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Enumeration of Adult Salmon and Hyrologic Data at a Resistance Board Weir on Beaver Creek, Alaska, 1996–1997

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Floating weir and trap on Beaver Creek. BLM photo.

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Enumeration of Adult Salmon and Hydrologic Data at a Resistance Board Weir on Beaver Creek, Alaska, 1996-1997

Nathan Collin and Jon Kostohrys

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Abstract

From July 8 to September 25, 1996, and June 14, to August 11, 1997, a resistance board weir was operated on Beaver Creek, a tributary of the Yukon River. In 1996 a total of 654 chum salmon *Oncorhynchus keta* and 192 chinook salmon *Oncorhunchus tshawytscha* were counted During 1997 a total of 34 summer chum and 315 chinook salmon were counted. Other resident species observed were Arctic grayling *Thymallus arcticus*, northern pike *Esox lucius*, and longnose sucker *Catostomus catostomus*. Installation of the weir was later than scheduled in 1996, possibly resulting in portions of the chinook salmon run being missed. Water levels and discharge were significantly higher in 1996 than 1997.

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1 Introduction

Beaver Creek was designated a National Wild River on December 2, 1980 when Congress amended the Wild and Scenic Rivers Act (P.L. 90-542) as part of the Alaska National Interest Lands Conservation Act (P.L. 96-487). The Bureau of Land Management (BLM), in its River Management Plan for the Beaver Creek National Wild River (BLM, 1983), proposed to "conduct an inventory of fish, wildlife and habitat within the river corridor and continue to monitor the effects of river management actions, population trends and habitat use".

Accurate salmon escapement data are critical for evaluating and providing stock status information on salmon populations, harvest management strategies, monitoring baseline data, and describing populations, particularly in mixed stock fisheries. Aerial survey escapement counts in the Yukon River drainage have been highly variable (Schultz *et al.*, 1993), and are only an index of relative strength of salmon runs (Barton, 1984). In previous years salmon were observed during float trips from the Bear/Champion Creek confluence to Victoria Creek by BLM employees conducting other surveys. Between 1991 and 1995 a total of 3 chum salmon *Oncorhynchus keta* and 662 chinook salmon *Oncorhynchus tshawytscha* were observed (Lubinski, 1995).

In 1996 and 1997, a resistance board weir was installed by the BLM on Beaver Creek National Wild River. Those were the first two years of a five-year study designed to: (1) enumerate the anadromous fisheries utilizing the middle to upper reaches of the Beaver Creek component of the National Wild and Scenic Rivers System, (2) determine run timing and run strength of the summer runs, (3) monitor hydrological conditions at the weir site, and (4) collect and preserve scales and caudal fin tissue for genetic stock analysis if run size permits.

2 Study Area

The Beaver Creek watershed, located in the eastern interior of Alaska, is part of Yukon-Tanana uplands (Figure 1). This area is characterized by forested upland plateaus, some of gentle relief but others topped by steep 1,000 to 1,600 meter tundra covered mountains. Beaver Creek, like its tributaries, is narrow and steep in the headwaters, but widens downstream as the gradient decreases, increasing the meandering to form sloughs and extensive marshy lowlands. The relatively flat floodplain, often underlain by discontinuous permafrost, ranges from 1.6 to 4.8 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, 80 air km north of Fairbanks, Alaska. It flows 179 km through the 445 thousand- hectare White Mountains National Recreation Area and then an additional 303 km through the Yukon Flats National Wildlife Refuge, where it drains into the Yukon River. The weir site is approximately 322 km upriver from the mouth of Beaver Creek (Figure 2). This section of the river is 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 fisherman (BLM, 1983).

3 Material and Methods

3.1 Weir Construction and Installation

Construction of the main components of the weir began in April 1996. Additional components, the trap, and fencing attached from trap to shore were constructed at the site on Beaver Creek. The pickets for the weir are 3.0 m long, 2.5 cm inside diameter schedule 40 polyvinyl chloride (PVC) conduit. Pickets are sealed at both ends and joined together with polyethylene and aluminum stringers to maintain conformity of space between pickets. Spacing between each picket is 3.2 cm. Each panel is 1.2 m wide. Eighteen pickets were used per panel and

FIGURE 1: Location map.

