Gitanyow Fisheries Authority

Kitwanga River Salmon Enumeration Facility – 2012 Annual Report

Submitted to: Gitanyow Hereditary Chiefs
Pacific Salmon Foundation
Fisheries and Oceans, Canada
Tides Canada
Skeena Wild Conservation Trust

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Abstract

In 2012, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Salmon Enumeration Facility (KSEF) for the 10th consecutive year to count all five Pacific salmon species returning to the Kitwanga River. From July 28th to October 14th a total of 5,476 sockeye, 848 chinook, 16,320 pink, 426 chum, and 2,961 coho salmon (including 77 Coded Wire Tag (CWT)) were enumerated through the facility. The 2012 sockeye return was well below the highest recorded of 20,804 in 2010, well above the lowest return of 240 fish in 2007, but exceeds the overall run average (2003-2011) by approximately 1,200 fish. The 2003 to 2012 sockeye return data suggests that a sporadic but positive rebuilding of the population is occurring since the 2007 low –point. The 2012 chinook return is the third lowest recorded at the KSEF since the year 2003, is 47 percent below the running average from 2003 to 2011, and marked the fifth consecutive decline in the running average since the KSEF record return of 3,225 fish in 2007 The 2012 even year pink run compares to a maximum even year return of 71,070 fish in 2004 and a minimum return of 4,245 fish in 2008. The 2012 pink returns was approximately 9,000 fish less than the even-year running average of 25,625 (years 2004, 2006, 2008, 2010; skewed by 2004 return), however was the second highest recorded in an even year since 2003. It is important to note that the 2011 odd year pink salmon return was the lowest ever recorded by GFA, which is striking since the 2011 fish originated from the highest ever recorded run of 559,865 fish (88% decrease). Broodstock from this run will be returning to the KSEF in 2013, and results are highly anticipated. The 2012 chum salmon return was 50% of the average escapement recorded from 2003-2011, and marks the 7th year of numbers well below the running average. The 2012 coho escapement was 81% of the average escapement recorded from 2003-2011. However, the running average is skewed by two abnormally high returns in 2005 and 2009 (7,100 and 12,080 fish respectively), while most of the other years runs ranged between approximately 1,000 and 3,000 fish. GFA assumes that the 2012 coho escapement is underestimated due to flooding and fence damage leading to the closure of the fence on October 15th before the coho run was likely complete. GFA presumes that only escapement counts for coho salmon were compromised. Based on previous run-time records, the other salmon species likely passed though the KSEF before its closure.

Acknowledgements

Gitanyow Fisheries Authority (GFA) would like to thank the Gitanyow Hereditary Chiefs for their continued leadership and support for the GFA program. GFA would also like to acknowledge the financial contributions in 2012 from DFO's Stock Assessment program (Prince Rupert), DFO's Aboriginal Fisheries Program, the Pacific Salmon Foundation and Skeena Wild Conservation for jointly funding the project. GFA would also like to acknowledge the hard work of the fence staff whose dedication throughout the program made the operations a success. In 2012 GFA staff members included: Les McLean, Earl McLean, Vernon Russell, Phillip Johnson, Scott Williams, Derek Kingston, Mark Cleveland, Gregory Rush, Kevin Koch, Sandy Hnatiak, Brenton Williams and Eric Hill.

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1. BACKROUND AND INTRODUCTION

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, their primary spawning grounds, turning red every fall as the sockeye congregated to spawn on their respective spawning grounds (Cleveland et. al., 2006). By the 1970's most fishing sites along the Kitwanga River were abandoned and aboriginal fishing for sockeye ceased due to low run numbers and concerns for their extinction (Cleveland et. al., 2006).

The reason for Kitwanga sockeye stock decline has not been exactly determined; however over-exploitation by commercial ocean fishers is believed to be one of the largest contributors to the decline. Past fishery re-constructions for the last 40 years show average exploitations on Kitwanga sockeye of over 50% with highs in some years exceeding 70% (Cox-Rogers, et. al. 2010). Other causal factors considered is habitat degradation in Gitanyow Lake due to soil erosion from poor logging and road building activities, which may have contributed to sedimentation of important lakeshore spawning grounds (Cleveland et. al. 2006).

Historical DFO salmon escapement data system (SEDS) records for Kitwanga Sockeye are incomplete. In 1999, with help from the DFO's Aboriginal Fisheries Strategy (AFS) program GFA initiated a Kitwanga sockeye-rebuilding program to conserve, protect and recover the stock.

A key component of the rebuilding program included determining annual sockeye returns to Gitanyow Lake and investigating potential limiting factors affecting sockeye production. In 2000, 2001, and 2002 the GFA established and operated a temporary counting fence located approximately 4-km downstream of Gitanyow Lake, below all know Kitwanga sockeye spawning grounds. Sockeye escapement for 2000, 2001, and 2002 were 260, 227, and 971 respectively, well below historic levels by the tens of thousands and cause for concern to the Gitanyow People (Cleveland et. al, 2006).

Unfortunately, the temporary fence was periodically susceptible to flooding and breaching. It was also very costly and time consuming to maintain. Therefore, GFA recommended and eventually acquired funding from various groups to build a permanent counting structure near the

mouth to the Skeena River. During the winter and spring of 2003, the Kitwanga River Salmon Enumeration Facility (KSEF) was constructed approximately 4 Km upstream of the Skeena River confluence at a cost of $750,000 (Cleveland, 2003). The KSEF was operational in July 2003 when salmon were counted through the facility for the first time (Cleveland, 2004). This initiative benefited management groups by providing accurate annual counts of sockeye, chinook, pink, chum and coho salmon returning to the Kitwanga River system.

In conjunction with counting fences, GFA initiated various studies to research potential limiting factors to Kitwanga sockeye production and efforts to rebuild the stocks have also been undertaken. These include spawning habitat assessments and restoration projects, which lead to fresh gravel placement and sediment removal in 2006 and 2007 (Kingston 2008, 2009). Using Gitanyow Lake stock, GFA released approximately 93,000 hatchery fry into Gitanyow Lake in 2007 and 2008. Approximately 77% of the hatchery releases were marked with an adipose fin clip to assess return rates (Cleveland 2007, 2009 and McCarthy and Cleveland 2012). In addition, a reduction in exploitation was promoted by GFA for both the ocean and inland fisheries during peak migration periods for Kitwanga sockeye (mid to late timed, peaking DFO Stat week 74). In response, DFO did implement reduced fishing regimes to allow Kitwanga sockeye to rebuild. Exploitation rates in the last 4 years have averaged less than 25% overall.

Since 2003 the KSEF has proved useful for fisheries managers to provide in-season and post season information and support management decisions for Skeena River salmon stocks. Not only is the KSEF used as a middle Skeena salmon indicator, but it is also the only fence in the Skeena River watershed that provides an accurate salmon count for both pink and chum salmon.
The 2012 season marks the tenth year of obtaining accurate results at the KSEF, and as such, escapement data from 2000 to 2002 obtained from the temporary weir, stream walks and aerial flights prior to the construction of the KSEF and presented in previous reports are no longer included.

In addition, the KSEF is a key assessment tool used to assess the Kitwanga Sockeye Rebuilding Program initiated in 2003. With the recent upgrades to the counting stations in 2010, GFA now can check for sockeye adipose fin clips, which is a signature for sockeye salmon hatchery fish released in Gitanyow Lake in 2007 and 2008 (Cleveland 2007, 2009). In addition, GFA implanted coho smolts with Coded Wire Tags (CWT) starting in 2009. Recovering the CWT coho will help GFA and DFO understand migration and the harvest patterns of the various

commercial, sport and aboriginal fisheries in Alaska and Canada. CWT data can also provide an estimate of ocean survival rates when recovered at the KSEF.

In 2012, the KSEF was operated with funding contributions from Fisheries and Oceans Canada, Pacific Salmon Foundation, Skeena Wild Conservation Trust and the Gitanyow Fisheries AFS program. This report summarizes the sampling results and findings for the KSEF program in 2012.

2. DESCRIPTION OF THE STUDY AREA

The Kitwanga River is a fifth order stream that drains into the Skeena River approximately 250 km northeast of Prince Rupert, B.C.. It supports six species of Pacific salmon including pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*) and steelhead trout (*O. mykiss*). The Kitwanga River is also known to support populations of resident rainbow trout (O. mykiss), cutthroat trout (*O. clarki*), Dolly Varden (*Salvelinus malma),* bull trout *(S. confluentus*), mountain whitefish (*Prosopium williamsoni*) and various other species of coarse fish (Cleveland, 2000). It is coded 40-2200 by the B.C. Watershed Classification System. The UTM coordinates at its confluence are 090055840 N, 6106300 E. The drainage encompasses an area of approximately 83,000 hectares and has a total mainstem length of 59 kilometres (Cleveland, 2000). Gitanyow Lake separates the Upper and the Lower Kitwanga River. The Upper Kitwanga is located directly north of Kitwancool Lake and has a main stem length of approximately 23 km. The Lower Kitwanga River flows south for approximately 36 km between Gitanyow Lake and the Skeena River. The Lower Kitwanga River has four major tributaries Tea Creek (40-2200-010), Deuce Creek (40-2200-020), Kitwancool Creek (40-2200-030) and Moonlit Creek (40-2200-040). The Upper Kitwanga River has no major tributaries and exhibits a multi-channel meandering configuration, with numerous beaver dams along its lower reaches.

The KSEF is located on the Kitwanga River approximately 4 km upstream from its confluence with the Skeena River (Figure 1). Access to the site and the facility was provided through a private road and property owned by Marcus and Don Halvorson. To ensure long-term access to the site the Gitanyow Hereditary Chiefs applied for and were granted a Statutory Right of Way permit to both the access road and the site where the counting fence is located. The Right of Way was granted on March 26, 2003 and has recently been re-negotiated with the term now ending in

2036. As there are Gitwangak First Nation interests near the KSEF site, fishery labourers from the Gitwangak community are employed annually by GFA to help operate the facility.

