BLIND CREEK CHINOOK SALMON ENUMERATION WEIR, 2005

CRE-37-05

Prepared for the Yukon River Panel

by

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ABSTRACT

A weir was operated in Blind Creek to enumerate chinook salmon returns in 2005. Biological data, including size, age and sex composition and genetic material was collected from a representative sample of the chinook run. Spaghetti tags applied at the DFO tagging program at Bio-Island near the Canada/U.S. border were recovered. The weir operation began on July 15 and continued until August 15. The first fish through the weir was counted on July 20. In total, 525 chinook were counted through the weir. Out of a sample size of 161 fish, 48% were female and 52% were male. Jacks (males with a fork length <630 mm) represented 11% of the total fish sampled. Six orange spaghetti tags were retrieved from fish passing through the weir and one was found loose on the bank below the weir. Tissue samples for DNA analysis have been collected from chinook during weir operations since 2003. The sampling goal of 200 was reached this year.

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INTRODUCTION

Blind Creek is part of the Pelly River sub-basin and supports a significant run of chinook salmon. With growing concerns over the effects of mining in the Blind Creek drainage, Ross River Dena Council (RRDC) initiated an enumeration weir in 1995 to monitor the chinook population. Since then, the weir has been operated annually with the exception of 2001 and 2002 (Vust, 1999; Wilson, 1997,1998, 2004,2005). Counts obtained from weir operations have ranged from a low of 373 (1998) to a high of 1,155 (2003).

Sustaining a healthy population of chinook salmon in the Pelly River watershed is of great importance to a number of user groups along the Pelly River basin and along the Yukon River downstream of the Pelly River. Since very little quantitative information is available on chinook salmon utilization in the Pelly River drainage, obtaining an accurate count of annual chinook returns to Blind Creek provides a valuable escapement index for the Pelly River system. The weir operation also facilitates the recovery of spaghetti tags from mark recapture studies in the Yukon River drainage and the collection of biological information important for future restoration and conservation of the Blind Creek stock such as sex-length-age data and genetic material.

The proximity of the weir operation to the Town of Faro provides an opportunity to increase public awareness of the chinook salmon resource and management programs. The weir site is located approximately 10 km southeast of the Town of Faro and can be accessed from a maintained mining road. In recent years, a considerable number of tourists as well as local people have stopped to view the weir operation and a great deal of interest has been shown in salmon and the enumeration project.

This report presents the results of the 2005 weir operation. The specific objectives of the weir program were as follows:

- Provide an accurate count of chinook spawners returning to Blind Creek;
- Collect biological information including age-sex-length data and genetic material from a representative sample of the Blind Creek stock;
- Recover spaghetti tags applied by DFO for management purposes;
- Prepare an interpretive brochure for distribution to visitors of the Town of Faro Interpretive center.

Major funding for this project was provided by the Yukon River Restoration and Enhancement (R&E) Fund. Additional funding was provided by the Town of Faro, Student Employment Program.

STUDY AREA

Blind Creek flows in a southwesterly direction from its headwaters in the Anvil Range into the Pelly River, approximately 10 km southeast of the Town of Faro. The creek and its tributaries drain an area of approximately 618 km^2. Major lake systems in the drainage basin include the

Blind Lake and Swim Lake chains. A mining access road from the Town of Faro crosses the creek at two locations, approximately 2 km (bridge #1) and 3 km (bridge #2) upstream from its confluence with the Pelly River[1] (Figure 1). Aerial surveys have identified chinook spawning sites throughout the lower 40 km of the creek, with the largest concentrations observed between 20 and 35 km upstream of the mouth (Harder, 1996; Wilson, 2001, 2002).

METHODS

Site Selection

The weir was placed approximately 1 km upstream of the creek mouth and 30 m downstream of the first bridge crossing (Figure 1). This area has consistently been used since weir operations began in 1995. It is accessible from the Town of Faro on a maintained mining road and is in close proximity to an existing First Nation camp. The majority of the chinook population can be counted from this point since most spawning occurs upstream.

