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## Adult Salmon Runs and Streamflow Data at a Resistance Board Weir on Beaver Creek, Alaska, 1998-2000

Nathan Collin, Lon Kelly and Jon Kostohrys



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## **Cover Photo**

Beaver Creek weir and trap, 2000. BLM photo.

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### **Abstract**

From July 6 to July 7, 1998, July 9 to August 8, 1999, and July 3 to August 14, 2000, a resistance board weir was operated on Beaver Creek, a tributary to the Yukon River. In 1998 high water washed out the weir trap within 18 hours of its installation, and as a result no data were collected. In 1999, 75 summer chum salmon (*Oncorhynchus keta*) and 128 chinook salmon (*Onchorhynchus tshawytscha*) were counted through the weir. In 2000, 11 summer chum salmon and 114 chinook salmon were counted through the weir. In all years when data were collected there was a disparity between numbers of male and female fish, with males outnumbering females. Mean monthly discharges in Beaver Creek ranged from 22 cms in June 1999 to 98 cms in August 1998. Monthly discharges were generally above the 13-year mean in 1998 and 2000, and below the 13-year mean in 1999. Salmon counts were highest in July following daily discharges that exceeded the mean.

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# 1 Introduction

In 1996 and 1997, the Bureau of Land Management operated a resistance board weir on Beaver Creek in Alaska. These were the first two years of a five-year study designed to count salmon using the middle to upper reaches of the Beaver Creek component of the National Wild and Scenic Rivers System, located in the White Mountains National Recreation Area. This work, along with additional background information, is described in a BLM open file report (Collin and Kostohrys, 1998).

In this paper, we document the data collected in the final three years of the project: 1998, 1999 and 2000. During these years we determined the length and sex of each salmon passing through the weir trap. In 2000 we also attempted to determine the age of the salmon we processed by collecting scale samples. We monitored hydrologic conditions at the weir site each year.

The project ended in 2001, when the only work at the site consisted of removing the weir and project camp from the field.

The objectives of the project were these:

- Describe the timing and strength of summer salmon runs in upper Beaver Creek.
- Describe the composition of salmon spawning aggregates using upper Beaver Creek.
- Monitor hydrologic conditions at the weir site.

## 2 Study Area

The upper Beaver Creek watershed, located in the eastern interior of Alaska, is part of Yukon-Tanana upland (Wahrhaftig, 1965). This area is characterized by forested upland plateaus, some of gentle relief but others topped by steep, 1,000 to 1,600 m tundra-covered mountains. Beaver Creek, like its tributaries, is narrow and steep in the headwaters, but widens downstream as the gradient decreases, increasing in meander to form sloughs and extensive, marshy lowlands. The relatively flat floodplain, often underlain by discontinuous permafrost, ranges from 1 to 5 km wide. Numerous springs occur in the basin that contribute significantly to winter streamflow.

Beaver Creek National Wild River originates at the confluence of Bear and Champion Creeks, about 80 km north of Fairbanks, Alaska. It flows 180 km through the 445,000-hectare White Mountains National Recreation Area and then an additional 300 km through the Yukon Flats National Wildlife Refuge, where it meets the Yukon River. The weir site is approximately 325 km upriver from the mouth of Beaver Creek (Figure 1). This section of the river is wide and straight, and the substrate consists primarily of coarse gravel (2.5 cm - 7.62 cm), small cobble (7.62 cm - 15.2 cm), and large cobble (15.2 cm - 30.5 cm). This substrate is typical of Beaver Creek from Victoria Creek upriver to the headwaters.

Fish species found in Beaver Creek include Arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), northern pike (*Esox lucius*), burbot (*Lota lota*), sheefish (*Stenodus leucichthys*), longnose sucker (*Catostomus catostomus*), slimy sculpin (*Cottus cognatus*), chum salmon (*Oncorhynchus keta*), and chinook salmon (*Oncorhynchus tshawytscha*). Arctic grayling is the species most sought after by sport fishers (BLM, 1983).

## 3 Material and Methods

### 3.1 Weir construction and installation

The materials, construction methods, and installation of the weir are generally described by Collin and Kostohrys (1998). In 1999 picket panels were added between the trap and the bank to move the trap out into the stream to maintain adequate depth at low flows. The weir installation is shown in Figure 2.

The weir was operated in the same manner as in 1996 and 1997 (Collin and Kostohrys, 1998). Visual inspections for holes and structural problems were conducted daily. Fish carcasses and debris were cleaned from the weir as they accumulated. Cleaning typically involved walking on the weir panels until they were partially submerged to allow the current to flush the debris off. At times it was necessary to remove debris fouling the weir by hand.

