Gitanyow Fisheries Authority

The 2009 Kitwanga River Salmon Smolt Assessment

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1.0 Proponent Information

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2.0 Introduction

Since 1999, the Gitanyow Fisheries Authority (GFA) has been studying the limiting factors affecting sockeye salmon production in the Kitwanga Watershed. One of the highest assessment priorities for the Kitwanga Sockeye Salmon Recovery Plan (KSRP), which was initiated in 2006, was to monitor the yearly health and abundance of Kitwanga sockeye salmon smolts emigrating from Gitanyow Lake (Cleveland et al., 2006).

Over the last seven years, GFA with support from Fisheries and Oceans Canada (DFO) stock assessment biologists, have experimented with many different smolt weir and trap designs in an effort to accurately enumerate Kitwanga sockeye smolt production on a yearly basis (Williams et al. 2002, McCarthy 2005, Kingston 2006/2009 & Koch 2008). For the most part, these smolt weir and trap designs that were tested were deemed unusable on the Kitwanga River because they were often rendered inoperable during high water when most of the smolts move out of the lake and migrate down the Kitwanga River. Therefore, GFA with the help of DFO engineers designed a permanent smolt fence that would be constructed from concrete and aluminum at the outlet of Gitanyow Lake.

In 2007, the GFA were successful in acquiring funding from the Ministry of Forests (MOF), Ministry of Environment (MOE), Gitanyow Hereditary Chiefs (GHC) and DFO to complete Phase I construction of a permanent smolt fence. Phase I consisted of the establishment of a concrete sill in the Kitwanga River from which aluminum transoms could be erected to support fence panels for smolt enumeration. The concrete sill was successfully constructed and installed in March and April of 2007, at a cost of $100,000.

In 2008, the GFA acquired funding from the Pacific Salmon Commission (PSC), MOF, GHC and DFO to initiate Phase II of the Kitwanga Smolt Fence, which included the fabrication and construction of the aluminum fence components to make the permanent smolt fence operational. Phase II of the project was successfully implemented in March of 2008 at a cost of an additional $100,000.

The smolt fence is a vital component in the rebuilding of the Kitwanga sockeye stocks. Reliable estimates of the number of smolts leaving Gitanyow Lake each year help measure the effectiveness of pilot programs such as sockeye fry out planting into Gitanyow Lake and sockeye lakeshore spawning ground restoration works that have been performed in Gitanyow Lake. The smolt fence will not only play a critical role in assessing freshwater production of wild and hatchery sockeye smolts in Gitanyow Lake but also help to determine adult sockeye survival rates specific to the Kitwanga stock.

Since the establishment of the Kitwanga River permanent smolt fence in 2008 the GFA have been able to successfully enumerate sockeye/coho smolts and other resident trout species under high water events with no interruptions. In 2009, the GFA in conjunction with the normal enumeration program incorporated a Coded Wire Tag (CWT) program specific to emigrating coho smolts. This report summarizes the results of the 2009 Kitwanga River Smolt Assessment undertaken on the Kitwanga River.

3.0 Methods

Installation of the permanent smolt fence started on April 13th, 2009 and the smolt fence was rendered operational on April 17th, 2009 when the final components were connected to the concrete sill. The smolt-sampling period continued until July 14th, 2009 when all of the aluminum components were pulled from the river. The permanent smolt fence was 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 smolt fence 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.