Weir Construction

Construction of the weir began by the assembly of a counting chamber in the middle of the stream. This consisted of pre-fabricated panels of electrical conduit connected together to form an enclosure measuring 2 m (L) X 0.7 m (W) X 1.0 m (H). Wooden tripods were then placed downstream of the counting chamber in a 'V' configuration to direct fish moving close to the bank towards the counting chamber. Once in place, the tripods were joined together by wooden stringers to support the fencing panels. These panels consisted of 12, 3 meter long electrical conduit pieces that were strung vertically through four horizontal steel plates drilled with holes and welded to prevent movement. Panels were laid side by side against the weir supports and connected by inserting a loose conduit through an empty hole drilled at each end of the steel plates. The counting chamber was connected to the weir structure using two, 2 meter long conduit panels that were tapered to fit the weir panels. These were placed at each downstream corner of the pen and angled towards the weir to form a V-shaped staging area for fish moving into the counting chamber. A sheet of black poly was draped over the staging area to prevent disturbing fish.

After the panels were in place, sand bags were placed along the bottom upstream side of the weir to prevent scouring of the creek substrate and undermining of the structure. A white 'flashboard' was secured to the bottom of the counting chamber to improve visibility of salmon passing through. A platform was placed alongside the counting chamber for enumerating and sampling fish and accessed from the bank via a wooden walkway. See photograph in Figure 2 showing view of weir and sampling station.

A container to hold fish for recovery from handling stress was placed immediately upstream of the sampling platform (Figure 3). This was constructed of plywood and consisted of four shallow chambers to support individual fish. The container was submerged just beneath the

[1] The two bridges on the mining access road are referred to as bridge #1 and bridge #2 for the purposes of this report.