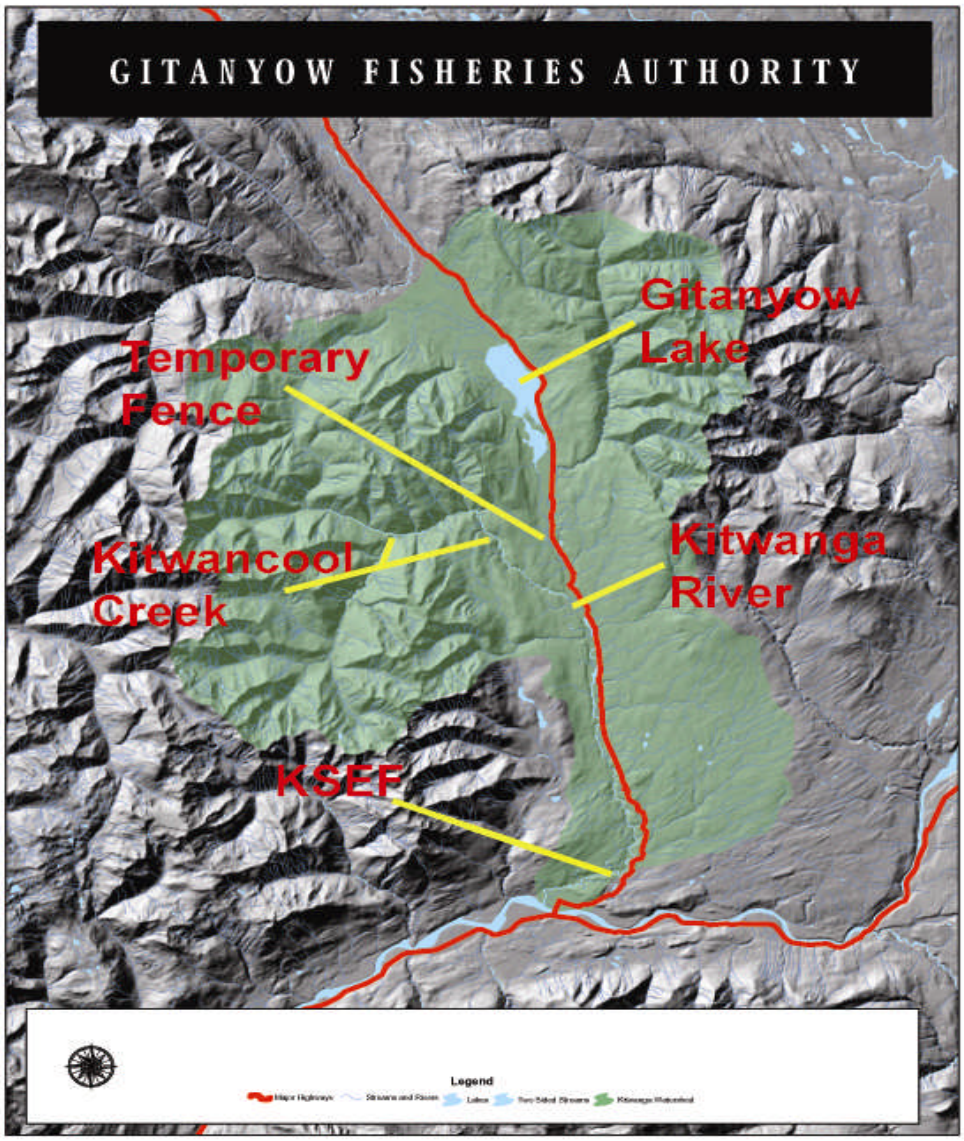

Figure 1: Map of the Kitwanga Watershed including the KSEF (operating from 2003-2012) and the temporary fence sites (operating from 2000-2002).

3. METHODS

The counting fence is located approximately 4 Km upstream of the mouth to the Skeena River and below most salmon spawning areas (Cleveland, 2004). The KSEF operates during the summer and fall months and uses aluminum panels that funnel fish into one of two counting stations located on the left and right banks of the river (Photo series 1). From late fall through to the following summer, fence panels and counting boxes are removed allowing fish unimpeded movement past the site. The KSEF is approximately 30m wide and spans perpendicular to the rivers flow. The upstream ends of eighteen aluminum panels are secured to a cement base by metal hooks. The hooks allow the floating panels to hinge up and down as water levels fluctuate. The downstream ends of the panels are secured with 1/4" aircraft cable to eight - 1500 lb winches suspended from an overhead walkway bridge (see red flagging tape attached to cables in Photo Series 1). The winches and adjoining cables allow the fence to be easily raised or lowered depending on the water level and debris build-up at the KSEF.

Once the aluminum panels are secured, the left and right bank counting stations are installed so that all fish can be recorded as they migrate past the fence (Photo Series 1). Fisheries technicians stationed at each trap box visually identify and tally fish by species. Each trap box has two counting chutes to direct fish into one of two large holding pens where they can be examined more closely, if necessary. A white teflon reflective background is used on the bottom of the trap boxes to make fish visual identification easier. A plexiglass-bottomed viewing box floats on the water to reduce glare and improve the fish visibility. Trap boxes are equipped with hand winches, which are raised or lowered to allow adequate water levels in the chutes.

In March 2010 several upgrades were made to the counting stations prior to the salmon migration season. These upgrades proved to be very successful for the operations of the fence allowing GFA technicians the ability to more effectively stop and inspect every coho and sockeye for an adipose fin clip.

In 2012 GFA installed three experimental rotating panels (Photo Series 2), designed to ease cleaning of leaves, woody debris, and dead pitch salmon during the fall rainy period. High water levels and debris accumulation often overwhelms the fence and result in early closure before all the salmon have escaped into the river. The new panel design was used during the regular fence

operations and proved very successful in self-cleaning by rotation. Additional rotating panels will be added in 2013 until eventually the entire fence will be converted to a rotating design.

Photo Series 1: The general KSEF structure including fence panels, right and left bank counting stations, overhead walkway, and winch cables suspended from the walkway that raise and lower fence panels according to flow rate and debris build-up.

Photo Series 2: Rotating panels installed in 2012.

Photo Series 2: Counting stations used at the KSEF.

In 2012, portions of the migrating salmon were systematically sampled to acquire a full range of fish sizes and scales for length/age analysis. When retrieved sampled fish were placed in a "V" trough equipped with a hose and electric pump that provided a constant supply of fresh river water (Photo Series 3 showing sockeye and chum specimens). Samples from all species, except for pink salmon, were visually inspected to identify the presence of marks (e.g. adipose fin clip), measured for length and inspected for sex, ripeness and overall condition.

Scale samples were collected for aging and are present in this report using the European method, where the age is presented in a two-number sequence with the first number representing the fresh water occupation period and the second number representing the salt water occupation period.

Photo Series 3: "V" trough with fresh water and aerator used to sample sockeye salmon (left) and chum salmon (right) at the KSEF.

All coho were examined for the absence of an adipose fin (Photo 4) and was documented as being from GFA's Coho Coded Wire Tag (CWT) program, which was initiated during the 2009 salmon smolt assessment at the Gitanyow Lake outlet (Kingston, 2010). Chinook and pink salmon specimens are shown in Photo's 5 and 6 respectively. Afterward sampling, fish were immediately returned to the trap boxes to recover and allowed to swim freely upstream.

Photo 4: Coho salmon sampled at the KSEF.

Photo 5: Chinook salmon sampled at the KSEF.

Photo Series 6: Pink salmon sampled at the KSEF (male left, female right).

GFA fisheries staff members working at the KSEF are instructed on proper fish handling techniques to reduce the stress on the fish. Crews of two fisheries technicians visually enumerated and tallied the salmon as they swam through each trap box. One GFA technician would work on the right bank counting station and the other on the left bank counting station during each shift. The hours of operation were during daylight hours. One two-person fisheries crew would work a morning shift then a second two-person crew would take over in the afternoon, all of which would count and sample fish throughout the daily operational period..

A manual stage gauge was used to measure river levels. Fisheries personnel recorded river levels four times daily. The manual stage gauge was established at the KSEF in 2004 and is used to compare water levels and flood events from year to year. GFA staff also recorded water temperature, rain gauge measurements and air temperature daily throughout the salmon migration season in 2012.

4. RESULTS

The operation of the KSEF in 2012 marked the 10th consecutive year and operated of a total of 81 days from July 27th to October 14th. Water levels fluctuated dramatically during the last week of operation with a peak flow on October 15th, which topped the KSEF and forced the closure of the project for the year approximately a week prematurely. Based on average run timing through the KSEF (2003-2011), GFA assumes that all of the chinook, pink and chum and 99% of the sockeye and 86% of the coho would have moved through KSEF by the end of the project. A total of 26,038 salmon were counted through the fence during this period (Table 1).

Hatchery returns were expected from the 2008 outplants returning as 5 year old hatchery fish (McCarthy and Cleveland 2012), however numbers were expected to be minimal (<50 adults), and therefore did not warrant that hatchery identification (adipose clips) be performed in 2012.

Table 1: Run timing and total counts for all species counted through the KSEF in 2012.

Species	**Run Start**	**Mid Run**	**Run end**	**Peak Run Range**	**Total Escapement**
Sockeye	August 3rd	August 31st	October 5th	August 13th – September 2nd and September 28th	5,476
Chinook	July 3rd	August 20th	September 13th	August 13th – August 30th	848
Pink	July 12th	September 4th	September 29th	August 17th - September 14th	16,320
Chum	August 12th	September 4th	September 28th	August 22nd – September 19th	426
Coho	August 12th	September 10th	October 14th	August 20th – September 28th	2961 (incl. 77 CWT)

Water levels were higher than normal in 2012 during the first month and a half (July 26th to August 21st) and during two briefer periods between September 30th to October 3rd and October 13th to 15th. However, GFA staff maintained the fence without breaches until October 15 when the fence flooded due to extremely high water levels and excessive debris accumulation marking the end of the counting season. The highest water level occurred on October 1st peaking at 1.45m (Figure 2).