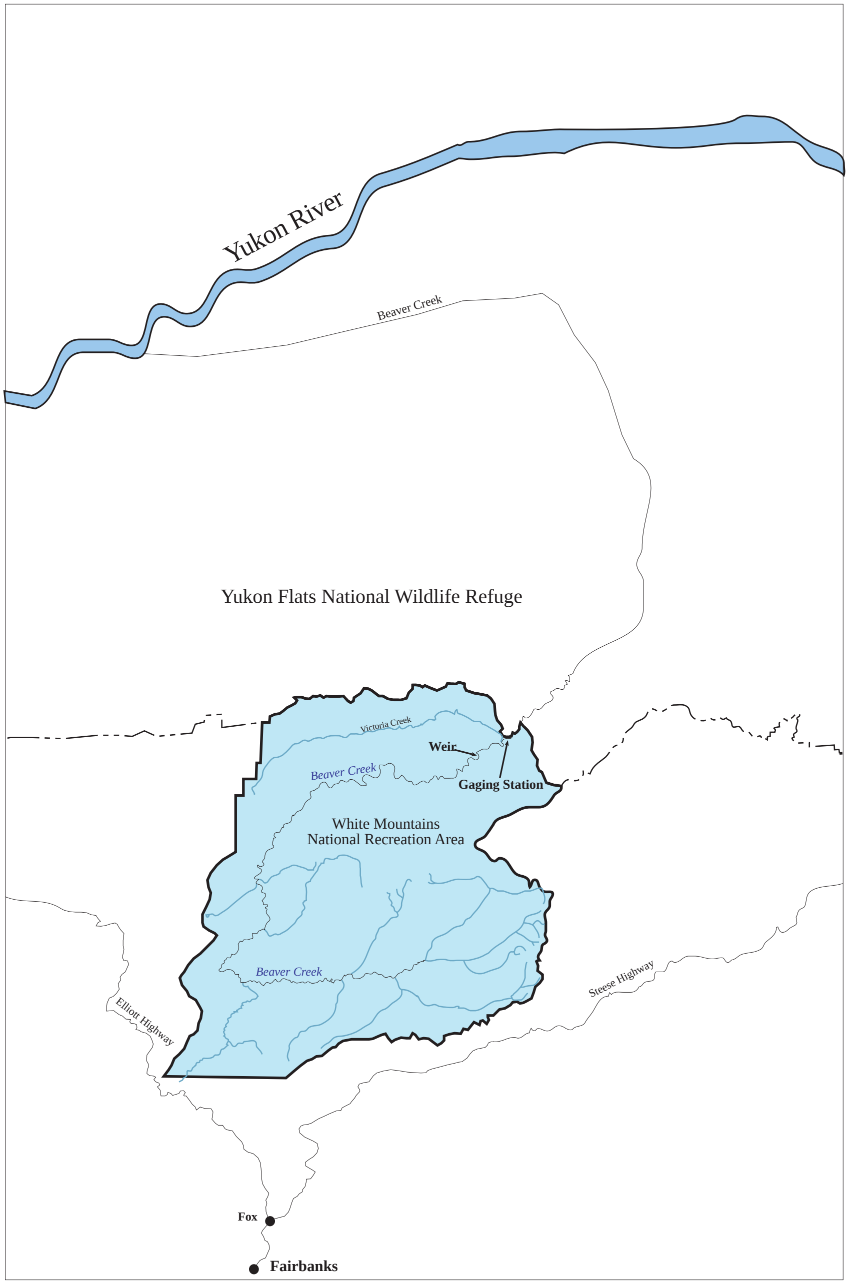

FIGURE 2: Map of Beaver Creek weir location.

are spaced 6.8 cm center to center. The total weir is approximately 70 m in length.

During 1997, 20 of the panels were extended to 6.1 m long. A resistance board was attached to each panel which measured 0.6 m high and 1.2 m wide and were constructed of laminated plywood and styrofoam. This was to help keep the panels from submerging during high water events.

Duckbill anchors were secured in the substrate. A 10 mm cable was threaded through the anchors and attached to a winch on the south bank of the creek. The winch applied tension to the cable. The panels were attached to the cable using two fabricated steel hooks bolted into the aluminum stringer at the bottom of each panel (Figure 3). Sand bags were placed along the upstream edge of the cable to prevent washout of gravel beneath the cable.

During 1996 the live trap (Figure 4), which was 1.2 m high, 1.8 m long and 1.2 m wide, was constructed of 2.5 cm PVC pipe and galvanized steel corner brackets. A high density polyethylene, nonabrasive net was attached to the frame to form the trap. Adjustable doors at both ends of the live trap were used to trap fish for identification and counting.

In 1997, a new trap was constructed of an aluminum frame and panels of aluminum angle and PVC pickets. It measured 1.8 m high, 3.5 m long, and 1.2 to 2.4 m wide. A passing chute was installed on the downstream edge of the trap. This allowed fish to pass through the weir into the live trap, where they could be counted or biological samples could be taken.

The weir was visually inspected daily for holes and structural integrity. Fish carcasses and debris were cleaned from the weir as they accumulated. Cleaning usually involved walking on the weir panels until they were partially submerged and allowing the current to flush the debris off.

3.2 Biological Data

The weir was operational from July 8 to September 25, 1996, and June 14 to August 11, 1997. High water levels during 1996 prevented installation and operation of the weir until July 8.

Summer chum and chinook salmon passing through the weir were observed, counted, and identified to species. Daily counts were monitored between 0900 to 0900 (24 hr. period). Chum and chinook salmon were sampled for sex and fork length, measured to the nearest mm. In 1996, due to problems with the trap, only 10 fish carcasses caught on the weir were sampled. In 1997, no chum salmon were sampled due to small sample size (N=34). 100 chinook salmon were sampled from live fish caught in the trap and then released. A sample of the caudal fin was clipped for genetic sampling.

3.3 Hydrology

Each year, a staff gage was installed to measure water levels. The gage was surveyed to reference elevation (bench) marks, significant high-water marks, and the current water level. Cross-sectional discharge (streamflow) measurements were made using a Price AA current meter to measure water velocity and a top-setting wading rod and tag line for depth and width. 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). Data was then compared to the automated water-level recorder data that has been collected since 1988 at a site just upstream of Victoria Creek (Kostohrys & Sterin, 1994), about 8.9 km downstream of the weir.

4 Results

4.1 Weir performance

In 1996, logistics and high water delayed installation of the weir by approximately three weeks. The weir was operational from July 8 to September 25. Picket spacing was adequate to prevent the passage of adult chum and chinook salmon. However, 3 to 4 chum salmon were observed forcing their way through the wire-welded fence between the weir and shore. During high water some areas of the weir accumulated gravel on the lower end of the panels. Also during high water events stream velocity increased and submerged some of the panels located in the middle. Buoys were installed to alleviate this problem. No major problems that affected the performance of the weir were encountered.

