Gitanyow Fisheries

Authority

The 2013 Kitwanga River Salmon Smolt Assessment

Submitted to: Gitanyow Hereditary Chiefs
Pacific Salmon Foundation
Fisheries and Oceans Canada (Prince Rupert – Stock Assessment)

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Abstract

In 2013, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Smolt Enumeration Facility (KsF) for the 6th consecutive year since initiated in 2008 to enumerate sockeye and coho salmon smolts, and other resident trout and char species. The KsF was operated from April 8th to June 18th, 2013. The 2013 sockeye smolt population estimate was 84,294 fish and was comprised mostly of 1-Yr old smolts (98%). The peak run of 17,308 sockeye smolts occurred on May 7th when 21% of the entire run migrated past the KsF on that day, which is comparable to previous years when peak runs generally occur in the 1st or 2nd week of May. Approximately 90% of the sockeye smolts migrated through the weir in a ten-day period from May 4th to May 14th, 2013, which is also comparable to previous years. Freshwater production estimates for Gitanyow Lake sockeye in 2013 were estimated at 69 sockeye smolts per female spawner from the 2011 adult run, which was a modest improvement over the previous two years. Coho smolt counts totaled 14,347 fish during the 2013 KsF operation, however coho smolts were still passing through in the 100's of fish per day at fence closure. Budget constraints did not allow for the full capture of the coho smolt run. Aging results showed that 1-year-old smolts were most abundant (74.5%), follow by 2-year-old smolts (25.2%), and one fish was identified as a 3-year-old fish. A total of 12,971 coho smolts were implanted with Coded Wire Tags (CWT's) to provide an estimate of adult exploitation rates in subsequent years.

Acknowledgements

The GFA would like to thank Fisheries and Oceans Canada (Prince Rupert – Stock Assessment division), Pacific Salmon Foundation and the Gitanyow Hereditary Chiefs AFS program for jointly funding the operation of the KsF in 2013. The GFA would also like to thank the Pacific Salmon Commission (PSC) for funding the KsF facility aluminum walkway upgrade project. GFA would also like to acknowledge the hard work of the GFA smolt fence staff whose dedication throughout the program made the operations a success. In 2013, GFA staff members included: Les McLean, Earl McLean, Vern Russell, Phillip Johnson, Brenton Williams, Johnny Martin, Owen Russell, Ian Riemenschneider Kevin Koch, Mark Cleveland, Gregory Rush and Derek Kingston.

1. INTRODUCTION AND BACKGROUND

Historically, the Gitanyow fished salmon in the Kitwanga River for food, social and ceremonial purposes with sockeye being the main salmon species of choice. In the early 1900's sockeye stocks were thriving and Gitanyow Elders spoke of the lakeshores of Gitanyow Lake turning red every fall as the sockeye congregated to spawn on their respective spawning grounds. However, by the 1920's the Elders talked of the noticeable declines in the returns of the Kitwanga sockeye stock. By the 1960's most fishing sites along the Kitwanga River were abandoned and aboriginal fishing for sockeye had ceased due to low run numbers and concerns for the unique stock (Cleveland 2005, Kingston 2013).

One of the largest contributors to sockeye decline is suspected to be over-exploitation of the stock in commercial ocean fisheries. Past fishery re-constructions for the last 40 years show the average exploitation on Kitwanga sockeye has been over 50% and reaching as high as 70% in some years (Cox-Rogers, DFO, Pers. comm., 2010). Other factors likely contributed to the declines such as sockeye habitat destruction in the Kitwanga Watershed due to poor forest harvesting practices, which include the sedimentation of spawning beds, the disruption of water flow patterns, and changes in water quality of Gitanyow Lake tributary streams (Cleveland 2006, Kingston 2013).

Accurate Kitwanga adult salmon escapement data has been ongoing since the construction and continual operation of the Kitwanga River Salmon Enumeration Facility (KSEF) in 2003 near the mouth of the Skeena River and the construction and continual operation of the Kitwanga River Smolt Enumeration Facility (KsF) in 2008. In 1999, GFA initiated a Kitwanga sockeye-rebuilding program to conserve, protect and recover the stock. One of the highest rebuilding priorities for the Kitwanga Sockeye Salmon Recovery Plan (KSRP), which was initiated in 2006, was to continue monitoring the yearly abundance of Kitwanga sockeye salmon smolts emigrating from Gitanyow Lake (Cleveland et al. 2006, Kingston 2013).

The KsF plays a critical role in allowing GFA to monitor Kitwanga sockeye smolt production from Gitanyow Lake on a yearly basis. Assessing smolt production is important to the Gitanyow because it helps gauge the effectiveness of sockeye-rebuilding programs currently being carried

out in the Kitwanga watershed. Since 1998, the GFA have been working diligently throughout the Kitwanga watershed to restore the sockeye stock to historical levels.

From 2000 to 2007, GFA experimented with different weir and trap designs in an effort to accurately count Kitwanga sockeye smolts on a yearly basis. For the most part, these trap designs were unusable on the Kitwanga River when an unknown number of smolts passed though undetected (Kingston 2013). In 2007 and 2008, the GFA were successful in acquiring funding to construct a permanent smolt fence on the Kitwanga River below Gitanyow Lake. The KsF became operational in April 2008 and since then has annually counted all salmonids emigrating downstream from Gitanyow Lake.

In 2009, GFA initiated a coho coded wire tagging (CWT) program, which are counted at the KSEF or captured and reported ideally in whole but realistically in part by Alaskan and Canadian fisheries. Tag recovery information helps fisheries managers determine coho survival rates and fisheries specific exploitation of yearly cohorts, which represent a portion of Skeena coho stocks with similar life history traits.

