>Eleocharis palustris</u> <u>Scirpus validus</u> <u>Carex rostrata</u> <u>Carex rhynchophysa</u> <u>Carex saxatilis</u> <u>Carex sp.</u>
13.	Water Lily	dwarf water lily yellow pond lily	<u>Nymphaea tetragona</u> Nuphar polysepalum
14.	Water Plantain	arrowhead	<u>Sagittaria</u> cuneata
15.	Water Milfoil	water milfoil milfoil mare's tail	<u>Myriophyllum spicatum</u> <u>Myriophyllum sp</u> . Hippuris vulgaris

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Detailed reports for the remaining seven lakes surveyed in 1983 follow. In alphabetical order the lakes are: Beaver, Bedlam, Bird, Dolly Varden, Neckshorta, Rock, and Two Island.

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#### BEAVER LAKE

## INTRODUCTION

A fishery survey of Beaver Lake was conducted from September 21-23, 1983. Additional water quality data were gathered on July 21, 1983. Table 1 summarizes Beaver Lake survey findings.

#### PHYSICAL FEATURES

Beaver Lake is tributary to the Kenai River via Beaver Creek. The lake is located in the west central section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 39' and longitude 150° 58'. The lake and surrounding area were classified in the Moderate Land Use Management Category under Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983). Beaver Lake has a surface area of 425 acres, a volume of 1,970 acre feet, and is at an elevation of 132 feet. The lake is relatively shallow with a mean depth of 4.6 feet and a maximum depth of 14 feet (Table 1 and Figure 1).

The watershed includes approximately 3,000 acres of bogs, lowlands, and low hills rising to slightly over 200 feet in elevation. The exact watershed acreage is difficult to determine due to the flat terrain. Mixed stands of mature and immature paper birch, and white spruce surround the lake with black spruce in wet areas. All the surrounding terrestrial habitat, except for a mature forest stand on the east side, was burned in the 1969 fire.

The water regimen of the lake is maintained by springs, runoff, four small inlet streams, and Beaver Creek, the single outlet. Little or no flow was detected in the inlets at the time of survey. Beaver Creek appeared to be flowing about five cubic feet per second. Beaver Creek provides anadromous fish passage for salmon and spawning habitat for rainbow trout.

Marathon Oil Road provides access to within one mile of the lake. However, the last five miles of the road are closed to public vehicular traffic. The lake can also be reached by float plane. There are no public facilities on the lake.

#### FISH

Fish captured included rainbow trout, juvenile coho salmon, longnose sucker, and threespine stickleback (Table 2). Rainbow trout taken in gill nets had a moderately high catch per unit of effort (CPUE) of 0.76 fish per net hour, while juvenile coho salmon were 0.05. Longnose sucker were abundant at a CPUE of 1.69. Minnow traps took a moderately high CPUE of threespine stickleback at 2.66 fish per trap hour, as well as low numbers of coho salmon, rainbow trout, and longnose sucker. A total of eight gill nets and 20 minnow traps were used to measure fish abundance.

U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

Table l.

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		Rooven Lake	· .	Survey Date	-7 (s) 9/21	-21 <i>-</i> 83 -23/83	Water ( <u>Fish</u>	}ua].
Wate	er Body	Deaver Lake					~	
1.	Location: Latitude	Refuge N 60° 39' 35"	Kenai NWR Longitude	W 150° 58' 35"	T _7N Map. 1	_R <u>10</u> Ref(	<u>  5 3</u> ;-3	5
2.	Physical   Volume	Data: Surface /	Area <u>425 Ac.</u> Water Color	Max. Depth <u>14</u> Dark Yellow G	<u>Ft.</u> Mea reen Wa e bas four	an Dept ter Tra Small	n <u>4.6 E</u> ns <u>3.6</u> inlets.	<u>t.</u> 
•.	Drainage Three of of the Ta	Area 3,000 AC the inlets are ake. The flow w	in the western was extremely lo	sub-basin and th w to negligible	<u>e fourth a</u> at the tim	t the no	rvey.	end)
·	Outlets ( lake. F	cfs) <u>Beaver Cr</u> low was difficul	reek, the only only only only only only on the evaluate,	<u>utlet, 18 locate</u> <u>but was estimate</u>	<u>d to be ap</u>	proxima	tely 5	cfs.
	Spawning trout sp	Habitat Beaver awning habitat.	Creek connects	to the Kenai Ri	ver and pr	ovides	The la	$\frac{1}{1}$
3.	Access <u>M</u> miles of Water Qua pH 7. Kjeldahl	arathon Uil Road the road are c lity: D.O. 9.5 6 Alk. N 0.51 mg/1 ME	<u>a provides acces</u> losed to public <u>-8.0 mg/1</u> <u>49 mg/1</u> I <u>77.3</u> SI	vehicles. mp. <u>19.1–18.0°</u> Hard. <u>51 mg/1</u> F <u>2,66</u> Po	<u>C</u> CON Ph 1,1ution	d. <u>109</u> os. <u>36</u> <u>None</u>	umhos_@ _ug/l	<u>) 25</u> °(
4.	Fish Spec salmon (	ies: (Abundanc L), longnose su	e, H/M/L, Intro cker (H), threes	duced) <u>Rainbow</u> spine stickleback	trout (M-H < (M-H) Tota	1), juve al Spec	<u>nile co</u> ies <u>4</u>	2ho
5.	Managemer FWS in 1 trout, f	nt History: 1978. These sur high populations	Beaver Lake was veys found mode of longnose su	<u>surveyed in 1967</u> rately high to 1 cker, and a few .	7 by the AI high popula juvenile co	)F&G_and ations_c pho_salm	Lby the second s	e how
6.	Current F the lake Longnose normal medium	Fishery Status: e. The lake als e sucker were ab fish tolerance l to high producti	<u>Rainbow trout</u> o serves as a n oundant (CPUE 1. mits. Alkalini vity.	are the dominan ursery area for 69). Water qual ty concentration	t game fis juvenile c ity condit indicates	h (CPUE oho salr ions wen the lal	0.76) non ce with <e is="" o<="" td=""><td>in  </td></e>	in  
7.	Vegetatio crowfoo	on : Aquatic t (1 Sp.), water	Plant families milfoil (1 Sp.	- pondweed (2 Sp ), bur reed (1 S	.), water p.), sedge Covera	<u>1ily (2</u> (2 Sp. age %	<u>Sp.),</u> ). 28	
	Terrestr 	ial <u>Surrounding</u> and black sprud	y habitat is mai ce. Bogs were c	nly mature and i lassified as scr	mmature pa ub=shrub t	per bir o emerg	<del>ch, whi</del> ent	-te
8.	Wildlife Five tr	: <u>Waterfowl (4</u> umpeter swans a	<u>Sp.), passerines</u> nd one bald eag	(2 Sp.), raptor e were seen on t	rs (1 Sp.) The lake.	mammal	<u>s (3 S</u>	<u>).</u>
9.	Recreati as a te Faciliti	on: Hunting, ent camp fishery es None	fishing. In 1 . The tent camp	976 an aircraft o fishery is no l	operator wa onger in o	as usino peratio	the land	ake
	<u>Survey</u> C	rew: Fried	ersdorff, Chalk	, Johnson, Bailey	У			<u></u> :

# Figure 1.

# **BEAVER LAKE**

(425 Acres)



Table 2.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

	Water Body	Beaver Lake	Code No	Survey Date	9/21-23/83
• .					

,	Averade	·	<u> </u>				Fi	sh CPUE	•	
Gear	Fishing Time (hrs.)	Amount Gear (Sg.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour	
8 Gill Nets	27	1280.	1.0	Rainbow Trout	• 5	0-2-3	0.15	N/A	N/A	
· · · · · · · · · · · · · · · · · · ·				Coho Salmon	y 2	0-0-9	0.26	N/A N/A	N/A N/A	
		1200	20	Rainbow Trout	58	6-27-25	1.68	N/A	N/A	
		1200	2.0	Coho Salmon	1	0-0-1	0.03	N/A	N/A	
•	•			Longnose Sucker	39	0-0-39	1.13	N/A	N/A	
		1280	2.5	Rainbow Trout	61	10-30-21	1.77	N/A	N/A	
			_ • •	Longnose Sucker	69 .	0-0-69	2.00	N/A	N/A	
	•	1280	.3.0	Rainbow Trout	37	7-24-6	1.07	N/A	N/A	
	•			Longnose Sucker	109	0-0-109	3.15	N/A	N/A N/A	
•		1280	4.0	Rainbow Trout	3	0-2-1	0.09	$\cdot N/A$	N/A	
• •				Longnose Sucker	146	0-0-140	) 4.23			
By Species	. 27	6400		Rainbow Trout	164	23-85-56	5 0.95	0.76	N/A	
by operation .	• •			Coho Salmon	10	0-0-10	0.06	0.05	NZA NZA	
	· · ·			Longnose Sucker	365	0-0-365	2.11	1.09	<u>N/A</u>	
Total Fish	27	6400		All Species	539	23-85-43	1 3.11	2.49 -	°⊂ N/A	
•		•		·						
								•		
20 Minnow Tr:	ang 23	N/A	N/A	Rainbow Trout	8	0-0-8	N/A	N/A	0.02	
20 1111100 110	1p3 20	1.		Coho Salmon	18	0-0-18	N/A	N/A	0.04	
· · ·				Longnose Sucker	1	0-0-1	N/A	N/A	<0.01	
:				Threespine Stickleback	1222	0-0-1222	N/A	N/A	2.66	
Total Fish	23	N/A	N/A	All Species	1249	0-0-1249	N/A	N/A	2.72	
								· · · · · · · · · · · · · · · · · · ·		

Rainbow trout captured in gill nets had a mean fork length of 12.0 inches (305 mm), while the mean fork length from minnow traps was 4.5 inches (115 mm). The fork length range for both gears was from 3.6 inches (92 mm) to 16.9 inches (430 mm). Trout weight averaged 0.8 pounds (363 g) from gill nets and 0.3 pounds (15.8 g) from minnow traps. Weight from both gears varied from 0.02 pounds (9.2 g) to 2.1 pounds (960 g). Condition factors for rainbow trout ranged from 0.51 to 1.93 with a mean of 1.18. Table 3 provides a breakdown for rainbow trout weight and condition by length class. Age structure of the rainbow trout varied from one to eight years. Average annual growth of the trout was 2.1 inches (55 mm). Table 4 shows age and growth of rainbow trout back calculated from scale samples. a stand where the second second second second second second second second second second second second second se Coho salmon captured in gill nets and minnow traps had a mean fork length of 4.6 inches (117 mm) with a range from 3.3 inches (84 mm) to 5.6 inches (143 mm). Their mean weight was 0.04 pounds (18.2 g) and varied from 0.02 pounds (6.9 g) to 0.07 pounds (29.7 g). Coho condition factors averaged 1.09 with a range of 0.86 to 1.23. A sample of 16 coho salmon contained both one and two year old fish. No length or weight data were taken on longnose sucker.

#### AQUATIC VEGETATION

Aquatic vegetation was abundant in shallow areas around the lake's periphery and in the southwest sub-basin. Water lily and pondweed were the dominant plant families. Other families included crowfoot, water milfoil, bur reed, and sedge. Approximately 28 percent of the lake was covered with aquatic plants. Table 5 lists aquatic species found with locations plotted in Figure 1.

#### WATER QUALITY

During July all water quality parameters measured were found to be within acceptable limits for fish. Lake water fertility was medium to high using a classification of Minnesota Lakes based on alkalinity levels (MacKenthun and Ingram 1967). Specific conductance at 25°C was 109 umhos, total alkalinity 49 mg/l, total hardness 51 mg/l, total phosphorus 36 ug/l, and Kjeldahl nitrogen 0.51 mg/l. During July dissolved oxygen (Table 6) was slightly supersaturated at the surface (9.5 mg/l) to about 80 percent saturated near the bottom (8.0 mg/l). The lake was not thermally stratified. Water color was dark yellow green with a Secchi disc visibility of 3.6 feet. The Morphoedaphic Index was 77.3 and Shoreline Development Factor 2.66. Additional water quality data are presented in Tables 1 and 7.

#### MANAGEMENT HISTORY

Beaver Lake was first surveyed by the Alaska Department of Fish and Game in 1967 (Logan 1967). They used three 125 foot x 6 foot experimental gill nets that were fished for 23 hours: A total of 96 rainbow trout, 134 longnose sucker, and 2 juvenile coho salmon were captured for respective CPUE's of 1.39, 1.97; and 0.03 fish per net hour. State biologists indicated the lake had an excellent rainbow trout sport fishery according to Don Johnson,
# FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Beaver Lake - 1983

# FISH LENGTH BY MESH SIZE

Gear Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F. Length SD* (mm)	F. Length Range (mm)
8 Gill Nets Rainbow Tro 20 Minnow Traps	out 1.0 2.0 2.5 3.0 4.0 0.125	3 50 56 35 3 7	275 275 312 342 285 115	 43.3 45.7 36.4 27.6 68.7 14.1	$225 - 300 \\ 210 - 400 \\ 240 - 430 \\ 275 - 400 \\ 210 - 345 \\ 92 - 130$
4 · · · · · · · · · · · · · · ·					

FISH WEIGHT BY LENGTH CLASS


Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
20 Minnow Traps 8 Gill Nets	Rainbow Trout	$51 - 100 \\ 101 - 150 \\ 201 - 250 \\ 251 - 300 \\ 301 - 350 \\ 351 - 400 \\ 401 - 450 \\ 100 \\$	2 5 22 33 36 23 1	9.45 18.4 144 255 418 613 960	0.35 2.78 42.4 53.7 79.8 117	9.2 - 9.7 16.6 - 23.3 100 - 280 125 - 370 255 - 645 400 - 950 960 - 960

# FISH CONDITION (K) BY LENGTH CLASS

Gear Species	Length Class (mm)	Sample No.	Condition · Mean	(	Condition SD	Condition Range
20 Minnow Rainbow 'Traps 8 Gill Nets	Trout $51 - 100$ 101 - 150 201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	2 5 22 33 36 23 1	1.10 0.99 1.19 1.15 1.19 1.23 1.21		0.21 0.09 0.26 0.16 0.13 0.21	0.95 - 1.25 0.90 - 1.11 0.94 - 1.93 0.51 - 1.45 0.82 - 1.50 0.89 - 1.88
Totals	A11	122	1.18		0.19	0.51 - 1.93
*Standand Deviation	an an an an an an an an an an an an an a					•

\*Standard Deviation

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Table 3.

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Table 4.

# AGE-GROWTH\* OF RAINBOW TROUT BEAVER LAKE, 1983

Year Class	No.	Fork Le I	ength (1 II	FL) In 1 III	Millime IV	ters at V	Annulı VI	us Forr VII	nation VIII	Capture FL
1982 1981 1980	1 5 7	.58 39 40	85 103	164			· .			92 122 218
1979	8	41	87	148	205			•••	• •	261
1978	.8	43	94	155	215	277	•			324
1977	5	41	86	149	215	276	325			359
1976	l 1	33	80	155	226	278	344	377	1 4	400
1975	1	58	<sup>,</sup> 97	143	186	232	310	384	426	430
Total	No.	36	35	30	23	15	7	2	1	
Ave.	FL(mm)	42	92	154	211	274	326	381	426	•
Ave.	FL(in)	1.7	3.6	6.1	8.3	10.7	12.8	14.9	16.8	

\*Not corrected for length at scale formation

#### BEAVER LAKE ASSOCIATED VEGETATION

#### AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name		
Emergent Emergent	Cunid SR	sedge spike rush	<u>Carex sp.</u> Eleocharis palustris		
Floating Floating Floating	BR DWL YPL	bur reed dwarf water lily yellow pond lily	Sparganium angustifolium Nymphaea tetragona Nuphar polysepalum		
Submergent Submergent Submergent Submergent	MR PL PR WWC	water milfoil pondweed pondweed crowfoot	Myriophyllum spicatum Potamogeton filiformis Potamogeton perfoliatus Ranunculus confervoides		
l <u></u>	قر -	WETLANDS VEGETATION			
Class	Symbol	Vegetation Reference			
		National	Watlands Inventory (Konai)		

Emergent PEM5 Scrub-shrub PSS1B National Wetlands Inventory (Kenai) National Wetlands Inventory (Kenai

## TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name	
Trees Trees Trees Trees Trees Trees	BS IB IS MB MS	black spruce immature paper birch immature white spruce mature paper birch mature white spruce	<u>Picea mariana</u> <u>Betula papyrifera</u> <u>Picea glauca</u> Betula papyrifera Picea glauca	
Shrubs Shrubs	A ŞG	alder sweet gale	<u>Alnus sp.</u> Myrica gale	
Below Shrub	G	grass	Gramineae	

Table 6.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

### Water Analysis Data Sheet

 Study
 Remote & Roadside Lake Study, Kenai NWR, 1983-84

 Water Body
 Beaver Lake
 Survey Date/Time
 7-21-83/1345

 Lake Location (Latitude) N 60° 39' 35"
 (Longitude) W 150° 58' 35"

 Code No.
 Survey Crew
 Friedersdorff, Jakubas

 Cloud Cover (%)
 80
 Wind (mph)
 3-5
 Air Temp (°C)
 Chop (in)
 3 0

Sample Depth (m)	Water Temp.	D.O. (mg/1)	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (y <b>g</b> /l)
	<u> </u>	9:5	7.6	97*	49	51	XVI	],]	36
1	19 0	9:6							
2	18.2	9 5	7 6	97			(4		•
	18.0	8,15	7.0						
	18.0	8.0	·		······································				
	10.0								
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Remarks: Equipment used: D.O. & Temp.- YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Marson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20'cm Secchi disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 7.

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# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

Study	Remote & R	<u>oadside La</u>	<u>ke Study. K</u>	enai NWE	<u>, 1983-8</u>	34	/1 [ 0 0	3	- 61.
Water B	ody Beave	r Lake	Surv	vey Date	(1100)	<u>9722783</u>		· · · · ·	
Lake Lo	cation (Lat	itude) <u>N 60</u>	<u>39' 35"</u>			N 150 5	8-35-		
Code No		Survey Lre	W <u>· Fried</u>	ersdorti Air Te	mn (°C)	11 2 0	hop (in)	6.08	
Cloud C	lover (%) <u>98</u>	<u>, 4955</u> Wind (	mpn) <u>3-5</u>		p ( 0)_			F Satisfies	
Station	ll			49.586		and the second second		T	
									1.2.10

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Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	рН )т	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (u.g/l)
0	10.2	9.9						2.0	
1	10.2	9.9							
2	10.1	9.9					( <b>4</b>		
3	10.0	9:9		•		1			
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Remarks: Equipment used: D.O. & Temp. -YSI 57 Meter; Water Transparency 20 cm Secchi disc.

a Kenai charter pilot, who was operating a fly-in tent camp on the lake. The lake was again sampled on June 1-2, 1978, by the U.S. Fish and Wildlife Service (Crateau, Wooley, and Oliver 1978). One experimental gill net, fished for 19 hours, captured 58 longnose sucker and 17 rainbow trout. The suckers had a mean fork length of 16.1 inches (410 mm) with a range of 10.4 inches (263 mm) to 19.5 inches (495 mm). The mean weight of the suckers was 1.5 pounds (700 g) and ranged from 0.4 pounds (185 g) to 2.8 pounds (1,275 g). The mean condition factor for the 17 rainbow trout was 0.91. CPUE for rainbow trout was 0.89 fish per net hour and 3.05 for longnose sucker. No other fishery surveys are known to have been conducted on the lake.

#### WILDLIFE

A total of five trumpeter swans were seen on the lake. There was also one bald eagle. Three additional species of waterfowl, two species of passerines, and one gull were also observed. We located one trumpeter swan nesting site. The number and variety of birds we observed may have been lower than normal due to high winds and rain. Three active and one inactive beaver lodges were located on the lake along with moose and muskrat sign. All wildlife species recorded are listed in Table 8.

# RECREATIONAL USE

The lake is believed to receive only light fishing and hunting pressure due to difficult access. No anglers were present during our survey. A hunting camp with a cleared area, "A" frame, table, and racks, was located at the southeast end of the lake. The remainder of the lake shows little sign of human use.