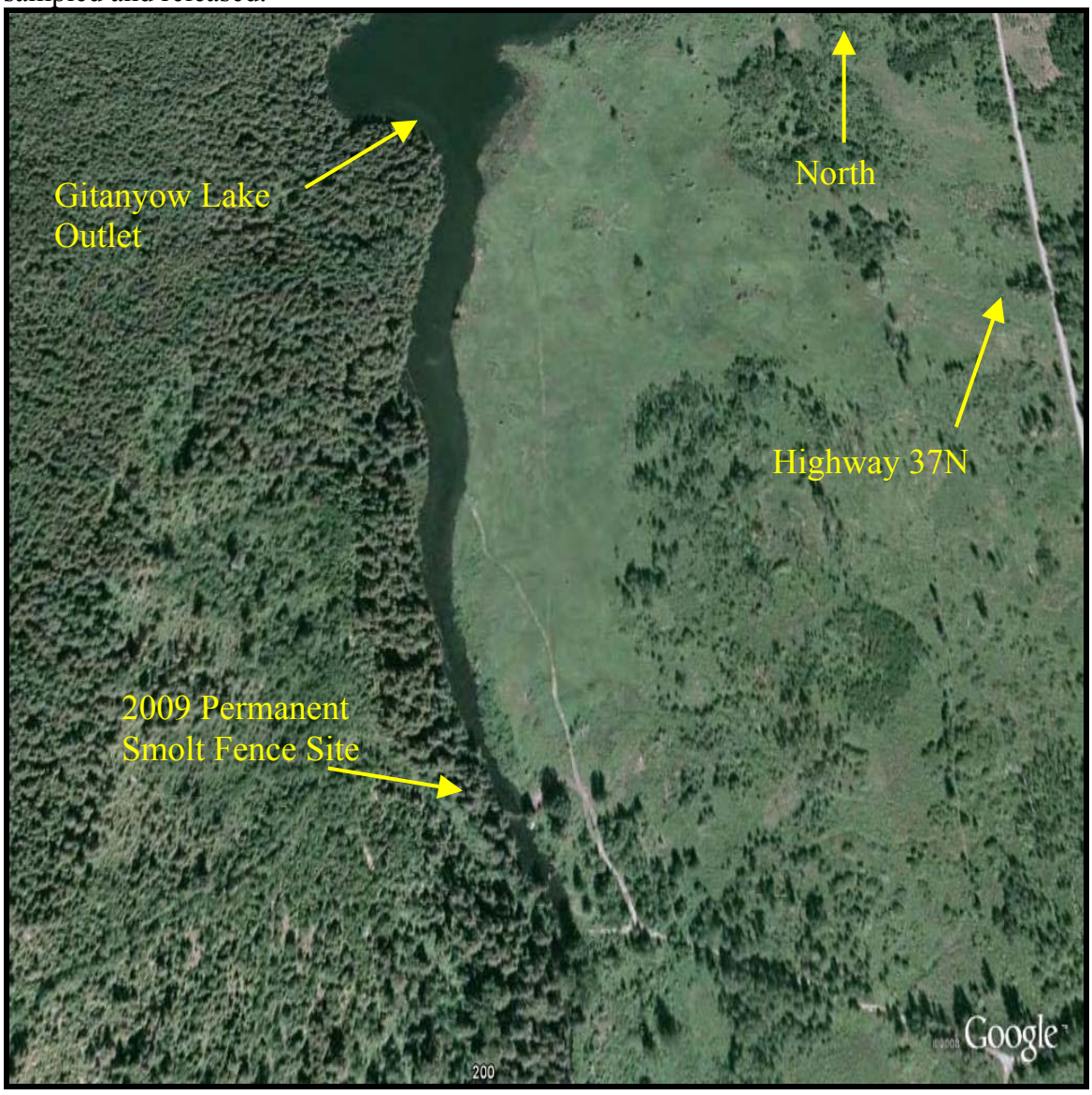


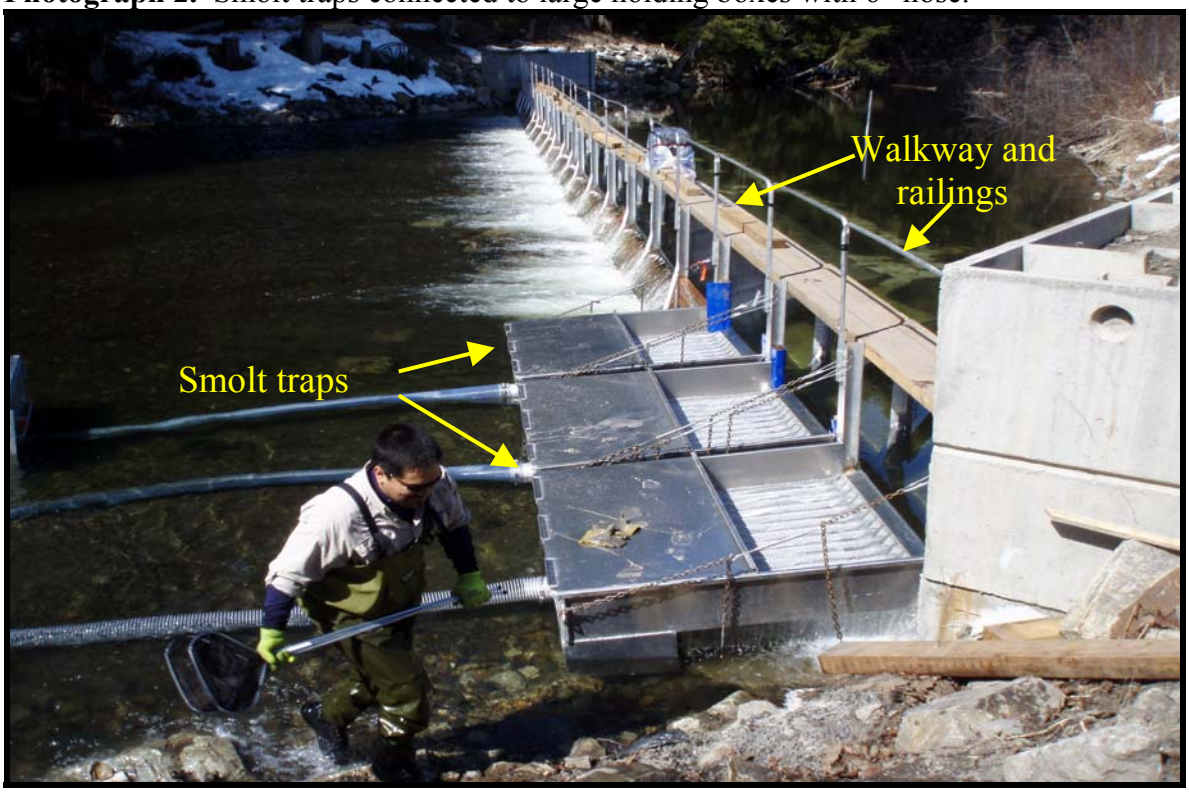
Figure 1. Location of the 2009 Kitwanga River smolt fence showing reference to Gitanyow Lake outlet and Highway 37N (Image supplied from www.googleearth.com).

The aluminum weir and smolt trap boxes were attached to preformed concrete aprons that were placed in the riverbed during Phase I of the smolt fence completion project in 2007 (Kingston, 2008). The weir was constructed of prefabricated smolt panels, trap boxes and transoms that could be easily set-up and taken down to monitor the yearly sockeye and coho smolt emigration.

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 de-watering screens, the fish were then transported down the V-shaped grooves where the water velocity was too great for them to swim back upstream. A 6" rigid plastic hose connected the smolt trap to a large covered 4' X 8' holding box where smolts were held until they were sampled and enumerated (Photograph 2). In 2009 the smolt trapping apparatus consisted of three individual smolt traps that were connected to three large 4' X 8' holding boxes. A temporary wooden walkway and aluminum railings were secured to the top of the transoms to allow GFA workers access to the smolt traps and clean the fence with ease (Photograph 3). Four to five rows of 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.

Photograph 1. Smolt trap box showing dewatering screen.

Photograph 2. Smolt traps connected to large holding boxes with 6" hose.



Photograph 3. Completed smolt fence showing smolt traps, holding boxes and walkway.