In 2008 and 2009 the KsF was used to monitor the production of Kitwanga hatchery sockeye fry out planting programs that took place in Gitanyow Lake in 2007 and 2008 (Cleveland 2007, 2009). At present, all progeny from this program are considered absent or undetectable.

In this report, emigration (downstream flow) for the 2013 spring smolt run of anadromous sockeye and coho smolts and resident trout and char species passing through the KsF from Gitanyow Lake will be discussed. The 2013 smolt sampling season represents the 6th consecutive year that this project has been implemented.

In 2013, the KsF was operated with funding contributions from Fisheries and Oceans Canada (Stock Assessment - Prince Rupert), Pacific Salmon Foundation and the DFO's AFS program. This report summarizes the results and findings for the KsF program in 2013.

2. METHODS

Counts at the KsF started on April 8th, 2013 and continued until June 12th, 2013. All of the aluminum components were installed then pulled from the river during this period. The KsF is located on the Kitwanga River approximately 600m downstream from the outlet of Gitanyow Lake (UTM's 9U 557014E; 6131839N - Figure 1). The design of the KsF consists of an aluminum-based weir that passively diverts emigrating smolts and other resident trout species into one of three trap boxes where they can be easily enumerated, sampled and released.

Figure 1: Location of the Kitwanga River Smolt Enumeration Facility (KsF) showing reference to Gitanyow Lake outlet and Highway 37N (Image supplied from www.googleearth.com).

The aluminum weir and smolt trap boxes were attached to preformed concrete aprons that were placed in the riverbed during the construction of the smolt fence completion project (Kingston, 2008). The weir is constructed of prefabricated smolt panels, trap boxes and transoms that can be easily installed and removed by the GFA fisheries technicians. The aluminum weir is designed to mimic the physical features of a beaver dam where water is backed-up, forming a head of water upstream of the weir which spills over in a desired location. Traps boxes are installed at the spill locations and easily capture downstream moving fish that key in on the area. The weir is installed at a 45º angle to the rivers flow, which naturally moves fish to the left bank of the river where the trap boxes are installed.

The trap boxes were designed with dewatering screens that funneled the smolts into a small holding box where they remained trapped (see Figures 2-5 for photos of fence design). Once the fish were committed to entering the dewatering screens, the fish are then transported down the V-shaped grooves where the water velocity was too great for them to swim back upstream. From the small holding boxes that are attached to the dewatering screens, fish continue to move downstream through a 6" rigid plastic hose to a large covered 8' X 4' X 4' holding box where they remain until they are sampled each day. The KsF consisted of three smolt traps that were connected to three large holding boxes. Four to five rows of 6" X 6' stop-logs were placed at the back of each transom to create a damming effect upstream of the fence. The stop-logs created a 6" to 12" head effect upstream of the fence at each of the smolt traps, which allowed them to work effectively to catch fish.

Crews of two or three GFA fisheries technicians would check the trap first thing in the morning and conduct fish sampling and smolt enumeration work. The fence site was visited again just before dark to clean debris off the fence and ensure the traps were fishing at the proper water level. Trap adjustments could be made so the optimum amount of water was flowing through each trap area. This ensured the fish were captured in a passive, harmless manner. Sub samples of all sockeye smolts caught daily were measured to determine their lengths and weights. Fork lengths were taken to the nearest 1 mm and weights to the nearest 0.1 grams.

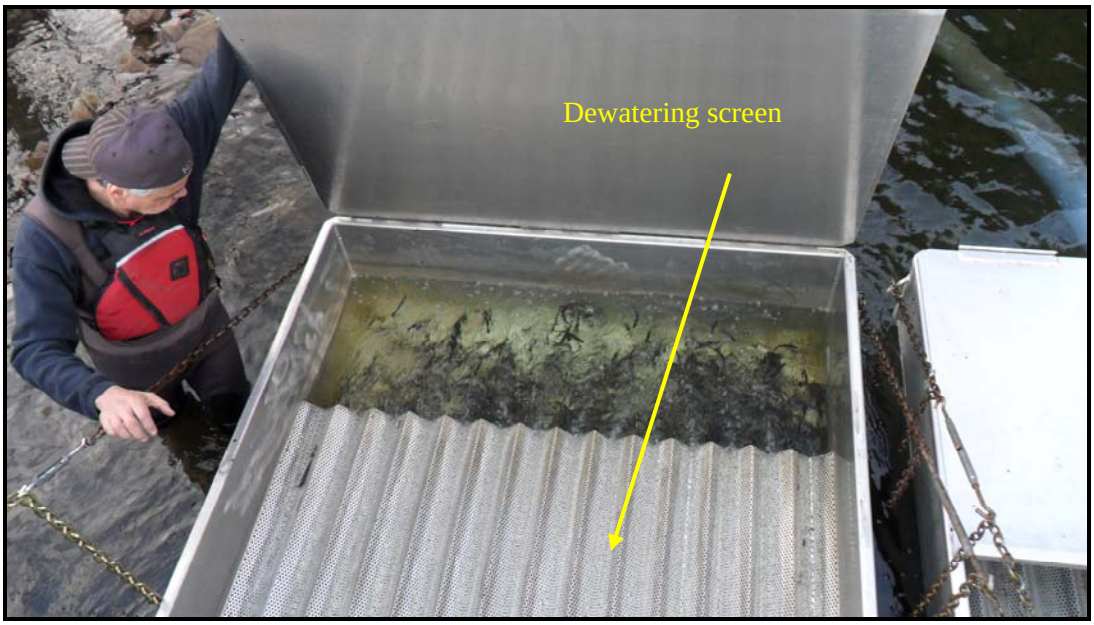

Figure 2: Photo of smolt trap box showing dewatering screen.