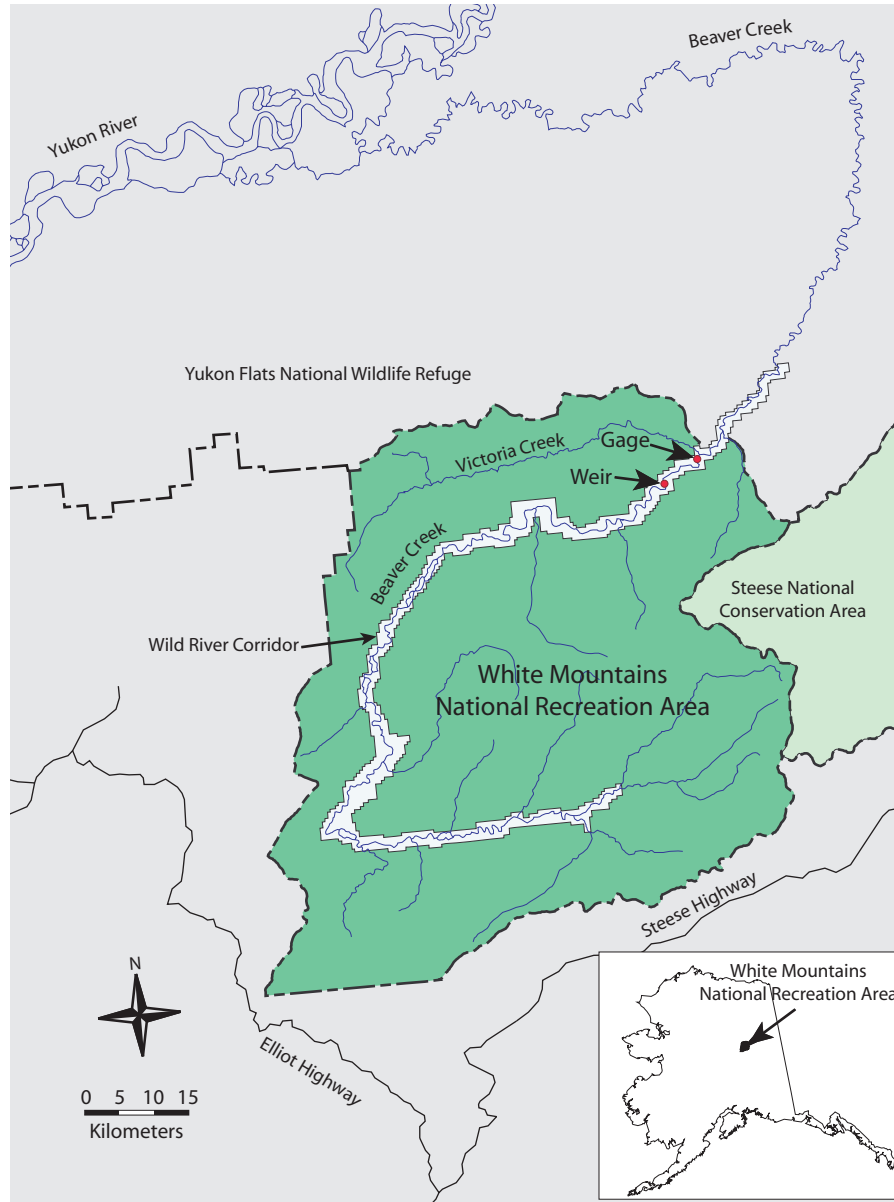


FIGURE 1 Location map.





FIGURE 2 Installed weir and trap.

### 3.2 Salmon

Salmon data were collected in 1999 and 2000. In 1999 all salmon data were collected by one of us (Collin). In 2000, rotating teams of two staff members worked at the site in ten-day shifts.

During its operation the weir was monitored at least every six hours—more often around the peak of the migration. When fish were present in the trap a staff member entered the trap, and processed the fish one at a time. Fish were classified by species and sex and fork lengths were measured to the nearest millimeter in a padded aluminum cradle.

Data were called by in Motorola satellite phone to the Alaska Department of Fish and Game for use in escapement estimates.

In 2000 scales were taken from chinook and chum salmon to provide data on age classes. Scales were sampled following Alaska Department of Fish and Game protocol for the preferred area on the fish. Scales were placed in labeled coin envelopes, one envelope per fish. Scales were pressed at the Northern Field Office on a Carver Model 3912 press at 66 C at 6.8 t for 30 s. The Alaska Department of Fish and Game Commercial Fisheries Division read the scales and determined age for chinook salmon.

After a fish was processed, it was carried upstream of the weir, where it was supported by hand and allowed to recover in relatively slow current prior to release.

### 3.3 Hydrology

A staff gage was installed each year to measure water levels. The gage was surveyed to reference elevation (bench) marks, significant high-water marks, and the current water level. The datum of the water level readings was adjusted so that the water level reading corresponded to the deepest depth of the river at the weir. Cross-sectional discharge (stream-flow) measurements were made using a Price AA current meter to measure water velocity, and a top-setting wading rod and tag line were used for depth and width.

The staff gage readings were then used as the independent variable to compute discharge. A water level versus discharge rating was developed by combining the direct discharge measurements and computer-simulated peak flows using log-log regression statistics (Rantz et al., 1982). A single water level versus discharge rating was developed using discharge measurements for all three years. Dif-

ferences from the actual measurements to the values calculated using the single log-log regression equation were kept within about five percent using the shifting control method (Rantz et al., 1982). Data were then compared to the automated water-level recorder data that have been collected from 1988 to 2000 at a site about 9 km downstream of the weir, just upstream of Victoria Creek (Kostohrys et al., In preparation).

## 4 Results

### 4.1 Weir performance

In 1998 the weir was installed on July 6. The water level rose rapidly and the trap washed downstream on July 7. No salmon data were collected in 1998. The high water continued throughout the summer and the weir was allowed to freeze into the winter ice.

In the spring of 1999, all weir panels were removed. The old trap was recovered, in pieces, from several pools downstream. The weir had sustained damage to many pickets and resistance boards during flooding, freezing in, and breakup. Approximately one-fifth of the pickets were repaired or replaced on site. The refurbished panels were then installed on the original cable with a replacement trap. During 1999 the weir was operational from July 9 to August 8. Counting ceased on August 8 due to rapidly rising water.

