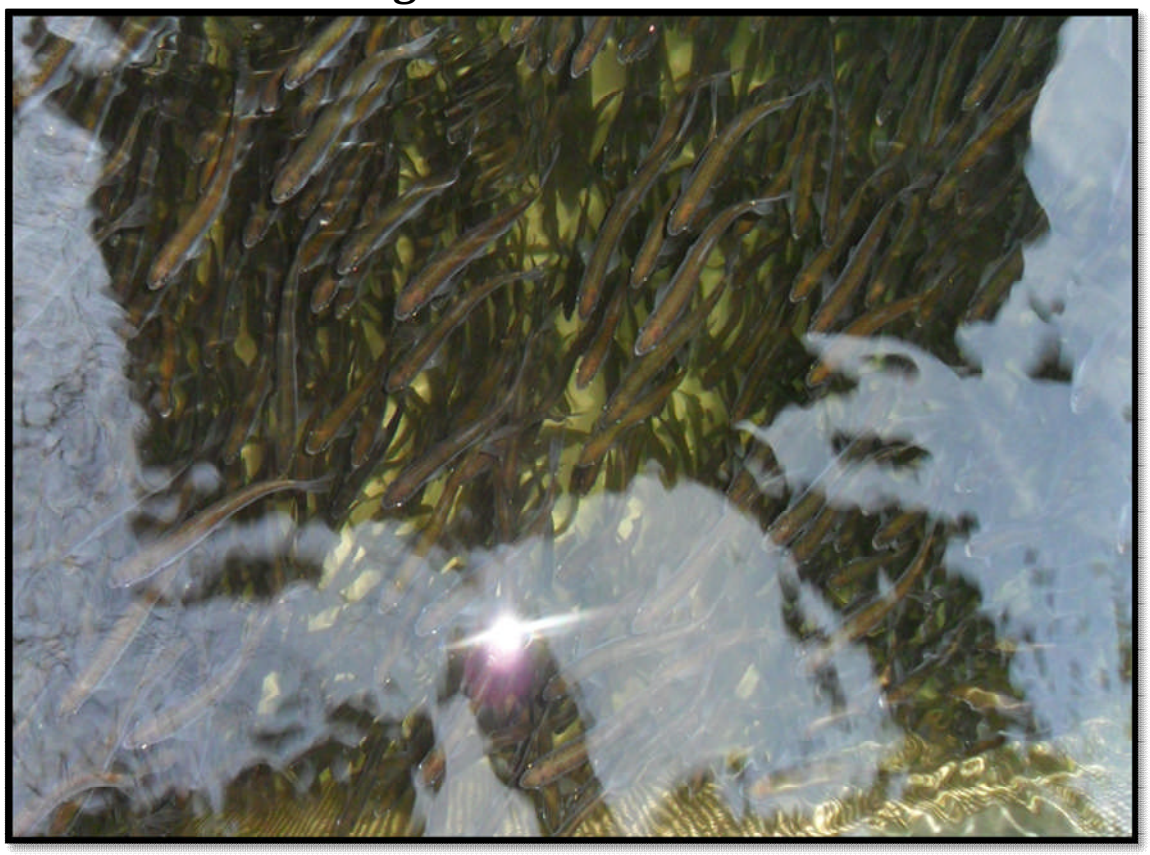
Gitanyow Fisheries Authority

The 2012 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 2012, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Smolt Enumeration Facility (KsF) for the 5th consecutive year to enumerate sockeye salmon smolts, coho salmon smolts and other resident trout and char species. The KsF was operated from April 13th to June 9th, 2012. The 2012 sockeye smolt population estimate was 400,907 and was comprised mostly of 1-Yr old smolts (96.0%). The timing of the sockeye smolt run was quite compressed with over 98% of the run migrating past the KsF in a two week period from May 2nd to May 16th. Freshwater production estimates for Gitanyow Lake in 2012 were estimated at 41 sockeye smolts per female spawner, the lowest production recorded since the GFA started enumerating smolts at the KsF in 2008.

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 2012. 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 2012, GFA staff members included: Les McLean, Earl McLean, Vern Russell, Phillip Johnson, Brenton Williams, Scott Williams, Eric Hill, Kevin Koch, Mark Cleveland, Gregory Rush and Derek Kingston.

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1.0 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 (Cleveland, 2005). However, by the 1920's the Elders talked of the noticeable declines in the returns of the Kitwanga sockeye stock (Cleveland, 2005). 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).

A definite answer as to why the Kitwanga sockeye stock declined has not been determined but several factors are suspected to have contributed to the decline. One of the largest contributors to the decline is believed 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 that have likely contributed to the declines are linked to sockeye habitat destruction in the Kitwanga Watershed due to poor forest harvesting practices. Specific habitat impacts include the sedimentation of spawning beds the disruption of water flow patterns and changes in water quality of Gitanyow Lake tributary streams (Cleveland, 2006).

Historical DFO salmon escapement data system (SEDS) records for Kitwanga sockeye are incomplete and somewhat unreliable; therefore the determinations of accurate historical escapements are not possible.

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 health and abundance of Kitwanga sockeye salmon smolts emigrating from Gitanyow Lake (Cleveland et al., 2006).

From 2000 to 2007, GFA experimented with different weir and trap designs in an effort to accurately enumerate Kitwanga sockeye smolts on a yearly basis (Williams et al. 2002, McCarthy 2005, Kingston 2006 & Koch 2008). For the most part, these trap designs were deemed unusable on the Kitwanga River because they were often rendered inoperable during high water when many of the smolts migrated out of Gitanyow Lake.

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 fence was named the Kitwanga River Smolt Enumeration Facility (KsF).

The KsF was rendered operational in April, 2008 and has been used annually to enumerate all sockeye emigrating from Gitanyow Lake. Since 2009, GFA has also monitored coho smolt abundance through the KsF and have initiated a coho coded wire

tagging (CWT) program. Other resident trout and char species are opportunistically monitored at the site for general biological reasons.

In 2008 & 2009 the KsF was also 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 & Cleveland, 2009).

In the spring of 2012, the GFA operated the KsF to enumerate salmon smolts and other resident trout and char species. The 2012 smolt sampling season represents the fifth consecutive year that this project has been implemented at the KsF. Unfortunately the GFA did not operate the coho CWT program in 2012 due to budgeting constraints but plan to re-establish the program for the 2013 sampling season.

2.0 Introduction

The KsF plays a critical role in allowing the 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.

In 2009, the GFA began implanting emigrating coho smolts with CWT's (Kingston, 2010). Returning adult coho that have been implanted with a CWT are recovered in Alaskan and Canadian fisheries and at the Kitwanga River Salmon Enumeration Facility (KSEF). Tag recovery information helps fisheries managers determine coho survival rates and fisheries specific exploitation of yearly cohorts, which are assumed to be representable for all Skeena coho stocks with similar life history traits.

Since the establishment of the KsF in 2008, the GFA have been able to successfully enumerate sockeye smolts, coho smolts and other resident trout species under high water events with no interruptions.

In 2012, 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 enumeration results and findings for the KsF program in 2012.

3.0 Methods

Installation of the KsF started on April 9th, 2012 and the smolt facility was rendered operational on April 13th, 2012 when the final components were connected to the concrete sill. The smolt-sampling period continued until June 9th, 2012 when all of the aluminum components were pulled from the river. 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 consisted of an aluminum 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.