Figure 3: Photo of large holding boxes attached to smolt trap boxes with 6” hose.

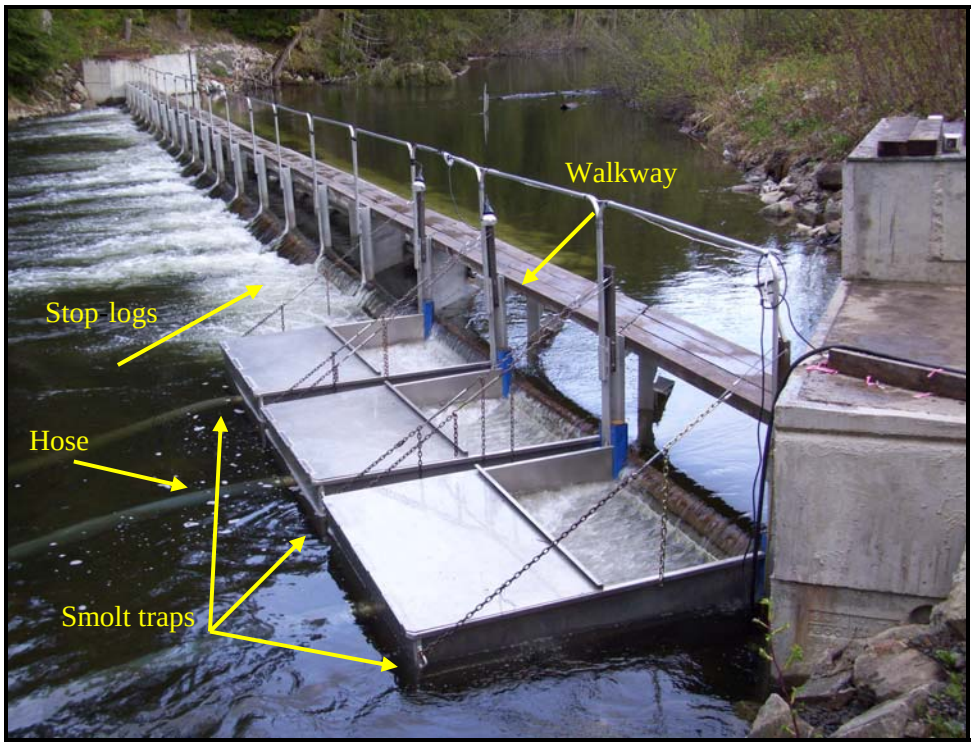

Figure 4: Photo of smolt fence installed showing smolt traps, 6" hose, stop-logs and walkway.

Figure 5: Photo of smolt holding box with captured sockeye smolts.

2.1 Coho Coded Wire Tag (CWT) Program

Since 2009, but excluding 2012, GFA implemented a Kitwanga coho smolt CWT program in conjunction with the operation of the KsF. As in other years nearly all coho captured in 2013 (12,971 out of 14,347 smolts or 90 % of the sample) were implanted with a CWT. In addition to tagging, scales were taken from approximately 3% of the run (400 out of 14,347 fish) for age determination. Fork lengths were taken to the nearest 1 mm and weights to the nearest 0.1 grams.

Coho implanted with a CWT were first anaesthetized using a bath of river water and clove oil. All tagged coho were given an adipose fin clip to make them recognizable by commercial fishers and the KSEF counting crew upon return. Once anaesthetized, the CWT's were implanted into the nose of the coho with a Mark II automated tag injector (see Figure 6 for installation set-up). Tagged coho were then released down a Quality Control Device (QCD) to detect whether the tags had been properly implanted into the fish. All coho found to have not retained their tag were re-tagged. As an added quality control measure approximately 10% of each days tagged group were held for 24-hrs and passed through the QCD for a second time to determine tag loss and mortality. Following all sampling and tagging operations, coho smolts were placed back into large holding boxes in the Kitwanga River and released at nightfall.

Figure 6: Photo of Coded Wire Tag (CWT) machine, Quality Control Device (QCD) and sampling station set-up.

2.2 KsF Facility Upgrades in 2013

A key upgrade for the KsF in 2013 was the replacement of the wooden walkway above the smolt fence with aluminum bar grating. The wooden walkway was very slippery, labour intensive to install, and starting to deteriorate.

Therefore, in the spring of 2013 the GFA acquired financial assistance from the Pacific Salmon Commission (PSC) to replace the wooden walkway with aluminum non-skid bar grating, which increased the installation time of the KsF and provided a much safer walkway for the staff working at the facility (Figures 7 and 8). The new walkway is expected to last for the life of the KsF.

The fabrication of the new aluminum non-skid walkways started on March 12, 2013 and final installation of the new panels was completed on April 7th, 2013. The first step of the fabrication process started by cutting the 1" aluminum bar grating material into seven - 24' long X 18" wide panels. A piece of 1" aluminum flat bar was them welded to the end of each panel so that all of the walkway panels could be bolted together.

Forty aluminum panel clamps were also fabricated which helped to hold the walkway onto the existing smolt fence transoms. The walkway clamps consisted of a 10" piece of 1.5" aluminum angle with two 6" "J" hooks. All seven of the aluminum non-skid walkways were placed on top of the aluminum transoms and bolted together at each end. Two walkway clamps were placed at each transom and tightened down so that the walkway was secured in place. Aluminum safety railings were also secured to the top of the transoms to allow the GFA technicians access to the smolt traps across the non-skid walkways and to clean the fence with ease.

