

BLIND CREEK CHINOOK SALMON ENUMERATION WEIR, 2013

CRE-37-13

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Restoration and Enhancement Fund

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ABSTRACT

A weir was operated in Blind Creek in 2013 to enumerate the Chinook salmon (*Onchorynchus tshawytscha*) escapement and obtain biological information from the stock. This was the 11th year a weir has been operated in Blind Creek with funding by the Yukon River Panel, Restoration & Enhancement Fund. Camp set up and weir construction was initiated on July 19. The weir was located in the same general area used for the past 10 years, approximately 1 km upstream of the confluence with the Pelly River. Operation of the weir began on July 24 and continued through to August 19. The first fish passed through the counting chamber on July 29 which was similar timing to previous late run years in Blind Creek. A total of 312 Chinook salmon was counted in 2013 which was 60% of the 10 year average escapement of 523 into Blind Creek. The midpoint of the run occurred on August 9 and 90% of the run had passed through the weir by August 14. Migrating Chinook were sampled randomly throughout the period of weir operation to obtain information on the age-sex-length structure of the run. A total of 149 Chinook salmon (48% of the run) was live sampled. Of these, 89 (60%) were female and 60 (40%) were male. The mean mid-eye fork (MEF) length of females and males sampled was 806.4 mm and 714.1 mm, respectively. The DFO scale lab determined ages from 99 Chinook sampled. Age-6 (67%) was the dominant age class, followed by age-5 fish (19%). Age-4 and age-7 fish represented 6% and 8% of the sample, respectively.

INTRODUCTION

Blind Creek is a tributary of the Pelly River in the upper Yukon River drainage supporting a significant Chinook salmon population. The creek flows for about 45 km from headwater lakes located in the Anvil Range and empties into the Pelly River near the town of Faro. Chinook escapements in Blind Creek have been monitored periodically between 1989 and 2000 through aerial surveys or enumeration weir operations and annually since 2003 through weir operations. The previous 10 year average run size is 523 with annual returns ranging from 270 (2010) to 1,155 (2003). Aerial survey results have shown that Chinook salmon spawning occurs throughout the lower 40 km of the creek with highest concentrations found between 12 and 35 km upstream (Harder 1996; Wilson 2001, 2002).

Chinook salmon escapement data from Blind Creek along with data obtained from other Chinook stock assessment projects in the Yukon River drainage provides managers with information that can be used to forecast subsequent pre-season run size and recruitment in the Yukon River and implement management strategies for conserving Chinook populations. The Blind Creek weir is currently one of three Chinook assessment projects¹ in the upper Yukon River providing spawning ground escapement data for this purpose.

Chinook salmon at the weir have been live sampled for age, sex and length (ASL) data during operations since 2003. Sampling is conducted over the entire run and randomly each day to obtain a representative sample of the escapement. This information provides important biological baseline data on the health of the stock as well as information used by fishery managers to construct sibling based pre-season run forecasts. ASL data collected over a number of years can also be used to support investigations into basin-wide trends in the composition of Chinook stocks. In addition, Chinook size and age data from 2011 and subsequent years will assist fisheries managers in determining the effectiveness of the gillnet mesh size restrictions in Alaska implemented in 2011 to allow more of the larger and older fish to reach spawning grounds.

The proximity of the weir operation to the town of Faro and road access has allowed for public viewing of the weir operation and an opportunity to increase awareness of Yukon River salmon 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 (Blind Creek Road). On average, about 80 different people visit the weir annually including tourists to the Faro area as well as local people. As a consequence, a great deal of interest has been shown in the returning Chinook salmon and the enumeration project.

A proposal to continue weir operations in Blind Creek was submitted by J. Wilson and Associates to the Yukon River Panel Restoration and Enhancement (R&E) fund in January 2013. The proposal was accepted and financial support was received from the R&E fund. This report is a summary of the 2013 project. This was the eleventh consecutive year a weir has been

¹ The other two assessment projects are the Teslin River Sonar and Big Salmon River Sonar enumeration projects (R&E Fund projects: CRE-01N and CRE-41).

operated in Blind Creek with funding by the Yukon River Panel, Restoration & Enhancement Fund.

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 (Figure 1). The creek and its tributaries drain an area of approximately 618 km². 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 (lower bridge) and 3 km (upper bridge) upstream of its confluence with the Pelly River. The weir site is located approximately 1 km upstream of the creek mouth and 30 m downstream of the lower bridge crossing.