#### FISHERY RESOURCE SUMMARY

Our fishery survey indicated the lake had a moderately high abundance of rainbow trout (CPUE 0.76). Recruitment of younger rainbow trout age classes is occurring. Beaver Creek is believed to provide good rainbow trout spawning habitat. Evidence of rainbow trout spawning has been found in Beaver Creek (Elliot and Finn 1983). The creek also provides anadromous fish passage to the Kenai River. Juvenile coho salmon utilize the lake as a nursery area. Other fish species present include a high abundance of longnose sucker and moderately high abundance of threespine stickleback. Our survey results supported findings of previous fish surveys. Lake water fertility is moderate to high. Other water quality parameters were within acceptable fish tolerance limits. Current sport fishing pressure is believed to be low. Beaver Lake is considered to have-theopotential to support a moderately high yield rainbow trout sport fishery. Le Table 8.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Wildlife Data Sheet

Study <u>Remote & Roadside Lake Study, Kenai NWR, 1983-84</u> Water Body <u>Beaver Lake</u> Survey Date/Time <u>9/21-23/83 + 10-7-83</u> Lake Location (Latitude)N 60° 39' 35" (Longitude)<u>W 150°-58' 35"</u> Code Number Survey CrewFriedersdorff, Chalk, Johnson, Bailey

Ani ·Cla	mal . ss	Common Name Nu	mber	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds	s Waterfowl	Barrow's Goldeneye Green-winged Teal Red-breasted Merganser Trumpeter Swan	14 15 3 5	0-0-14 0-0-15 0-0-3 0-0-5 S	Flock Flock Single ingle/Flo	Sight Sight Sight ck Sight	Flight Water Water Water
	Gulls	Unid. Gull	2	0-0-2	Single	Sight	Flight
	Passerines	Gray Jay Common Redpoll	1 1	0-0-1 0-0-1	Single Single	Sight Sight	- -
	Raptors	Bald Eagle	ĺ	0-0-1	Single	Sight	Lake Edge
Mamm	als Big Game	Moose		-		Browse	• • •
	Furbearers	Beaver Muskrat	1 -	0-0-1	'Single - N	Sight Aussel Shel	Water ls -

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles

Remarks:

• One swan had radio collar. Three active and one inactive beaver lodges on the lake. BEDLAM LAKE

#### INTRODUCTION

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A fishery survey of Bedlam Lake was conducted on August 18-19, 1983. Additional water quality data were gathered on July 20, 1983. Table 1 summarizes Bedlam Lake survey findings.

PHYSICAL' FEATURES

2日本語の「小説」の時、

Bedlam Lake is located in the northern section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 55' and longitude 150° 20'. The lake and surrounding area were designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. Bedlam Lake has a surface area of 150 acres, a volume of 1,900 acre feet, and is at an elevation of 177 feet. The lake has a mean depth of 12.7 feet and maximum depth of 27 feet (Table 1 and Figure 1).

Bedlam Lake is situated in low hill terrain. Mull Lake and several smaller ponds are included in an approximate 3,000 acre watershed. Terrestrial vegetation consists of a forest of mature black spruce, white spruce, paper birch and alder shrubs. A large scrub-shrub bog is located at the east end of the lake.

Lake water level is maintained by streams, springs, and runoff. Bedlam Creek is the only outlet for the lake and flows about five miles to Cook Inlet. This outlet stream is 14 feet wide and one to three feet deep proximal to the lake. A beaver dam, located about 100 yards downstream from the lake, had been opened; water was flowing through it at four to six cubic feet per second. Hundreds of juvenile rainbow trout were seen in the stream. Bedlam Creek provides trout spawning habitat for the lake. We did not ascertain if the stream below the lake was open for the migration of anadromous fish. A sluggish inlet stream, in the southeastern part of the lake, connects to Mull Lake. It is about 16 feet wide, three feet deep, and heavily vegetated. Flow in this stream was imperceptible.

Access to the lake is by float plane. Alaska Bush Carrier Inc. holds a Special Use Permit for the lake and have two camp sites on the lake. There are no other public facilities.

FISH Rainbow trout, sockeye (Kókánée) salmon, threespine stickleback, and slimy sculpin were netted during our survey (Table 2). Rainbow trout was the primary game fish in the lake with a gill net catch per unit of effort (CPUE) of 1.45 fish per net hour. This tied with one other lake for the highest rainbow trout relative abundance found during 1983. Three sockeye salmon were also captured (CPUE 0.02). Sockeye size indicated the fish may be result kokanee - the resident form of sockeye salmon. Arthough-it-is-likely-the sockeye were kokanees proof of in a lake spawning was not found during the support Threespine stickleback from minnow traps were in moderately high

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# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

			7-20-83 Water Qu
Wat	er Body Bedlam Lake	Survey Date(s)	8/18-19/83 Fish
1.	Location: Refuge Kenai NWR LatitudeN 60° 55' 30"Longitud	TTTTTT eW_150° 20' 45"Maj	ON R <u>6W</u> S <u>28</u> p. Ref. <u>Kenai (D-1)</u>
2.	Physical Data: Surface Area 150 Ac. Volume 1,900 Ac. Ft: Water Col Drainage Area 3,000 Ac. Mull Lake. It was 16 feet wide by thr Outlets (cfs) Bedlam Creek is the sin Cock Inlet. The flow was estimated to	Max. Depth <u>27 Ft.</u> or <u>Green Yellow</u> ets (cfs) <u>There is one in</u> ree feet deep. Flow was ngle lake outlet. It flow be between four and six	Mean Depth <u>12.7 Ft.</u> Water Trans <u>15 Ft.</u> <u>imperceptable</u> . <u>ws five miles to</u> <u>cfs</u> .
	Spawning HabitatBedlam Creek prov	ides rainbow trout spawni	ng habitat.
	Access Float plane.		
3.	Water Quality: D.O. <u>9.6-0.8 mg/1</u> pH <u>7.7</u> Alk. <u>59 mg/1</u> Kjeldahl N <u>0.36 mg/1</u> MEI <u>33.4</u>	Temp. <u>19.3-15.0°C</u> Hard. <u>59 mg/1</u> SDF <u>1.86</u> Pollution	Cond. <u>129 umhos @ 25°</u> Phos. <u>15 ug/1</u> <u>None</u>
4.	Fish Species: (Abundance, H/M/L, Int salmon (L), threespine stickleback (M	roduced) <u>Rainbow trout</u> -H), slimy sculpin	(H), sockeye/ kokanee Fotal Species 4
5.	Management History: The ADF&G surve trout, coho salmon, and sockeye (koka	yed the lake în 1964. 'Th nee) salmon.	ey found rainbow
•		i esukt	<u> </u>
6.	Current Fishery Status: <u>A high abun</u> 1.45), as well as, a low abundance of spine stickleback and slimy sculpin c commedium to high fertility. Water	dance of rainbow trout wa //sockeye (kokanee) salmor constituted the forage spe quality conditions were	as indicated (CPUE (CPUE 0.02). Three- ecies. The lake had favorable for fish.
7.	Vegetation : Aquatic Plant famili	ies - pondweed (7 Sp.), wa	ater lily (2 Sp.), morsetail (1 Sp.),
• •	water milfoil (I Sp.), sedge (I Sp.). Terrestrial <u>A mature white spruce</u> constitutes the dominant vegetation.	black spruce, and paper	erage % <u>38</u> birch forest
8.	Wildlife: Waterfowl (5 Sp.), passeri	nes (2 Sp.), raptors (1 S	p.), mammals (3 Sp.).
_		a comping A Special Us	e Dowmit is held by
9.	Alaska Bush Carrier for fly-instent Facilities Alaska Bush Carrier has	camps, Fishing pressure two camp sites on the la	is estimated to be lig ke. There are no
	other public facilities.	· · · · · · · · · · · · · · · · · · ·	

Survey Crew:

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Table l.

Friedersdorff, Jakubas

Figure 1.

BEDLAM LAKE



Table'2.

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# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE .

Summary Fish Catch and Effort Data

	Wate	r Body	Bedlam Lake	Code NoS	urvey Date	8/18-19/	83	· ·		10
•	-	· .						•	•	
·	Average		··· - · ·				Fis	sh CPUE		`
Gear	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour	
6 Gill Nets	24	960	1.0	Rainbow Trout	· 12	2-0-10	0.52	N/A	N Z A	
	•	960	2.0	Rainbow Trout	106	25-30-51	4.60	N/A	N/A	
		960	2.5	Rainbow Trout Sockeye Salmon	58 1	0-0-1 8-21-29 0-0-1	0.04 2.52	N/A N/A	N/A N/A	
•	•	960	3.0	Rainbow Trout	28	4-14-10	1.22	N/A	N/A N/A	
· · · · · · · · · · · · · · · · · · ·	<u>`</u>	960	4.0	Rainbow Trout	6	1-4-1	0.04	N/A . N/A	· N/A N/A	
By Species	24 ·	4800	A11	Rainbow Trout Sockeye Salmon- <sup>J</sup>	210 3	40-69-10 0-0-3	1 1.75 0.03	1.45	N/A N/A	
Total Fish	24	4800	A11	All Species	213	40-69-10	4 1.78	1.48 7	N/A	
14 Minnow Traps	25	N/A	N/A .	Threespine Stickleback Rainbow Trout	× 902 10 ·	0-0-902 0-0-10	N/A N/A	N/A N/A	2.58	<u> </u>
Total Fish	25	N/A.	N/A	All Species	912	0-0-912	N/Å	N/A	2.61	
Seine	, N/A	, N/A	N/A	Threespine Stickleback Rainbow Trout Slimy Sculpin	210 2 1	0-0-210 0-0-2 0-0-1	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	<del></del>
otal Fish	N/A	N/A	N/A	All Species	213	0-0-213	N/A	N/A	N/A	

V Remand Service or Kakana Summer

abundance (CPUE 2.58), while several juvenile rainbow trout were also taken. One slimy sculpin was captured in a seine. A total of six gill nets and 14 minnow traps were used to determine fish abundance.

Rainbow trout captured in gill nets had a mean fork length of 11.0 inches (279 mm) while those taken in minnow traps averaged 4.1 inches (104 mm). The length range of these fish was from 3.4 inches (85 mm) to 19.9 inches (505 mm). The mean weight of the rainbows was 1.2 pounds (546 g) and varied from 0.02 pounds (7.4 g) to 3.2 pounds (1,460 g). The trout mean condition factor was 1.28 ranging from 0.61 to 2.62. Rainbow trout were found to range in age from one to nine years. The average annual growth rate of rainbow trout was 1.9 inches (48 mm).

The three sockeye (kokanee) salmon had a mean fork length of 11.6 inches (295 mm) varying from 8.5 inches (215 mm) to 13.4 inches (340 mm). Their weight averaged 1.0 pound (445 g) and ranged from 0.3 pounds (140 g) to 1.5 pounds (686 g). The mean condition factor for sockeye (kokanee) salmon was 1.52. Table 3 gives details of rainbow trout and sockeye salmon weight and conditon by length class. Table 4 shows rainbow trout age and growth determined by scale analysis. Sockeye salmon scales could not be aged.

#### AQUATIC VEGETATION

Aquatic vegetation was distributed around the lake periphery and in the lake's southeast end. Pondweed and water lily were the dominant families. Duck weed, water milfoil, and rush were also present. Aquatic vegetation covered about 38 percent of the lake's surface area. Table 5 gives a complete list of aquatic species with locations plotted on Figure 1.

#### WATER QUALITY,

Lake water quality was satisfactory for fish. An alkalinity level of 59 mg/l indicated the lake was medium to high in fertility (MacKenthun and Ingram 1967). This was above the average fertility measured in the 18 lakes sampled during 1983. Specific conductance at 25°C was 129 umhos. Phosphorus was 15 ug/l and Kjeldahl nitrogen 0.36 mg/l. A pH of 7.7 equaled the most alkaline conditions found during the year. During July the lake did not have a hypolimnion, but water temperature declined with depth. The steepest temperature decline occurred between 13 feet and the bottom dropping from 18.5°C to 15°C. (Table 6). Dissolved oxygen levels in the lake were generally high. During July they were slightly supersaturated near the surface at 9.6 mg/l to 60 percent saturated being 5.9 mg/l at 20 feet. An oxygen level of 0.8 mg/l (one percent saturation) was present just above the lake bottom. Water color was greenish yellow, and Secchi disc water transparency was 15 feet. The lake had a Morphoedaphic Index of 33.4 and Shoreline Development Factor of 1.86. Additional water quality data are presented in Tables 1 and 7.

# FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Bedlam Lake, 1983

Gear	Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F.Length SD* (mm)	F.Length Range (mm)
6 Gill Nets 14 Minnow Traps	Rainbow trout Sockeye salmon	1.0 2.0 2.5 3.0 4.0 0.125 2.0 2.5 3.0	11 97 54 25 6 8 1 1 1	- 133 262 330 407 385 104 330 215 340	48.4 62.3 73.4 67.5 11.9 10.3 -	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

# FISH LENGTH BY MESH SIZE

# FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets 14 Minnow Traps ,	Rainbow trout Sockeye salmon	51 - 100 $101 - 150$ $151 - 200$ $201 - 250$ $251 - 300$ $301 - 350$ $351 - 400$ $401 - 450$ $451 - 500$ $501 - 550$ $201 - 250$ $301 - 350$	3 6 2 9 14 6 13 29 11 1 1 2	$     \begin{array}{r}       10.1 \\       27.8 \\       100 \\       165 \\       273 \\       485 \\       680 \\       949 \\       1134 \\       1460 \\       140 \\       598 \\     \end{array} $	2.70 25.7 7.07 29.8 34.0 164 135 138 207 - - 124	7.40 - 12.8 $12.9 - 80$ $95 - 105$ $105 - 210$ $230 - 360$ $225 - 710$ $425 - 885$ $710 - 1350$ $625 - 1350$ $1460 - 1460$ $140 - 140$ $510 - 686$

Table 3.

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Table 3 (Continued)

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
	<u> </u>					1 00 1 00
6 Gill Nets	Rainbow trout	51 - 100	3	1.23	0.04	1.20 - 1.28
14 Minnow Traps		101 - 150	6	1.51	0.55	1.22 - 2.62
• • • • • • • • • • • • • • • • • • •	and the second second second second second second second second second second second second second second second	151 - 200	2	1.41	0.18	1.28 - 1.53
		201 - 250	29	~ 1.37	0.13	1.15 - 1.78
	ا المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( المعنى ( ا المعنى ( المعنى ( الم	251 - 300	14	1.30	0.13	1.00 - 1.42
1	المرواني المروانية معرورة معالمة المعالية . المرواني المروانية المروانية المعرورة المعالية . المروانية المروانية المروانية المحمد المحمد .	301 - 350	6	1.40	0.41	0.79 - 2/07
		351 - 400	13	1.27	0.15	0.95 - 1.55
		401 - 450	29	1.18	0.09	0.94 - 1.35
		451 - 500	11	1.08	0.20	0.61 - 1.27
	····	501 - 550	1	1.13	<b>-</b> .	1.13 - 1.13
	Sockovo salmon	201 - 250	i	1.41	<u>م</u> رو	1.41 - 1.41
	SUCKEYE Samon	301 - 350	2	1.58	0.23	1.42 - 1.74
TRADARS	Painbow thout		114	-1.28	0.22	0.61 - 2.62
TOTALS	Sockeye salmon	A11	3	1.52	0.19	1.41 - 1.74

\*Standard Deviation

# FISH CONDITION FACTOR (K) BY LENGTH CLASS

· · · ·

Table 4.

# AGE-GROWTH\* OF RAINBOW TROUT Bedlam Lake, 1983

Year		F	ork Leng	ıth (FL	) in M <sup>.</sup>	illimet	ers at	Annulas	Format	ion	Capture
Class	No.	Ī	II	III	<u> </u>	<u> </u>	VI	VII	VI11	· 1 X	Weiger F Lawie
1982 😽	3	48								t e e	(19.2.94?).
1981	7	43	87	•			• <b>•</b>	•			124
1980	٦	48	<b>9</b> 5	138						•	190
1979	2	25	74	123	168						215
1978	3	43	75	121	168	219					263
1977	. 3	42	76	111	151	211	285				328
1976	4	41	¥ 08	118	164	216	279	344			399
1975	4	38	. 79	132	184	240	302	369	436		476
1974	1	31	82	132	167	214	264	303	342	439 ,	505
Total N	lo.	28	25	18	17	15	12	• 9	5	1	3 
Ave. FL	(mm)	) 41	81	123	168	222	287	351	417	439	
Ave. FL	. (in	) 1.6	3.2	4.8	6.6	8.7	11.3	13.8	16.4	17.3	

\*Not corrected for length at scale formation



Table 5.

# BEDLAM LAKE ASSOCIATED VEGETATION

# AQUATIC VEGETATION

1			
Class	Symbol	Common Name	Scientific Name
Emergent Emergent Floating Floating Floating Floating Floating Floating	HTF SR BR Dum DWL PN ST YPI	horsetail spike rush bur reed duckweed dwarf water lily pondweed arrowhead yellow pond lily	Equisetum fluviatile Eleocharis palustris Sparganium angustifolium Lemna minor Nymphaea tetragona Potamogeton natans Sagittaria cuneata Nunhan palusonalum
Submergent Submergent Submergent Submergent Submergent Submergent Submergent	DuT MR PA PF PG PL FR PZ	star duckweed water milfoil pondweed pondweed pondweed pondweed pondweed pondweed	Lemna trisulca Myriophyllum spicatum Potamogeton alpinus Potamogeton friesii Potamogeton filiformis Potamogeton perfoliatus Potamogeton zosterifolius

# WETLANDS VEGETATION

	Class Şymbol			Veg	etation Re	eference
•	Scrub-shrub PSS1B Emergent EM5B	_		National National	Wetlands Wetlands	Inventory (Kenai) Inventory (Kenai)
			• •			

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name	
Trees	BS	black spruce	<u>Picea mariana</u>	
Trees	MB	mature paper birch	<u>Betula:papyrifera</u>	
Below shrut	BB	buck bean	<u>Menyanthesitrifoliata</u>	
Below shrut	CR	sedge	<u>Carex rostrata</u>	
Below shrut	MFF	marsh fivefinger	<u>Potentilla:palustris</u>	

Table 6.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S.-FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

Study Remote and Roadside Lake Study, Kenai NWR, 1983-84

Water Body Bedlam Lake	Survey Date/Time 7-20-83/1420
Lake Location (Latitude) N 60° 5	5' 30" (Longitude) W 150° 20' 45"
Code No. Survey Crew	Friedersdorff, Jakubas
Cloud Cover (%) 100 Wind (mph)	✓1 Air Temp (°C) 17.2 Chop (in) 0.0
Station	

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	19.3	9.6	7.7	115*			XII	4.5	15
1	19.3	9.5				•			
2	19.2	9.5					1.4		
3	19.1	9.5		115	59	59	•		
-4	18.5	9.0							
5	17.5	7.8					•		
6	16.5	5.9		•			,	•	
6.5	15.0	0.8			•	•			·
						:			
							1 1 2		
	*Cor	ducti	ity i	djusted t	o 25°C is 12	9 umhos			
	•	<u>;</u> +				-		•	
						•			
						· ·		-	
		• •						•	
							· · -		

Remarks: Equipment used: \_\_D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Light Rain Table 7.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

	•	•		-					
Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/1)
0	17.1	8:6				•		5.5	
1	17.0	8.6				•.			
2	17.0	8.6					1 -	:	· · · · · · · · · · · · · · · · · · ·
3	17.0	8.6							-
4	17.0	8.6							
5	17.0	8.6							
.6	16.2	7.2			•		. 1		·
• 7	14.8	0.7				•			
									······
		· · ·						•	
	·								· · · · · · · · · · · · · · · · · · ·
								-	
	· · · · ·					•	the start	and the second	
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				19 <b>2</b> 4	· · · · · · · · · · · · · · · · · · ·			建晶体的主	NUMBER OF A
		·	÷ .	an an an an an an an an an an an an an a	1 Appendia Constanti		<b>自</b> 注意。	建建建立	
						· · ·		1- 19.24	the start of the start
	· .						•		
		1997 - S.		· .	•				

Remarks: Equipment used: D.O. & Temp. YSI 57 Meter; Water Transparency 220cm

#### MANAGEMENT HISTORY

Bedlam Lake was first surveyed by the Alaska Department of Fish and Game in 1964. They found rainbow trout, coho salmon, and sockeye (Kokanee) salmon at respective catches of 1.13, 0.13, and 0.04 fish per hour (McMullen 1964). In 1972, the U.S. Fish and Wildlife Service investigated a complaint that beaver dams on Bedlam Creek were preventing migration of coho salmon from Cook Inlet to the lake. Aerial and ground surveys indicated that the stream flow of Bedlam Creek, at the time of survey, was too low to permit fish migration.