During 1997, the weir was operational from June 14 to August 11. The addition of the longer panels and resistance boards helped alleviate the

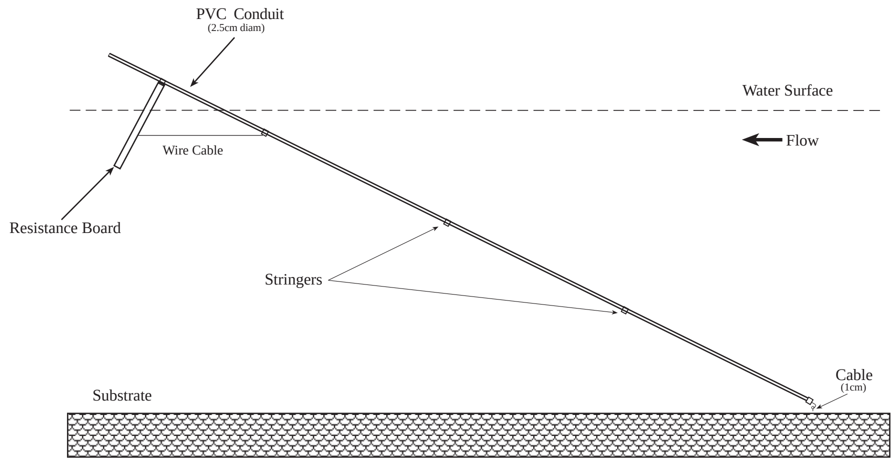

FIGURE 3: Lateral view of installed weir panel.

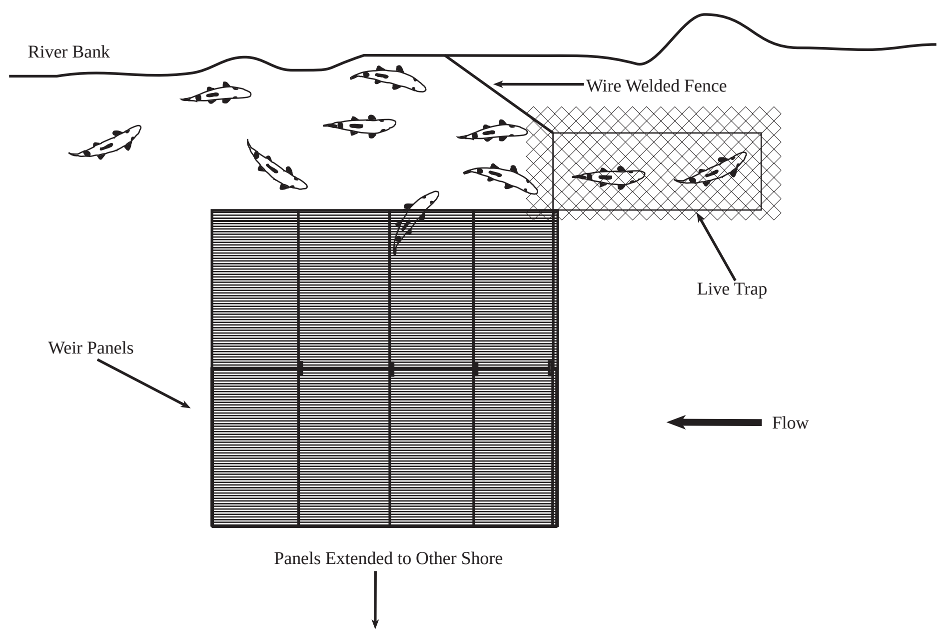

FIGURE 4: Overhead view of weir section depicting fish passage through live trap and weir section, 1996 and 1997.

problem of panels submerging during high water events. The new live trap and passing chute allowed fish to be counted and biological samples could be taken.

4.2 Biological Data

1996

In 1996, summer chum salmon (N=654) were the most abundant species counted, followed by chinook salmon (N=192). Three resident species were also counted. They were Arctic grayling (N=15), northern pike (N=7), and longnose sucker (N=2).

Chum salmon daily counts showed an increasing trend, reaching a peak on July 22 before beginning a decline (Figure 5). A total of eight chum salmon were sampled for sex, and length. Fork lengths of sampled chum salmon ranged from 580 mm to 705 mm fork length.

Chinook salmon daily counts began declining three days after the weir was installed. The peak of the migration occurred on July 9 (Figure 5). A total of two chinook salmon were sampled for sex, and fork length. The samples were male. Fork length of sampled chinook salmon were both 805 mm.

1997

During 1997, 34 summer chum and 315 chinook salmon were counted (Figure 5). Three resident species also passed through the weir. They were Arctic grayling (N=4), northern pike (N=5), and longnose sucker (N=63).

Salmon were first observed in the creek July 8. Chum salmon never peaked. The peak of the migration for chinook salmon occurred July 26 and then began declining.

A total of 100 chinook salmon were sampled for length and sex. All samples were collected between July 20 and July 24. Males accounted for 92% of the total count. Fork lengths of chinook sampled ranged from 510 mm to 1075 mm fork length.

4.3 Hydrology

Water levels fluctuated between 0.3 to 1.1 meters in 1996, and from 0.1 to 0.5 meters in 1997 (Figure 6). The datum of the water level readings was adjusted so that the numbers reported correspond to the deepest depth of the river at the weir. These readings were then used as the independent variable to compute discharge (Figure 7) from a log-log regression equation. A water level versus discharge rating was developed using discharge measurements from both years, with seperate equations for water levels above and below 0.762 meters. Differences from the actual measurements to the values calculated using the log-log regression equations were about five percent, well within accepted tolerances (Rantz *et al.*, 1982).The mean daily discharge and summary data as well as regression statistics are listed in Appendix B.

5 Discussion

5.1 Weir Performance

The use of resistance board weirs in Alaska is relatively new (Tobin, 1994). Resistance board weirs are less likely to be damaged or washed out by high flows and debris than the conventional rigid weir designs. When compared to sonar enumeration, resistance board weirs provide more accurate identification of species, eliminate the need for test fisheries, do not require expensive electronics equipment, and require less time spent interpreting data after field work is completed (Melegari & Wiswar, 1994).