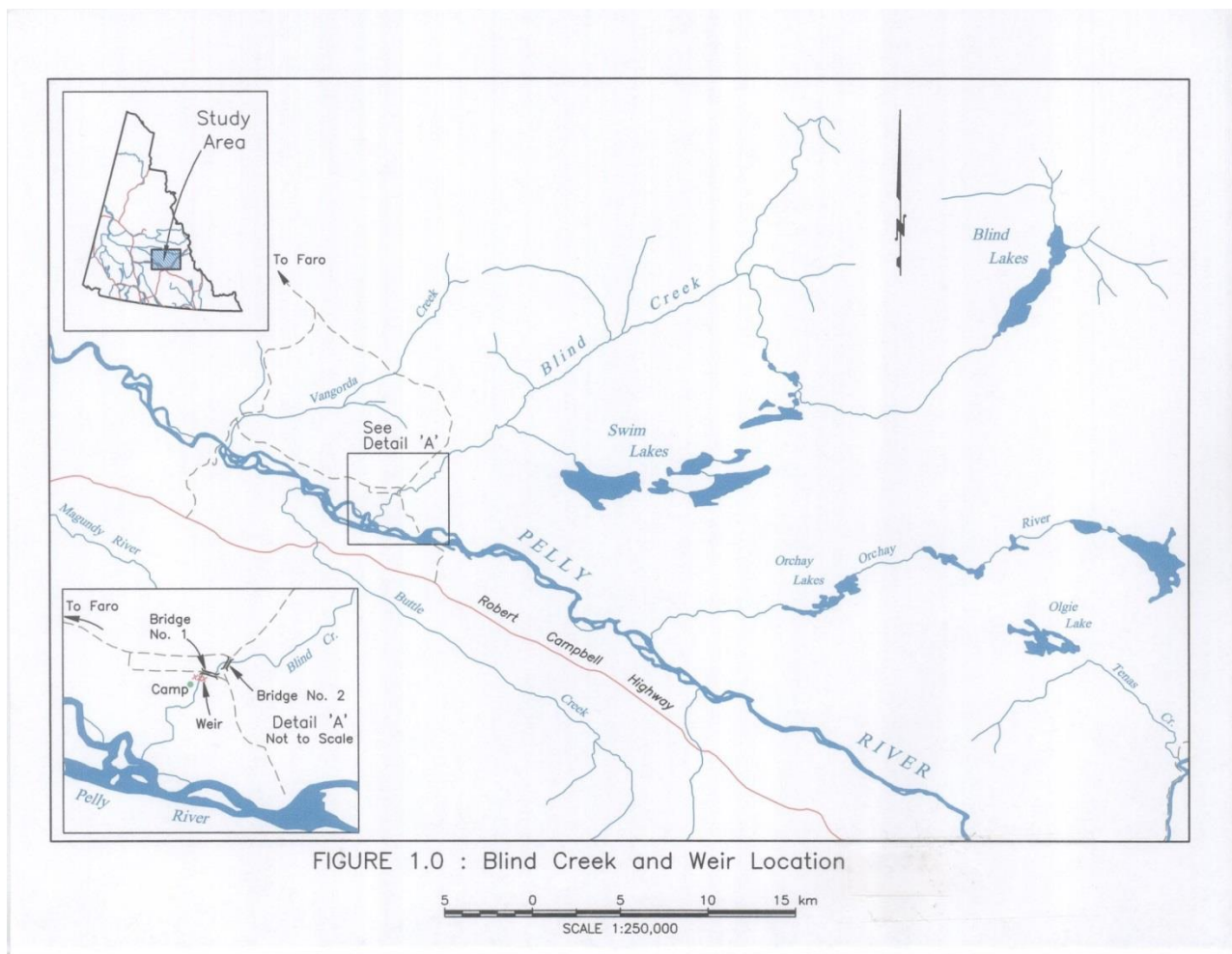


Figure 1. Blind Creek and Weir Location

OBJECTIVES

The specific objectives of this project are as follows:

- 1) Install and operate a weir to obtain a count of the total 2013 Chinook escapement in Blind Creek above the weir;
- 2) Conduct live sampling at the weir to obtain age-sex-length (ASL) data from a representative sample of migrating Chinook with a minimum goal of 25% of the run;
- 3) Provide information about the Chinook weir operation to the Town of Faro Interpretive Centre and on-site interpretation to increase public awareness of the salmon resource and management programs.

METHODS

Camp Set-up

Transportation of staff and supplies from Whitehorse to the site was by truck on July 19. Although the initial plan was to depart on July 16, forest fires in the vicinity of the Robert Campbell Highway resulted in road closures at that time. Due to the uncertainty of access it was decided to take the longer route via the South Canol Road. Materials for the camp were transported to the site from storage in Faro on July 19 and 20.

As in previous years, the camp was set up on the west side of Blind Creek approximately 80 metres from the weir site and comprised of three wall tents: one to house a kitchen/eating area and two for sleeping quarters.

Weir Construction

Weir construction was started on July 21 and completed (fish tight) by July 24. The weir was positioned in the creek approximately 5 meters upstream of the site that has been used since 2003. This was done to avoid an area of undercutting along the west bank at the previous site which had become progressively worse over the years. The removal of the Environment Yukon stilling well (previously used for hydrological measurements) in early July by staff from Environment Yukon in Whitehorse enabled placement of the weir upstream where bank conditions were more stable. With the use of new meters and data loggers, the stilling well was no longer needed for collecting hydrological data (Kolot, personal communication).

Weir materials stored on site from previous operations were used in construction. Construction of the weir began with the placement of the counting chamber in the main current and at the upstream apex of the fence location. This chamber consisted of conduit panels connected together to form an enclosure measuring 2m (L) X 0.7 m (W) X 1.0 m (H). Two triangular shaped conduit panels, each 2 metres long, were used to connect the chamber to the fence and create a staging area for fish moving into the chamber. The fence was constructed of conduit panels and tripods placed downstream of the counting chamber in a 'V' configuration to direct fish moving close to the bank towards the staging area (Figure 2).

