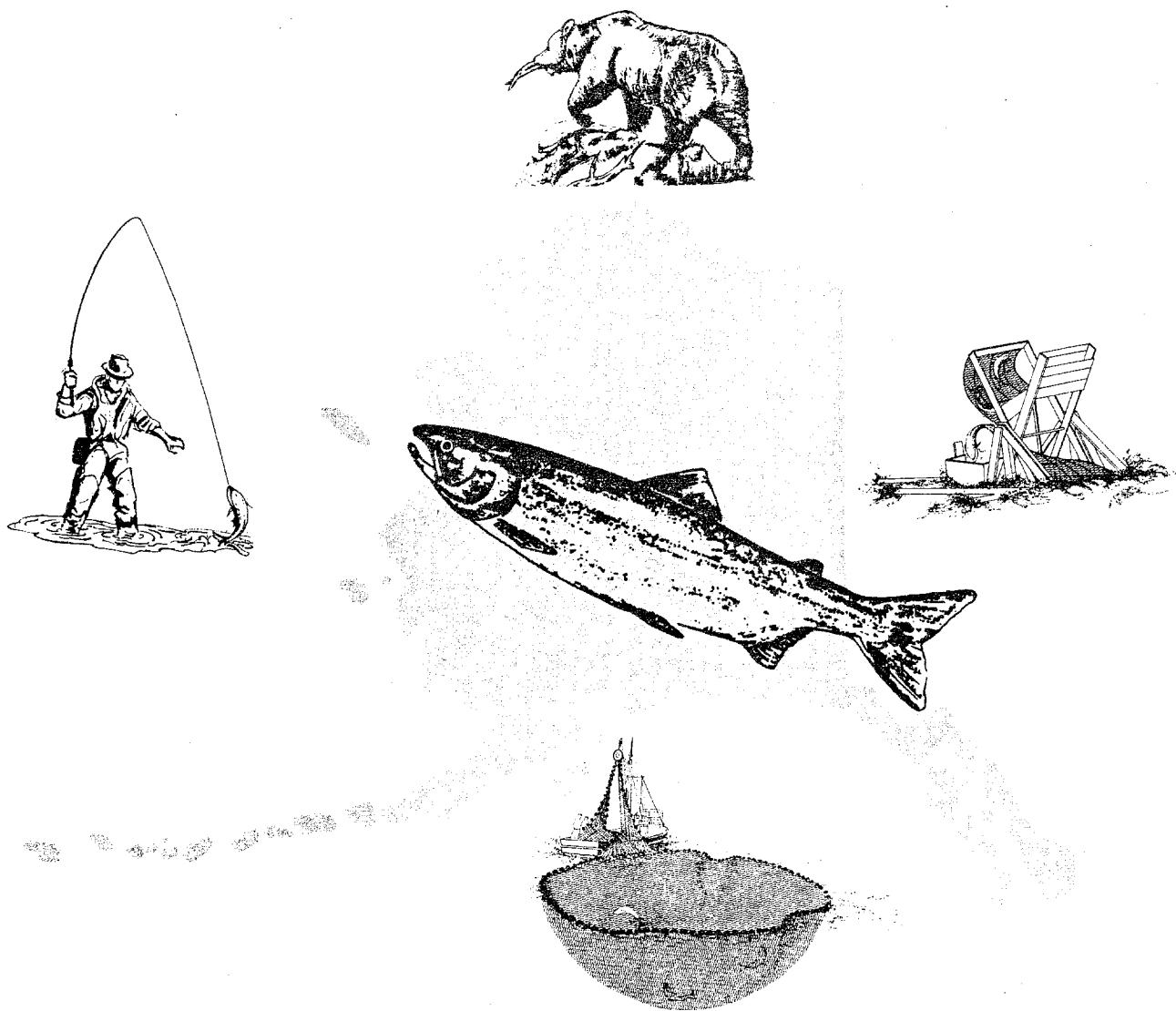


# **WATER RESOURCE INVENTORY AND ASSESSMENT, ARCTIC NATIONAL WILDLIFE REFUGE, 1991 STREAM DISCHARGE GAGING DATA**

Alaska Fisheries Progress Report Number 92-2



March 1992

Region 7

U.S. Fish and Wildlife Service • Department of the Interior

**WATER RESOURCE INVENTORY AND ASSESSMENT**

**ARCTIC NATIONAL WILDLIFE REFUGE**

**1991 Stream Discharge Gaging Data**

**Alaska Fisheries Progress Report**

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## 1991 STREAM DISCHARGE

### Introduction

This progress report documents the accomplishments of the fourth year of a multi-year water resource inventory on the coastal plain (1002 area) of the Arctic National Wildlife Refuge (ANWR). This progress report is intended to provide stream discharge and water temperature data for consideration in other inventory or management activities. These data represent the hydrologic conditions for the 1991 summer season.

The 1002 area of the Arctic National Wildlife Refuge is located in the remote northeast corner of Alaska adjacent to the Beaufort Sea. Because of the remoteness, extreme climatic conditions, small populace, and lack of competitive water use in the past, there has been little interest in the water resources (water yields, discharge rates, flood frequencies, etc.) from state, federal, or private agencies. The nearest stream gaging station (U.S. Geological Survey gage #15908000, Sagavanirktok River) is located 80 miles west of the Canning River, the western boundary of the 1002 area. The Sagavanirktok River is larger than any river in the 1002 area. Therefore the Sagavanirktok River database cannot be extrapolated to provide discharge and flood information for the rivers in the 1002 area.

Hydrologic data for the 1002 area are limited. Childers et al. (1977) reported a reconnaissance level investigation of rivers, springs, aufeis fields, and lakes of the Arctic coastal plain including the 1002 area. Childers et al. (1977) reported data on channel characteristics, watershed characteristics, and estimated flood characteristics of the Canning River, Marsh Creek, Sadlerochit River, Hulahula River, Jago River, and Okerokovik River. Childers et al. (1977) also reported discharge rates and selected water quality parameters for the Katakuruk River Springs, Sadlerochit Springs, Hulahula River Spring, and Okerokovik River Springs. Six lakes were sampled for water quality, ice thickness, and water depth.

Daum et al. (1984), Glesne and Deschermeier (1984), and Smith and Glesne (1982) reported selected physical and chemical characteristics of streams and springs across the 1002 area. Elliott and Lyons (1990) reported on the availability of winter water within stream systems within the 1002 area. A study of the quantity and distribution of water within lakes of the 1002 area was conducted and reported by Elliott (1990), and Trawicki et al. (1991).

There are no precipitation gages located within the 1002 area. The closest precipitation gage is located on Barter Island, and is operated by the U.S. Soil Conservation Service (SCS). The SCS maintains six other precipitation gages in the Arctic region located at: Atigun Camp, Atigun Pass, Barrow, Pruhdoe Bay, Sagwon, and Toolik River. The National Oceanic and Atmospheric Administration (NOAA) maintains seven weather stations in the Arctic region. The data collected from these gages are not representative of precipitation events that occur in the drainage basins of the 1002 area. A combination of data from the SCS stations located in the general vicinity of the 1002 area indicate near average precipitation during the winter months and slightly

below (0-10%) the longterm average precipitation during the summer months (SCS 1990 and unpublished data).

U.S. Fish and Wildlife Service (1989), Lyons (1990), and Lyons and Trawicki (1991) collected and reported discharge and water temperature data for several rivers and streams in the 1002 area for the summers of 1988, 1989, and 1990, respectively. This progress report is a continuation of these studies. The objectives of the 1991 activities were to continue the quantification of water yield and seasonal stream discharge, and to measure stream water temperatures of watersheds within the 1002 area of the ANWR. At the conclusion of the multi-year water resource inventory, stream discharge rates, discharge frequency distributions, average monthly water yields, and flood frequencies and sizes will be quantified.

### Methods

The Water Resources Branch initiated a stream gaging network consisting of eight gaging stations in the 1002 area in 1988. In 1989 the stream gaging network was expanded to 10 gaging stations (Figure 1). The new gaging stations were located on the Niguanak River and Sikrelurak River. Stream discharge data were collected for the Tamayariak River, West Fork of Itkilyariak Creek, Sadlerochit River, Sadlerochit Spring Creek, Akutoktak River, Niguanak River, and Sikrelurak River. Table 1 contains the legal description of the location of each stream gage. Since the Tamayariak River is a hydrologically diverse system with abundant fish and wildlife resources, four stream gages were installed on this watershed.

Water depths and temperatures were measured at all ten stream gaging stations in 1991. A pressure transducer and temperature thermistor was attached to an anchor and placed on the stream bottom at each gaging station. A cable connected the pressure transducer and temperature thermistor to a computerized field recorder located along the river bank. The field recorder took depth and temperature readings at five minute intervals. Water depths were measured to the nearest 0.01 ft, and water temperatures were measured to the nearest 0.1°C. The field recorder summarized the five minute interval data automatically for each 24 hour period into a report that included: average depth, maximum depth, time of maximum depth, minimum depth, time of minimum depth, average temperature, maximum temperature, time of maximum temperature, minimum temperature, and time of minimum temperature. The summarized data were stored on a data storage pack, and summarized data were later down-loaded onto a computer.

Calibration data were collected at each gaging station on a weekly basis. More frequent visits were made to gaging stations during extreme high and low flow periods to increase the range of calibration data collected. Calibration data were collected using standard stream discharge measurement procedures (Buchanan and Somers 1969, and Lyons 1988) and included stream discharge in cubic feet per second (cfs), water depth, and water surface elevation.