Figure 7: Aluminum walkway clamps fastened to the walkway and transoms.

Figure 8: Completed weir installation with new non-skid walkway and safety railings.

The KsF upgrade project was completed on time and within the allowable budget. The GFA successfully replaced the existing wooden walkway bridge with new aluminum non-skid panels to ensure added safety to the staff working at the site. The upgrades to the KsF occurred prior to

the 2013 sockeye smolt migration and therefore no smolts counts were compromised. The GFA would like to thank the PSC for helping to fund the KsF facility upgrade project and Don Hjorth for helping to design the new aluminum non-skid walkways.

3. RESULTS

Five species of salmonids were enumerated through the KsF between April 8th and June 18th, 2103: sockeye and coho salmon, cutthroat and rainbow trout and bull trout char (Table 1). Sockeye and coho salmon were stratified into 1 and 2 year old fish based on visual observations in the field. Dolly Varden char may be mixed in with the juvenile bull trout samples in Table 1, as these were not differentiated in the field. Other species counted include whitefish (165), sculpin (1,833), northern squawfish (33), and peamouth chub (2).

Table 1: Number of fish by salmonid species (salmon/trout/char) counted through the KSF from April 8th and June 18th, 2013.

1-YR Old SX	2-YR Old SX	Total Sx Smolts	1-YR Old Coho	2-YR Old Coho	Total Coho Smolts	CT	Adult BT (> 300mm)	Juv. BT (< 300mm)	RBT
84,229	65	84,294	14,318	29	14,347	547	262	106	105

The following sections will describe run timing, and age and size distribution/statistics for sockeye and coho smolts, and also, sockeye smolt production and details of the coho coded wire tagging (CWT) program.

3.1 Salmonid Run Timing

3.1.1 Sockeye Run Timing

In 2013, 84,294 sockeye smolts were counted migrating downstream though the KsF. The first sockeye smolt was counted on April 24th and the last on June 17th one day before operations ceased (Table 2; Figure 9). Sockeye were counted in single-digit numbers 2 weeks prior to June 17th and any missed fish post-closure are considered insignificant compared to the total run.

Table 2: 2013 sockeye run timing highlights compared to 2001 to 2012 results.

Year	Run Start	Run End	Run Peak	Run Midpoint
2001	April 29th	May 27th	May 6th	May 13th
2002	April 27th	June 1st	May 12th	May 11th
2003	April 23rd	June 2nd	May 2nd	May 13th
2004	April 19th	May 20th	April 30th	May 5th
2005	April 17th	May 19th	May 2nd	May 3rd
2006	April 22nd	May 25th	May 4th	May 9th
2007	May 1st	May 30th	May 10th	May 15th
2008	April 30th	May 28th	May 11th	May 14th
2009	May 1st	June 7th	May 18th	May 19th
2010	April 21st	June 11th	May 3rd	May 17th
2011	April 25th	June 23rd	May 14th	May 25th
2012	April 26th	June 7th	May 9th	May 17th
2013	**April 24th**	**June17th**	**May 7th**	**May 22nd**
Average 2001 -2012	**April 25th**	**June 16th**	**May 12th**	**May 22nd**

The peak run of 17,308 sockeye smolts occurred on May 7th when 21% of the entire run migrated past the KsF on that day, which is comparable to previous years when peak runs generally occur in the 1st or 2nd week of May. The midpoint of the run occurred on May 22nd and is also comparable to previous years results. Approximately 90% of the sockeye smolts migrated through the weir in a ten-day period from May 4th to May 14th, 2013, which is also comparable to previous years. Based on the above, the KsF was operational essentially during the entire sockeye smolt run.

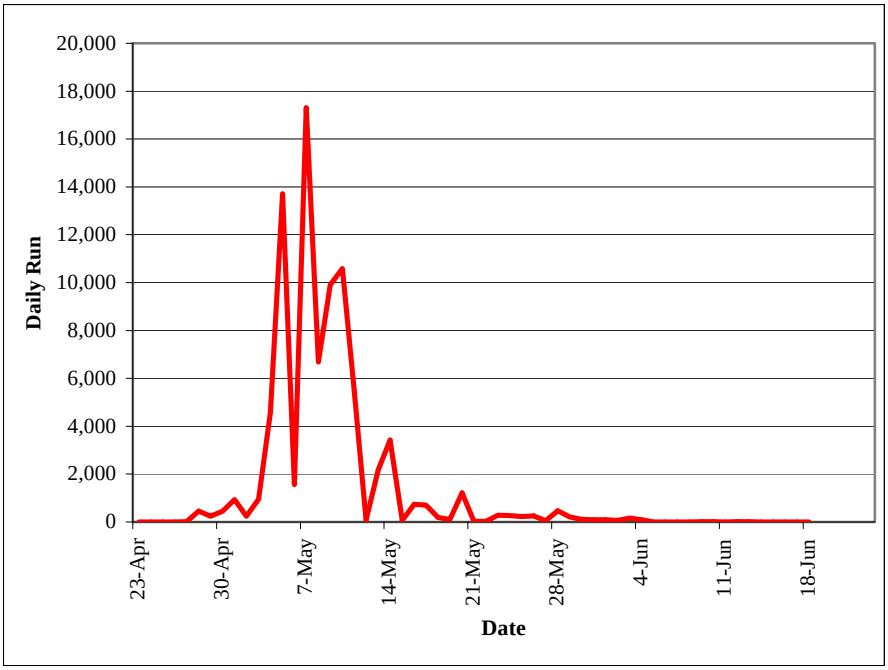

Figure 9: Daily run timing for sockeye smolt emigrating through the KsF in 2013.