Crews of two or three GFA fisheries technicians would check the trap first thing in the morning and conduct fish sampling and smolt enumeration works. 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. Slight 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, unharmful way. Approximately 10% of the sockeye smolts were sampled each day for length and weight measurements (Photograph 4). Fork lengths were taken to the nearest 1 mm and weights to the nearest 0.1 grams. Scale samples were taken along with length and weight measurements and sent to Carol Lidstone of Birkenhead scale analysis for aging (Photograph 5). A proportion of the larger cutthroat trout (>200mm) were marked with floy tags and released downstream to study their life history traits. Water levels and temperatures were recorded daily. The smolts that were sampled during the morning sessions were held in the large covered holding boxes until night when they were released and allowed to continue their journey downstream. Both hatchery and wild sockeye smolts were encountered in 2009. Hatchery fish were identified by the lack of an adipose fin, which was purposely removed prior to their release from the hatchery so they could be recognizable. All hatchery sockeye smolt escapement and length/weight measurements were kept separate from the wild sockeye smolt populations for statistical purposes.

Photograph 4. Sampling sockeye smolts for length and weight measurements.

Photograph 5. A 3-year old Kitwanga sockeye smolt being sampled.

3.1 Coho Coded Wire Tag (CWT) Program

In 2009, GFA initiated a CWT program for coho smolts. Nearly all of the coho smolts that were captured at the smolt weir were implanted with a CWT and released downstream. During the daily sampling procedures the coho smolts were enumerated along with the other fish species and set aside so they could be implanted with a CWT. Approximately 50-100 coho smolts at a time were placed in buckets with an aerator and carried to the coho sampling station. Five to ten coho smolts at a time were then placed in an anaesthetic solution of clove oil. Once anaesthetized a sub sample of the coho were measured for length and weight each day. Fork lengths were taken to the nearest 1 mm and weights to the nearest 0.1 grams. The CWT were applied from a Mark IV automated tag injector (Photograph 6). Once the tag was implanted the coho were then released down the Quality Control Device (QCD) to detect whether the tag was properly implanted into the fish (Photograph 7). Approximately 10% of the coho smolts that were tagged each day were held in a separate bin for a 24-hr period to determine tag loss and mortality. All other coho smolts were placed back into the large holding boxes in the Kitwanga River and released at night with the sockeye smolts. The adipose fin was removed from each coho that was implanted with a CWT so that they can be recognizable throughout the different fisheries when they return as adults.

Photograph 6. Coded Wire Tag (CWT) machine and sampling station setup.

Photograph 7. GFA technicians checking for coho CWT retention with a Quality Control Device (QCD).

4.0 Results and Discussion

4.1 Smolt Migration Timing

The 2009 smolt trap was successful in capturing sockeye smolts, coho smolts, bull trout, cutthroat trout, steelhead/rainbow trout, Rocky mountain whitefish and sculpins. The first sockeye smolt was enumerated on May 2nd, 2009 and the last sockeye smolt was enumerated on June 7th, 2009. The peak of the sockeye smolt emigration occurred on May 18th, 2009 where over 19% of the entire run migrated past the smolt fence that day (Figure 2). Approximately 96% of the sockeye smolts migrated through the smolt fence in a two-week period from May 7th to May 20th, 2009. The peak of the 2009 smolt migration (May 18th) was approximately 12 days later than the 2001-2008 smolt peak average on May 6th (Figure 2).