In 1996, the weir performed well and was effective in allowing accurate counts of migrating salmon. Picket spacing of the weir panels was adequate to prevent adult chum and chinook salmon from passing between the pickets; however, smaller resident species may have passed through the weir undetected. The trap needed to be redesigned to assist in the capture of fish. High water levels can temporarily submerge weir panels (Booth, 1993; Tobin, 1994).

During 1997 with the addition of the redesigned trap and the longer panels with resistance boards, the weir was extremely effective in allowing accurate counts of migrating salmon. Picket spacing of the weir panels was adequate to prevent adult chinook and chum salmon from passing between the pickets; however, smaller resident species may have passed through the weir undetected.

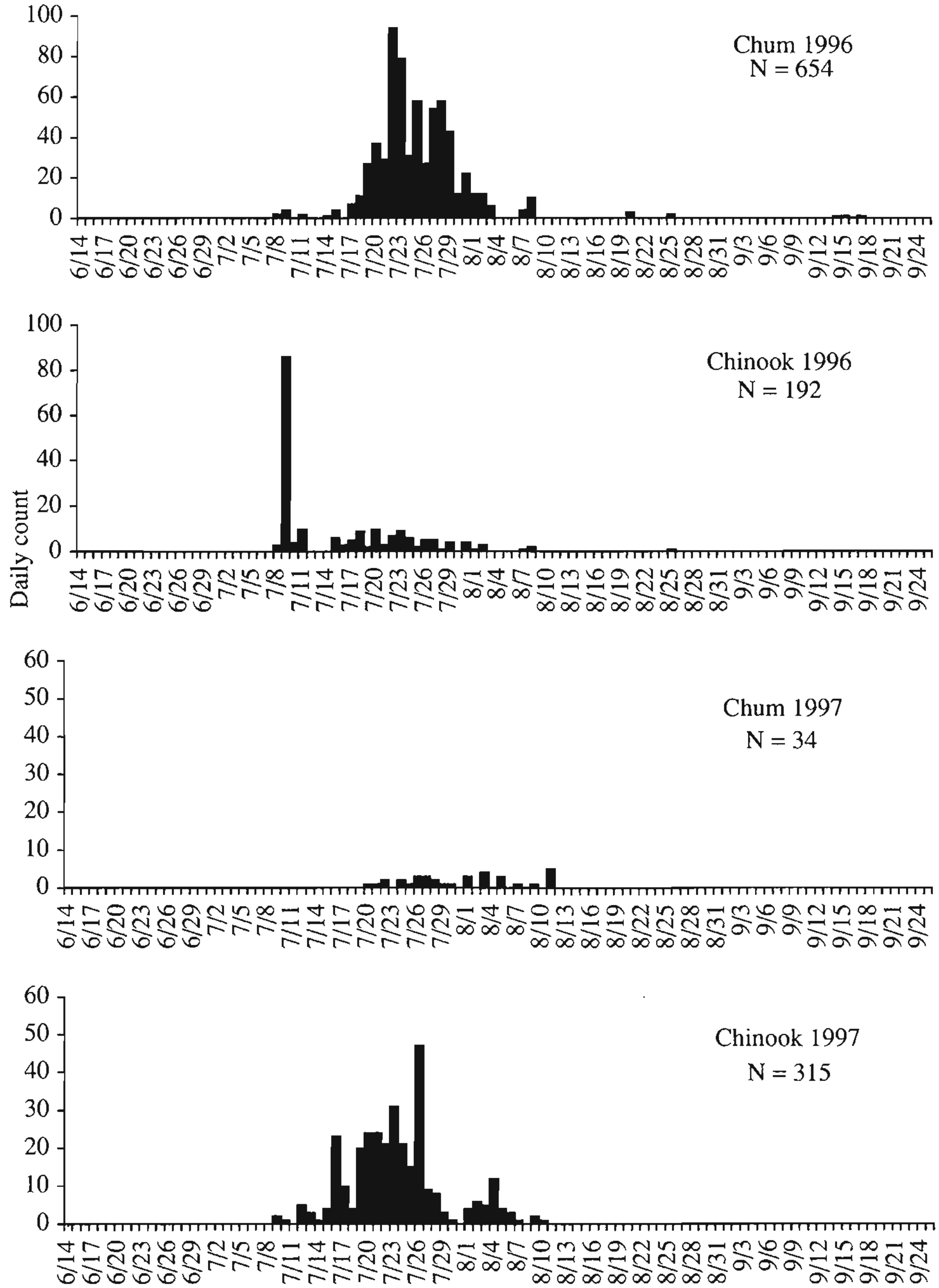

FIGURE 5: Daily counts of summer chum and chinook salmon passing through the Beaver Creek weir, 1996 and 1997. Weir operated from July 8 to September 25, 1996 and June 14 to August 11, 1997.

