

The 2004 Clements Lake Sockeye Smolt Enumeration

Summary Report



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1.0 Proponent Information

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2.0 Introduction

Clements Creek and Clements Lake located northeast of Stewart, British Columbia form part of the Bear River watershed and are one of many drainages considered to be important spawning habitat for several species of salmon including coho and sockeye. Whenever degradation of habitat occurs, either naturally or from ongoing development, concerns are often raised regarding sustainability of fish populations.

The estimated number of adult sockeye on the spawning ground in this area was documented at less than 500 throughout the 1930's, 40's and 50's. Throughout the 1960's, up to 3500 adult sockeye were recorded. This was historically considered fairly high but it should be noted that methods of assessing these numbers may have been relatively crude. It may suggest that poor counting techniques were used or counts were done outside the migration period. Information available from the Stock Assessment Branch of the Department of Fisheries and Oceans (DFO) Canada indicated that the population dropped significantly in the mid 1960's and again in the 1980's. More recently, this area became a concern as testimonials from the long time residents indicated that the adult escapement of sockeye (number of fish returning to spawn) had dropped to alarming rates and were believed to be in jeopardy. It therefore seemed appropriate to enumerate the smolt population which, in turn, would give solid, documented indications of current conditions of stock numbers reinforcing previous adult enumeration.

If the sockeye population is on a decline in this area, it would be appropriate to note the possible influences and determine a viable means to reverse the trend. By determining migration timing of adult sockeye, it may be possible to conclude that visual counts done recently may have been done at an inappropriate time and therefore the situation is not as dire as previously indicated. It may also be possible to infer habitat degradation which might indicate the need to increase spawning areas through habitat restoration, construction of spawning channels, possible strategic removal of beaver dams or other appropriate measures.

This report summarizes the major findings of the *2004 Clements Lake Sockeye Smolt Enumeration* and is intended to update the DFO Stock Assessment Branch on existing and projected populations, provide feedback to the Pacific Salmon Commission, and establish strong educational opportunities and stewardship within the local community regarding this unique run of sockeye.

3.0 Background and Methods:

Background:

This study was conducted on Clements Creek approximately 40 meters upstream of the Highway #37 Culvert Crossing. This creek flows out of Clements Lake and feeds into the Bear River approximately 100 meters below Highway #37.

The Clements Creek study site is situated in the “Bear River Watershed”.

The specific location: Latitude: 56 03' 17 “; Longitude: 129 54' 58”

UTM Grid Zone 9 - easting: 442945 northing: 621256

The Clements Lake occupies approximately 17.9 hectares.

The Clements Creek from the streambed to the outlet into the Bear River is approximately 1.2 kilometers.

The study was set up and conducted under the umbrella of the Department of Fisheries & Oceans (DFO) Canada who provided personnel, labour, travel, equipment, technical expertise and training of Bear River Salmonid Enhancement Society personnel (BRSES) as their “in kind” contribution to this Pacific Salmon Commission (PSC) funded project.

The focus of this study was on smolt enumeration which would assist in analysing previous adult numbers and give some indication of future spawning stocks.

The study was originally proposed for the period April 15 to July 15, 2004. The project was prematurely terminated as of June 5, 2004 due to significant bear activity which put DFO and BRSES personnel in potential danger and was affecting the trap itself. A mother grizzly bear and two cubs had been seen on several occasions in the area and had begun to tamper with the trap system. Migrating sockeye smolts had already declined to small numbers by this time so it was felt that significant data was not lost because of this decision.

The first day of sampling was April 16; the last day of sampling was June 5, 2004.

Sampling and assessment was generally done twice per day when required – morning and evening.

Samples of scales and DNA were also taken and forwarded to DFO Stock Assessment Branch. A report from this sampling is pending.

