Gitanyow Fisheries Authority

The 2015 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 2015, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Smolt Enumeration Facility (KsF) for the 8th 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 2nd to June 23rd, 2015. The 2015 sockeye smolt population estimate was 12,165 fish (lowest count recorded since 2008) and was comprised mostly of 1-Yr old smolts (99%). The peak run of 4,114 sockeye smolts occurred on May 2nd when 34% of the entire run migrated past the KsF on that day. This is comparable to previous years when peak runs generally occur in the 1st or 2nd week of May (Figure 9). The midpoint of the run occurred on May 20th and is also comparable to previous years results. Approximately 99% of the sockeye smolts migrated through the weir in a 24-day period from April 18th to May 11th, 2015, which is also comparable to previous years. Freshwater production estimates for Gitanyow Lake sockeye in 2014 were estimated at 44 sockeye smolts per female spawner from the 2013 adult run, which was the third lowest recorded since 2008. A Vaki Bioscanner was used for a portion of the peak sockeye run and will be used in future years to assist fence staff during peak run periods. Coho smolt counts totaled 4,517 fish during the 2015 KsF operation, however coho smolts were still passing through in relatively high numbers at fence closure. Budget constraints did not allow for the full capture of the coho smolt run. A total of 2,029 coho affixed with a CWT were successfully released downstream in 2015 (out of 4,517 smolts or 45 % of the run to June 23rd, 2015). The 2014 age results, not presented in 2014 report, were available for this report. Scales from 545 coho smolts from 2014 were submitted to DFO for age analysis and of these, 374 scales were deemed readable (7.2% of the total run of 5,222 fish). The majority of the coho were 1-year old fish (74%; originating from the 2012 adult run of 2,691 fish), followed by 2-year old coho (26%; originating from the 2011 adult run of 1,422 fish). Based on previous years, 1-year-old smolts are most abundant, followed by 2-year-old smolts, then incidental 3-year-old smolts.

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 2015. GFA would also like to acknowledge the hard work of the GFA smolt fence staff whose dedication made the operations a success including: Les McLean, Earl McLean, Vern Russell, Phillip Johnson, Brenton Williams, Johnny Martin, Owen Russell, Morgan Douse, Mark Cleveland, Derek Kingston, Gregory Rush and Kevin Koch.

1. INTRODUCTION AND BACKGROUND

In this report, emigration (downstream flow) for the 2015 spring smolt run of anadromous sockeye (*Oncorhynchus nerka*) and coho (*O. kisutch*) salmon smolts and resident trout and char species passing through the KsF from Gitanyow Lake will be discussed. The 2015 smolt sampling season represents the 8th consecutive year that this project has been implemented.

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 often 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 spawning habitat destruction in the Kitwanga Watershed due to poor forest harvesting practices, which include sedimentation, 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). Annual KsF reports from 2009 to 2014 can be viewed on http://www.gitanyowfisheries.com/kitwanga-smolt-fence-enumeration .

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.

This report summarizes the results and findings for the KsF program in 2015.

2. METHODS

Counts at the KsF started on April 2nd, 2015 and continued until June 23rd, 2015. All of the aluminum components were installed then pulled from the river outside this period allowing free-flow of fish. 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 2).

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 2-6 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 daily 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: Completed aluminum weir installed in 2013 with new non-skid walkway and safety railings.