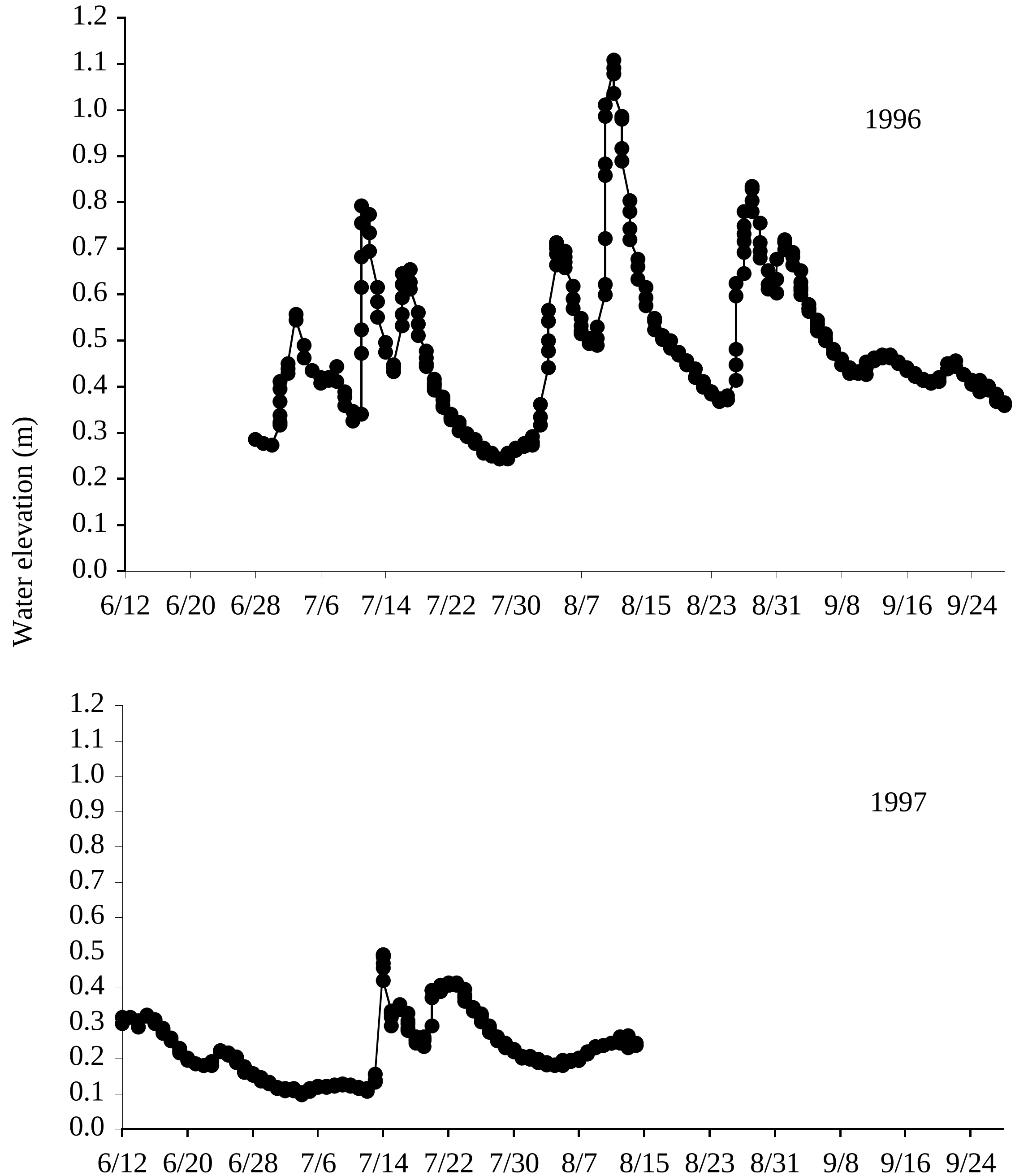

FIGURE 6: Daily water elevation during weir operation, Beaver Creek, 1996 and 1997.