Method:

Installation of a 4' X 3' incline plane trap (IPT), sandbag fence and related components were installed on Clements Creek April 15, 2004. The creek is relatively small, shallow and the water level fluctuates up and down frequently. It was quickly determined by DFO staff that these fluctuating changes in stream discharge (flow) reduced the IPT's usefulness at this location. As a result, the IPT was removed and replaced with a fyke net and floating trap box which proved to be very effective in these conditions and did not appear to hinder the downstream migration of smolts in any way.

The fyke net and floating box is a downstream trapping system which creates a funnel that feeds into a length of pipe which then feeds into the floating capture box. It allows for natural movement of the smolts.

The fencing was placed at an angle from each shoreline to form a crude funnel shape leading into the fyke net and was held in place in the stream bed with steel rebar and standard sandbags. The fence itself is constructed of dimensional 2X4 lumber covered with ¼ inch hardware cloth. The fence, as designed, allows for dispersal of high water flow while remaining 'fish-tight'. (Photograph #1 below).

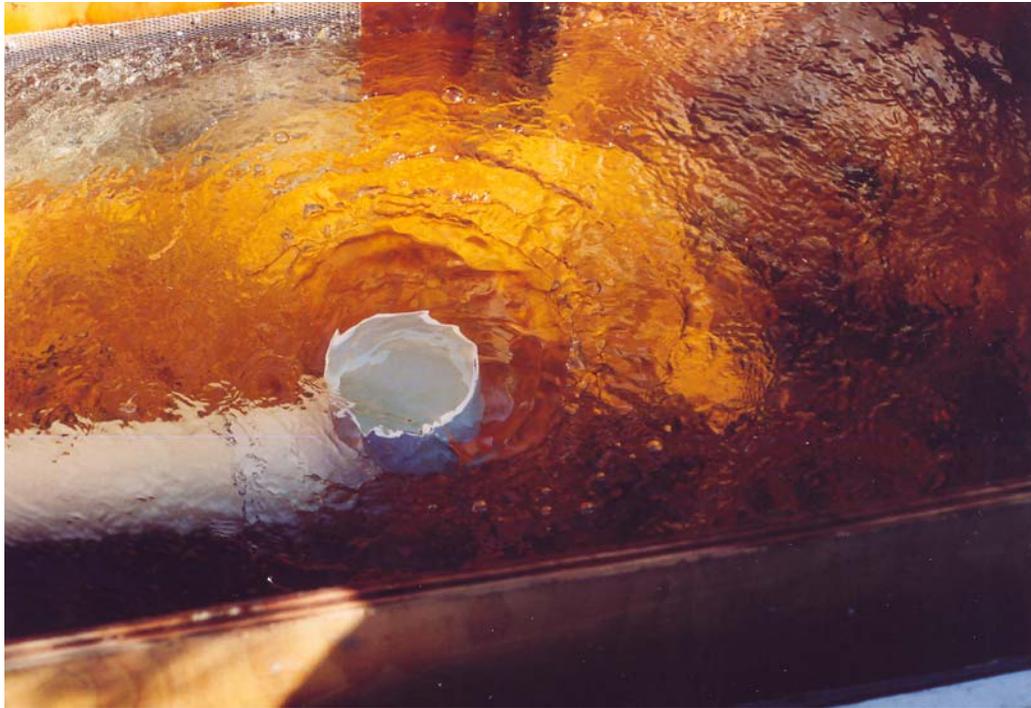


Photograph #1: Fence and Fyke Net – Clements Creek Site

From the fyke netting, the smolts were then guided down a length of PVC piping which was connected to a corresponding PVC elbow positioned upward, and captured inside the trap box. The floating box was constructed using dimensional lumber and plywood. It was approximately 48" X 30" X 24" and had a hinged lid. The lower end of the box had 2 rectangular holes and each side had one hole, covered with 1/8" perforated aluminium to allow for outflow of water. Attached to both sides of the main trap box were 2 "pontoon" type floats which were approximately 10" X 84" long made of plywood and some standard high density foam insulation. A baffle was placed across the inside of the box which gave the smolts a resting area at the "back" of the box. (See Photographs 2, 3 and 4)