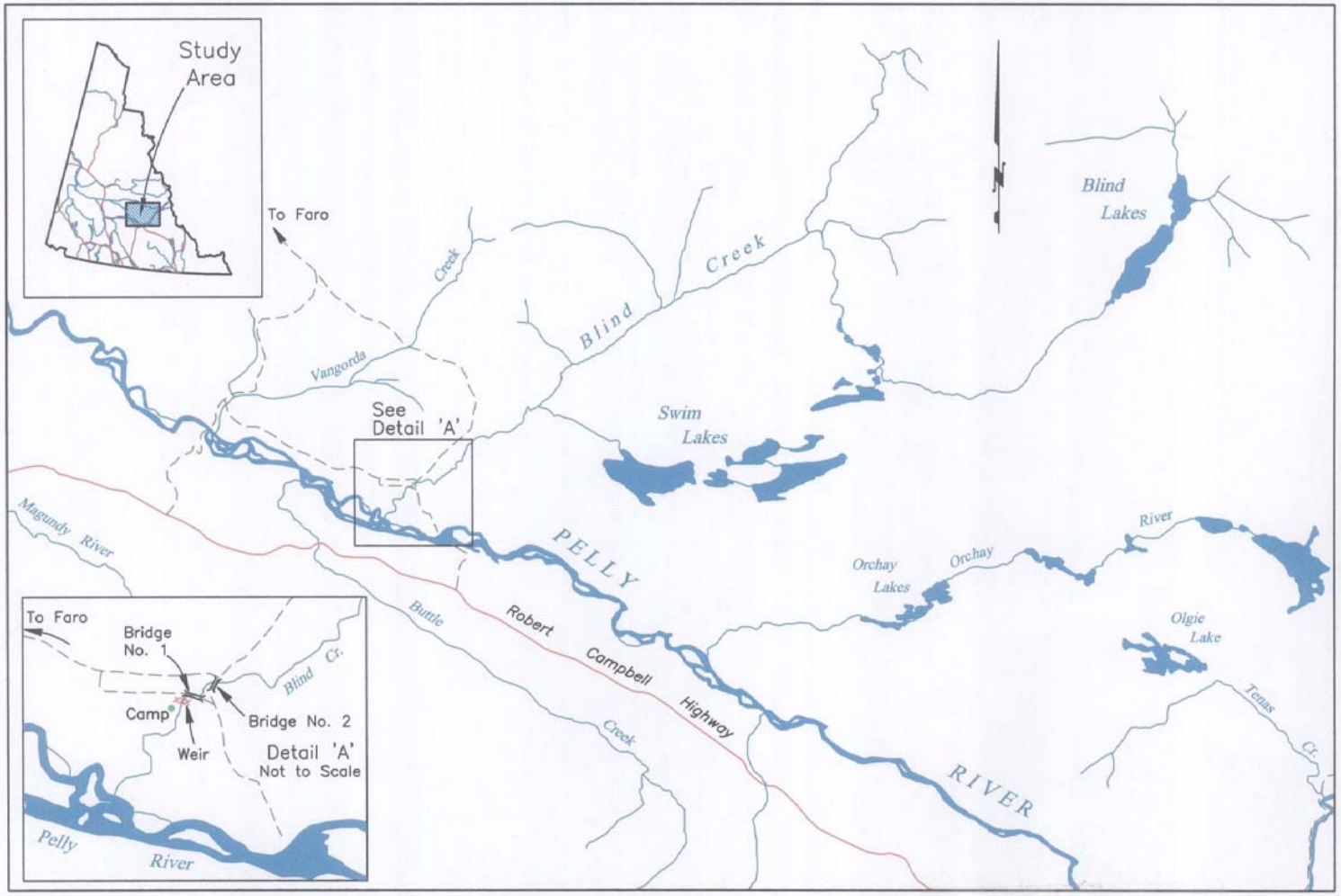

FIGURE 1.0 : Blind Creek and Weir Location

surface level to allow some water to flow over the chambers. Once the fish regained its strength it could then swim over the top and continue upstream.

Construction of the weir started on July 13 and was completed the following day. Panels for construction of the counting chamber and three additional panels for the weir were pre-fabricated in Whitehorse and transported to the site by truck. All other weir components used were stored on site from previous weir operations.

Figure 2. Weir and sampling station viewed from the north bank.

Figure 3. Chinook salmon resting in recovery chamber after sampling.

Weir Operation

Personnel were on site 24 hours a day for the duration of the chinook run. The weir was monitored daily from first light until dark. To allow chinook to pass through the counting chamber, two or three pieces of conduit were removed from both the downstream and upstream end of the chamber. After a number of fish had passed through, the upstream opening was closed and the next fish moving in held for sampling. To close the openings quickly, refrigerator grates hinged to the chamber in front of the openings were swung shut by the force of water. This allowed weir monitors time to insert the conduit pieces and avoid fish escaping the chamber. After closing the downstream opening, all chinook held in the chamber were immediately sampled to avoid causing stress on the fish. Only a small number of chinook were held at any one time. Sampling events were attempted each day and, when possible, at various times to obtain a representative sample of the daily run.

Fish held for sampling were dip netted from the counting chamber and placed in a v-shaped trough filled with water. Information on sex, size (fork length) and general condition was recorded. Scale samples (5 per fish) were taken from fish for age determination only when it was possible to do so quickly and without stressing the fish. DNA samples were taken by removing a small portion of tissue from the operculum of each fish using a paper punch and preserved in alcohol. After sampling, chinook were placed in the recovery container before continuing upstream. Chinook with spaghetti tags were held in the counting chamber and dip netted for tag recovery. Spaghetti tags, DNA tissue samples and scale samples were sent to DFO stock assessment branch, Whitehorse for analysis.

The weir was checked regularly for scouring and areas of possible escape. Debris collecting on the weir was removed on a daily basis.

Physical Measurements

Weir personnel recorded general weather and water conditions each morning. Air and water temperatures were taken using a hand-held thermometer. Water depth measurements were taken from a staff gauge installed by Water Survey of Canada about 25 meters downstream of bridge #1 along the right bank.

Water Survey of Canada, Whitehorse, Yukon provided stream discharge and daily water temperature data. Stream discharge was recorded between May and September. Water temperatures were recorded every 15 minutes using a data logger installed in the stilling well. Due to problems with the data logger, temperatures were recorded only between May 11 and July 19.