3.1.2 Coho Run Timing

In 2013, 14,347 coho smolts were counted migrating downstream though the KsF. The first coho smolt was counted on April 10th and the last on June 18th when operations ceased (Table 3; Figure 10). The KsF ceased operations when coho smolts were still passing through in the 100's of fish, therefore did not capture the entire run. This was due to budget constraints and successfully achieving the primary goal of implanting over 10,000 coho smolts with a CWT. Two peak runs of coho smolts were observed on June 3rd (1,347 fish) and June 12th (1,348 fish). Daily counts of 100+ fish began on May 23rd and continued in approximately the 100-1,000 fish range until closing.

Table 3: 2013 coho run timing highlights compared to 2009 to 2012 results.

Year	Run Start	Run End	Run Peak	Run Midpoint
2009	April 19th	July 13th	June 26th	June 1st
2010	April 17th	June 25th	May 31st	May 22nd
2011	April 26th	June 28th	June 2nd	May 28th
2012	April 25th	June 8th	May 28th	May 18th
2013	**April 10th**	**N/a**	**June 3rd and 12th**	**N/a**
Average 2009 – 2012	**April 22nd**	**June 1st**	**June 7th**	**May 26th**

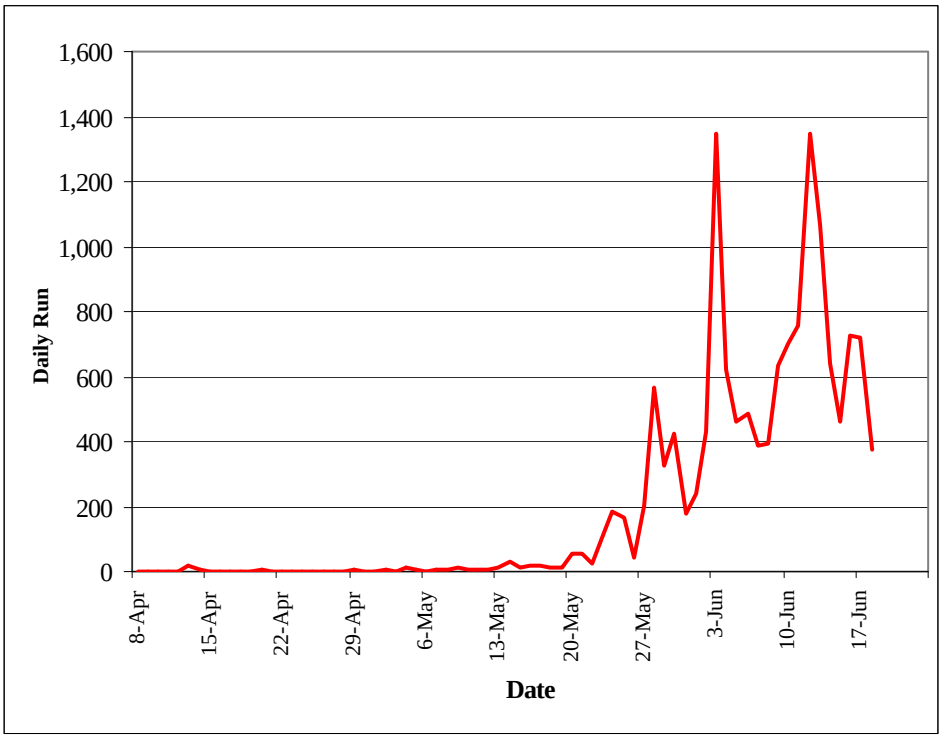

Figure 10: Daily run timing for coho smolt emigrating through the KsF in 2013.

3.1.3 Run Timing of Other Species

The cutthroat emigration through the KsF (547 fish) was relatively condensed within an 18-day period from April 28th to May 15th (379 fish or 70% of total count). No pattern was observed for bull trout/Dolly Varden char or rainbow trout in which counts were spread out and arrived in single or low double-digit numbers throughout the KsF operation.

3.2 Sockeye and Coho Age and Size Structure

3.2.1 Sockeye Age and Size Structure

Scales from 700 sockeye smolts were submitted to Birkenhead Scale Analyses for age analysis and of these, 685 fish (98%) were identified as 1-year-old smolts and one fish was identified as 2-year-old fish (159mm, 39.7g), while the remaining scales were deemed unreadable. The 2013 mean length (101.3mm) and weight (10.1g) was comparable to that found in previous years at the KsF (Tables 4 and 5). Fork length distribution for 1-year-old smolts, grouped into 5mm intervals, was unimodal with the majority of fish falling into the 100-105mm length class (Figure 11).

Table 4: Length and weight statistics for 1-year-old sockeye sampled in 2013 (n=685).

Statistic	Length (mm)	Weight (g)
Mean	101.3	10.08
Standard Error	0.286	0.086
Median	102	10
Mode	104	9.5
Standard Deviation	7.484	2.252
Sample Variance	56.010	5.072
Kurtosis	0.475	-0.048
Skewness	-0.497	0.012
Range	52	14.3
Minimum	71	3.5
Maximum	123	17.8
Count	685	685
Confidence Level(95.0%)	0.56	0.17