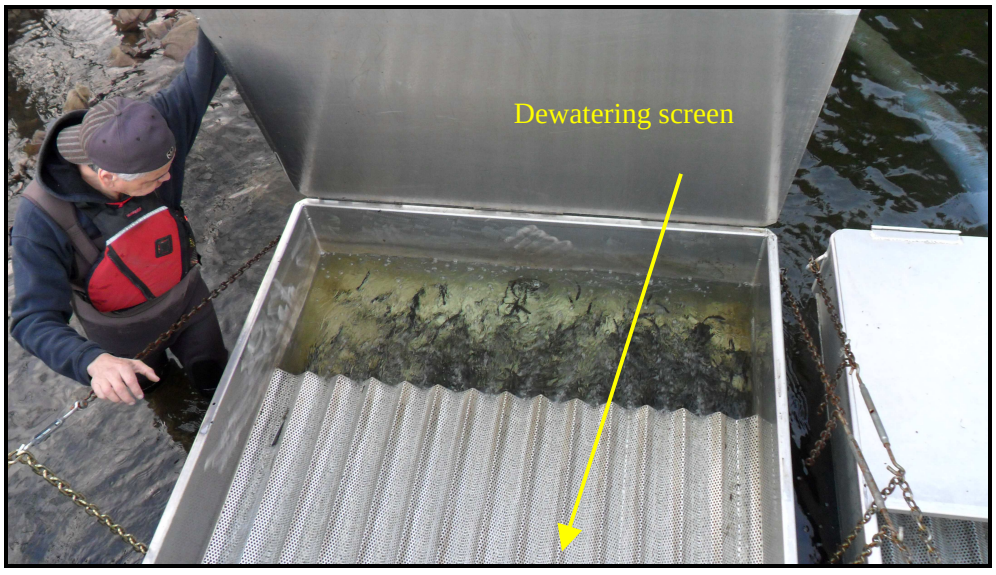

Figure 3: Photo of smolt trap box showing dewatering screen.

Figure 4: Photo of large holding boxes attached to smolt trap boxes with 6” hose.

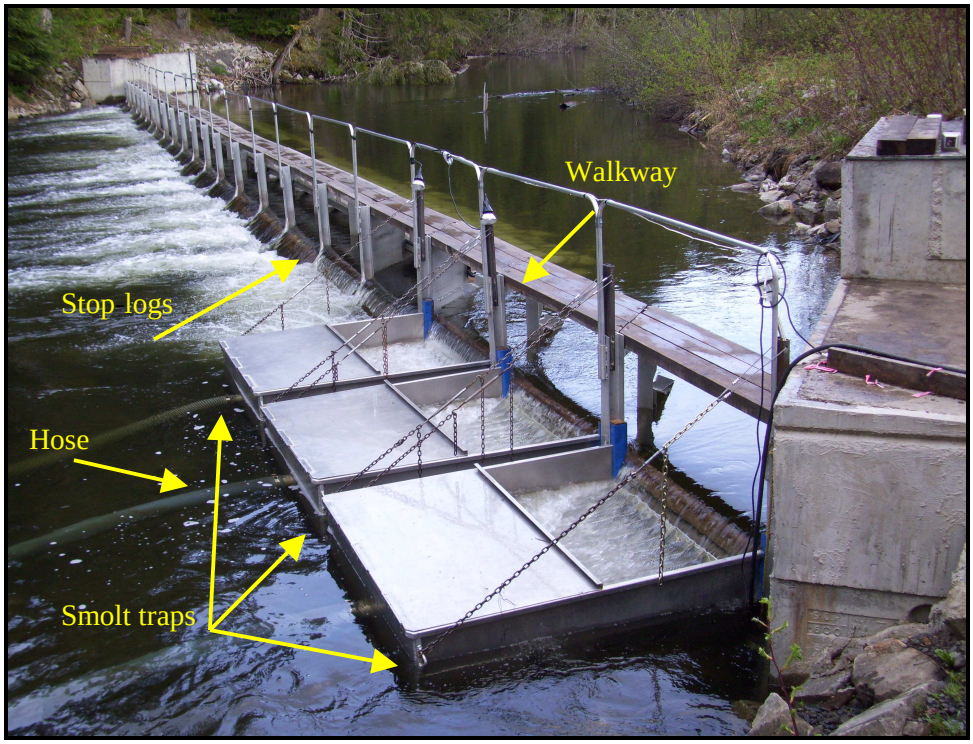

Figure 5: Photo of smolt fence installed showing smolt traps, 6” hose, stop-logs and walkway.

Figure 6: 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 half or more of all coho captured in 2015 were implanted with a CWT. In addition to tagging, scales were taken from approximately 14% of the run (623 out of 4,517 fish) for age determination. For all submitted age samples, 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 7 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 7: Photo of Coded Wire Tag (CWT) machine, Quality Control Device (QCD) and sampling station set-up.

