Gitanyow Fisheries

Authority

Kitwanga River Salmon Enumeration Facility – 2011 Annual Report

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

Prepared by: Mike McCarthy, HBSc. &
Mark C. Cleveland, B.Sc., R.P.Bio.
Gitanyow Fisheries Authority
P.O. Box 148
Kitwanga, BC, V0J 2A0

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Abstract

In 2011, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Salmon Enumeration Facility (KSEF) for the 9th consecutive year to count all five Pacific salmon species returning to the Kitwanga River. From July 13th to October 12th, 2011 a total of 2,366 sockeye (including 63-hatchery sockeye), 845 chinook, 68,410 pink, 460 chum, and 1,422 coho salmon (including 209 Coded Wire Tag (CWT)) were enumerated through the facility. The 2011 Kitwanga sockeye escapement is slightly below the running average, since GFA started counting in 2000, but well above the extremely poor returns experienced in 2000, 2001, and 2007. Hatchery sockeye represented 2.7% of the 2011 return. Aging results from wild and hatchery sockeye combined, showed that 61% of the adult sockeye returns in 2011 were 4-year old fish and the bulk of the remainder was 5-year old fish (38%). The 2011 odd year pink salmon return was the lowest ever recorded by GFA, which is striking since the 2011 fish originated from of the highest ever recorded run of 559,865 fish (88% decrease). Compared to previous returns, chinook and chum escapements were low and the GFA have been observing a decline in escapements from both species. The 2011 coho escapement was low when compared to previous years but it is likely underestimated due to the closure of the fence on October 12th before the end of the run when a flood event damaged the facility. GFA believes that only escapement counts for coho salmon were compromised because all other salmon species were predicted to have already migrated past the KSEF before its closure.

Acknowledgements

GFA would like to thank the Gitanyow Hereditary Chiefs, Fisheries and Oceans Canada (Prince Rupert – Stock Assessment), Pacific Salmon Foundation, Tides Canada and Skeena Wild Conservation Trust for jointly funding the operation of the permanent fence in 2011. GFA would also like to acknowledge the hard work of the fence staff whose dedication throughout the program made the operations a success. In 2011 GFA staff members included: Les McLean, Earl McLean, Vernon Russell, Phillip Johnson, Scott Williams, Derek Kingston, Mark Cleveland, Gregory Rush, Kevin Koch, Jarvis Williams, Sandy Hnatiak, Brenton Williams, and Frank Vipond.

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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). 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 28% overall.

Since 2003 the KSEF has proved as a useful tool 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 fence count for both pink and chum salmon.

In addition, the KSEF is a key assessment tool used to assess the Kitwanga Sockeye Rebuilding Program initiated in 2006. 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 to understand migration patterns of coho salmon whether harvested in the various commercial, sport and aboriginal fisheries in Alaska and Canada or escaping into the Kitwanga River and recaptured at the KSEF.

In 2011, the KSEF was operated with funding contributions from Fisheries and Oceans Canada, Pacific Salmon Foundation, Tides Canada, Skeena Wild Conservation Trust and the Gitanyow Fisheries AFS program. This report summarizes the sampling results and findings for the KSEF program in 2011.

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.

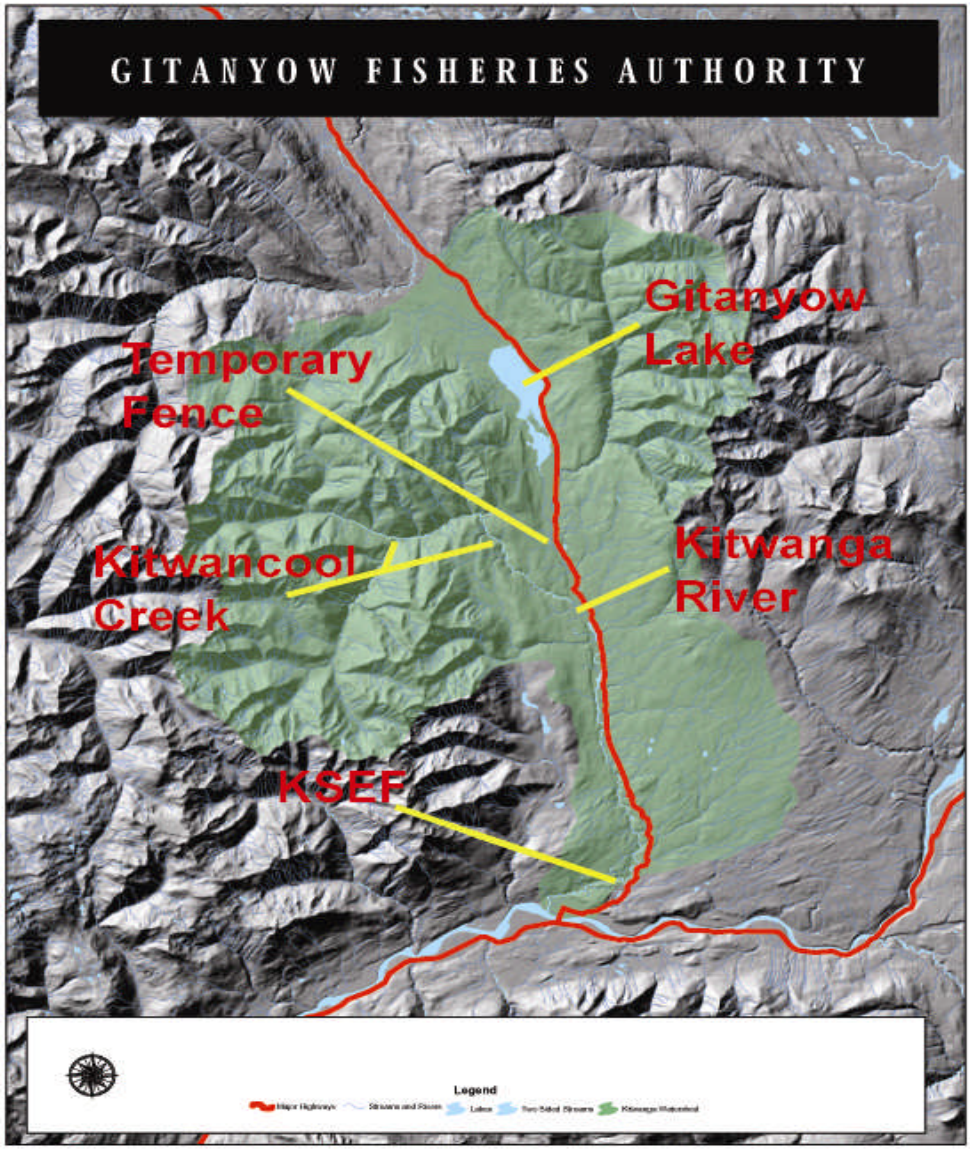

Figure 1: Map of the Kitwanga Watershed including the KSEF (operating from 2003-2011) and the temporary fence sites (operating from 2000-2002).

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.

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.

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 2). 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.