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 funnelled the smolts into a small holding box where they remained trapped (Photograph 1). 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 (Photograph 2). In 2012, the KsF consisted of three smolt traps that were connected to three large holding boxes. A temporary wooden walkway and aluminum railings were secured to the top of the transoms to allow GFA technicians access to the smolt traps and to clean the fence with ease (Photograph 3). 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 (Photograph 3). 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.

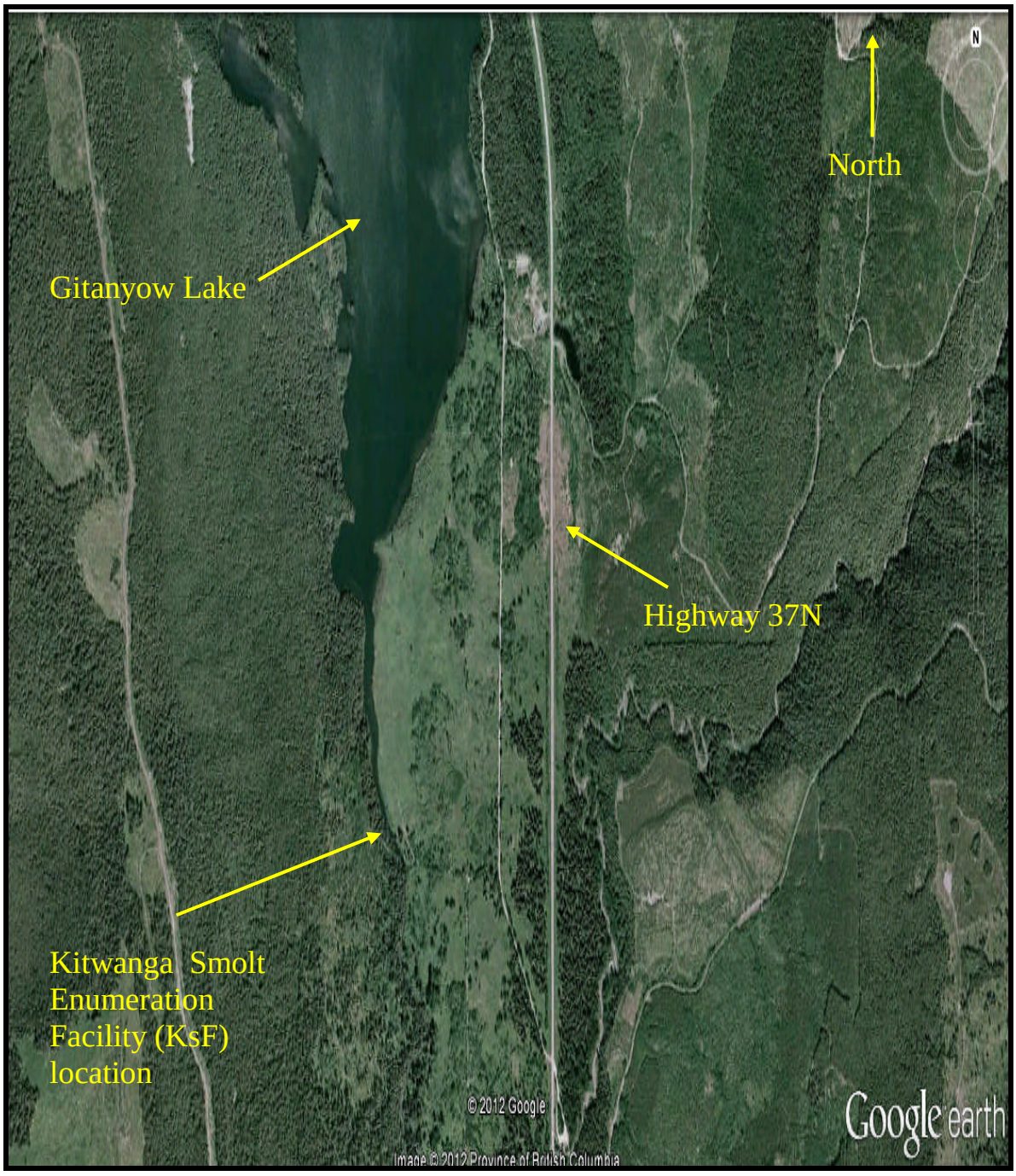
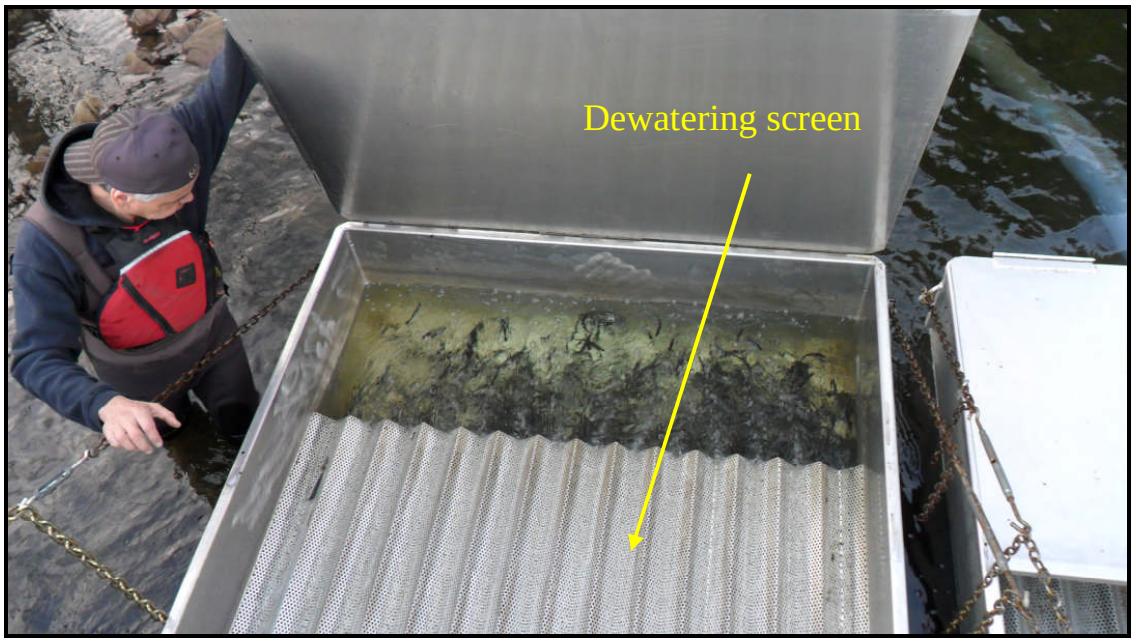
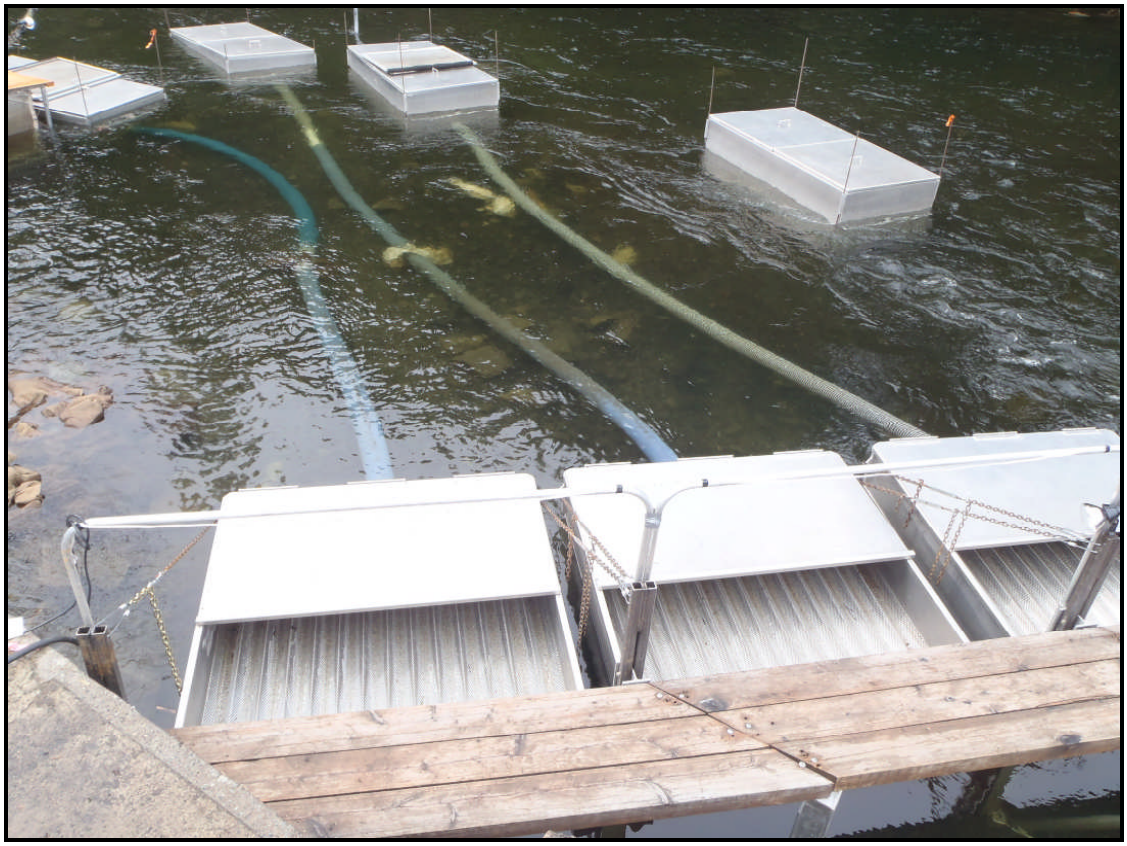