In 2000 the weir was operational from July 3 to August 14. High water submerged the weir panels and washed the trap downstream on August 14, marking the end of data collection for the project. The high water persisted into October, when it was finally possible to remove the weir.

The weir was removed from the field in 2001. At that time many of the pickets had become brittle, probably due to exposure to sunlight and extreme temperatures. The panels were disassembled, destroying the pickets in the process. With the exception of the pickets, the weir components were salvaged.

## 4.2 Salmon

### 1999

A total of 128 chinook salmon passed through the weir in 1999. Chinook salmon daily counts were relatively concentrated around the peak of the migration, which occurred on July 27, trailing off until the last day of data collection (Figure 3). Males outnumbered females throughout the period. Fork length of chinook salmon ranged from 525 mm to 1018 mm. Figure 4 provides length-frequency histograms for the salmon passing through the weir in 2000.

A total of 75 summer chum salmon passed through the weir in 1999. Chum salmon daily counts showed a gradual increasing trend prior to July 8, and then continued with no clear declining trend, as shown in Figure 3. Fork length of sampled chum salmon ranged from 549 mm to 720 mm.

In 1999 the ratio of male to female chinook salmon counted was 11:1. The ratio for chum salmon was 4:1.

### 2000

A total of 114 chinook salmon were counted in 2000. The peak of the migration for chinook salmon occurred July 23 and then daily counts declined quickly (Figure 3). The marked disparity between male and female numbers observed in 1999 persisted. Fourteen female chinook salmon passed through the weir in 2000.

Figure 5 provides length-frequency histograms for the chinook salmon passing through the weir in 2000. Two chinook salmon that had been marked with blue spaghetti tags by the Alaska Department of Fish and Game near the mouth of the Yukon passed through the weir.

A total of 11 chum salmon were counted through the weir in 2000. Chum salmon never showed a peak (Figure 3). Chum salmon continued to appear at the weir through the end of the period, one or two at a time.

The ratio of male to female chinook salmon counted in 2000 was 7:1. The ratio for chum salmon was 10:1.

Of the 114 chinook salmon processed in 2000, 65 scale samples were read to determine the age of the fish (Table 1). Scales from 13 of the 14 female chinook salmon could be read, as opposed to 52 of

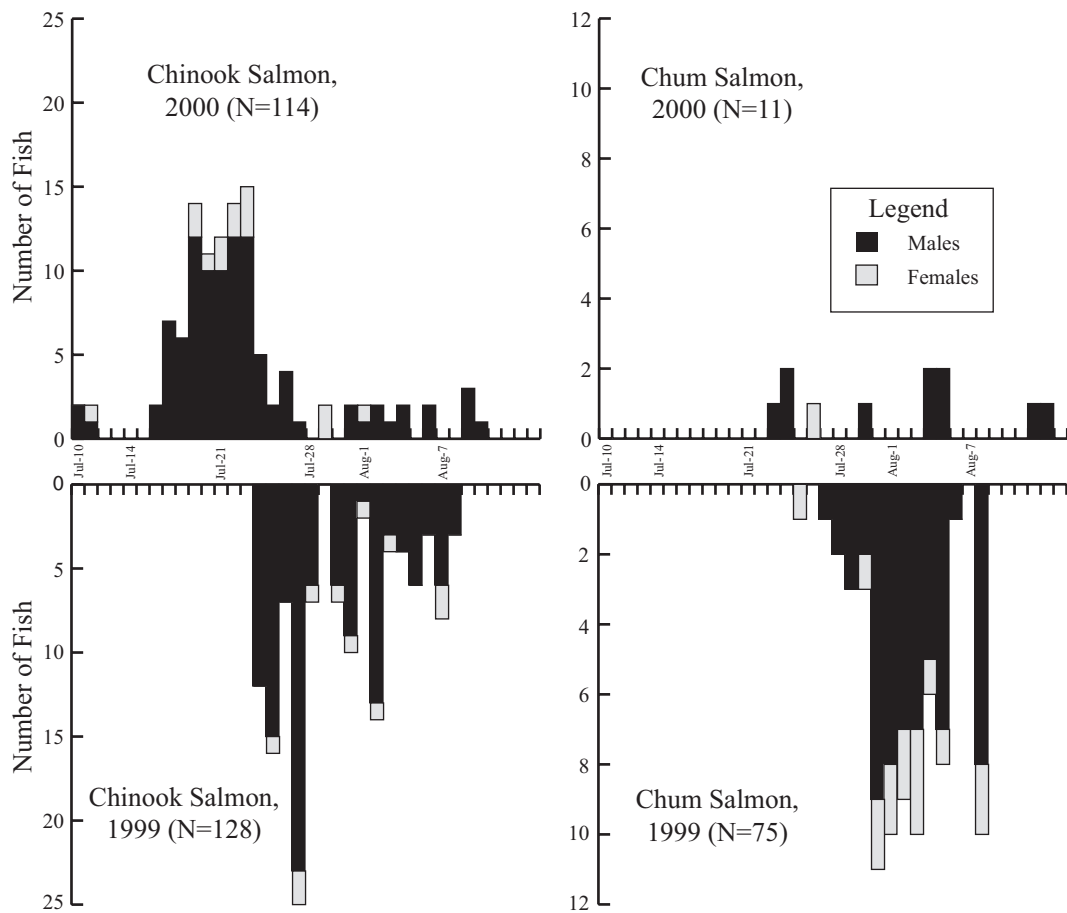


FIGURE 3 Daily counts of summer chum and chinook salmon passing through the Beaver Creek weir, 1999 and 2000. Weir operated from July 9 to August 8, 1999, and July 8 to August 14, 2000.

the 100 male chinook salmon. Of the 49 scale samples that could not be aged, 38 were identified as “not pressed” or “bad press” by the press operator, and these were not passed on to the Alaska Department of Fish and Game. The ratio of ages read to samples taken (65:114) is atypically low for studies of this type in Alaska (Price, 2002). Most of the scales that were not pressed, or were not pressed satisfactorily, were moldy or severely curled when removed from the envelopes. None of the 11 chum salmon scale samples were aged because the samples were lost after they were delivered from the field.