2.2 Vaki Bioscanner unit (Vaki)

In March 2014, the GFA received funding from the Pacific Salmon Commission Northern Fund, which allowed us to purchase an electronic single-channel Vaki Bioscanner unit (Vaki) from PR Aqua Supplies Ltd. in Nanaimo, BC (See Figure 8 for trough design, digital counter, and instream operation). An aluminum stand and fish holding basin were fabricated to hold the Vaki. In April 2014, the Vaki was secured to a wooden floating platform and tested during the regular smolt enumeration program. The Vaki consists of an electronic control unit, V-channel and scanner. The control unit gathers and displays data from the scanner. The control unit also supplies power to the scanner. The V-channel regulates the flow of fish and water, and separates the fish through the scanner, making it possible to count them. The scanner counts the fish as they pass through the V-channel, and relays data to the control unit via the connector lead. The Bioscanner is very gentle as no mechanical parts touch the fish when counted, and the fish are in water at all times (Kingston 2014).

A water source was attached to the Vaki, which supplied a flow rate of 5.0 – 6.5 Liters/minute and was powered by a gas powered generator. Smolts were placed into the holding basin of Vaki

and allowed to swim down the V-channel at their leisure. As the fish come out of the holding basin they are close together, therefore require separation to be counted accurately. The V-form ensures that the fish cannot turn around, and also that they are not crowded together. The curved form accelerates the fish down the channel. If two fish are close together in the beginning the one that is little bit ahead will accelerate faster and this causes a separation of the fish (Kingston 2014).

Once the fish swim down the V-channel they are dropped into a holding bucket with water. When approximately 100 fish have been logged through the control unit a manual count is performed to calibrate the accuracy of the unit. Several accuracy calibrations are completed at the start of each day to make sure the unit is accurately counting smolts. Once several calibrations have been completed the control unit is re-zeroed and the smolts are placed into the holding basin 20-30 at a time until all smolts have been run through the Vaki (Kingston 2014).

Figure 8: Photo series of the Vaki Bioscanner trough design, digital counter, and instream operation.

3. RESULTS

Five species of salmonids were enumerated through the KsF between April 2nd and June 23rd, 2015: sockeye and coho salmon, cutthroat (*Oncorhynchus clarkii*) and rainbow (*O. mykiss*) trout and bull trout char (*Salvelinus confluentus*; Table 1). Sockeye smolts were stratified into 1 and 2 year old fish based on visual observations in the field. Dolly Varden char (*Salvelinus malma*) 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 mountain whitefish (*Prosopium williamsoni*, 133 fish), sculpin (*Cottidae sp*., 4,046 fish), northern pikeminnow (*Ptychocheilus oregonensis*, 50 fish), and redside shiner (*Richardsonius balteatus*, 10 fish).

Table 1: Number of fish by salmonid species (salmon/trout/char) counted through the KSF from April 2nd and June 23rd, 2015.

1-YR Old SX	2-YR Old SX	Total Sx Smolts	Total Coho Smolts	CT	Adult BT (> 300mm)	Juv. BT (< 300mm)	RBT
12,063	102	12,165	4,517	492	278	267	97

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 Sockeye Salmon

3.1.1 Sockeye Run Timing

In 2015, 12,165 sockeye smolts were counted migrating downstream though the KsF. The first sockeye smolt was counted on April 4th and the last on June 7th (Table 2). The peak run of 4,114 sockeye smolts occurred on May 2nd when 34% of the entire run migrated past the KsF on that day. This is comparable to previous years when peak runs generally occur in the 1st or 2nd week of May (Figure 9). The midpoint of the run occurred on May 20th and is also comparable to previous years results. Approximately 99% of the sockeye smolts migrated through the weir in a 24-day period from April 18th to May 11th, 2015, which is also comparable to previous years. Based on the above, the KsF was operational essentially during the entire sockeye smolt run.

Table 2: 2015 sockeye run timing highlights compared to 2001 to 2014 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
2014	April 12th	June17th	May 2nd	May 20th
2015	**April 4th**	**June 7th**	**May 2nd**	**May 5th**