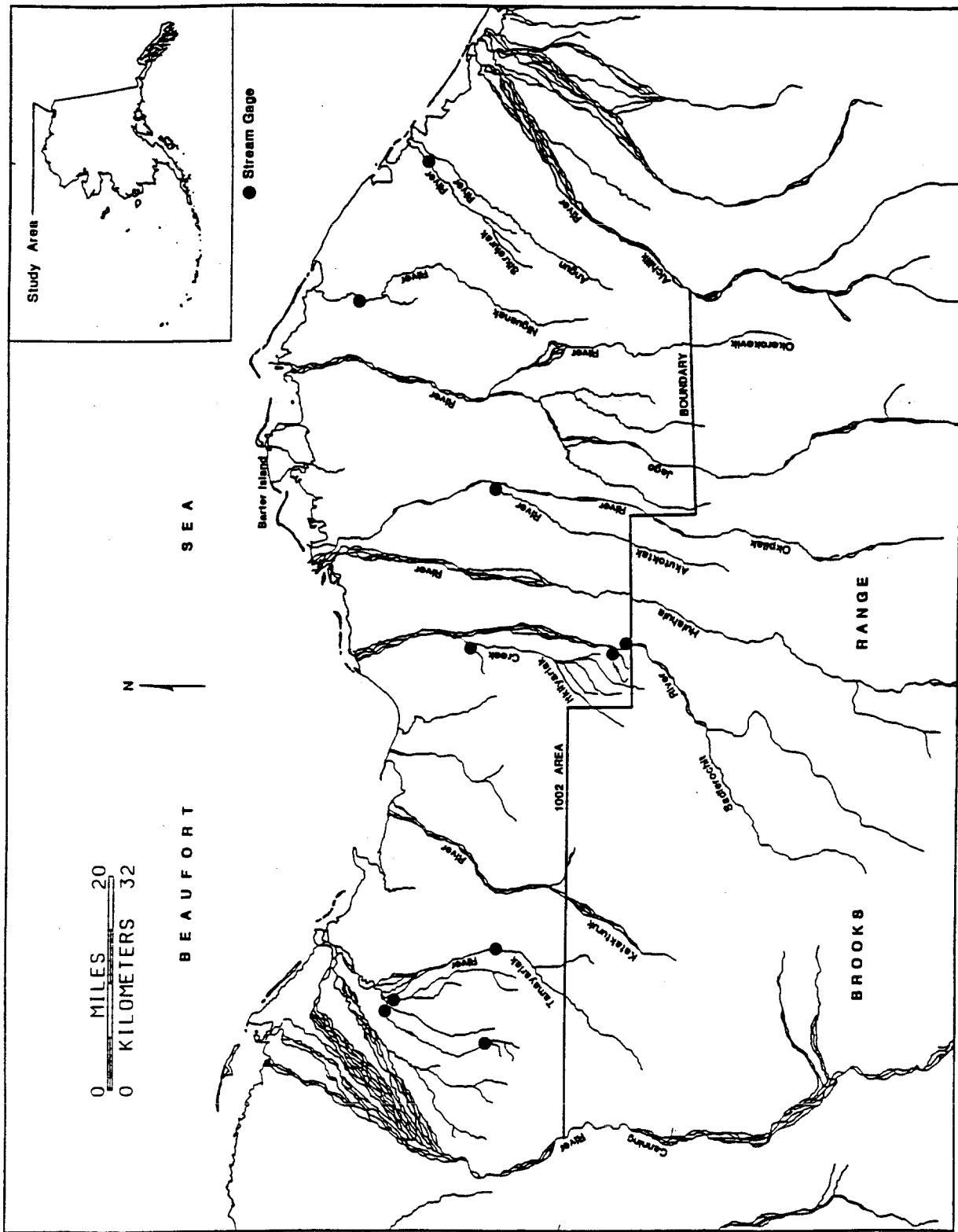


Figure 1.-The 1002 area of the Arctic National Wildlife Refuge with stream discharge gaging station locations.

Table 1.-Stream gaging station locations.

Watershed	Gage Location
Akutoktak River	Center Sec. 36, T6N, R33E
West Fork, Itkilyariak Creek	NE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 33, T6N, R31E
Niguanak River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 36, T8N, R36E
Sadlerochit River	NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 31, T4N, R32E
Sadlerochit Spring Creek	NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 36, T4N, R31E
Sikrelurak River	SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 36, T7N, R38E
Tamayariak River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 35, T6N, R26E
Lower West Fork, Tamayariak River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 12, T7N, R25E
Middle Fork, Tamayariak River	Center Sec. 12, T7N, R25E
Upper West Fork, Tamayariak River	W $\frac{1}{2}$ W $\frac{1}{2}$ Sec. 33, T6N, R25E

Through regression analysis of water depth (x) and stream discharge (y), a linear or polynomial regression equation was obtained for each stream gage. Using the regression equations, water depth data were converted to stream discharge for each stream gaging station.

Average daily discharge was estimated for gaging stations that experienced technical problems during the stream gaging period. For a single missing data point, the missing data point was estimated by averaging the data point from the day prior to and the day following the missing data point. For small data gaps (2-5 days), data points were estimated using the average rate of change in discharge from several streams with similar watershed characteristics. For larger data gaps, a linear relationship was established between the stream with missing data and a stream with similar watershed characteristics and discharge rates. The relationship was established from the average daily discharge for all days that the two streams had records in common. The linear relationship was used to estimate the missing average daily discharge of one stream from the known average daily discharge of the other stream. Where no relationship could be established between two rivers the data gap was left as missing data.

Peak storm discharge was estimated for gaging stations that were damaged or destroyed during a flood event. Peak storm discharge was estimated by surveying the elevation of the high water mark with respect to the benchmark at the gaging station. From the survey, the water depth at the peak of the storm discharge was calculated. The water depth was entered into the regression equation for the gaging station, allowing the peak storm discharge to be calculated.

## Results

Stream gaging stations were installed on June 4, 1991, on the Akutoktak River, Niguanak River, Sadlerochit River, Sadlerochit Springs Creek, Sikrelurak River, Tamayariak River and the Middle Fork Tamayariak River. Ice conditions on the West Fork Itkilyariak Creek and Lower West Fork Tamayariak River delayed stream gage installation until June 7, 1991. Ice conditions on the Upper West Fork Tamayariak River prevented stream gage installation at this location until June 20, 1991. All stream gaging stations were in service until September 24, 1991.

Calibration data were collected from June 13 through September 10. Using the calibration data, polynomial regression equations were obtained for each stream gaging station, except Sadlerochit Springs gaging station. No regression equation was obtained for the Sadlerochit Springs gaging station due to unreliable readings from the field recorder.

Flooding in late July altered the cross sectional area at stream gaging stations located on the Akutoktak River, West Fork Itkilyariak Creek, Sadlerochit River, Tamayariak River, Lower West Fork Tamayariak River, Middle Fork Tamayariak River, and the Upper West Fork Tamayariak River. Due to the altered cross-sectional areas, a second (post-flood) set of calibration data were collected. Utilizing the pre- and post-flood regression equations (Table 2), water depth measurements recorded with the stream gaging equipment were converted to stream discharge (Appendix A). The Niguanak and Sikrelurak Rivers were not affected by the July flood, and therefore single regression equations were used for the entire data sets from these two gaging stations.

The average daily discharge of the Tamayariak River 1988-1991 (Figure 2) clearly shows the highlights of the 1991 stream gaging period and the large variability in discharge records among the four years of record. Note the early installation of the stream gage, the high discharge measurements associated with the early stream gage installation, and the estimated maximum discharge associated with the July flood.

Flooding in late July was extreme during the 1991 stream gaging season. Heavy rains and rapidly rising rivers were reported by field crews camped in the foothills along the Sadlerochit River. Stream gaging equipment on the West Fork Itkilyariak River, Sadlerochit River, and the Lower West Fork Tamayariak River were damaged during the flood. The Tamayariak River stream gaging station was completely washed away. The field recorder was found 0.5 mile downstream after the river subsided. The pressure transducer, temperature thermistor, and anchor were never recovered. The July 1991 flood produced record breaking extreme maximum discharges for the four years of record on the Sadlerochit River (21,000 cfs; estimated), Tamayariak River (5,200 cfs; estimated) and the Lower West Fork Tamayariak River (1,433 cfs).

Ice conditions and high water made stream gage installation difficult. Stream gaging stations were installed just after breakup, during the high spring breakup flow. This was the earliest that stream gaging stations were

Table 2.-Regression equations from stream discharge calibration data, where x = water depth (ft) and y = stream discharge (cfs).

Watershed	Regression Equation	R <sup>2</sup>
Akutoktak River	$y_a = 151.5 - 57.9x - 48.1x^2 + 19.7x^3$ $y_b = 245.6 - 178.0x + 2.1x^2 + 13.1x^3$	0.99 0.99
West Fork Itkilyariak Creek	$y_a = 28.6 - 77.8x + 72.7x^2 - 9.2x^3$ $y_b = 120.6 - 197.5x + 80.9x^2$	0.99 0.99
Niguanak River	$y_c = 3030.0 - 2356.8x + 556.3x^2 - 35.7x^3$	0.99
Sadlerochit River	$y_a = 1361.3 - 1283.5x + 413.3x^2$ $y_b = -79.8 + 515.0x - 173.1x^2 + 80.6x^3$	0.99 0.99
Sadlerochit Springs Creek	no equation	
Sikrelurak River	$y_c = -105.9 + 217.7x - 169.2x^2 + 57.0x^3$	0.99
Tamayariak River	$y_a = 513.0 - 823.9x + 343.5x^2$ $y_b = -3369.0 + 3928.7x - 1527.2x^2 + 203.9x^3$	0.99 0.99
Lower West Fork Tamayariak River	$y_a = 249.4 - 176.5x + 10.7x^2 + 8.2x^3$ $y_b = 426.5 - 372.2x + 82.5x^2$	0.99 0.99
Middle Fork Tamayariak River	$y_a = -251.3 + 391.4x - 224.2x^2 + 49.5x^3$ $y_b = 132.7 - 200.9x + 79.4x^2$	0.99 0.99
Upper West Fork Tamayariak River	$y_a = -4093.1 + 3377.1x - 943.2x^2 + 89.8x^3$ $y_b = 138.4 - 166.5x + 38.8x^2 + 7.6x^3$	0.99 0.99

$y_a$  = Pre-flood regression equation.