# WILDLIFE

Belam Lake had one inactive beaver lodge on the eastern end. Although the dam on Bedlam Creek looked as if it had not been maintained in 1983, Alaska Bush Carrier personnel reported they had seen beaver living downstream from the lake. No active beaver lodge was present on the lake. Beaver may have been in neighboring Mull Lake, but no investigation was made since Mull Lake was scheduled for survey in 1984. Two sandhill cranes were seen as well as a large number of ducks. A great horned owl was heard at night. Muskrat and moose sign were detected. All wildlife species identified are listed in Table 8.

#### RECREATIONAL USE

Recreational uses of Bedlam Lake include fishing, wildlife viewing, and camping. Alaska Bush Carrier records indicate 83 fishing clients used the commercial tent camp facilities in 1982. The tent camp operators further indicated that most fishing takes place during the warm weather months. The lake has a reputation as a good rainbow trout fishery.

#### FISHERY RESOURCE SUMMARY

Bedlam Lake is a remote, wilderness lake. Our fishery survey found a Royaud high abundance of rainbow trout (CPUE 1.45). This CPUE tied with one other lake as the highest rainbow trout catch rate found in 1983. Sockeye (kokanee) salmon were taken in a low number. A moderately high abundance (kokanee) salmon were taken in a low number. A moderately high abundance of threespine stickleback and low number of slimy sculpin were also present The variety of rainbow trout age classes found indicated that successful spawning and recruitment are taking place yearly. The outlet stream is providing rainbow trout spawning habitat. We did not determine if an adromous fish migration from Cook Inlet is blocked. Lake water fertility was moderate to high, and water quality parameters were favorable for fish maintenance. Fishing pressure is estimated to be light. Bedlam Lake is considered to have the potential to support a high yield rainbow trout and low yield sockeye (kokanee) salmon sport fishery. Table 8.

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#### KENAI FISHERY RESOURCES STATION ALASKA\_FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Wildlife Data Sheet

Remote and Roadside Lake Study, Kenai NWR, 1983-84

Study Water Body <u>Bedlam Lake</u> Survey Date/Time 8-18-83 Lake Location (Latitude) <u>N 60° 55' 30"</u> (Longitude) <u>N 150° 20' 45"</u> Code Number Survey Crew Friedersdorff, Jakubas

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds	•				· · · ·	
Waterfowl	Barrow's Goldeneye Surf Scoter Uņid. Ducks Réd-necked Grebe Sandhill Crane	2 5 J+ 28 4 2.	0-2-0 0-0-5 0-0-28 0-0-4 0-0-2	Single Flock Flock Flock -	Sight Sight Sight Sight Sound	Water Water Flight Water 
Passerine	s Gray Jay Belted Kingfisher	1 1	0-0-1 0-0-1	Single Single,	Sound Sight	_ MB,MS
Raptors	Great Horned Owl	2	0-0-2	Single	Sound	MB,MS
Mammals Big Game	Moose	_	- · _	-	Tracks	-
Furbearer	s Muskrat	-	-	-	Mussel Shel	ls –
Others	Unid. Bats	2	0-0-2	Pair	Sight	Shoreline

M=Male; F=Female; U=Undetermined; J=Juvenile; Includes Juveniles MB=Mature Birch; MS=Mature Spruce Longia -Remarks: One inactive beaver lodge and dam on eastern outlet tributary no sign of recent beaver activity.

#### BIRD LAKE

#### INTRODUCTION

A fishery survey of Bird Lake was conducted from August 22-24, 1983. Additional water quality data were gathered on July 20, 1983. Table 1 summarizes Bird Lake survey findings.

# PHYSICAL FEATURES

Bird Lake is located in the northern section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 58' and longitude 150° 24'. The lake and surrounding area were designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. Bird Lake has a surface area of 203 acres, a volume of 3,420 acre feet, and is at an elevation of 121 feet. The lake has a mean depth of 16.9 feet and maximum depth of 27 feet (Table 1 and Figure 1).

The watershed consists of rolling hills interspersed by lowland bogs. Approximately 990 acres form the lake's drainage basin. Mature white spruce and paper birch constitute the primary terrestrial vegetation surrounding the lake. Pockets of black spruce are found in low lying areas. Wetlands are situated around the periphery of the lake with a large emergent class wetland at the northern end.

Lake water level is maintained by springs and runoff. There are no inlet streams to the lake. A single outlet stream, at the northern end of the lake, is about 12 feet wide and one foot deep. Stream flow is blocked by a low head beaver dam. The beaver dam, located adjacent to the lake, appears capable of passing fish during high flows. Seepage and flow through the beaver dam was estimated to be between two and four cubic feet per second. This outlet stream provides some rainbow trout spawning habitat and may be a migration route to more distant spawning habitat. The outlet stream is connected to a nearby unnamed lake. Aerial photos indicate the smaller lake is probably, at least during high water periods, connected to Vogel Lake. In turn Vogel Lake forms the headwaters of Miller Creek which flows 3.8 miles to Cook Inlet. We did not confirm if fish passage between Bird Lake and Cook Inlet was possible. U.S. Geological Survey Map (D-2) does not show a stream connection between Bird and Vogel lakes.

Access to the lake is by float plane. Rust's Flying Service has a fly-in tent camp permit for Bird Lake. They have one camp site on the small island in the northern half of the lake. There are no other public facilities.

#### FISH

Rainbow trout, threespine stickleback, and slimy sculpin were captured during our survey (Table 2). Rainbow trout was the only game fish taken in gill nets. Trout catch per unit effort (CPUE) was moderately high at 0.88 fish per net hour. Threespine stickleback were indicated to be moderately abundant from Table l.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Wate	er Body Bird Lake	Survey_Date(s)	7-20-83 Water Qual 8/22-24/83 Fish
].	Location: Refuge <u>Kenai NWR</u> Latitude <u>N 60° 58' 25"</u> Longitud	T le <u>W 150° 24' 30"</u>	<u>   10N    R    6W    S  7   </u> Map. Ref. <u>  Kenai (D-2)</u>
2.	Physical Data: Surface Area 203 Ac. Volume 3,420 Ac. Ft. Water Col Drainage Area 990 Ac. Inl	Max. Depth <u>27 Ft.</u> or <u>Dark yellow green</u> ets (cfs) <u>None</u>	Mean Depth <u>16.9 Ft.</u> Water Trans <u>11.5 Ft</u>
	Outlets (cfs) <u>One stream at the northeliocks</u> the stream near the lake. Aer <u>Cook Inlet</u> . Spawning Habitat <u>The outlet stream</u> <u>Fish apparently pass over the beaver</u> Access <u>Aircraft</u>	n end of the lake flowin ial photos indicate pos provides <u>some rainbow</u> dam during high flows.	ng 2-4 cfs. A beaver dam ssible high water flow to trout spawning habitat.
3.	Water Quality:         D.O.         9.7-1.6 mg/1           pH         7.4         Alk.         39 mg/1           Kjeldahl N         0.34 mg/1         MEI         19.3	Temp. <u>19.3-13.0°C</u> Hard. <u>40 mg/1</u> SDF <u>1.20</u> Polluti	Cond. <u>99 umhos @ 25°C</u> Phos. <u>14 ug/1</u> onNone
4.	Fish Species: (Abundance, H/M/L, Int stickleback (M), slimy sculpin.	croduced) <u>Rainbow tro</u>	ut (M-H), threespine _ Total Species3
5.	Management History: There is no pre Take.	vious fishery managemen	t history for this
6.	Current Fishery Status: <u>This lake c</u> abundance of rainbow trout. Threespi present.	urrently contains a mod ne stickleback and slim	lerately high (CPUE 0.88) ny sculpin are also
7.	Vegetation : Aquatic Plant families milfoil (3 Sp.), bur reed (1 Sp.), wa (7 Sp.), Terrestrial <u>A mature white spruce-pa</u>	s - sedge (3 Sp.), horse ater lily (2 Sp.), crowt C aper birch forest is the	etáil (1 Sp.), water foot (1 Sp.), pondweed overage % 27 e dominant vegetation.
8.	Wildlife: Waterfowl (5 Sp.), paśse beaver lodge was present on the lake	rines (3 Sp.), mammals	(4 Sp.). One active
9.	Recreation: Sport fishing, wildlife is believed to be light to moderate. Facilities Rust's Flying Service has located on the lake There are no o	viewing, wilderness ca a Special Use Permit a ther public facilities.	mping. Fishing pressure and one tent camp site
	Survey Crew: Friedersd	orff, Jakubas	



Table 2.

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Summary Fish Catch and Effort Data

Water Body \_\_\_\_\_Bird Lake \_\_\_Code No.\_\_\_\_Survey Date 8/22-24/83

	Average		<u></u>	· · · · · · · · · · · · · · · · · · ·	<u> </u>	. Fis	h CPUE	
Gear	Fishing Time (hrs.)	Amount Mesh Gear Size (Sq.Ft.) (In.)	Fish Species	Total Fişh Number	Sex so M-F-U	1000 q.ft.hrs.	Net Hour	Trap Hour
8 Gill Nets	24	1280 1.0 1280 2.0 1280 2.5 1280 3.0 1280 4.0	Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	1 74 52 35 7	.0-0-1 26-39-9 18-30-4 11-23-1 1-3-3	0.03 2.41 1.69 1.14 0.23	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
Total Fish	24	6400 A11	All Spécies	169	56-95-18	1.10	0.88	N/A
5 1.8 Minnow Trap	s 23	N/A. N/A	Threespine Stickleback Rainbow Trout	808 1	0-0-808 0-0-1	N/A N/A	N/A N/A	1.95 <0.01
Total Fish	23	N/A	All Species	809	0-0-809	N/A	N/A	1.95
Seine		N/A N/A	Rainbow Trout Threespine Stickleback Slimy Sculpin	3 327 4	0-0-3 0-0-327 0-0-4	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
Total Fish		N/A P.N/A	All Species	334	0=0-334	N/A	N/A	N/A

minnow traps with a CPUE of 1.95 fish per trap hour. A low number of slimy sculpin and several small rainbow trout were captured by seine. Eight gill nets and 18 minnow traps were used to determine fish abundance.

Rainbow trout captured in gill nets had a mean fork length of 13.4 inches (341 mm) and ranged from 8.7 inches (220 mm) to 19.3 inches (490 mm). Their mean weight was 1.2 pounds (551 g) ranging from 0.3 pounds (135 g) to 3.0 pounds (1,360 g). The mean condition factor for rainbow trout was 1.26 and varied from 0.75 to 1.50. One juvenile rainbow trout taken by a minnow trap was 3.2 inches (82 mm) in fork length. Table 3 provides rainbow trout weight and condition by length class. Rainbow trout varied in age from one to nine years. Their average annual growth rate was 1.9 inches (49 mm). Table 4 shows rainbow trout age and growth.

#### AQUATIC VEGETATION

Aquatic vegetation was concentrated along the lake shoreline and in the vicinity of the island. Approximately 27 percent of the lake surface area contained aquatic plants. Dominant families included pondweed, water lily, and sedge. A complete list of species is in Table 5 with locations plotted in Figure 1.

#### WATER QUALITY

All water quality parameters measured were within acceptable tolerance limits for fish. The lake had low to medium fertility based on alkalinity level (MacKenthun and Ingram 1967). It was above the average fertility of the 18 lakes samples in 1983. Specific conductance at 25°C'was 99 umhos. A pH of 7.4 was slightly alkaline. Phosphorus was 14 ug/l, Kjeldahl nitrogen 0.34 mg/l, and total hardness 40 mg/l. In July the lake was thermally stratified at around 13 feet (Table 6). Water temperature ranged from 19.3°C at the surface to 13.0°C at the bottom. The overall July dissolved oxygen pattern for the lake was high. Dissolved oxygen at the surface was 9.7 mg/l (slightly supersaturated). A limited amount of low oxygen water at 1.6 mg/l (15 percent saturation) was present near the bottom. Water color was dark yellow green, and Secchi disc water transparency was 11.5 feet. The lake had a Morphoedaphic Index of 19.3 and Shoreline Development Factor of 1.20. Additional water quality data are in Tables 1 and 7.

# MANAGEMENT HISTORY

No previous fishery surveys have been conducted on Bird Lake.

Bird Lake had one active beaver lodge located along the northeast shore, plus an inactive lodge in the southern half of the lake. Beaver had been maintaining the outlet stream dam. Moose and muskrat were seen. Broods of northern pintail, common loon, and red-necked grebe were also sighted along with several species of passerines. All wildlife species identified are listed in Table 8.

#### Table 3.

# FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Bird Lake - 1983

#### FISH LENGTH BY MESH SIZE

Gear	Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F. Length SD* (mm)	F. Length Range (mm)
8 Gill Nets	Rainbow trout	2.0 2.5 3.0 4.0	67 48 34 5	307 356 379 399	56.3 45.4 43.8 80.7	220 - 460 275 - 460 290 - 485 320 - 490

# FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
8 Gill Nets	Rainbow trout	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	11 28 42 40 20 5	159 285 467 662 913 1266	23.5 51.3 73.6 114 103 98.1	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
		FISH CO	NDITION (K)	BY LENGTH CLASS		
Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
8 Gill Nets	Rainbow trout	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	11 28 42 40 20 5	1.25 1.26 1.29 1.27 1.22 1.19	0.11 0.14 0.13 0.14 0.06 0.08	1.09 - 1.41 0.96 - 1.50 0.87 - 1.48 0.75 - 1.50 1.10 - 1.32 1.12 - 1.33
Totals		A11	146	1.26	0.13	0.75 - 1.50

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\*Standard Deviation

# Table 4.

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# AGE-GROWTH\* OF RAINBOW TROUT Bird Lake, 1983

.

No	Fo	rk Leng	th (FL	<u>) in M</u>	illimet V	ers at VI	Annulas VII	Formati VIII	on TX	Capture Fl
10.	<u>1</u>		111	1 4	¥	¥1	VII	¥111	17	
]	57									82
0										
0										
. 4	48	88	141	180						230
5	. 36	78	119	168	229					292
4	4]	77	126	180	238	291		1.4		339
5	39	.77	118	164	222	286	343			392
6	40	76	123	175	233	296	361	426		458
] ]	32	68	109	159	209	272	322	377	454	490
No.	26	25	25	25	21	16 '	12	7	]	
L (mm)	41	78	124	172	229	290	350	419	454	
L (in)	• 1.6	3.1 .	4.9	6.8	9.0	11.4	13.8	16.5	17.9	
	No. 1 0 0 4 5 4 5 6 1 No. L (mm) L (in)	No.         Fo           1         57           0         0           4         48           5         36           4         41           5         39           6         40           1         32           No.         26           L (mm)         1.6	No.         Fork Leng           I         II           1         57           0         0           0         4           4         48           5         36           4         41           7         5           39         77           6         40           1         32           No.         26           25         25           1         78           1.6         3.1	No.         Fork Length (FL           I         I         II           1         57           0         0           4         48         88           4         48         88           5         36         78           4         41         77           5         39         77           6         40         76           1         32         68         109           No.         26         25         25           1         78         124           1         1.6         3.1         4.9	No.         Fork Length (FL) in M           1         II         III         IV           1         57         0         0         0           0         4         48         88         141         180           5         36         78         119         168           4         41         77         126         180           5         39         77         118         164           6         40         76         123         175           1         32         68         109         159           No.         26         25         25         25           1         78         124         172           1         1.6         3.1         4.9         6.8	No.         Fork Length (FL) in Millimet           I         II         III         IV         V           1         57         0         0         0         0           0         4         48         88         141         180           5         36         78         119         168         229           4         41         77         126         180         238           5         39         77         118         164         222           6         40         76         123         175         233           1         32         68         109         159         209           No.         26         25         25         21           C         41         78         124         172         229           I         (in)         1.6         3.1         4.9         6.8         9.0	No.         Fork Length (FL) in Millimeters at I           I         II         III         IV         V         VI           1         57         0 <td>No.         Fork Length (FL) in Millimeters at Annulas           I         II         II         II         V         VI         VII           1         57         0         &lt;</td> <td>No.         Fork Length (FL) in Millimeters at Annulas Formati           I         II         III         IV         V         VI         VII         VIII           1         57         0<td>No.         Fork Length (FL) in Millimeters at Annulas Formation           I         II         III         III         V         VI         VII         VIII         IX           1         57         0        </td></td>	No.         Fork Length (FL) in Millimeters at Annulas           I         II         II         II         V         VI         VII           1         57         0         <	No.         Fork Length (FL) in Millimeters at Annulas Formati           I         II         III         IV         V         VI         VII         VIII           1         57         0 <td>No.         Fork Length (FL) in Millimeters at Annulas Formation           I         II         III         III         V         VI         VII         VIII         IX           1         57         0        </td>	No.         Fork Length (FL) in Millimeters at Annulas Formation           I         II         III         III         V         VI         VII         VIII         IX           1         57         0

\*Not corrected for length at scale formation



7.

Table 5.

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# BIRD LAKE ASSOCIATED VEGETATION

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Class	Symbol	Common Name	Scientific Name
Emergent Emergent Emergent Emergent Emergent	Blr CU CR HFT MT	bulrush sedge sedge horsetail mare's tail	<u>Scirpus validus</u> <u>Carex sp.</u> <u>Carex rostrata</u> Equisetum fluviatile Hippuris vulgaris
Floating Floating Floating	BR DWL YPL	bur reed dwarf water lily yellow pond lily	Sparganium angustifolium Nymphaea tetragona Nuphar polysepalum
Submergent Submergent Submergent Submergent Submergent Submergent Submergent Submergent Submergent	MR MRs PBr PF PG PL PP PR PR6 WWC	water milfoil water milfoil pondweed pondweed pondweed pondweed pondweed pondweed crowfoot	Myriophyllum spicatum Myriophyllum sp. Potamogeton berchtoldi Potamogeton friesii Potamogeton gramineus Potamogeton praelongus Potamogeton perfoliatus Potamogeton robbinsii Ranunculus 'confervoides

# AQUATIC VEGETATION

WETLANDS VEGETATION

Class	Symbol	Vegetation Reference
Emergent	PEM5B	National Wetlands Inventory (Kenai)
Scrub-shrub	PSS1B	National Wetlands Inventory (Kenai)

# TERRESTRIAL VEGETATION

Class	Symbol .	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	MB	mature paper birch	Betula papyrifera
Trees	MS	mature white spruce	Picea glauca
Shrubs	SG	sweet gale	Myrica gale
Below Shrub	BB	buck bean	<u>Menyanthes</u> <u>trifoliata</u>
Below Shrub	G	grass	<u>Gramineae</u>

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Table 6.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study. Kenai NWR, 1983-84Water BodyBird LakeSurvey Date/TimeLake Location (Latitude) N 60° 58' 25"(Longitude) W 150° 24' 30"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%) 75Wind (mph) 0Air Temp (°C) 16.5Chop (in) 0.0

				•	-	_			
Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	19.3	9.7	7.4	88*			XVI	3.5	·
1	19.3	9.7							
2	19.2	9.7							
3	18.8	9.7		88	39	40			14
4	18.0	9.0							
5	16.9	8.2							
6	15.0	4.0							
7	13.0	1.6	· · · ·				1		
								1	
		1							
		*Cond	uctiv	ity adjust	ed to stand	ard 25°C	is 99 um	hos.	
· · · · · · · · · · · · · · · · · · ·		+	1						a service and the service of the ser
	<u> </u>					and the s	de sate	Bath &	and the second second
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	L							· · · · .	