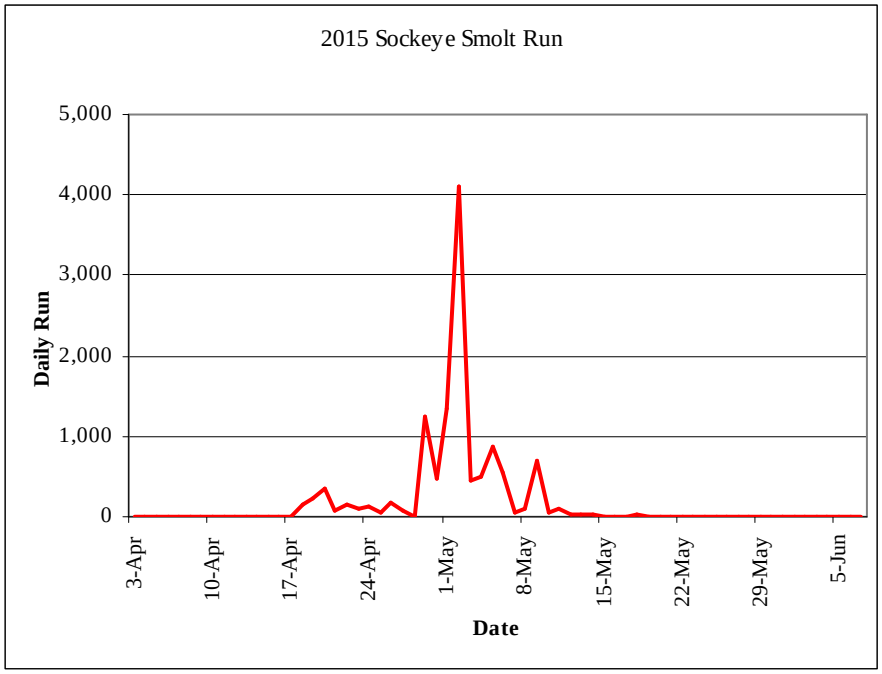

Figure 9: Daily run timing for sockeye smolt emigrating through the KsF in 2015 (n=12,165).

3.1.2 Sockeye Age and Size Structure

Scales from 550 sockeye smolts were submitted to Birkenhead Scale Analyses for age analysis and of these, 511 fish were deemed readable (4.2% of the total run). A total of 505 smolts were identified as 1-year-old fish (99% of the sample) and 6 smolts were identified as 2-year-old fish. The 2015 mean length of 1-year-old smolts (112 mm) and weight (13.5 g) was the largest mean size recorded since 2008 at the KsF (Tables 3 and 4). Fork length distribution for 1-year-old smolts, grouped into 5mm intervals, was unimodal with the majority of fish falling into the 110 - 115 mm length class (Figure 10). Two-year old smolts (n=6) averaged 157mm (ranged from 147 to 177mm) and 39g (ranged from 32.9 to 51.6g).

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 2015 results (112mm, 13.5g) and averages from 2008 to 2015 (105mm, 11.2g) compares to Babine Lake (79mm, 4.9g), Cultus Lake (82mm, 6.2g), and Chilko Lake (82mm, 6g).

Table 3: Length and weight statistics for 1-year-old sockeye sampled in 2015 (n=505).

Statistic	Length (mm)	Weight (g)
Mean	112.0	13.5
Standard Error	0.26	0.10
Median	112	13.5
Mode	115	13.7
Standard Deviation	5.74	2.17
Sample Variance	32.94	4.72
Kurtosis	-0.14	-0.23
Skewness	-0.31	0.05
Range	32	11.8
Minimum	94	7.2
Maximum	126	19
Count	505	505
Confidence Level (95.0%)	0.50	0.19

Table 4: 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
2014	444	104.1	80 / 124	11.0	5.7 / 18.8
2015	505	112.0	94/126	13.5	7.2/ 19.0
Average 2008 - 2015		**105.3**	**64 / 151**	**11.2**	**2.3/ 32.7**