$y_b$  = Post-flood regression equation.

$y_c$  = Entire season regression equation.

# Tamayariak River

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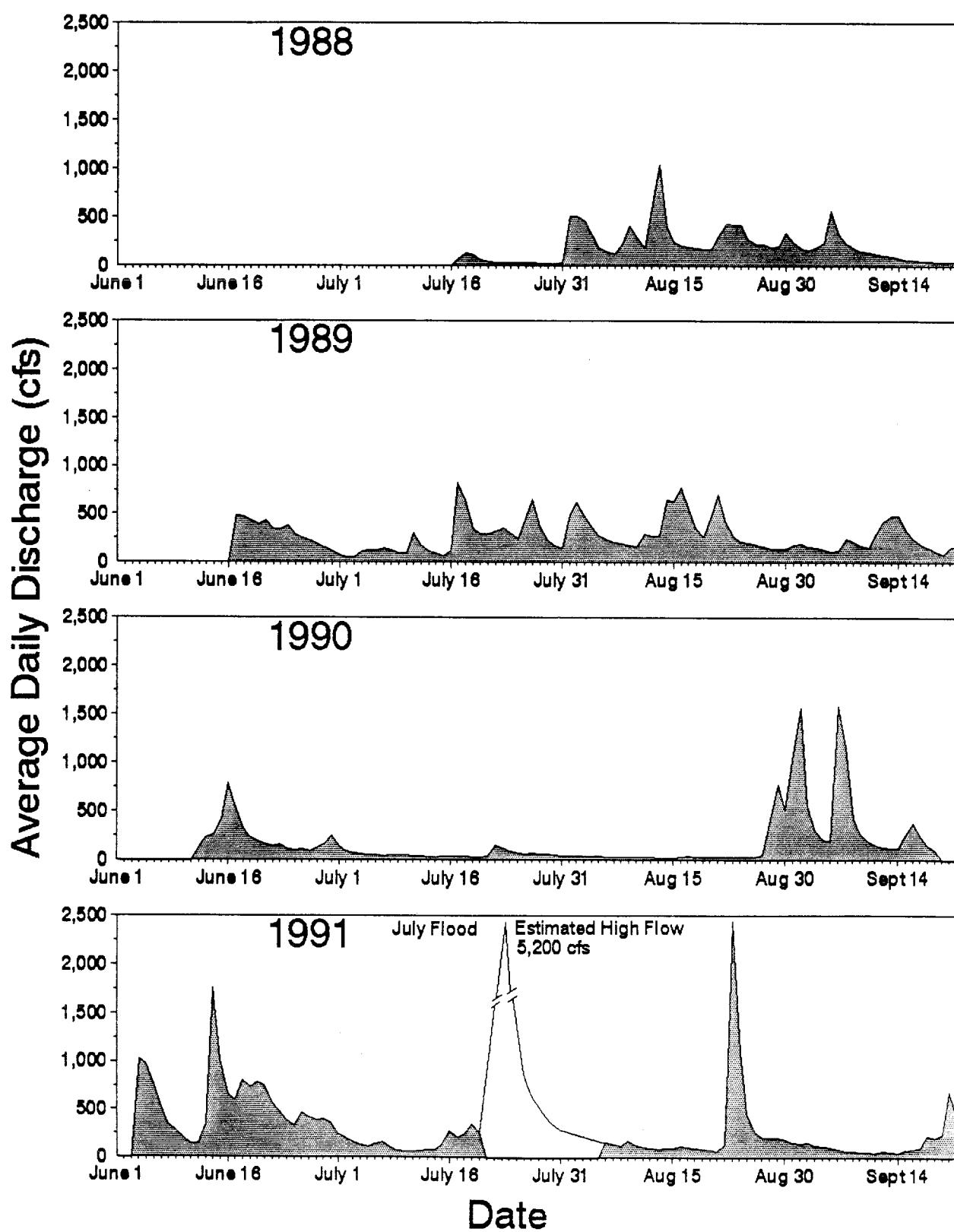


Figure 2.-Comparison of discharge records for the Tamayariak River for the four years of record, 1988-1991.

operating with respect to breakup. The early stream gage installation yielded extreme maximum discharge records of 1,867 cfs to be set on the Middle Fork Tamayariak River, and 1,787 cfs on the Sikrelurak River on June 4, 1991.

Two extreme minimum flow records were also set. Both minimum flow records were set in conjunction with the low flows and cold water temperatures that occur just before freeze-up. Extreme minimum discharge records of 39 cfs and 8.3 cfs were recorded on the Sadlerochit River on September 15, 1991, and on the Tamayariak River on September 14, 1991 respectively. Extreme minimum discharge records of 0 cfs on the Sikrelurak River during September 6-8, 1991, tie minimum discharge records set in 1989 and 1990.

Water temperature measurements taken from all gaging stations except Sadlerochit Springs are given in Appendix B. The daily average water temperature as well as the maximum and minimum temperatures and the time of each are provided.

Equipment malfunction, and damage or movement of field recorders, pressure transducers and temperature thermistors due to flooding resulted in data gaps at several stream gaging stations throughout the gaging period (Table 3). Field recorders stopped logging data on the Niguanak River, Lower West Fork Tamayariak River, and the Middle Fork Tamayariak River. Field recorders were replaced and average daily discharge estimates were made for the missing data. Although the field recorder at the Sadlerochit Springs Creek gaging station was operating the entire season, the water depth data from the field recorder were inconsistent and considered to be unreliable. The entire Sadlerochit Springs Creek data set was discarded. High water during breakup and the July flood caused data gaps on the West Fork Itkilyariak Creek (16 days; 2 events), Sadlerochit River (14 days), Tamayariak River (16 days), and the Upper West Fork Tamayariak River (1 day). Average daily discharge estimates were made for data gaps on the West Fork Itkilyariak Creek (3 days, 1 event) and the Upper West Fork Tamayariak River. No relationships could be established to estimate the remainder of the missing discharge data.

#### Discussion

Fiscal year 1991 was the fourth year of a multi-year water resource inventory program designed to quantify stream discharge rates, discharge frequency distribution, average monthly water yields, and flood frequencies and sizes within the 1002 area of the Arctic National Wildlife Refuge. Figure 2 shows the extreme variability in discharge data for the four years of record and illustrates the need of several years of discharge data before quantification of drainage basin characteristics can be made.

The closest river with a long record of discharge measurements is the Sagavanirktoq River. The Sadlerochit and Tamayariak Rivers are the largest rivers with gaging stations in the 1002 area. A comparison of the average daily discharge of the Sadlerochit ( $R^2=0.48$ ) and Tamayariak ( $R^2=0.22$ ) rivers

Table 3.-Summary of missing 1991 stream discharge and temperature data.

Gage Location	No. Days	Dates of Missing Data	Remarks
West Fork Itkillyariak Creek	3	6/15-6/17	Debris pulled pressure transducer from anchor. Discharge data were estimated. No temperature data were lost.
	13	7/22-8/3	Field recorder was flooded. Discharge and temperature data were lost.
Niguanak River	3	6/4-6/6	Field recorder malfunctioned and was replaced. Discharge and temperature data were lost.
	6	6/07-6/12	Field recorder malfunctioned. Data storage pack was replaced. Discharge and temperature data were lost.
	3	9/22-9/24	Pressure transducer malfunctioned. Discharge data were estimated. No temperature data were lost.
Sadlerochit River	14	7/21-8/4	Debris pulled pressure transducer from anchor during flood event. Peak storm discharge was estimated. Discharge data were lost. No temperature data were lost.
Sadlerochit Springs	110	6/7-9/24	Unreliable probe readings. Data were discarded.
Tamayariak River	16	7/21-8/5	Flood washed out gaging station. Peak storm discharge was estimated. Discharge and temperature data were lost. Gaging station equipment was lost or destroyed.
Lower West Fork Tamayariak River	2	7/23-7/24	Field recorder stopped logging data and had to be replaced. Discharge data were lost. Temperature data were lost.
Middle Fork Tamayariak River	3	8/11-8/13	Field recorder stopped logging data and had to be replaced. Discharge data were estimated. Temperature data were lost.
Upper West Fork Tamayariak River	1	8/5	Anchor and probes were reset because flood altered channel and stream bottom. Discharge datum was estimated.

to the Sagavanirktok River for 1988, 1989, and 1990 were unsuccessful. The Sagavanirktok River is a much larger drainage system than any drainage within the 1002 area and a strong correlation was not expected.

Early installation of stream gaging stations in 1991 provided additional discharge information for the breakup period that has previously not been recorded. The 1991 data still do not cover the entire breakup process. Due to the extreme conditions that exist prior to and during breakup, stream gaging stations cannot be installed until the river channel is free of anchor ice. This accounts for the limited documentation of discharge measurements during the breakup period.

Seven new extremes for the period of record were set during the 1991 gaging season. Record breaking maximum discharges were recorded in conjunction with breakup on the Sikrelurak River and Middle Fork Tamayariak River. Maximum record breaking discharges were recorded during the July flood on the Sadlerochit, Tamayariak and Lower West Fork Tamayariak Rivers. Two record breaking minimum flow records were set just prior to freeze up on the Sadlerochit and Tamayariak rivers. Low flows in mid September on the Sikrelurak River tied the extreme low flow record (0 cfs) set in 1989 and 1990.