Female chinook salmon in the sample of 65 aged fish were older and longer for any given age

than male chinook salmon in the sample.

### 4.3 Hydrology

Monthly discharge is compared in Table 2. Water levels and daily discharges are plotted in Figure 6. Mean daily discharge for 1998, 1999, and 2000 is tabulated in Appendix B.

## 5 Discussion

### 5.1 Weir siting and performance

Weir performance was consistent with that observed in the first two years of the project (Collin

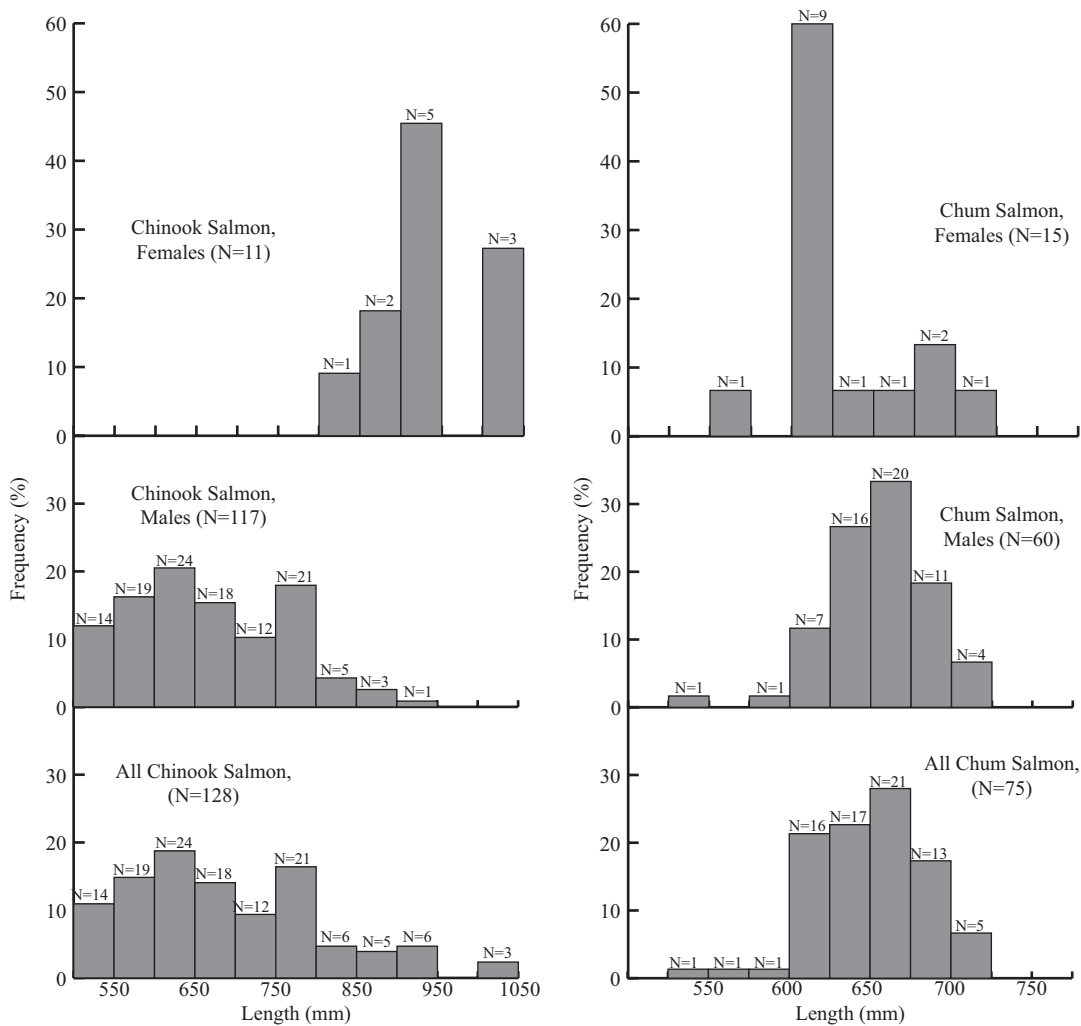


FIGURE 4 Length-frequency histograms for chinook and chum salmon at the weir, 1999.

TABLE 1 Chinook salmon escapement and mean length (mm) by sex and age, Beaver Creek, 2000.