Before the fence was completely constructed, however, a large log had drifted downstream and lodged against the weir overnight. Unfortunately, this resulted in some displacement of the partial fence and chamber and the weir having to be readjusted. Extreme freshet conditions in the spring of 2013 resulted in bank erosion which left a considerable amount of debris in the stream (Figure 3).



Figure 2. Weir structure looking from west bank.



Figure 3. Washout below upper bridge on Blind Creek road due to spring floods.

After the fence was completed, 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 (Figure 4). Black poly was

secured over the staging area to prevent fish moving in from seeing weir attendants on the platform.



Figure 4. View of counting chamber and sampling station looking from the west bank.

Weir Operation

Personnel were on site 24 hours a day for the duration of the Chinook run. Commencing July 24, the weir was monitored daily from first light until dark and kept closed at night. Daily and cumulative counts were recorded and relayed three times per week by phone to DFO Whitehorse Stock Assessment.

Chinook moving up behind the weir were allowed access to the counting chamber by raising a vertical gate secured to the downstream opening. After a few Chinook moved into the chamber the gate was closed and the fish immediately sampled. Only a small number of fish (<10) were held at any one time. In the instance where Chinook were observed accumulating behind the weir, a few were allowed to pass through the chamber without being sampled to avoid delaying the run. This was achieved by removing two or three pieces of loose conduit from the front panel. After a few fish were counted through the chamber, the conduit pieces were replaced and the next fish moving in held for sampling.

Sampling events were attempted each day and, when possible, at various times throughout the day to obtain a representative sample of the daily run. Chinook held for sampling were removed from the counting chamber by dip net and placed in a v-shaped trough filled with water (Figure 5). The sex, mid-eye fork length (MEF) and general condition of fish (rated: good, fair or poor) was recorded. Five scales were taken from each fish and placed on standard scale cards for age determination. Scale cards and an electronic copy of ASL data were submitted to DFO, Whitehorse at the completion of field operations. Scales were analyzed for age by the DFO scale analysis lab at the Pacific Biological Station, Nanaimo, B.C.

On August 12, the water became extremely muddy/silty making it impossible to see fish in the counting chamber. The source of this influx of silt was unknown but may have originated from the clay banks which abut the creek in the upper drainage. These conditions lasted for several days. At this time it was possible to detect fish moving into the pen by the vibration of the conduit when fish hit the upstream end panel. When this occurred the gate was closed and all fish were removed by dip net and either released upstream or sampled.

The weir was checked at least twice a day for scouring and areas of possible escape and several times throughout the day during higher water. Debris collecting on the weir was removed as required.



Figure 5. Chinook salmon sampling.

Physical Measurements

Water and air temperatures were taken each morning at the weir using a hand-held thermometer. Water depth readings were taken at the same time from the Yukon Department of Environment staff gauge located about 25 m downstream of the lower bridge along the west bank.

Environment Yukon (Water Resources Branch) monitored stream flows and water temperatures in Blind Creek between May and September, 2013. Hydrological conditions in Blind Creek have been monitored by Environment Yukon since 1992 (Appendix 7).

Public Awareness

Copies of the salmon brochure produced in 2005 by the proponent were provided to the Town of Faro Interpretive Centre at the start of the project. This brochure contains information about the salmon resource and weir operation for visitors to the Faro area. On-site interpretation was

provided by the proponent and field technicians. A daily record of the number of visitors viewing the weir operation was maintained.

RESULTS

Chinook Counts

A total of 312 Chinook salmon was counted through the weir between July 24 and August 19. Daily and cumulative counts are presented in Appendix 1. The first Chinook passed through the counting chamber on July 29, approximately five days later than the previous 10 year average arrival date. Fifty percent of the run had passed through the weir by August 9 and 90% by August 14.

Biological Sampling

A total of 149 Chinook salmon (48% of the run) was live sampled for age-sex-length data (see sampling data, Appendix 2). Of these, 89 (60%) were female and 69 (40%) were male. The mean fork length of females and males sampled was 806.4 mm and 714.1 mm, respectively. The length frequency of female and male Chinook sampled is presented in Figure 6. Complete age data was determined from 99 of the Chinook sampled². Age 6 (1.4, 2.3)³ was the dominant age class at 66.6% followed by age 5 (1.3) at 19.2%. Age 4 (1.2) fish represented 6.1% and age 7 (2.4), 8.1%. Mean length at age data for male and female Chinook sampled is presented in Table 1.

Table 1. Mean length at age of Chinook sampled from Blind Creek, 2013.