Water temperatures were favorable for fish during the fence operation ranging from 6.5 °C to 12.0 °C.

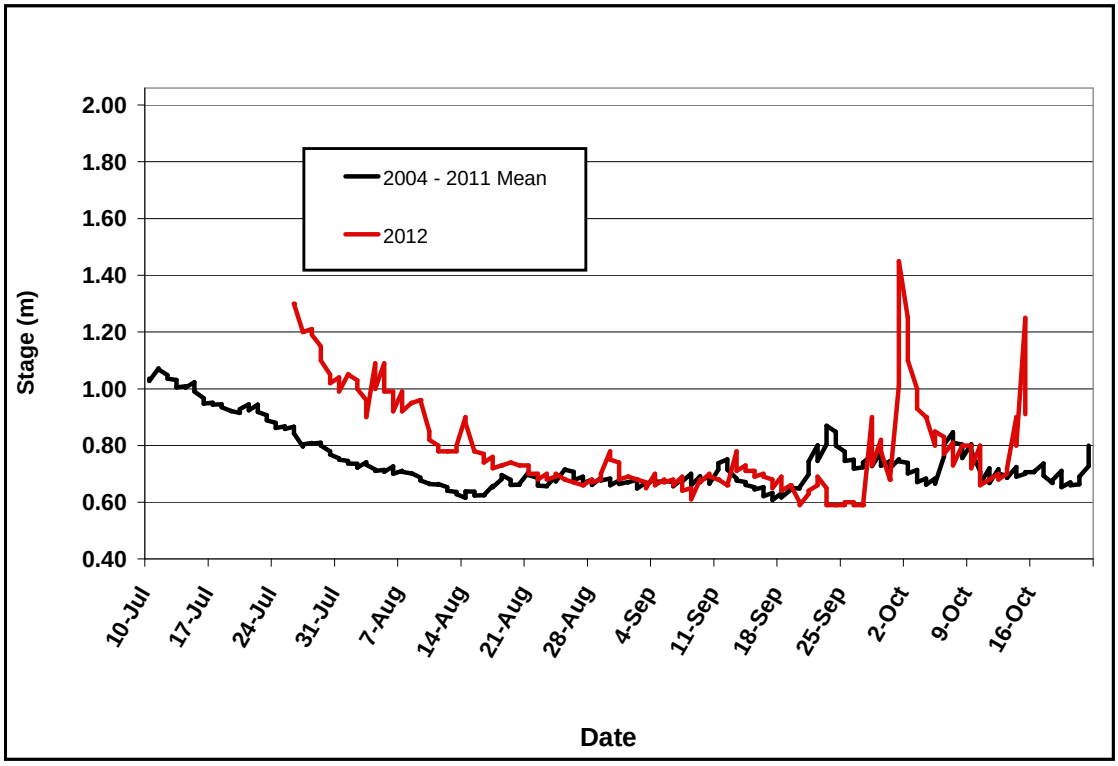

Figure 2: Water Stage at the KSEF, 2004-2011 average and 2012 recordings.

Species-specific breakdowns, including total counts, run timing, historical run numbers, size, age and sex structure, and coho coded wire tag returns are as follows:

4.1 Sockeye

A total of 5,476 sockeye were counted at the KSEF in 2012. Sockeye escapement in 2012 were well below the recorded high of 20,804 in 2010, well above the lowest count of 240 counted in

2007, but approximately 1,200 fish greater than the 2003 to 2011 running average of 4,264 fish (Figures 3). The 2003 to 2012 running average has now increased slightly and now stands at 4,385 sockeye per year.

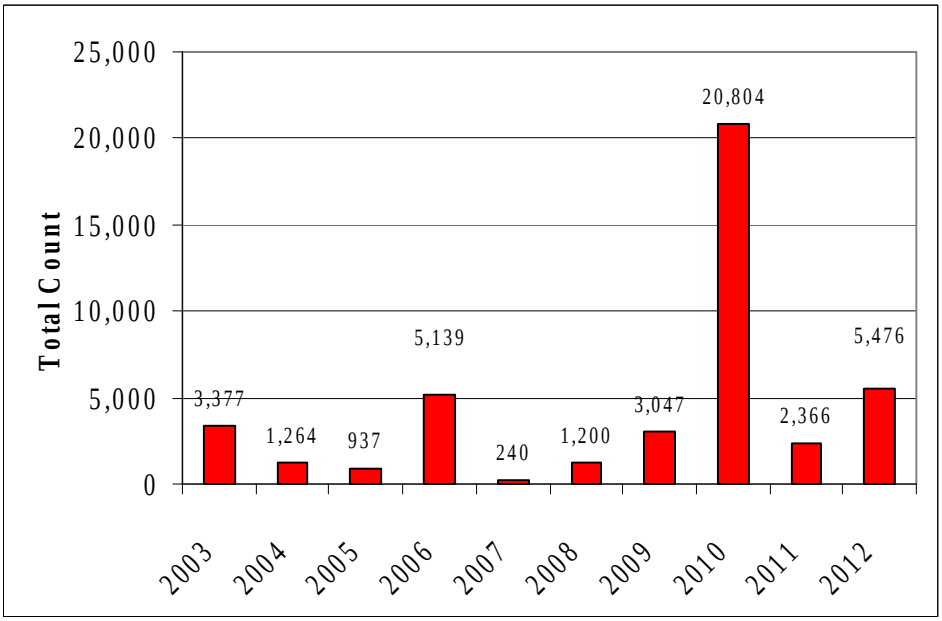

Figure 3: Annual Sockeye escapement into the Kitwanga River from the year 2003 to 2012.

In 2012, the first sockeye passed through the KSEF on August 3rd approximately 3 weeks later than previous years, probably due to higher than normal water levels experienced in the Kitwanga in July of 2012. The last sockeye migrated through the fence on October 5th (Figure 5), which is similar to most years, however small abnormal bursts did occur in 2008 and 2009 after the 2012 October 15th closure date (Koch and Cleveland 2009, Koch and McCarthy 2010). The 2012 main run timing range for Kitwanga sockeye occurred roughly over a 3-week period from August 13th to September 7th, representing 76 percent of the total run. An outlier one-day burst of 1,180 sockeye (22 percent of the total run) occurred on September 28th. It is important to note that two single-day events accounted for 59 percent of the total run (August 30th, 2,045 sockeye representing 37 percent of the total run, and the September 28th event noted above).

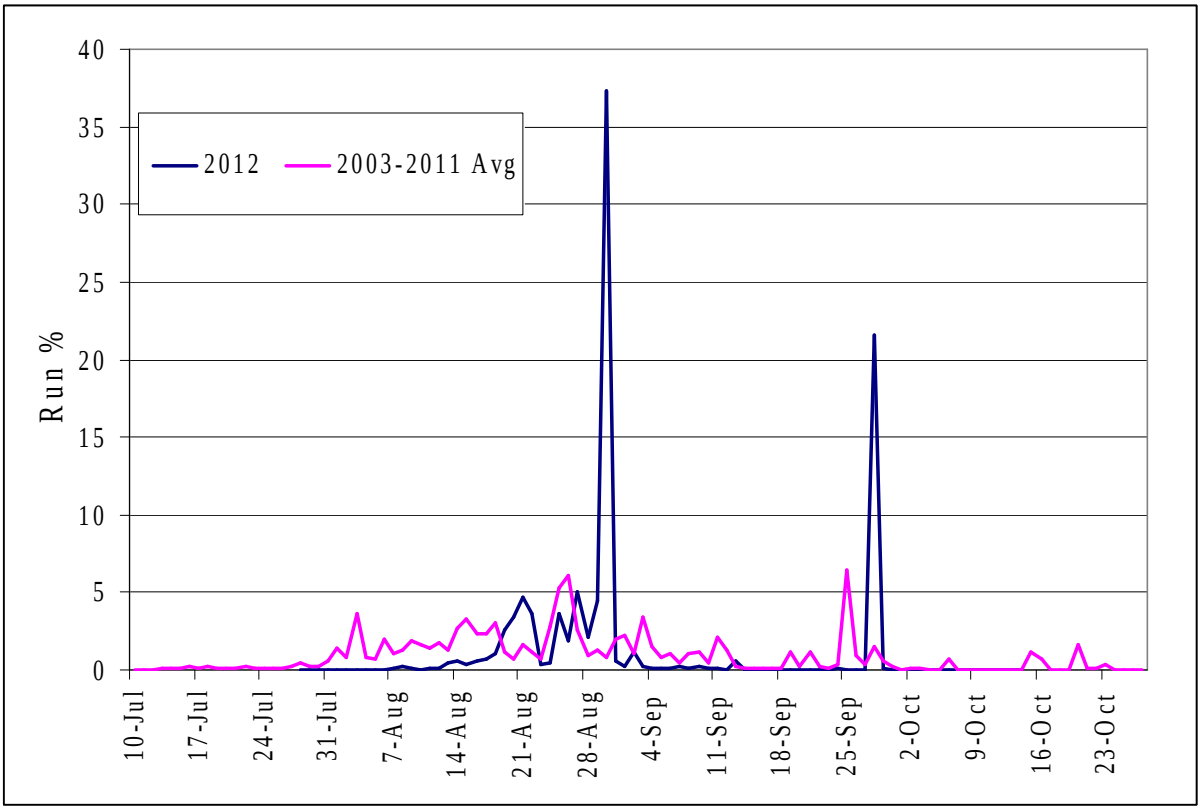

Figure 4: Kitwanga River sockeye salmon average run timing (daily run percent) for 2003-2011 vs. run timing for 2012 at the KSEF.