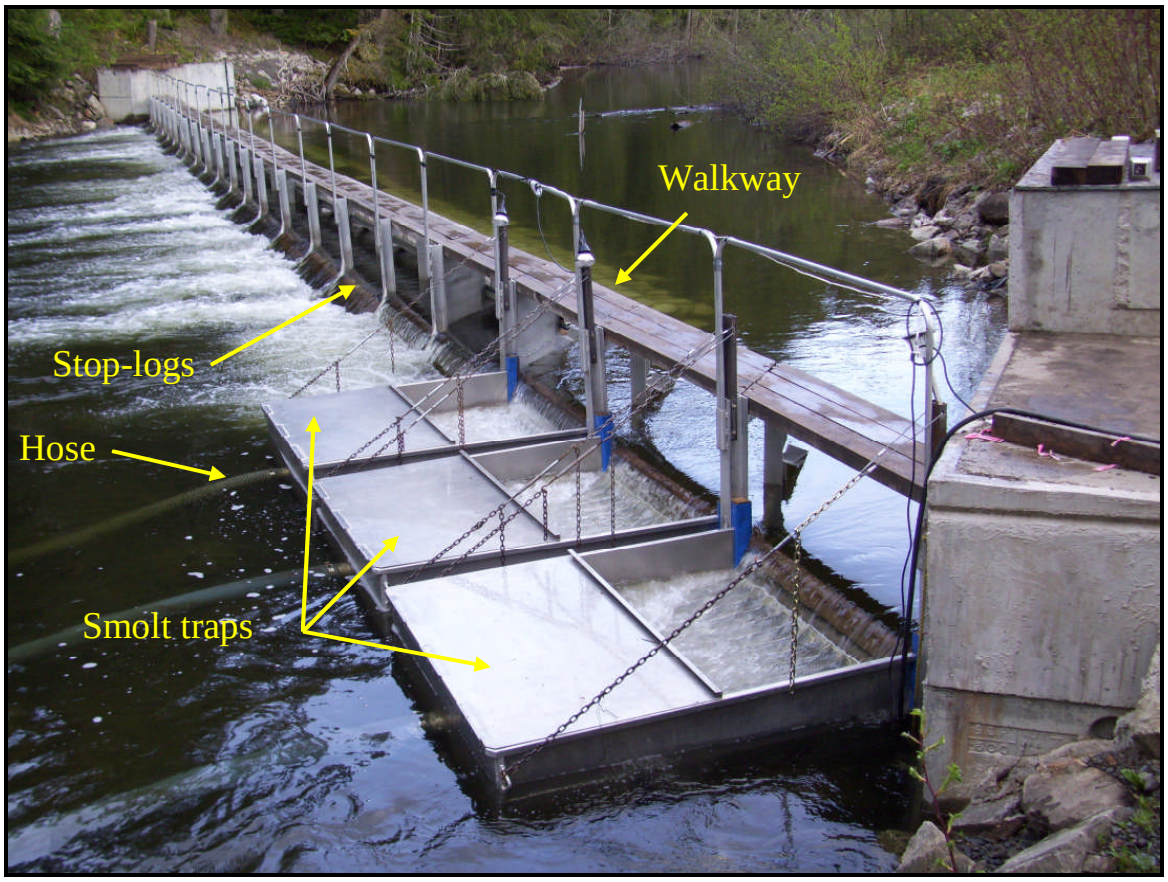
Figure 1. Location of the Kitwanga River Smolt Enumeration Facility (KsF) showing reference to Gitanyow Lake outlet and Highway 37N (Image supplied from www.googleearth.com).



Photograph 1. Smolt trap box showing dewatering screen.



Photograph 2. Large holding boxes attached to smolt trap boxes with 6” hose.



Photograph 3. Smolt fence installed showing smolt traps, 6" hose, stop-logs and walkway.

Scales samples were taken for sockeye and coho smolts for aging purposes and sent to Birkenhead Scale Analysis in the post-season to be aged. Environmental conditions such as water levels, water temperatures, weather conditions and air temperature were recorded at the KsF on a daily basis.

The vast majority of sockeye smolts that migrate out of Gitanyow Lake have been documented to move downstream at dusk and early evening. Therefore, all sockeye smolts that were caught and sampled during the morning shifts were held until dusk before being released downstream of the weir and allowed to continue on their journey to the ocean. Smolts were held in three large 8' X 4' X 4' covered aluminum boxes, so that predators couldn't access them prior to being released at nightfall (Photograph 4). A portion of the cutthroat trout and bull trout caught at the KsF were also sampled for lengths, weights and scales. All the other fish species caught in the weir were documented.

On the high smolt capture evenings where the nightly smolt numbers exceeded 20,000 plus sockeye the night crews would dipnet a portion of smolts out of the holding boxes and release them downstream because the smolt density in the boxes was too great and it was thought that these high densities could cause mortality. The following day net calibration tests were conducted to estimate the number of smolts that the dipnet could

accommodate. The sockeye smolt population was estimated by adding the total daily catch from each of the three smolt traps plus the estimated population of smolts from the dipnet samples, which only occurred on May 9th, 2012.