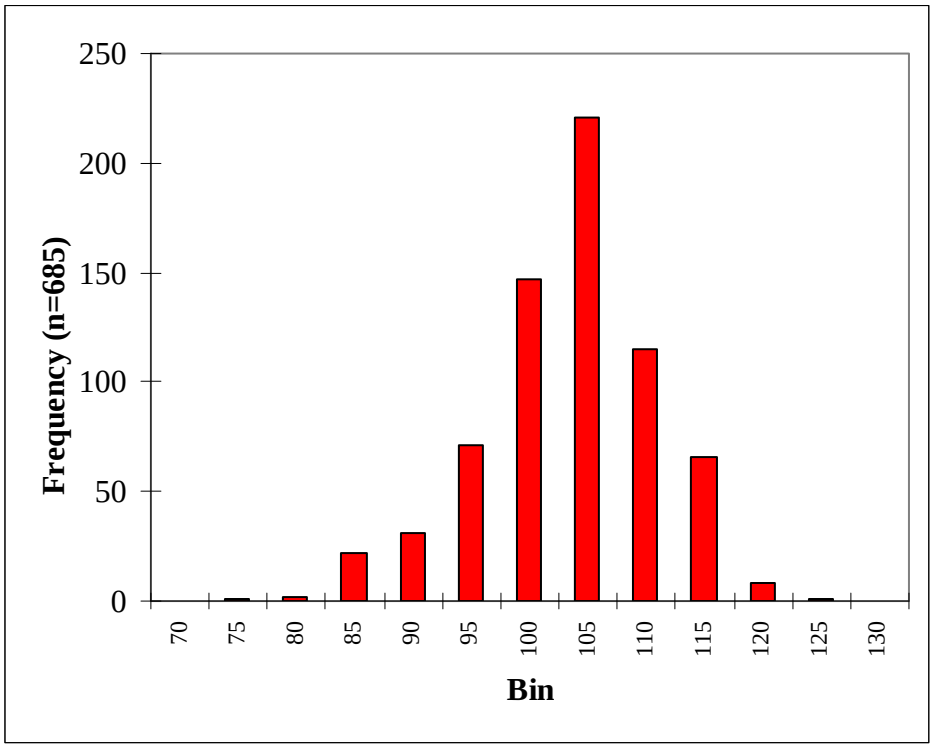

Figure 11: Length distribution (5mm class intervals) for 1-year-old sockeye sampled in 2013 at the KsF (n=685)

Table 5: Lengths and weight statistics for one-year-old sockeye sampled since 2008 at the KsF.

Year	Sample Size (N)	Mean Fork Length (mm)	Max. / Min. Fork Length (mm)	Mean Weight (g)	Max. / Min. Weight (g)
2008	1,224	102.8	76 / 122	9.9	4.9 / 28.5
2009	320	112.1	86 / 132	13.4	5.7 / 21.3
2010	2,490	106.4	77 / 128	11.5	4.1 / 21.5
2011	740	106.6	85 / 151	11.8	6.1 / 32.7
2012	1,680	96.7	64 / 124	8.5	2.3 / 15.5
2013	684	101.3	71 / 123	10.1	3.5 / 17.8
Average 2008 - 2012		**104.9**	**64 / 151**	**11.0**	**2.3/ 32.9**

Data from age 1-year-old Gitanyow Lake sockeye smolts shows that average lengths and weights are relatively large when compared to three other high-profile BC sockeye producing lakes (approximately 20 years of data for Babine, Cultus, and Chilko Lakes; in Groot and Margolis

1991). The 2013 results (101mm, 10g) and averages from 2001 to 2012 (105mm, 11g) compares to Babine Lake (79mm, 4.9g), Cultus Lake (82mm, 6.2g), and Chilko Lake (82mm, 6g).

3.2.2 Coho Age and Size Structure

Scales from 400 coho smolts were submitted to DFO for age analysis and of these, 377 fish (94%) provided readable ages. One-year old smolts were most abundant (n=281, 74.5%, mean of 130mm and 23.1g), follow by 2-year-old smolts (n=95, 25.2%, mean of 138mm and 27.8g), and one fish was identified as a 3-year-old fish (192mm and 68.9g; Tables 6 and 7). The remaining scales were deemed unreadable. The 2013 mean length (132mm) and weight (24.4g) for the entire 400 fish sample was comparable to that found in previous years at the KsF (Tables 8). Fork length distribution for 1 and 2 -year-old smolts, grouped into 5mm intervals, was unimodal with the majority of fish falling into the 130-135mm length class for both age groups (Figure 12).

Table 6: Age distribution for coho smolts sample in 2013 (n=400).

European	Gilbert-Rich	Brood Yr.	Frequency	Percent
30	44	2009	1	0.3%
20	33	2010	95	25.2%
10	22	2011	281	74.5%
Total			377	100.0%

Table 7: Length and weight statistics for coho aged 1 and 2 years old sampled in 2013 (n=399).

Statistic	Length		Weight	
	Age 1	Age 2	Age 1	Age 2
Mean	129.6	137.6	23.1	27.8
Standard Error	0.50	1.96	0.25	1.45
Median	131	133	23.3	24
Mode	128	132	26.4	22.4
Standard Deviation	8.32	19.14	4.26	14.10
Sample Variance	69.30	366.50	18.12	198.68
Kurtosis	0.79	6.55	0.03	11.12
Skewness	-0.62	2.54	-0.14	3.32
Range	50	103	24.3	77.8
Minimum	97	112	10.2	15.4
Maximum	147	215	34.5	93.2
Count	281	95	281	95
Confidence Level(95.0%)	0.98	3.90	0.50	2.87

Table 8: Coho smolts mean fork lengths and weights from 2009 to 2013.