Exploitation Rates for 2012 from the Alaskan, Canadian Marine and In-River fisheries was estimated at 32 percent (5% Alaska, 22% Canadian marine, 5% In-river) (pers. comm. Peter Hall, 2012). Without exploitation (estimated 2,577 sockeye removed), the estimated total return for would have been approximately 8,053 sockeye (Table 2).

Table 2: Kitwanga sockeye salmon escapements from 2000 – 2012 with estimated Exploitation Rates from the Alaskan, Canadian Marine and In-River fisheries. Total exploitation rates were provided by the Prince Rupert – DFO.

Return Year	Escapement	Total Exploitation (Alaskan + Can. Marine + In-River)	Estimated Total Return
2003	3,377	38.0%	5,447
2004	1,264	38.3%	2,047
2005	937	27.9%	1,300
2006	5,139	54.2%	11,208
2007	240	61.3%	619
2008	1,200	50%	2,400
2009	3,047	15%	3,585
2010	20,804	14.5%	24,332
2011	2,366	31.0%	3,429
2012	5,476	32%	8,053

Fork length measurements, age and sex data was collected from 268 sockeye (5 percent of the run). Of these samples, male composition was slightly greater than females at 152 males (52%) and 127 females (47%); the sex was unknown for three samples (1%). Average fork length was slightly greater for males and also showed a wider range in size than females (Table 3). Size class (5 cm) histogram showed a uni-modal distribution, dominated by fish in the 56 to 60 cm size class (50%) followed by fish in the 51 to 55 cm size class (36%; Figure 5). When male and female average length was compared to previous years, the 2012 results fell within the historical range (Table 4). Average length recorded since 2003 were remarkably similar and within a narrow 5-cm size range for males (55 to 60 cm), and females (52 and 57 cm; note: data for 2005 and 2007 was not available in time for this report).

Table 3**.** Sockeye salmon fork length statistics at the KSEF in 2012.

	Male	Female	Total
Average	58	55	56
Minimum	48	48	48
Maximum	69	63	69
Count	138	127	265

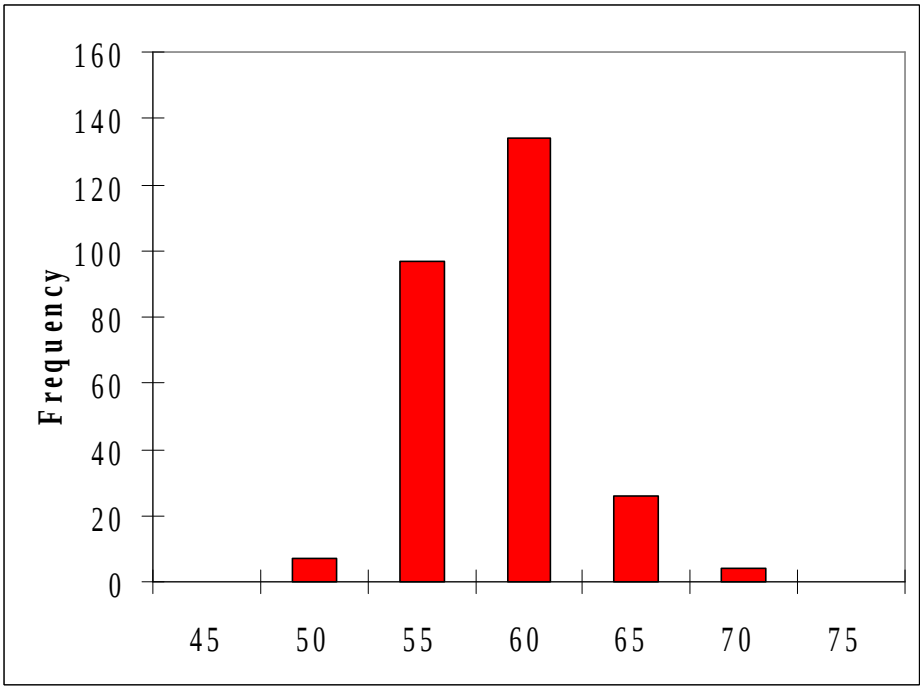

Figure 5: Fork length distribution for sockeye salmon in 2012 (n=268); X axis labels are 5 cm length class upper boundaries.

Table 4: Average length (cm) for sockeye male, female and combined sexes from 2003 to 2012

Year	Male	Female	Combined
2003	58.8	55.3	56.6
2004	58.3	56.4	57.1
2005	57.5	57.2	-
2006	55.3	52.6	53.8
2007	-	-	-
2008	58.3	54.9	56.3
2009	57.4	54.3	55.8
2010	56.5	53.9	55.3
2011	59.0	56.0	57.5
2012	58.0	55.0	56.0

In 2012, 268 scale samples were collected from adult sockeye and submitted to Carol Lidstone of Birkenhead Scales Analysis for age determination, and of these, 242 were confidently readable providing a 4.4 percent sample of the total run. Complete age specific sex and length data sets were available for 240 of these age samples (4.4 percent of the total run; Table 5). Both males and females were mostly 4-year old returning sockeye originating from the 2008 run (94 and 96 percent respectively) and mean size differing slightly at 58 and 55 cm respectively. The remaining sockeye were 5-year old fish originating from the 2007 run and mean size differed slightly for males and females at 61 and 60 cm respectively.

Table 5**.** Sockeye salmon age, sex and fork length statistics at the KSEF in 2012 (CL = mean variance at 95% confidence).

Sex	All Years				
	Count	Mean (cm)	CL (95%)	Min (cm)	Max (cm)
All male	126	57.7	0.6	48	69
All female	114	55.3	0.5	48	63
Total	240	56.5	0.4	48	69

Sex	1.2 (4- Year Old Returning Sockeye)				
	Count	Mean (cm)	CL (95%)	Min (cm)	Max (cm)
Male	119	57.5	0.6	48	69
Female	109	55.1	0.5	48	62
All	228	56.3	0.4	48	69

Sex	1.3 (5-Year Old Returning Sockeye)				
	Count	Mean (cm)	CL (95%)	Min (cm)	Max (cm)
Male	7	61.4	3.1	57	66
Female	5	60.0	3.7	55	63
All	12	60.8	2.0	55	66

4.2 Chinook Salmon

A total of 848 adult chinook salmon returned to the KSEF in 2012 (in addition to 7 jack chinook, which are not included in further analysis). The 2012 return is well below the highest observed return of 3,225 chinook in 2007 and is similar to the minimum observed of 824 chinook in 2009 (Figure 6). This chinook salmon count is the third lowest recorded at the KSEF since the year 2003, is 47 percent below the running average from 2003 to 2011, which was 1,771 fish (Figure 6). Furthermore, the 2012 return marked the fifth consecutive decline in the running average since the KSEF record return in 2007; the running average now stands at 1,678 fish/year.

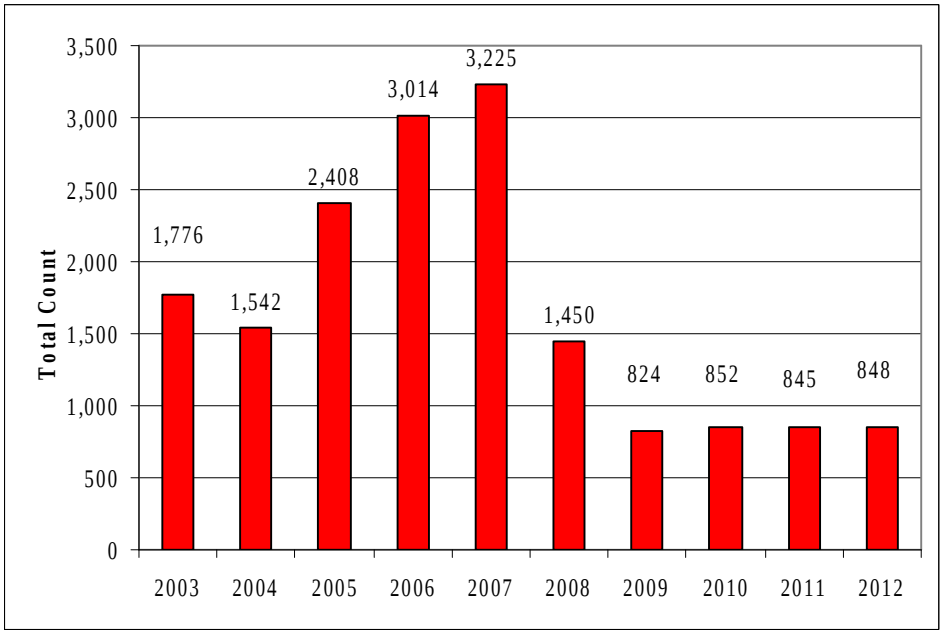

Figure 6: Annual escapement for chinook salmon from 2003 to 2012.

In 2012, the first chinook salmon was counted at the KSEF on July 29th and the last on September 13th. The 2012 main run timing range for Kitwanga chinook occurred from August 14th to August 30th (94 % of the total run). The highest count was observed on August 19th (203 fish or 24 percent of the total) was 10 days later than the average highest peak for years 2003 to 2011 (Figure 7).