		Age (all sampled fish spent one year in fresh water)							
		3		4		5		6	
		No.	%	No.	%	No.	%	No.	%
Male	N=52	5	7.7	37	56.9	10	15.4	0	0.0
Female	N=13	0	0.0	4	6.2	8	12.3	1	1.5
All	N=65	5	7.7	41	63.1	18	27.7	1	1.5
Male	Mean Length	602.0		773.9		816.4		no data	
	Std. Error	25.9		59.7		58.5		no data	
Female	Mean Length	no data		871.3		892.5		835.0	
	Std. Error	no data		47.7		48.7		0.0	

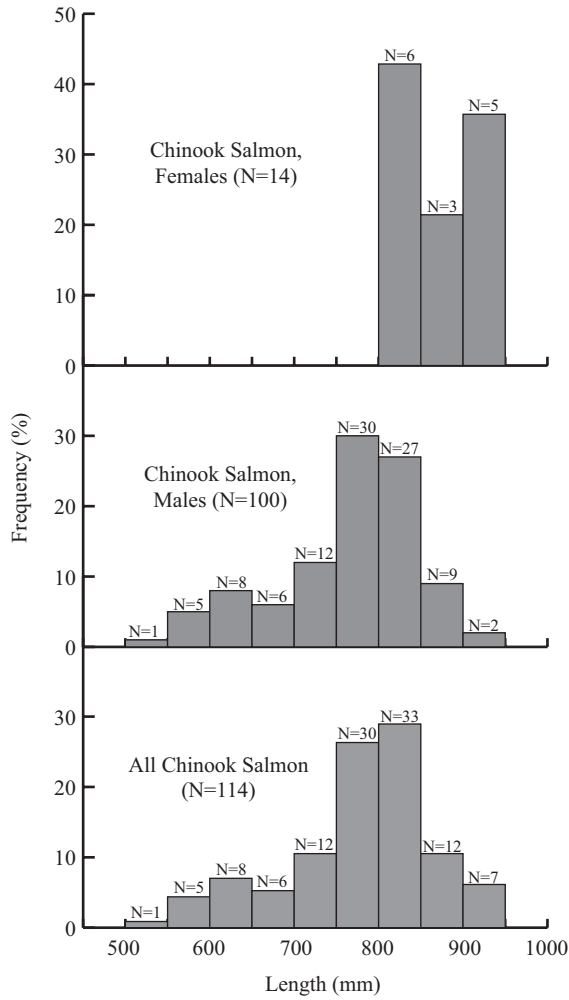


FIGURE 5 Length-frequency histograms for chinook salmon at the weir, 2000.

TABLE 2 Comparative mean monthly discharge for Beaver Creek.

	June		July		August	
	$m^3/sec$	% of 13-year mean	$m^3/sec$	% of 13-year mean	$m^3/sec$	% of 13-year mean
13-year Mean <sup>a</sup>	62	100%	31	100%	56	100%
1998	31	51%	70	223%	90	160%
1999	22	36%	24	75%	48	87%
2000	87	141%	29	91%	80	144%

<sup>a</sup>From stream gage data at site 9 km downstream, Beaver Creek above Victoria Creek (Kostohrys et al., In preparation)

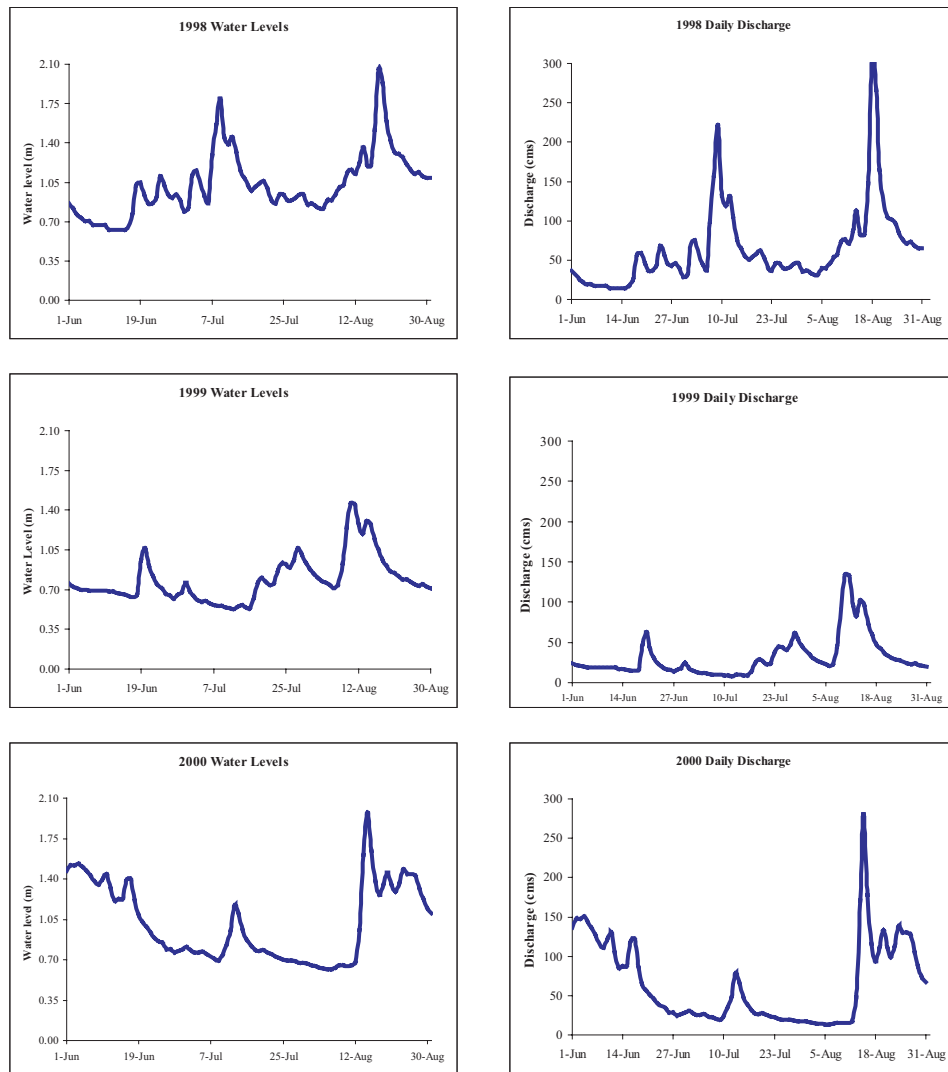


FIGURE 6 Water surface level and mean daily discharge at the Beaver Creek weir, 1998 through 2000.