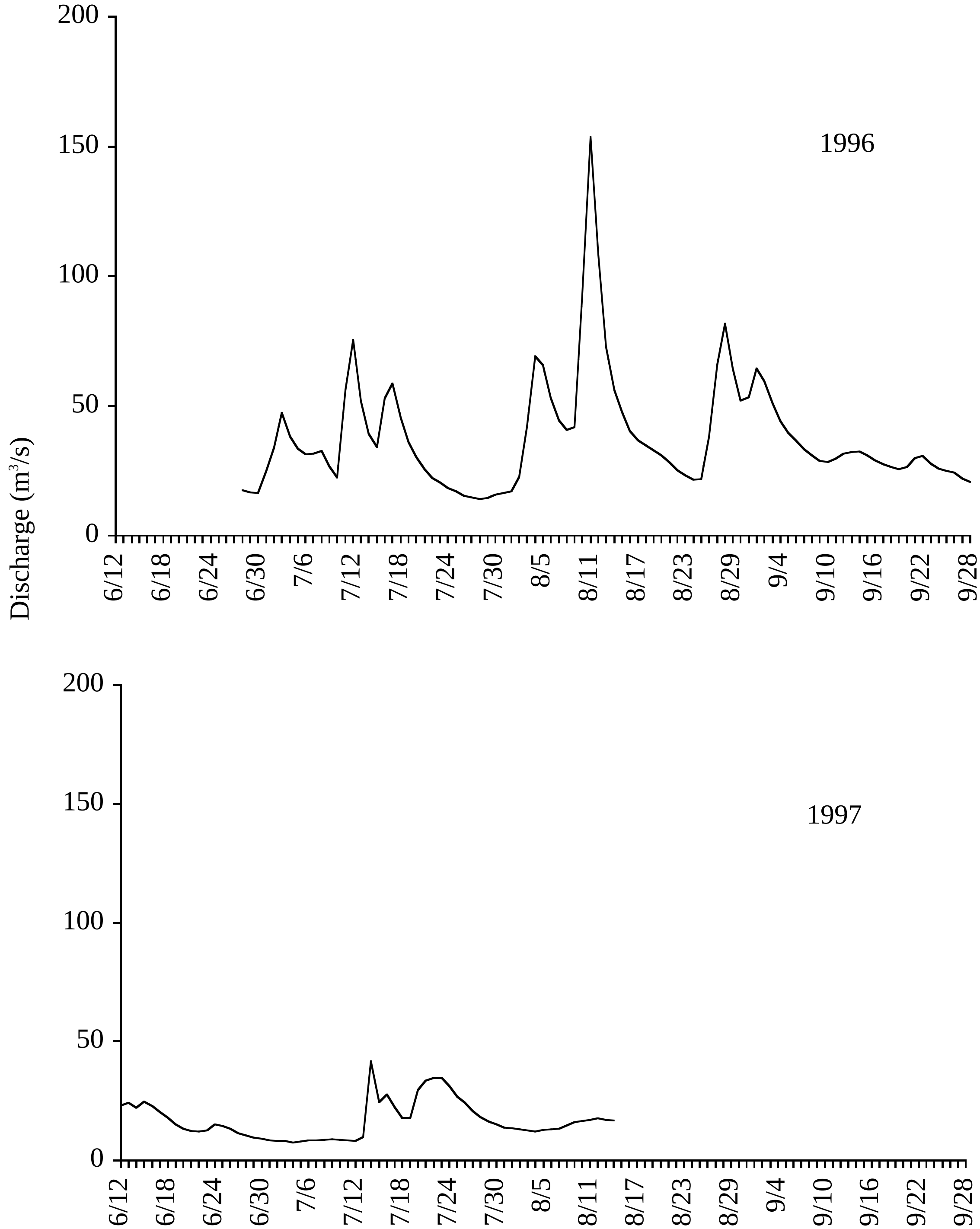

FIGURE 7: Mean daily discharge during weir operation, Beaver Creek, 1996 and 1997.

TABLE 1: Comparative mean monthly discharge for Beaver Creek.

Month	Five-year mean[a]	1996 m^3/sec	1996 % of five-year mean	1997 m^3/sec	1997 % of five-year mean
June	74	ND[b]	ND	16	21%
July	27	32	119%	18	67%
August	46	51	110%	15	32%
September	53	33	62%	ND	ND

[a]From (Kostohrys and Sterin, 1994)
[b]"ND" indicates no data.

5.2 Biological data

1996

Due to logistical problems and high water, it is possible that early portions of the chinook salmon run were not counted during 1996. Because of this, the weir counts of chinook salmon are conservative, and size and sex data samples are low and are probably not representative of the entire run. However, no salmon were observed in the creek from June 28 to July 7, two weeks before the weir began operation on July 8. Peak migration of chum salmon and chinook salmon occurred on July 9 and July 22 respectively.

1997

Run timing for chinook salmon during 1997 did not appear to be similar to 1996. Peak migration occurred on July 26, 17 days later than in 1996. Chum salmon never peaked.

Numbers of chum and chinook salmon changed considerably from the previous summer. The chum salmon weir count for 1997 (N = 34) was drastically lower than in 1996 (N = 654). The 1997 weir count of chinook salmon (N = 315) was higher than in 1996 (N = 192).

Beaver Creek provides suitable spawning habitat to sustain a small run of chum and chinook salmon. The small salmon runs may be more susceptible to over-harvest, now that the BLM has improved boat access and is promoting water-related recreation in the drainage.

5.3 Hydrology

The contrast in streamflow for 1996 and 1997 was extreme (Figure 7). While hydrologic data is incomplete for a full summer comparison, the streamflow and corresponding water levels for 1997 were about half that of 1996 for the month of July, when the majority of salmon were counted, and also significantly lower than the five year average for the stream gage above Victoria Creek (Kostohrys & Sterin, 1994).The increased streamflow in early July of 1996 and mid to late July of 1997 may correlate to the timing of the salmon runs, as the peak migration both years followed periods of higher water.

5.4 Recommendations

The weir should be installed during middle to late June and operated through late August to decrease the potential of missing a portion of the run. Aerial surveys during peak migration would help determine if fish are spawning below the weir. Other data that may be collected include more cross-sectional discharge measurements, water temperature, and conductance.

6 Acknowledgments

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References

Barton, L. H. 1984. *A catalog of Yukon River salmon spawning escapement surveys.* Technical Data Report 121. Alaska Department of Fish and Game, Juneau, Alaska.

BLM. 1983. *River management plan for the Beaver Creek National Wild River, Alaska*.

Booth, J. A. 1993. *Migration timing and abundance of adult salmonids in the Uganik River, Kodiak National Wildlife Refuge, Alaska, 1990 and 1991.* Alaska Fisheries Progress Report 93-1. U.S. Fish and Wildlife Service, Kenai Fishery Assistance Office, Anchorage, AK.

Kostohrys, Jon, & Sterin, Bunny G. 1994. *Water resources of Beaver Creek national wild river, Alaska. Stream gaging data from 1988 to 1992.* Open file report. U.S. Department of Interior, Bureau of Land Management., Anchorage, Alaska.

Lubinski, Brian. 1995. *BLM trip reports, 1992 to 1994*. Trip report. Bureau of Land Management, Northern District, White Mountains National Recreation Area, Fairbanks, Alaska.

Melegari, J. L., & Wiswar, D. W. 1994. *Abundance and run timing of adult salmon in the Gisasa River, Koyukuk National Wildlife Refuge, Alaska, 1994*. Fishery Data Series 95-1. U.S. Fish and Wildlife Service, Fairbanks, Alaska.

Rantz, S. E., *et al.* 1982. *Measurement and computation of streamflow*. USGS Water-Supply Paper 2175, vol. 1 and 2. U. S. Department of the Interior, Geological Survey.

Schultz, K. C., Holder, R. R., Barton, L. H., Bergstrom, D. J., Blaney, C., Sandone, G. J., & Schneiderhan, D. J. 1993. *Annual management report for subsistence, personal use, and commercial fisheries of the yukon area, 1992*. Regional information report 3A93-10. Alaska Department of Fish and Game, Anchorage, Alaska.

Tobin, J. H. 1994. *Construction and performance of a portable resistance board weir for counting migrating adult salmon in rivers*. Alaska Fisheries Technical Report 22. U. S. Fish and Wildlife Service, Kenai Fishery Resource Office, Kenai, Alaska.