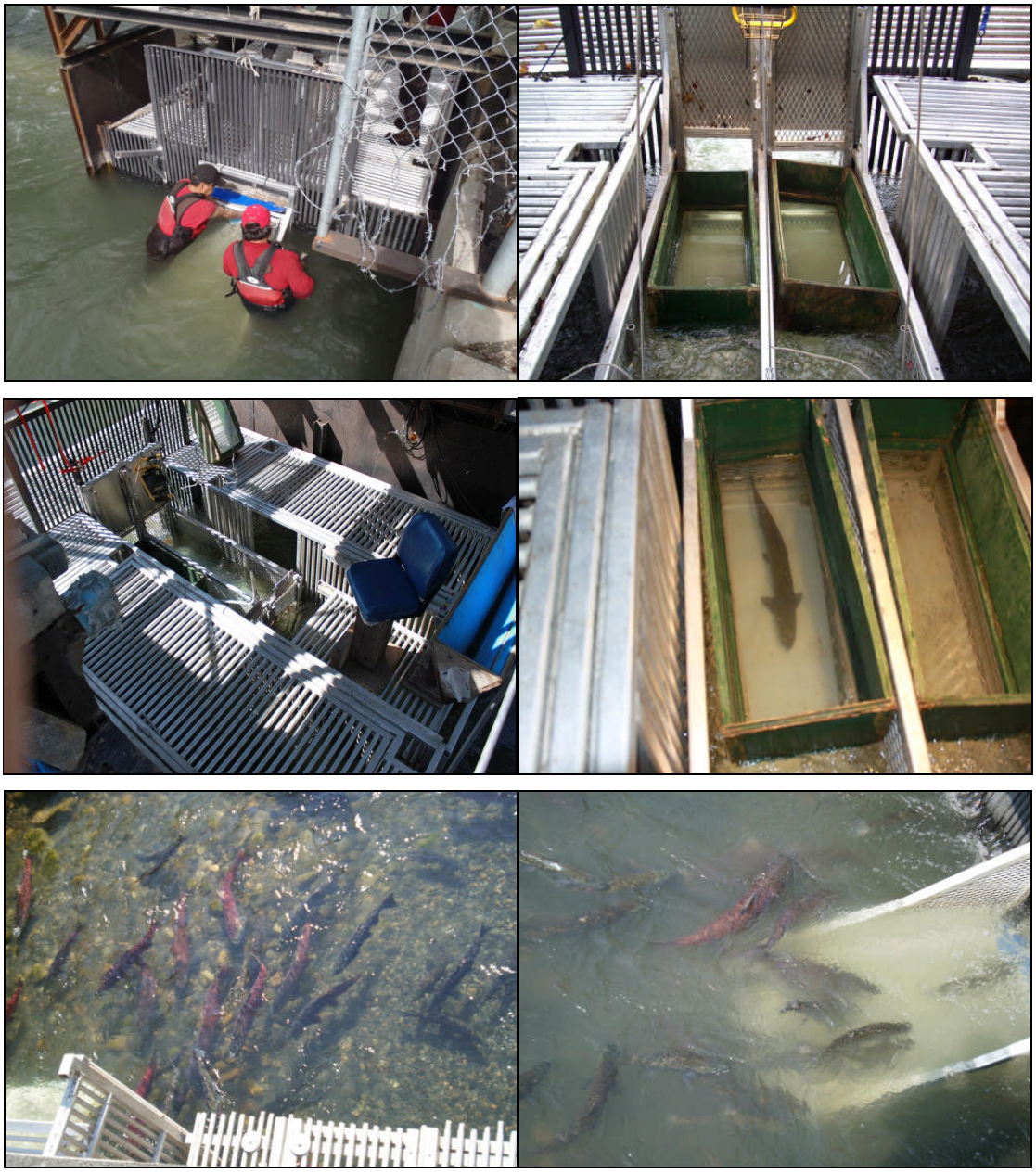

Photo Series 2: Counting stations used at the KSEF.

In 2011, portions of the migrating salmon were systematically sampled to acquire a full range of fish sizes and scales for length/age analysis. When retrieved the fish is placed in a "V" trough equipped with a hose and electric pump that provides a constant supply of fresh river water (Photo Series 3). Fish were visually inspected to identify the presence of marks (eg. adipose fin clip), determine sex, ripeness and overall condition. Afterwards, fish were immediately returned to the trap box to recover and allowed to swim freely upstream.

Photo Series 3: "V" trough with fresh water and aerator used to sample fish at the KSEF.

All sockeye were stopped and examined for an adipose fin clip to determine whether the fish was a hatchery or a wild sockeye (Photo Series 4). Hatchery sockeye originated from earlier enhancement efforts initiated by GFA in 2006/07 and 2007/08 (Cleveland 2007, 2009).

Photo Series 4: Wild sockeye (left) and hatchery sockeye with adipose fin removed (right).

All coho were examined for the absence of an adipose fin (Photo 5) 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 (Photo 6) and chum salmon (Photo 7) were also sampled, however pink salmon were simply counted and allowed to pass through (Photo Series 8).

Photo 5: Coho salmon sampled at the KSEF.

Photo 6: Chinook salmon sampled at the KSEF.

Photo 7: Chum salmon sampled at the KSEF.

Photo Series 8: Pink salmon photographed 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 counted and sampled fish till dark.

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 2011.

4. RESULTS

The operation of the KSEF in 2011 marked the 9th consecutive year and operated of a total of 92 days from July 13th to October 12th. A total of 73,474 salmon were counted through the fence during this period:

Table 1: Run timing and total counts for all species counted through the KSEF in 2011.

Species	**Run Start**	**Mid Run**	**Run end**	**Peak Run Range**	**Total Escapement**
Sockeye	July 16th	August 25th	October 9th	August 8th – September 11th	2,366 (incl. 63 hatchery)
Chinook	July 19th	August 19th	September 17th	August 6th – September 3rd	845
Pink	July 24th	August 28th	September 27th	August 9th - September 17th	68,410
Chum	August 8th	September 5th	October 8th	August 23rd – September 20th	460
Coho	August 10th	September 10th	October 12th	August 24th – October 12th	1,422 (incl. 207 CWT)

Water levels were higher than normal in 2011 for most of the year, which proved periodically challenging (Figure 2). However, GFA staff maintained the weir without breaches until September 23rd, 2011 when the fence flooded due to extremely high water levels (Photo series #9). The fence was submerged for a total of 80 hours when the levels rose quickly to 2.0m, the highest level ever recorded in any year while the fence was in the river. The fence was raised again on September 26th, 2011 once water levels had receded.

Photo Series 9: Flood events at the KSEF in 2010 and 2011.

On the final day the fence was in operation, high leaf and small debris loads during a windstorm on October 12th forced the closure of the facility pre-maturely when several fence panels were damaged. Water temperatures throughout the sampling period were slightly lower than observed in previous years, with temperatures in the 7 to 8 ºC range at the project end.