and Kostohrys, 1998). The weir could not be operated effectively during high water periods, making it impractical to collect data late in the season. This probably resulted in missing part of the summer chum salmon run and any fall chum salmon run that might have occurred in 1999 and 2000. We believe the weir would have provided more information at a site with lower current velocity. There is a site approximately 2 km downstream that might provide better high water conditions for the weir. We believe it would be a good investment to monitor or model expected current velocities prior to choosing

a new weir site.

Although the trap had an upstream door, when we opened this to allow fish to swim out, the fish would often wash back onto the weir. We would then recover and carry the fish upstream to slower water. This process caused extra stress, so we stopped using the door. When possible, we recommend the trap be placed in such a way that fish can swim through the upstream door into water where it would be easy to maintain position in the stream.

The pickets were cut up to lower the cost of removing the weir from the field, but the panels can

be re-constructed to any desired length by replacing the pickets since all the other panel components were salvaged. The pickets had probably reached the end of their useful life due to brittleness, which we believe was caused by exposure to sunlight and extreme cold. It would be advisable to plan on replacing pickets at intervals of 4 to 5 years if this or similar weirs are used in the future. The cable that anchored the weir is still in the stream, and should be removed in the summer of 2002. At this writing, the weir components (exclusive of pickets) are available for use of other projects on Beaver Creek or elsewhere.

## 5.2 Salmon

In 1999 and 2000, numbers of chinook and chum salmon declined from previous summers. This continued the trend initially described in 1997 (Collin and Kostohrys, 1998). Chum salmon numbers counted through the weir declined more rapidly between 1997 and 2000 than chinook salmon numbers. The skewed sex ratios may suggest the end of the run, characteristically dominated by females, was missed, however there is not a strong pattern of later arrivals by females shown in the data we collected.

There were problems with our method of scale collection and subsequent processing, as shown by the poor ratio of successfully aged scales to samples taken. With the chinook salmon, it appeared the results would have been better had we removed the scales from the envelopes in camp and then cleaned them carefully prior to mounting on gummed cards. This method of transferring scales from envelopes to cards is currently providing the most consistent results for salmon scale sampling projects in Alaska (Price, 2002). We could also have improved the results for chinook salmon by processing the scales promptly after they were returned to Fairbanks. In the case of the 11 chum salmon scale samples, these were simply lost after they came back to the office from the field, indicating a need for better filing.

We know of at least 4 jet boats owned and operated on Beaver Creek by private property owners in the National Recreation Area. Subsistence regulations have changed recently, and increased fishing pressure may thus occur near the mouth of Beaver Creek. Recreational use is increasing on Beaver Creek. The military have used the river for survival

training, and sometimes land helicopters on gravel bars and go fishing. With such a small number of female salmon available for spawning above the weir, managers need to know if human activities such as subsistence, sport fishing, or boating are affecting salmon spawning aggregations within the National Recreation Area. To answer questions like this, it will be necessary to go beyond the current study to look at spawning and rearing habitats, and to identify current and potential patterns of human activity affecting fish stocks.

The Bureau of Land Management should build on this project. While it is unrealistic to monitor all the salmon stocks within the Yukon River basin, monitoring spawning aggregations at strategic locations within the basin could provide a good indication of the overall health of salmon stocks. The Beaver Creek weir project has been a component of this monitoring strategy, providing stock status information on one of the smaller chinook and chum populations in the upper basin. Small stocks can be sensitive to overharvest and environmental factors. It is important to monitor these stocks as a long-term commitment and to try to understand natural fluctuations within the population. A summary report should be prepared to put the data from the Beaver Creek weir in a larger context, both spatially and temporally, and to attempt to explain the observations made during the operation of the weir.

## 5.3 Hydrology

The contrast in streamflow for the three years was extreme (Figure 6). The streamflow and corresponding water levels for 1999 were about a third of that of 1998 and 80% of 2000 for the month of July, when the majority of salmon were counted, and also significantly lower than the 13-year average (Table 2) for the stream gage above Victoria Creek (Kostohrys et al., In preparation). The period of increasing streamflow in mid to late July in both 1999 and 2000 may correlate to the timing of the salmon runs, as the peak migration both years followed periods of relative higher water.

## 6 Acknowledgments

We want to express particular gratitude to Gerry Wyse, Eric Yeager, Collin Cogley, Tim DuPont,

Randy Goodwin, Chuck Joy, Nora Kelly, Jim Heriges, Mike Bradley, Shane Phillips, Bighead Smiley, and Brandon Peterson, who all helped construct, maintain, install, operate, and remove the weir and camp. The U.S. Fish and Wildlife Service Fisheries Resource Office in Fairbanks, Alaska, provided technical assistance that made the project possible.