RESULTS

Chinook counts

A total of 525 chinook salmon was counted between July 15 and August 15 (see daily counts Appendix 1). The first fish was counted through the weir on July 20. On the last day the weir

was operated (August 15), five fish moved through the weir that were in poor condition and suspected of having spawned below the weir. Fifty percent of the run had passed through the weir by August 4 and 90%, by August 10.

Biological Sampling/Tag Recovery

A total of 161 chinook was sampled for length, age and sex data (see Appendix 2). Tissue samples for DNA analysis were taken from 53 of the chinook sampled. Of the total sampled, 78 were female and 83 were males (including 18 jacks <630 mm (FL)). The median fork length for females was 820 mm and the range from 710 mm to 1020 mm. For adult males (>630 mm), the median fork length was 81 mm and the range from 640 mm to 1050 mm. Fork length frequencies of chinook sampled are shown in Figure 4. Age analysis of scale samples was not completed at the time of writing this report.

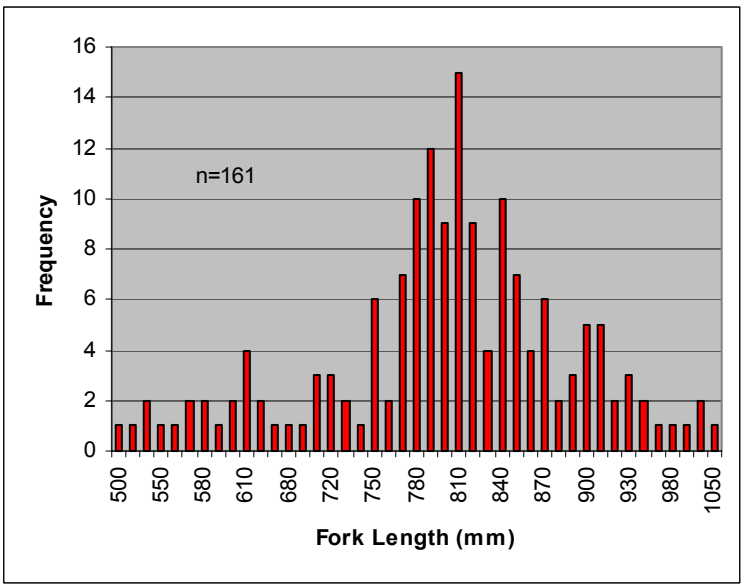

Figure 4. Length frequency of Blind Creek chinook sampled in 2005.

Six chinook passing through the weir had been tagged with orange spaghetti tags; all of which were recovered. These fish moved through the weir between 14 and 19 days after they were tagged at the DFO fish wheels near the Canada/U.S. border[2] (Table 1). An additional loose tag was found on the bank below the weir. Although, not all fish passing through the weir were examined for tag scars or fin clips, none of the fish sampled showed markings indicating tag loss.

[2] The actual date of arrival in Blind Creek is not known since fish tended to hold behind the weir for some time before moving through.

Table 1. Tag recoveries at Blind Creek weir, 2005

TAG #	SEX	DATE RECOVERED	DATE TAGGED	# DAYS OF MIGRATION
A 00160	M	July 29	July 11	18
A 00473	M	Aug 5	July 17	19
A 00810	M	Aug 7	July 23	15
A 00654	F	Aug 7	July 21	17
A 01006	M	Aug 9	July 26	14
A 00675	F	Aug 9	July 21	19
A 00466*	M	Aug 10	July 17	N/A

* Loose tag found downstream of weir on bank.

Physical Measurements:

Water temperatures recorded by Water Survey of Canada between May 11 and July 19 are illustrated in Figure 4. The maximum water temperature during this period was 12.8°C on July 13. Early morning temperatures recorded between July 15 and August 15, using a thermometer, ranged from 9°C to 12°C (see Appendix 3).