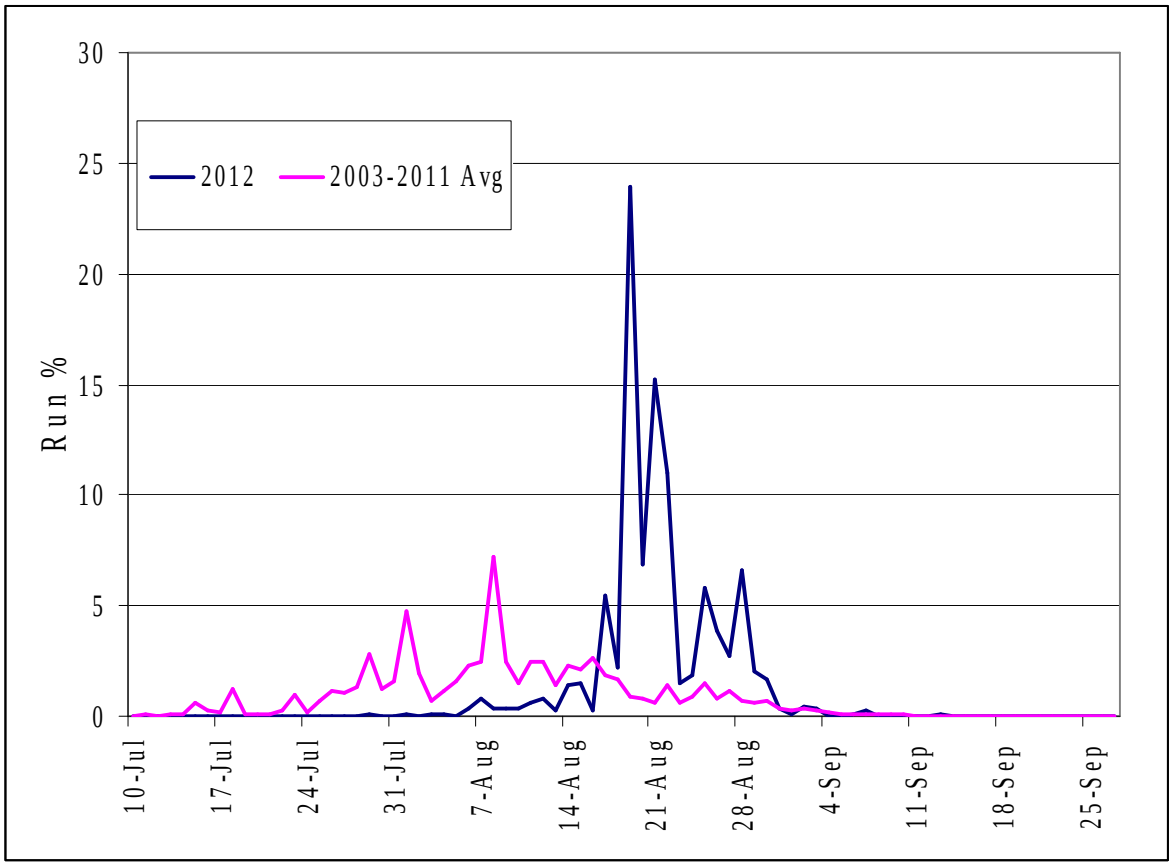

Figure 7: Kitwanga Chinook % Run past KSEF by day for 2003-11 vs. 2012

Length, age, and sex data was collected from 128 chinook salmon (15 % of the total run) in 2012. Male and female sex ratios were 57 and 43 percent respectively. Size class (5 cm) histogram showed a varied distribution, but dominated slightly by fish in 66 to 70 cm size class and in the 86 to 90 cm size class (approximately 18% each; Figure 8). Average fork length of the total sample was 80 cm and for males and females were 77 and 84 centimeters respectively (Table 6). Compared to length data collected since 2008, the 2012 mean lengths were slightly smaller and continuing a general trend of decreasing average size (Table 7).

Age samples collected in 2012 were not yet analyzed for inclusion in this report; however results will be presented in the KSEF 2013 Annual Report.

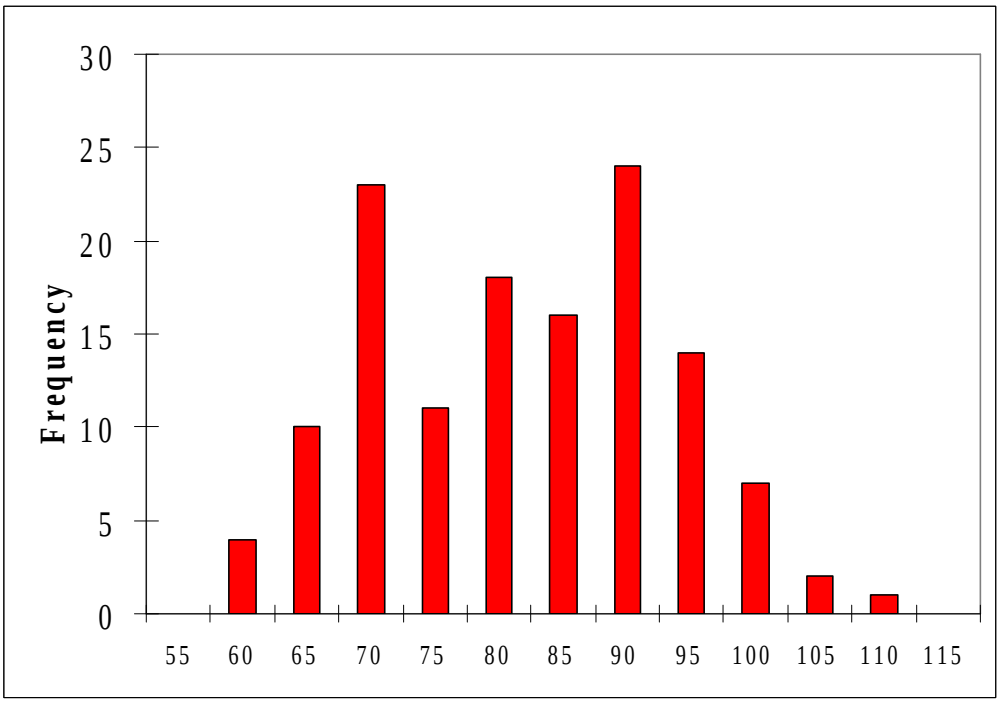

Figure 8: Fork length distribution for chinook salmon in 2012 (n=130); X axis is 5 cm length class upper boundaries.

Table 6: Average, minimum, and maximum fork lengths (cm) for chinook salmon sampled in 2012 at the KSEF (n=128).

	Male	Female	Total
Average	77	84	80
Minimum	58	63	58
Maximum	110	102	102
Count	73	55	128

Table 7: Average length (cm) for chinook male, female and combined sexes from 2008 to 2012.

Year	Male	Female	Combined
2008	87.8	92.3	89.2
2009	83.6	88.6	85.6
2010	74.6	87.5	80.7
2011	76.0	86.0	80.1
2012	77.0	84.0	80.0

4.3 Pink Salmon

A total of 16,320 adult pink salmon migrated past the KSEF in 2012. This compares to a maximum even year return of 71,070 fish in 2004 and a minimum return of 4,245 fish in 2008 (Figure 9). The 2012 pink returns was approximately 9,000 fish less than the even-year running average of 25,625 (years 2004, 2006, 2008, 2010; skewed by 2004 return), however was the second highest recorded in an even year since accurate counts were initiated in 2003.

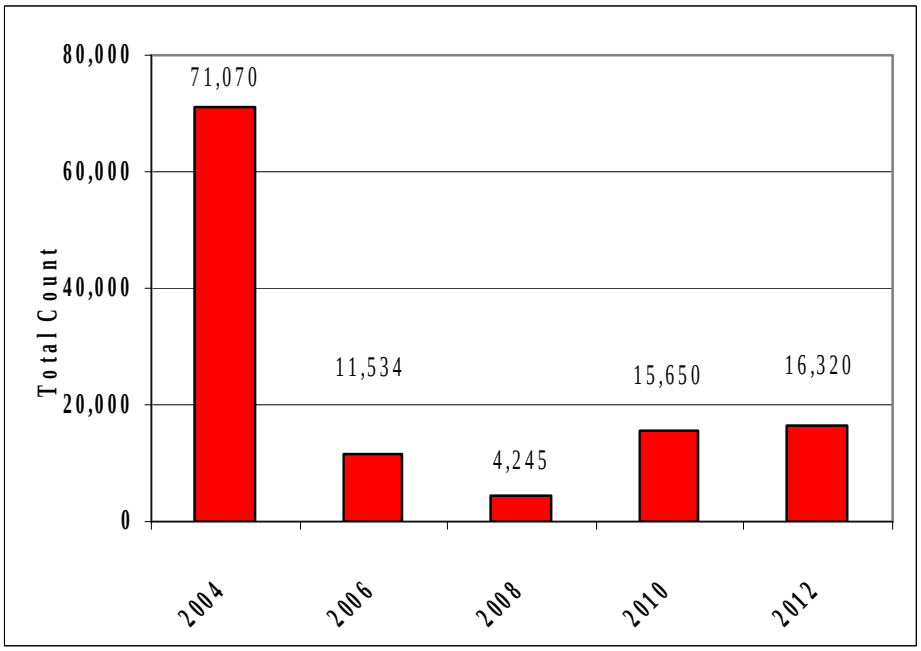

Figure 9: Annual escapement for even year pink runs at the KSEF.

As in all years pinks in 2012 were 2-year old fish. All of the run would have originated from 2010 return, which was similar at 15,650 fish. The bulk of the run occurred over a 3-week period between August 18th and September 9th (98 % of the run; mainly >100 fish per day; maximum count of 2,703 fish on August 30th; 692 fish per day on average; Figure 10). The peak run in 2012 was approximately 2 weeks later than average.