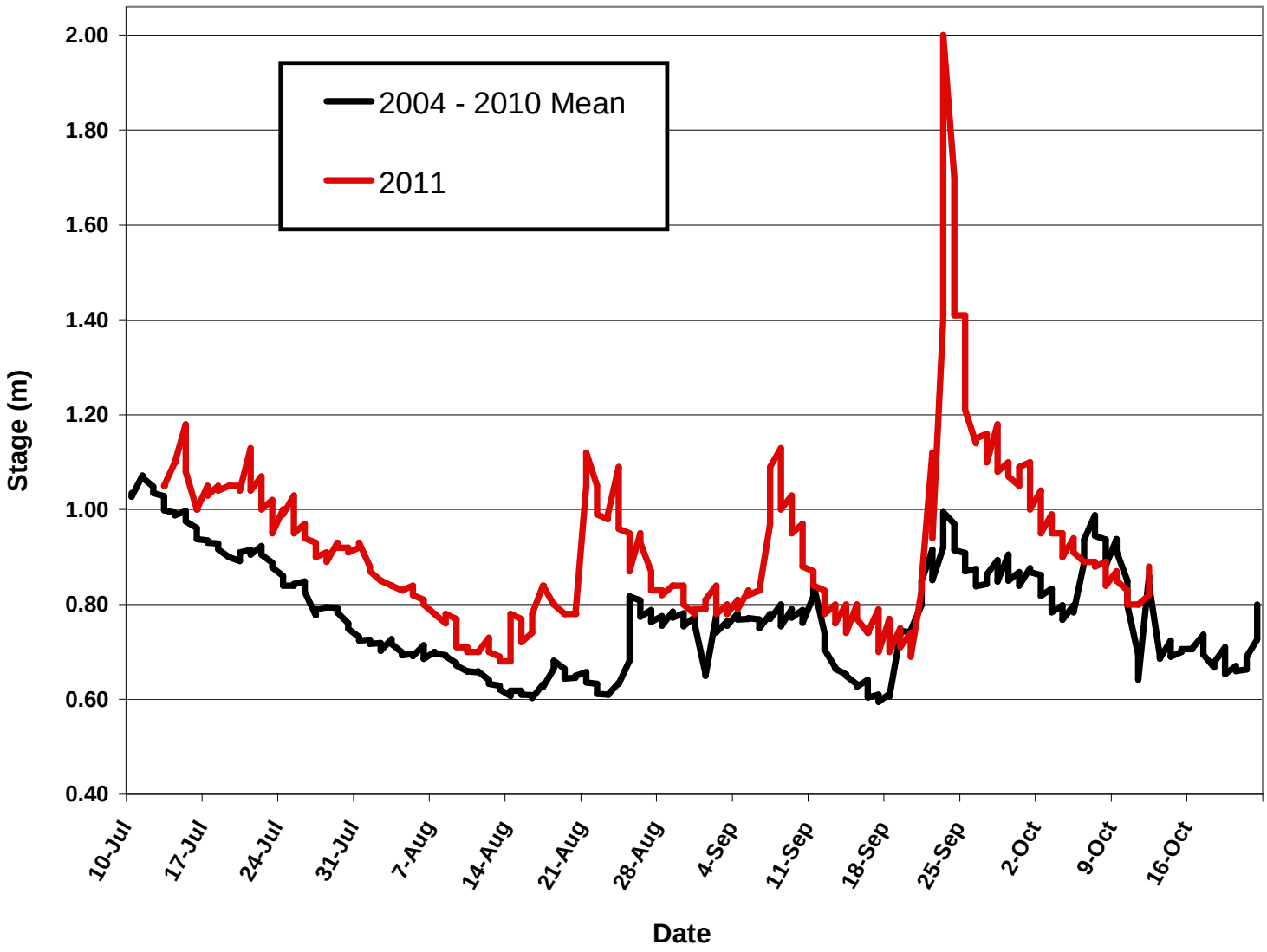

Figure 2: Water Stage at the KSEF, 2004-2010 average and 2011 recordings.

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

4.1 Sockeye

A total of 2,366 sockeye including 63 hatchery fish were counted at the KSEF in 2011. Hatchery sockeye represented 2.7% of the 2011 return. Sockeye escapement in 2011 was well below the recorded high of 20,804 in 2010 but somewhat averages the overall run numbers GFA counted

since 2000 (Figures 3). The 2010 sockeye escapement was thirteen times greater than the average escapement from 2000-2009, which was 1,582 fish. After adding the relatively high 2010 counts, the running average prior to the 2011 season stood at 3,406 fish. The post 2011 average is relatively unchanged and now stands at 3,319 fish.

Hatchery Production

In 2006 and again in 2007, GFA collected Kitwanga sockeye broodstock from Gitanyow Lake spawning grounds as part of a sockeye rebuilding program initiated by extremely poor returns in previous years. Fertilized eggs were incubated for approximately 3 months and then fry were reared for an additional 4 months at the Kispiox hatchery.

In 2007, approximately 80,810 fry were released into Gitanyow Lake as >1g fry. Of these fry 59,734 (74%) were marked with an adipose fin clip, while the remaining 21,076 (26%) were released unclipped. In 2008, an additional 12,216 clipped fry were released into Gitanyow Lake. These originated from broodstock collected in 2007.

In 2010, 250 adult marked sockeye were counted through the KSEF. These fish originated from the 2006 brood stocking program. GFA predicted that an additional 88 unmarked hatchery sockeye also returned to the Kitwanga River assuming that marked and unmarked fry survivals rates were similar. Therefore, the total hatchery return for 2010 equaled approximately 338 sockeye originating exclusively from the 2006 broodstock / 2007 fry release program (scale aging confirmed that all fish were 4 year olds).

In 2011, an additional 63 clipped hatchery sockeye were counted through the KSEF. Of these fish, an estimated 58 fish were 4 years olds originating from the 2008 fry release program (confirmed with scale age data) and another 5 were 5-year-old fish originating from the 2007 release. The 2007 returns can be expanded further by adding one additional fish to account for unclipped 5 year old hatchery sockeye (5x26%), bringing the total estimated 2007 hatchery return for 2011 to 64 fish.

Kitwanga sockeye are almost exclusively 4 and 5 year old fish. All hatchery fish originating from the 2006 brood stocking and 2007 fry release programs likely completed their life cycle

bringing the total returns to date 338+6=344 fish. Therefore, the fry to adult (spawner) survival rate for hatchery fish originating from the 2006 brood year or 2007 fry release period is approximately 0.43%. More hatchery returns in 2012 are expected from the 2008 outplants returning as 5 year old hatchery fish, however numbers are expected to be minimal.

Sockeye returns from years 2000 to 2002 were recorded at a temporary fence located approximately 4-km downstream of Gitanyow Lake, while returns from 2003 to 2010 were collected at the KSEF located approximately 4 km upstream of the Skeena River confluence (Figure 3; see Figure 1 above for site locations).