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; We Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hach AC-DT; Hardness - Hach HA-DT. Table 7:

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

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Studý Water B Lake Lo	StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyBird LakeSurvey Date/TimeBird LakeSurvey Date/Time8-23-83/1335Lake Location (Latitude)N 60" 58' 25"(Longitude)Water BodySurvey EriedersdorffJakubas										
Cloud C	over	85	Survey ∶W	ind (mph)	5-10 Air	Temp (°C)	12.5 C	hop (in)	4.0		
Station											
			• •								
Sample	Water	• •		Conduct-	Total	Total		Water	Total		
Depth	Temp.	· D.O.	рН	ivity	Alkalinity	Hardness (mg/1)	Water	(m)	$(_{\rm um}/1)$		
(m)	(°C)	(mg/.1	·	(u mno)				· (	<u></u>		
0	16.2	9.5						_3.5			
1	16.2	9.5									
2	16.2	9.4									
3	16.0	9;2									
4	16.0	8.8									
5	16.0	8.3									
6	15.8	8.0									
7	15.5	4.7					1				
		· ·									
		<u> </u>				-	s:				
	. Ja		<u> </u> →-	1		19 <b>-</b> 94					
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	· ·	1	1								
· · ·	<u> </u>	1	· ·								

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency - 20cl Secchi Disc; Occasional rain. Table 8.

#### KENAI FISHERY RESOURCES STATION ALASKA\_FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Wildlife Data Sheet

Study	Remot	ce & Roadside	Lake S	Study,	Kenai N	IWR, 198	3-84		
Water	Body B	rd Lake	Surv	'ey Dat	e/Time	8/22-	24/83	}	
Lake	Location	(Latitude) N	<u>60°</u> 58	25"	(Longi	tude)W	150°	24'	30"
Code	Number	Survey	Crew	Friede	ersdorff	-, Jakut	as		
							-		

Animal	Common	Number	Sex	Animal	Verifi-	Habitat
Class	Name		M-F-U	Assoc.	cation	Type
Birds Waterfowl	Northern Pintail Mallard Unid. Ducks Common Loon Red-necked Grebe	8 J+ 1 4 3 J+ 4 J+	0-1-7 0-1-0 0-0-4 1-1-1 0-0-4	Brood Single Single/Pa Brood Single/Pain	Sight Sight ir Sight Sight ^ Sight	Water Water Water Water Water
Passerine	s Rusty Blackbird	12	0-0-12	Flock	Sight	Flight
	Savannah Sparrow	1	0-0-1	Single	Sight	Bog
	Black-capped Chickad	ee 1	0-0-1	Singlé	Sight	MB,BS
Mammals	Unid. Bear	-	_	Single	Feces	. <del>-</del>
Big Game	Moose	2	0-1-1	Cow/Calf	Sight	
Furbearer	s Muskrat Beaver	1	0-0-1 0-0-1	Single Single	Sight Sight	- Water

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; BS=Black Spruce Remarks: One active and one inactive beaver:lodge on lake.

#### RECREATIONAL USE

Recreational uses of Bird Lake include fishing, wilderness camping, and wildlife viewing. During our survey a party of five people, flown in by Rust's Flying Service, were using the tent camp facility. Tent camp records for 1982 indicate around 300 people used the tent camp. According to representatives of the flying service, fishing is generally good for rainbow trout.

#### FISHERY RESOURCE SUMMARY

Our fishery survey found a moderately high abundance of rainbow trout (CPUE 0.88) in the lake. Threespine stickleback and slimy sculpin were also present as forage species. Although most of the rainbow trout were found to be four years and older, several juvenile trout were captured. Young trout were also seen in the lake and outlet stream. This indicates successful spawning is occurring, and recruitment of younger age classes is taking place. The outlet stream, despite the presence of the beaver dam, appears to provide some rainbow trout spawning habitat and allow passage of fish during high water. Sport fishing pressure is estimated to be low to moderate. Dissolved oxygen levels were generally good for fish. Lake water fertility was low to moderate, and other water quality parameters were within acceptable limits. Bird Lake is considered to have the potential to support a moderately high yield rainbow trout sport fishery.

#### DOLLY VARDEN LAKE

#### INTRODUCTION

Three fishery surveys of Dolly Varden Lake were conducted on June 7-8, August 2-3, and September 26-27, 1983. Additional water quality data were gathered on July 13, 1983. Table 1 summarizes Dolly Varden Lake findings.

#### PHYSICAL FEATURES

Dolly Varden Lake is located in the north central section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 42' and longitude 150° 46'. Approximately 750 acres make up the lake's watershed. There is an intermittent stream connecting Dolly Varden Lake to Anertz Lake during high water periods. Aerial photos further indicate a northerly drainage pattern from Anertz Lake to Cashka Lake thence a stream-floodway combination west and north 1.2 miles to the Swanson River. Relief patterns on U.S. Geological Survey Map (C-3) confirm this drainage pattern, but show no stream connections between the three lakes and the Swanson River. Predominant terrestrial vegetation consists of a mixed forest of paper birch, white spruce, black spruce, and quaking aspen. Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983) divides the lake into the Intensive and Traditional Land Management Categories. The lake has a surface area of 242 acres, a volume of 7,540 acre feet, and is at an elevation of 240 feet. The lake is relatively deep with a mean depth of 31 feet and a maximum depth of 95 feet (Table'l and Figure 1).

Lake water level is maintained by springs, runoff, and intermittent streams. Two small inlet streams, shown by U.S. Geological Survey Map Kenai (C-3) on the southwest and southeast sides of the lake, were not evident during our survey and are not shown on the report map. The seasonal stream at the north end of the lake which connects to Anertz Lake was reported by Kubik and Reynolds (1960) as a "slough" flowing between one and five cubic feet per second. During our three surveys, this intermittent stream had no flow. However, we believe the stream provides periodic access for rainbow trout immigration to Dolly Varden Lake. There are abundant rocky shoals around the lake capable of supporting char spawning.

Swanson River Road provides direct automobile access to the lake. Recreational facilities include multiple camping sites, fire pits, a water well, outhouse, parking areas, and a concrete boat ramp.

#### FISH

Dolly Varden/Arctic char, rainbow trout, threespine stickleback, and coastrange sculpin were captured in the lake during the three 1983 fish surveys (Tables 2, 3, and 4). Char was the dominant game fish with catch abundance ranging from low to moderately high. Catch per unit effort (CPUE) for char

		Table l.	U.S. FISH AND WIL	DLIFE SERVICE	•
	Wate	er Body	Lake Survey Dolly Varden Lake	Summary Survey Date(s)	7-13-83 Water Qua 6/7-8-83, 8/2-3/83 Fish 9/26-27/83
	1.	Location: Latitude	Refuge Kenai NWR N 60° 42' 25" Longitude	W 150° 46' 50"	<u>7N R 9W S 12</u> Map. Ref. <u>Kenaï C-3</u>
• • •	2.	Physical Volume 7 Drainage during ou	Data: Surface Area 242 Ac. ,540 Ac. Ft. Water Colo Area 750 Ac. Inle r surveys.	_ Max. Depth <u>95 Ft.</u> r <u>Medium Green</u> ts (cfs) <u>No inlet s</u>	Mean Depth <u>31 Ft.</u> Water Trans <u>43 Ft.</u> treams were visible
		Outlets ( flow duri	cfs) There is one outlet strend our surveys, but connects t	am at the north end o to Anertz Lake during	f the lake. It had no high water perfods.
		Spawning There are Access _T	Habitat <u>Rainbow trout are bel</u> e extensive rocky shoals in the here is direct automobile acce	ieved to immigrate fr a lake to support char ass from Swanson River	rom the Anertz Lake area. r spawning. r Road.
	3.	Water Qua pH 7.1 Kjeldahl	lity: D.O. <u>13.2-4.3 mg/]</u> T Alk. <u>17 mg/1</u> N <u>0.19 mg/1</u> MEI <u>3.6</u> S	emp. <u>16.9-4.2°C</u> Hard. <u>28 mg/1</u> DF <u>1.98</u> Polluti	Cond. <u>34 umhos @ 25°C</u> Phos. <u>6 ug/1</u> ion <u>None</u>
	4.	Fish Spec rainbow t	ies: (Abundance, H/M/L, <u>I</u> ntr rout (L), threespine stickleba	oduced) <u>Dolly Varde</u> ack (H), coastrange so	en/Arctic_char_(M-H), culpin Total Species4
	5.	Managemen Arctic ch Tound a h introduce the FWS 1	t History: <u>Previous fishery</u> Mar, rainbow trout, stickleback Nigh abundance of char and low ed to the lake in 1976 to aid to inform the anglers about the	surveys by ADF&G and and sculpin in the abundance of rainbow the food chain. Recor char sport fishery.	YFWS found Dolly Varden/ lake. A 1976 FWS survey trout. Gammarus were mmendations were made by
	6.	Current F abundance Forage s (CPUE 0.4	ishery Status: Dolly Varden I of char (CPUE 0.81) and low becies include threespine stic 48).	<u>ake currently containabundance of rainbow</u> kleback (CPUE 0.57) an	ns a moderately high trout (CPUE 0.04). nd coastrange sculpin
•	7.	Vegetatic <u>reed (1</u> (1 Sp.). Terrestri of paper	n : Aquatic <u>Plant families</u> Sp.), <u>buckwheat (1 Sp.)</u> , water al <u>Terrestrial vegetation co</u> birch, white spruce, black sp	- sedge (4 Sp.), hors lily (1 Sp.), p*ondwe nsists primarily of a ruce, and quaking asp	etail (1 Sp.), bur ed (2 Sp.), primrose Coverage % 10 
: .	8.	Wildlife:	Waterfowl (2 Sp.), terns (	1 Sp.), passerines (1	<u>O Sp.), mammals (2 Sp.).</u>
					· · ·
	9.	Recreatio	n: Camping, wildlife viewing,	fishing, hunting, bo	ating.
		Facilitie and cond	es Multiple campsites, picnic rete boat ramp.	tables, fire pits, c	uthouse, water well,

Survey Crew: Friedersdorff and Jakubas

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# DOLLY VARDEN LAKE



Table 2:

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM Ú.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body Dolly Varden Lake Code No. \_\_\_\_\_ Survey Date \_\_\_\_\_6/7-8/83

······	Average	· · · · · · · · · · · · · · · · · · ·						0.00115	·····		
Gear & Catch Category	Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U		<u>sh CPUE</u> Net Hour	Trap Hour		
8 Gill Nets	26	1280 1280 1280 1280 1280 1280	1.0 2.0 2.5 3.0 4.0	Dolly Varden/A. Char Dolly Varden/A. Char Rainbow Trout Dolly Varden/A. Char Dolly Varden/A. Char Rainbow Trout	3 78 2 20 4 1	, 1-1-1 8-28-42 0-0-2 1-1-18 2-1-1 0-0-1	0.09 2.34 0.06 0.60 0.12 0.03	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A		
By Species	26	6400	A11	Dolly Varden/A. Char Rainbow Trout	105 3	12-31-62 0-0-3	0.63	0.51	N/A N/A		
Total Fish	26	6400	A11.	All Species	108	12-31-65	0.65	0.52	N/A		
18 Minnow Trap	s 28	N/A	N/A	Threespine Stickleback Coastrange Sculpin	289 113	0-0-289 0-0-113	N/A ~ N/A	N/A N/A	0.57		
Total Fish	28	N/A	N/A .	All Species	402 .	0-0-402	N/A	N/A	0.80		
Seine	N/A	N/A	N/A	Threespine Stickleback Coastrange Sculpin	53 4	0-0-53 0-0-4	N/A N/A	N/A N/A	N/A N/A		
Total Fish	N/A	' N/A	N/A	All Species	57	0-0-57	N/A	N/A	N/A		
						· · ·		•			
			ALASK U.S.	ALASKA FISHERY RESOURCES STATION U.S. FISH AND WILDLIFE SERVICE							
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			Summar	y Fish Catch and Effort	Data						
	Wate	r Body Dolly	Varden	Lake_Code NoSur	vey Date	8/2-3/83	· · · · ·	;			
	•		•	·			•	· .			
Gear & Catch Category	Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	- Sex s M-F-U	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour		
8 Gill Nets	24	1280 1280 1280 1280	1.0 2.0 2.5 3.0	Dolly Varden/A. Char Dolly Varden/A. Char Rainbow Trout Dolly Varden/A. Char	1 11 7 6 0	1-0-0 2-7-2 2-5-0 3-2-1	0.03 0.36 0.23 0.20 0.00	N/A N/A N/A N/A	N/A N/A N/A N/A N/A		
 By Species	24	6400	4.0 A11	Dolly Varden/A. Char Rainbow Trout	18 7		0.12	0.09 0.04	<u> </u>		
Total Fish	24	6400	A1.1	All Species	25	8-14-3	0.16	0.13	N/A		
18 Minnow Traps	25	N/A	N/A	Threespine Stickleback Coastrange Sculpin	16 159	0-0-16 0-0-159	N/A N/A	`N/A N/A	0.04 0.35		
Total Fish	25	N/A	N/A .	All Species	175 .	0-0-175	N/A	N/A	0.39		
Seine	N/A	N/A	N/A	Threespine Stickleback Coastrange Sculpin	4	0-0-4 0-0-5	N/A N/A	N/A N/A	N/A N/A		
Total Fish	N/A	N/A	N/A	All Species	9	0-0-9	N/A	N/A	N/A		
								•.			
		4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			:						

## Table 4.

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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

Water Body <u>Dolly Varden Lake</u>Code No. Survey Date <u>9/26-27/83</u>

Average Gear & Catch CategoryAmount Fishing Time (hrs.)Mesh Gear Size (ln.)Fish Species Fish NumberTotal Fish NumberTotal NumberTotal 1000Net Net Net M-F-U8 Gill Nets2512801.0Dolly'Varden/A. Char 128020.06N/AN/A8 Gill Nets2512802.0Dolly Varden/A. Char 12802.50.01/2Varden/A. Char 31225-64-233.50N/AN/A12802.5Dolly Varden/A. Char Rainbow Trout30-2-10.09N/AN/A12803.0Dolly Varden/A. Char Rainbow Trout30-2-10.09N/AN/A12803.0Dolly Varden/A. Char Rainbow Trout31-1-10.09N/AN/A12804.0Dolly Varden/A. Char Rainbow Trout31-0-20.09N/AN/ABy Species256400AllDolly Varden/A. Char Rainbow Trout16241-84-371.010.81N/ATotal Fish256400AllAll Species16842-87-391.050.84N/ACoastrange Sculpin Coastrange Sculpin2140-0-214N/AN/A0.48	•	-	•	•						
8 Gill Nets 25 1280 1.0 Dolly Varden/A. Char 2 0-0-2 0.06 N/A N/A   1280 2.0 Dolly Varden/A. Char 112 25-64-23 3.50 N/A N/A   1280 2.5 Dolly Varden/A. Char 36 12-16-8 1.13 N/A N/A   1280 2.5 Dolly Varden/A. Char 36 12-16-8 1.13 N/A N/A   1280 3.0 Dolly Varden/A. Char 9 3-4-2 0.28 N/A N/A   1280 3.0 Dolly Varden/A. Char 9 3-4-2 0.28 N/A N/A   1280 4.0 Dolly Varden/A. Char 3 1-1-1 0.09 N/A N/A   Rainbow Trout 3 1-1-1 0.09 N/A N/A   Rainbow Trout 6 1-3-2 0.04 0.03 N/A   Rainbow Trout 6 1-3-2 0.04 0.03 N/A   Total Fish 25 6400 All All Species 168 42-87-39 1.05 0.84 N/	Gear & Catch Category	Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish N <del>u</del> mber	Sex M-F-U	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour
By Species 25` 6400 All Dolly Varden/A. Char 162 41-84-37 1.01 0.81 N/A   Total Fish 25 6400 All All Species 168 42-87-39 1.05 0.84 N/A   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-40 N/A N/A 0.09   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-40 N/A N/A 0.09   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-214 N/A N/A 0.48	8 Gill Nets	25	1280 1280 1280 1280 1280 1280	1.0 2.0 2.5 3.0 4.0	Dolly Varden/A. Char Dolly Varden/A. Char Dolly Varden/A. Char Rainbow Trout Dolly Varden/A. Char Rainbow Trout Dolly Varden/A. Char	2 112 36 3 9 3 3	0-0-2 25-64-23 12-16-8 0-2-1 3-4-2 1-1-1 1-0-2	0.06 3.50 1.13 0.09 0.28 0.09 0.09 0.09	N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A
Total Fish 25 6400 All All Species 168 42-87-39 1.05 0.84 N/A   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-40 N/A N/A 0.09   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-214 N/A N/A 0.09   18 Minnow Traps 25 N/A N/A Threespine Stickleback 40 0-0-214 N/A N/A 0.48	By Species	25`	6400	A11	Dolly Varden/A. Char Rainbow Trout	162 6	41-84-37 1-3-2	7 1.01 0.04	0.81 0.03	N/A N/A
18 Minnow Traps   25   N/A   N/A   Threespine Stickleback   40   0-0-40   N/A   N/A   0.09     18 Minnow Traps   25   N/A   N/A   Threespine Stickleback   40   0-0-40   N/A   N/A   0.09     18 Minnow Traps   25   N/A   N/A   0.09   0.00	Total Fish	25	6400	A11	All Species	168	42-87-39	9 1.05	0.84	N/A
	18 Minnow Traps	25	N/A	N/A	Threespine Stickleback Coastrange Sculpin	40 214	0-0-40 0-0-214	N/A N/A	N/A N/A	0.09 0.48
Total Fish 25 N/A N/A All Species 254 U-U-254 N/A N/A U.56	Total Fish	25	N/A	N/A	All Species	254 .	0-0-254	N/A		0.56

was 0.51, 0.09, and 0.81 fish per net hour for June, August, and September respectively. During August, when surface water temperature was near 20°C (68°F), no char were captured in floating nets. Throughout the year char were consistently more abundant in deep set nets than floating nets. Nets fished below 30 feet, where water temperatures were 10°C (50°F) or cooler, had char CPUE's of 1.01, 0.25, and 1.25 during June through September. Our data indicated that char were found mostly in water temperatures of 10°C (50°F) or cooler and remained in this temperature range during our three surveys.

Rainbow trout abundance was low with CPUE's of 0.01, 0.04, and 0.03 fish per net hour for June, August, and September. All except two of the rainbow trout were taken in floating nets indicating their preference for the warmer water temperatures near the lake's surface.

Threespine stickleback were found in moderately high abundance from minnow traps during June at a CPUE of 0.57 per trap hour. Coastrange sculpin were most abundant in September at a CPUE of 0.48. A total of eight gill nets and 18 minnow traps were fished during each survey to determine fish abundance. Seining was employed to find additional fish species.

During the year rainbow trout had a mean fork length of 13.2 inches (335mm) varying from 8.9 inches (225mm) to 19.3 inches (490mm). Their weights averaged 1.1 pounds (507 g) and ranged from 0.3 pounds (115 g) to 1.9 pounds (880 g). During the sampling period the mean condition factors of the rainbow trout steadily increased from 0.94 in June, to 1.31 in August, and 1.50 in September (Tables 5, 6, and 7). Trout ranged in age from four to nine years (Table 8). Average annual growth of rainbow trout, back calculated from scales, was 2.1 inches (54mm) per year.

Dolly Varden/Arctic char captured in gill nets had a mean fork length of 11.8 inches (299mm) and varied from 9.3 inches (235mm) to 17.9 inches (455mm). Their weight mean was 0.7 pounds (304 g) varying from 0.1 pounds (50 g) to 2.6 pounds (1,200 g). Mean condition factors changed very little between spring and fall being 1.05 in June, 1.03 in August, and 1.08 in September.

#### AQUATIC VEGETATION

Aquatic vegetation in the lake was sparse and largely confined to the shoreline and shallow areas. Yellow pond lily, horsetail, and sedges were the dominant emergent and floating vegetation, while chara was the major submergent plant. Approximately 10 percent of the lake was covered by aquatic plants. A list of aquatic species identified is in Table 9 with locations plotted on Figure 1.