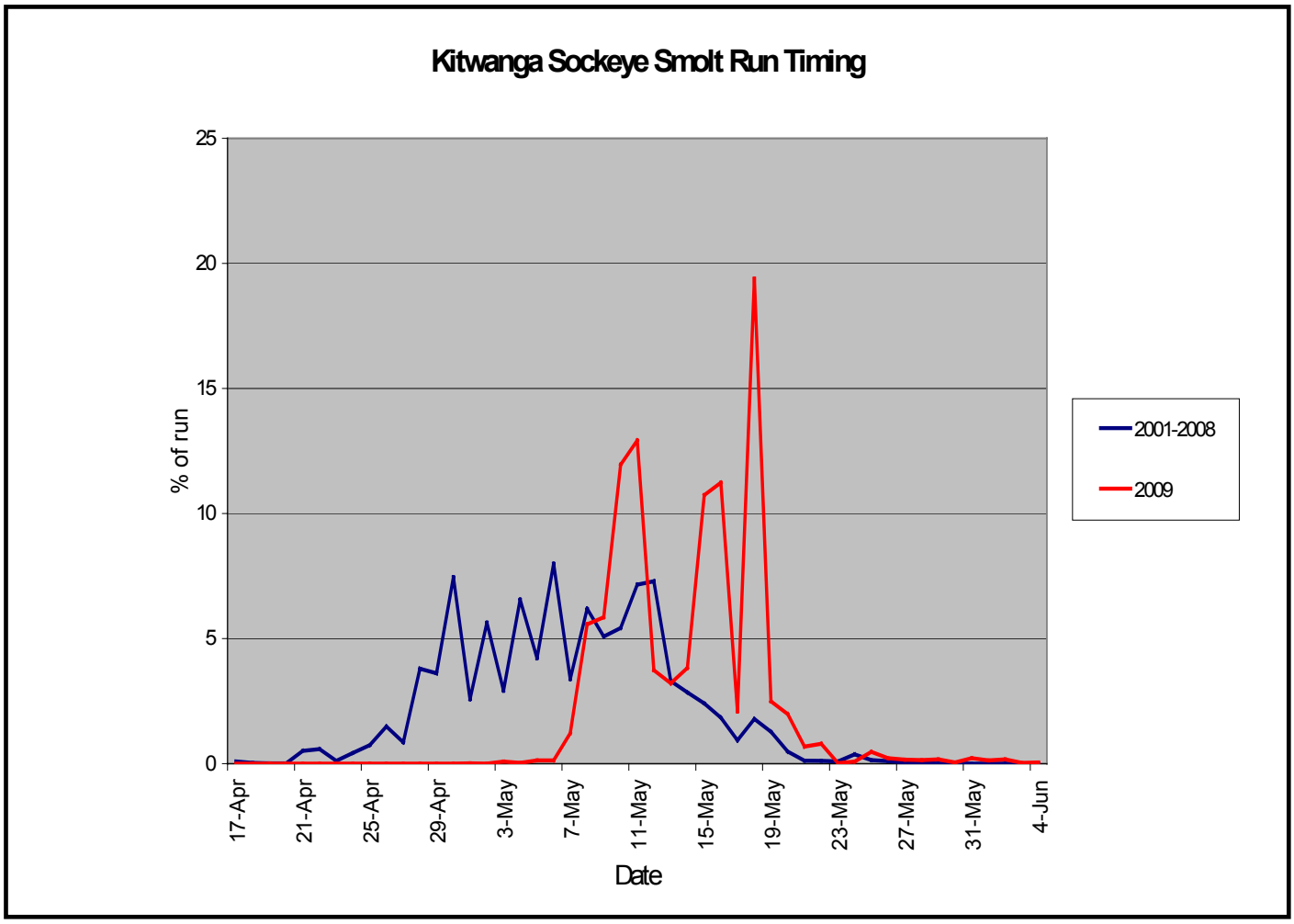


Figure 2: Kitwanga River sockeye smolt run timing average (2001-2008) compared to 2009.

The first coho smolt was enumerated on April 19th, 2009 and the last coho smolt was enumerated on July 13th, 2009. The peak of the coho smolt emigration occurred on June 27th, 2009 where 7% of the run migrated past the smolt fence (Figure 3).

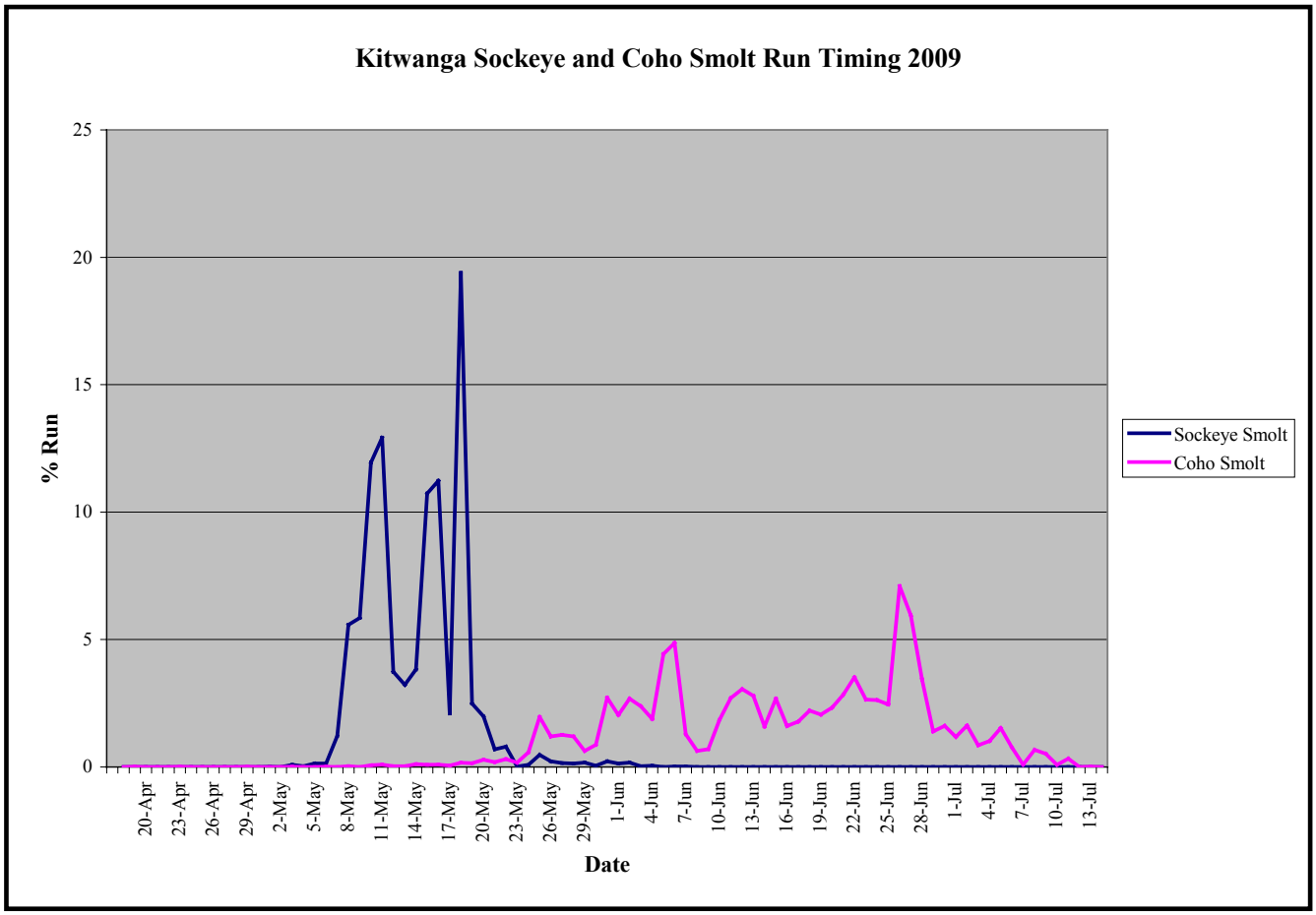


Figure 3: Kitwanga River coho and sockeye smolt run timing 2009.

4.2 Age Structure

Sockeye Smolts

In 2009, a total of 436 sockeye smolt scale samples were analysed for age composition. The results are summarized in Table 1, with a summary letter included in Appendix 1. Approximately 73.6% of smolts aged were age 1.0 (European Age) wild smolts and only 4.4% were aged as age 2.0 wild smolts (Table 1). One age 3.0 wild smolt was analyzed and represented 0.2% of the samples. All of the hatchery smolts examined were age 1.0 (Table 1).

Table 1: Summary of sockeye scale analysis conducted by Carole Lidstone of Birkenhead Scale Analyses (2009).