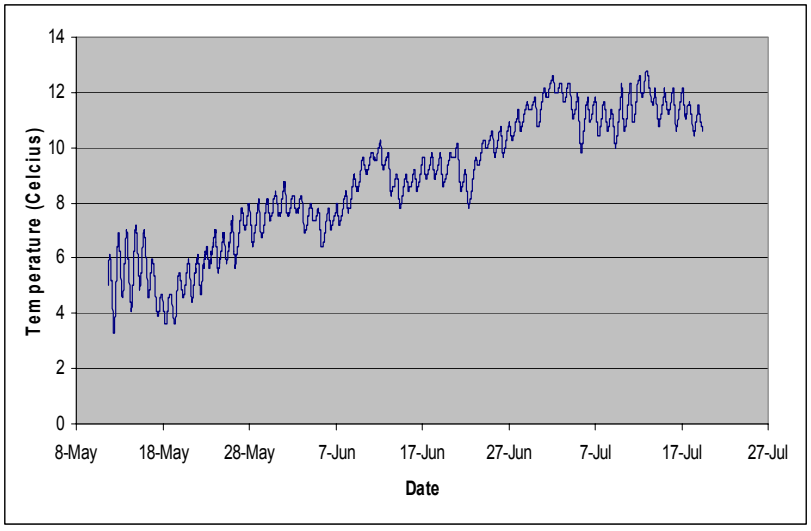

Figure 5. Water Temperatures in Blind Creek, May 11-July 19, 2005 (Water Survey of Canada Data).

Stream discharge peaked on May 18 in 2005 (Figure 6). Frequent rains during the summer resulted in periodic increases in flow rates. The mean daily discharge in July and August ranged from a high of 5.57 m^3/sec, on July 19, to a low of 1.47 m^3/sec, on August 18. The mean, maximum and minimum discharge in July and August for the period 1992 to 2005 is presented in Appendix 4.

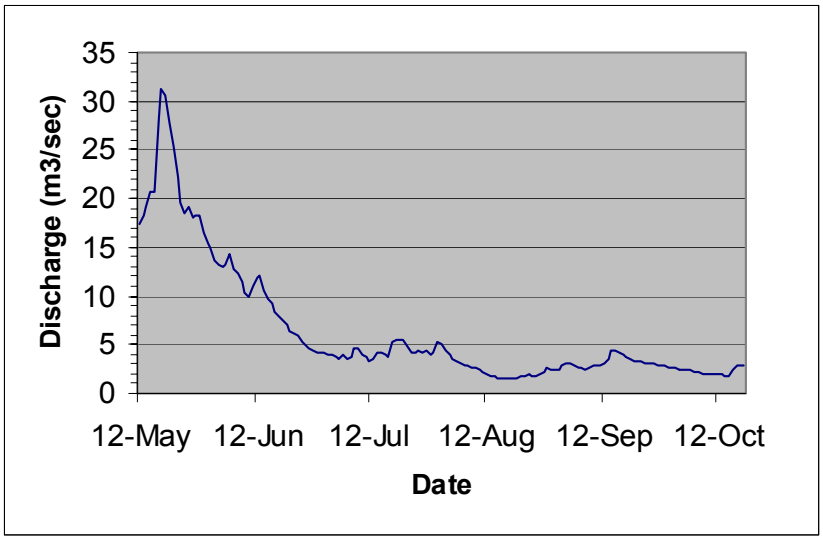

Figure 6. Stream discharge in Blind Creek, 2005

DISCUSSION

The total number of chinook salmon through the Blind Creek weir this year was the second lowest count recorded since weir operations began in 1995[3] and 37% below the average weir passage of 833 chinook. This was lower than expected based on border escapement estimates this year, which were slightly above (1%) the 1995-2004 average (JTC, 2006). The reasons for the low return to Blind Creek this year are not certain, but it is possible that returns in the primary brood year producing 5-year-old fish were low[4]. There is no data available from weir operations in 2000 to validate this, however, the number of chinook returning to spawning grounds in the Upper Yukon River in 2000 was well below average, despite predictions of average to above average runs. It has been speculated that changes in ocean temperature regimes which occurred in 1998 affected the ocean ecosystem and hence the marine survival of salmon.

It is unlikely that many chinook, if any, would have been missed at the start of the run. During the previous two years of weir operation (2003-2004), chinook were generally not observed behind the weir until July 17 (Wilson, 2004,2005). Chinook normally pool below the weir for a period of time before moving through, and frequently break the surface. It was difficult to see if there were fish in the creek at the beginning of the season due to turbid water conditions, however, there were no fish observed breaking the surface below the weir until July 19, the day before the first fish moved through the counting chamber.