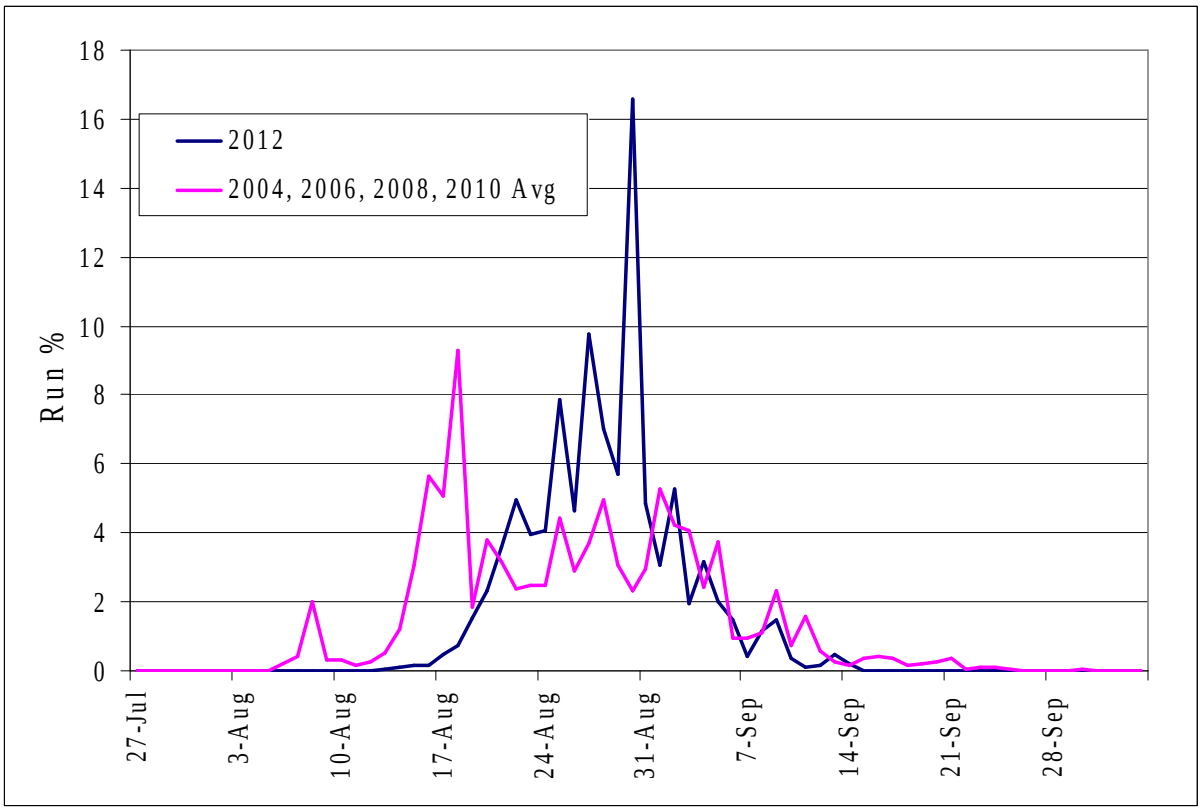

Figure 10: Run timing for pink salmon (daily run %) in 2012 vs. average even year run between 2004 and 2010.

4.4 Chum Salmon

A total of 426 adult chum salmon migrated past the KSEF in 2012. The 2012 run compares to a maximum return of 1,862 fish in 2005 and a minimum return of 150 fish in 2008 (Figure 11). The 2012 chum escapement is 50% of the average escapement recorded from 2003-2011, which was 848 fish. The current average now stands at 806 fish/year.

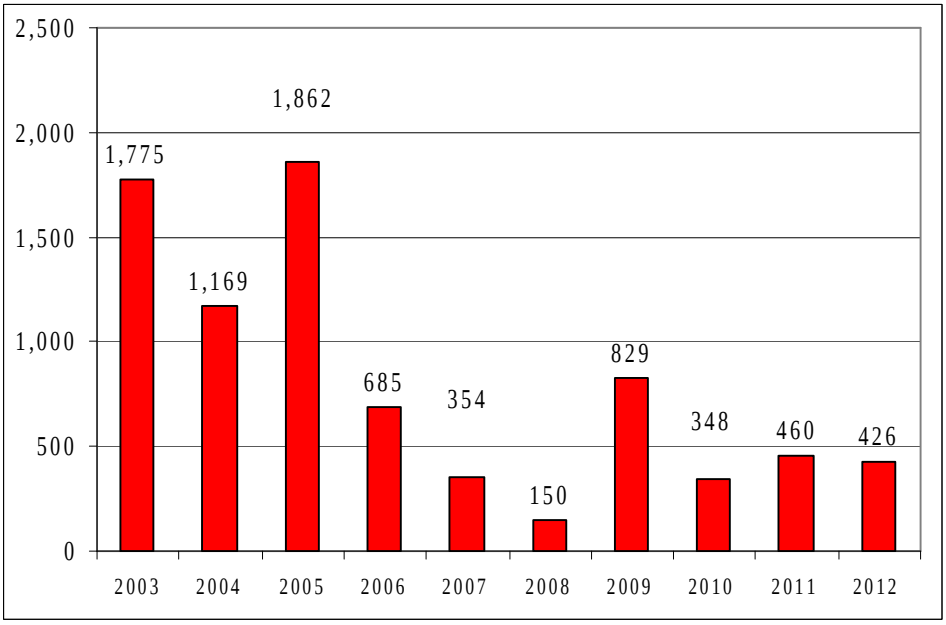

Figure 11: Annual escapement for chum salmon at the KSEF.

In 2012, the first chum salmon was counted at the KSEF on August 12th and the last on September 28th. The bulk of the run occurred over a 4-week period between August 22nd and September 19th (90 % of the run; mainly >10 fish per day; 13 fish per day on average; maximum count of 41 fish on August 30th; Figure 12). Three smaller spikes occurred on September 9th, 13th, and 18th (28, 35, and 31 fish respectively), and when combined with the August 30th count represented 32 percent of the total run.

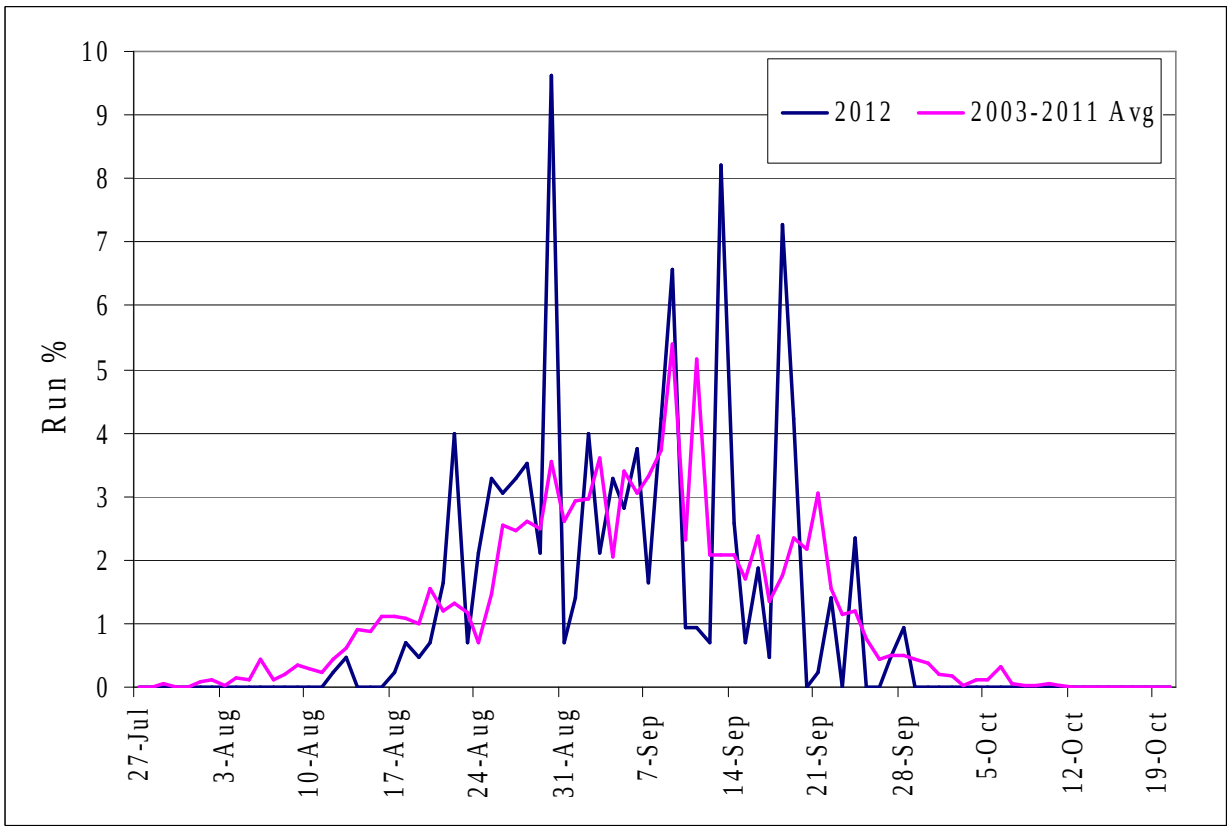

Figure 12: Kitwanga River chum salmon average run timing (daily run %) for 2003-2011 vs. run timing for 2012 at the KSEF.

Fork length, sex and age data was collected from 78 chum salmon in 2012 (18% of the run). Size class (5 cm) histogram showed a uni-modal distribution, dominated by fish in 76 to 85 cm length intervals (approximately 56%; Figure 13). Male and female sex ratios were 41 and 59 percent respectively. On average, males were slightly larger than females (80 and 77 cm respectively; Table 8). Compared to length data collected since 2008, the 2012 mean lengths were consistently within the 70 to 80 cm range (Table 9).