## References

- BLM 1983. River management plan for the Beaver Creek River, Alaska. Statutory management and development plan, Bureau of Land Management, Fairbanks, Alaska.
- Collin, N. and Kostohrys, J. 1998. Enumeration of Adult Salmon and Hydrologic Data at a Resistance Board Weir on Beaver Creek, Alaska, 1996-1997. Alaska open file report 70, Bureau of Land Management, Fairbanks, Alaska.
- Kostohrys, J. et al. In preparation. Water Resources of Beaver Creek National Wild River, Alaska. Stream Gaging Data from 1993 to 2000. Alaska open file report, Bureau of Land Management, Fairbanks, Alaska.
- Price, R. 2002. Personal communication. Richard Price is a research biologist with the Alaska Department of Fish and Game, Region 3. He reads scales for most federal and state salmon projects occurring in Alaska, including the Beaver Creek Weir Project.
- Rantz, S. E. et al. 1982. Measurement and Computation of Streamflow, volume 1 and 2 of *Water-Supply Paper 2175*. U. S. Geological Survey, Washington, DC.
- Wahrhaftig, C. 1965. Physiographic divisions of Alaska. Prof. Paper 482, U. S. Geological Survey, Washington, DC. With separate map at 1:2,500,000.



**Appendix A.**  
**Daily and cumulative counts**

TABLE A.1 Daily and cumulative counts of salmon passing through the Beaver Creek weir, 1999 and 2000

Date	1999				2000			
	Chinook salmon		Chum salmon		Chinook salmon		Chum Salmon	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
Jul 03	no data	no data	no data	no data	0	0	0	0
Jul 04	no data	no data	no data	no data	0	0	0	0
Jul 05	no data	no data	no data	no data	0	0	0	0
Jul 06	0	0	0	0	0	0	0	0
Jul 07	0	0	0	0	0	0	0	0
Jul 08	0	0	0	0	0	0	0	0
Jul 09	0	0	0	0	0	0	0	0
Jul 10	0	0	0	0	2	2	0	0
Jul 11	0	0	0	0	2	4	0	0
Jul 12	0	0	0	0	0	4	0	0
Jul 13	0	0	0	0	0	4	0	0
Jul 14	0	0	0	0	0	4	0	0
Jul 15	0	0	0	0	0	4	0	0
Jul 16	0	0	0	0	2	6	0	0
Jul 17	0	0	0	0	7	13	0	0
Jul 18	0	0	0	0	6	19	0	0
Jul 19	0	0	0	0	14	33	0	0
Jul 20	0	0	0	0	11	44	0	0
Jul 21	0	0	0	0	12	56	0	0
Jul 22	0	0	0	0	14	70	0	0
Jul 23	0	0	0	0	14	84	1	1
Jul 24	12	12	0	0	5	89	2	3
Jul 25	16	28	1	1	2	91	0	3
Jul 26	7	35	0	1	4	95	1	4
Jul 27	25	60	1	2	1	96	0	4
Jul 28	7	67	2	4	0	96	0	4
Jul 29	0	67	3	7	2	98	0	4
Jul 30	7	74	3	10	0	98	1	5
Jul 31	10	84	11	21	2	100	0	5
Aug 01	2	86	10	31	2	102	0	5
Aug 02	14	100	9	40	2	104	0	5
Aug 03	4	104	10	50	1	105	0	5
Aug 04	4	108	6	56	2	107	2	7
Aug 05	6	114	8	64	0	107	2	9
Aug 06	3	117	1	65	3	110	0	9
Aug 07	8	125	0	65	0	110	0	9
Aug 08	3	128	10	75	0	110	0	9
Aug 09	no data	no data	no data	no data	3	113	0	9
Aug 10	no data	no data	no data	no data	1	114	0	9

*Table continues on next page...*

TABLE A.1 1999 and 2000 salmon counts, continued

Date	1999				2000			
	Chinook salmon		Chum salmon		Chinook salmon		Chum Salmon	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
Aug 11	no data	no data	no data	no data	0	114	0	9
Aug 12	no data	no data	no data	no data	0	114	0	9
Aug 13	no data	no data	no data	no data	0	114	2	11
Aug 14	no data	no data	no data	no data	0	114	0	11

**Appendix B.**  
**Mean daily discharges**

TABLE B.1 Mean daily discharge ( $m^3/s$ ) and summaries for Beaver Creek at the weir, 1998. Discharges shown in *italics* are estimated from the stream gage above Victoria Creek.

Date	Discharge	Date	Discharge	Date	Discharge
1-Jun	37	1-Jul	31	1-Aug	37
2-Jun	31	2-Jul	69	2-Aug	34
3-Jun	25	3-Jul	75	3-Aug	31
4-Jun	23	4-Jul	59	4-Aug	31
5-Jun	20	5-Jul	45	5-Aug	40
6-Jun	20	6-Jul	38	6-Aug	40
7-Jun	17	7-Jul	99	7-Aug	45
8-Jun	17	8-Jul	158	8-Aug	54
9-Jun	17	9-Jul	222	9-Aug	57
10-Jun	17	10-Jul	132	10-Aug	74
11-Jun	14	11-Jul	119	11-Aug	76
12-Jun	14	12-Jul	132	12-Aug	71
13-Jun	14	13-Jul	106	13-Aug	88
14-Jun	14	14-Jul	76	14-Aug	113
15-Jun	14	15-Jul	65	15-Aug	82
16-Jun	17	16-Jul	55	16-Aug	82
17-Jun	25	17-Jul	50	17-Aug	147
18-Jun	57	18-Jul	54	18-Aug	312
19-Jun	59	19-Jul	58	19-Aug	266
20-Jun	45	20-Jul	62	20-Aug	164
21-Jun	37	21-Jul	53	21-Aug	125
22-Jun	37	22-Jul	40	22-Aug	105
23-Jun	42	23-Jul	37	23-Aug	102
24-Jun	68	24-Jul	45	24-Aug	96
25-Jun	57	25-Jul	45	25-Aug	85
26-Jun	45	26-Jul	40	26-Aug	76
27-Jun	42	27-Jul	40	27-Aug	71
28-Jun	45	28-Jul	42	28-Aug	74
29-Jun	40	29-Jul	45	29-Aug	68
30-Jun	28	30-Jul	45	30-Aug	65
		31-Jul	36	31-Aug	65
Monthly summaries:					
June		July		August	
Max.	68	Max.	222	Max.	312
Min.	14	Min.	31	Min.	31
Mean	31	Mean	70	Mean	90

TABLE B.2 Mean daily discharge ( $m^3/s$ ) and summaries for Beaver Creek at the weir, 1999. Discharges shown in *italics* are estimated from the gage above Victoria Creek.