Year	Sample Size (N)	Mean Fork Length (mm)	Max. / Min. Fork Length (mm)	Mean Weight (g)	Max. / Min. Weight (g)
2009	95	134.8	111 / 172	26.5	13.6 / 55.1
2010	550	141.2	103 / 272	31.1	11.8 / 195.4
2011	525	130.2	104 / 230	23.5	10.8 / 114.9
2012	400	129.8	93 / 173	22.3	8.5 / 51.7
2013	400	131.8	97 / 215	24.4	10.2 / 93.2

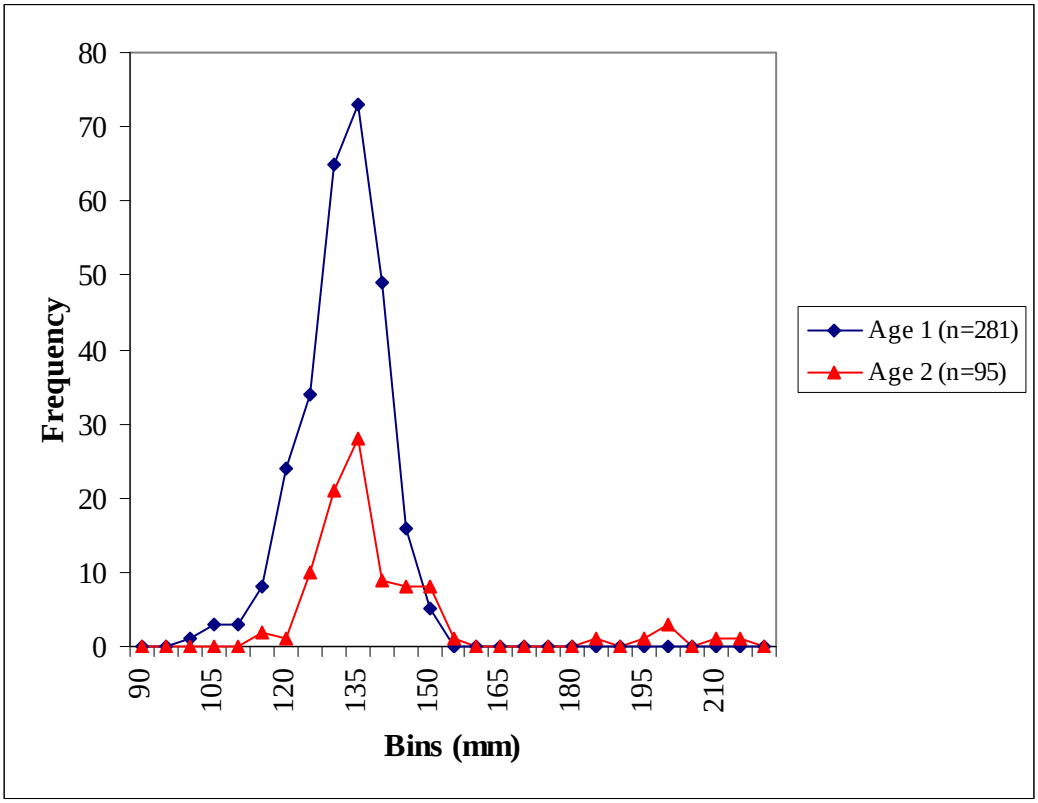

Figure 12: Length distribution (5mm class intervals) for 1 and 2-year-old coho sampled in 2013 at the KsF.

An estimated total of 12,791 coho CWT were successfully released downstream in 2013 (Table 9). This total takes into account tag loss and mortality from 1,877 coho from two differentiated tag groups.

Table 9: Coho CWT estimates for tag mortality, tag loss, and total CWT's released in 2013 at the KsF.

CWT Tag Group	Tag Loss # (%)	Mortality # (%)	Tag Loss + Mortality %	Sample Size	# Coho Tagged (Corrected for tag loss and mortality)
A08 D03/51	3 (0.8%)	2 (0.5%)	1.20%	398	2,210
A18 D60/23	6 (0.4%)	22 (1.4%)	1.80%	1,479	10,761
Total				1,877	12,971

3.3 Sockeye Smolt Population Estimates and Smolt Production

A total of 84,294 sockeye smolts were captured during the 2013 study period and was considered a complete account of the run (Table 10). The 2013 population estimate was 46% below the 2008 to 2012 running average of 157,280 smolts at the KsF, however this average is skewed by the record 2012 count of 400,907 smolts.

In 2013, an estimated average of 69 smolts were produced per female spawner (Table 11). This estimate was generated by dividing the total number of 1-yr old smolts produced in 2013 by the number of adult females that escaped to the river and presumed to have successfully spawned in 2011 (2,366 total spawners x 52 female ratio = 1,230 females; McCarthy 2012). The 2013 Kitwanga smolt production was higher than the declines observed in 2011 and 2012, but much lower than that observed in 2009 and 2010 when relatively few sockeye returned to Kitwanga River. What appears to be an inverse relationship between # of spawners and smolt production could be due to the carrying capacity of either the spawning grounds or their rearing environment in the lake.

Table 10: Kitwanga River sockeye smolt population estimate and trap efficiency from 2001 – 2013.

Year	# Smolts Marked	# Smolts Recaptured	Trap Efficiency %	Total Smolts Captured	2-Yr. Old Smolts	Hatchery Smolt Population Estimate	Wild Smolt Population Estimate	95% C.I. Lower	95% C.I. Upper
2001	570	13	2	1,921		--	**78,389**	39,332	117,446
2002	1,827	294	16	6,842		--	**42,402**	38,074	46,730
2003	1,702	78	5	4,806		--	**103,623**	81,628	125,619
2004	1,177	36	3	3,773		--	**120,155**	82,732	157,578
2005	4,516	372	8	8,252		--	**99,942**	90,461	109,423
2006	2,166	171	8	8,591		--	**108,248**	92,925	123,571
2007	4,889	521	11	7,436		--	**69,667**	64,225	75,109
2008	N/A	N/A	N/A	229,026		2,753	**226,273**	213,486	239,060
2009	N/A	N/A	N/A	36,554	311	1,273	**35,281**	--	--
2010	N/A	N/A	N/A	113,068	24	--	**113,068**	---	--
2011	N/A	N/A	N/A	83,854	137	--	**83,854**	--	--
2012	N/A	N/A	N/A	400,907	91	--	**400,907**	389,448	412,336
2013	N/A	N/A	N/A	84,294	65	--	**84,294**	---	---

Table 11: Sockeye smolt production in 2013 compared to results from the KsF from 2008 to 2012.