SEX	AGE*	Brood Year	Mean MEF (mm)	Count of Sex	%
Female	1.3	2008	772	5	5.1
	1.4	2007	802	47	47.5
	1.5	2006	925	1	1.0
	2.3	2007	783	2	2.0
	2.4	2006	845	6	6.1
F Total			805	61	61.6
Male	1.2	2009	524	6	6.1
	1.3	2008	714	14	14.1
	1.4	2007	775	16	16.2
	2.3	2007	705	1	1.0
	2.4	2006	750	1	1.0
M Total			710	38	38.4
Grand Total			769	99	100.0

*European age format

² Partial ages were determined for 43 fish sampled; no age could be determined for 7 of the sampled fish

³ European age format, e.g. 1.4 denotes a 6 year old fish with 1+ years freshwater residence and 4 years marine.

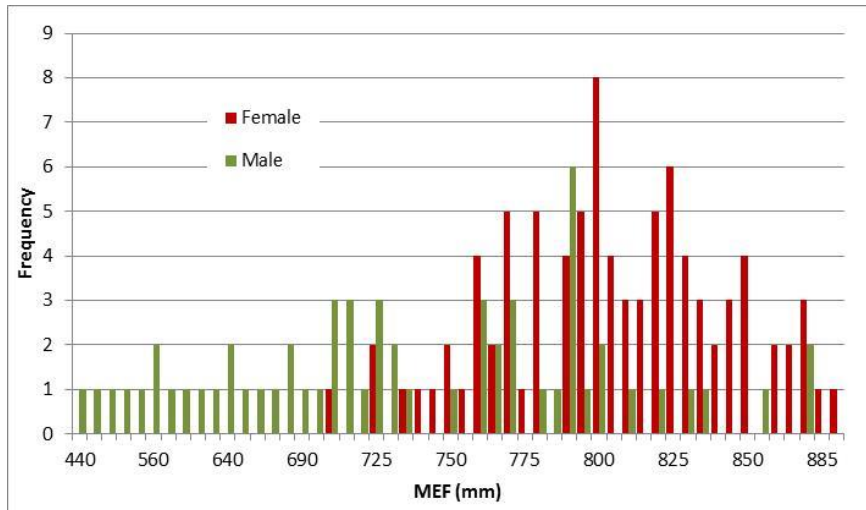


Figure 6. Length frequency of female and male Chinook sampled in 2013.

Physical Measurements

Water levels were moderate throughout most of the weir operation. Extreme freshet conditions resulted in the washout of a section of the Blind Creek road below the upper bridge and considerable amounts of in-stream debris (Figure 3). Daily weather and water conditions recorded by weir attendants in July and August are presented in Appendix 8. Stream discharge data was not available at the time of writing.

A data logger deployed by Environment Yukon (Water Resources Branch) in Blind Creek recorded water temperatures every 15 minutes between May 14 and September 20. Raw data obtained from Environment Yukon showed that a maximum water temperature of 14.9°C was reached on August 12. Mean water temperatures in July and August were 11.1° C and 11.0° C, respectively.

Public Awareness

At least 48 people visited the weir site over the course of operations this year including local people and tourists visiting the Faro area.

DISCUSSION

The 2013 project was successful at obtaining a total count of the Chinook escapement above the weir in Blind Creek. Despite some delay in weir installation, it is unlikely that any fish arrived in the creek before it was in place based on assessments in the lower Yukon River which indicated a late run. Chinook were not observed behind the weir until July 28 which was similar timing to previous late run years in Blind Creek (Appendix 5). The weir functioned well and remained ‘fish tight’ throughout its operation.

The low escapement in 2013 follows a trend of low returns observed in Blind Creek in recent years. The total run size (312) was 60% of the 10 year average escapement of 523. Below average Chinook returns were also observed in the Big Salmon River (Mercer & Wilson 2014) and near the Canada/U.S. border at the Eagle sonar station (DFO Whitehorse unpublished data 2013).

During the early part of the run, Chinook moved up behind the weir in small groups and tended to move into the counting chamber relatively quickly. At the peak of the run, however, larger groups were observed holding behind the weir in a pool downstream of the weir and a number of the fish that were captured for sampling were ripe females which was evident by the softness of the ventral area and easy expulsion of some eggs. To avoid delaying the run, a few of the fish were counted through the counting chamber without being sampled.

The random sample of the 2013 Blind Creek run was comprised of a considerable number of large healthy females. The proportion of females (60%) was higher than the average (47%) observed in the past 10 years at Blind Creek (Appendix 3). Of the females for which ages were determined, 80% were age-6 fish. As a result, there may be good production from this year's escapement despite the low return.

This year weir technicians again assisted DFO personnel in the collection of Chinook eggs from fish captured at the weir for use in incubation programs in the Ross River School and Del van Gorder School in Faro. The weir project has provided a means for collecting broodstock and conducting egg takes for classroom incubation programs in local schools under DFO's 'Stream to Sea' aquatic education program. Fry produced from this program are released back to Blind Creek. This is an ongoing program designed to educate students on Yukon River salmon and salmon habitat and foster an environmental stewardship ethic.

ACKNOWLEDGEMENTS

The author would like to thank Brad Wilson, Emily Ross and John Ollie for their assistance in weir operations. Michael Miron provided assistance installing the weir. Jonathan Kolot of Environment Yukon, Water Resources Branch, provided water temperature data for this report.

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Personal Communication:

Jonathan Kolot, Environment Yukon, Water Resources Branch, Whitehorse, Yukon.