The two largest rivers with gaging stations (Sadlerochit and Tamayariak Rivers) recorded record high and record low discharges during the 1991 gaging season. Overall discharge for the 1991 gaging season was between the continuous high flow season of 1989 and the extended low flow season of 1990.

Estimates of missing data were made for small data gaps or where a strong relationship between discharge from two streams was found. As additional data are collected these relationships should improve and missing discharge records may be estimated.

### References

- Buchanan, T.J., and W.P. Somers. 1969. Discharge measurements at gaging stations. U.S. Geological Survey Techniques Water-Resource Investigation of the United States Geological Survey, Book 8, Chapter A8, Washington D.C.
- Childers, J.M., C.E. Sloan, J.P. Meckel, and J.W. Nauman. 1977. Hydrologic reconnaissance of the eastern north slope, Alaska. U.S. Geological Survey Open-File Report 77-492, Anchorage, Alaska.
- Daum, D., P. Rost, and M. Smith. 1984. Fisheries studies on the north slope of the Arctic National Wildlife Refuge, 1983. Pages 464-522 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1983 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.
- Elliott, G.V. 1990. Quantification and distribution of winter water within lakes of the 1002 area, Arctic National Wildlife Refuge, 1989. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 7, Anchorage, Alaska.
- Elliott, G.V. and S.M. Lyons. 1990. Quantification and distribution of winter water within river systems of the 1002 area, Arctic National Wildlife Refuge. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 6, Anchorage, Alaska.
- Glesne, R.S., and S.J. Deschermeier. 1984. Abundance, distribution and diversity of aquatic microinvertebrates on the north slope of the Arctic National Wildlife Refuge, 1982 and 1983. Pages 523-569 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1983 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.
- Lyons, S.M. 1988. Stream discharge measurement handbook. U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska.
- Lyons, S.M. 1990. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1989 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 8, Anchorage, Alaska.
- Lyons, S.M., J.M. Trawicki. 1991. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1990 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report, Anchorage, Alaska.

Smith, M.W., and R.S. Glesne. 1982. Aquatic Studies on the north slope of the Arctic National Wildlife Refuge, 1981 and 1982. Pages 291-364 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1982 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.

Soil Conservation Service. 1990. Alaska snow survey, 1990 annual data summary. U.S. Department of Agriculture, Anchorage, Alaska.

Trawicki, J.M., S.M. Lyons, and G.V. Elliott. 1991. Distribution and quantification of water within lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska.

U.S. Fish and Wildlife Service. 1989. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1988 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report, Anchorage, Alaska.

**Appendix A**

**Surface Water Discharge Records**

## ARCTIC NATIONAL WILDLIFE REFUGE

## Akutoktak River

LOCATION.--Lat 60°49'58", long 143°46'50", in center sec. 36, T.6N., R.33E., 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi<sup>2</sup>, of which 66.0 mi<sup>2</sup> is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,703 cfs Aug. 20, 1989 @ 2350 hrs; Minimum Discharge, 0.7 cfs Aug. 18, 1990.

## JUNE 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -	- - -	- - -	- - -	- - -
2	- - -	- - -	- - -	- - -	- - -
3	- - -	- - -	- - -	- - -	- - -
4	566	0003	746	1343	467
5	395	0153	566	2358	264
6	194	0003	264	2358	144
7	124	0028	147	2358	90
8	73	0218	92	2338	59
9	50	0008	61	2358	43
10	40	0718	51	2358	33
11	31	2318	37	0733	28
12	58	2358	152	0003	35
13	308	2358	410	0003	152
14	597	1848	768	0003	400
15	451	0013	669	2358	362
16	296	0008	366	1458	268
17	284	2323	371	1138	242
18	348	1948	395	0923	292
19	256	0013	376	1353	214
20	227	0113	264	1218	197
21	169	0033	227	1803	144
22	124	0058	169	2358	92
23	76	0003	92	1353	71
24	64	0003	73	2353	53
25	43	0003	53	1113	39
26	53	2358	128	0628	35
27	163	0423	191	0003	131
28	100	0013	141	2358	76
29	61	0228	76	2353	47
30	46	0558	56	2243	40
TOTAL	5197	- - -	- - -	- - -	- - -
AVERAGE	192		257		149
MAXIMUM	597		768		467
MINIMUM	31		37		28
ACRE FT	10308	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Akutoktak River

JULY 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	62	1023	73	0013	42
2	50	0023	61	2358	39
3	32	0028	40	2358	25
4	22	0003	25	2358	18
5	14	0003	18	2018	13
6	10	0018	13	1753	8.7
7	8.7	0023	9.8	1603	7.6
8	7.1	0028	8.7	2353	5.3
9	4.9	0003	5.3	2353	4.1
10	4.5	1603	4.5	0318	3.8
11	3.8	0013	4.1	2358	3.8
12	3.8	1258	4.5	0633	3.4
13	3.8	0003	4.1	2043	3.4
14	3.8	0733	4.5	1853	2.8
15	3.1	2358	3.8	0003	2.8
16	4.5	0823	5.3	2003	3.4
17	3.8	0243	4.9	1908	2.8
18	3.8	0618	4.1	2303	3.1
19	53	0948	82	0003	3.4
20	44	0008	64	2353	30
21	37	1933	39	0408	33
22	60	2358	134	0213	38
23	314	1318	433	0003	136
24	236	0013	338	2353	168
25	122	0013	168	2353	90
26	71	0008	90	2358	55
27	47	0003	55	2358	38
28	36	0008	38	1753	34
29	33	0323	37	2328	29
30	29	2353	34	1433	28
31	63	1608	76	0008	34
TOTAL	1389	- - -	- - -	- - -	- - -
AVERAGE	45	61			29
MAXIMUM	314	433			168
MINIMUM	3.1	3.8			2.8
ACRE FT	2755	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Akutoktak River

AUGUST 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	63	0018	73	2358	54
2	45	0013	54	2343	38
3	34	0003	39	2353	30
4	28	0003	30	2318	27
5	29	2033	31	0413	27
6	26	0158	31	2218	22
7	20	0033	23	2358	17
8	19	1028	21	0053	17
9	19	2333	26	0658	16
10	23	0038	26	2353	21
11	18	0003	21	2353	16
12	15	0008	16	2348	13
13	12	0008	13	2038	11
14	55	1318	93	0003	12
15	96	1733	104	0653	88
16	100	0923	104	2353	93
17	80	0003	93	2358	68
18	60	0003	68	2358	54
19	47	0008	54	2353	40
20	37	0003	40	2358	33
21	29	0003	33	2343	26
22	25	1443	27	2348	24
23	30	2358	39	0128	23
24	44	1823	47	0003	39
25	43	0018	45	2358	39
26	34	0003	39	2358	31
27	26	0008	30	2358	23
28	21	0013	23	2358	19
29	17	0003	19	2353	15
30	14	0003	15	2358	13
31	11	0003	13	2358	10
TOTAL	1118	- - -	- - -	- - -	- - -
AVERAGE	36		42		31
MAXIMUM	100		104		93
MINIMUM	11		13		10
ACRE FT	2218	- - -	- - -	- - -	- - -