[3] Weir counts in 1996 and 2000 were not reported and the weir was not operated in 2001 and 2002. Later installation dates in 1997, 1998 and 1999 may have resulted in early run fish being missed (Appendix 5).
[4] Yukon River chinook return primarily as age-5 and age-6 and occasionally as age-4 and age-7.

Tissue samples for genetic stock identification have been collected from Blind Creek chinook since 2003 during weir operations. The number of samples collected this year brings the total collected to date to 200. This is the baseline sample size goal for distinct chinook salmon stocks in the Yukon River drainage and completes the sampling program for the Blind Creek chinook stock. These samples, along with others currently being collected in the Pelly River sub-basin will enable managers to identify Pelly River stocks in mixed stock fisheries.

The weir operation continued to be visited by a number of tourists as well as local people this year. Weir operators reported at least 130 visitors to the weir site over the course of operations, many of whom were directed to the weir by staff at the Town of Faro Interpretive Centre. Due to the interest shown in this operation in past years, a request was made by staff at the Interpretive Centre for information about the weir operation that could be distributed to visitors of the center. A salmon brochure shown in attachment to this report was produced for the interpretive center in 2005 and contains information about the salmon resource and weir operation.

ACKNOWLEDGMENTS

The author would like to thank the following individuals for their contribution to this project: Jan MacKenzie for producing the salmon brochure for the Town of Faro Interpretive Centre and also providing on-site supervision during initial weir operations; Sue Moodie for providing supervision for the remainder of weir operations; Ryan Berg for assisting in weir operations and Jeff Salo, a student from the Town of Faro, for assisting with weir operations and providing information to visitors. Thanks also to Brian Mercer for his assistance in constructing the weir and setting up the camp.

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Appendix 1. Blind Creek Weir Chinook Salmon Counts, 2005.

DATE	Daily Count	# Sampled	Cumulative
15-Jul	0	0	0
16-Jul	0	0	0
17-Jul	0	0	0
18-Jul	0	0	0
19-Jul	0	0	0
20-Jul	1	0	1
21-Jul	0	0	1
22-Jul	1	1	2
23-Jul	0	0	2
24-Jul	0	0	2
25-Jul	0	0	2
26-Jul	2	0	4
27-Jul	10	2	14
28-Jul	8	3	22
29-Jul	13	8	35
30-Jul	105	0	140
31-Jul	18	3	158
1-Aug	15	5	173
2-Aug	15	12	188
3-Aug	35	13	223
4-Aug	45	22	268
5-Aug	46	17	314
6-Aug	53	22	367
7-Aug	54	21	421
8-Aug	31	6	452
9-Aug	18	9	470
10-Aug	15	4	485
11-Aug	14	5	499
12-Aug	11	4	510
13-Aug	7	1	517
14-Aug	3	1	520
15-Aug	5	2	525
TOTAL:	525	161	