#### WATER QUALITY

The main water quality survey was accomplished on July 13, 1983, with additional dissolved oxygen-water temperature profiles taken in August and September. Lake water fertility was classified as low at 17 mg/l using a classification based on alkalinity level (MacKenthun and Ingram 1967).

Table 5.

## FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Dolly Varden Lake - June 7, 1983

Gear	Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F. Length SD* (mm)	F. Length Range (mm)
B Gill Nets	Rainbow Trout	2.0	2	228 490	3.54	225 - 230 490 - 490
	Dolly Varden/Arctic Char	2.0 2.5 3.0	74 20 4	284 328 383	27.2 36.5 40.1	235 - 365 240 - 425 325 - 410

# FISH WFIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
8 Gill Nets	Rainbow Trout Dolly Varden/Arctic	201 - 250 451 - 500 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	2 1 2 3 31 18 2 2	118 490 53 180 224 325 525 798	3.54 3.54 8.66 34.0 50.2 99.0 38.9	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

### FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
8 Gill Nets	Rainbow Trout Dolly Varden/Arct Char	201 - 250 451 - 500 ic 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	2 1 2 ~3 31 18 2 2	1.00 0.81 1.37 1.18 1.05 0.98 1.01 1.10	0.01 0.04 0.09 0.09 0.05 0.04 0.14	0.99 - 1.01 0.81 - 0.81 1.34 - 1.40 1.09 - 1.26 0.89 - 1.23 0.90 - 1.08 0.98 - 1.04 1.00 - 1.20
Totals D	Rainbow Trout Colly Varden/Arctic C	All har All	3 58	0.94 1.05	0.11 0.11	0.81 - 1.01 0.89 - 1.40

\*Standard Deviation

## Table 6.

# FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Dolly Varden Lake - August 2, 1983

FISH LENGTH BY MESH SIZE								
Gear	Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F. Length SD* (mm)	F. Length Range (mm)		
8 Gill Nets	Rainbow Trout Dolly Varden/Arctic Char	2.0 1.0 2.0 2.5	7 1 10 6	319 270 292 318	58.4 _ 22.9 15.4	240 - 415 270 - 270 270 - 345 305 - 345		

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
8 Gill Nets	Rainbow Trout	201 - 250 251 - 300 301 - 350 351 - 400 401 - 450	1 2 2 1 1	160 293 468 670 880	17.7 81.3 -	160 - 160 280 - 305 410 - 525 670 - 670 880 - 880
	Dolly Varden/Arctic Char	251 - 300 301 - 350	8 6	224 349	20.7 57.8	190 - 260 270 - 435

## FISH CONDITION (K) BY LENGTH CLASS

	1 1011 001101		LENGTH OLIDO		
	Length Class	Sample	Condition	Condition	Condition
Gear Species	<u>(mm)</u>	No.	Mean -	<u>SD</u>	Range
3 Gill Nets Rainbow Trout	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	1 2 2 1 - 1	1.16 1.35 1.33 1.44 1.23	7.07 <0.01 0.11	1.16 - 1.16 1.34 - 1.35 1.25 - 1.40 1.44 - 1.44 1.23 - 1.23
Dolly Varden/Arctic Char	251 - 300 301 - 350	8 6	1.03 1.04	0.09 0.10	0.90 - 1.18 0.91 - 1.17
Totals Rainbow Trout Dolly Varden/Arctic Ch	All ar All	7 14	1.31 1.03	0.10 0.10	1.16 - 1.44 0.90 - 1.18
*Standard Deviation					

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## Table 7.

## FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Dolly Varden Lake - September 26, 1983

Gear	Species	Mesh Size (in)	Sample No.	F.Length Mean (mm)	F.Length SD* (mm)	F. Length Range (mm)
8 Gill Nets	Rainbow Trout	2.5 3.0	2 2	360 393	28.3	340 - 380 390 - 395
	Dolly Varden/A. C	har 2.0 2.5 3.0 4.0	102 33 9 1	284 322 384 345~	21.2 28.1 32.8	240 - 360 280 - 385 345 - 455 345 - 345

#### FISH WEIGHT BY LENGTH CLASS

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			CON MELCHIL DI			•
		Length		Weight	Weight	Weight
Gear	Species	Class	Sample	Mean	SD	Range
		(mm)	No	(g)	(g)	(g)
3 Gill Nets	Rainbow Trout	301 - 350	]	745		745 - 745
		351 - 400	3	800	18.0	780 - 815
	D. Varden/A. Char	201 - 250	1	190	-	190 - 190
		25] - 300	54	232	37.8	160 - 330
		301 - 350	27	381	86.5	270 - 585
		351 - 400	10	598	59.2	525 - 725
		451 - 500	1	1200	_	1200 - 1200

## FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
8 Gill Nets	Rainbow Trout D. Varden/A. Char	301 - 350 351 - 400 201 - 250 251 - 300	~1 3 1 54	1.90 1.37 1.22 1.04	0.10	1.90 - 1.90 1.31 - 1.49 1.22 - 1.22 0.82 - 1.70
	; . ;	301 - 350 351 - 400 451 - 500	27 10 1	1.12 1.16 1.27	0.16 0.08 -	0.95 - 1.63 1.00 - 1.28 1.27 - 1.27
Totals D	Rainbow Trouť . Varden/A. Char	A11 A11	4 93	1.50 1.08	0.28 0.14	1.31 - 1.90 0.82 - 1.70

Standard Deviation

## Table 8.

## AGE-GROWTH\* OF RAINBOW TROUT Dolly Varden Lake, 1983

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Year		Fo	rk Leng	th (FL	) in M	illimet	ters at	Annula	s Format	ion	Capture
Class	No.	Ī	ĪI	III	IV	V	٧I	VII	VIII	IX	<u> </u>
1979	3	47	96	143	193						232
1978	1	52	100	142	185	242					285
1977	4	42	81	125	177	235	287				327
1976	5	36	77	118	165	222	277	336			388
1975											
1974	1	38	66	113	159	206	281	337	• 403	455	492
Total	No.	14	14 ,	14	14	11	10	6	]	1	
Ave. F	L (mm)	41	83	127	175	227	281	336	403	455	
Ave. F	L (in)	1.6	3.3	5.0	6.9	8.9	11.1	13.2	15.9	17.9	

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\*Not corrected for length at scale formation

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### DOLLY VARDEN LAKE ASSOCIATED VEGETATION

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## AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name
Emergent	Crh	sedge	<u>Carex</u> rhynchophysa
Emergent	Cunid.	sedge	<u>Carex</u> <u>sp</u> .
Emergent	CR	sedge	<u>Carex</u> rostrata
Emergent	HFT	horsetail	Equisetum fluviatile
Emergent	SR	spike rush	Eleocharis palustris
Emergent	TL	tufted loosestrife	Lysimachia thyrsiflora
Floating	BR	bur reed	Sparganium angustifolium
Floating	SW	water smartweed	Polygonum amphibium
Floating	YPL	yellow pond lily	Nuphar polysepalum
Submergent	PG	pondweed	<u>Potamógeton</u> gramineus
Submergent	PR	pondweed	Potamogeton perfoliatus

### WETLANDS VEGETATION

Class	Symbol	Vegetation Reference
Scrub-shrub	PSS4/1B	National Wetlands Inventory (Kenai)

## TERRESTRIAL VEGETATION

Class	Symbo]	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	CW	cottonwood	<u>Populus balsamifera</u>
Trees	IB	immature paper birch	<u>Betula papyrifera</u>
Trees	IS	immature white spruce	<u>Picea glauca</u>
Trees	MB	mature paper birch	<u>Betula papyrifera</u>
Trees	MS	mature white spruce	<u>Picea glauca</u>
Trees	QA	quaking aspen	<u>Populus tremuloides</u>
Trees	W	willow	<u>Salix sp</u> .
Shrubs	A '	alder	<u>Alnus sp</u> .
Shrubs	SG	sweet gale	<u>Myrica gale</u>
Shrubs	W	willow	Salix sp.

Water pH was near neutral at 7.1. Conductivity was 34 umhos at 25°C, total hardness 28 mg/l, phosphorus 6 ug/l, and Kjeldahl nitrogen 0.19 mg/l. Water color was medium green, and Secchi disc water transparency was 43 feet. The lake had a Morphoedaphic Index of 3.6 and Shoreline Development Factor of 1.98.

The lake was thermally stratified in July with the thermocline occurring between 20 and 36 feet. The September survey indicated the lake was close to fall overturn since nearly uniform water temperatures prevailed between the surface and bottom. During July dissolved oxygen levels were generally high throughout the entire water column (Table 10). At this time dissolved oxygen was slightly supersaturated from the surface down to 36 feet with a low dissolved oxygen : concentration of 4.3 mg/1 (31 percent saturation) at 92 feet. Tables 1, 11, and 12 give additional water quality data.

#### MANAGEMENT HISTORY

Dolly Varden Lake was first surveyed by the Alaska Department of Fish and Game (ADF&G) in 1960 (Kubik and Reynolds 1960). They reported the presence of Arctic char, rainbow trout, stickleback, and sculpin. They also noted two small inlet streams on the southeast side of the lake and a small slough running to Anertz Lake. They reported these streams to be flowing between one and five cubic feet per second.

The U.S. Fish and Wildlife Service (FWS) made a series of gill net fish surveys between 1974 and 1976. The June 13-26, 1974, survey yielded 15 Dolly Varden at a CPUE of 0.14 char per net hour. The second survey on June 26, 1975, captured 14 Dolly Varden for a CPUE of 0.20.' These char were found to be 2, 3, and 4 years old. A creel survey during this period found sport fishing on Dolly Varden Lake to have a relatively low yield of 0.07 char per hour. Moreover, plankton productivity was estimated to be low, and a recommendation was made to introduce <u>Gammarus</u> into the lake to aid the food chain. About 2,000 <u>Gammarus</u> were transported from Bernice Lake and released in Dolly Varden Lake on September 12, 1975 (Crateau, 1975).

In the third fishery survey accomplished on June 1-2, 1976, a total of 78 Dolly Varden and one rainbow trout were captured for respective CPUE's of 1.08 and 0.01 fish per net hour. The mean fork length of the char was 10.5 inches (267mm) and mean weight was 0.6 pounds (250 g). Age classes of the char were 3 to 5 years. The single rainbow trout was 17.1 inches (435mm) fork length and weighed 2.0 pounds (910 g). It was aged at 5 years.

The increase in char abundance during this third survey, according to Crateau (1976), was due to the survey being conducted earlier in the year plus sampling in the larger sub-basin as opposed to earlier sampling in the smaller lake sub-basin. Based upon these new results, Fish and Wildlife Service biologists recommended: (1) further survey in Dolly Varden Lake be discontinued for five years; (2) no rehabilitation or enhancement projects be initiated; (3) inform the public that an adequate fishery presently exists which can be successfully fished in the early spring or deeper water during the summer; and (4) inform interested anglers the larger lake sub-basin lends itself to a greater degree of fishery success. No further management measures are known to have been implemented on the lake. Table 10.

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyDolly Varden LakeSurvey Date/limeT\_13-83/1330T\_13-83/1330Lake Location (Latitude)N 60° 42' 25"(Longitude) W 150° 46' 50"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)0Wind (mph)15Air Temp (°C)16.4Chop (in)6-12

Sample	Water			Conduct-	Total	Total .		Water	Total
Depth	Temp.	D.O.	рН	ivity	Alkalinity	Hardness	Water	Trans.	Phosphate [
(m)	(°C)	(mg/1	)	(u mho)	(mg/l)	(mg/l)	Lolor	<u>    (III)                              </u>	<u>(uy/i)</u>
0	16.9	11.1	7.1	29*	17	28	X	13	. b
1	16.9	11.2	· .						
2	16.9	11.2					1 4		
3	16.8	11.2							
4	16.8	11.2							
5	16.8	11.2							
6	16.8	11.2					1		
7	14.9	12.5				·			•
8	12,0	13.0							
9	9.2	13.2				jť			
10	8.0	13.2							
11	7.0	13.1		*Conduct	vity correc	ted to 25	1C is 34	umhos.	
12	6.3	12.6							· ·
13	5.6	12.0					ļ		
14	5.5	11.8		30	28				
15	5.3	11.6							
16	5.1	9.2	1.						
17	5.0	9.6							
18	5.0	9.4	<u></u>				-		
19	4.9	9.0	1						

Remarks:

Table 10. Continued

#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyDolly Varden LakeSurvey Date/Time7-13-83/1330Lake Location (Latitude)N 60° 42' 25"(Longitude)W 150° 46' 50"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)OWind (mph)15Air Temp (°C)Station

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l)	рН	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (ug/1)
20	4.9	8.6						-	
2]	4.9	8.2							
22	4.9	8.0,					1.4		
23	4.8	7.8					-		
24	4.8	7.6							
25	4.5	7.6						•	
26	4.5	7.4					1		
27	4.5	7.2				•			
28	4.2	4.3							
						4	•		
		·							
	<u> </u>						1		
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		-							
J	.l =					ot 57 N /	0		· VET COT 22

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT.

#### Table 11.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water Body Dolly Varden LakeSurvey Date/TimeBody Dolly Varden LakeSurvey Date/TimeLake Location (Latitude)N 60° 42' 25"Code No.Survey CrewSurvey CrewFriedersdorff, JakubasCloud Cover (%)0Wind (mph)0-5Air Temp (°C)21.0Chop (in)2.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1)	рН	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate ı (ug/l)
0	19.8	10.0						11.0	
1	19.5	.10.2							I
2	19.0	10.2					1 -4		
3	18.9	10.2							
4	18.3	10.4							
5	18.2	10.4							
6	18.0	10.4					1		
7	17.5	10.4							
8	14.0	12.0							
9	11.2	12.6	•			1	-		
10	9.0	12.6							
11	7.5	12.6							
12	6.9	12.4							
13	6.2	12:0							
14	6.0	11.4						-	
15	5.5	10.4							
16	5.1	9.8			]				
17	5.0	9.2							
18	5.0	8:4						-	
19	4.8	7.9						-,*	

Remarks:

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Table 11 Continued

## Water Analysis Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84		<u>·</u>
Study Body Dolly Varden Lake Survey Date/Time 8-3-83	/1545 <u>·</u>	
Water body <u>body</u> (Latitude) N 60° 42' 25" (Longitude) W 150°	46' 50"	
Lake Location (Latitude)		·
Code No Wind (mph) (1-5 Air Temp (°C) 21.0	Chop (in)	2.0
Cloud Cover $\binom{1}{k}$ with $\binom{mpn}{2}$ $\frac{2}{2}$ $\frac{2}{2}$ $\frac{2}{2}$		
Station		

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l)	,pH	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
20	4.8	7.4					•		••••••
21	4.8	7.1							
22	4.6	6.7							
23	4.5	6.5							
24	4.5	6.4							
25	4.5	6.0							
26	4.2	5.4					1		
27	4.2	5.4	· · ·			*			
28	4.2	5.0							
		<u> </u>							
		1 .							
	+	<u> </u> .							··.·
	<u> </u>	1						~	•
	<u> </u>		<u> </u>			1			
	+	+	1	· · · · · · · · · · · · · · · · · · ·	· · · · ·	1			
	+		· <u> </u>						
	+	· · .	<u> </u>	· · · · ·					
			+						
	1	<u>.!</u>	<u></u>	L	1	J	ıi	<b>.</b>	·

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency.- 20cm Secchi Disc.

Table 12.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

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Water Analysis Data Sheet

Study \_\_\_\_ Remote & Roadside Lake Study, Kenai NWR, 1983-84

Sample	Water			Conduct-	Total	Total		Water	Total
Depth	Temp.	D.O.	、рН	ivity	Alkalinity	Hardness	Water	Trans.	Phosphate
(m)	<u>(°C)</u>	(mg/1	)	(u mho)	(mg/1)	(mg/l)	Color	<u>(m)</u>	(ug/1)
0	8.5	12.0						8.6	
1	8.5	11.8				•			
2	8.5	11,6					1 -		
3	8.5	11.3							
4	8.5	11.3							
5	8.5	11.2							
6	8.5	11.2					j		
7	8.5	11.2			· .	*			
8	8.5	11.2							
9	8.5	11.2							
10	8.5	11.2							
11	8.5	11.2							
12	8.5	11.2							*
13	8.5	11:1							
14	8.2	11.1							
15	7.1	11.0						•	
16	6.0	8.7							·
17	5.4	8.0							
18	5.0	7:0							
19	5.0	6.2						•••	

Remarks:

Table 12 Continued

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyDolly Varden LakeSurvey Date/Time9-27-83/1600Lake Location (Latitude)N 60° 42' 25"(Longitude)W 150° 46' 50"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)10-15Air Temp (°C)2.0Station

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
20	5.0	5.8							
21	5.0	5.4				•		-	
22	5.0	5.0,					14	-	
23	5.0	0.8							
24	5.0	0.5							
					•		1		
						•			
	<u>;</u>								
					· · · · · · · · · · · · · · · · · · ·				
				· · · · · · · · · · · · · · · · · · ·					
			  -	·					
1	·								
					r			***	
Remarks	• Equ	uipmen	t use	d: D.O. &	Temp YSI	57 Meter	; Water	Transpar	ency - 20cm

Secchi Disc.

#### WILDLIFE

From June to September many passerine birds were observed. Common loons, Arctic terns, plus an unidentified duck in summer plumage were also seen. Several red squirrels were in the campground, and moose sign was observed around the lake. Table 13 lists wildlife species identified by sight or sign.

#### RECREATIONAL USE

Recreational uses of Dolly Varden Lake include camping, wildlife viewing, fishing, boating, and hunting. The lake is one of the more popular camping sites on the refuge. Many of the camping sites have a scenic view of the lake. Campers were present each time we surveyed the lake. A question frequently asked by campers was what kind of of fish were in the lake and how to fish for them. We observed very few anglers during our surveys. Winter ice fishing is known to take place. No annual fishing pressure data are available.

#### FISHERY RESOURCES SUMMARY

Our three fishery surveys indicate that Dolly Varden/Arctic char was the primary game fish in the lake, and that they are moderately high in abundance (CPUE 0.81). Char capture locations show these fish preferred water temperatures of 10°C (50°F) and cooler and were found mostly in this temperature range during the survey period. Rainbow trout were low in abundance (CPUE 0.05) and were found mostly in surface waters. Threespine stickleback and coastrange sculpin constituted the forage species in the lake.

Previous surveys by the ADF&G and FWS confirmed the fish species diversity we found. The 1967 FWS survey indicated a high abundance of char. It appears the lake has supported a good population of char for a number of years. We believe factors contributing to the low abundance of rainbow trout include the lack of suitable spawning area, limited immigration of trout through the intermittent stream from Anertz Lake, and predation of young trout by the dominant population of char.

Water quality conditions were within fish tolerance limits. The lake is low in fertility. Dolly Varden Lake is considered to have the potential to support a moderately high yield char and low yield rainbow trout sport fishery.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

### Wildlife Data Sheet

Study	Remote and Roadside Lake Study Kenaj NWR 1983 84
Water Body	Dolly Varden Lake Survey Date/Time 6/7-8/83
Lake Locat	tion (Latitude)N 60° 42' 25" (Longitude) W 150° 46' 50"
Code Numbe	rSurvey Crew Friedersdorff, Jakubas

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type	
Birds						· · · · · · · · · · · · · · · · · · ·	
Waterfowl	Unid. Duck Common Loon	1 2	0-0-1 1-1-0	Single Pair	Sight Sight	Water Water	
Terns	Arctic Tern	2	0-0-2	Single	Sight	Flight	
Passerines	Ruby-crowned Kinglet Northern Waterthrush White-crowned Sparro Swanson's Thrush Slate-sided Junco Gray Jay Rusty Blackbird Yellow-rumped Warble Alder Flycatcher Tree Swallow	: Many Many Many Many Many Many 3 er Many -	 - - - - 0-0-3 - - -		Sound Sound Sound Sight Sight Sound Sound Sight	MB,SM Shoreline MB,SM MB,SM MB,SM BS,MS,MS Bog, BS Flight	
Mammals Big Game	Moose	_	-		Browse	-	
Others	Red Squirrel	-	-	Single	Sight	Campground	

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; SM=Spruce Mix; BS=Black Spruce; MS=Mature Spruce Remarks:

### NECKSHORTA LAKE

#### INTRODUCTION

A fishery survey of Neckshorta Lake was conducted from August 24-26, 1983. Additional water quality data were gathered on July 20, 1983. Table 1 summarizes Neckshorta Lake survey findings.