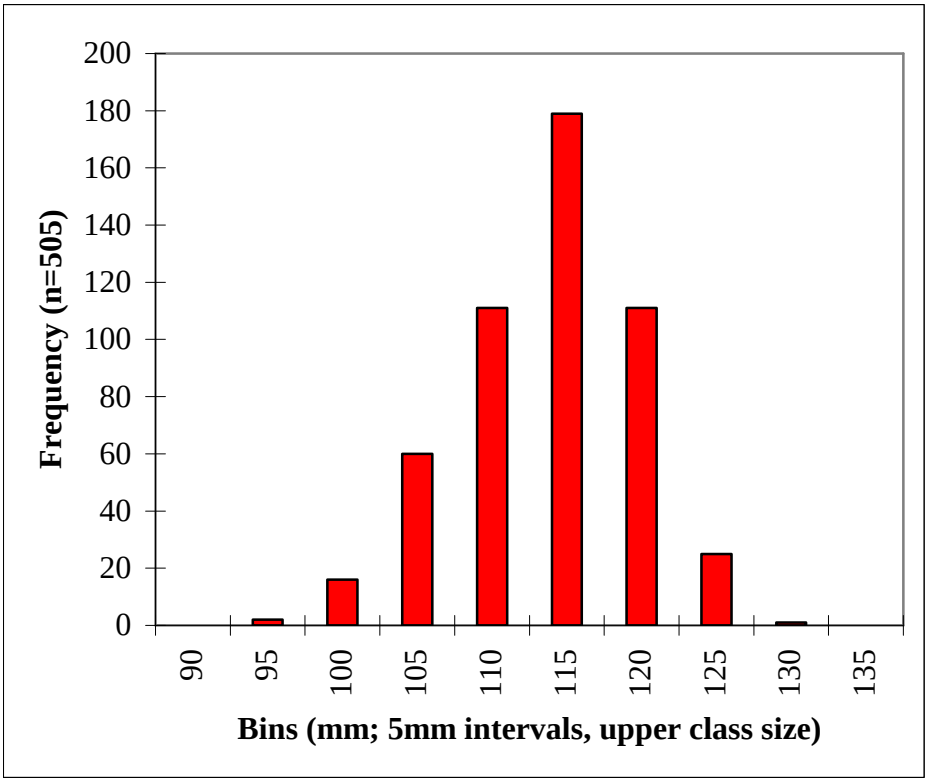

Figure 10: Length distribution (5mm class intervals) for 1-year-old sockeye sampled in 2015 at the KsF (n=505).

3.1.3 Sockeye Smolt Population Estimates and Smolt Production

A total of 12,165 sockeye smolts were counted in 2015 and was considered a complete account of the run (Table 5). The 2015 smolt run was the lowest recorded since 2008, and was 91% below the 2008 to 2014 running average of 142,094 smolts/year at the KsF, however this average is skewed by the record 2012 count of 400,907 smolts. The running average since 2008 now stands at 125,350 smolts/year. KsF counts prior to 2008 can be found in http://www.gitanyowfisheries.com/kitwanga-smolt-fence-enumeration .

In 2015, an estimated average of 44 smolts were produced per female spawner (Table 6). This estimate was generated by dividing the total number of 1-yr old smolts produced in 2015 by the number of adult females that escaped to the river and presumed to have successfully spawned in 2013 (828 total spawners x 0.33 female ratio = 273 females; McCarthy 2014). The 2015 Kitwanga smolt production was the third lowest recorded since 2008.

Table 5: Kitwanga River sockeye smolt population estimate from 2008 – 2015.

Year	Total Smolts Captured	2-Yr. Old Smolts	Hatchery Smolt Population Estimate	Wild Smolt Population Estimate
2008	229,026		2,753	**226,273**
2009	36,554	311	1,273	**35,281**
2010	113,068	24	--	**113,068**
2011	83,854	137	--	**83,854**
2012	400,907	91	--	**400,907**
2013	84,294	65	--	**84,294**
2014	46,955	42	--	**46,955**
2015	12,165	92	--	**12,165**

Table 6: Sockeye smolt production in 2015 compared to results from the KsF from 2008 to 2015.

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
2014	46,955	2,574	18
2015	**12,165**	**277**	**44**
Average	**125,291**	**2,366**	**94**

3.1.4 Vaki Bioscanner Results

The Vaki Bioscanner was used in 2015 to assist the crew in counting sockeye smolts during their peak run period. Due to the low 2015 smolt run this scanner was only needed for 2 days. Based on previous years, peak runs may exceed 10,000+ sockeye/day, therefore the Vaki Bioscanner will be of value during future smolt runs. As noted above, the low 2015 smolt run was mainly due to a low 2013 adult return and smolt counts could likely increase in 2016 from the 2014 return of about 13,700 returning adults and again in 2017 from the 2015 return of about 4,500 returning adults.

3.2 Coho Salmon

3.2.1 Coho Run Timing

In 2015, 4,517 coho smolts were counted migrating downstream though the KsF. The first coho smolt was counted on April 8th and the last on June 23rd when operations ceased (Table 7; Figure 11). The KsF ceased operations when coho smolts were still passing through in double and triple digit numbers, therefore did not capture the entire run. This was due to budget constraints and successfully achieving the primary goals of capturing the entire sockeye smolt run and implanting coho smolts with a CWT for adult tracking purposes.