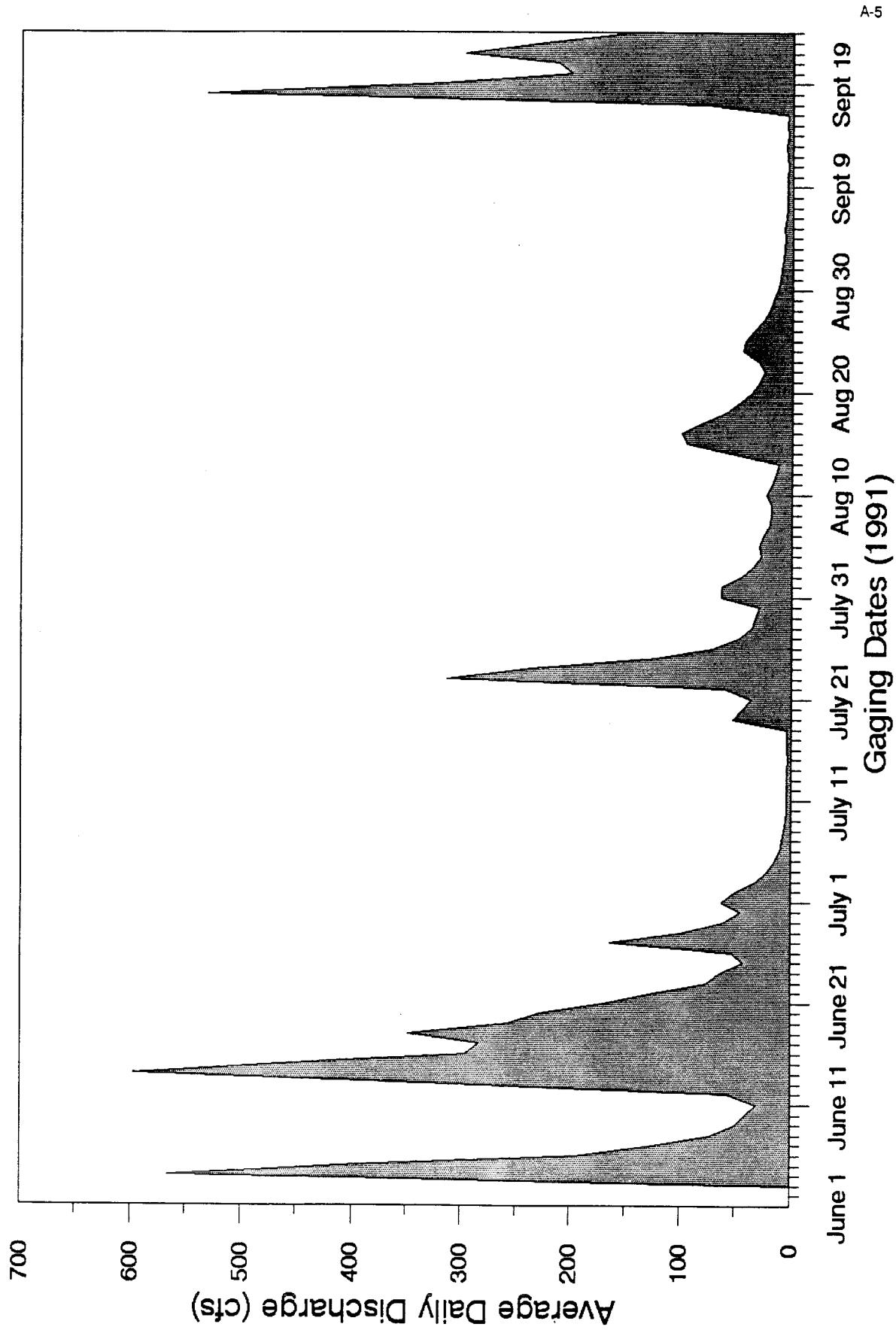
## ARCTIC NATIONAL WILDLIFE REFUGE

## Akutoktak River

SEPTEMBER 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	10	0013	10	2353	8.7
2	8.2	0018	8.7	0813	7.7
3	7.3	1443	7.7	0728	6.5
4	6.9	1438	6.9	0728	6.5
5	7.3	1423	9.7	2358	5.7
6	5.4	1528	5.7	2338	5.0
7	4.7	0008	5.0	2243	4.4
8	5.0	1748	5.4	0253	4.4
9	5.0	1803	5.7	0848	4.4
10	4.7	1018	7.3	0813	2.4
11	4.4	0013	5.4	2358	3.4
12	4.7	1358	6.5	0128	3.2
13	5.4	0003	6.5	0758	4.7
14	4.4	1113	7.7	0733	2.4
15	5.0	1053	10	0558	3.2
16	4.2	2348	4.4	0818	3.9
17	76	2348	673	0003	4.4
18	532	0253	686	2353	424
19	318	0008	424	2348	243
20	200	0003	243	2348	168
21	213	2323	260	0028	168
22	298	0803	330	0008	257
23	226	0048	275	2358	188
24	141	0008	188	1933	104
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
TOTAL	2094	- - -	- - -	- - -	- - -
AVERAGE	87	133			68
MAXIMUM	532	686			424
MINIMUM	4.2	4.4			2.4
ACRE FT	4154	- - -	- - -	- - -	- - -

Akutoktak River  
1991



## ARCTIC NATIONAL WILDLIFE REFUGE

## Itkilyariak Creek, West Fork

LOCATION.--Lat 69°50'19", long 144°24'43", NE<sup>1/4</sup>NW<sup>1/4</sup>NW<sup>1/4</sup> sec. 33, T.6N., R.31E., 0.6 miles upstream from the confluence with the Itkilyariak Creek, 20.75 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--26.9 mi<sup>2</sup>, of which 8.7 mi<sup>2</sup> is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 3rd Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,419 cfs Aug. 20, 1989 @ 1825 hrs; Minimum Discharge, 0 cfs July 2-6, 1989, and July 13-16, 1990.

## JUNE 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -		- - -		- - -
2	- - -		- - -		- - -
3	- - -		- - -		- - -
4	- - -		- - -		- - -
5	- - -		- - -		- - -
6	- - -		- - -		- - -
7	155	1545	167	0635	122
8	111	0005	144	0835	100
9	90	0005	111	0730	80
10	70	0005	80	0655	61
11	61	2355	70	0515	52
12	70	2340	111	0945	61
13	178	2355	260	0005	100
14	241	1550	276	2245	19
15	170 e	0010	- - -	1345	- - -
16	120 e	0035	- - -	1105	- - -
17	100 e	2215	- - -	1310	- - -
18	178	1850	221	0810	144
19	144	0010	189	1225	111
20	144	1800	189	0940	100
21	122	2235	167	1315	90
22	100	0005	155	1510	70
23	70	2020	100	1115	52
24	52	0020	80	1515	37
25	37	2400	52	1405	30
26	80	1515	155	0625	37
27	70	0010	100	1300	61
28	52	0010	80	1150	44
29	44	1625	61	1140	30
30	37	0005	44	1510	37
TOTAL	2495		- - -		- - -
AVERAGE	104		134		68
MAXIMUM	241		276		144
MINIMUM	37		44		19
ACRE FT	4949		- - -		- - -

NOTE: e = Estimated

## ARCTIC NATIONAL WILDLIFE REFUGE

## Itkilyariak Creek, West Fork

JULY 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	30	0015	37	1620	24
2	19	0010	24	1655	14
3	14	0025	19	1905	11
4	* 11	0205	14	2230	8.1
5	8.1	2355	11	1925	6.5
6	8.1	0230	14	1855	6.5
7	8.1	0040	11	1715	8.1
8	8.1	2400	8.1	2350	6.5
9	6.5	0330	6.5	2355	6.0
10	6.5	1710	8.1	0140	6.0
11	6.5	1425	6.5	2355	6.5
12	6.5	1345	8.1	0155	6.5
13	8.1	0645	8.1	2345	6.5
14	6.5	0010	6.5	2250	6.0
15	6.0	2355	6.5	2400	6.0
16	11	1105	19	2400	6.5
17	8.1	0005	11	2115	8.1
18	8.1	2105	14	1555	6.5
19	14	1310	14	2355	11
20	8.1	2400	11	2340	8.1
21	37	1945	178	0345	8.1
22	- - -	- - -	- - -	- - -	- - -
23	- - -	- - -	- - -	- - -	- - -
24	- - -	- - -	- - -	- - -	- - -
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
31	- - -	- - -	- - -	- - -	- - -
TOTAL	239	- - -	- - -	- - -	- - -
AVERAGE	11		21		8.4
MAXIMUM	37		178		24
MINIMUM	6.0		6.5		6.0
ACRE FT	475		- - -		- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Itkilyariak Creek, West Fork

AUGUST 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -	- - -	- - -	- - -	- - -
2	- - -	- - -	- - -	- - -	- - -
3	- - -	- - -	- - -	- - -	- - -
4	11	0722	11	1917	11
5	11	0942	11	2242	9.5
6	13	2012	21	0007	10
7	14	0017	20	2342	12
8	11	2357	14	1432	11
9	16	2357	17	0007	14
10	17	0647	20	2357	13
11	11	0012	13	2347	9.5
12	7.9	0022	9.5	2342	7.0
13	6.1	0002	7.0	2342	5.6
14	5.2	0007	5.6	2327	4.8
15	5.6	2347	6.1	0037	4.8
16	7.4	1257	8.4	0012	6.1
17	7.9	0647	8.4	1707	7.9
18	7.9	0452	8.4	2352	7.0
19	6.1	0002	7.0	2357	5.6
20	4.8	0027	5.6	2357	4.4
21	4.1	0002	4.4	2352	3.4
22	14	2342	207	0627	3.1
23	173	0022	210	2337	154
24	115	0022	157	2342	86
25	64	0002	88	2357	49
26	40	0037	49	2352	32
27	29	0447	34	2332	26
28	29	0712	33	0017	26
29	31	0607	38	2212	26
30	26	0512	32	2307	21
31	22	0742	25	2317	18
TOTAL	710	- - -	- - -	- - -	- - -
AVERAGE	25	38		21	
MAXIMUM	173	210		154	
MINIMUM	4.1	4.4		3.1	
ACRE FT	1408	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