### PHYSICAL FEATURES

Neckshorta Lake is located in the northern section of the Kenai National Wildlife Refuge at latitude 60° 57' and longitude 150° 23'. The lake and surrounding area were designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. Neckshorta Lake has a surface area of 123 acres, a volume of 1,300 acre feet, and is at an elevation of about 140 feet. The lake has a mean depth of 11 feet and a maximum depth of 27 feet (Table 1

The lake is surrounded by relatively flat terrain with black spruce dominating the northern end of the lake and white spruce and paper birch becoming more prominent toward the southern end. A bulrush wetland divides the two subbasins making up the lake. Additional emergent wetlands are found along the western and southern shores. The watershed is approximately 600 acres in area.

The lake's water level is maintained by springs and runoff. A 1969 Alaska Department of Fish and Game survey indicated there was one intermittent inlet (probably near the center of the lake) and one intermittent outlet (probably at the southern end of the lake). At the time of the State survey, both streams were flowing less than one cubic foot per second. We found almost no evidence of these streams, and no flow was occurring. Aerial photos indicate a floodway from the south end of Neckshorta Lake to a small nearby unnamed lake, thence another floodway running northwest to Angler Lake. A stream connects Angler Lake to Kraenberi Lake, and from this lake Seven Egg Creek runs about 9.5 miles to Cook Inlet. U.S. Geological Survey Map Kenai (D-2) shows no stream connections between Neckshorta, Angler, and Kraenberi lakes.

Access to the lake is by float plane. The Alaska Floatplane Service formerly held a Special Use Permit for a fly-in tent camp. They did not renew their permit in 1981 reportedly due to poor fishing. Although their tent was still present during our survey, it was removed later in the year. There are no other public facilities on the lake.

#### FISH

Rainbow trout and threespine stickleback were the only species captured during the survey (Table 2). Trout abundance was indicated as moderately high with a catch per unit of effort (CPUE) of 0.50 fish per net hour. The CPUE of threespine stickleback was moderate at 1.07 fish per trap hour. Six gill nets and 14 minnow traps were used to determine fish abundance.

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## -Table 1. U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

.

Wat	ter Body Neckshorta Lake	Survey Date(s)	7-20-83 Water Qual. 8/24-26/83 Fish
].	<u>Location: Refuge Kenai NWR</u> Latitude <u>N 60° 57' 50"</u> Longi	tude <u>W 150° 23' 30"</u>	<u>10N_R_6W_S_18</u> Map. Ref. <u>Kenai (D-2)</u>
2.	Physical Data: Surface Area 123 Volume 1,300 Ac. Ft. Water ( Drainage Area 600 Ac.	Ac. Max. Depth <u>27 Ft.</u> Color <u>Green Yellow</u> Inlets (cfs) <u>None</u>	Mean Depth <u>11 Ft.</u> Water Trans <u>16 Ft.</u>
	Outlets (cfs) None at the time the south end of the lake during pe	of survey. A stream outl eriods of high water.	et may be present at
	Spawning Habitat <u>No rainbow trout</u>	spawning habitat was loca	ated,
	Access Aircraft		
3.	Water Quality: D.O. 10.0-1.5 mg/1 pH 7.3 Alk. 31 mg/1 Kjeldahl N 0.34 mg/1 MEI 6.2	Temp. <u>20.0-9.8°C</u> Hard. <u>29 mg/1</u> SDF <u>2.22</u> Pollutic	_Cond. <u>66_umhos_@_25°C</u> Phos. <u>18_ug/1</u> onNone
4.	Fish Species: (Abundance, H/M/L, <u>J</u> stickleback (M).	Introduced)Rainbow tro	ut (M-H), threespine
5.	Management History: <u>A 1969 fishery</u> threespine stickleback in the lake inlet and one intermittent outlet were reported to be flowing at les	survey by the ADF&G found . They also indicated tha stream were present. Both s than one cfs.	Total Species 2 rainbow trout and tone intermittent of these streams
6.	Current Fishery Status: Our surver rainbow trout (CPUE 0.50) and a mod 1.07). Little or no recruitment of to be taking place. The lake rainbo be in decline.	y indicated a moderately-h derate amount of threespin f young rainbow trout age ow trout sport fishery is	igh abundance of e stickleback (CPUF classes appears to believed to currently
7.	Vegetation : Aquatic Plant familie (1 Sp.), bur reed (1 Sp.), water water milfoil (1 Sp.), crowfoot (1 Terrestrial <u>The lake is surrounde</u> birch, and white spruce	es - gentain (1 Sp.), sedg 1ily (2 Sp.), pondweed (4 Cc ed_by_mature_forests_of_b]	e (2 Sp.), horsetail Sp.), musk grass (1 Sp.), verage %53 ack_spruce, paper
8.	Wildlife: <u>Waterfowl (1 Sp.), rapto</u> bear were seen in the near vicinit	rs (1 Sp_), mammals (3 Sp v of the lake.	)Twoiyoung_black
9.	Recreation: Fishing, camping, will	dlife viewing.	
	Facilities None		
	Survey Crew:Friedersdorff,	Jakubas	



Table 2.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Summary Fish Catch and Effort Data

Wate	er Body <u>Ne</u>	ckshorta	Lake Code NoSu	irvey Date	8/24-26	5/83		
Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	Fi 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour
23	960 960 960 960 960	1.0 2.0 2.5 3.0 4.0	Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	5 18 14 19 13	0-1-4 7-5-6 6-6-2 8-9-2 5-6-2	0.23 0.82 0.63 0.86 0.59	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
23	4800	A11	All Species	69	26-27-16	0.63	0.50	N/A
22	N/A	N/A	Threespine Stickleback	330	0-0-330	N/A	N/A	1.07
22	N/A	N/A	All Species	330	0-0- 330	N/A	N/A	1.07
	Wate Average Fishing Time (hrs.) 23 23 23 22 22	Water Body <u>Ne</u> Average Fishing Amount Time Gear (hrs.) (Sq.Ft.) 23 960 960 960 960 960 23 4800 23 4800 22 N/A 22 N/A	Water Body   Neckshorta     Average   Fishing   Amount   Mesh     Time   Gear   Size     (hrs.)   (Sq.Ft.)   (In.)     23   960   1.0     960   2.0   960     960   2.5   960     960   3.0   960     960   4.0   23     23   4800   All     22   N/A   N/A     22   N/A   N/A	Water BodyNeckshorta Lake Code No.SuAverageFishingAmountMeshFish SpeciesTimeGearGearSize(hrs.)(Sq.Ft.)239609602.0Rainbow Trout9602.5Rainbow Trout9603.0Rainbow Trout9604.0Rainbow Trout23480024N/AN/AN/AAll Species	Water BodyNeckshorta Lake Neckshorta Lake Code No.Survey DateAverage Fishing Time (hrs.)Amount Gear Size (In.)Fish Species Fish Number239601.0 960Rainbow Trout 18 9605 960239601.0 960Rainbow Trout 18 96014 19 960239601.0 960Rainbow Trout 19 96019 960234800All AllAll Species6922N/AN/AAll Species330	Water BodyNeckshorta Lake Code No.Survey Date8/24-26Average FishingAmountMesh GearFish SizeSex Fish NumberFish M-F-U239601.0Rainbow Trout50-1-49602.0Rainbow Trout187-5-69602.5Rainbow Trout146-6-29603.0Rainbow Trout198-9-29604.0Rainbow Trout135-6-2234800AllAll Species6926-27-1622N/AN/AAll Species3300-0-33022N/AN/AAll Species3300-0-330	Water Body   Neckshorta Lake Code No.   Survey Date   8/24-26/83     Average Fishing   Amount   Mesh   Fish Species   Total   1000     Time   Gear   Size   Fish   Sex   sq.ft.hrs.     (hrs.)   (Sq.Ft.)   (In.)   Number   M-F-U     23   960   1.0   Rainbow Trout   5   0-1-4   0.23     960   2.0   Rainbow Trout   18   7-5-6   0.82     960   2.5   Rainbow Trout   14   6-6-2   0.63     960   3.0   Rainbow Trout   19   8-9-2   0.86     960   4.0   Rainbow Trout   13   5-6-2   0.59     23   4800   All   All Species   69   26-27-16   0.63     22   N/A   N/A   Threespine Stickleback   330   0-0-330   N/A	Water BodyNeckshorta Lake Code No.Survey Date8/24-26/83Average Fishing Time Gear (hrs.)Mesh Gear Size (hrs.)Fish Species Fish NumberTotal Fish NumberTotal Net Sex M-F-U239601.0Rainbow Trout Rainbow Trout50-1-40.23N/A9602.0Rainbow Trout 960187-5-60.82N/A9602.5Rainbow Trout Rainbow Trout187-5-60.63N/A9603.0Rainbow Trout Rainbow Trout198-9-20.86N/A9604.0Rainbow Trout Rainbow Trout135-6-20.59N/A234800A11A11 Species6926-27-160.630.5022N/AN/AA11 Species3300-0-330N/AN/A

Rainbow trout captured in Neckshorta Lake were larger and older than in most other lakes we sampled during 1983. Mean fork length of the trout was 16.8 inches (426mm) with a range from 14.6 inches (370 mm) to 21.7 inches (550mm). The average weight was 2.2 pounds (1,010 g) and varied from 0.7 pounds (305 g) to 4.7 pounds (2,125 g). Rainbow trout were growing at an average yearly rate of 1.9 inches (49 mm). The youngest trout captured was 4 years old and the oldest 10 years old. The average fish age was also generally older than other lakes sampled in 1983. Moreover, we saw no evidence of juvenile rainbow trout. We hypothesize that the stream providing access for young trout to the lake has not been active for several years. Apparently there are few, if any, young trout in the lake at present. Table 3 gives a breakdown of fish weight and condition by length class. Age and growth of trout is shown in Table 4.

#### AQUATIC VEGETATION

Aquatic vegetation was widely distributed around the lake with pondweed, yellow pond lily, and bulrush being the dominant vegetation. A thick stand of bulrush blocked the narrow passage connecting the two lake sub-basins. About 53 percent of the lake surface area was covered with aquatic plants. A complete list of aquatic plants identified is given in Table 5.

#### WATER QUALITY

Water quality parameters measured during the July survey indicated favorable conditions for fish. The lake has low to medium fertility (MacKenthun and Ingram 1967) with an alkalinity level of 31 mg/l. Specific conductance was 66 umhos at 25°C. Phosphorus was 18 ug/l and Kjeldahl nitrogen 0.34 mg/l. The pH was 7.3. Water temperature gradually declined from 20°C at the surface to 9.8°C near the bottom. During July dissolved oxygen was slightly supersaturated at 20 feet (Table 6). Lower oxygen levels prevailed near the bottom. Water color was greenish yellow, and Secchi disc water transparency was 16 feet. The lake had a Morphoedaphic Index of 6.2 and Shoreline Development Factor of 2.22. Additional water quality data are given in Tables 1 and 7.

#### MANAGEMENT HISTORY

Neckshorta Lake was surveyed by the Alaska Department of Fish and Game (ADF&G) in 1969 (Howe and Ashmore 1969). They collected rainbow trout and threespine stickleback. Their sample of 23 rainbow trout had a mean weight of 1.07 pounds (486 g) and mean length of 13.6 inches (345 mm). Their catch was 0.50 trout per hour using two experimental gill nets fished for about 24 hours.

#### WILDLIFE

Wildlife sightings on the lake were limited. Common loons were present, and we saw a pair of young black bear in the emergent bog to the west side of the lake. We also saw a large bull moose near the lake. Wildlife species identified are listed in Table 8.

Table 3.

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### FISH LENGTH, WEIGHT, AND CONDITION SUMMARY Neckshorta Lake - 1983

Gear	Species	Mesh Size (in)	Sample No.	F. Length Mean (mm)	F. Length SD* (mm)	F. Length · ∧Range (mm)				
6 Gill Nets	Rainbow Trout	1.0 2.0 2.5 3.0 4.0	1 13 12 18 11	370 423 388 431 466 ~	69.7 89.4 57.9 37.6	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$				

## FISH LENGTH BY MESH SIZE

## FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets	Rainbow Trout	201 - 250 251 - 300 301 - 350 351 - 400 401 - 450 451 - 500 501 - 550	1 2 7 6 17 18 3	305 335 534 789 1,004 1,289 1,608	91.9 62.6 105 110 168 448	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

## FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
6 Gill Nets	Rainbow Trout	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	1 2 7 6 17 18 3	2.21 1.51 1.38 1.48 1.30 1.18 1.12	0.04 0.14 0.13 0.09 0.17 0.15	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
Totals	Rainbow Trout	A11	54	1.31	0.21	0.81 - 2.21

'Standard Deviation

Table 4.

AGE-GROWTH\* OF RAINBOW TROUT Neckshorta Lake - 1983

•

Year		Fork	Length	(FL)	in Mi	11imet	ers at	Annula	s Form	ation		Cant
Clas	s No.	I	II	III	IV	V	VI	VII	<u>- 1011</u> VIII		. <u>X</u>	Lapture
			<u> </u>									<u>Г</u>
1979	]	33	66	116	174							240
1978	1	37	80	122	165	212						260
1977	7	34	73	118	170	226	284					335
1976	4	31	63	99	153	220	291	357				406
1975	6	37	66	104	152	207	276	334	401			454
1974	5	32	63	103	151	209	282	343	407	457		497
1973	1	31	58	101	151	232	290	356	422	465	504	550
Total	No.	25	25	25	25	24	23	16	12	6	]	
Ave.	FL(mm)	34	67	108	158	216	283	344	405	458	504	
Ave.	FL(in)	1.3	2.6	4.3	6.2	8.5	11.1	13.5	16.0	18.0	19.8	, 

\*Not corrected for length at scale formation

Table 5.

#### NECKSHORTA LAKE ASSOCIATED VEGETATION

#### Class Symbol Common Name Scientific Name Emergent ΒB buck bean Menyanthes trifoliata Emergent Bĩr bulrush Scirpus validus Emergent HTF Equisetum fluviatile horsetail Emergent SR spike rush Eleocharis palustris Floating BR bur reed Sparganium angustifolium Floating DWL dwarf water lily Nymphaea tetragona Floating PN pondweed Potamogeton natans Floating YPL yellow pond lily Nuphar polysepalum Submergent chara СН Chara sp. Submergent MR water milfoil Myriophyllum spicatum Submergent PA pondweed Potamogeton alpinus Submergent PBr . pondweed Potamogeton berchtoldi Submergent PΡ pondweed Potamogeton praelongus Submergent WWC crowfoot Ranunculus confervoides

### AQUATIC VEGETATION

•

#### WETLANDS VEGETATION

Class	Symbol	Vegetation Reference
Emergent	PEM5B	National Wetlands Inventory (Kenai)
Scrub-shrub	PSS1B	National Wetlands Inventory (Kenai)

## TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees Trees Trees	BS MB MS	black spruce mature paper birch mature white spruce	<u>Picea mariana Betula papyrifera Picea glauca</u>
Shrubs	SG	sweet gale	<u>Myrica gale</u>
Below Shrub	G	grass	Gramineae

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water BodyNeckshorta LakeSurvey Date/TimeTotal7-20-83/1535Lake Location (Latitude)N 60° 57' 50"(Longitude)W 150° 23' 30"Code No.Survey CrewCode No.Survey CrewFriedersdorff, JakubasCloud Cover (%)100Wind (mph)0-5Air Temp (°C)17Chop (in)StationNo.

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	20.0	9.7	7.3	60*			XII	5.0	18
]	19.6	9.7							
2	19.1	9.6							
3	18.8	9.6							
4	17.9	9.6		55	31	29			· · · · ·
5	15.2	10.0							
6	12.0	9.4				• • •	-		
7	10.2	4.7				1			·
8	9.8	1.5				······			······
						· · · · · · · · · · · · · · · · · · ·	,		
	*Co	nducti	vity	adjusted t	o 25°C is 60	5 umhos			
	ļ 								
				1					
							-		
					¢.				

Remarks: Equipment used: D.O. & Temp. - YSI 57 meter; Conductivity.- YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 7.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

Study Remote & Roadside Lake Study Kenai NUR 1002 04
Water Body Neckshorta Lake Survey Date / 1903-04
Lake Location (latitude) N 60° 57' 50" (Longitude) N 708 bai 20"
Code No Survey Crow Enjedonsdonff Jalubas
Cloud Covon (%) IDO Ward (m 1) Frederiscorrit, Jakubas
(mpn) = 5-10 Air lemp (°C) II Chop (in) 6.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/l	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water	Water Trans.	Total Phosphate
0	15.8	10.0						. 6.0	(49/1)
]	15.8	9.8						U_ <u></u>	
2	15.8	9.7							
3	15.8	9.6,	i						
4	15.8	9.6							
5	15.5	9.5							
6	15.2	8.7							
7	13.0	4.5							
			- -						
									· · · · · · · · · · · · · · · · · · ·
			3						
			·						

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency - 20 cm Secchi Disc. Table 8.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

## Wildlife Data Sheet

Study <u>Remote &amp; Roadside Lake</u>	<u>Study</u> , Kenai NWR, 1983-84
Water Body <u>Neckshorta Lake</u> Surv	ey Date/Time 8-26-83
Lake Location (Latitude) N 60° 57'	<u>50"</u> (Longitude) <u>W 150° 23' 30"</u>
Code NumberSurvey Crew	Friedersdorff, Jakubas

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds	Alexandra					· ·
Waterfow]	Common Loon	4	0-0-4	Flock	Sight	Water
Raptors	Northern Harrier	1	0-0-1	Single	Sight	Bog
Mammals Big Game	Moose Black Bear	1 2	1-0-0 0-0-2	Single Pair	Sight Sight	- Shore
Furbearers	Muskrat	-		_	Mussel Shells	_

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles

Remarks:

#### RECREATIONAL USE

Recreational uses of Neckshorta Lake include fishing, wildlife viewing, and camping. Since the withdrawal of the Alaska Floatplane Service, we believe little fishing is currently taking place on the lake due to its remoteness.

#### FISHERY RESOURCE SUMMARY

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Neckshorta is a remote, wilderness lake. Rainbow trout were the only game fish captured along with threespine stickleback. The trout CPUE of 0.50 represented the low end of our moderately high abundance range. Similar findings were previously made by the ADF&G. We found no flowing inlet or outlet streams. The lack of young rainbow trout and absence of a trout spawning stream indicates that recruitment of young trout may not be taking place. This appears to be a limiting factor to the continuation of the rainbow trout sport fishery.

Lake water fertility was low to moderate. Other water quality parameters were satisfactory for fish. Fishing pressure is believed to be low. Neckshorta Lake is considered to have the current potential to support a moderate yield rainbow trout sport fishery, but the trout population appears to be declining at the current time due to the lack of recruitment.

ROCK LAKE

#### INTRODUCTION

A fishery survey was conducted on Rock Lake from September 12-14, 1983. Additional water quality data were gathered on July 21, 1983. Table 1 summarizes Rock Lake survey findings.

#### PHYSICAL FEATURES

Rock Lake is tributary to the West Fork Moose River. It is located in the central section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 39' and longitude 150° 38'. The lake and surrounding area were designated as wilderness by the Alaska National Interest Lands Conservation Act of 1980. Rock Lake is part of the Swan Lake Canoe Route and a component of the National Recreation Trail System. The lake has a surface area of 330 acres, a volume of 9,060 acre feet, and is at an elevation of 215 feet. Mean depth of the lake is 27 feet, and maximum depth is 53 feet (Table 1 and Figure 1).