Two peak runs of coho smolts were observed on June 2nd (446 fish) and June 6th (311 fish), which can be considered normal. Daily counts of 100+ fish began on May 18th and continued in approximately the 100-400 fish/day range until closing.

Table 7: 2015 coho run timing highlights compared to 2009 to 2014 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
2014	April 25th	N/a	June 17th and 20th	N/a
2015	**April 8th**	**N/a**	**June 2nd and 6th**	**N/a**

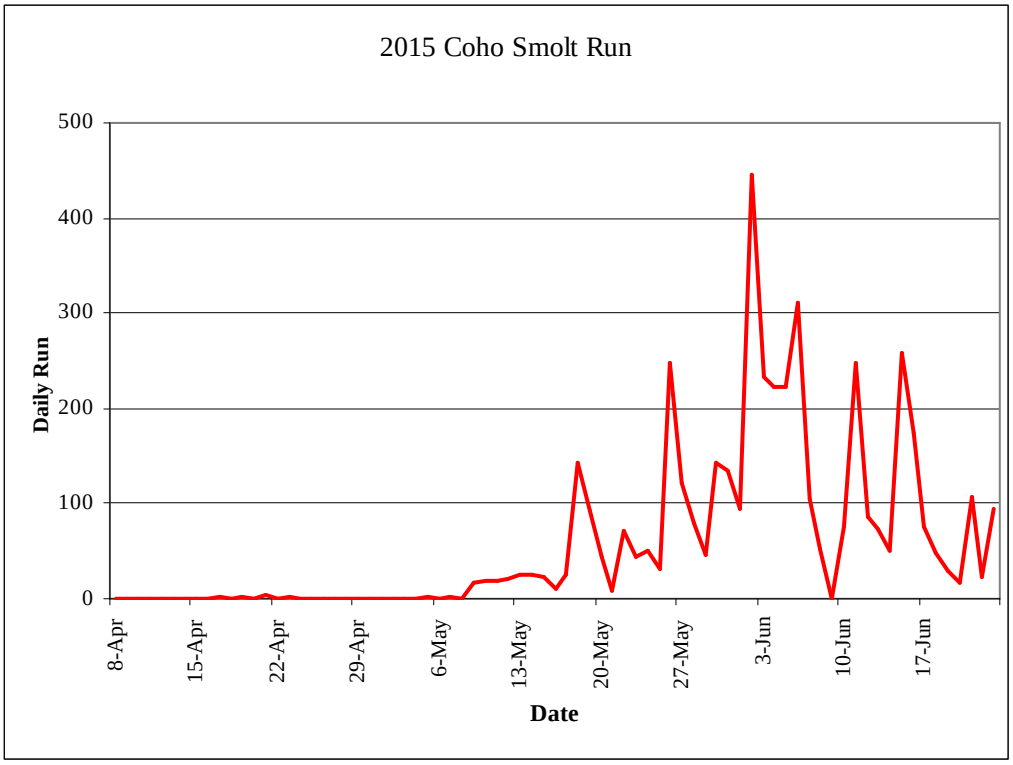

Figure 11: Daily run timing for coho smolt emigrating through the KsF in 2015 (n=4,517).

3.2.2 Coho Age and Size Structure

Scales from 623 coho smolts from the 2015 run were submitted to DFO for age analysis, however unfortunately results were not available in time for this report and will be presented in the 2016 Annual Report. The 2014 age results, not presented in 2014 report, were available for this report. Scales from 545 coho smolts from 2014 were submitted to DFO for age analysis and of these, 374 scales were deemed readable (7.2% of the total run of 5,222 fish; Table 8). The majority of the coho were 1-year old fish (74%; originating from the 2012 adult run of 2,691 fish), followed by 2-year old coho (26%; originating from the 2011 adult run of 1,422 fish). Based on previous years, 1-year-old smolts are most abundant, followed by 2-year-old smolts, then incidental 3-year-old smolts.

Table 8: 2014 coho smolt age results.