Year	**Smolt Estimate**	**Female Spawners**	**Smolts per Female**
2008	226,273	2,643	86
2009	34,970	125	280
2010	113,044	684	165
2011	83,717	1,615	52
2012	400,907	9,778	41
2013	84,294	1,230	69

4. DISCUSSION AND RECOMMENDATIONS

Since 2008, GFA has accurately enumerated sockeye smolts migrating out of Gitanyow Lake at the KsF for the past five years, even during spring flood events. GFA will continue to monitor the migration of sockeye smolts from Gitanyow Lake on a yearly basis as long as funding carries forward. Kitwanga sockeye smolt production is of great interest to fisheries managers and one of the highest assessment priorities currently undertaken by GFA in the Kitwanga Watershed.

The 2013 sockeye smolt population estimate was 84,294, which were comprised almost exclusively of 1-year-old smolts. Run timing spread, peak run date, and size and age distribution was similar to previous years. The 2013 Kitwanga sockeye freshwater production estimate from Gitanyow Lake was 69 sockeye smolts were produced per adult female from the 2011 brood year. When comparing the size of 1-year-old smolts from Gitanyow Lake to three other British Columbia sockeye producing lakes (Babine Cultus, and Chilko Lakes; Groot and Margolis 1991), Kitwanga smolts are relatively larger in both length and weight.

Since 2009, but excluding 2012, the GFA have implemented a CWT program on the Kitwanga River to assess survival and harvest rates on coho to track commercial fishing pressure on this stock in both Alaska and BC waters. It is expected that the GFA will resume this worthwhile program in 2014 where the plan is to mark over 10,000 coho smolts in order to obtain sufficient numbers of recoveries from marine fisheries to estimate the exploitation rate.

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Appendix 1

Letter from Carol Lidstone of Birkenhead Scale Analyses regarding 2013 sockeye smolt aging results

Birkenhead Scale Analyses

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December 11, 2013

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P.O. Box 148,
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Re: 2013 Kitwanga River Smolt Sockeye Scale Analysis

Hi Derek,

Attached is the analysis for the sockeye smolt scales collected from the Kitwanga River from April 28 - May 25, 2013. The updated version of the Excel file includes the scale age, circuli counts, location of freshwater stresses, and relevant comments.

The total sample size is 700 fish, with two age 1+ coho, and 698 sockeye, mounted on 28 books. Of the 28 books, 14 have been fully analyzed to include age, circuli counts, location of freshwater stress and relevant comments. The other 14 books were partially analyzed, by scanning the scales quickly to provide age and ensure the typical Kitwanga pattern is exhibited. If any scales from the partial analysis exhibit anything out of the ordinary, the circuli counts and comments are provided. I alternated between full and partial analysis to provide data for the entire sampling period.

Of the 700 fish sampled, 8 samples were unreadable. Two samples appear to be age 1+ coho, although labelled as sockeye. The majority of readable sockeye are age 1 (n=689), of which three exhibit plus growth (ie. age 1+), and one sample is age 2.

Age One Sockeye (n=689): Weights range from 3.5-17.8 grams. Lengths range from 71-123 mm, with one at 10.2 mm, which must be an error (assume should be 102 mm).

Circuli counts are provided for 346 of the age one smolts. All of the scales exhibit the typical Kitwanga freshwater stress, including the 343 sockeye that were partially analyzed. As usual, the freshwater stress ranges from moderate to strong. However there are two samples where the stress is very strong, and in a mixed stock sample I may age these samples as two year olds, rather than identify them as Kitwanga one year olds with a freshwater stress (see Comments column).

The circuli counts from the focus to the freshwater stress range from 5-16, stress to annulus 3-13, for a total circuli count, excluding plus growth, of 12-24. Plus growth is exhibited on three samples, starting on May 20, and is always 2 circuli. The total counts including plus growth also range from 12-24.

Age Two Sockeye (n=1): There is one age 2 sockeye, with a weight of 39.7 grams and length of 159 mm. The first freshwater year does not exhibit a freshwater stress, and has a circuli count of 13; the second freshwater year has a total circuli count of 22, with a stress at 8; so the total circuli count for both years is 35.

Four other large smolts were sampled, but unfortunately the scales are missing or unreadable. Book 71227 #6 at 37.7 grams is a large scale, but mounted upside down with grooved side facing down, so image is unreadable. Book 71227 #13 at 42.3 grams is a large scale, but regenerated. Book 71234 #2 contains two entries on the spreadsheet, one at 11.6 grams and the other at 66.3 grams. Unfortunately there are no large scales in box 2, only age 1 smolts. Based on the weight/length data and scale size, I suspect these three samples are age 2. Finally, Book 71005 was not provided, which contains a smolt at 172.6 grams. Based on ages by weight from the 2012 sample, I suspect this smolt is age 3.

Please let me know if you have any questions or concerns regarding the results. I will return the scales and results to you via Xpress Post. Once again, thank you very much for the opportunity to complete this work for you.

Sincerely,

Carol Lidstone
Birkenhead Scale Analyses