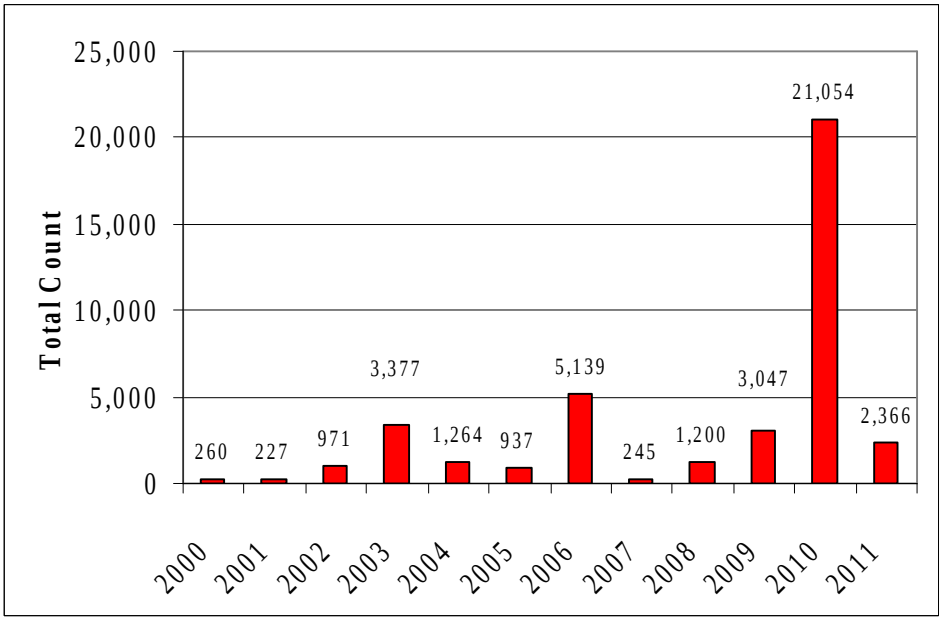

Figure 3: Annual Sockeye escapement into the Kitwanga River from the year 2000 to 2011.

In 2011, the first sockeye passed through the KSEF on July 16th similar to previous years and the last sockeye migrated through the fence on October 9th (Figure 4). The 2011 main run timing range for Kitwanga sockeye occurred from August 8th to September 11th. Kitwanga hatchery sockeye peak run timing (16 fish) coincided with the peak run of 307 wild sockeye on September 8th, and were counted sporadically in low numbers on other dates.

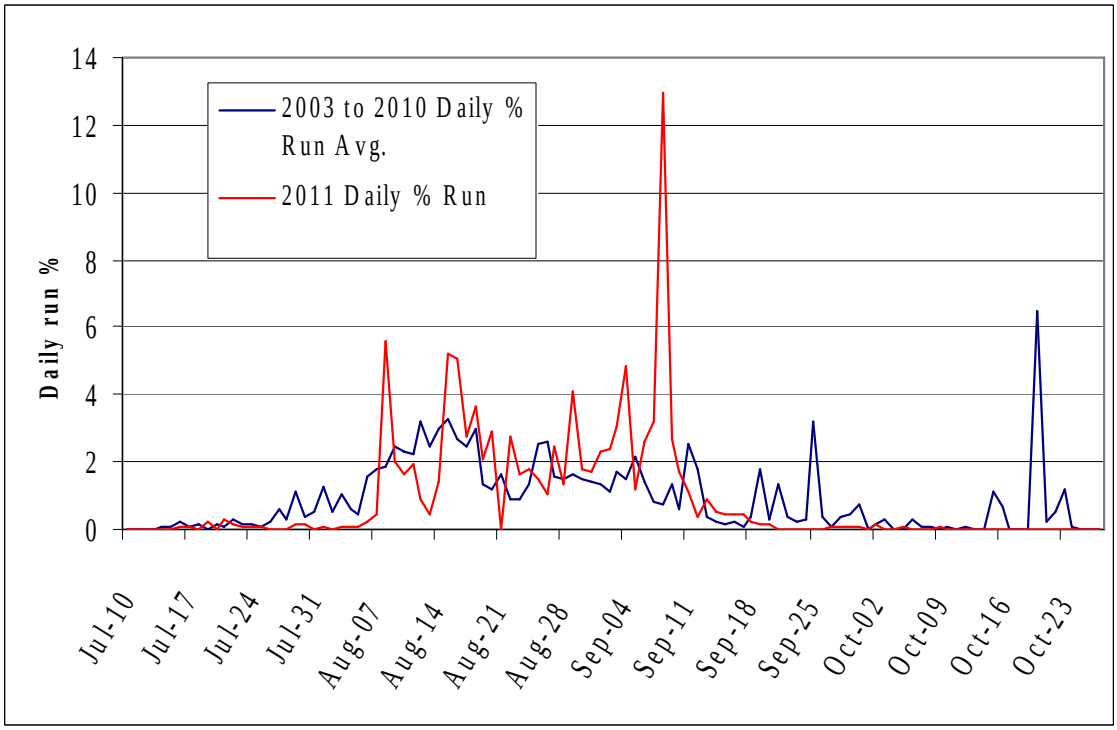

Figure 4. Kitwanga River sockeye salmon average run timing (daily run percent) for 2003-2010 vs. run timing for 2011 at the KSEF.

Table 2: Kitwanga sockeye salmon escapements from 2000 – 2011 with estimated Exploitation Rates from the Alaskan, Canadian Marine and In-River fisheries.

Return Year	Escapement	Total Exploitation (Alaskan + Can. Marine + In-River)	Estimated Total Return
2000	260	54.5%	571
2001	227	58.0%	541
2002	971	58.2%	2,321
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%	24,344
2011	2,366	31.0%	3,099

Fork length measurements, age and sex data was collected from 276 wild sockeye (12 percent of the wild run) and 40 hatchery-raised sockeye (63 percent of the hatchery run) in 2011. Of the 316 sockeye sampled sex ratios between males and females were similar at 152 males (48%) and 164 females (52%).

Sockeye fork length averages for samples collected in 2011 were similar for males, females, wild, and hatchery fish; however, wild stock showed a wider range of sizes than hatchery stock (Table 3).

Table 3**.** Sockeye salmon fork length statistics at the KSEF, 2011

	Avg. Fork Length (cm)	**Fork Length Range (cm)**	**Sample Size**
Wild Male	59	41 to 68	130
Hatchery Male	59	51 to 66	21
Wild Female	56	38 to 68	146
Hatchery Female	56	54 to 62	19

In 2011, 319 scales samples were taken from both wild (n=279) and hatchery (n=40) sockeye and sent to Carol Lidstone of Birkenhead Scales Analysis for age determination. Of the scales submitted, 270 were readable (238 wild and 32 hatchery; Table 5). For wild fish, males and females were mostly 4-year old returning sockeye (60 and 69 percent respectively) and the bulk of the remainder was 5-year old fish. Hatchery sockeye returns for both males and females were almost entirely 4-year old returning fish (2007 broodstock/2008 outplants), however four 5-year old fish were counted (2006 broodstock/2007 outplants).

Table 4. Age structure for sockeye salmon sampled at the KSEF in 2011 (n=270).

Age	Wild Male (n=114)	Wild Female (n=124)	Wild Total (n= 238)	Hatchery Male (n=18)	Hatchery Female (n=14)	Hatchery Total (n=32)	Combined Total (n=270)
Age 1.1 (2009 brood year)	1 (1%)	2 (2%)	3 (1%)	0	0	0	3 (1%)
Age 1.2 (2008 brood year)	69 (60%)	86 (69%)	155 (65%)	16 (89%)	14 (100%)	30 (94%)	185 (69%)
Age 1.3 (2007 brood year)	43 (38%)	36 (29%)	79 (33%)	2 (11%)	0	2 (6%)	81 (30%)
Age 2.2 (2007 brood year)	1 (1%)	0	1 (1%)	0	0	0	1 (<1%)

4.2 Chinook Salmon

A total of 845 chinook returned to the KSEF for 2011 and this compares to a maximum observed of 3,225 in 2007 and the minimum observed of 824 in 2009. The chinook salmon count is the second lowest recorded at the KSEF by the GFA since the year 2003 (Figure 5). The 2011 chinook return is 49% below the average recorded from 2000 to 2010 that was 1,735 fish. The 2011 return numbers marked the fourth consecutive decline in the running average, which now stands at 1,661 fish.