Date	Discharge	Date	Discharge	Date	Discharge
1-Jun	24	1-Jul	18	1-Aug	35
2-Jun	22	2-Jul	15	2-Aug	30
3-Jun	20	3-Jul	13	3-Aug	26
4-Jun	20	4-Jul	12	4-Aug	25
5-Jun	19	5-Jul	12	5-Aug	23
6-Jun	19	6-Jul	11	6-Aug	20
7-Jun	19	7-Jul	10	7-Aug	23
8-Jun	19	8-Jul	10	8-Aug	45
9-Jun	19	9-Jul	10	9-Aug	91
10-Jun	19	10-Jul	9.3	10-Aug	134
11-Jun	18	11-Jul	8.8	11-Aug	133
12-Jun	18	12-Jul	8.4	12-Aug	96
13-Jun	17	13-Jul	9.5	13-Aug	82
14-Jun	17	14-Jul	10	14-Aug	102
15-Jun	16	15-Jul	9.1	15-Aug	96
16-Jun	15	16-Jul	8.8	16-Aug	74
17-Jun	15	17-Jul	14	17-Aug	59
18-Jun	16	18-Jul	25	18-Aug	48
19-Jun	48	19-Jul	29	19-Aug	42
20-Jun	62	20-Jul	26	20-Aug	37
21-Jun	42	21-Jul	23	21-Aug	34
22-Jun	31	22-Jul	24	22-Aug	31
23-Jun	24	23-Jul	38	23-Aug	28
24-Jun	20	24-Jul	45	24-Aug	28
25-Jun	17	25-Jul	43	25-Aug	26
26-Jun	15	26-Jul	41	26-Aug	24
27-Jun	14	27-Jul	48	27-Aug	23
28-Jun	16	28-Jul	62	28-Aug	24
29-Jun	18	29-Jul	54	29-Aug	22
30-Jun	25	30-Jul	45	30-Aug	21
		31-Jul	39	31-Aug	20
Monthly summaries:					
June		July		August	
Max.	62	Max.	62	Max.	134
Min.	14	Min.	8.4	Min.	20
Mean	22	Mean	24	Mean	48

TABLE B.3 Mean daily discharge ( $m^3/s$ ) and summaries for Beaver Creek at the weir, 2000. Discharges shown in *italics* are estimated from the gage above Victoria Creek.

<b>Date</b>	<b>Discharge</b>	<b>Date</b>	<b>Discharge</b>	<b>Date</b>	<b>Discharge</b>
1-Jun	<i>136</i>	1-Jul	30	1-Aug	16
2-Jun	<i>147</i>	2-Jul	27	2-Aug	15
3-Jun	<i>147</i>	3-Jul	25	3-Aug	14
4-Jun	<i>150</i>	4-Jul	25	4-Aug	14
5-Jun	<i>144</i>	5-Jul	26	5-Aug	14
6-Jun	<i>136</i>	6-Jul	24	6-Aug	14
7-Jun	<i>127</i>	7-Jul	22	7-Aug	14
8-Jun	<i>116</i>	8-Jul	20	8-Aug	16
9-Jun	<i>110</i>	9-Jul	19	9-Aug	16
10-Jun	<i>122</i>	10-Jul	24	10-Aug	15
11-Jun	<i>130</i>	11-Jul	34	11-Aug	16
12-Jun	<i>105</i>	12-Jul	48	12-Aug	18
13-Jun	85	13-Jul	78	13-Aug	48
14-Jun	88	14-Jul	66	14-Aug	171
15-Jun	88	15-Jul	48	15-Aug	280
16-Jun	<i>119</i>	16-Jul	38	16-Aug	178
17-Jun	<i>122</i>	17-Jul	31	17-Aug	116
18-Jun	85	18-Jul	27	18-Aug	93
19-Jun	65	19-Jul	26	19-Aug	110
20-Jun	57	20-Jul	27	20-Aug	133
21-Jun	51	21-Jul	25	21-Aug	110
22-Jun	45	22-Jul	24	22-Aug	99
23-Jun	40	23-Jul	22	23-Aug	113
24-Jun	37	24-Jul	21	24-Aug	139
25-Jun	34	25-Jul	20	25-Aug	130
26-Jun	28	26-Jul	19	26-Aug	130
27-Jun	28	27-Jul	19	27-Aug	127
28-Jun	25	28-Jul	18	28-Aug	105
29-Jun	26	29-Jul	17	29-Aug	88
30-Jun	28	30-Jul	17	30-Aug	74
		31-Jul	17	31-Aug	67
Monthly summaries:					
June		July		August	
Max.	150	Max.	78	Max.	280
Min.	25	Min.	17	Min.	14
Mean	87	Mean	29	Mean	80