Topography of the watershed is flat. Approximately 1,100 acres form the lake's drainage basin. Terrestrial vegetation consists of an immature black spruce-paper birch forest and several islands of mature white spruce and paper birch mix along the southwestern shore. Several minor scrub-shrub bogs lie along the lake's shoreline. The entire area was burned in the 1947 fire.

The lake water level is maintained by springs, bog seepage, runoff, and intermittent streams. A small inlet stream formed by bog seepage on the northeast shoreline was flowing about one-tenth cubic foot per second. Water marks in the bog indicate that high water levels have been as much as three feet about the level found during our survey. The single outlet stream, which connects to the West Fork Moose River, is located in the southwestern part of the lake. This stream has a defined channel 12 feet wide and one to two feet deep. The stream mouth was blocked from the lake by an 18-inch gravel shoreline berm. A short distance from the lake, the stream had pools of water and a small flow from spring seepage. We believe the outlet stream provides seasonal fish passage to the Moose River system where spawning habitat is available. Most of the lake's shoal water areas appeared to have large expanses of gravel.

Rock Lake is extremely remote. The primary means of access to the lake is by canoe. Aircraft access is currently prohibited by refuge regulation.

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#### FISH

Sockeye (kokanee) salmon, longnose sucker, threespine stickleback, and slimy sculpin were the species captured during our survey (Table 2). Sockeye (Kokanee) salmon was the only game fish found in the lake and was captured at a moderate abundance with a catch per unit effort (CPUE) of 0.21 fish per net hour. Table ].

## U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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					· · ·	7-21-83	Water	0แลไ
Wat	er Body	Rock Lake		Surve	ey Date(s)	9/12-14/83	Fish	
1.	Location: Latitude	Refuge N 60° 39' 20	Kenai NWR Longitud	e <u>W 150° 38</u>	T 3' 15"		<u>S_3</u> nai (C-	35 -2)
2.	Physical Volume Drainage stream at during th Outlets ( lake. F seasonal	Data: Surface 9,060 Ac. Ft. Area 1,100 t the northeast ne survey. cfs) A singl low was blocked fish access to	Area <u>330 Ac.</u> Water Col Ac. Inl corner of the e outlet strear by an 18-inch the West Fork	Max. Depi or <u>Medium</u> ets (cfs) lake. It wa n is located gravel shore Moose River	ch <u>53 Ft.</u> <u>Green</u> <u>There is on</u> as flowing in the sou berm. Th	Mean Depth Water Tran e bog associa about one-ten thwest sectio is stream pro	n <u>27</u> Ft ns <u>16 F</u> ted in] th cfs n of th vides	<u>t</u> et
	Spawning <u>stream ma</u> Access	Habitat <u>There</u> ay provide seas The lake is ac	<u>are large grav</u> onal spawning l cessable only l	vel shoal are nabitat. by canoe.	eas_around	the lake. Th	e outle	<u></u>
3.	<u>Water Qua</u> pH <u>7.6</u> Kjeldahl	lity: D.O. 11 Alk. N 0.52 mg/1 M	.6-0.5 mg/1 44_mg/1 I11.7	Temp. <u>18.1-</u> Hard. SDF <u>1.49</u>	7.5°C _39_mg/1 Poiluti	Cond. <u>98_um</u> Phos. <u>9</u> onNone	<u>hos @                                   </u>	25°C
4.	Fish Spec Tongnose	ies: (Abundan sucker (M), th	ce, H/M/L, Int reespine stick	roduced) So leback (M), s	ockeye (kok slimy sculp	anee) salmon in _ Total Speci	(M), es_4	
5.	Managemen	t History:	No previous fi	shery survey	<u>has been c</u>	onducted on t	his lal	<u><e.< u=""></e.<></u>
6.	Current F 0.21) of anadromo is prese	ishery Status: sockeye (kokan us sockeye salm nt, as well as,	Rock Lake ee) salmon. I on. A moderat threespine st	currently co t may also s e abundance ickleback an	ntains a mc ervice as a (CPUE 0.26) d slimy scu	derate abunda juvenile nur of longnose lpin.	nce (C sery f sucker	PUE or
7.	Vegetatio (1 Sp.), (2 Sp.), Terrestri birch fo	n : Aquatic buckwheat (1:S quillwort (1 S alVege rest with stand	Plant familie p.), water lil p.). tation_consist s_of_mature_wh	s <u>- sedge (</u> ] y ( <u>] Sp.), w</u> s_primarily_ ite_spruce_a	<u>Sp.), hors</u> ater_milfoi C of_an_immat nd_paper_bi	etail (1_Sp.) ] (1_Sp.), po overage % ure_black_spr rch	., bur ndweed 4 uce-pa	reed
8.	Wildlife: 	Raptors (2 S (2 Sp.).	p.), waterfowl	<u>(5 Sp.), gu</u>	lls (2_Sp_)	passerines	<u>(1_Sp_</u>	-),
9.	Recreatio National Facilitie	n: <u>This</u> lake Recreation Tra s <u>There are n</u>	is part of the il System. o recreational	Swan Lake C	anoe Route	and part of t	:he	

Survey Crew: Friedersdorff, Jakubas

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## ROCK LAKE



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## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

. Water Body <u>Rock Lake</u> Code No. Survey Date 9/12-14/83	}
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Goop & Cotch	Average	0					 Fi	sh CPUE	
Category	Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	1000 sq.ft.hrs.	Net Hour	Trap Hour
8 Gill Nets	27	1280 1280	1.0 - 2.0	Sockeye Salmon <u>l</u> / Sockeye Salmon	. 11 19	1-1-9 <sup>.</sup> 1-2-16	0.06 0.11	N/A N/A	N/A N/A
		1280	. 2.5	Longnose Sucker Sockeye Salmon	4	0-0-4 1-0-5	0.02	N/A N/A	N/A N/A
		1280	3.0	Sockeye Salmon	15	0-0-15 1-2-0	0.09 0.02	N/A N/A	N/A N/A
) 1		1280	4.0	Sockeye Salmon Longnose Sucker	20 7 18	0-0-20 1-5-1 0-0-18	0.12 0.05 0.10	N/A N/A N/A	N/A N/A N/A
_	27	6400	All	Sockeye Salmon Longnose Sucker	46 57	5-10-31 0-0-57	0.27 0.33	0.21 0.26	N/A N/A
Total Fish	27	6400	A11	All Species	103	5-10-88	0.60	0.48 ·	N/A
20 Minnow Traps _	24	N/A	N/A	Threespine Stickleback Slimy Sculpin	621 3	0-0-621 0-0-3	N/A N/A	N/A N/A	1.29 0.01
Total Fish	24	N/A	N/A	All Species	624	0-0-624	N/A	N/A	1.30
Seine				Threespine Stickleback Slimy Sculpin Sockeye Salmon	115 11 1	0-0-115 0-0-11 0-0-1	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
Total Fish				All Species	127	0-0-127	N/A	N/A	N/A

1/ These sockeye may be kokanee salmon.

and the second second second second second second second second second second second second second second second

Mean fork length of the sockeye (kokanee) was 9.2 inches (234 mm) and ranged from 4.1 inches (104 mm) to 19.5 inches (495 mm). Their weight averaged 0.7 pounds (300 g) and ranged from 0.03 pounds (14.2 g) to 3.6 pounds (1,620 g). Age of the sockeye (kokanee) was from one to five years, while average annual growth was 2.9 inches (74 mm). The size, age structure, and scale pattern of the sockeye indicated the larger fish may have, been kokanee (resident sockeye salmon). However, no evidence of lake spawning was apparent during the survey. We could not determine if the one year olds were anadromous or young kokanee. The lake may contain both forms of sockeye salmon.

Longnose sucker were moderately abundant with a CPUE of 0.26 fish per net hour. Mean fork length of the sucker was 16.2 inches (411 mm) with a range from 11.8 inches (300 mm) to 18.5 inches (470 mm). Threespine stickleback were also moderate in abundance (CPUE 1.29), and slimy sculpin had a CPUE of 0.01. A summary of fish length, weight, and condition factors are in Table 3. Age-growth of sockeye (kokanee) salmon, back calculated from scales, is in Table 4.

#### AQUATIC VEGETATION

The distribution of aquatic vegetation in the lake was spotty, occupying only four percent of the surface area. Smartweed and pondweeds were the most abundant types of vegetation. Additional submerged aquatic plants may have been present, but due to high winds which disturbed the surface, submerged plants were difficult to see. A complete list of plant species identified is shown in Table 5 with locations plotted in Figure 1.

#### WATER QUALITY

The water quality parameters measured indicated the lake had suitable conditions for fish. The lake is of medium to high fertility based on its alkalinity level of 44 mg/l (MacKenthun and Ingram 1967). The pH was 7.6 while conductivity at 25°C was 98 umhos. Phosphorus was 9 ug/l, Kjeldahl nitrogen 0.52 mg/l, and total hardness 39 mg/l. During July the lake was thermally stratified between 23 and 33 feet (Table 6). Water temperature ranged from 18.1°C at the surface to 7.5°C on the bottom. Dissolved oxygen concentrations were supersaturated from the surface to 26 feet, dropped to 5.8 mg/l (49 percent of saturation) at 39 feet, and to 0.5 mg/l (3 percent saturation) near the bottom. Water color was medium green, and Secchi disc water transparency was 16 feet. The lake had a Morphoedaphic Index of 11.7 and Shoreline Development Factor of 1.49. Tables 1 and 7 give additional water quality data.

#### MANAGEMENT HISTORY

No previous fishery survey has been conducted on Rock Lake.

iusic ...

# Rock Late - 1983

Mesh F. Length F. Length F. Length Gear Species Size Sample Mean SD\* Range (in)No. (mm)(mm) (mm)8 Gill Nets Sockeye (Kokanee) Salmon 1.0 11 164 128 104 - 495 2.0 17 209 73.5 105 -370 2.5 6 235 91.9 105 -330 3.0 3 297 22.5 275 320 -4.0 7 368 42,9 300 425 -Longnose Sucker 2.0 4 390 21.6 370 420 ⊷ 2.5 15 ٩., 414 40.6 300 ---470 3.0 18 398 27.1 350 ---440 4.0 18 426 28.6 340 -460 -FISH WEIGHT BY LENGTH CLASS Length Weight Weight Weight Species Gear Class Sample Mean SD Range (mm)No. (g) (g) (q) Sockeye (Kokanee) 8 Gill Nets 101 - 150 14 16.1 2.77 14.2 -25.3 Salmon 151 - 200 7 135 135 ----135 201 - 250 8 184 35.7 125 250 ---251 - 300 4 354 86.7 260 430 ---301 - 350 6 569 40.4 525 625 -351 - 400 4 780 66.2 730 - 875

## FISH LENGTH BY MESH SIZE

## FISH CONDITION (K) BY LENGTH CLASS

1620

1620

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- 1620

451 - 500

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
8 Gill Nets	Sockeye (Kokanee) Salmon	101 - 150 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400 451 - 500	14 1 8 4 6 4 1	1.27 1.69 1.79 1.51 1.58 1.37	0.08 0.23 0.18 0.17 0.14	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
Totals	Sockeye (Kokanee) Sal	mon All	38	1.48	0.25	1.34 - 1.34 1.03 - 2.19

## Table 4.

## AGE-GROWTH\* OF SOCKEYE (KOKANEE) SALMON Rock Lake, 1983

Year		Fork Leng	th (FL) ir	n Millime	ters at	Annulas	ormation	Capture
Class	No.	<u> </u>	II	III	IV	V	VI	FL
			den 4		· · · · · · · · · · · · · · · · · · ·			
1982	4	75						115
1981	8	78	155					217
ĺ								<u> </u>
1980	6	69	143	230				306
1979	2	63	137	209	293			388
		· ·						500
1978	1	71	127	189	283	382		495
	ļ	1						
Total	No.	21 ,	17	9	3	1		
Ave.	FL (n	nn) 73	147	221	290	382		
Ave.	FL (i	n) 2.9	5.8	8.7	11.4	15.0		
<u></u>		atad fair	7					

*Not cor	rrected	for	length	at	scale	for	mation
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# Table 5.

# ROCK LAKE ASSOCIATED VEGETATION

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# AQUATIC VEGETATION

Class	Symbol	Common Name	Scientific Name				
Emergent	HTF	horsetail	<u>Equisetum fluviatile</u>				
Emergent	SR	spike rush	Eleocharis palustris				
Floating	BR	bur reed	<u>Sparganium angustifolium</u>				
Floating	SW	water smartweed	Polygonum amphibium				
Floating	YPL	yellow pond lily	Nuphar polysepalum				
Submergent	MR	water milfoil	<u>Myriophyllum spicatum</u>				
Submergent	PL	pondweed	<u>Potamogeton filiformis</u>				
Submergent	PR	pondweed	<u>Potamogeton perfoliatus</u>				
Submergent	QW	quillwort	Isoetes muricata				
	ş	WETLANDS VEGETATION					
Class	Symbo]	Vegeta	tion Reference				
Scrub-shrub	PSS1B	National Wetlands Inventory (Kenai					
Scrub-shrub	PSS1C	National Wetlands Inventory (Kenai					
Scrub-shrub	PSS4/1B	National Wetlands Inventory (Kenai					

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees Trees Trees Trees Trees	BS IB IS MB MS	black spruce immature birch immature spruce mature birch mature spruce	<u>Picea mariana</u> <u>Betula papyrifera</u> <u>Picea glauca</u> <u>Betula papyrifera</u> <u>Picea glauca</u>
Below Shrub	G	grass	Gramineae

Table 6.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84

ter Body Rock Lake Survey Date/Time 7-21-83/1050
ke Location (Latitude) N 60° 39' 20" (Longitude) W 150° 38' 15"
de No. Survey Crew Friedersdorff, Jakubas
oud Cover (%) 75 Wind (mph) 10 Air Temp (°C) 16 Chop (in) 2.0
ation

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	18.1	9.9	7.6	85*			VIII	5.0	· 9
_1	18.1	10.0			х.				
2	18.0	10.0							
3	17.9	10.0							
4	17.9	10.0			44	39			
5	17.8	10.0							
6	17.0	10.0							
7	15.2	10.6	1.						
8	13.0	11.6		80		-			
9	10.2	11.6	1 <b>6</b>	f.					
10	9.0	10.6							
11	8.4	8.0							;;
12	8.0	5.8							
13	7.9	3.0		2					
14	7.9	2.5							
15	7.5	0.5				{			
	*Co	nductiv	ity.	djusted t	o 25°C is 98	a umhos			

Remarks: Equipment used: D.). & Temp. - YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-UTe Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT. Table 7.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

Water Analysis Data Sheet

StudyRemote & Roadside Lake Study, Kenai NWR, 1983-84Water Body Rock LakeSurvey Date/Time9-13-83/1200Lake Location (Latitude)N 60° 39' 20"Code No.Survey CrewFriedersdorff, JakubasCloud Cover (%)75Wind (mph)20-25Air Temp (°C)12.0Chop (in)12.0

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	13.2	10.6						4.5	
1	13.2	10.5							
2	13.2	10.5							
3	13.2	10.4							
4	13.2	10.4						**** ***/*****************************	
5	13.2	10.4						· · · · · · · · · · · · · · · · · · ·	
6	13.2	10.4							· · · · · · · · · · · · · · · · · · ·
7	13.2	10.4							
8	13.2	10.4							
9	13.2	10.4							
10	13.2	10.4	******						
11	13.2	10.0							·
12	13.0	0.9							
13	12.0	0.5							
Remarks	: Fo	1110000		d. n n 2	Town VS1	57 Moton	······		

<s: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency - 20cm Secchi Disc.

#### WILDLIFE

Three bald eagles were flying or perching near the lake. A great horned owl was heard. Waterfowl included common loon, red-necked grebe, and three species of ducks. A large number of Bonaparte's gulls were feeding in the lake. The only mammal seen was a mature moose. Wildlife species identified are listed in Table 8.

#### RECREATIONAL USE

The main recreational use of Rock Lake is canoeing. Ancillary uses include wildlife viewing and fishing. The degree of fishing pressure is unknown. During the survey two canoe parties passed through the lake. Although the parties did some fishing, no fish were hooked.

# FISHERY RESOURCE SUMMARY

Rock Lake is a wilderness lake remotely located on the refuge canoe system. Our survey found a moderate abundance of sockeye (kokanee) salmon (CPUE 0.21). The age, size, and scale pattern of these fish indicated the larger ones may be kokanee salmon. The lake may also serve as a nursery area for anadromous sockeye salmon juveniles. The intermittent outlet stream at the southwest end of the lake provides a seasonal migratory route for fish during high water periods. Additional species in the lake included a moderate abundance of longnose sucker (CPUE 0.26), plus the forage species threespine stickleback and slimy sculpin. Lake water fertility was moderate to high. Water quality parameters were generally suitable for fish. Rock Lake is considered to have the potential to support a mountaic yield landlocked sockeye or kokanee salmon sport fishery. ~ .

# KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Wildlife Data Sheet

Study	Ren	ote & Roadsi	de Lake	Study	Kenai	NHP 7	003 0/		
Water	Body F	lock Lake	Surv	ey Date	:/Time	<u>۱ ــــو. دارا قاـ</u> ۲ ۲ ــ ۵			······
Lake	Location	(Latitude) N	60° 39'	20"	(Longi	tude) i	<u> </u>	201	151
Code	Number	Survey	Crew	Frieder	rsdorff	L. Jakı	ibas		

Animal Class	Common Name	Number	Sex M-F-U	Animal Assoc.	Verifi- cation	Habitat Type
Birds						
Waterfowl	Common Merganser Barrow's Goldeneye Surf Scoter Common Loon Red-necked Grebe	43 J+ 4 6 8 15	0-0-43 0-0-4 F 0-0-6 0-0-8 F 0-0-15	Flock lock/Single Pair/Flock lock/Single Single/Pair Flock	Sight Sight Sight Sight Sight	Water Water Water Water Water
Gulls	Parasitic Jaeger Bonaparte's Gull	] 28 J	0-0-1 0-0-28	Single Flock	Sight Sight	Flight Water
Passerines	Common Raven	4	0-0-4	Flock	Sight	ΙB
Raptors	Bald Eagle Great Horned Owl	3 J+ 2	0-0-3 0-0-2	Single Single	Sight Sound	Shore MB
Mammals Big Game	Moose	]	0-0-1	Single	Sight	Shore
Others	Snowshoe Hare	-	_		Cuttings	-

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB= Mature Birch; IB=Immature Birch Remarks:

## INTRODUCTION

A fishery survey of Two Island Lake was conducted from August 8-10, 1983. Additional water quality data were gathered on July 20, 1983. Table 1 summarizes Two Island Lake survey findings.

## PHYSICAL FEATURES

Two Island Lake is located in the northern section of the Kenai National Wildlife Refuge (NWR) at latitude 60° 53' and longitude 150° 16'. Alternative "C" of the draft Kenai NWR Comprehensive Conservation Plan (USFWS 1983) classifies the lake and surrounding area in the Minimal Land Management Category. Two Island Lake has a surface area of 120 acres, a volume of 1,500 acre feet, and is at an elevation of 130 feet. The lake has a mean depth of 13.3 feet and maximum depth of 25 feet (Table 1 and Figure 1).

The watershed is composed of gently rolling hills reaching an elevation of 270 feet. Terrestrial vegetation consists of a mature white spruce-paper birch forest interspersed with some small islands of black spruce. A large emergent wetland lies along the south shore of the lake. The lake's watershed is approximately 2,000 acres in area, but is difficult to define. The 1915-1920 fire burned some of the surrounding forest.

The water regimen of the lake is controlled by springs, streams, and runoff. The major outlet, Pincher Creek, is located on the east side of the lake and flows about six miles to Cook Inlet. A beaver dam, at the outlet of Pincher Creek, raises the lake's water level about three feet above the downstream creek bed. Water was flowing over and around the dam at about five cubic feet per second. Below the dam the creek had good spawning gravel. This stream serves as rainbow trout spawning habitat and as a migratory stream for anadromous fish. Two swampy inlets on the south and west sides of the lake had little flow.

Aircraft is the only practical means of access to the lake. Big Red's Flying Service has a Special Use Permit for a fly-in tent camp. They have two camp sites, one on each of the two lake islands. No other public facilities are on the lake.