The chinook counts from years 2000 to 2002 were recorded by a combination of stream walks and helicopter flights during the peak-spawning season. The chinook returns from 2003 to 2010 were collected from the KSEF. Chinook salmon spawning grounds are widespread throughout the Kitwanga River watershed including its mainstem, Kitwancool River, and Moonlit Creek. Return results are considered highly accurate following the establishment of the KSEF and estimated prior.

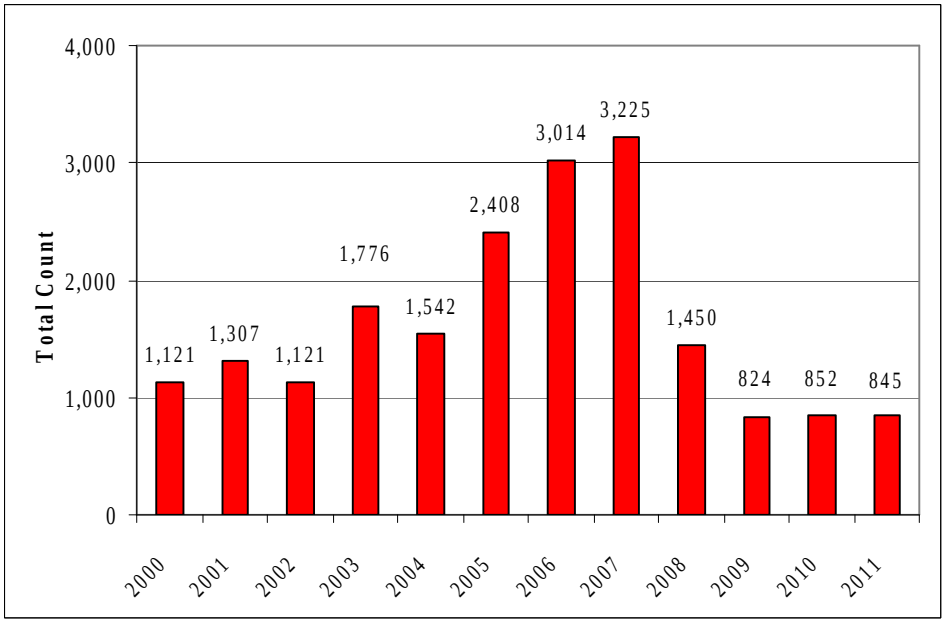

Figure 5: Annual escapement for chinook salmon from 2000 to 2011.

In 2011, the first chinook salmon was counted at the KSEF on July 19th and the last on September 17th. Apart from an early burst on July 25th (40 fish), the 2011 main run timing range for Kitwanga chinook occurred from August 4th to September 4th (89 % of the total run). The highest count in 2011 (August 8th) coincided exactly with the average maximum peak for all years combined (2003 to 2010; Figure 6).

Length, age, and sex data was collected from 179 chinook salmon (21 % of the total run) in 2011. Male and female ratios were 59 and 41 percent respectively. Average fork length for males and females were 86 and 76 centimeters respectively (Table 5).

Of the 127 readable scales from the aging sample collected in 2011 (15 % of the 2011 run), the majority of fish were 5-year old returns followed by 4-year old returns (Table 6). Of the 48 readable scales collected in 2010 (6 % of the 2010 run; data was not available for inclusion into the 2010 report), the majority of fish were 4-year old fish while the remainders were mostly 5 and 6 year old fish (Table 6).

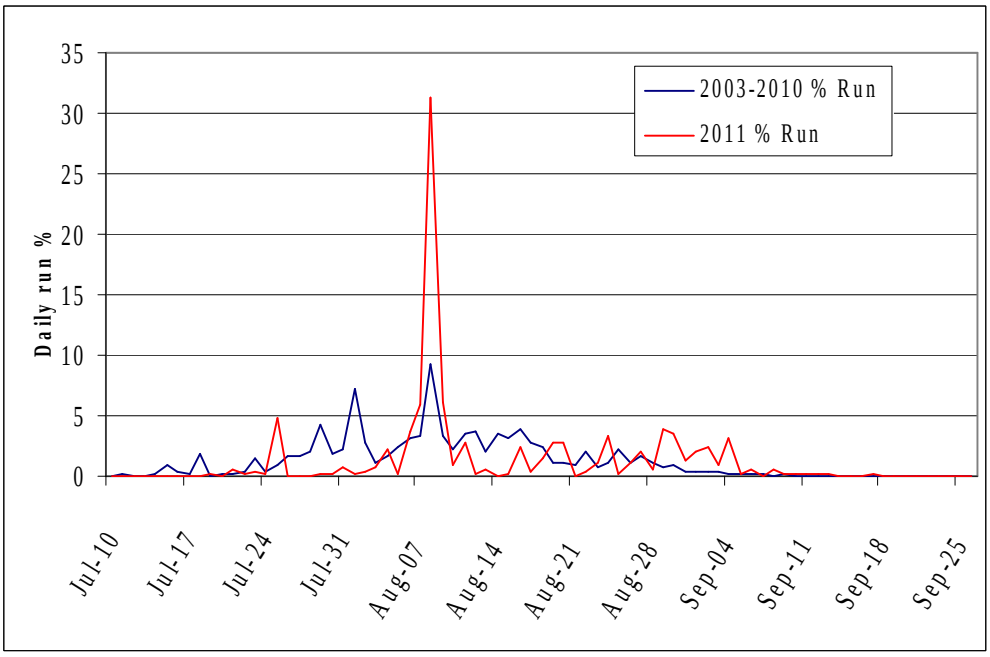

Figure 6: Kitwanga River chinook salmon average run timing (daily run percent) for 2003-2010 vs. run timing for 2011 at the KSEF.

Table 5: Average, minimum, and maximum fork lengths (cm) for chinook salmon sampled in 2011 at the KSEF.

	Female	Male
Average	86	76
Minimum	64	50
Maximum	100	100
Count	74	105

Table 6: Age distribution for chinook salmon sampled in 2011 and 2010 at the KSEF.

European Age	2011 CH aging Results			2010 CH Aging Results		
	Frequency	Percent	Brood Yr.	Frequency	Percent	Brood Yr.
1.1	2	1.6%	2008	1	2.1%	2007
1.2	35	27.6%	2007	22	45.8%	2006
1.3	83	65.4%	2006	12	25.0%	2005
1.4	7	5.5%	2005	13	27.1%	2004
Totals	127	100%		48	100%	

4.3 Pink Salmon

A total of 68,410 adult pink salmon migrated past the KSEF in 2011. The 2011 pink returns was 20% of the average escapement from the odd year average return of 339,379 (2003, 2005, 2007, 2009) and the lowest recorded in an odd year since accurate counts were initiated in 2003 (Figure 7).