Appendix A: Biological data

TABLE 2: Daily and cumulative counts of salmon passing through the Beaver Creek weir, 1996

	Chinook salmon		**Chum salmon**	
Date	**Daily**	**Cumulative**	**Daily**	**Cumulative**
Jul 07	0	0	0	0
Jul 08	3	3	2	2
Jul 09	86	89	4	6
Jul 10	4	93	0	6
Jul 11	10	103	2	8

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TABLE 2: 1996 salmon counts, continued

	Chinook salmon		Chum salmon	
Date	**Daily**	**Cumulative**	**Daily**	**Cumulative**
Jul 12	0	103	0	8
Jul 13	0	103	0	8
Jul 14	0	103	1	9
Jul 15	6	109	4	13
Jul 16	3	112	0	13
Jul 17	5	117	7	20
Jul 18	9	126	11	31
Jul 19	2	128	27	58
Jul 20	10	138	37	95
Jul 21	3	141	29	124
Jul 22	7	148	94	218
Jul 23	9	157	79	297
Jul 24	6	163	31	328
Jul 25	2	165	58	386
Jul 26	5	170	27	413
Jul 27	5	175	54	467
Jul 28	1	176	58	525
Jul 29	4	180	43	568
Jul 30	0	180	12	580
Jul 31	4	184	22	602
Aug 01	1	185	12	614
Aug 02	3	188	12	626
Aug 03	0	188	6	632
Aug 04	0	188	0	632
Aug 05	0	188	0	632
Aug 06	0	188	0	632
Aug 07	1	189	4	636
Aug 08	2	191	10	646
Aug 09	0	191	0	646
Aug 10	0	191	0	646
Aug 11	0	191	0	646
Aug 12	0	191	0	646
Aug 13	0	191	0	646
Aug 14	0	191	0	646
Aug 15	0	191	0	646
Aug 16	0	191	0	646
Aug 17	0	191	0	646
Aug 18	0	191	0	646
Aug 19	0	191	0	646
Aug 20	0	191	3	649
Aug 21	0	191	0	649
Aug 22	0	191	0	649
Aug 23	0	191	0	649
Aug 24	0	191	0	649
Aug 25	1	192	2	651

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TABLE 2: 1996 salmon counts, continued

	Chinook salmon		Chum salmon	
Date	**Daily**	**Cumulative**	**Daily**	**Cumulative**
Aug 26	0	192	0	651
Aug 27	0	192	0	651
Aug 28	0	192	0	651
Aug 29	0	192	0	651
Aug 30	0	192	0	651
Aug 31	0	192	0	651
Sep 01	0	192	0	651
Sep 02	0	192	0	651
Sep 03	0	192	0	651
Sep 04	0	192	0	651
Sep 05	0	192	0	651
Sep 06	0	192	0	651
Sep 07	0	192	0	651
Sep 08	0	192	0	651
Sep 09	0	192	0	651
Sep 10	0	192	0	651
Sep 11	0	192	0	651
Sep 12	0	192	0	651
Sep 13	0	192	0	651
Sep 14	0	192	1	652
Sep 15	0	192	1	653
Sep 16	0	192	0	653
Sep 17	0	192	1	654
Sep 18	0	192	0	654
Sep 19	0	192	0	654
Sep 20	0	192	0	654
Sep 21	0	192	0	654
Sep 22	0	192	0	654
Sep 23	0	192	0	654
Sep 24	0	192	0	654
Sep 25	0	192	0	654

TABLE 3: Daily and cumulative counts of salmon passing through the Beaver Creek weir, 1997

	Chinook salmon		Chum salmon	
Date	**Daily**	**Cumulative**	**Daily**	**Cumulative**
Jun 14	0	0	0	0
Jun 15	0	0	0	0
Jun 16	0	0	0	0
Jun 17	0	0	0	0
Jun 18	0	0	0	0
Jun 19	0	0	0	0
Jun 20	0	0	0	0

Table continues on next page...

TABLE 3: 1997 salmon counts, continued

	Chinook salmon		Chum salmon	
Date	Daily	Cumulative	Daily	Cumulative
Jun 21	0	0	0	0
Jun 22	0	0	0	0
Jun 23	0	0	0	0
Jun 24	0	0	0	0
Jun 25	0	0	0	0
Jun 26	0	0	0	0
Jun 27	0	0	0	0
Jun 28	0	0	0	0
Jun 29	0	0	0	0
Jun 30	0	0	0	0
Jul 01	0	0	0	0
Jul 02	0	0	0	0
Jul 03	0	0	0	0
Jul 04	0	0	0	0
Jul 05	0	0	0	0
Jul 06	0	0	0	0
Jul 07	0	0	0	0
Jul 08	0	0	0	0
Jul 09	2	2	0	0
Jul 10	1	3	0	0
Jul 11	0	3	0	0
Jul 12	5	8	0	0
Jul 13	3	11	0	0
Jul 14	1	12	0	0
Jul 15	4	16	0	0
Jul 16	23	39	0	0
Jul 17	10	49	0	0
Jul 18	4	53	0	0
Jul 19	20	73	0	0
Jul 20	24	97	1	1
Jul 21	24	121	1	2
Jul 22	21	142	2	4
Jul 23	31	173	0	4
Jul 24	21	194	2	6
Jul 25	15	209	1	7
Jul 26	47	256	3	10
Jul 27	9	265	3	13
Jul 28	8	273	2	15
Jul 29	3	276	1	16
Jul 30	1	277	1	17
Jul 31	0	277	0	17
Aug 01	4	281	3	20
Aug 02	6	287	0	20
Aug 03	5	292	4	24
Aug 04	12	304	0	24

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TABLE 3: 1997 salmon counts, continued