Sample Date	Sx Smolt	European Age	Gilbert-Rich Age	Brood Year	Frequency	Percentage
May 2009	Wild	1.0	22	2007	321	73.6
May 2009	Wild	2.0	33	2006	19	4.4
May 2009	Wild	3.0	44	2005	1	0.2
May 2009	Hatchery	1.0	22	2007	95	21.8
Total					436	100.00

All wild one year-old scales exhibited a freshwater stress; the location of the stress varied with each fish, but was usually found within the 6th and 14th circuli. The total number of circuli in the first year of growth ranges from 14-24, and in general, the total circuli count is directly related to smolt length and weight (Appendix 1). In 2008, the hatchery sockeye smolt scales exhibited a different growth pattern than the wild sockeye smolt scales. The hatchery smolt sockeye scales had more rapid growth and wider circuli spacing near the focus with a stress between the 3rd-7th circuli (Appendix 1.) In 2009, the hatchery sockeye smolt scales did not exhibit wider circuli spacing when compared to the wild sockeye smolt scales. Both wild and hatchery sockeye smolts demonstrated the same growth pattern (Appendix 1).

Of the two year-old sockeye smolts studied for age only 40% showed a stress in the first year of growth, but all of them exhibited a stress in the second year of growth. The circuli counts in the first year were relatively low ranging from 8-17 and from 22-30 in the second year. The total circuli counts for two year-old fish range from 33-43. It appears that the majority of these fish had slow growth rate in the first year of lake residency compared to normal Kitwanga growth. This observation was based on a low circuli count and lack of the typical stress that is usually seen in one year-old Kitwanga sockeye smolts (Appendix 1).

Only one three year-old sockeye was captured in 2009 and this fish exhibited a typical Kitwanga freshwater stress in each year of growth, with the total circuli counts of 68 (Appendix 1).

Coho Smolts

In 2009, a total of 136 coho smolt scale samples were analyzed for age. Approximately 69.9% of the coho smolts aged were age 1.0 (European Age) and 30.1% were age 2.0 wild smolts (Table 2). All Kitwanga coho salmon smolts originate from the wild and there has been no hatchery production of the stock.

Table 2: Summary of coho scale analysis conducted by Carole Lidstone of Birkenhead Scale Analyses (2009).

Sample Date	Co Smolt	European Age	Gilbert-Rich Age	Brood Year	Frequency	Percentage
May 2009	Wild	1.0	22	2007	95	69.9
May 2009	Wild	2.0	33	2006	41	30.1
Total					136	100.00

4.3 Length and Weight Statistics

Wild Sockeye Smolts Age 1.0

In 2009, a total of 321 wild age 1.0 sockeye smolts were sampled for length and weight measurements. The average fork length of wild age 1.0 sockeye smolts was 112.1 mm (Table 3). Fork lengths ranged from a minimum of 86 mm to a maximum of 178 mm (Figure 4). Average weight measurements of wild age 1.0 sockeye were 13.4 grams (Table 3). Weights ranged from a minimum of 5.7 grams to a maximum of 52.1. The 2009 age 1.0 sockeye smolts on average were 2.3 mm longer and 0.9 grams heavier than the 2001-2009 Kitwanga sockeye smolt length and weight averages (Table 3).

Table 3: Kitwanga River sockeye wild smolts mean fork lengths and weights for 2001-2009 (Williams et al. 2002, McCarthy 2005, Kingston 2006/2009 & Koch 2008).

Year	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
2001	1,750	103.5	10.2
2002	1,389	103.9	10.6
2003	1,025	112.3	14.0
2004	465	114.1	14.4
2005	260	116.4	13.4
2006	750	115.0	14.3
2007	349	108.2	12.0
2008	1,224	102.8	9.9
2009	320	112.1	13.4
Average		**109.8**	**12.5**

Wild Sockeye Smolts Age 2.0 and Age 3.0

In 2009, a total of 19 wild age 2.0 sockeye smolts were sampled for length and weight measurements. Average fork length of wild age 2.0 sockeye smolts was 179.9 mm (Table 4). Average weight measurement of wild age 2.0 sockeye was 63.6 grams (Table 4). Only one wild age 3.0 sockeye smolt was sampled and its fork length and weight was 300.0 mm and 275.0 grams respectively (Table 4.)

Table 4: Wild sockeye smolts age 2.0 and age 3.0 mean fork lengths and weight for 2009.

Age	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
2.0	19	179.2	63.6
3.0	1	300.0	275.0