Photograph 4. Smolt holding box with captured sockeye smolts.

4.0 Results and Discussion

4.1 Smolt Migration Timing

In 2012, the GFA successfully implemented the Kitwanga River smolt enumeration program for the 5th consecutive year. The first sockeye smolt was enumerated on April 26th and the last on June 7th, 2012 (Table 1). The midpoint of the run occurred on May 17th and the peak of the emigration occurred on May 9th, 2012 where 22.6% of the entire run migrated past the KsF in one day (Figure 2). Approximately 98% of the sockeye smolts migrated through the weir in a two-week period from May 2nd to May 16th, 2012. The peak of the 2012 migration was approximately 3 days earlier than the 2001-2011 average of May 12th (Table 1). The midpoint of the 2012 run was approximately 5 days earlier than the 2001-2011 midpoint average of May 22nd (Table 1).

Table 1. Kitwanga sockeye smolt run timing table showing start, end, peak, and midpoint from 2001 to 2012.

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
Average 2001 - 2011	**April 25th**	**June 16th**	**May 12th**	**May 22nd**

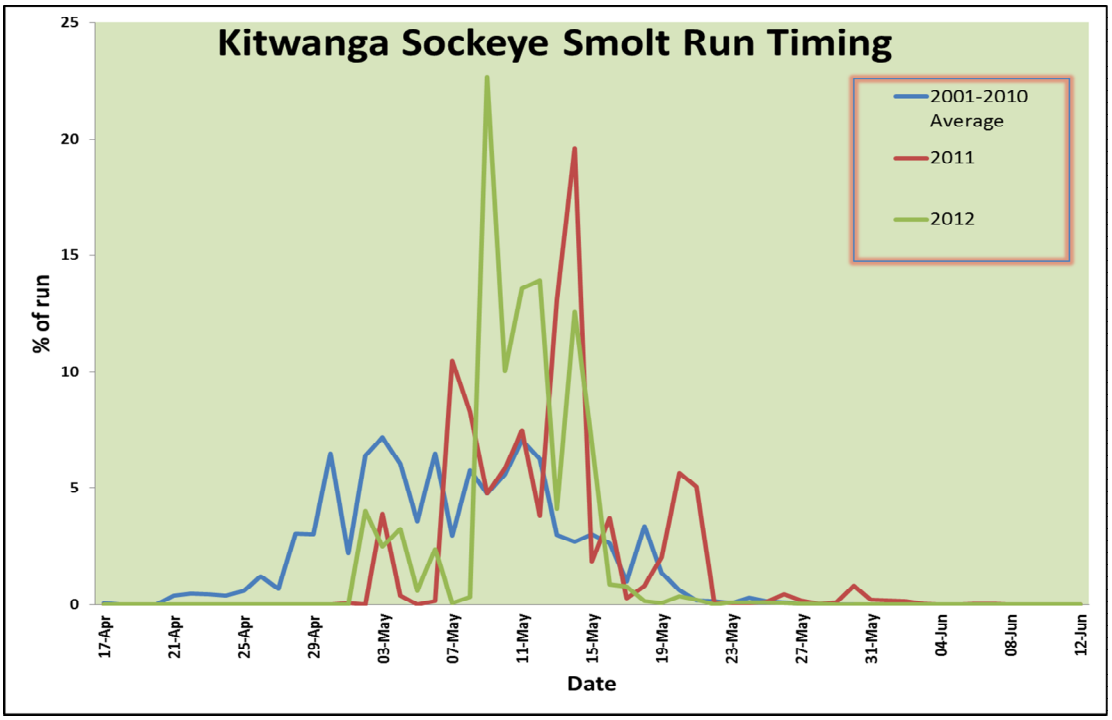


Figure 2. Kitwanga sockeye smolt run timing average (2001-2010) compared to 2011 and 2012.

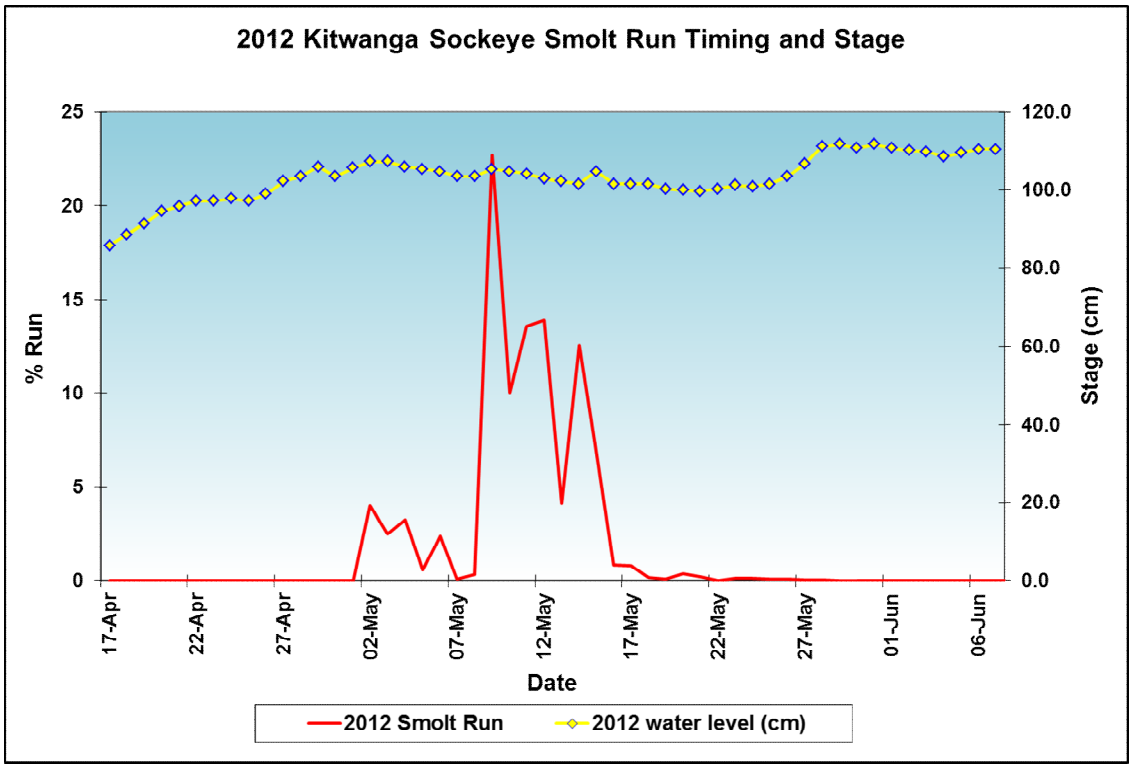


Figure 3. 2012 Kitwanga sockeye smolt run timing at the KsF and associated water stage.

A total of 4,459 coho smolts were enumerated through the KsF in 2012. The first coho smolt was enumerated on April 25th, 2012 and the last on June 8th, 2012. The peak of the coho run occurred on May 28th, 2012 where 11.3% of the run migrated past the KsF (Figure 4). The midpoint of the 2012 coho run occurred approximately 8 days earlier than the 2009-2011 midpoint average (Table 2). When comparing the timing of the 2012 Kitwanga coho smolt run with water stage it appears that most of the coho migrated when water levels were at peak flows (Figure 5).

Table 2. Kitwanga coho smolt run timing table showing start, end, peak, and midpoint from 2009 to 2012.

