Gitanyow Fisheries

Authority

Kitwanga River Salmon Enumeration Facility – 2014 Annual Report

Submitted to: Gitanyow Hereditary Chiefs,
Pacific Salmon Foundation,
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Abstract

In 2014, the Gitanyow Fisheries Authority (GFA) operated the Kitwanga River Salmon Enumeration Facility (KSEF) for the 12th consecutive year to count and biologically sample Pacific salmon returning to the Kitwanga River. The fence stayed operational from July 10th to October 16th, 2014 and was only breached once during this period by high water on September 28th-29th for approximately 12 hours. A total of 13,699 sockeye, 967 chinook, 75,416 pink, 423 chum, and 5,222 coho salmon were enumerated through the facility. The 2014 sockeye return of 13,699 fish was well below the highest recorded of 20,804 in 2010, above the lowest return of 240 fish in 2007, but well above the running average of 4,062 fish per year (2003-2013). The 2014 chinook return of 967 fish was 36 percent below the running average of 1,595 fish (2003 – 2013) and marked the 6th consecutive year of counts below 1,000 fish compared to 1,450 to 3,225 fish counted from years 2003 to 2008. The 2013 pink run of 75,416 fish surpassed the maximum even year return of 71,070 fish in 2004 and well above the minimum return of 4,245. The 2014 pink return originated from the 2012 broodyear, which had an escapement of 16,320 fish, meaning the 2014 return more than quadrupled replacement. The 2014 chum salmon return of 423 fish was 40% below the average escapement recorded from 2003-2013 (784 fish), and marked the 9th consecutive year of low escapements; there is no sign of recovery to the 1,000+ chum returns encountered in years 2003 to 2005. The 2014 coho return of 5,222 fish was well below the highest return of 12,080 coho in 2009 and well above the 690 fish return in 2004. However, the 2014 coho return is 31% above the running average from 2003 to 2013, which was 3,986 fish/year. GFA is confident that essentially the entire runs of chinook, pink and chum salmon were captured during fence operation and only a small portion of the sockeye run (6% based on previous run timing curves) and an unknown portion of the coho run may have been missed due to early fence closure after an extreme high water event.

Acknowledgements

Gitanyow Fisheries Authority (GFA) would like to thank the Gitanyow Hereditary Chiefs for their continued leadership and support for the GFA program, the 2014 project donors: Fisheries and Oceans Canada, the Pacific Salmon Foundation (PSF) and the Pacific Salmon Commission (PSC). GFA gratefully acknowledges our field staff for all their hard work and dedication throughout the program, which made the operations a success. In 2014 GFA technicians included: Les McLean, Earl McLean, Vernon Russell, Phillip Johnson, Owen Russel, Johnny Martin, Morgan Douse and Brenton Williams and GFA lead staff: Derek Kingston, Mark Cleveland, Gregory Rush, Kevin Koch.

Table of Contents

1. Introduction and Background 1
2. Description of the Study Area 3
3. KSEF Design and Operating Methods 4
4. Results 7
   4.1 Sockeye 10
   4.2 Chinook Salmon 15
   4.3 Pink Salmon 17
   4.4 Chum Salmon 19
   4.5 Coho Salmon 21
5. Discussion and Recommendations 24
6. References 25

List of Tables

Table 1: Run timing and total escapement for all species counted through the KSEF in 2014. 9
Table 2: Kitwanga sockeye salmon escapements from 2000 – 2014 with estimated Exploitation Rates from the Alaskan Marine and In-River fisheries. Total exploitation rate estimates were provided by the Prince Rupert – DFO. 12
Table 3. Sockeye salmon fork length statistics at the KSEF in 2014. 12
Table 4: Average length (cm) for sockeye female, male and combined sexes from 2003 to 2014. 13
Table 5. Sockeye salmon age, sex and fork length statistics at the KSEF in 2014 (CL = mean variance at 95% confidence). 14
Table 6: Average, minimum, and maximum fork lengths (cm) for chinook salmon sampled in ... 17
2014 at the KSEF (n=38). 17
Table 7: Average length (cm) for chinook male, female and combined sexes from 2008 to 2014. 17
Table 8: Mean, minimum and maximum fork lengths (cm) for chum salmon sampled in 2014 at the KSEF. 20
Table 9: Average length (cm) for chum male, female and combined sexes from 2008 to 2014. ... 20
Table 10: Mean, minimum, and maximum fork lengths (cm) for coho salmon sampled in 2014 at the KSEF. 22
Table 11: Mean length (cm) for coho male, female and combined sexes from 2010 to 2014. 23