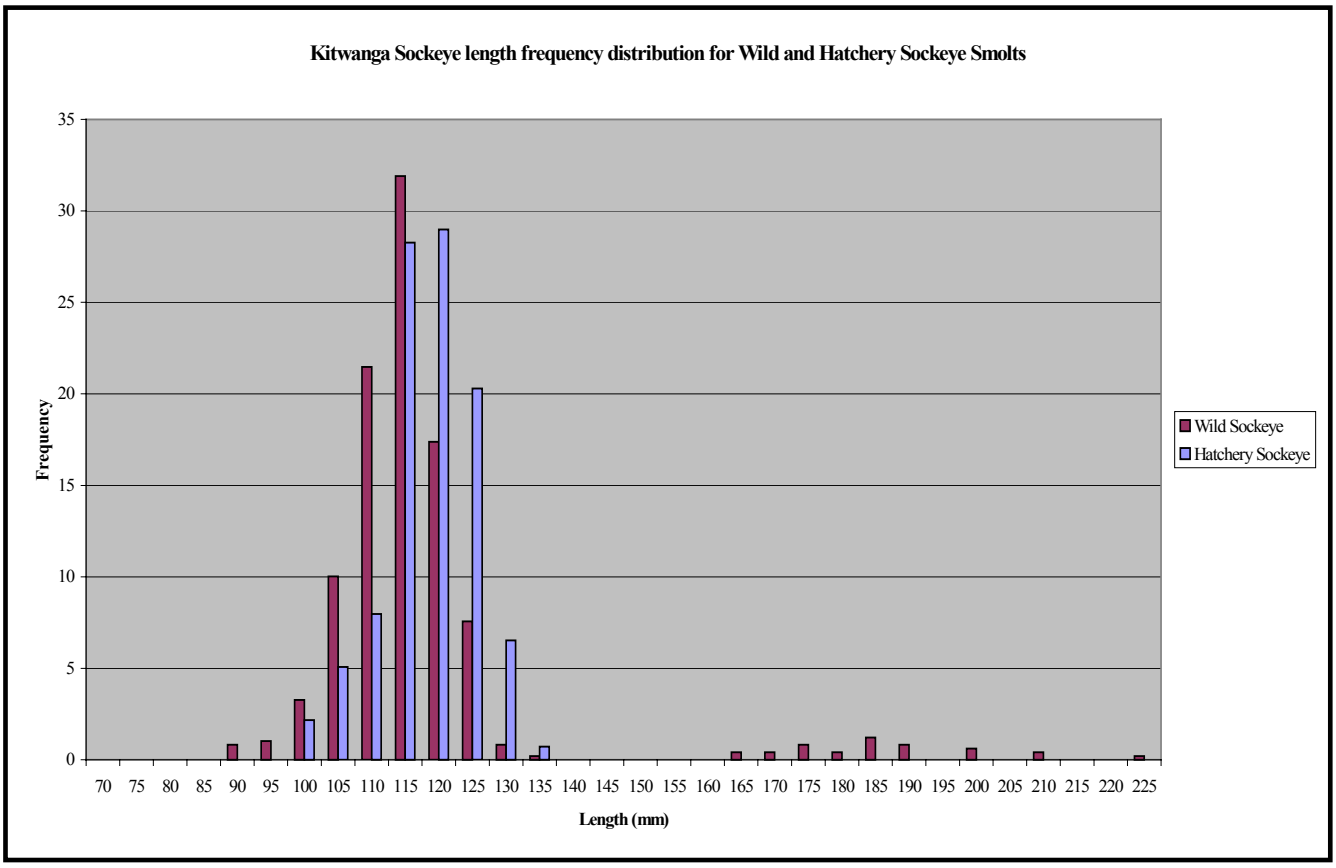


Figure 4. Length frequency histogram of Kitwanga sockeye wild smolts versus hatchery smolts 2009.

Hatchery Sockeye Smolts

In 2009, a total of 138 hatchery sockeye smolts were sampled for length and weight measurements. Average fork lengths of hatchery sockeye smolts were 116.3 mm (Table 5). Fork lengths ranged from a minimum of 96 mm to a maximum of 132 mm. The average weight measurement was 15.3 grams (Table 5). Weights ranged from a minimum of 9.2 grams to a maximum of 21.5 grams. In 2009, hatchery sockeye smolts on average were 8.1 mm shorter and 3.7 grams lighter than 2008 hatchery sockeye smolts (Table 5).

Table 5: Hatchery sockeye smolts mean fork length and weight for 2008/2009.

Year	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
2008	53	124.2	19.0
2009	138	116.3	15.3

Wild Coho Smolts

In 2009, a total of 95 wild age 1.0 coho smolts were sampled for length and weight measurements. Average fork lengths of wild age 1.0 coho smolts were 134.8 mm (Table 6). Fork lengths ranged from a minimum of 111 mm to a maximum of 172 mm (Figure 5). Average weight measurement of wild 1.0 coho was 26.5 grams (Table 6). Their smolt weights ranged from a minimum of 13.6 grams to a maximum of 55.1 grams. Age 2.0 coho smolts had an average fork length of 142.1 mm (Table 6). Their fork lengths ranged from a minimum of 126 mm to a maximum of 165 mm (Figure 5). Average weight measurements of wild 2.0 coho were 30.4 grams (Table 6). Their smolt weights ranged form a minimum of 19.5 grams to a maximum of 45 grams

Table 6: Wild coho smolts age 1.0 and age 2.0 mean fork lengths and weight for 2009.

Age	Sample Size (N)	Mean Fork Length (mm)	Mean Weight (g)
1.0	95	134.8	26.5
2.0	41	142.1	30.4

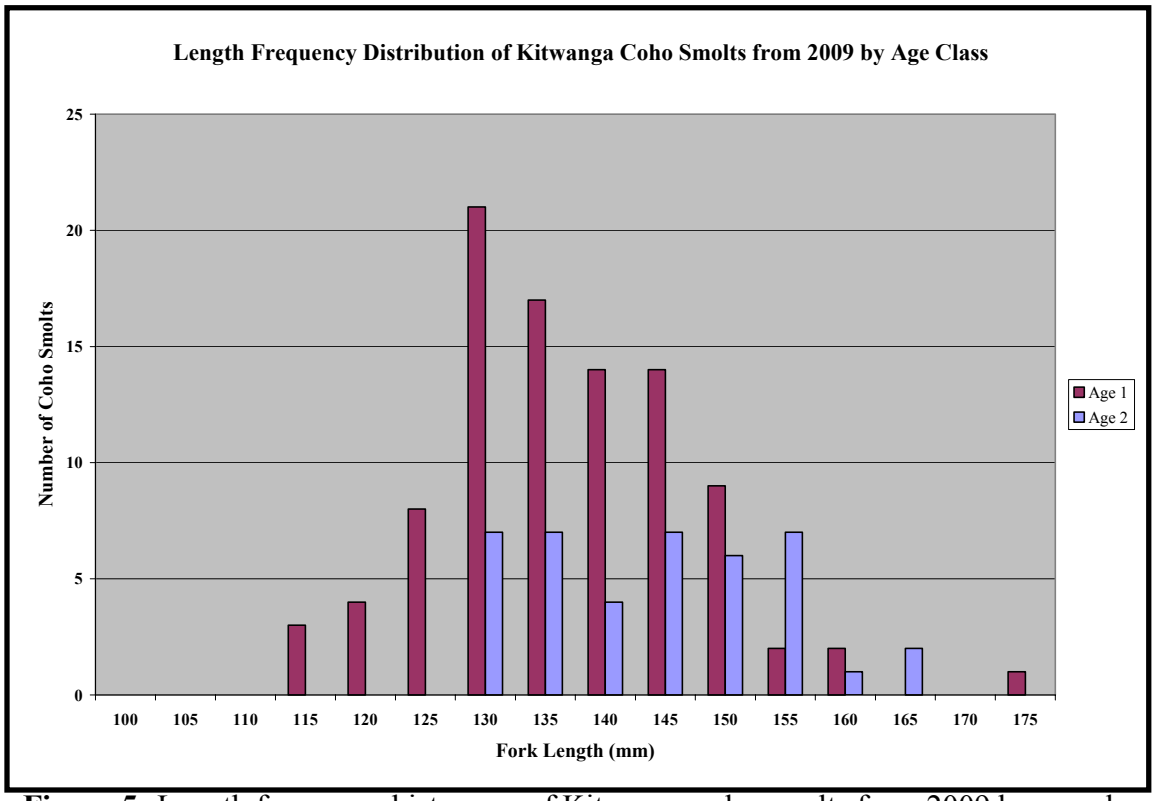


Figure 5. Length frequency histogram of Kitwanga coho smolts from 2009 by age class.