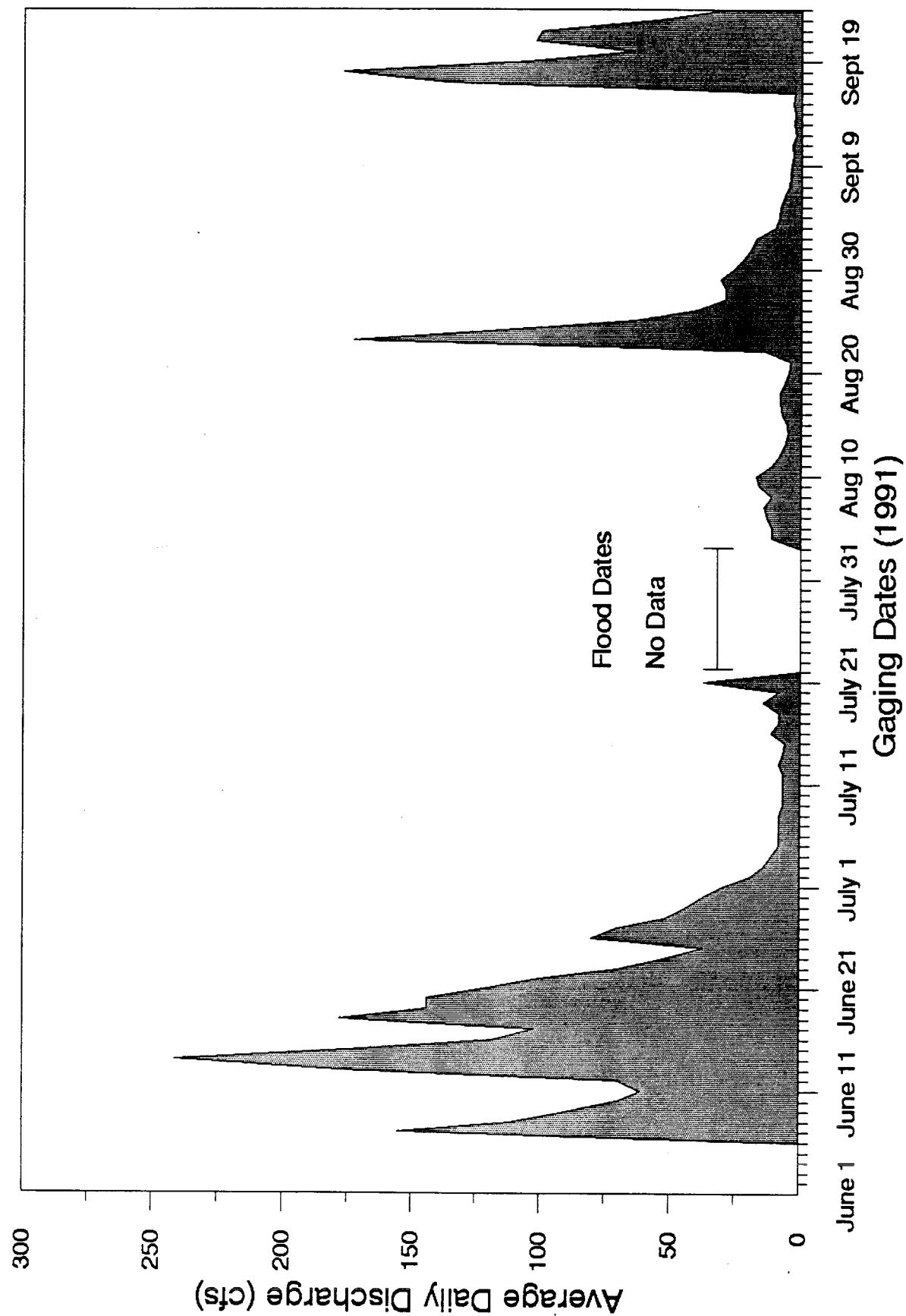
## Itkilyariak Creek, West Fork

SEPTEMBER 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	19	0507	20	1847	17
2	17	0402	21	2347	12
3	10	0002	12	2337	9.0
4	8.4	0007	9.0	2157	7.9
5	7.9	1537	9.0	2352	7.0
6	6.5	0007	7.4	2357	5.6
7	4.8	0007	5.6	2332	4.1
8	4.4	1722	4.8	0322	4.1
9	4.1	0002	4.4	1332	3.7
10	3.1	2257	5.2	1457	2.0
11	3.7	0122	4.8	1247	2.5
12	2.2	0002	3.1	1902	1.7
13	2.8	2242	3.7	1422	2.2
14	2.5	2332	4.4	0647	1.1
15	3.4	0037	4.4	1327	2.8
16	2.5	2352	3.4	1337	2.0
17	137	1937	226	0002	3.4
18	177	0007	207	2352	154
19	105	0007	154	2357	79
20	64	0007	81	1522	57
21	102	2137	129	0022	60
22	100	0012	127	2342	76
23	56	0012	78	2357	44
24	29	0017	44	1027	21
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
TOTAL	872	- - -	- - -	- - -	- - -
AVERAGE	36	49		24	
MAXIMUM	177	226		154	
MINIMUM	2.2	3.1		1.1	
ACRE FT	1730	- - -	- - -	- - -	- - -

**West Fork Itkillyariak Creek**  
1991

A-10



## ARCTIC NATIONAL WILDLIFE REFUGE

## Niguanak River

LOCATION.--Lat 70°0'35", Long 143°1'54", NW&NW&NE& sec. 36, T.8N., R.36E., 6 miles upstream from the mouth, 16.5 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.--136.2 mi<sup>2</sup>.

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,071 cfs Aug. 21, 1989 @ 0310 hrs; Minimum Discharge, estimated 0 cfs Aug. 2, 7, 10-27, 1990.

## JUNE 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -		- - -		- - -
2	- - -		- - -		- - -
3	- - -		- - -		- - -
4	- - -		- - -		- - -
5	- - -		- - -		- - -
6	- - -		- - -		- - -
7	- - -		- - -		- - -
8	- - -		- - -		- - -
9	- - -		- - -		- - -
10	- - -		- - -		- - -
11	- - -		- - -		- - -
12	- - -		- - -		- - -
13	1114	2359	1268	0004	1023
14	1281	1504	1319	1859	1241
15	1114	0044	1272	1824	977
16	888	0004	998	1839	813
17	781	2349	877	1459	691
18	946	2324	1074	0259	851
19	867	0004	1059	1314	755
20	765	2054	872	1214	659
21	654	0004	824	1454	571
22	525	0004	712	2144	422
23	352	0024	427	1654	304
24	308	0209	408	2349	250
25	215	0044	254	1554	189
26	246	2359	313	0004	204
27	326	2359	422	1244	291
28	361	0314	446	1559	313
29	339	2339	427	1224	287
30	308	0029	422	2334	242
TOTAL	11391		- - -	- - -	- - -
AVERAGE	633		744		560
MAXIMUM	1281		1319		1241
MINIMUM	215		254		189
ACRE FT	22593		- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Niguanak River

JULY 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	200	0014	242	1619	182
2	175	0204	193	1554	161
3	148	0004	168	1834	132
4	117	0004	139	2359	95
5	82	0004	95	1024	77
6	100	2354	123	0009	87
7	117	0759	135	2344	95
8	77	0004	95	1404	72
9	67	0004	72	2359	63
10	54	0004	63	2359	46
11	43	0009	46	0854	39
12	41	2219	46	0854	36
13	48	2229	54	0539	45
14	59	2359	77	0744	52
15	87	2344	100	0009	77
16	106	2359	126	0124	97
17	109	0109	126	2249	92
18	87	0014	92	2354	82
19	79	2224	97	0944	72
20	95	0704	106	1619	90
21	120	2354	165	0229	95
22	193	2359	321	1454	165
23	515	1049	581	0004	321
24	366	0009	490	2354	308
25	219	0004	308	2359	165
26	132	0009	165	2349	114
27	103	0014	114	2359	92
28	77	0004	92	2359	70
29	65	0014	70	1404	61
30	63	0014	67	2359	59
31	56	2019	61	0859	52
TOTAL	3802	- - -	- - -	- - -	- - -
AVERAGE	123		149		103
MAXIMUM	515		581		321
MINIMUM	41		46		36
ACRE FT	7540	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Niguanak River

AUGUST 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	52	0004	59	1259	50
2	45	0004	50	1029	43
3	36	0004	45	2359	31
4	26	0004	31	2359	23
5	23	2304	43	0909	21
6	37	1744	48	0224	29
7	29	0004	37	0949	28
8	28	1534	36	0724	25
9	26	0824	31	1529	23
10	21	0004	23	1244	18
11	17	0009	21	2359	16
12	15	2344	16	1054	14
13	16	2359	20	1019	15
14	18	2359	21	1109	17
15	20	0159	25	1019	18
16	21	2014	23	0839	18
17	21	0019	23	0939	18
18	16	0004	20	2359	13
19	11	0004	13	0819	10
20	10	0029	11	2354	8.5
21	9.3	1244	11	0644	7.8
22	15	2354	21	0004	10
23	23	1349	31	0154	17
24	28	1959	31	0619	25
25	28	0004	29	0819	25
26	23	0004	26	2359	22
27	17	0004	22	0949	16
28	14	0004	16	0819	13
29	13	0004	15	0819	11
30	11	0004	12	2344	10
31	9.3	1609	10	0749	9.3
TOTAL	678	- - -	- - -	- - -	- - -
AVERAGE	22		26		20
MAXIMUM	52		59		50
MINIMUM	9.3		10		7.8
ACRE FT	1346	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