	Chinook salmon		Chum salmon	
Date	**Daily**	**Cumulative**	**Daily**	**Cumulative**
Aug 05	4	308	3	27
Aug 06	3	311	0	27
Aug 07	1	312	1	28
Aug 08	0	312	0	28
Aug 09	2	314	1	29
Aug 10	1	315	0	29
Aug 11	0	315	5	34

Appendix B: Hydrologic data

TABLE 4: Mean daily discharge (m^3/s) and summaries for Beaver Creek at the weir, 1996

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
Jun 01		Jul 01	25	Aug 01	17	Sep 01	64
Jun 02		Jul 02	34	Aug 02	23	Sep 02	59
Jun 03		Jul 03	47	Aug 03	42	Sep 03	51
Jun 04		Jul 04	38	Aug 04	69	Sep 04	44
Jun 05		Jul 05	33	Aug 05	66	Sep 05	40
Jun 06		Jul 06	31	Aug 06	53	Sep 06	37
Jun 07		Jul 07	32	Aug 07	44	Sep 07	33
Jun 08		Jul 08	33	Aug 08	41	Sep 08	31
Jun 09		Jul 09	27	Aug 09	42	Sep 09	29
Jun 10		Jul 10	22	Aug 10	93	Sep 10	28
Jun 11		Jul 11	56	Aug 11	154	Sep 11	30
Jun 12		Jul 12	75	Aug 12	108	Sep 12	32
Jun 13		Jul 13	52	Aug 13	73	Sep 13	32
Jun 14		Jul 14	39	Aug 14	56	Sep 14	32
Jun 15		Jul 15	34	Aug 15	47	Sep 15	31
Jun 16		Jul 16	53	Aug 16	40	Sep 16	29
Jun 17		Jul 17	59	Aug 17	37	Sep 17	28
Jun 18		Jul 18	45	Aug 18	35	Sep 18	26
Jun 19		Jul 19	36	Aug 19	33	Sep 19	26
Jun 20		Jul 20	30	Aug 20	31	Sep 20	26
Jun 21		Jul 21	26	Aug 21	28	Sep 21	30
Jun 22		Jul 22	22	Aug 22	25	Sep 22	31
Jun 23		Jul 23	20	Aug 23	23	Sep 23	28
Jun 24		Jul 24	18	Aug 24	22	Sep 24	26
Jun 25		Jul 25	17	Aug 25	22	Sep 25	25
Jun 26		Jul 26	15	Aug 26	38	Sep 26	24
Jun 27		Jul 27	15	Aug 27	66	Sep 27	22
Jun 28	17	Jul 28	14	Aug 28	82	Sep 28	21
Jun 29	17	Jul 29	14	Aug 29	64	Sep 29	
Jun 30	16	Jul 30	16	Aug 30	52	Sep 30	
		Jul 31	16	Aug 31	53		
Monthly summaries:							
June		July		August		September	
Max.	17	Max.	75	Max.	154	Max.	64
Min.	16	Min.	14	Min.	17	Min.	21
Mean	17	Mean	32	Mean	51	Mean	33
Seasonal summary:							
Peak W.L.(m)	1.48	Discharge	162	Date	Aug 11		
Min. W.L.(m)	0.37	Discharge	14	Date	Jul 28		

TABLE 5: Mean daily discharge (m^3/s) for Beaver Creek below Yellow Creek, 1997

Date	Discharge	Date	Discharge	Date	Discharge
Jun 01		Jul 01	8.3	Aug 01	14
Jun 02		Jul 02	8	Aug 02	13
Jun 03		Jul 03	8	Aug 03	13
Jun 04		Jul 04	7.4	Aug 04	12
Jun 05		Jul 05	8	Aug 05	13
Jun 06		Jul 06	8.4	Aug 06	13
Jun 07		Jul 07	8.4	Aug 07	13
Jun 08		Jul 08	8.6	Aug 08	15
Jun 09		Jul 09	8.8	Aug 09	16
Jun 10		Jul 10	8.6	Aug 10	16
Jun 11		Jul 11	8.3	Aug 11	17
Jun 12	23	Jul 12	8	Aug 12	18
Jun 13	24	Jul 13	10	Aug 13	17
Jun 14	22	Jul 14	42	Aug 14	17
Jun 15	25	Jul 15	24	Aug 15	
Jun 16	23	Jul 16	28	Aug 16	
Jun 17	20	Jul 17	22	Aug 17	
Jun 18	18	Jul 18	18	Aug 18	
Jun 19	15	Jul 19	18	Aug 19	
Jun 20	13	Jul 20	29	Aug 20	
Jun 21	12	Jul 21	33	Aug 21	
Jun 22	12	Jul 22	35	Aug 22	
Jun 23	12	Jul 23	35	Aug 23	
Jun 24	15	Jul 24	31	Aug 24	
Jun 25	14	Jul 25	27	Aug 25	
Jun 26	13	Jul 26	24	Aug 26	
Jun 27	11	Jul 27	21	Aug 27	
Jun 28	10	Jul 28	18	Aug 28	
Jun 29	10	Jul 29	16	Aug 29	
Jun 30	9	Jul 30	15	Aug 30	
		Jul 31	14	Aug 31	
Monthly summaries:					
June		July		August	
Max.	25	Max.	42	Max.	18
Min.	9.0	Min.	7.4	Min.	12
Mean	16	Mean	18	Mean	15
Seasonal summary:					
Peak W.L.(m)	0.90	Discharge	45	Date	Jul 14
Min. W.L.(m)	0.50	Discharge	7.3	Date	Jul 4

TABLE 6: Regression statistics for Beaver Creek at the weir: water level versus discharge.

	Water level < 0.76 m	Water level > 0.76 m
m	3.29	2.56
b	4.27	4.08
r^2	0.97	0.99
se_{est}	0.06	0.05