4.4 Population Estimate

Sockeye Smolts

In 2009, the sockeye smolt population was estimated by adding the daily total captured from each smolt trap. A total of 35,281 wild sockeye smolts were captured during the 2009 study period (Table 7). The 2009 hatchery smolt population estimate was 1,273. The hatchery smolt production for 2009 accounted for 3.6 % of the entire sockeye smolt migration.

Table 7: Kitwanga River sockeye smolt population estimate and trap efficiency for 2001-2009.

Year	# Smolts Marked	# Smolts Recaptured	Trap Efficiency %	Total Smolts Captured	**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	1,273	**35,281***	-	-

***Note:** 2009 wild smolt population estimate includes 311 two-year-old smolts

Other Species

In 2009, the smolt trap was effective at capturing 9862 coho smolts (Table 8). Resident trout species were also captured during the study and these totals accounted for 781 Cutthroat trout, 481 Bull trout and 192 rainbow trout (Table 8.). Total numbers of other fish captured, including Rocky mountain whitefish, sculpins and redside shiners were 616, 4989 and 13 respectively (Table 8).

Table 8. Summary of other fish species caught at the Kitwanga smolt fence in 2009.

Year	Coho Smolts	Cutthroat Trout	Bull Trout	Rainbow Trout	Rocky Mountain Whitefish	Sculpin	Redside Shiner
2009	9862	781	481	192	616	4989	13

4.5 Sockeye Smolts/Female Estimate

In 2009, the estimate for wild sockeye smolts produced per adult female was 289 (Table 9). This estimate was based on 125 female spawners that were enumerated past the adult enumeration fence in 2007. Conversely, the hatchery sockeye smolts produced per female was 318 (Table 9). This estimate was based on 4 female spawners that were used in the Kitwanga Sockeye Enhancement program in 2007. The 2009 estimate for wild and hatchery sockeye smolts produced per adult female is over three times greater than the 2008 estimate (Table 9). In comparison Cultus and Chilko Lakes, which are located in the Fraser watershed, produce an average of 108 and 115 smolts/female respectively (Hall, 2009). Both of these lakes have been collecting sockeye smolt estimates for over 30 years.

Table 9. Estimate of smolts per adult female for wild and hatchery sockeye in 2008/2009.

	Year	Smolt Estimate	Female Spawners	Smolts/Female
Wild Sockeye	2008	226,273	2643	86
Wild Sockeye	2009	34,970	125	280
Hatchery Sockeye	2008	2,753	29	95
Hatchery Sockeye	2009	1,273	4	318

4.6 Coho CWT Tagging Program

In 2009, 8701 coho smolts were implanted with a cwt (Table 10). This cwt total was corrected for tag loss and handling mortality compiled from sub samples of tagged coho smolts that were held for 24-hour periods. Four separate tag groups were used during the 2009 study with tag loss mortality rates ranging from 0.5% to 2.6% (Table 10).

Table 10. Kitwanga Coho CWT groups release report summary 2009.

CWT Tag Group	#Tagged (Corrected for tag loss and mortality)	#Lost CWT plus Mortality	Sample Size	Tag Loss plus mortality %	Total Release (#tagged + #lost cwt + #untagged)	Fork Length (mm)	Weight (grams)
A08 D03/42	4214	13	533	2.4 %	4244	133.8	24.9
A08 D03/50	1800	1	190	0.5 %	1811	145.4	32.8
A08 D03/52	1848	0	195	2.6 %	1858	143.4	33.2
A08 D04/17	839	2	146	1.4 %	844	137.7	29.0
Total	**8701**						

4.7 Other Findings

Ice Off & Sockeye Smolt Run Peak

Kitwanga sockeye smolt emigration from Gitanyow Lake is usually closely linked to when the ice comes off of Gitanyow Lake (Koch, 2008). In 2009 the lake ice was off on May 9th and the peak of the sockeye smolt run was observed 9 days later (Table 10). Over the past four years since GFA has been monitoring Gitanyow Lake ice conditions, results have shown that from the day that the ice melts off the lake to the peak of the smolt migration is a relatively short time window that ranges between 4-9 days (Table 11).

Table 11: Shows general relationship between ice-off and the peak of the Kitwanga sockeye smolt run.

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

5.0 Conclusion and Recommendations

In 2009, the GFA were successful in installing and operating a permanent smolt fence on the Kitwanga River for the second consecutive year. The permanent smolt fence remained operable for the entire sockeye and coho smolt migration with no breaches. The wild sockeye smolt population estimate for 2009 was 36,554. This estimate was comprised of 34,970 1-Yr old smolts and 311 2-Yr old smolts. A total of 1,273 hatchery sockeye smolts were also enumerated in 2009. The hatchery sockeye smolt production accounted for 3.6 % of the entire sockeye smolt migration.

In 2009, for the first time the GFA operated the permanent smolt fence much later than normal so they could enumerate the entire coho smolt migration. A total of 9,862 coho smolts were enumerated. GFA also initiated a CWT program where 8701 coho smolts were implanted with a cwt.