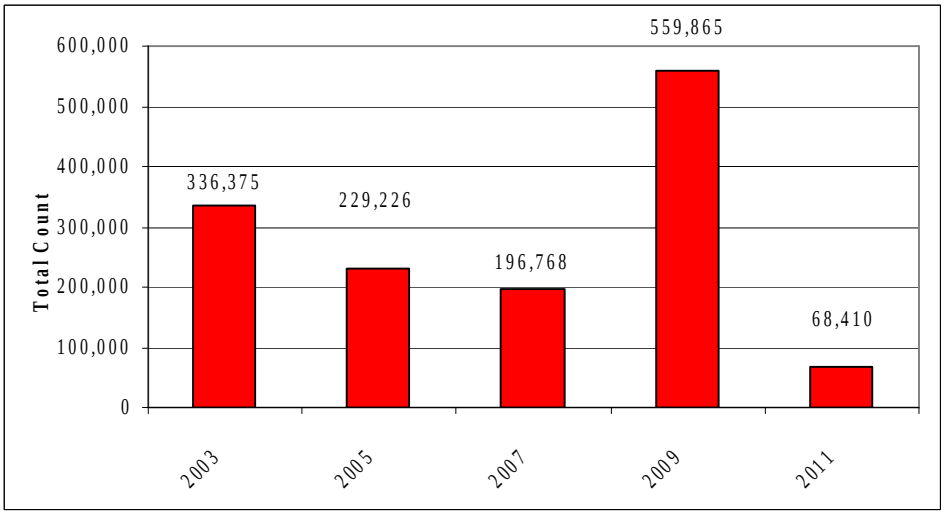

Figure 7: Annual escapement for odd year pink runs at the KSEF.

As in all years pinks in 2011 were 2-year old fish. All of the run would have originated from 2009 from a return of 559,865 (highest ever recorded at the KSEF), which represents a significant decline (88 %) in this run for the 2011 stock. The minimum odd year return prior to 2011 was 196,763 in 2007. The bulk of the run occurred over a 5-week period between August 9th and September 17th (99 % of the run; >200 fish per day; 1702 fish per day on average; Figure 8).

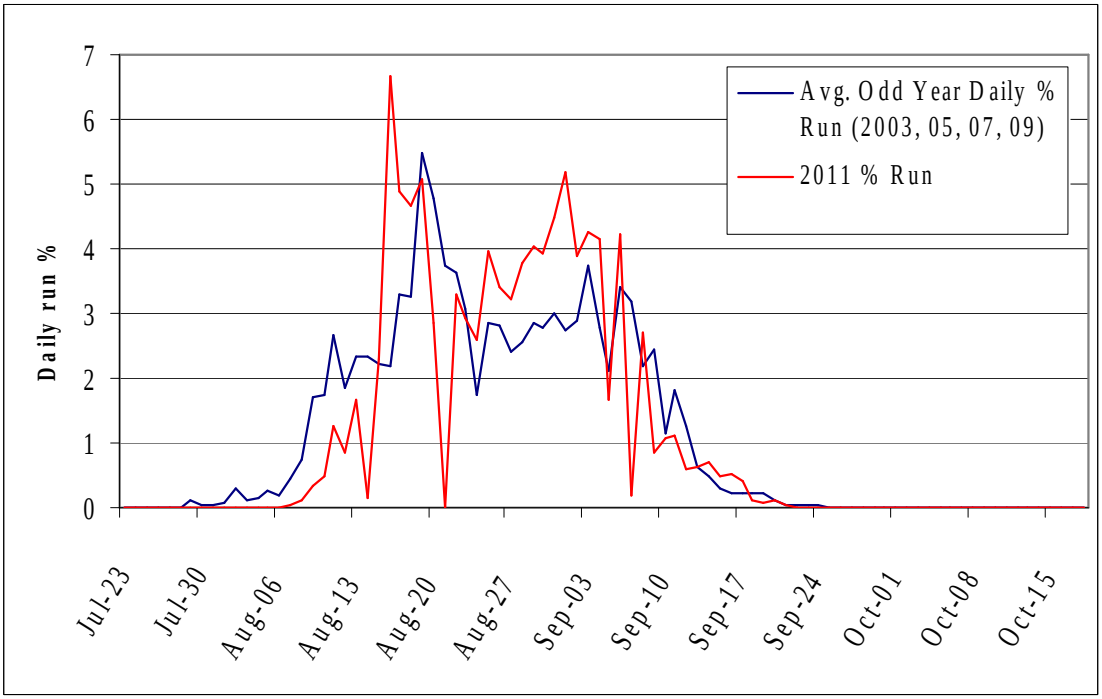

Figure 8: Run timing for pink salmon (daily run %) in 2011 vs. average odd year run between 2003 and 2009.

4.4 Chum Salmon

A total of 460 adult chum salmon migrated past the KSEF in 2011. The 2011 chum escapement is 50% of the average escapement recorded from 2003-2010, which was 918 fish (Figure 9). The current average now stands at 867 fish.

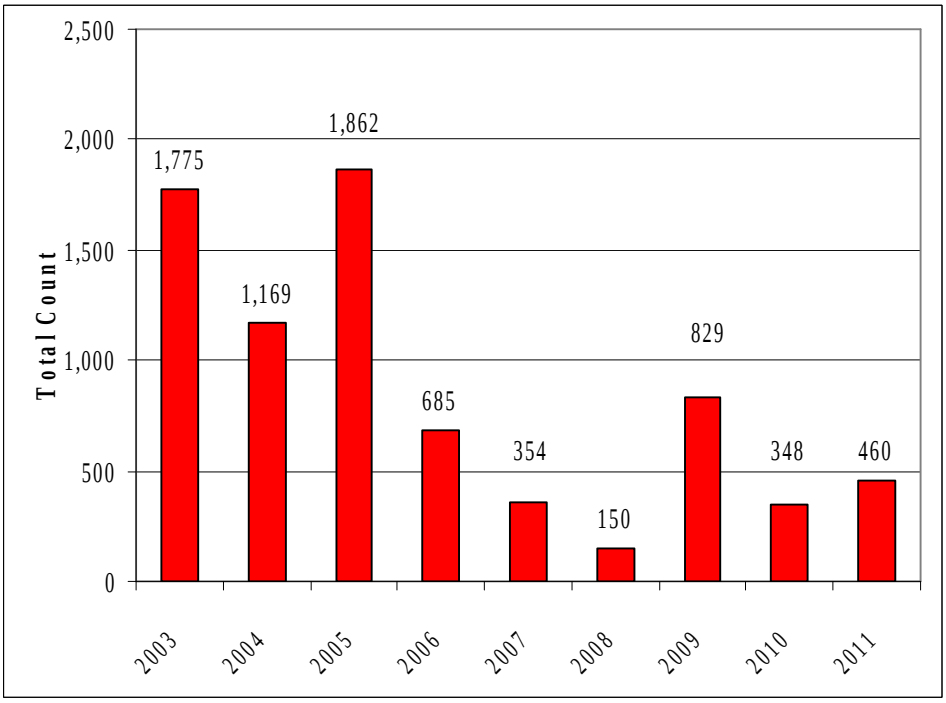

Figure 9: Annual escapement for chum at the KSEF.

In 2011, the first chum salmon was counted at the KSEF on August 8th and the last on October 11th. The bulk of the run occurred from August 24th to September 28th (93% of the total run; Figure 10). Overall the start of the run was delayed by approximately one week and ended approximately 1 week earlier compared to the historical average.

Fork length, sex and age data was collected from 95 chum salmon in 2011 (21% of the run). Male and female sex ratios were 65% and 35% respectively and were similar in average length (approximately 70 cm; Table 7).