Photograph #2: Floating Trap Box, Pipe and Fyke Net
(DFO Assistant Habitat Technician – R. Dams)



Photograph #3: – PVC Pipe and Elbow Inside Floating Trap Box



Photograph #4: – Floating Trap
(DFO Personnel – R. Dams)

Early in the sampling period it was noted that the sockeye smolts appeared to be very “shy” of the aluminium IPT and they seemed to avoid coming downstream which delayed migration. Once the IPT was removed and replaced with the fyke net and floating box, the sockeye smolt count took a huge jump as they appeared to resume their normal, downstream migration.



Photograph #5: Incline Plane Trap (IPT) at Clements Creek Site

Once captured, the smolts were put in a plastic basin which contained approximately 2 gallons of water using a standard dip net.

Common “Alka-Seltzer” was used to anesthetise the smolts thereby allowing inspection and measurement. (CO₂ as the principle influence)

All fish were identified, then counted and a random sample of 20 smolts were measured each day (primarily sockeye and coho). They were then placed in another basin containing fresh water where they recovered and were returned to the downstream side of the creek below the trap.

DNA and scale sampling was also done and the information forwarded to DFO Stock Assessment Branch. This was done simply by gently taking a smear off the side of the smolt with a standard scalpel. The smear was placed on a scale book for future analysis.

4.0 RESULTS and DISCUSSION:

Juvenile

The Clements Lake Sockeye trap system was successful in trapping sockeye smolts, coho smolts (*differentiated as coho (0+) and coho (1+)*), Dolly Varden and sculpin.

NOTE: C01+ = greater or equal to 1+.

The first fish were captured on April 16 using the IPT system which quickly proved to be a poor method at this site. It did not bode well under highly fluctuating water levels and seemed to inhibit the sockeye smolt's natural downstream migration.

Table #1 – Illustrates the Total Smolt Count for the Clements Lake Smolt Enumeration.

The total number of sockeye smolts enumerated during the sample period of April 16 – June 5 was 8728; the peak period fell between May 1 and May 9; the largest number daily migration was May 5. (total 979)

From April 16 to June 5, there was considered to be a very high number of Dolly Varden migrating simultaneously with the other species. It is presumed that this may have had a slight affect on the total number of sockeye smolts enumerated as they were subject to predation within the trap by the Dolly Varden.

Peak migration of coho (0+) was: May 16 – June 1

Peak migration of coho (1+) was: April 30 – May 9

Figure 1. - Illustrates the Length Frequency of the smolts which were enumerated. From this data 68.6% of the smolts were assumed as Age 1 and 31.4% were assumed as Age 2. Scale sample data, which is pending, may also be helpful.

Adult:

On August 11, 2004 DFO personnel made a visual inspection of the creek. The creek was walked from its confluence with the Bear River upstream to the Clements Lake and no barriers were found. It was noted that the creek flow was very low. Temperature that day was 17 C. Numbers of coho (CO +) were noted as 'very numerous'. Bear sign was prevalent. A lower breached dam was noted as having changed the creek flow and a channel was documented as flowing down stream on the left.

Water flows at the culvert were noted as low and estimated as 2 – 3 cubic feet per second (CFS). There were no visible signs of beaver problems anywhere along this system.

Another survey was conducted on September 14, 2004 by DFO personnel. A boat was used to examine the lakeshore on Clements Lake. Visibility of the lake water was estimated at 5 feet. 114 carcasses and 42 live sockeye salmon were noted.

Redds and actively spawning sockeye were observed in the lake only in an approximate area of 400 meters close to the creek fan. It was suspected that the peak of spawning had occurred 1 week prior to this inspection.

As previously noted, available figures from the early 1940's, 50's and 60's show relatively low numbers of sockeye adults in the Clements Creek area. These results may be skewed by poor counting techniques or counts done outside the migration period. Beaver dams were noted in later data periods as having affected spawning and escapements.