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
Average 2009 – 2011	**April 22nd**	**June 1st**	**June 7th**	**May 26th**

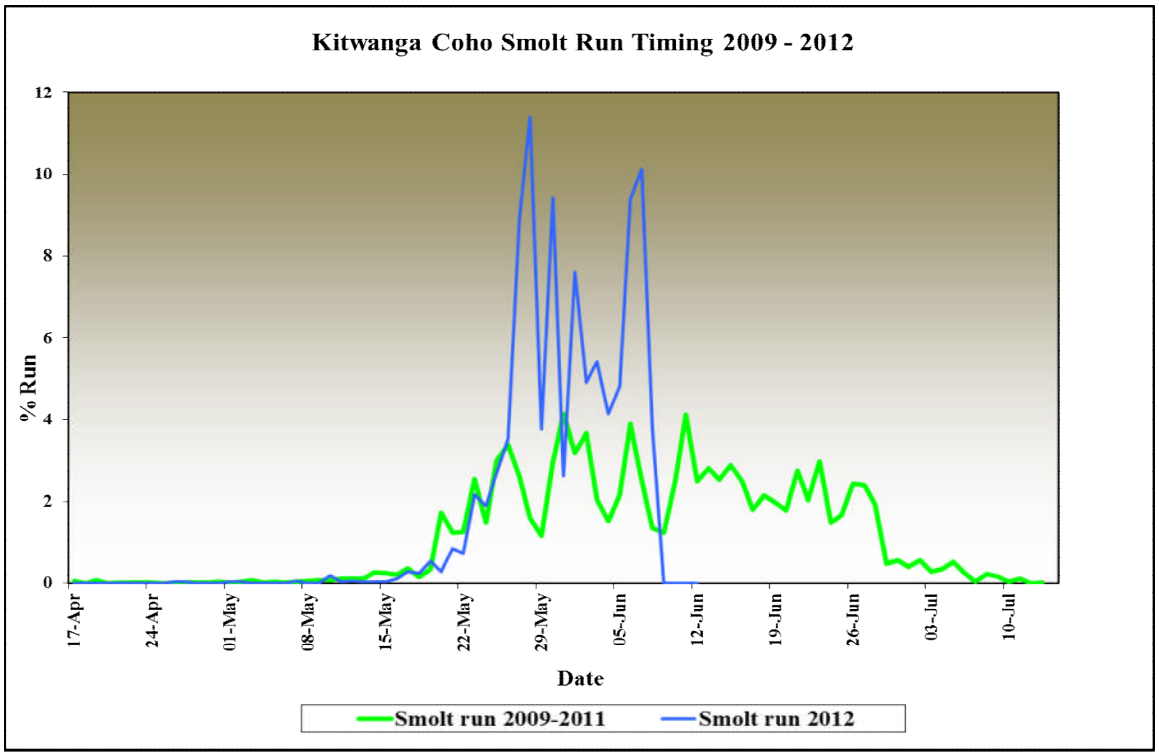


Figure 4. Kitwanga coho smolt run timing at the KsF from 2009 to 2012.

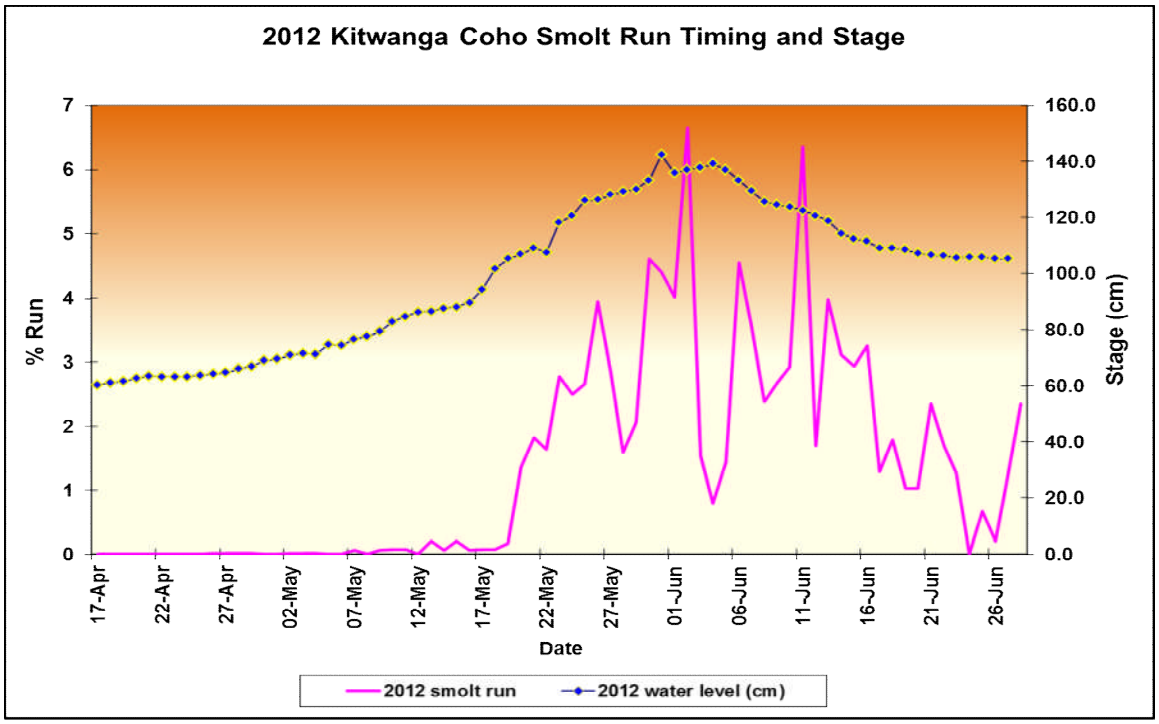


Figure 5: 2012 Kitwanga coho smolt run timing at the KsF and associated water stage.

4.2 Age Structure

Sockeye Smolts

In 2012, a total of 734 sockeye smolt scale samples were analysed for age composition. Approximately 96.0% of the sockeye smolts were aged as 1.0 year-old smolts originating from the 2010 broodyear (Table 3). All one year-old scales examined in 2012 exhibited a freshwater stress; the location of the stress varied but was usually found within the 5th and 17th circuli. The total number of circuli in the first year of growth ranged from 10 to 23 (Appendix 1). Plus growth was observed on 12 of the 1.0 year-old samples, which started on May 22, 2012 and ranged from 2-3 circuli (Appendix 1.) Age 2.0 smolts accounted for 2.5% and Age 3.0 smolts accounted for 1.5% of the sample (Table 3).

Table 3. Summary of 2012 sockeye scale analysis conducted by Carole Lidstone of Birkenhead Scale Analyses.

Sample Date	Sockeye Smolt	European Age	Gilbert-Rich Age	Brood Year	Frequency	Percentage
April - June 2012	Wild	1.0	22	2010	704	96.0
	Wild	2.0	33	2009	18	2.5
	Wild	3.0	44	2008	12	1.5
				Total	**734**	**100%**

Coho Smolts

In 2011, a total of 456 coho smolt scales were collected and sent to the Pacific Biological Station (PBS) for aging. At the time of printing the 2011 Kitwanga River Salmon Smolt report the coho scales had not yet been analyzed, therefore aging results are being presented in this year's 2012 Kitwanga River Salmon Smolt report. In 2011, a total of 456 coho smolt scale samples were analysed for age composition. Approximately 69.3% of the coho smolts were aged as 1.0 year-old smolts originating from the 2009 broodyear (Table 4). Age 2.0 smolts accounted for 30.3% and Age 3.0 smolts accounted for 0.4% of the sample (Table 4).