Appendix 1. Blind Creek weir Chinook salmon counts, 2013.

DATE	Daily Count	Cumulative	# Sampled	#Females sampled	#Males sampled	Comments
24-Jul	0	0	0	0	0	weir fish tight
25-Jul	0	0	0	0	0	
26-Jul	0	0	0	0	0	
27-Jul	0	0	0	0	0	
28-Jul	0	0	0	0	0	1 Chinook seen below weir
29-Jul	1	1	0	0	0	First fish through weir
30-Jul	0	1	0	0	0	
31-Jul	2	3	1	1	0	
1-Aug	0	3	0	0	0	
2-Aug	2	5	2	1	1	
3-Aug	6	11	3	0	3	
4-Aug	19	30	11	5	6	
5-Aug	35	65	15	9	6	
6-Aug	28	93	7	3	4	
7-Aug	48	141	17	10	7	
8-Aug	4	145	2	1	1	
9-Aug	25	170	25	14	11	
10-Aug	36	206	16	10	6	
11-Aug	52	258	17	13	4	
12-Aug	12	270	8	4	4	muddy water conditions
13-Aug	5	275	1	0	1	
14-Aug	19	294	12	11	1	
15-Aug	7	301	7	3	4	
16-Aug	6	307	2	2	0	
17-Aug	5	312	3	2	1	
18-Aug	0	312	0	0	0	
19-Aug	0	312	0	0	0	weir removed
TOTAL:	312		149	89	60	

Appendix 2. Blind Creek Chinook salmon live sampling results, 2013.

DATE	FISH #	SEX	MEF (mm)	AGE*	Condition (Good/Fair/Poor)	comments
31-Jul	1	F	835	1.4	G	
2-Aug	2	M	700	1.3	G	
2-Aug	3	F	795	1.4	G	
3-Aug	4	M	725	1.4	G	Gillnet mark
3-Aug	5	M	705	M3	F	
3-Aug	6	M	705	1.3	G	
4-Aug	7	M	760	1.3	G	
4-Aug	8	M	765	1.3	G	
4-Aug	9	M	880	1F	G	
4-Aug	10	F	835	2.4	G	
4-Aug	11	M	680	1.3	F	Gillnet mark, some fungus
4-Aug	12	F	815	1.4	G	Gillnet mark
4-Aug	13	F	760	1.4	G	
4-Aug	14	M	820	M4	G	
4-Aug	15	M	705	2.3	G	
4-Aug	16	F	835	1.4	G	Gillnet mark
4-Aug	17	F	800	M4	G	Ripe
5-Aug	18	M	790	RS	G	
5-Aug	19	F	780	1.4	G	
5-Aug	20	M	690	1.3	G	
5-Aug	21	F	790	M4	G	Gillnet mark
5-Aug	22	M	785	1.4	G	
5-Aug	23	F	805	1.3	G	
5-Aug	24	F	790	1.4	G	
5-Aug	25	M	730	1.3	G	
5-Aug	26	M	665	RG	G	
5-Aug	27	F	820	M4	G	
5-Aug	28	M	695	1.3	G	
5-Aug	29	F	825	2.4	G	
5-Aug	30	F	820	1.3	G	
5-Aug	31	F	850	1.4	G	
5-Aug	32	F	880	M4	G	
6-Aug	33	M	560	1.2	G	
6-Aug	34	M	730	M3	G	
6-Aug	35	M	790	1.3	G	
6-Aug	36	M	830	M3	G	
6-Aug	37	F	745	1.3	G	Gillnet mark
6-Aug	38	F	790	1.4	G	
6-Aug	39	F	750	1.4	G	Ripe
7-Aug	40	M	725	1.4	G	
7-Aug	41	F	805	1.4	G	
7-Aug	42	F	765	1.4	G	Ripe
7-Aug	43	F	830	1.4	G	Ripe
7-Aug	44	M	790	1.4	G	
7-Aug	45	M	800	1.4	G	
7-Aug	46	M	790	1.4	G	
7-Aug	47	F	760	1.4	G	Ripe
7-Aug	48	F	865	1.4	G	Ripe
7-Aug	49	F	875	2.4	G	Ripe