Appendix 2. Chinook salmon sampling data, Blind Creek weir, 2005

DATE	FISH #	SEX	FORK LENGTH (mm)	DATE	FISH #	SEX	FORK LENGTH (mm)	DATE	FISH #	SEX	FORK LENGTH (mm)
Jul-22	1	M	660	Aug-4	58	M	840	Aug-7	115	M	710
Jul-27	2	M	900		59	M	910		116	M	680
	3	M	930		60	M	610		117	F	930
	4	F	770		61	F	790		118	M	940
	5	M	550		62	F	810		119	M	830
	6	F	810		63	M	970		120	F	790
Jul-29	7	F	730		64	M	780		121	F	880
	8	F	800		65	F	870		122	M	750
	9	F	980		66	F	830		123	F	870
	10	F	730		67	M	770		124	F	860
	11	M	810		68	M	820		125	F	800
	12	M	870		69	M	440		126	M	780
	13	F	770	Aug-5	70	M	610		127	M	580
	14	F	790		71	M	600		128	M	840
Jul-31	15	M	770		72	M	780	Aug-8	129	M	850
	16	M	840		73	M	850		130	M	840
	17	F	870		74	M	590		131	F	920
Aug-1	18	F	770		75	M	600		132	M	1050
	19	M	580		76	M	770		133	F	910
	20	F	820		77	F	800		134	F	860
	21	M	780		78	F	900	Aug-9	135	M	560
	22	M	540		79	F	830		136	M	690
Aug-2	23	M	510		80	F	790		137	M	790
	24	M	800		81	M	570		138	F	790
	25	F	800		82	F	780		139	M	780
	26	F	760		83	M	750		140	F	1010
	27	M	500		84	M	790		141	M	890
	28	M	820		85	F	790		142	F	850
	29	M	540		86	F	800		143	F	850
	30	F	710	Aug-6	87	M	610		144	M	760
	31	F	750		88	F	810	Aug-10	145	M	810
	32	F	750		89	F	840		146	F	810
	33	M	810		90	M	860		147	F	840
	34	M	720		91	M	820		148	M	720
Aug-3	35	M	810		92	M	570	Aug-11	149	F	780
	36	F	820		93	F	870		150	M	790
	37	F	820		94	F	910		151	F	910
	38	M	800		95	M	820		152	M	910
	39	F	770		96	F	900		153	M	610
	40	F	740		97	F	850	Aug-12	154	F	1020
	41	F	840		98	F	840		155	F	810
	42	M	640		99	F	850		156	M	780
	43	F	850		100	M	880		157	F	820
	44	F	900		101	F	830	Aug-13	158	F	800
	45	M	790		102	M	890	Aug-14	159	F	780
	46	F	920		103	F	870	Aug-15	160	F	710
	47	M	890		104	F	810		161	F	750
Aug-4	48	M	790		105	M	780				
	49	F	810		106	F	840				
	50	M	800		107	F	810				
	51	M	790	Aug-7	108	M	930				
	52	M	840		109	M	940				
	53	F	810		110	F	900				
	54	M	1020		111	F	810				
	55	M	810		112	F	860				
	56	M	720		113	M	750				
	57	F	820		114	M	640				

Appendix 3. Blind Creek Weather and Water Conditions, 2005

DATE	TIME	AIR TEMP (°C)	WATER TEMP (°C)	WATER LEVEL (cm)	WATER CLARITY	WEATHER
July 15	10:00 am		12	67	Murky	Cloud with sunny periods
July 16	8:00 am	12	11	65	Murky	Mostly sunny, hot
July 17	9:30 am	12	12	64	Murky	Rain most of day
July 18	9:00 am	11	11	73	Murky	Rain overnight/skies clearing by afternoon
July 19	9:20 am	15	12	79	Murky	light rain in a.m./sunny & hot in afternoon
July 20	8:15 am	11	12	78	Murky	Rain overnight, sunny periods during day
July 21	8:00 am	10	11	78	Murky	Rained all night, cool night /sunny during day
July 22	8:30 am	11	10	75	Murky	Clear cool night, sunny am
July 23	8:15 am	10	9	71	Murky	Mostly sunny with periodic rain/wind squalls
July 24	8:15 am	9	10	70	Better visibility	Mostly cloudy – clearing towards evening
July 25	1:30 pm	20	11	72		Cloudy with showers in a.m./sunny,hot p.m.
July 26	9:00 am	11	11	71		Partial cloud, scattered showers
July 27	8:00 am	10	10	71		Partial cloud, scattered showers
July 28	8:00 am	11	11	70	Water clearer	Rained all night and all day
July 29	8:05 am	11	11	71	Slightly Turbid	Rained all night, clear morning
July 30	7:45 am	10	11	76		Rain all night and most of the day
July 31	8:15 am	10	10	76	Turbid	Skies clearing in afternoon
Aug. 1	8:30 am	10	9	73	Moderately turbid	Cool night, clear skies
Aug. 2	8:00 am	10	10	70	Visible	Clear skies
Aug. 3	8:15 am	10	10	68	Slightly Turbid	Clear skies
Aug. 4	8:30 am	12	10	66	Slightly turbid	Scattered rain and cloud
Aug. 5	8:15 am	11	10	65	Less Turbid	Partial cloud with scattered rain showers
Aug. 6	8:30 am	11	11	64	Clear	Cloudy, hail and heavy rain storms
Aug. 7	8:15 am	11	11	64	Clear	Overcast, light rain
Aug. 8	8:15 am	11	11	63	Clear	Cloudy
Aug. 9	8:00 am	7	10	61.5	Clear	Clear skies
Aug. 10	8:15 am	10	10	59	Clear	Clear skies
Aug. 11	8:15 am	11	11	59	Clear	Clear skies
Aug. 12	8:15 am	10	11	58	Clear	Mostly sunny, smoke haze
Aug. 13	8:15 am	10	12	57	Clear	Mostly sunny and hot, smoke haze
Aug. 14	8:15 am	8	10	56	Clear	Mostly sunny and hot, smoke haze
Aug. 15	8:15 am	14	11	56	Clear	Strong winds overnight, mostly sunny
Aug. 16	8:15 am	11	12	55	Clear	Rain overnight, clearing during day