Table 4. Summary of 2011 coho scale analysis conducted by the Pacific Biological Station in Nanaimo,BC

Sample Date	Coho Smolt	European Age	Gilbert-Rich Age	Brood Year	Frequency	Percentage
April - June 2011	Wild	1.0	22	2009	316	69.3
	Wild	2.0	33	2008	138	30.3
	Wild	3.0	44	2007	2	0.4
				Total	**456**	**100%**

4.3 Length and Weight Statistics

Sockeye Smolts Age 1.0

A total of 1,680 sockeye smolts were sampled for lengths and weights. The average fork length of age 1.0 sockeye smolts was 96.7 mm and ranged from 64 mm to 124 mm (Table 5). Average weight measurements were 8.5 grams and ranged from 2.3 grams to 15.5 grams (Table 5). In 2012, age 1.0 sockeye smolts on average were 12.5 mm or 11.5% shorter and 3.8 grams or 30.1% lighter than the average collected between 2001-2011 (Table 5).

Table 5: Mean fork lengths and weights for Age 1.0 Kitwanga sockeye smolts from 2001 to 2011 (Williams et al. 2002, McCarthy 2005, Kingston 2006, 2009, 2010, 2011, 2012 & Koch 2008).

Year	Sample Size (N)	Mean Fork Length (mm)	Max. / Min. Fork Length (mm)	Mean Weight (g)	Max. / Min. Weight (g)
2001	1,750	103.5		10.2	
2002	1,389	103.9		10.6	
2003	1,025	112.3	94 / 156	14.0	7.6 / 32.9
2004	465	114.1	94 / 159	14.4	8.2 / 31.1
2005	260	116.4	90 / 135	13.4	6.1 / 23.2
2006	750	115.0	94 / 135	14.3	7.0 / 26.0
2007	349	108.2	85 / 125	12.0	5.0 / 18.1
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
Average 2001 - 2011		**109.2**	**76 / 159**	**12.3**	**4.1 / 32.9**

Sockeye Smolts Age 2.0

In 2012, eighteen age 2.0 sockeye smolts were sampled which yielded an average fork length of 189 mm and average weight of 78.9 grams (Table 5).

Table 6: Wild sockeye smolts age 2.0 mean fork length and weight for 2011 and 2012.

Year	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
2011	7	211	101.4
2012	18	189	78.9

Sockeye Smolts Age 3.0

Twelve age 3.0 sockeye smolts were sampled and the average fork length was 261 mm and weight was 157.9 grams (Table 6).

Table 7: Wild sockeye smolts age 3.0 mean fork length and weight for 2011and 2012.

Year	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
2011	2	264	179.1
2012	12	261	157.9

In 2012, the most frequent length category for age 1.0 sockeye smolts was 97 to 99mm and 185 to 187mm for age 2.0/3.0 sockeye (Figure 6). In 2012, there was a distinct separation in length classes between age 1.0 and 2.0/3.0 year old sockeye smolts (Figure 6).

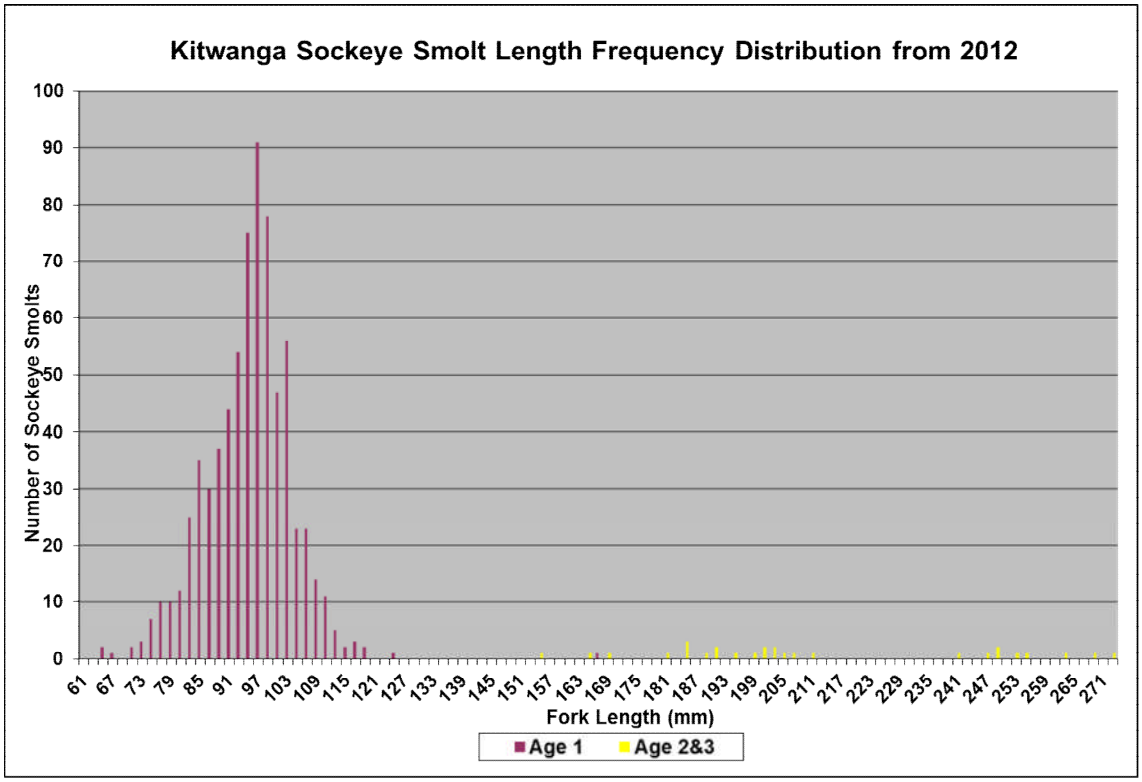


Figure 6: Kitwanga sockeye smolt length frequency distribution from 2012.

Coho Smolts

In 2012, 400 coho smolts were sampled for length and weight measurements representing 9% of the run. Average fork lengths of coho smolts were 129.8 mm and ranged from 93

mm to 173 mm. Average weights were 22.3 grams and ranged from 8.5 grams to 51.7 grams (Table 8).

Table 8: Coho smolts mean fork lengths and weights from 2009 to 2012.

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
Average 2009 -2012		**135.4**		**27.0**	

After receiving the aging results from the 2011 coho smolts we were able to compare the length at age of 1.0 and 2.0 year-old fish. An age at length histogram was plotted to separate the two age classes. In 2011, there was no clear separation in lengths as the two age classes largely overlapped (Figure 7). The most frequent length category for age 1.0 coho smolts was 130 to 135 mm and 135 to 140mm for age 2.0 coho (Figure 7.)