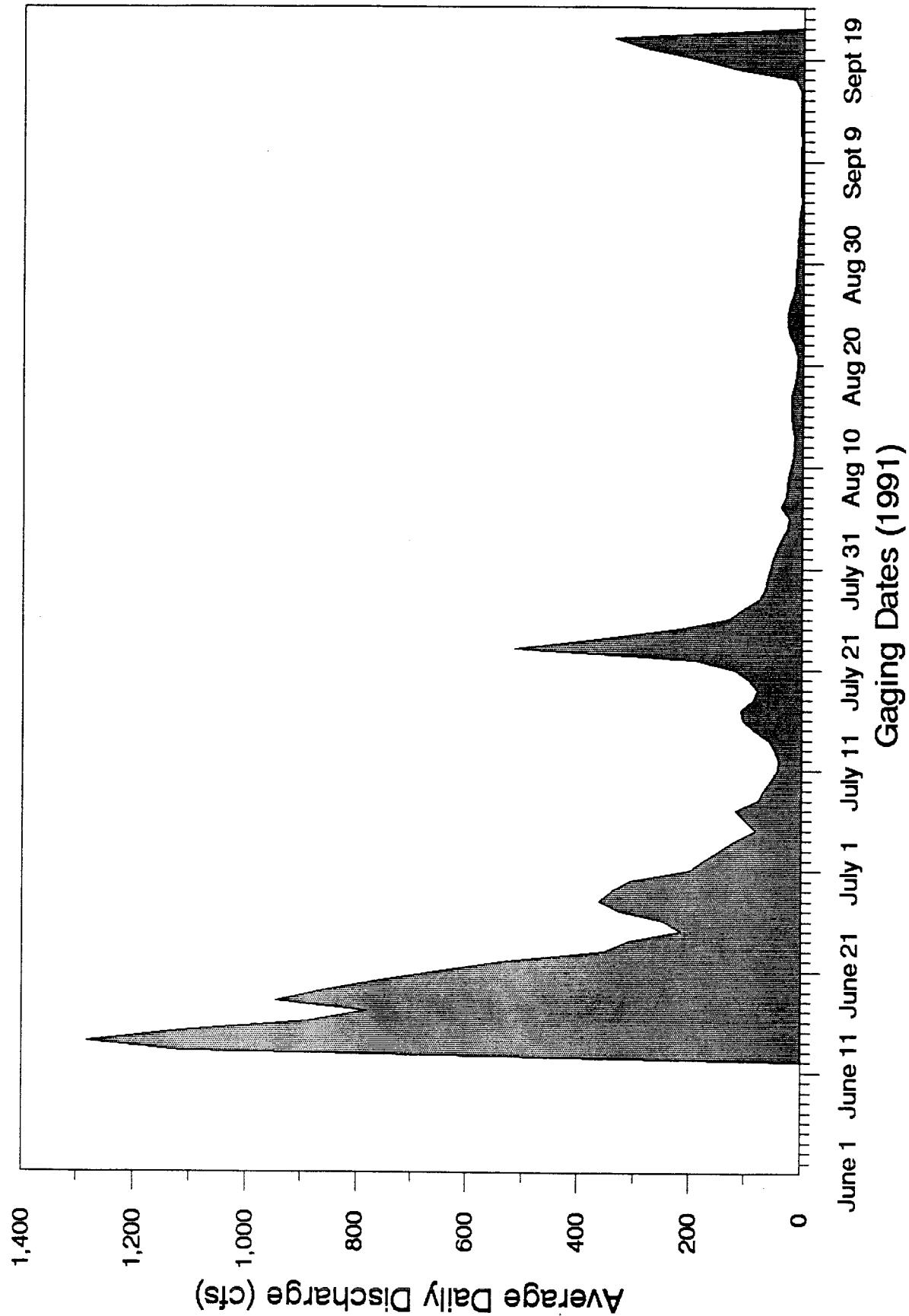
## Niguanak River

SEPTEMBER 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	9.3	0619	11	2309	8.5
2	8.5	1619	9.3	2354	7.8
3	7.8	1704	7.8	0454	7.1
4	6.4	0004	7.1	2329	2.8
5	3.4	2009	5.8	1044	2.1
6	3.8	1924	6.4	1014	2.1
7	5.2	1729	7.1	2359	3.4
8	3.8	1814	5.8	0324	2.6
9	5.2	1329	6.4	0704	4.2
10	3.8	0004	4.7	2014	3.4
11	3.4	2339	5.8	1144	2.1
12	4.7	0114	7.1	1304	3.4
13	4.7	1729	6.4	0934	3.1
14	3.8	0204	5.2	2349	2.8
15	3.8	1209	14	0919	2.1
16	4.7	2319	7.8	1044	2.4
17	16	2359	61	0014	7.1
18	117	2359	193	0004	63
19	196	2344	250	0849	165
20	283	2344	300	0029	246
21	339	2349	432	0024	300
22	- - -	- - -	- - -	- - -	- - -
23	- - -	- - -	- - -	- - -	- - -
24	- - -	- - -	- - -	- - -	- - -
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
TOTAL	1034	- - -	- - -	- - -	- - -
AVERAGE	49	64		40	
MAXIMUM	339	432		300	
MINIMUM	3.4	4.7		2.1	
ACRE FT	2050	- - -		- - -	

Niguanak River  
1991

A-15



## ARCTIC NATIONAL WILDLIFE REFUGE

## Sadlerochit River

LOCATION.--Lat 69°38', long 144° 22'50", in NW&SW& sec. 31, T.4N., R.32E., 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi<sup>2</sup>, of which 517.5 mi<sup>2</sup> is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi<sup>2</sup> depending on existing climatic conditions.

PERIOD OF RECORD.-- July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 21,000 cfs July 21, 1991; Minimum Discharge, 39 cfs Sept. 15, 1991 @ 1413 hrs.

## JUNE 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -	- - -	- - -	- - -	- - -
2	- - -	- - -	- - -	- - -	- - -
3	- - -	- - -	- - -	- - -	- - -
4	1304	2358	2165	1543	977
5	1583	0138	2252	1658	1126
6	1291	0023	2013	1858	947
7	844	0133	1172	2343	641
8	543	0313	661	2348	475
9	430	0008	475	2343	397
10	371	0008	397	2358	365
11	374	0003	365	1803	389
12	389	0443	382	1743	398
13	365	2358	418	0003	385
14	792	2353	1149	0003	418
15	1028	0443	1267	1848	835
16	918	0513	1104	2103	759
17	768	2358	1329	1628	648
18	1932	2348	3371	0003	1329
19	2584	0013	3461	1353	1948
20	2921	2358	3906	1423	2342
21	3305	2333	4355	1423	2681
22	3621	0258	4537	1658	3131
23	3067	2233	4563	1223	2324
24	2880	0003	4458	1933	2131
25	2097	2258	2415	1628	1868
26	3715	1508	6137	0638	2288
27	3239	0018	4510	1653	2720
28	2527	0128	2942	1538	2200
29	2642	2238	3004	1438	2324
30	2880	1913	3461	0958	2508
TOTAL	48412	- - -	- - -	- - -	- - -
AVERAGE	1793		2454		1428
MAXIMUM	3715		6137		3131
MINIMUM	365		365		365
ACRE FT	96024	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Sadlerochit River

JULY 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	2324	0003	3067	2018	1916
2	1775	0203	2046	2038	1527
3	1432	0318	1641	2308	1242
4	1195	0543	1316	2333	1039
5	987	0558	1071	2358	871
6	909	2353	1050	1908	844
7	1050	0553	1172	2238	909
8	844	0013	957	2358	705
9	648	0013	705	2348	577
10	554	0028	583	2353	512
11	475	0013	517	2358	440
12	421	0013	440	2253	399
13	401	0758	406	1948	390
14	399	1818	412	0438	390
15	433	1308	455	0018	399
16	543	0853	634	0003	444
17	538	0708	572	0003	507
18	835	2358	1685	0003	527
19	1641	0618	2097	2358	1207
20	1060	0033	1230	2348	890
21	9200 e		21000 e	0523	853
22	- - -		- - -	- - -	- - -
23	- - -		- - -	- - -	- - -
24	- - -		- - -	- - -	- - -
25	- - -		- - -	- - -	- - -
26	- - -		- - -	- - -	- - -
27	- - -		- - -	- - -	- - -
28	- - -		- - -	- - -	- - -
29	- - -		- - -	- - -	- - -
30	- - -		- - -	- - -	- - -
31	- - -		- - -	- - -	- - -
TOTAL	24782		- - -	- - -	- - -
AVERAGE	1126		2038		852
MAXIMUM	9200 e		21000 e		2148
MINIMUM	399		406		390
ACRE FT	49154		- - -		- - -

NOTE: e = Estimate

## ARCTIC NATIONAL WILDLIFE REFUGE

## Sadlerochit River

AUGUST 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -	- - -	- - -	- - -	- - -
2	- - -	- - -	- - -	- - -	- - -
3	- - -	- - -	- - -	- - -	- - -
4	- - -	- - -	- - -	- - -	- - -
5	819	0123	895	2228	750
6	1092	1438	1583	0523	730
7	1020	0008	1263	2343	856
8	872	2023	994	0628	798
9	812	0033	985	2303	673
10	614	0028	685	2308	549
11	523	0043	559	2233	474
12	479	1803	503	1513	460
13	620	2208	1351	0208	465
14	919	0008	1263	2228	736
15	763	1348	819	0438	717
16	784	1008	819	2353	723
17	698	0038	743	2353	655
18	620	0018	667	2353	559
19	528	0008	565	2343	489
20	465	0003	493	2328	433
21	380	0038	406	2358	351
22	608	2333	3643	0748	339
23	1732	0048	3439	2348	1092
24	887	0013	1102	2353	763
25	655	0038	763	1808	592
26	538	0003	597	2223	493
27	470	0028	503	1853	437
28	442	0603	465	1938	419
29	442	0953	460	2148	424
30	451	1033	479	0058	428
31	451	1043	479	2328	428
TOTAL	18684	- - -	- - -	- - -	- - -
AVERAGE	692		982		586
MAXIMUM	1732		3643		1092
MINIMUM	380		406		339
ACRE FT	37059	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