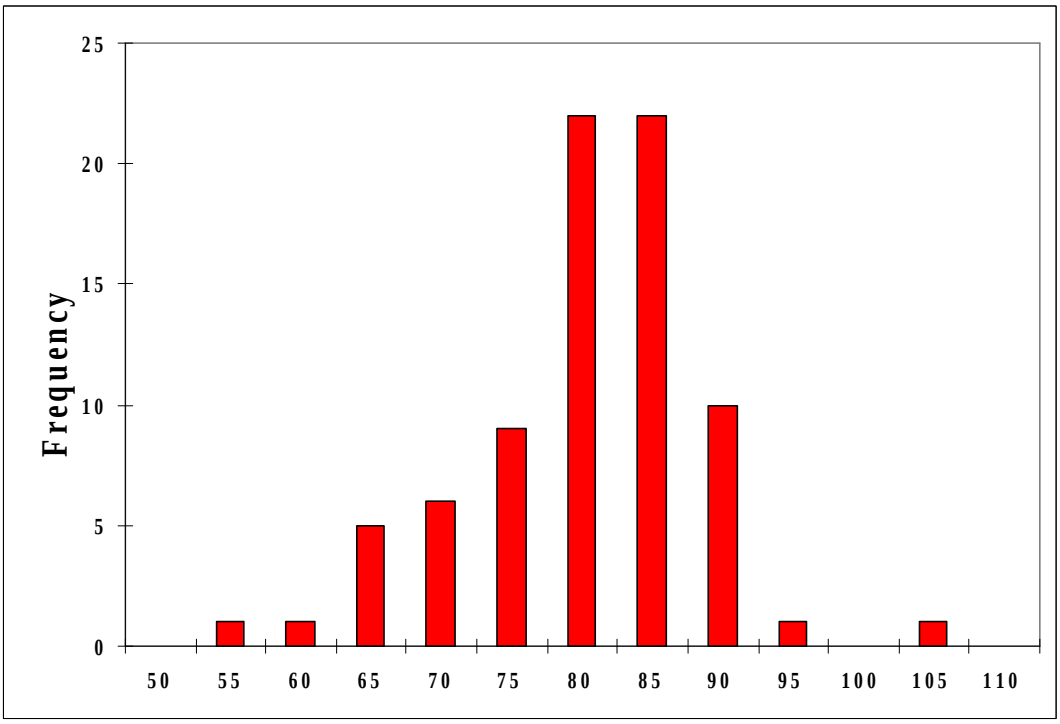

Figure 13: Fork length distribution for chum salmon in 2012 (n=130); X-axis labels are 5 cm length class upper boundaries.

Table 8: Average, minimum and maximum fork lengths (cm) for chum salmon sampled in 2012 at the KSEF.

	Male	Female	Total
Average	80	77	78
Minimum	59	52	52
Maximum	101	87	101
Count	32	46	78

Table 9: Average length (cm) for chum male, female and combined sexes from 2008 to 2012.

Year	Male	Female	Total
2008	77.0	70.3	75.0
2009	76.1	72.0	73.7
2010	76.5	73.9	75.1
2011	71.0	70.0	70.7
2012	80.0	77.0	78.0

Age results for 2012 chum salmon returns were not available at the time of the report. However, 2011 age results not available for the 2011 report are presented in this report. Of the readable scales from the 2011 aging sample (98 samples out of a run total of 460 fish, or 21% of the 2011 run), the majority of fish (95 percent) were 4-year old returns originating from the 2007 brood stock, followed by low but near equal 3 and 5-year old returns originating from the 2006 and 2008 brood stock respectively (Table 10). Chum salmon almost immediately migrate to the ocean post-hatch therefore there are no freshwater annuli.

Table 10: Age distribution for chum salmon sampled in 2011 at the KSEF.

European Age	Brood Yr.	Frequency	Percent
0.2	2008	2	2
0.3	2007	93	95
0.4	2006	3	3
Total		98	100

4.5 Coho Salmon

A total of 2,961 coho including 77 coded wire tagged (CWT) coho were enumerated at the KSEF in 2012 (Figure 18). The 2012 coho escapement is 81% of the average escapement recorded from 2003-2011, which was 3,658 fish/year. However the running average is skewed by two abnormally high returns in 2005 and 2009 (7,100 and 12,080 fish respectively), while most of the other years runs ranged between approximately 1,000 and 3,000 fish (Figure 14). The current running average now stands at 3,588 fish/year. The 2012 run compares to a maximum return of 12,080 fish in 2009 and a minimum return of 690 fish in 2004, however in 2004 the KSEF closed relatively early on September 24th due to flooding and fence damage. GFA assumes that the 2012 coho escapement value of 2,961 fish is underestimated due to breaching/flooding and subsequent closure of the fence on October 15th before the coho run was likely complete.

In 2012, the first coho salmon was counted at the KSEF on August 12th and the last on October 14th, the last day of counting before the fence closed. The bulk of the run occurred sporadically and roughly over a 6-week period between August 20th and September 28th (98 % of the run; generally >10 fish per day; 73 fish per day on average; maximum and relatively high count of 2,002 fish on September 28th; Figure 15). Three smaller spikes occurred on August 30th, and

September 14th and 24th (172, 103, and 126 fish respectively), and when combined with the September 28th count, represented 81 percent of the total run.

Possibly other peak runs could have occurred after the KSEF was closed on October 15th. For example in 2008, a total of 1,105 coho passed though the KSEF on October 22 (last day of operation) representing 38 percent of that years run. Another example was in 2009, when a total of 2,081 coho passed though the KSEF on October 23 representing 17 percent of that years run, and in addition, during the 2009 period between October 15th and 28th when the fence closed, the run represented 25 percent of the total run (Source: GFA KSEF 2003-2012 data file).

Results from the KSEF (2003 to 2012) and the temporary fence (2000 to 2002) have shown that many coho salmon tend to migrate through the Kitwanga River to their respective spawning grounds during high-water events in late September and October. However, in 2012 and several flood events in earlier years (2003, 2004, 2010, 2011), the fence was disabled possibly well before the coho run was complete. As noted above, GFA is confident that all other salmon species essentially completed their run before these breaches occurred.

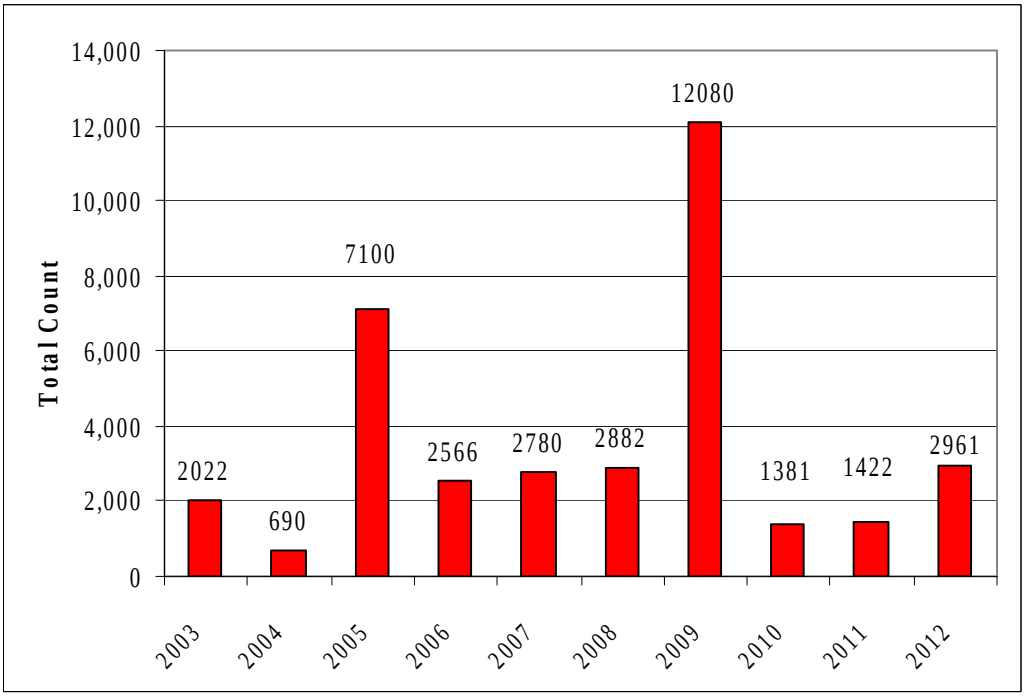

Figure 14: Annual escapement for coho salmon from 2003 to 2012 at the KSEF.

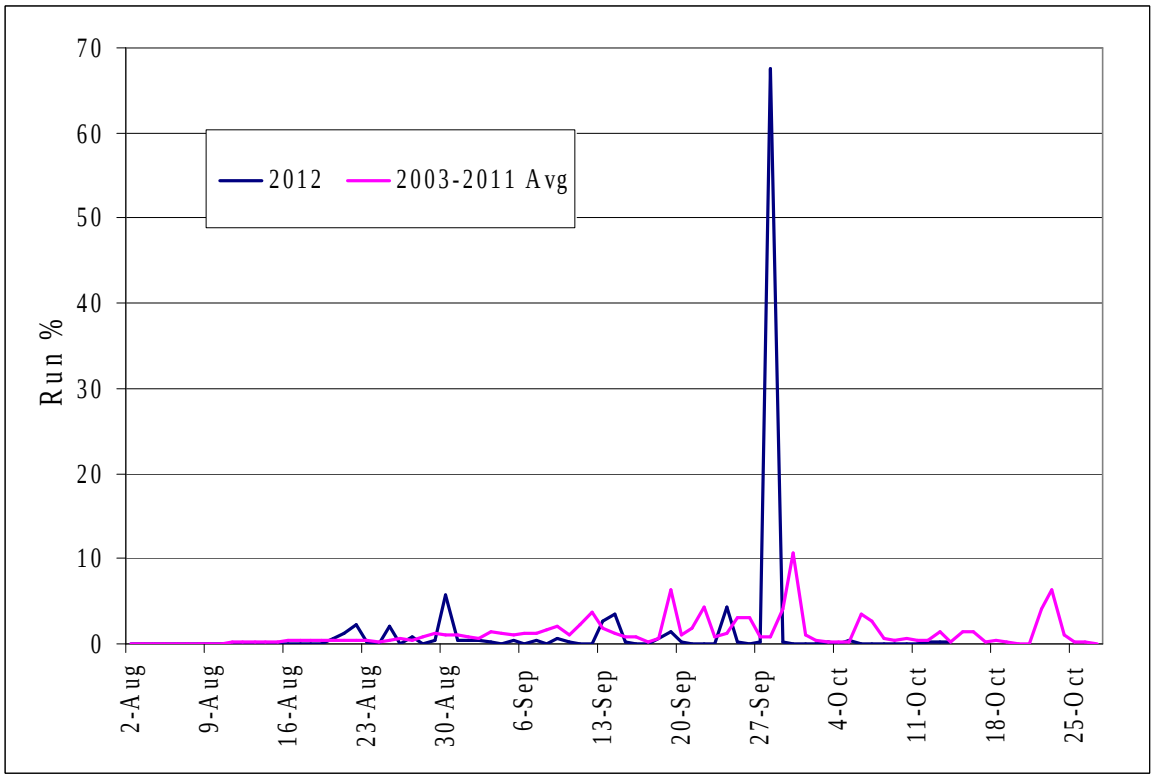

Figure 15: Kitwanga River coho salmon average run timing (daily run %) for 2003-2011 vs. run timing for 2012 at the KSEF.