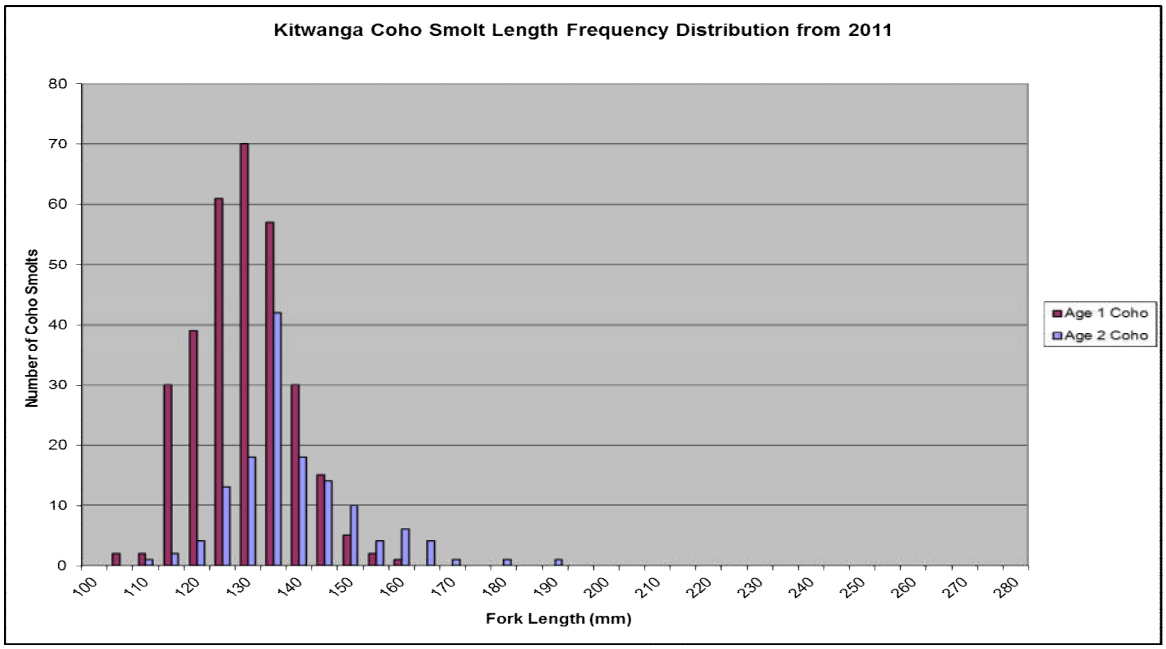


Figure 7. Kitwanga coho smolt length frequency distribution from 2011.

4.4 Population Estimate

Sockeye Smolts

In 2012, the sockeye smolt population was estimated by adding the total daily catch from each of the three traps plus the estimated population of smolts from the dipnet samples on May 9th, 2012. A total of 400,998 sockeye smolts were captured during the 2012 study period, which included 91 two-year-old smolts (Table 9). The 95% upper and lower confidence intervals for the smolt population estimate were 412,336 and 389,448 respectively (Table 9). The 2012 population estimate is the highest estimate ever recorded since the GFA started enumerating sockeye smolts at the KsF in 2008.

Table 9: Kitwanga River sockeye smolt population estimate and trap efficiency from 2001 - 2012.

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

Other Species

The KsF enumerated a total of 400 cutthroat trout. Other resident trout species were enumerated during the study and these totals accounted for 93 adult bull trout (> 300 mm), 184 Juvenile Bull Trout (< 300 mm) and 55 rainbow trout (Table 10). Other fish species captured, included 12 Rocky mountain whitefish and 168 sculpins (Table 10).

Table 10. Summary of other fish species caught at the Kitwanga smolt fence in 2012.

Year	Cutthroat Trout	Bull Trout Adult (> 300 mm)	Bull Trout Juvenile (< 300 mm)	Rainbow Trout	Rocky Mountain Whitefish	Sculpin
2012	400	93	184	55	12	168

4.5 Sockeye Smolt Production

In 2012, it is estimated that an average of 41 smolts were produced per female spawner (Table 11). This estimate was generated by dividing the total number of 1-yr old smolts produced in 2012 by the number of adult females that escaped to the river and presumed

to have successfully spawned in 2010 (Kingston, 2011). The 2012 Kitwanga smolt production is the lowest production recorded since the GFA started accurately enumerating smolts at the KsF in 2008.

Table 11. Estimate of smolts per female spawner for Kitwanga wild sockeye from 2008 to 2012.

Year	Smolt Estimate	Female Spawners	Smolts/Female
2008	226,273	2643	86
2009	34,970	125	280
2010	113,044	684	165
2011	83,717	1615	52
2012	400,907	9778	41

4.5 Other Findings

Ice Off & Sockeye Smolt Run Peak

From studies conducted on Kitwanga sockeye smolt emigration it has been determined that Kitwanga sockeye smolts usually leave Gitanyow Lake shortly after the ice comes off the lake (Koch, 2008). In 2012, ice off occurred on May 4th and the peak of the smolt run occurred 5 days later. Over the past six years the peak of Kitwanga sockeye smolt migration ranged between 4 and 12 days after ice off with the average being 8.3 days (Table 12).

Table 12: Relationship between ice-off and the peak of the Kitwanga sockeye smolt run from 2006 – 2012.

Year	Date of ice off Gitanyow Lake	Peak of smolt migration	Time from ice off Gitanyow Lake to peak of smolt emigration
2006	April 26th	May 4th	8 Days
2007	May 6th	May 10th	4 Days
2008	May 4th	May 11th	7 Days
2009	May 9th	May 18th	9 Days
2010	April 21st	May 3rd	10 Days
2011	May 2nd	May 14th	12 Days
2012	May 4th	May 9th	5 Days
Average 2006 – 2011			**8.3**

4.7 Smolt Size Comparison

Data from age 1.0 Gitanyow Lake sockeye smolts shows that average lengths and weights when compared to other BC sockeye producing lakes are quite large (Table 13). Also evident is a slight reduction in Gitanyow Lake sockeye sizes from the 2001-2011 average compared to 2012 (Table 13). This reduction in sizes can be attributed to the relatively large number of smolts that resided in the lake from 2011 to 2012, which could have created an increased competition for food resources

Table 13: Comparative size data of age 1.0 sockeye smolts from Gitanyow Lake and several other British Columbia lake systems.

	1-Yr. Old Sockeye Smolt Length (mm)			1 Yr. Old Sockeye Smolt Weight (g)			
Lake or System	**Average**	**Range**	**No. Years**	**Average**	**Range**	**No. Years**	**Source**
Babine	79	75-83	22	4.9	3.9-5.8	22	Groot and Margolis, 1991
Cultus	82	68-94	21	6.2	3.0-8.6	21	Groot and Margolis, 1991
Chilko	82	73-101	20	4.6	3.1 - 8.4	20	Groot and Margolis, 1991
Gitanyow (Yrs. 2001-2011)	109.2	76-159	11	12.3	4.1 - 32.9	11	Gitanyow Fisheries, 2011
Gitanyow (Yr. 2012)	96.7	64-124	1	8.5	2.3 - 15.5	1	Gitanyow Fisheries, 2012

5.0 Conclusion

The GFA have accurately enumerated both sockeye and coho smolts at the KsF for the past five years. Since 2008, the KsF has remained operational for the entire sockeye and coho smolt migration period even during spring flood events. GFA will continue to monitor the migration of sockeye smolts from Gitanyow Lake on a yearly basis. Kitwanga sockeye smolt production is of great interest to fisheries managers and one of the highest assessment priorities currently undertaken in the Kitwanga watershed. The ulimate goal of the GFA is to restore the sockeye stock to historical levels.