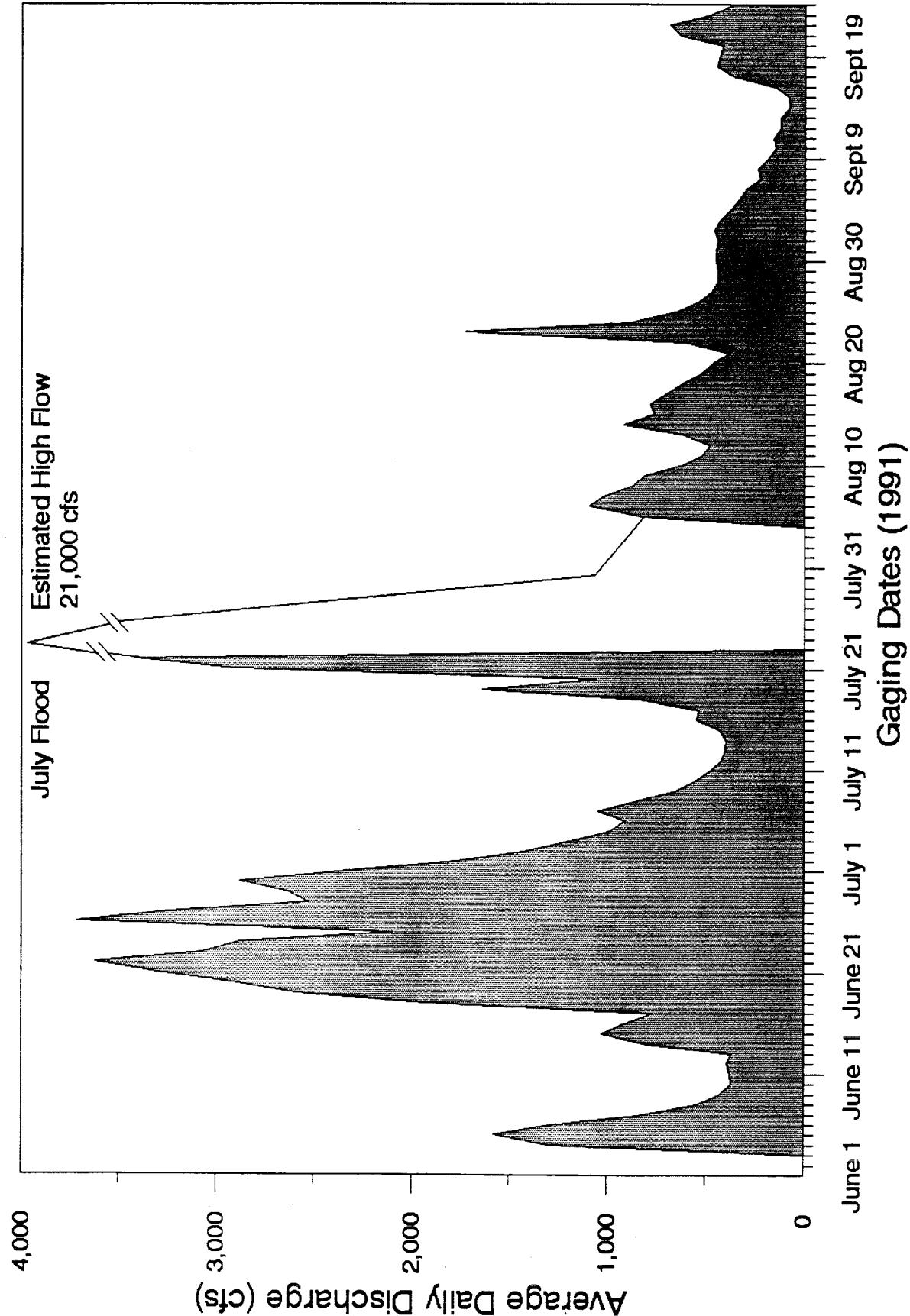
## Sadlerochit River

SEPTEMBER 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	442	1018	470	2248	424
2	460	1038	493	2258	424
3	424	0923	456	2358	380
4	376	0713	397	2358	343
5	334	0643	347	2318	310
6	294	0143	318	2358	263
7	227	0003	263	1723	204
8	235	0338	270	2133	208
9	188	0013	208	1503	168
10	148	0128	188	1848	120
11	156	0508	196	2358	120
12	120	1758	152	0628	108
13	124	0008	136	2358	112
14	78	2348	120	1133	44
15	83	1758	128	1413	39
16	148	2333	267	0008	99
17	368	2348	465	0003	270
18	446	2353	470	1423	433
19	433	0208	474	1238	415
20	415	0358	446	1943	389
21	631	2348	777	0008	419
22	685	0118	777	2343	597
23	484	0008	608	1608	433
24	355	0018	451	1753	294
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
TOTAL	7657	- - -	- - -	- - -	- - -
AVERAGE	319	370		276	
MAXIMUM	685	777		597	
MINIMUM	78	120		39	
ACRE FT	15187	- - -	- - -	- - -	- - -

# Sadlerochit River

1991



## ARCTIC NATIONAL WILDLIFE REFUGE

## Sikrelurak River

LOCATION.--Lat 69°54'43", Long 142°30'52", SEC SEC sec. 36, T.7N., R.38E., at confluence with the West Fork Sikrelurak River, 31 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.-74.7 mi<sup>2</sup>.

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1787 cfs June 4, 1991 at 2015 hr.; Minimum Discharge, 0 cfs July 20, 1989, August 14-28, 1990, and Sept. 6-8, 1991.

## JUNE 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	- - -	- - -	- - -	- - -	- - -
2	- - -	- - -	- - -	- - -	- - -
3	- - -	- - -	- - -	- - -	- - -
4	586	2015	1787	0915	285
5	888	0145	1181	2345	771
6	534	0010	799	2245	422
7	304	0030	441	1320	215
8	190	0130	246	1100	161
9	133	0105	167	2355	100
10	88	2400	100	1045	75
11	80	1800	86	0120	75
12	138	2255	343	0035	77
13	359	2315	486	0750	294
14	578	1805	683	0030	453
15	447	2400	586	1125	393
16	343	2400	410	0850	313
17	289	2400	343	1225	250
18	308	1915	381	0820	250
19	234	0005	304	1025	193
20	186	2400	234	0845	149
21	136	1930	177	0935	106
22	92	2400	149	2355	73
23	68	1840	84	0925	57
24	55	0005	70	2355	49
25	44	2115	49	1135	39
26	51	2215	67	0715	38
27	68	1845	86	0820	59
28	61	0005	72	0940	52
29	58	1735	75	0745	46
30	44	0005	55	2350	40
TOTAL	6362	- - -	- - -	- - -	- - -
AVERAGE	236		350		187
MAXIMUM	888		1787		771
MINIMUM	44		49		38
ACRE FT	12618	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Sikrelurak River

JULY 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	38	0005	40	1005	35
2	36	1805	42	0920	31
3	31	1955	36	1005	27
4	25	0005	32	1505	23
5	24	2010	29	0945	20
6	26	1925	34	0850	20
7	22	2400	29	2345	20
8	18	2120	21	1140	16
9	16	0010	20	1110	14
10	14	2400	16	2355	13
11	13	2125	16	1050	10
12	13	2010	16	0940	11
13	14	2120	18	1000	11
14	16	2140	23	0950	11
15	17	1750	21	0830	13
16	18	1855	27	0810	13
17	15	2400	21	1030	12
18	14	1750	17	0810	11
19	14	1930	21	0920	10
20	14	2120	20	0845	10
21	39	2030	52	0535	31
22	47	2350	86	1315	38
23	118	1430	136	0005	88
24	98	0015	116	2355	84
25	70	2400	86	2345	62
26	55	2400	62	2340	51
27	46	0010	51	2355	44
28	40	0005	44	1050	38
29	36	2135	39	1000	34
30	33	0005	37	1335	31
31	31	0010	32	0835	29
TOTAL	1012	- - -	- - -	- - -	- - -
AVERAGE	33		40		28
MAXIMUM	118		136		88
MINIMUM	13		16		9.5
ACRE FT	2008	- - -	- - -	- - -	- - -

## ARCTIC NATIONAL WILDLIFE REFUGE

## Sikrelurak River

AUGUST 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	28	2400	31	1155	26
2	25	0010	29	1210	23
3	18	2400	26	1355	15
4	14	2400	16	1615	13
5	14	2040	18	0955	12
6	16	0035	19	1240	13
7	13	0015	17	1340	11
8	12	1950	14	0955	10
9	11	0010	13	1325	8.9
10	8.9	2400	11	1450	8.4
11	8.4	0110	10	1840	7.3
12	7.8	2355	10	1235	7.3
13	10	0235	10	1505	8.4
14	8.9	2350	11	1300	7.3
15	8.9	0120	11	1120	7.8
16	10	2325	12	1110	8.4
17	8.9	0010	12	1830	7.8
18	6.2	0010	8.9	2320	5.1
19	4.6	2400	5.1	0750	4.1
20	4.6	0455	5.1	2345	4.1
21	4.6	2355	6.2	0825	4.1
22	8.9	2030	12	1020	6.2
23	11	2305	13	0605	8.9
24	14	2335	15	0010	13
25	15	1630	16	0500	15
26	14	0035	15	2345	13
27	11	2400	13	2355	10
28	10	2400	10	0955	1.0
29	7.8	2400	8.9	2245	7.3
30	6.7	0005	7.3	2240	5.7
31	5.7	0205	6.2	2310	5.1
TOTAL	344	- -	- -	- -	- -
AVERAGE	11	13		10	
MAXIMUM	28	31		26	
MINIMUM	4.6	5.1		1.0	
ACRE FT	683	- - -		- - -	

## ARCTIC NATIONAL WILDLIFE REFUGE

## Sikrelurak River

SEPTEMBER 1991

DATE	AVE.DAILY DISCH. CU.FT/SEC	TIME OF MAX DISCH.	MAX DISCH. CU FT/SEC	TIME OF MIN DISCH.	MIN DISCH. CU. FT/SEC
1	5.1	0400	5.7	1715	4.6
2	4.1	0240	5.1	2355	3.1
3	3.6	1305	4.1	2330	3.1
4	3.1	1440	3.6	2340	2.5
5	3.6	0910	5.1	2350	1.5
6	3.1	1400	8.9	0430	0.0
7	2.0	1050	4.1	0835	0.0
8	2.5	1610	5.7	0050	0.0
9	4.1	1645	5.1	0525	1.5
10	3.6	2235	6.2	0450	1.0
11	6.2	0940	13	0325	2.0
12	4.1	1750	7.3	0400	1.0
13	5.1	2355	6.7	0705	3.1
14	6.2	0225	7.3	2355	3.6
15	8.9	0955	17	0030	3.1
16	7.8	0700	18	0250	3.1
17	11	2355	24	0745	7.3
18	40	2355	72	2400	24
19	80	2350	118	0750	61
20	133	0820	141	2400	116
21	146	2255	186	0905	128
22	158	0235	190	2345	138
23	111	2400	141	0915	84
24	79	2400	104	1000	54
25	- - -	- - -	- - -	- - -	- - -
26	- - -	- - -	- - -	- - -	- - -
27	- - -	- - -	- - -	- - -	- - -
28	- - -	- - -	- - -	- - -	- - -
29	- - -	- - -	- - -	- - -	- - -
30	- - -	- - -	- - -	- - -	- - -
TOTAL	832	- - -	- - -	- - -	- - -
AVERAGE	35		46		27
MAXIMUM	158		190		138
MINIMUM	2.0		3.6		0.0
ACRE FT	1649		- - -	- - -	- - -