Age results for 2011 chum salmon returns were not available at the time of the report. However, 2010 age results not available for the 2010 report are presented in this report. Of the readable scales from the 2010 aging sample (99 samples out of a run total of 348 fish, or 28% of the 2010 run), the majority of fish were 4-year old returns followed by 5-year old returns (Table 8). Age data from 2010 was submitted by DFO in the Gilbert-Rich aging system and was converted by GFA into the European system for this report. Chum salmon immediately return to the ocean post-hatch therefore there are no freshwater annuli.

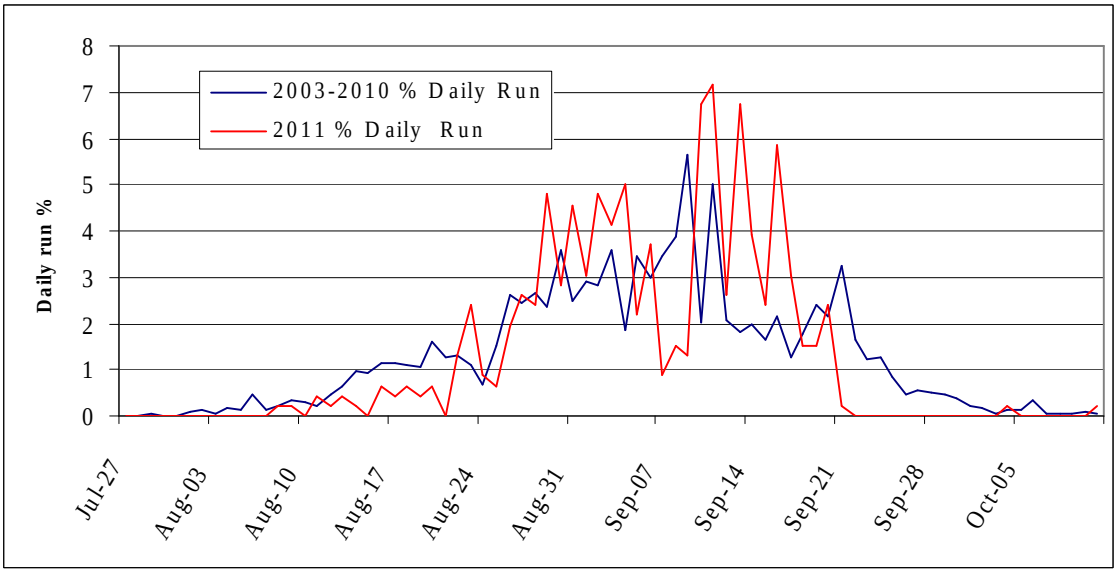

Figure 10: Kitwanga River chum salmon average run timing (daily run %) for 2003-2010 vs. run timing for 2011 at the KSEF.

Table 7: Average, minimum and maximum fork lengths (cm) for chum salmon sampled in 2011 at the KSEF.

	Female	Male
Average	70	71
Minimum	60	60
Maximum	81	91
Count	33	62

Table 8: Age distribution for chum salmon sampled in 2010 at the KSEF.

European Age	Brood Yr.	Frequency	Percent
2.0	2007	3	3
3.0	2006	81	82
4.0	2005	15	15
Total		99	100

4.5 Coho Salmon

A total of 1,422 coho including 210 coded wire tagged (CWT) coho were enumerated at the KSEF in 2011 (Figure 11). GFA predicts that the 2011 coho escapement value of 1,422 is underestimated due to breaching of the fence on September 23rd because of flooding and the closure of the KSEF on October 12th before the coho run was predicted to be complete.

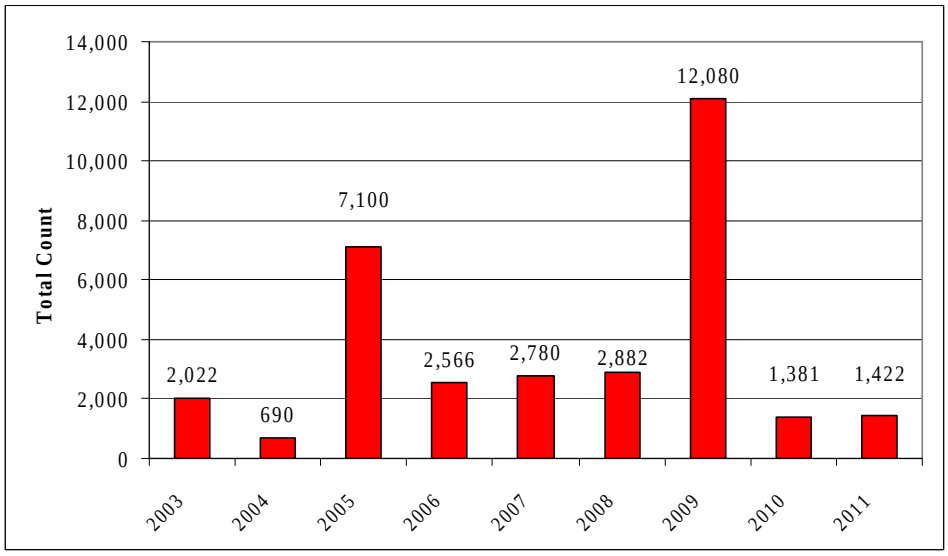

Figure 11: Annual escapement for coho salmon from 2003 to 2011 at the KSEF.

In 2011, the first coho passed through KSEF on August 10th (Figure 12). For the time the fence was operational, the bulk of the run occurred between September 2nd and September 17th, which is approximately 2 weeks earlier than average for the period prior to when the KSEF ceased operation on October 12th. Possibly other peak runs could have occurred after the KSEF was closed in prior years.

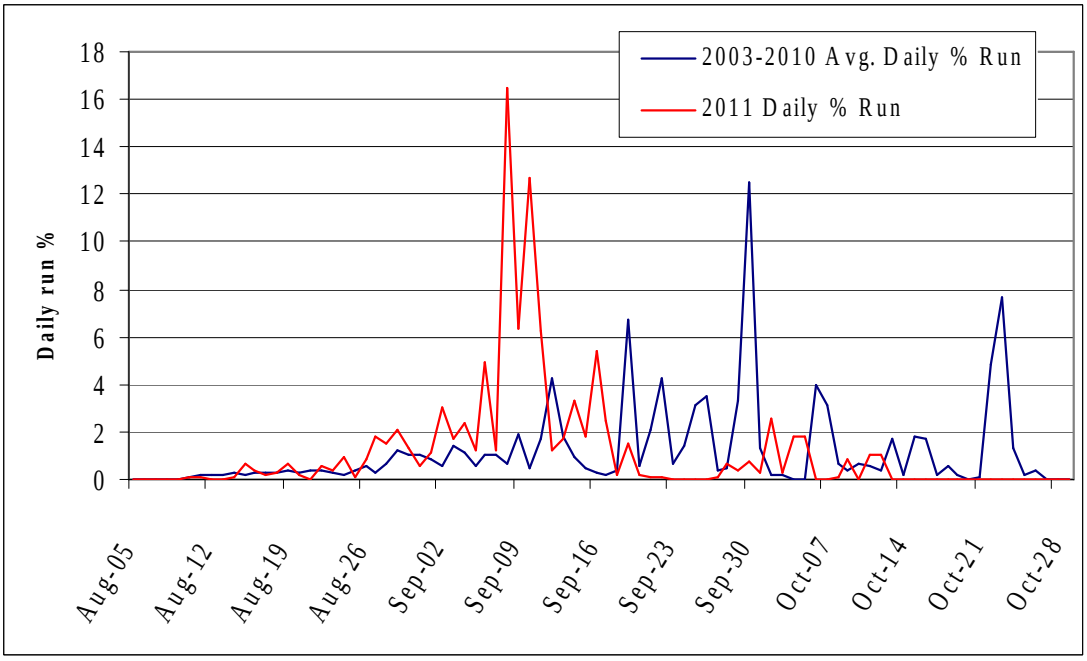

Figure 12: Kitwanga River coho salmon average run timing (daily run %) for 2003-2010 vs. run timing for 2011 at the KSEF.