Appendix 4. Mean, Maximum and Minimum discharge in CMS for July and August, Blind Creek, 1992-2005.

	JULY Daily Discharge (m^3/sec)					**AUGUST** Daily Discharge(m^3/sec)				
	Mean	Max.	Max. Day	Min.	Min. Day	Mean	Max.	Max. Day	Min.	Min. Day
1992	9.87	13.06	14/07	6.59	31/07	4.47	6.24	01/08	3.30	27/08
1993	8.93	12.0	11/07	7.41	30/07	7.41	9.18	12/08	6.55	30/08
1994	3.92	5.50	01/07	2.52	27/07	1.48	2.61	01/08	0.94	21/08
1995	4.71	8.09	06/07	2.60	01/07	4.91	5.79	29/08	3.88	15/08
1996	4.80	8.87	12/07	2.67	31/07	3.92	7.62	30/08	2.24	03/08
1997*	4.96	9.66	25/07	2.53	04/07	9.11	10.3	01/08	7.71	03/08
1998	-	-	-	-	-	-	-	-	-	-
1999	4.49	12.5	02/07	2.12	25/07	2.25	3.20	01/08	1.93	27/08
2000	-	-	-	-	-	-	-	-	-	-
2001	8.49	16.2	17/07	5.20	31/07	3.33	5.00	01/08	2.28	18/08
2002	2.85	4.95	06/07	2.25	28/07	2.71	5.81	30/08	1.82	11/08
2003	5.25	14.6	07/07	3.26	29/07	2.49	4.27	01/08	1.37	21/08
2004	3.41	4.57	01/07	3.02	17/07	2.51	3.41	01/08	2.28	26/08
2005	4.28	5.57	19/07	3.23	12/07	2.31	4.48	01/08	1.47	18/08

* no data available for period from July 14 to July 24 and after August 3
note: 1998 and 2000 data not available

Appendix 5. Chinook Counts and Weir Operation Dates, Blind Creek, 1989, 1990, 1995-2005.

YEAR	METHOD	CHINOOK COUNTS	WEIR IN	WEIR OUT
1989	Aerial survey [a]	400	August 7	August 7
1990	Aerial survey [a]	443	August 14	August 14
1995	Weir	826	NR	NR
1996	Aerial survey [a]	422	August ?	August ?
1996	Weir	NR	July 28	August 17
1997	Weir	957	July 24	August 22
1998	Weir	373	July 19	August 19
1999	Weir	892	July 28	August 22
2000	Weir	NR	NR	NR
2001	Aerial survey [b]	226	August 21	August 21
2002	Aerial survey [b]	107	August 15	August 15
2003	Weir	1,155	July 16	August 18
2004	Weir	792	July 11	August 15
2005	Weir	525	July 15	August 15

[a] aerial survey conducted by P.A. Harder and Associates Ltd (Harder, 1996)
[b] aerial survey conducted by RRDC and Jane Wilson & Associates (Wilson, 2001,2002)
NR - not reported