Length, age, and sex data was collected from 69 coho salmon in 2012 (2.3 % of the total run). Size class (5 cm) histogram showed a uni-modal distribution, dominated by fish in 61 to 65 cm length interval (approximately 38%; Figure 16). Male and female sex ratios were 54% and 46% respectively. Average fork length for males and females were similar at 61 and 62 centimeters respectively (Table 11). Compared to length data collected since 2010, the 2012 mean lengths were consistently within the 60 to 65 cm range (Table 12).

The 2012 age results for coho were not available for inclusion into this report, however after the DFO's Pacific Biological Station analysis are completed those results will be presented in the 2013 KSEF annual report. In this report, 2011 data is presented, which was not available to GFA in time for the 2011 KSEF Annual Report submittal deadline. Of the 154 readable scales from the 2011 aging samples (11% of the 2011 run of 1,422 fish), the majority of fish were 3-year old returns followed by 4-year old returns (Table 13). Each age class differed by the time coho spent in freshwater, but all spent one year in salt water.

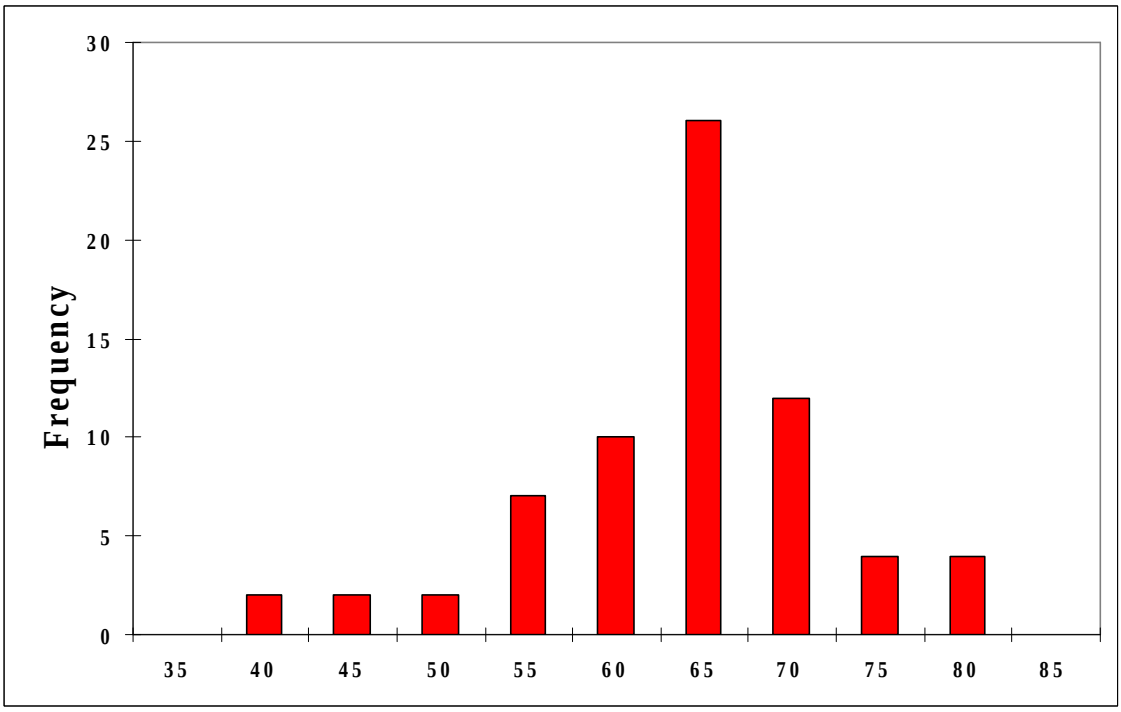

Figure 16: Fork length distribution for coho salmon in 2012 (n=69); X-axis labels are 5 cm length class upper boundaries).

Table 11: Average, minimum, and maximum fork lengths (cm) for coho salmon sampled in 2012 at the KSEF.

	Male	Female	Total
Average	62.3	60.7	61.2
Minimum	38.5	40	38.5
Maximum	76.6	77	77
Count	37	32	69

Table 12: Average length (cm) for chum male, female and combined sexes from 2008 to 2012.

Year	Male	Female	Total
2010	65.3	64.2	64.8
2011	60.8	62.5	61.4
2012	62.3	60.7	61.2

Table 13: Age distribution for coho salmon sampled in 2011 at the KSEF.

Age	Brood Yr.	Frequency	Percent
1.1	2008	95	72.3%
2.1	2007	59	27.7%
Total		154	100.0%

All coho smolts (including CWT implanted fish) processed through the smolt fence in a given year (spring) generally return to the KSEF 18 months afterwards. In the spring of 2011, GFA applied 4,064 CWT's to coho smolts at the Kitwanga Smolt facility, which is located at the outlet of Gitanyow Lake). These smolts were expected to return as adults in the fall of 2012.

Of the 4,064 coho marked with a CWT in 2011, GFA counted 77 CWT tagged coho (1.9% recovery) through the KSEF in 2012 before the closure of the fence on October 15th representing approximately 2.6 % of the 2012 KSEF run. Alaskan fisheries recovered another 19 Kitwanga River CWT coho [Ketchikan (49%), Sitka (27%), Craig (10%), Petersburg (5%), Hoonah (5%), Petersburg (5%) and Wrangell (5%) Inlets]. Canadian fishery results for coho CWT returns were not available in time for this report. Given that KSEF ceased operation before the anticipated completion of the coho run in 2012, along with data not yet submitted by DFO for Canadian fisheries component, a full account of the 2011-2012 CWT coho program cannot be finalized for this report.

5. DISCUSSION AND RECOMMENDATIONS

Since the construction of the KSEF in 2003 it has provided accurate and invaluable data in determining the strength of Kitwanga River salmon stocks against other middle Skeena salmon stocks. In 2012, the GFA successfully operated the KSEF to enumerate and collect biological information for sockeye, chinook, chum, pink and coho salmon returning to the Kitwanga River. Although the fence ceased operation in mid October due to high water GFA assumes only escapement counts for coho salmon were compromised.

In 2012 GFA installed three experimental rotating panels, designed to ease cleaning of leaves, woody debris, and dead pitch salmon during the fall rainy period. The new panels proved very successful and additional rotating panels will be added in 2013 until eventually the entire fence will be converted to a rotating design

A total of 5,476 sockeye were counted at the KSEF in 2012. The 2012 sockeye return is well below the highest recorded of 20,804 in 2010, well above the lowest return of 240 fish in 2007, but exceeds the overall run average (2003-2011) by approximately 1,200 fish. Most of the 2012 run originated from the 2009 return, which was moderately high at 3,047 fish. Apparently, a sporadic but positive rebuilding is occurring in the sockeye population since the crash in 2007. Hatchery sockeye planted in Gitanyow Lake in 2007 and 2008 were expected but in very low number, and therefore were not enumerated in 2012.

The 2012 chinook salmon run of 848 is the third lowest escapement ever recorded by the GFA since they started enumerating chinook salmon on the Kitwanga River through the KSEF in 2003. Chinook salmon numbers were 52% of the average and marks the fourth consecutive year of returns well below average, and should be cause for concern to fisheries managers. If escapements do not improve substantially in future years, recovery options may need to be explored.

A total of 16,320 adult pink salmon migrated past the KSEF in 2012. The 2012 return is very similar to their 2010 brood year (15,650 fish) and shows a gradual rebuild of the even year stock from the lowest recorded return in 2008 (4,245 fish). Odd year runs are expected to be significantly higher than even year runs. However, the 2012 return (lowest ever recorded) was actually lower than the highest odd year return of 71,070 in 2004, causing great concern for the even year run (McCarthy and Cleveland 2012).

A total of 426 adult chum salmon migrated past the KSEF in 2012, which is 50% of the average escapement recorded from 2003-2011, and marks the 7th year of numbers well below the running average since 2006. If escapements do not improve substantially in future years, recovery options may need to be explored.

A total of 2,961 coho including 77 CWT coho were enumerated at the KSEF in 2012, which shows approximately a 2 – fold improvement from the previous two years. Based on most years, coho are 3-year old fish, which means this run originated largely from the highest ever recorded 2009 return of 12,080 fish. The 2012 escapement is assumed to be an underestimate due to the fence closing before the entire run is complete. Although GFA suspects that the KSEF count encompasses a good majority of the 2012 coho run, past records indicate that large numbers of

fish can migrate past the KSEF after the October 15th 2012 closure. A total of 77 Kitwanga CWT coho were counted through the KSEF and another 19 documented in the Alaskan fisheries. Kitwanga CWT coho recoveries, in Canadian fisheries were not available in time for this report.

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