Based on the *2004 Clements Lake Sockeye Smolt Enumeration*, it can be assumed that adult numbers of sockeye salmon are better than originally indicated using equations and formulas which retrospectively estimated previous populations and which forecasted returning adults. (see data below)

Brood year for the 2004 smolts would have been 1999 and 2000. No data from DFO or the BRSES was recorded in 1999. For 2000, it was noted that there were approximately 100 spawning adults in the area. This number could be refuted based on calculations performed on the total number of outgoing smolts in 2004.

The physical site inspection conducted by DFO personnel in August and September would seem to refute that beaver dams have impacted adult sockeye migration this year.

Figure 2. - Illustrates the Historical Data on adult sockeye numbers available from the DFO Stock Assessment Branch. As previously noted, available figures from the early 1940's, 50's and 60's show relatively low numbers of sockeye adults in the Clements Creek area. These results may be skewed by poor counting techniques or counts done outside the migration period. Beaver dams were noted in later data periods as having affected spawning and escapements.

Of specific interest was the total sockeye count which was assessed as "very good numbers" for this drainage by DFO Stock Assessment staff.

The premise of the study was that the sockeye stocks in this area may be in jeopardy. The relatively high number of smolts (8728) enumerated would indicate that the adult numbers available to produce this number of smolts was also fairly high. There are two scenarios that we could incorporate the data into:

How many adults might be produced from the 8728 smolts enumerated in 2004? Some assumptions can be made as illustrated:

- A) 1) Assume approximately 4% smolt-to-adult survival.
2) Assume approximately 30% exploitation of surviving stocks.
Therefore:
8728 total smolts were enumerated X 4% = 349 adults 80% will return in 2006 (279)
20 % will return in 2007 (70)

349 adults minus 30% exploitation = 244 adults which will spawn

Assume that 244 of spawning adults has been produced from the 8728 smolts from Clements Creek.

How many adults may have produced the 8728 smolts in Clements Lake in 1999/2000?

- B) Production data available over a 45 year period for Chilko and Cultus Lakes indicates an Average smolt/spawner ratio of roughly 66 smolt/spawner. Speculation could be that $8728/66 = 132$ spawners produced the 2004 smolt output. North coast lakes are noted as slightly less productive so a ratio of 50 smolts/spawner might be more appropriate.
1) Assume approximately 4% smolt-to-adult survival.
2) Assume approximately 30% exploitation of surviving stocks.
Therefore:
 $8728 \text{ total smolts} / 50 = 174 \text{ spawners.}$

TOTAL SMOLT CATCH					
Daily Catch	Sockeye	Coho (0+)	Coho (1+)	Dolly Varden	Sculpin
April 16	0	0	0	18	2
April 17	0	29	28	35	35
April 18	0	0	1	2	1
April 19	0	0	32	58	2
April 20	0	0	3	31	0
April 21	0	0	6	30	0
April 22	0	0	25	42	1
April 23	1	0	19	26	3
April 24	0	0	20	40	4
April 25	0	0	17	32	1
April 26	0	0	0	0	0
April 27	0	0	26	90	3
April 28	0	0	0	0	0
April 29	0	0	49	153	4
April 30	435	11	193	330	2
May 1	794	6	649	400	4
May 2	587	13	304	194	3
May 3	573	18	305	44	7
May 4	793	19	589	32	5
May 5	979	20	973	22	1
May 6	687	27	578	23	3
May 7	330	12	300	29	5
May 8	679	10	427	47	6
May 9	387	8	354	75	2
May 10	263	5	263	32	7
May 11	64	4	55	8	2
May 12	183	24	124	4	4
May 13	162	9	147	61	1
May 14	266	304	155	38	9
May 15	220	507	150	36	8
May 16	226	1025	146	11	7
May 17	123	1012	127	115	13
May 18	162	811	128	141	12
May 19	124	1519	176	29	7
May 20	127	1026	162	39	9
May 21	97	1025	132	15	16
May 22	22	50	32	4	11
May 23	94	1200	138	8	10
May 24	49	1200	138	12	9
May 25	56	1000	142	14	6
May 26	56	600	181	12	3
May 27	54	500	102	6	0
May 28	14	0	53	4	0
May 29	29	1000	66	1000	11
May 30	22	800	79	16	2
May 31	17	900	71	9	3
June 1	20	800	74	23	6
June 2	13	500	58	5	6
June 3	7	300	32	17	11
June 4	11	200	47	17	5
June 5	2	50	14	1	2
TOTAL SMOLTS	8728	16544	7890	3430	274