Previous observations at the KSEF have shown that coho salmon tend to migrate to their respective spawning grounds during high-water events in late September and October, but in 2011 and several flood events in earlier years (2003, 2004 and 2010), a complete and accurate count of coho returns has not been possible. In some years the KSEF has been breached by high water levels, and uncontrollable build-ups of large amounts of leaves, post spawned salmon carcasses and small and large woody debris, which clog the fence panels beyond control. In these cases debris cannot be removed quickly enough to keep the fence above the water surface. Often large numbers of coho are holding behind the fence during these flood events. Even a 24-hour breach in the fence during the peak coho migration could account for over 50% of the coho population migrating past the fence without being counted (Kingston 2011).

Length, age, and sex data was collected from 179 coho salmon in 2011 (13 % of the total run). Male and female ratios were 66% and 34% respectively. Average fork length for males and females were similar at 61 and 63 centimeters respectively (Table 9).

Table 9: Average, minimum, and maximum fork lengths (cm) for coho salmon sampled in 2011 at the KSEF.

	Female	Male
Mean	62.5	60.8
Minimum	42	37.5
Maximum	72	83
Count	74	143

The 2011 age results for coho were not available for inclusion into this report, however after the DFO's Pacific Biological Station analysis are submitted those results will be presented in the 2012 KSEF annual report. In this report for 2011, 2010 data is presented, which was not available to GFA in time for the 2010 KSEF Annual Report submittal deadline.

Of the 94 readable scales from the 2010 aging samples (7% of the 2010 run), the majority of fish were 3-year old returns followed by 4-year old returns (Table 10). Each age class differed by the time they spent in freshwater, but all spent 1 year in salt water.

Table 10: Age distribution for coho salmon sampled in 2010 at the KSEF.

Age	**Brood Yr.**	**Frequency**	**Percent**
1.1	2007	68	72.3%
1.2	2006	26	27.7%
Total		94	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 2010, GFA applied 10,918 CWT's to coho smolts at the Kitwanga Smolt facility. These smolts were expected to return as adults in the fall of 2011 (Kingston, 2011a).

Of the 10,918 coho marked with a CWT in 2010, GFA counted 210 CWT tagged coho through the KSEF in 2011 before the closure of the fence on October 12th (approximately 15 % of the KSEF run). Alaskan fisheries recovered another 81 Kitwanga River CWT coho [Ketchikan (47%), Sitka (28%), Craig(16%), Excursion Inlet (5%), Petersburg (3%), and Gustavus (1%) Inlets]. Canadian fishery results for coho CWT returns were not available in time for this report. Given that KSEF ceased operation before the coho run was over in 2011, along with data not yet

submitted by DFO, a full account of the 2010 CWT coho program cannot be finalized for this report.

5. DISCUSSION AND RECOMMENDATIONS

Since the construction of the KSEF in 2003 it has proven to be very helpful in determining the strength of Kitwanga River and middle Skeena salmon stocks. In 2011, 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 a high debris event following a windstorm, only escapement counts for coho salmon were thought to be compromised.

In March 2010 several upgrades were administered to the counting stations prior to the salmon migration season. These upgrades proved to be very successful for the operations of the fence in the summer/fall 2010 and 2011. The upgrades allowed GFA technicians the ability to more effectively stop and inspect every coho and sockeye for an adipose fin clip. Being able to determine the absence of adipose fin clips on sockeye salmon helps the GFA to determine the production from fry outplanting programs conducted in 2007 and 2008. Similarly, being able to identify an adipose fin clip with a CWT on returning coho helps the GFA to determine ocean survival and harvest rates of coho throughout the various fisheries. New upgrades are being planned for the 2012 field season (rotating fence panels) that GFA hopes will greatly reduce the amount of manual labour required to clean leave litter, small woody debris, and salmon carcasses off the weir.

A total of 2,366 sockeye including 63 hatchery fish were counted at the KSEF in 2011. The 2011 sockeye return is well below the recorded 20,804 in 2010 but somewhat averages the overall run numbers GFA counted since 2000. Hatchery sockeye represented 2.6% of the total 2011 return. When added to the 2010 hatchery return of an estimated 338 fish, the total return to date is approximately 401 fish. This is the result of implanting 80,810 hatchery fry into Gitanyow Lake in 2007, and 12,216 in 2008, which amounts to a 0.43% total return rate for the entire hatchery program to date. More hatchery returns in 2012 are expected but these will consist of exclusively 5 year old fish and returns are expected to be minimal. Peak run timing of hatchery fish coincide with that of the wild fish, which shows a normalcy in hatchery sockeye behavior.

The 2011 chinook salmon run of 845 is the second lowest escapement ever recorded by the GFA since they started enumerating chinook salmon on the Kitwanga River in 2000. Chinook salmon were 49% of the average and marks the third consecutive year decline and should be cause for concern to fisheries managers.

A total of 68,410 adult pink salmon migrated past the KSEF in 2011. The 2011 pink returns is 20% of the average escapement from the odd year average return of 339,379 (2003, 2005, 2007, 2009), and historically number roughly over 200,000 fish for odd year returns. As in all years, pinks in 2011 run were 2-year old returning fish. All of the 2011 run would have originated from 2009 from a return of 559,865 (highest ever recorded at the KSEF), which represents a significant decline (88 %) in this run for the 2011 stock.

A total of 460 adult chum salmon migrated past the KSEF in 2011. The 2011 chum escapement is 50% of the average escapement recorded from 2003-2010, which was 918 fish. The 2011 chum run marks the 6th year of relative decline that started in the year 2006. If escapements do not improve substantially in future years, recovery options may need to be explored.

A total of 1,422 coho including 63 CWT coho were enumerated at the KSEF in 2011. The 2011 coho run is the second lowest escapement ever recorded by the GFA since they started coho in 2001. The 2011 coho escapement is 35% of the average escapement from 2001-2010 that was 4,059. However, this escapement is biased low since many more coho could have migrated past the KSEF after the fence was closed due to a high debris event that damaged the panels on October 12th. Alaskan fisheries recovered 81 Kitwanga River CWT coho and Canadian fisheries catch of CWT coho were not available in time for this report.

Salmon escapement estimates obtained prior to the construction of the KSEF in 2003 were of value for the first few years of operation for comparative purposes. Since the 2011 season marks the ninth year of operation in acquiring accurate results, GFA sees little value at this point for including pre-2003 data (stream walks and temporary fence data) in future reports.

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