DATE	FISH #	SEX	MEF (mm)	AGE	Condition (Good/Fair/Poor)	comments
7-Aug	50	M	810	M4	G	
7-Aug	51	F	800	1.4	G	Ripe
7-Aug	52	F	795	2.3	G	
7-Aug	53	M	510	1.2	G	
7-Aug	54	M	635	1.4	P	sway-back, Gillnet mark
7-Aug	55	F	795	1.4	G	
7-Aug	56	F	880	M4	G	Ripe
8-Aug	57	F	800	1.4	G	
8-Aug	58	M	555	1.2	G	
9-Aug	59	M	585	M2	G	
9-Aug	60	F	700	1.4	G	
9-Aug	61	M	770	1.4	G	
9-Aug	62	M	515	1.2	G	
9-Aug	63	F	805	M4	G	
9-Aug	64	M	680	M3	G	
9-Aug	65	M	770	1.4	G	
9-Aug	66	F	770	2.3	G	
9-Aug	67	F	795	1.4	G	
9-Aug	68	M	560	1.2	G	
9-Aug	69	F	845	M4	G	Ripe
9-Aug	70	M	640	M3	G	
9-Aug	71	F	840	1.4	G	
9-Aug	72	F	825	1.4	G	
9-Aug	73	F	800	1.4	G	
9-Aug	74	F	760	1.4	G	
9-Aug	75	F	825	1.4	G	Ripe
9-Aug	76	M	700	RG	G	
9-Aug	77	F	820	M4	G	Ripe
9-Aug	78	M	765	1.4	G	
9-Aug	79	M	790	M4	G	
9-Aug	80	F	820	1.4	G	Ripe
9-Aug	81	F	830	M4	G	Ripe
9-Aug	82	M	795	1.4	G	
9-Aug	83	F	800	1.4	G	Ripe
10-Aug	84	F	840	1.4	G	Ripe
10-Aug	85	F	800	M4	G	
10-Aug	86	F	875	1.4	G	
10-Aug	87	M	710	1.3	G	
10-Aug	88	M	880	1.4	G	
10-Aug	89	F	750	M3	G	
10-Aug	90	F	885	M4	G	
10-Aug	91	M	860	1.4	G	
10-Aug	92	F	780	1.4	G	
10-Aug	93	F	805	1.4	G	Ripe
10-Aug	94	F	850	1.4	G	
10-Aug	95	F	850	1.4	G	
10-Aug	96	F	795	M4	G	
10-Aug	97	M	640	M3	G	
10-Aug	98	M	750	2.4	G	
10-Aug	99	M	615	1.3	G	
11-Aug	100	M	735	1.4	G	

DATE	FISH #	SEX	MEF (mm)	AGE	Condition (Good/Fair/Poor)	comments
11-Aug	101	F	845	M4	G	
11-Aug	102	F	830	M4	G	Ripe
11-Aug	103	F	780	1.4	G	
11-Aug	104	M	800	M4	G	
11-Aug	105	F	865	1.4	G	one eye missing
11-Aug	106	F	820	1.4	G	
11-Aug	107	F	780	1.4	G	
11-Aug	108	F	810	1.4	G	
11-Aug	109	F	800	M4	G	
11-Aug	110	F	925	1.5	G	
11-Aug	111	M	780	1.4	G	
11-Aug	112	F	775	M4	G	
11-Aug	113	F	845	2.4	G	
11-Aug	114	M	760	M4	G	
11-Aug	115	F	830	M4	G	
11-Aug	116	F	770	RG	G	
12-Aug	117	F	825	1.4	G	
12-Aug	118	F	770	1.4	G	
12-Aug	119	M	660	1.3	G	
12-Aug	120	M	770	1.3	F	
12-Aug	121	M	790	1.4	G	
12-Aug	122	F	815	1.4	G	
12-Aug	123	M	620	M3	G	
12-Aug	124	F	770	M4	G	
13-Aug	125	M	440	M2	G	
14-Aug	126	M	700	RG	G	
14-Aug	127	F	770	RG	G	
14-Aug	128	F	815	1.4	G	
14-Aug	129	F	790	M5	G	
14-Aug	130	F	825	M4	G	Ripe
14-Aug	131	F	780	1.4	G	Ripe
14-Aug	132	F	880	2.4	G	
14-Aug	133	F	825	M4	G	
14-Aug	134	F	725	1.4	G	
14-Aug	135	F	800	M4	G	Ripe, Gillnet mark
14-Aug	136	F	725	RG	G	
14-Aug	137	F	760	1.4	G	
15-Aug	138	M	675	M3	G	
15-Aug	139	M	835	M4	G	Gillnet mark
15-Aug	140	M	445	1.2	G	
15-Aug	141	F	740	M4	F	
15-Aug	142	F	765	1.4	F	
15-Aug	143	M	760	M4	F	
15-Aug	144	F	735	1.3	G	
16-Aug	145	F	810	1.4	F	Ripe
16-Aug	146	F	810	2.4	G	
17-Aug	147	M	725	1.3	F	
17-Aug	148	F	755	1.3	G	
17-Aug	149	F	850	M3	G	

*European age format **No Ages:** RS = resorbed scale (growth at scale margin is missing), NS = no scale, RG= regenerate scale (center missing from scale). **Partial Ages:** F=freshwater stage M=Marine stage

Appendix 3. Sex composition of Chinook salmon sampled in Blind Creek, 2003-2013.

YEAR	Sample Size	# Females	% of Total	# Males	% of Total
2003	118	54	45.8%	64	54.2%
2004	19	8	42.1%	11	57.9%
2005	161	78	48.4%	83	51.6%
2006	101	41	40.6%	60	59.4%
2007	83	37	44.6%	46	55.4%
2008	191	88	46.1%	103	53.9%
2009	245	106	43.3%	139	56.7%
2010	185	77	41.6%	108	58.4%
2011	203	111	54.7%	92	45.3%
2012	134	65	49.0%	69	51.0%
2013	149	89	59.7%	58	40.3%
Average	144	69	46.9%	76	53.1%

Appendix 4. Percent composition of age class in sampling years 2006 through 2013.