The 2012 sockeye smolt population estimate was 400,907 which were comprised almost exclusively of 1-Yr old smolts (96.0%). The sockeye smolt run timing was quite compressed with over 98% of the run migrating past the weir in a two-week period from May 2nd to May 16th. The 2012 Kitwanga sockeye freshwater production estimate from Gitanyow Lake determined that 41 sockeye smolts were produced per adult female from the 2009 brood year.

When comparing the size of age 1.0 sockeye smolts from Gitanyow Lake to other British Columbia sockeye producing lakes, Kitwanga smolts appear relatively large and healthy. Only in 2012 when the smolt estimate was over 400,000 did we actually see a slight reduction in both average length and weights of age 1.0 smolts. Sockeye scale analysis for 2012 also showed that circuli counts started from 11 and usually Kitwanga age 1.0 smolts have circuli counts starting at about 15, indicating the 2012 sample contained some smaller fish.

Since 2009, the GFA have implemented a CWT program on the Kitwanga River to access survival and harvest rates on coho. Unfortunately in 2012, the GFA did not implement the CWT program due to budgeting constraints. It is expected that the GFA will resume this worthwhile program in 2013 where the plan is to mark 10,000 coho smolts in order to obtain sufficient numbers of recoveries from marine fisheries to estimate the exploitation rate.

References

Cleveland, M.C. 2005. The Kitwanga River Sockeye Salmon Enumeration, 2004. Gitanyow Fisheries Authority, Kitwanga, B.C. 32 pp.

Cleveland, M., S. Cox-Rodgers and K. Rabnett. 2006. Kitwanga Sockeye Salmon Recovery Plan (KSRP). A plan to preserve genetic diversity and rebuild an important race of sockeye salmon. Gitanyow Fisheries Authority, Kitwanga, BC; Department of Fisheries and Oceans Canada, Prince Rupert, BC; Skeena Fisheries Commission, Hazelton, BC.

Cleveland, M. 2008. Kitwanga Sockeye Enhancement Program, 2006/07. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 56 pp.

Groot, C. and L. Margolis, 1991. Pacific Salmon Life Histories. UBC Press. 543 pp.

Hall, P. 2009. Personal Communications, Stock Assessment Biologist – DFO, Prince Rupert, BC.

Kingston, D. 2006. The 2005 Kitwanga River Sockeye Smolt Survey. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 11pp.

Kingston, D. 2008. Kitwanga River Smolt Fence Completion Project – 2008. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 19 pp.

Kingston, D. 2009. The 2008 Kitwanga River Sockeye Smolt Assessment. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 16 pp.

Kingston, D. 2010. The 2009 Kitwanga River Salmon Smolt Assessment. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 22 pp.

Kingston, D. 2011. The 2010 Kitwanga River Salmon Smolt Assessment. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 23 pp.

Kingston, D. 2011. Kitwanga River Salmon Enumeration Facility – 2010 Annual Report Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 31 pp.

Kingston, D. 2012. The 2011 Kitwanga River Salmon Smolt Assessment. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 25 pp.

Koch, K. and D. Kingston 2008. The 2006 and 2007 Kitwanga River Sockeye Smolt Assessments Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 31 pp.

Koch, K. and M. Cleveland 2009. Kitwanga River Salmon enumeration Facility – 2008 Annual Report. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 45 pp.

Koch, K. and M. McCarthy. 2010. Kitwanga River Salmon Enumeration Facility – 2010 Annual Report. Gitanyow Fisheries Authority, Kitwanga, B.C. 32 pp.

Lidstone, C. 2009. Summary of the Sockeye Scale and Otolith Ageing Introductory Course. Delivered to the Skeena Fisheries Commission. Birkenhead Scale Analyses. Lone Butte, BC.

Lidstone, C. 2008. Untitled report including letter and spreadsheet provided to the Gitanyow Fisheries Authority. Birkenhead Scale Analyses. Lone Butte, BC.

McCarthy, M. 2005. The Sockeye Smolt Enumeration Program, 2004. Unpublished Report. Gitanyow Fisheries Authority, Kitwanga, BC. 10pp.

Williams, B. and P. Halliday. 2002. The 2001 Kitwanga River Sockeye Salmon (*Oncorhynchus nerka*) Smolt Sampling Program. Gitanyow Fisheries Authority. 21pp.

Appendix 1 – Letter from Carol Lidstone of Birkenhead Scale Analyses

Birkenhead Scale Analyses

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December 2, 2012

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P.O. Box 148,
Kitwanga, B.C. V0J 2A0

Re: 2012 Kitwanga River Smolt Sockeye Scale Analysis

Dear Derek,

Attached is the analysis for the sockeye smolt scales collected from the Kitwanga River from May 1-30, 2012. 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 777 fish, with 1 coho (age 2+) and 776 sockeye, mounted on 32 books. Books 70225 and 70229 have been fully analyzed since large smolts were targeted. Of the remaining 30 books, 16 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. I alternated between full and partial analysis to provide data for the month of May, not just the first two weeks.

Age 1 Smolts

The 30 books of random sampling contained a total of 736 sockeye, of which 32 were unreadable, and 704 were readable and all age 1.

Age One (n=704): Weights range from 2.3-14.9 grams. Lengths range from 64-124 mm, with one at 166 which may be in error. The 2012 sample contains some small smolts, with corresponding low circuli counts for Kitwanga River.

Circuli counts are provided for 359 of the age one smolts. Most exhibit a freshwater stress, with the exception of three samples, which do not exhibit a stress, but do show plus growth. The circuli counts of these three samples are 10, 11 and 13, and all have 2 plus growth. Otherwise the circuli counts from the focus to the freshwater stress range from 5-17, stress to annulus 3-13, for a total circuli count, excluding plus growth, of 10-23. Plus growth is exhibited on 12 samples, starting on May 22, and ranges from 2-3. The total counts including plus growth range from 11-23. Usually Kitwanga age 1 smolts have circuli counts starting at about 15, so the 2012 sample definitely contains some smaller fish. I assume the population size is high?

Books 70225 & 70229 – Large Smolts

A total of 40 large smolts were sampled, of which 10 are unreadable, usually because they are regenerated or mounted incorrectly, with the grooved side of the scale facing downwards (u/d). Of the 30 readable large smolts, 18 are age 2 and 12 are age 3.

Age Two (n=18): Weights range from 37.2–96.7 grams, then 144.4 and 167.7, which I believe are in error, since they do not correspond with the length. Lengths range from 155-211 mm. Seventeen samples exhibit a stress in each year, with the total circuli count in the first year between 16-24, and between 16-26 in the second year, for a total circuli count from 33–46. One age 2 smolt does not exhibit the typical Kitwanga pattern. This sample has no freshwater stresses, relatively wide circuli spacing, with a circuli count of 10 and 18 in the first and second years, respectively.

Age Three (n=12): Weights range from 134.7-189.2 grams. Lengths range from 240-281 mm, with one sample at 206 and another at 349, which I suspect may be in error. In general, the typical Kitwanga scale pattern is exhibited, however 5 samples do not exhibit a stress in the first year and have fairly low circuli counts, and 2 samples do not exhibit a stress in the third year of growth. The circuli counts in the first year range from 8-13 for those without a freshwater stress, and 15-26 with a freshwater stress, in the second year from 19-28, the third year from 12-22 for those with a stress, but 6 and 14 for those without a stress. The total circuli counts for all age 3 smolts range from 46-63.

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