Table 1: Summarised Smolt Counts

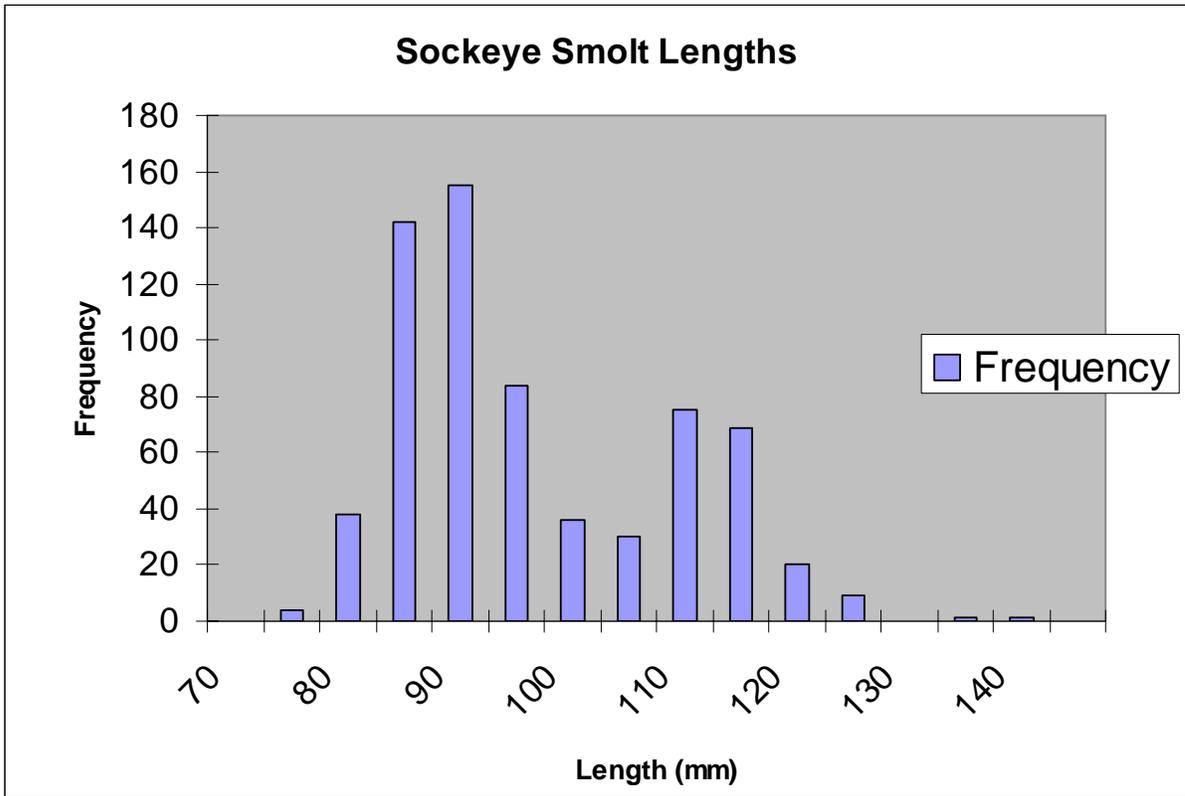


Figure 1: Size Frequency Histogram – Sockeye Smolts

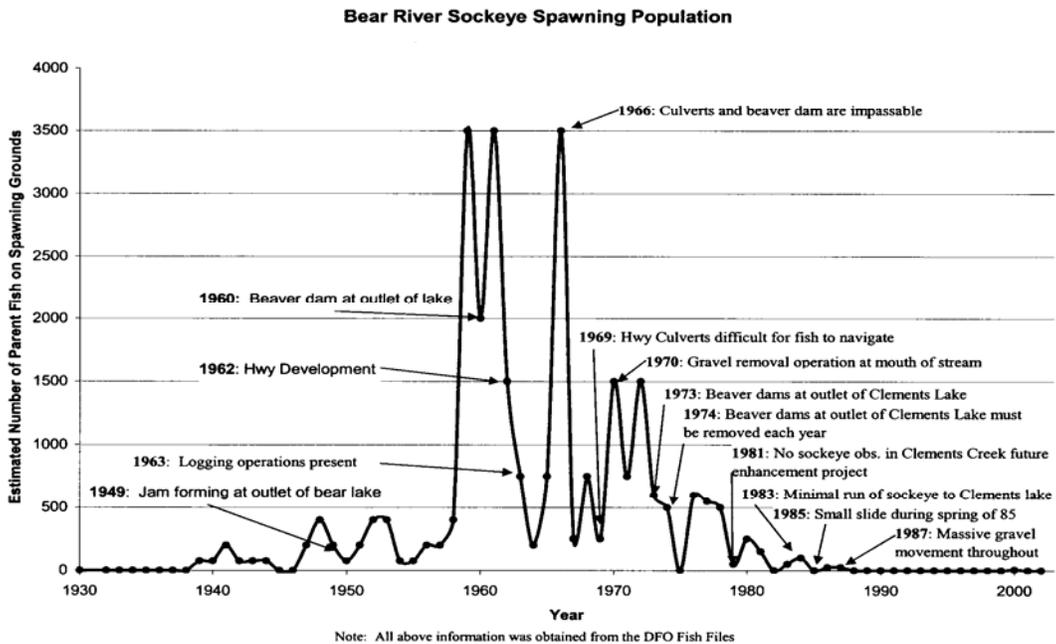


Figure 2: Historical Data – DFO – Adult Sockeye Populations

5.0 Conclusions and Recommendations

The following are main conclusions drawn from the Clements Creek Sockeye Smolt Enumeration:

- Past populations of the adult sockeye must not have been as low as was assumed.
- Beaver dams were not an issue for upstream fish passage this year. In the past four years counts have been done mainly in the creek during July/August and were likely obtained because of impaired passage due to beaver dams.
- These counts may have been done too late in the year and may have only caught the latter part of the run. Spring freshet seemed to be in late June and it's quite possible that this is when the main part of the sockeye salmon run enters Clements Creek.
- Lake counts should continue in the future as this seems a viable way to confirm adult spawning numbers. A suggested timing for this count would be early September.
- The Clements Creek should be walked once per month during June, July and August to breach beaver dams.
- A Juvenile Acoustic Survey *could* be conducted on the lake to determine where productivity is relative to where it could be. The results of that testing could then be compared with the smolt enumeration results and if the lake has a greater capacity, this would seem to indicate that habitat restoration might be considered in the future.
- A documented slide has caused the primary inlet creek to run sub-surface before entering the Lake and currently impairs migration of spawning adults. (See Figure 2 – 1985). A feasibility study could be conducted on various methods of diverting this channel to promote spawning environments. Rehabilitation projects in this area could serve to promote community awareness and environmental stewardship.
- The area of the Creek fan in the N.E. corner of the lake should be evaluated for possible spawning habitat restoration in case available lake spawning is a limiting factor for returning adults.