YEAR	SAMPLE SIZE*	% Of TOTAL				
		AGE-3	AGE-4	AGE-5	AGE-6	AGE-7
2006	36	0	71.0	20.0	0	0
2007	61	0	16.0	35.0	46.0	4.0
2008	146	0	10.3	47.9	37.0	4.8
2009	147	4.1	16.3	33.3	44.9	1.4
2010	127	0	8.7	53.5	33.1	4.7
2011	164	0	9.7	26.2	55.8	8.5
2012	105	0	10.5	38.1	46.7	4.8
2013	99	0	6.1	19.2	66.6	8.1

* Number of Chinook sampled for which age was determined.

Appendix 5. Blind Creek Chinook Counts from aerial surveys and weir operations, 1989, 1990, 1995-2013.

YEAR	METHOD	CHINOOK COUNTS	START DATE	ARRIVAL OF FIRST FISH	END DATE	50% of Run	90% of Run
1989	Aerial survey ^a	400	Aug 7		Aug 7		
1990	Aerial survey ^a	443	Aug 14		Aug 14		
1995	Weir	826	NR		NR		
1996	Aerial survey ^a	422	Aug ?		Aug ?		
1996	Weir	NR	July 28		Aug 17		
1997	Weir	957	July 24	July 25	Aug 22	July 30	Aug 8
1998	Weir	373	July 19	July 27	Aug 19	Aug 4	Aug 15
1999	Weir	892	July 28	Aug 1	Aug 22	Aug 6	Aug 10
2000	Weir	NR	NR		NR		
2001	Aerial survey ^b	226	Aug 21		Aug 21		
2002	Aerial survey ^b	107	Aug 15		Aug 15		
2003	Weir	1,155	July 16	July 17	Aug 18	July 29	Aug 5
2004	Weir	792	July 11	July 19	Aug 15	July 30	Aug 5
2005	Weir	525	July 15	July 20	Aug 15	Aug 4	Aug 10
2006	Weir	677	July 16	July 28	Aug 17	Aug 5	Aug 12
2007	Weir	304	July 17	July 24	Aug 17	Aug 6	Aug 12
2008	Weir	276	July 25	July 28	Aug 19	Aug 12	Aug 17
2009	Weir	716	July 20	July 27	Aug 19	Aug 6	Aug 10
2010	Weir	270	July 19	July 28	Aug 19	Aug 11	Aug 16
2011	Weir	360	July 15	July 24	Aug 18	Aug 10	Aug 13
2012	Weir	157	July 25	July 28	Aug 20	Aug 8	Aug 15
2013	Weir	312	July 24	July 29	Aug 19	Aug 9	Aug 14

^a aerial survey conducted by P.A. Harder and Associates Ltd.

^b aerial survey conducted by RRDC and Jane Wilson & Associates

NR - not reported

Note: weir operations in 1997, 1998 and 1999 involved enumeration of Chinook salmon only. Sampling conducted in later years resulted in delays in the normal migration timing.

Appendix 6. Daily and average Chinook salmon counts in Blind Creek, 1997-1999, 2003-2013

DATE	Daily Count 2013	Daily Count 2012	Daily Count 2011	Daily Count 2010	Daily Count 2009	Daily Count 2008	Daily Count 2007	Daily Count 2006	Daily Count 2005	Daily Count 2004	Daily Count 2003	Daily Count 1999	Daily Count 1998	Daily Count 1997	Daily Average
11-Jul										0					0
12-Jul										0					0
13-Jul										0					0
14-Jul										0					0
15-Jul			0						0	0					0
16-Jul			0					0	0	0	0				0
17-Jul			0				0	0	0	0	1				0
18-Jul			0				0	0	0	0	1				0
19-Jul			0	0			0	0	0	1	2		0		0
20-Jul			0	0	0		0	0	1	32	0		0		4
21-Jul			0	0	0		0	0	0	5	2		0		1
22-Jul			0	0	0		0	0	1	2	4		0		1
23-Jul			0	0	0		0	0	0	2	2		0		0
24-Jul	0		3	0	0		1	0	0	140	1		0		15
25-Jul	0	0	0	0	0	0	0	0	0	24	10	0	0	122	11
26-Jul	0	0	1	0	0	0	0	0	2	10	17	0	0	85	8
27-Jul	0	0	1	0	2	0	7	0	10	20	495	0	1	66	43
28-Jul	0	2	2	1	8	1	3	2	8	60	2	0	0	73	12
29-Jul	1	2	5	1	27	1	3	9	13	33	68	0	0	64	16
30-Jul	0	0	4	1	12	2	10	27	105	225	95	0	0	70	39
31-Jul	2	3	1	17	106	1	9	26	18	36	7	0	0	44	19
01-Aug	0	3	11	0	84	4	8	67	15	60	45	15	0	49	26
02-Aug	2	4	7	0	25	1	27	8	15	34	0	65	6	77	19
03-Aug	6	7	6	0	24	6	6	109	35	7	7	133	34	38	30
04-Aug	19	6	11	1	0	3	13	25	45	15	201	50	169	60	44
05-Aug	35	2	7	33	22	5	8	131	46	15	75	116	16	22	38
06-Aug	28	8	13	23	106	11	63	19	53	27	50	73	4	33	37
07-Aug	48	10	7	19	67	17	59	47	54	19	12	25	5	20	29
08-Aug	4	33	35	5	30	26	6	63	31	4	18	129	5	43	31
09-Aug	25	17	30	9	110	18	20	44	18	8	1	128	1	19	32
10-Aug	36	13	86	4	28	11	9	14	15	2	0	139	31	21	29
11-Aug	52	2	45	27	20	15	4	16	14	10	8	1	25	5	17
12-Aug	12	6	31	23	9	19	16	28	11	1	4	0	15	16	14
13-Aug	5	9	29	19	7	27	14	19	7	0	18	0	9	5	12
14-Aug	19	7	6	40	6	20	8	11	3	0	2	0	11	1	10
15-Aug	7	8	13	14	13	26	6	6	5	0	2	0	18	13	9
16-Aug	6	9	1	6	3	23	4	5			5	0	7	8	6
17-Aug	5	4	5	12	4	23		1			0	0	9	3	6
18-Aug	0	2	0	12	3	12					0	14	3		5
19-Aug	0	0		3	0	4						4	4		2
20-Aug		0										0			0
21-Aug												0			0
TOTAL	312	157	360	270	716	276	304	677	525	792	1155	892	373	957	