#### FISH

Rainbow trout, coho salmon, Dolly Varden, threespine stickleback, and ninespine stickleback were captured during our survey (Table 2). Rainbow trout, the primary game fish, were high in abundance with a catch per unit effort (CPUE) of 1.45 fish per net hour. This tied with one other lake for the highest catch rate for rainbow trout found during the 1983 surveys. Coho salmon juveniles were

# Table 1.

# U.S. FISH AND WILDLIFE SERVICE Lake Survey Summary

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Wat	er Body7	wo Island Lak	e	Survey	Date(s)	7-20-83 8/8-10/83	Water <u>Fish</u>	Qual.
].	Location: Refu Latitude <u>N 60°</u>	ge Kena 53' 00"	i NWR _Longitude _k	1 150° 16'	T 1	<u>9N</u> R <u>6W</u> Map. Ref. <u>Ker</u>	S <u>12</u> ai (D-1	
2.	Physical Data: Volume 1,500 Drainage Area on the west and	Surface Area Ac. Ft. 2,000 Ac. south sides	<u>120 Ac.</u> Water Color Inlets of the lake.	lax. Depth <u>Greenish</u> (cfs) <u>The</u> Flow from	<u>25 Ft.</u> Yellow re are two these in	Mean Depth Water Trans o small, swamp lets was extre	13.3 E 10 Et y inlet mely lo	t_  
	Outlets (cfs) <u>A flow of about</u> connects with ( Spawning Habitat lake.	There is one 5 cfs was pa ook Inlet and Pincher Cr	major outlet ssing over ar provides an eek provides	<u>Pincher (</u> nd around a anadromous rainbow tr	<u>Creek, on</u> <u>beaver d</u> fish mig out spawn	the lake's eas am. Pincher ( ration route. ing habitat fo	t side. Greek r the	
	Access Acce	ss to the lak	e is by aircr	aft.				
3.	Water Quality: [ pH 7.5 Kjeldahl N 0.4	0.0. <u>9.7-0.7</u> A1k. <u>89</u> <u>1 mg/1 MEI 1</u> :	mg/1 Temp mg/T 1 <u>3.3 SDF</u>	19.4-7 ard. 93 ].42	.0°C mg/l Pollutic	Cond. 177 um Phos22 t pnNone	hos @ 2 g/1	<u>5°C</u>
4.	Fish Species: ( threespine stic	, Abundance, H, k]eback (M-H)	/M/L, <u>I</u> ntrodu , ninespine s	ced) <u>Rair</u> tickleback	ibow trout	(H), coho sal ly Varden (L). Total Species	mon (L)	<u> </u>
5.	Management Histo They had a cato Fly-in tent can	ry: The U.S h rate of 0.7 p representat	. Fish and Wi 5 rainbow tro ives indicate	ldlife Ser out per hou d the lake	rvice surv Ir from ex 9 Was a go	eyed the lake perimental gfl od rainbow tro	in 1972 I nets. ut fish	ery.
6.	Current Fishery net catches (CF 0.15) was taker Forage species	<u>Status: A h</u> UE 1.45). A in gill nets were threespi	igh abundance low abundance . One Dolly ne sticklebac	of rainbo of anadro Varden was k (CPUE 2.	ow trout w mous juve captured 81) and o	as indicated f nile coho saln in a minnow t ne ninespine s	rom gil Ion (CPU Tap. tickleb	1 E ack.
7.	Vegetation : Aq (2 Sp.), water (2 Sp.), water Terrestrial <u>The</u> birch forest ir	uatic <u>Plant</u> milfoi] (2 Sp plantain (1 S dominant land terspersed wi	families - p .), bur reed) p.), crowfoot vegetation o th small isla	condweed (4 (1 Sp.), (1 Sp.), consists of ands of bla	Sp.), se duckweed hornworto a mature ick spruce	dge (2 Sp.), H (2 Sp.), Watev verage % white spruce	iorsetai 111y 25 paper	1
8.	<u>Wildlife:</u> <u>Wate</u> (l Sp.).	<u>rfowl (10 Sp.</u>	<u>), raptors (1</u>	,_pas	sserines (	A_Sp.), mamma	S	
9.	Recreation: Fi by Big Red's Fi Facilities Big are no other pu	<u>shing, campin</u> <u>ying Service</u> Red's Flying plic facilitie	ng, wildlife for a fly-in Service has es.	/iewing. / tent_camp. two_tent_c	<u>Special</u> amp sites	Use Permit is on the lake.	held There	
	Survey Crew: F	riedersdorff,	Jakubas					

# TWO ISLAND LAKE



Table 2.

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#### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Summary Fish Catch and Effort Data

Water Body \_\_\_\_\_\_ Two Island Lake Code No.\_\_\_\_\_\_ Survey Date \_\_\_\_\_8/8-10/83

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							. *	•		
Gear & Catch Category	Average Fishing Time (hrs.)	Amount Gear (Sq.Ft.)	Mesh Size (In.)	Fish Species	Total Fish Number	Sex M-F-U	Fi. 1000 sq.ft.hrs.	sh CPUE Net Hour	Trap Hour	
6 Gill Nets	23	960 960 960 960 960	1.0 1.0 2.0 2.5 3.0	Rainbow Trout Coho Salmon Rainbow Trout Rainbow Trout Rainbow Trout	~27 20 99 61 13	8-3-16 0-0-20 52-38-9 22-35-4 8-4-1	1.09 0.91 4.48 2.76 0.59	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A	
By Species	23	4800	A11	Rainbow Trout Coho Salmon	200 20	90-80-30 0-0-20	1.81 0.18	1.45 0.15	N/A N/A	
Total Fish	23	4800	ATT	All Species	220	80-80-50	1.99	1.59	·N/A	
14 Minnow Traps	29	N/A	N/A	Threespine Stickleback Ninespine Sticleback Rainbow Trout Coho Salmon Dolly Varden	1140 1 9 3 1	0-0-1140 0-0-1 0-0-9 0-0-3 0-0-1	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A	2.81 <0.01 0.02 0.01 <0.01	-
Total Fish	29	N/A	N/A	All Species	1154	0-0-1154	N/A	N/A	2.84	

netted at a CPUE of 0.15. The minnow traps took a moderately high abundance of threespine stickleback and one ninespine stickleback. This was the only ninespine stickleback captured from the 18 lakes sampled during the year. Also, one juvenile Dolly Varden was trapped along with additional rainbow trout and coho salmon. A total of six gill nets and 14 minnow traps were used to determine fish abundance.

Rainbow trout captured in gill nets had a mean fork length of 10.9 inches (277mm). The fork length range of the trout was 4.1 inches (105 mm) to 17.7 inches (450 mm). The mean weight of the rainbow trout was 0.72 pounds (327 g) and varied from 0.13 pounds (60 g) to 1.4 pounds (635 g). Trout taken in minnow traps were juveniles, and the one measured was 4.4 inches (112 mm) in fork length. The mean condition factor for trout was 1.23 varying from 0.63 to 1.57. Ages of the rainbow trout, back calculated from scales, was from two to six years. Average annual growth of the rainbow trout was 1.7 inches (43 mm).

The juvenile coho salmon taken from gill nets and minnow traps had a mean fork length of 4.3 inches (110 mm) and ranged from 4.1 inches (105 mm) to 4.9 inches (125 mm). Their average weight was 0.04 pounds (18.9 g) varying from 0.03 pounds (12.7 g) to 0.07 pounds (33.2 g). The mean condition factor for coho was 1.39 with a range from 1.04 to 1.56. All of the coho salmon were one year old.

The single Dolly Varden captured was 5.3 inches (135 mm) fork length and weighed 0.07 pounds (43.9 g). Its condition factor was 1.42. Table 3 shows rainbow trout and coho salmon weight and condition by length class. Table 4 displays rainbow trout age and growth.

#### AQUATIC VEGETATION

Aquatic vegetation was most heavily distributed around the periphery of the lake, north of one island, and in two shallow areas in the southern portion of the lake. Water milfoil, water lily, and pondweed were the dominant plant families. There were also several stands of bulrush in the lake. Aquatic vegetation covered approximately 25 percent of the lake's surface area. Aquatic plants identified are listed in Table 5.

#### WATER QUALITY

The July survey indicated the lake was moderate to high in fertility having an alkalinity level of 89 mg/l (MacKenthun and Ingram 1967). This was above the average fertility measured in the 18 lakes surveyed in 1983. Specific conductance at 25°C was 177 umhos. Phosphorus was 22 ug/l and Kjeldahl nitrogen 0.41 mg/l. The pH was alkaline at 7.5. The lake did not have a true hypolimnion, but temperatures dropped from 19.4°C at the surface to 7°C near the bottom. The most striking temperature decline started around 13 feet. During July dissolved oxygen levels were slightly supersaturated at the surface (9.6 mg/l) to 95 percent saturated around 10 feet (9.4 mg/l). From that point dissolved oxygen quickly declined to 1.6 mg/l (15 percent saturation) at 13 feet and to 0.7 mg/l (less than one percent saturation) near the bottom 12000 0.

Two Island Lake - 1983

FISH LENGTH BY MESH SIZE

F. Length F. Length Mesh F. Length Species Size SĎ\* Gear Sample Mean Range (in) (mm)No. (mm)(mm)6 Gill Nets 27 183 Rainbow Trout 1.0 88.5 105 - 330 14 Minnow Rainbow Trout 2.0 95 273 36.7 200 - 450 Traps Rainbow Trout 2.5 313 22.5 260 - 365 61 Rainbow Trout 3.0 344 35.5 13 250 - 380 0.125 Rainbow Trout 112 112 - 112 1 --Coho Salmon 1.0 20 112 5.23 105 - 125 Coho Salmon 0.125 3 98.7 96 - 100 2.30 Dolly Varden 0.125 135 135 - 135 1 ---

# FISH WEIGHT BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Weight Mean (g)	Weight SD (g)	Weight Range (g)
6 Gill Nets 14 Minnow Traps	Coho Salmon Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	101 - 150 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400	13 2 20 31 48 8	18.9 62.5 171 259 407 572	6.20 3.54 24.5 42.2 73.0 44.9	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$

# FISH CONDITION (K) BY LENGTH CLASS

Gear	Species	Length Class (mm)	Sample No.	Condition Mean	Condition SD	Condition Range
6 Gill Nets 14 Minnow Traps	Coho Salmon Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout Rainbow Trout	101 - 150 151 - 200 201 - 250 251 - 300 301 - 350 351 - 400	13 2 20 31 48 8	1.39 1.33 1.27 1.25 1.21 1.17	0.15 0.01 0.19 0.12 0.15 0.07	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$
[otals	Coho Salmon Rainbow Trout	All	13 109	1.39 1.23	0.15 0.15	1.04 - 1.56 0.63 - 1.57

\*Standard Deviation

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# Table 4.

# AGE-GROWTH\* OF RAINBOW TROUT Two Island Lake - 1983

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Year Class	No.	Fork Leng	nth (FL) i Iľ	n Millimete III	rs at Anr IV	nulus Forn V	nation VI	Capture FL
1981	. ]	45	85			****		112
1980	3	39	79	133				183
1979	3	46	93	144	196			240
1978	5	40	80	124	170			259
1977	5	44	80	119	165	266		309
1976	5	36	72	115	160	257	303	340
Total No	Э.	22,	22	21	18	10	5	
Ave. FL	(mm)	4]	80	125	170	262	303	
Ave. FL	(in)	1.6	3.1	4.9	6.7	10.3	11.9	

\*Not corrected for length at scale formation

Table 5.

# TWO ISLAND LAKE ASSOCIATED VEGETATION

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Class	Symbol	Common Name	Scientific Name
Emergent Emergent Emergent Emergent Emergent	Blr CS HTF HTP MT	bulrush sedge horsetail horsetail mare's tail	<u>Scirpus validus</u> Carex saxatilis Equisetum fluviatile Equisetum palustre Hippuris vulgaris
Floating Floating Floating Floating Floating	BR Dum DWL ST YPL	bur reed duckweed dwarf water lily arrowhead yellow pond lily	<u>Sparganium angustifolium</u> Lemna minor Nymphaea tetragona Sagittaria cuneata Nuphar polysepaTum
Submergent Submergent Submergent Submergent Submergent Submergent	Dut HW MR PF PG PR PR	star duckweed hornwort water milfoil pondweed pondweed pondweed pondweed	Lemna trisulca Ceratophyllum demersum Myriophyllum spicatum Potamogeton friesii Potamogeton gramineus Potamogeton perfoliatus Potamogeton zosterifolius
Submergent	WWC	crowfoot	Ranunculus confervoides

# AQUATIC VEGETATION

WETLANDS VEGETATION

Class	Symbol	Vegetation Reference
Scrub-shrub Emergent	PSS1B PEM5B	National Wetlands Inventory (Kenai) National Wetlands Inventory (Kenai)

# TERRESTRIAL VEGETATION

Class	Symbol	Common Name	Scientific Name
Trees	BS	black spruce	<u>Picea mariana</u>
Trees	MB	mature paper birch	Betula papyrifera
Trees	MS	mature white spruce	Picea glauca
Shrubs	A	alder	Alnus sp.
Below Shrub	CS	sedge	<u>Carex saxatilis</u>
Below Shrub	CR	sedge	<u>Carex rostrata</u>
Below Shrub	G	grass	<u>Gramineae</u>
Below Shrub	MFF	marsh fivefinger	<u>Potentilla palustris</u>
Below Shrub	WC	wild calla	<u>Calla palustris</u>

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(Table 6). Water color was greenish yellow and Secchi disc water transparency was 10 feet. The lake had a Morphoedaphic Index of 13.3 and a Shoreline Development Factor of 1.42. Additional water quality data are in Tables 1 and 7.

#### MANAGEMENT HISTORY

Two Island Lake was first surveyed by the U.S. Fish and Wildlife Service in 1972. An experimental gill net captured 50 rainbow trout for a catch of 0.75 fish per hour (Nelson and Crateau 1972). They indicated that the fly-in tent camp operators reported good rainbow trout fishing.

#### WILDLIFE

A relatively large number of birds were sighted during the survey. There were 10 species of waterfowl including a pair of trumpeter swans which were nesting on the lake, plus a single sandhill crane. Red-tailed hawks were seen flying over the lake. An old beaver dam blocked the outlet stream, but no recent sign of beaver activity was evident. One muskrat was sighted. Wildlife species identified are listed in Table 8.

#### RECREATIONAL USE

Recreational uses of Two Island Lake include sport fishing, camping, and wildlife viewing. Representatives of Big Red's Flying Service indicated that rainbow trout fishing was good for trout in the seven to 12-inch range. They further indicated that about 60 of their fly-in tent camp clients fished the lake in 1982. Most fishing took place during the warmer months. They know of no ice fishing or other people using the lake. Red's Flying Service has had their Special Use Permit since about 1967.

#### FISHERY RESOURCES SUMMARY

Two Island Lake is a remote lake that is primarily used for sport fishing. Our fishery survey found a high abundance of rainbow trout (CPUE 1.45). This was tied with one other lake for the highest catch rate of rainbow trout found in 1983. Juvenile coho salmon were low in abundance (CPUE 0.15). Threespine stickleback were moderately high in abundance. One ninespine stickleback and one juvenile Dolly Varden were also captured. The variety of rainbow trout age classes found indicates that successful spawning and recruitment is taking place yearly. Pincher Creek, the outlet stream, is providing good rainbow trout spawning habitat as well as a migratory route of anadromous coho salmon which were using the lake as a nursery.

Lake water fertility was moderate to high. Dissolved oxygen levels were excellent in the upper 10 feet of the lake. From this depth to the bottom, oxygen concentrations for fish ranged from highly undesirable to lethal. No winter fish kills have been reported. Fishing pressure, based on angler use reported by the tent camp operator, is estimated to be light. Two-Island Lake is considered to have the potential to support a high yield rainbow sport fishery. Table 6.

### KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

#### Water Analysis Data Sheet

Sample Depth (m)	Water Temp. (°C)	D.O. (mg/1	pH )	Conduct- ivity (u mho)	Total Alkalinity (mg/l)	Total Hardness (mg/1)	Water Color	Water Trans. (m)	Total Phosphate (ug/l)
0	19.4	9.6	7.5	158*			XII	3.0	22
Ĩ	19.2	9.6							
2	19.0	9.7							-
3	18.1	9.4	1	162	89	93	-		
4.	15.0	1.6			-				
5	10.2	0.7							
6	.7.0	0.7							
								•	
						1			
	*Condi	ctivi	y ad:	usted to	25°C is 177	umhos			
									,
				· · ·					

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Conductivity - YSI SCT-33 Meter; pH-Hach 17F & Markson 88 Meter; Water Color - Forel-Ule Scale; Water Transparency - 20 cm Secchi Disc; Alkalinity - Hach AC-DT; Hardness - Hach HA-DT.

# Table 7.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

# Water Analysis Data Sheet

Study	Remote & Roadside Lake Study, Kenai NWR, 1983-84
Water	Body Two Island Lake Survey Date/Time 8-10-83/1100
Lake 1	ocation (Latitude) N 60° 53' 00" (Longitude) W 150° 16' 20"
Code N	lo. Survey Crew Friedersdorff, Jakubas
Cloud	Cover (%) 35 Wind (mph) 5 Air Temp (°C) 14.0 Chop (in) 2.0
Static	on

Sample Depth	Water Temp.	D.O.	На	Conduct- ivitv	Total Alkalinitv	Total Hardness	Water	Water Trans.	Total Phosphate
(m)	(°C)	(mg/1	)	(u mho)	(mg/l)	(mg/l)	Color	(m)	(ug/1)
0	18.0	10.6						2.9	
]	17.9	10.4							
2	17.8	10.2							
3	17.8	10.2	3						
4	17.2	5.4							
5.	12.0	0.4							•
6	7.5	0.3							
		1	{			•			
						4 } }			
	1								
	:								

Remarks: Equipment used: D.O. & Temp. - YSI 57 Meter; Water Transparency - 20 cm Secchi Disc. Table 8.

## KENAI FISHERY RESOURCES STATION ALASKA FISHERY RESOURCES PROGRAM U.S. FISH AND WILDLIFE SERVICE

### Wildlife Data Sheet

Study Remote & Roadside Lake Study, Kenai NWR, 1983-84

	Contraction of the local division of the loc	and the second s			The local day in the lo	
Water	r Body	Two Island Lak	te Survey	Date/Time	8-8-83	
Lake	Locatio	n (Latitude) N	60° 53'	00" (Longi	itude)W 150°	16' 20"
Code	Number	Survey	Crew Fr	iedersdorft	-, Jakubas	

Animal Class	Common Name	Number	Sex M-F-U	Animaï Assoc.	Verifi- cation	Habitat Type
Birds	Pressule Colliteres					
Matellowi	Surf Scoter Common Merganser Lesser Scaup Mallard Unid. Ducks Common Loon Red-necked Grebe Trumpeter Swan Sandhill Crane	3 6 J 4 6 J+ 6 3 J+ 3 J+ 2 1	0-0-3 0-0-6 0-0-4 0-0-6 1-1-1 1-1-2 1-1-0 0-0-1	Flock Brood Flock Single/Brood Flock - Pair/Brood Pair Single	Sight Sight Sight Sight Sight Sight Sight Sight Sound	- Flight - - - - - -
Passerines	Gray Jay Black-capped Chickad Common Raven Rusty Blackbird	ee - -	64. 44.		-	MB,MS MB,MS MB,MS MB,MS
Raptors	Red-tailed Hawk	2		Pair-/	Sight	Flight
Furbearers	Muskrat	]	0-0-1	Single	Sight	_

M=Male; F=Female; U=Undetermined; J=Juvenile; J+ = Includes Juveniles MB=Mature Birch; MS=Mature Spruce Remarks: Old beaver cuttings seen and beaver dam still intact on stream. No recent sign of beaver.

<u>1</u>/ Possibly having a territorial fight.

PREPARED BY:

Assistant Project Leader

6-84 2 Date

# SUBMITTED BY:

4 Project Leader

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-12/6/84 Date

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