European	**`Gilbert-Rich**	**Brood Yr.**	**Frequency**	**Percent**
20	33	2011	96	25.7%
10	22	2012	278	74.3%
Total			374	100%

The 2015 mean length (132mm) and weight (24.4g) for the entire 544 fish sample was comparable to that found in previous years at the KsF (Tables 9 and 10). Fork length distribution for coho, grouped into 5mm intervals, was unimodal with the majority of fish falling into the 125-135mm length class (Figure 12).

Table 9: Length and weight statistics for coho smolts sample in 2015 (n=544).

Statistic	Length (mm)	Weight (g)
Mean	133.7	26.0
Standard Error	0.61	0.45
Median	132	24.3
Mode	130	22.2
Standard Deviation	15.32	11.29
Sample Variance	234.83	127.45
Kurtosis	10.70	43.23
Skewness	2.24	5.29
Range	142	138
Minimum	98	11.1
Maximum	240	149.1
Count	621	621
Confidence Level (95.0%)	1.21	0.89

Table 10: Coho smolts mean fork lengths and weights from 2009 to 2015.

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
2014	544	131.7	85 / 228	25.1	6.1/ 114.2
2015	621	133.7	98 / 240	26.0	11.1/ 149.1

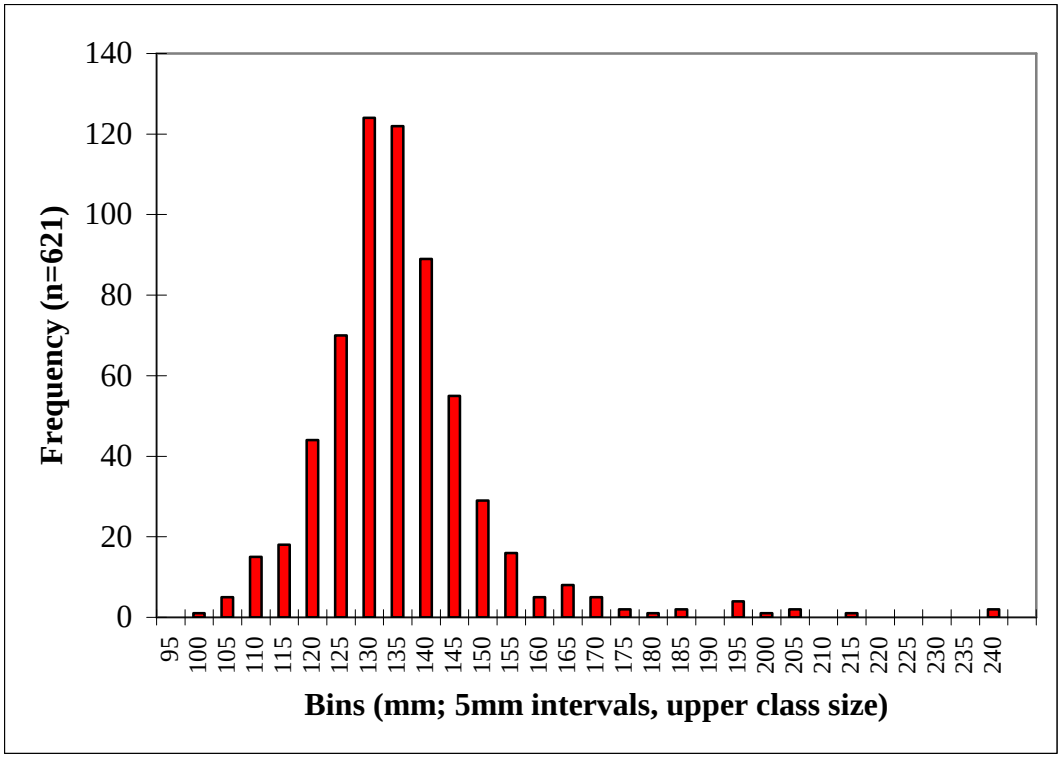

Figure 12: Length distribution (5mm class intervals) for coho sampled in 2015 at the KsF (N=544).

3.2.3 Coho Wire Tag Program

A total of 2,029 coho affixed with a CWT were successfully released downstream in 2015 (out of 4,517 smolts or 45 % of the sample; Table 10). This CWT total takes into account tag loss and mortality.

Table 11: Coho CWT estimates for tag mortality, tag loss, and total CWT's released in 2015 at the KsF.