Note: shaded areas denote start and end date of weir operations

Appendix 7. Mean, Maximum and Minimum discharge in cubic metres per second for July and August, Blind Creek, 1992-2012.

	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	4.56	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
2006	5.92	10.8	11/07	2.76	31/07	3.46	5.08	15/08	2.50	01/08
2007	5.60	10.8	03/07	3.36	27/07	3.03	4.93	08/08	1.43	31/08
2008	12.55	29.2	16/07	6.26	04/07	9.66	31.1	26/08	4.81	17/08
2009 ^a	3.62	6.49	11/07	1.79	31/07	2.24	4.44	27/08	0.81	07/08
2010	-	-	-	-	-	-	-	-	-	-
2011 ^b	-	-	-	-	-	-	-	-	-	-
2012	14.00	34.4	03/07	7.72	31/07	7.41	12.6	11/08	5.92	08/08

* no data available for period between July 14-July 24 and after August 3.

^a Preliminary data – February 10, 2009. Discharge data was not available for the period July 3-July 10.

^b No data available due to equipment malfunction

Note: 1998, 2000 and 2010 data not available

(Source: Environment Yukon, Water Resources Branch).

Appendix 8. Blind Creek weather and water conditions, 2013.

DATE	TIME	AIR TEMP (°C)	WATER TEMP (°C)	WATER LEVEL (cm)	WATER CLARITY	WEATHER
July 25	8:00	13	10.7	75	murky	mix sun & cloud, shower late afternoon
July 26	8:00	10	9.7	74	murky	early morning and evening rain showers
July 27	8:00	10	10.3	72	murky	cloudy in a.m. scattered showers throughout day
July 28	8:00	10	9.6	71	dark stained	sunny
July 29	8:00	10	10.5	66	dark stained	sunny & hot
July 30	8:00	13	11.0	65	dark stained	sunny & hot, thunderclouds build in afternoon
July 31	7:50	10.6	10.6	63	dark stained	sunny & hot, thunderclouds build with wind gusts
Aug. 1	7:50	10.5	11.2	64	dark stained	cloudy, rain showers later in day
Aug. 2	8:00	8	9.6	64	stained	clear skies, hot
Aug. 3	7:45	9	10.7	64	stained	clear skies, hot
Aug. 4	7:45	10.5	11.7	60	clearing	mostly cloudy, light rain shower in a.m.
Aug. 5	7:45	10.5	11.6	58	clear	mix sun & cloud, light rain in evening
Aug. 6	7:45	10.6	11.8	58	clear	mix sun & cloud, hot
Aug. 7	8:00	14.6	12.4	59	clear	cloudy, light rain
Aug. 8	7:45	14.6	11.5	59	clear	smoke haze, cloudy, rainy in p.m.
Aug. 9	7:45	9.3	10.2	62	murky	morning fog, sunny day
Aug. 10	8:00	9.1	10.0	60	clearing	mostly sunny, hot
Aug. 11	8:00	12	10.6	57	clear	sunny, clear skies, hot
Aug. 12	7:50	14.1	11.6	54	clear - muddy	sunny, clear skies, hot
Aug. 13	7:50	9	11.1	53	muddy	sunny, clear skies, hot
Aug. 14	8:00	8.5	10.9	53	murky	sunny in a.m. thunderclouds move around
Aug. 15	8:00	10.2	10.6	54	murky	rain in a.m. clearing
Aug. 16	8:00	9.3	10.4	59	murky	mostly sunny
Aug. 17	8:00	13.2	11.5	60	murky	cloudy, periodic rain showers
Aug. 18	8:00	5.5	9.6	59	murky	mix sun & cloud, light rain shower in afternoon
Aug. 19	7:45	8	-	-	murky	rain