A proportion of sockeye scales were collected from migrating sockeye and scale analysis determined that 95.4 %(73.6% wild, 21.8% hatchery) of the wild smolt migration was age 1.0 (European Age) fish and 4.4% were age 2.0 fish. The remaining 0.2% sockeye smolts were age 3.0 fish. A sub sample of length and weight measurements was taken from wild and hatchery smolts throughout the migration. Analysis determined that 2009 hatchery sockeye smolts on average were only 4% longer and 14% heavier than wild sockeye smolts. 2009 scale analysis also showed that wild 1.0 sockeye smolts and hatchery 1.0 sockeye smolts exhibited very similar growth patterns and the ager could not distinguish between wild and hatchery smolts based on scale growth patterns. Conversely, in 2008 there was a notable size differential between the wild and hatchery smolts with the hatchery smolt growth pattern being much larger.

Age determination of wild coho smolts concluded that 70% of the coho smolts were age 1.0 (European Age) and 30% were age 2.0 fish. There were no visual size differences between 1-Yr old coho and 2-Yr old coho as both year classes of coho smolts had overlapping length frequency distributions. Given this was the first year for aging coho smolts scales, it is recommended that future years smolt assessments continue to sample coho age structures to determine if there are distinct length differences between the 1-Yr old and 2-Yr old age classes as noted in Gitanyow Lake sockeye smolts.

In 2009, freshwater production estimates from Gitanyow Lake determined that 280 wild sockeye smolts were produced per adult female and 318 hatchery sockeye smolts were produced per adult female. Gitanyow Lake freshwater production estimate for the number of smolts produced per adult female when compared to other BC Sockeye lakes was over two and half times the average. Cultus and Chilko Lakes, which are located in the Fraser watershed, produce an average of 108 and 115 smolts/female respectively (Hall, 2009). Both of these lakes have been collecting sockeye smolt estimates for over 30 years.

The GFA, with help from MOF, DFO, MOE, and the GHC, has successfully implemented a sockeye smolt counting facility that will provide reliable estimates of the

sockeye and coho smolt migration from Gitanyow Lake on a yearly basis. In 2009, the GFA would like to acknowledge the DFO (Prince Rupert Stock Assessment), Skeena Wild and the GHC for funding the permanent smolt fence so that accurate smolt assessments were possible. The smolt escapement numbers will help biologists determine the freshwater production in Gitanyow Lake as well as smolt to adult survival rates specific to the Kitwanga sockeye stock when coupled with escapement results from the Kitwanga River Salmon Enumeration Facility. As coho smolt and adult assessments continue on the Kitwanga system, CWT information collected by the GFA and tag recaptures in the commercial fishery will help to determine ocean survival rates and exploitation of the stock in the various Alaskan and Canadian fisheries in the ocean and in freshwater recreational and aboriginal fisheries.

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Appendix 1 – Letter from Carol Lidstone of Birkenhead Scale Analyses

Birkenhead Scale Analyses

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October 4, 2009

Mark Cleveland,
Head Biologist
Gitanyow Fisheries Authority
P.O. Box 148,
Kitwanga, B.C. V0J 2A0

Re: 2009 Kitwanga River Sockeye Smolts - Scale Analysis

Dear Mark,

Attached is the analysis of the sockeye smolt scales collected from the Kitwanga River in May 2009. The updated version of the Excel file includes the scale age, circuli counts and relevant comments.

Of the 602 fish sampled, 167 were unreadable. Most were unreadable because the scales were mounted incorrectly with the grooved side facing down and the smooth side facing up. Many of these scales also had a film over them which could be either dirt or water. Only 3 samples contained regenerated scales and one sample, where no scales were collected.

None of the scales exhibit plus (spring) growth, which is the rapid growth following the formation of the last annulus.

Hatchery Sample (Age 1 n=95, 92 with readable circuli counts)
In 2008, the hatchery scales exhibited a different pattern than the wild scales. The hatchery scales had more rapid growth (wider circuli spacing) near the focus with a stress between the 3rd-7th circuli. Often another stress was present prior to the first annulus, but not always.

In 2009, the hatchery scales do not exhibit wider circuli spacing. Only 7 of the 92 readable scales exhibit an inner stress near the focus between the 3rd-5th circuli, followed by another stress prior to the first annulus. The remainder demonstrate the typical pattern seen with the wild sample, with one freshwater stress located between the 5^{th}-15^{th} circuli, and the total number of circuli ranging from 18-26 (with the exception of 68011 #10 total = 13). I would not be able to separate wild versus hatchery based on the results in 2009.

Wild Sample

One- Year Olds (n=320; 304 with readable circuli counts)

All of the one year-old scales collected from wild sockeye exhibit a freshwater stress; the location varies with each fish, but is between the 6th and 14th circuli. The strength of the stress ranges from weak, to moderate, to strong. The total number of circuli in the first year of growth ranges from 14-24, and in general, the total circuli count is directly related to smolt length and weight.

Two Year-Olds (n=18, excluding book 68019 #10 (108 mm/14g) where scale belongs with box #9; 17 with readable circuli counts)

Only 3 of the 17 fish with readable circuli counts exhibit a stress in the first year of growth, but all 17 exhibit a stress in the second year of growth. The circuli counts in the first year are relatively low for Kitwanga, ranging from 8-17, then from 22-30 in the second year. The total circuli counts range from 33-43. It appears the majority of these fish had a slow growth rate in the first year compared to normal Kitwanga growth, based on the low circuli count and lack of the typical stress.

Please note, there appears to be an error with the length for 68019 #22 (123 mm) but the weight appears to be correct (49.4 g) (K factor = 2.7).

Three Year-Old (n=1)
The three year-old scale (300 mm/275 g) exhibits a typical Kitwanga freshwater stress in each year of growth, with the total circuli counts = 68.

I look forward to hearing from you with comments regarding the results. Please contact me by e-mail if you have any questions or concerns, as I will be away from the office from October 5-19. Thank you very much for the opportunity to complete this work for you.

Sincerely,

Carol Lidstone
Birkenhead Scale Analyses

cc Derek Kingston, Fisheries Biologist, Gitanyow Fisheries Authority