CWT Tag Group	Tag Loss # (%)	Mortality # (%)	Tag Loss + Mortality %	Sample Size	# Coho Tagged (Corrected for tag loss and mortality)
A08 D03/60	26 (3.0%)	12 (1.4%)	4.40%	872	2,029

3.3 Run Timing of Other Species

The cutthroat emigration through the KsF (492 fish) was relatively condensed within a 24-day period from April 17th to May 10th (338 fish or 69% 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.

4. DISCUSSION AND RECOMMENDATIONS

Since 2008, GFA has accurately enumerated sockeye smolts migrating out of Gitanyow Lake at the KsF for the past eight 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 along with the KSEF is the highest assessment priorities currently undertaken by GFA in the Kitwanga Watershed.

Sockeye run timing spread, peak run date, and size and age distribution was similar to previous years. The 2015 sockeye smolt population estimate was 12,165, which were comprised almost exclusively of 1-year-old smolts. The 2015 smolt run was the lowest recorded since 2008, and was 91% below the 2008 to 2014 running average of 142,094 smolts at the KsF. This low smolt run and low freshwater production is of concern to GFA. The 2015 Kitwanga sockeye freshwater production estimate from Gitanyow Lake was 44 sockeye smolts were produced per adult female from the 2013 brood year (273 females), which remains low compared to previous years. Kitwanga 1-year-old smolts were on average the largest size recorded since 2008 and continue to be relatively larger in both length and weight compared to the size of 1-year-old smolts from three other high-profile BC sockeye producing lakes (Babine, Cultus, and Chilko Lakes; Groot and Margolis 1991).

As in most years, the majority of coho smolts were 1-year old fish (1-year post-hatch in Gitanyow Lake). 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. GFA will resume this worthwhile program in 2016 where the plan is to mark most of the coho smolts in order to obtain sufficient numbers of recoveries from marine fisheries and escapement through the KSEF thereby estimating an exploitation rate.

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Appendix 1

Letter from Carol Lidstone of Birkenhead Scale Analyses regarding 2015 sockeye smolt aging results

Birkenhead Scale Analyses

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February 4, 2016

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Re: 2015 Kitwanga River Smolt Sockeye Scale Analysis

Hi Derek,

Attached is the analysis for the sockeye smolt scales collected from the Kitwanga River from April 20 - May 12, 2015. The updated version of the Excel file includes the scale age, condition code, circuli counts, location of freshwater stresses, and relevant comments.

The total sample size is 550 sockeye, mounted on 22 books. Of the 22 books, 11 have been fully analyzed to include age, circuli counts, location of freshwater stress and relevant comments. The other 11 books have been 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. Please see the inventory sheet on the Excel file which shows which books are fully and partially analyzed.

Of the 550 fish sampled, 18 are unreadable as follows:

Condition Code:

5 Lateral Line n= 4 (although 2 of these are readable enough to confirm the scales exhibit the typical Kitwanga growth pattern of a 1 year old).
7 Unreadable (grooved side facing down, smooth side up) n = 11
8 Missing n= 1
9 Regenerated n = 2

Of the 532 readable scales, 525 are age 1 (98.7%) and 7 are age 2 (1.3%). None of the scales in this sample exhibit plus growth.

Age One Sockeye (n=525): Lengths range from 94 - 126 mm; weights range from 7.2 - 19.0 grams. The 18 unreadable samples that have corresponding length and weight data range from 100 - 123 mm, and 11.4 - 18.1 grams, respectively.

Circuli counts are provided for 257 of the age 1 smolts. All of the scales exhibit the typical Kitwanga freshwater stress, including the 268 sockeye that were partially analyzed. As usual, the freshwater stress ranges from moderate to strong.

Of the 257 age 1 samples, the circuli counts from the focus to the freshwater stress range from 6 -15, stress to annulus 6 - 16, for a total circuli count of 16 - 26.

Age Two Sockeye (n=7): Lengths range from 147 - 177 mm; weights range from 31.4 – 51.6 grams. They all exhibit similar growth patterns in the first year with small growth for Kitwanga sockeye, the absence of a freshwater stress, and circuli counts ranging from 8 to 11. The second year growth includes 3 samples with one freshwater stress, and 4 samples with two freshwater stresses; with the 2nd year circuli counts ranging from 17-23. The total circuli counts for the age 2 sockeye range from 27-34.

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