List of Figures and Photos

Figure 1: Map of the Kitwanga Watershed including the KSEF (operating from 2003-2014) and the temporary fence sites (operating from 2000-2002). 4
Figure 2: Photo series of 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.....5
Figure 3: Photo series of counting and sampling stations used at the KSEF. 7
Figure 4: Photo series of the high water event and breaching of the fence on September 29th, 2014 (left) and the dismantling of the fence following the high water event and fence closure on October 16th, 2014 (right). 8
Figure 5: Water Stage at the KSEF, 2004-2013 average and 2014 recordings. 9
Figure 6: Annual Sockeye escapement into the Kitwanga River through the KSEF from 2003 to 2014. 10
Figure 7: Kitwanga River sockeye salmon average run timing (daily run percent) for 2003-2013 vs. run timing for 2014 at the KSEF.....11
Figure 8: Fork length distribution for sockeye salmon in 2014 (n=438); X axis labels are 5 cm length class upper boundaries.....13
Figure 9: Annual escapement for chinook salmon from 2003 to 2014. 15
Figure 10: Kitwanga Chinook % Run past KSEF by day for 2003-13 vs. 2014.....16
Figure 11: Fork length distribution for chinook salmon in 2014 (n=38); X axis is 5 cm length class upper boundaries.....16
Figure 12: Annual escapement for even year pink runs at the KSEF from 2004 to 2014.....18
Figure 13: Run timing for pink salmon (daily run %) in 2014 vs. average even year run from 18
2004 and 2012.....18
Figure 14: Annual escapement for chum salmon at the KSEF from 2003 to 2014.....19
Figure 15: Kitwanga River chum salmon average run timing (daily run %) for 2003-2013 vs. run timing for 2014 at the KSEF.....20
Figure 16: Annual escapement for coho salmon from 2003 to 2014 at the KSEF.....22
Figure 17: Kitwanga River coho salmon average run timing (daily run %) for 2003-2013 vs. run timing for 2014 at the KSEF.....22
Figure 18: Fork length distribution for coho salmon in 2014 (n=66); X-axis labels are 5 cm length class upper boundaries).....23

1. INTRODUCTION AND BACKGROUND

Historically, the Gitanyow fished salmon in the Kitwanga River for food, social and ceremonial purposes with sockeye being the main salmon species of choice. In the early 1900's sockeye stocks were thriving and Gitanyow Elders spoke of the lakeshores of Gitanyow Lake turning red every fall as the sockeye congregated to spawn on their respective spawning grounds. However, by the 1920's the Elders talked of the noticeable declines in the returns of the Kitwanga sockeye stock. By the 1960's most fishing sites along the Kitwanga River were abandoned and aboriginal fishing for sockeye had ceased due to low run numbers and concerns for the unique stock (Cleveland 2005, Kingston 2013).

One of the largest contributors to sockeye decline is suspected to be over-exploitation of the stock in commercial ocean fisheries. Past fishery re-constructions for the last 40 years show the average exploitation on Kitwanga sockeye has been over 50% and reaching as high as 70% in some years (Cox-Rogers, DFO, Pers. comm., 2010). Other factors likely contributed to the declines such as sockeye habitat destruction in the Kitwanga Watershed due to poor forest harvesting practices, which include the sedimentation of spawning beds, the disruption of water flow patterns, and changes in water quality of Gitanyow Lake tributary streams (Cleveland 2006, Kingston 2013).

Accurate Kitwanga adult salmon escapement data has been ongoing since the construction and continual operation of the Kitwanga River Salmon Enumeration Facility (KSEF) in 2003 near the mouth of the Skeena River. In 1999, GFA initiated a Kitwanga sockeye-rebuilding program to conserve, protect and recover the stock. One of the highest rebuilding priorities for the Kitwanga Sockeye Salmon Recovery Plan (KSRP), which was initiated in 2006, was to continue monitoring the yearly abundance of Kitwanga sockeye salmon smolts emigrating from Gitanyow Lake (Kingston 2013) to arrive at estimates of adult to smolt survival rates.

Historically, the DFO Salmon Escapement Data System (SEDS) records for Kitwanga Sockeye are very limited. In most years, stream escapement counts were not completed and even in those years where they were performed, the results are suspect because Kitwanga sockeye are exclusively lakeshore spawners and lakeshore counts have proven to be very difficult and usually under estimated true annual escapements.

In 1999, GFA initiated a Kitwanga sockeye-rebuilding program to conserve, protect and recover the stock. A key component of the rebuilding program included the accurate determination of annual sockeye returns to Gitanyow Lake and investigations of the potential limiting factors to sockeye production. Subsequently, in 2000, 2001, and 2002 the GFA established and operated a temporary counting fence located about 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 escapement levels which are believed to be in the tens of thousands (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 about 4 Km upstream of the Skeena River confluence. The KSEF was operational in July 2003 when salmon were counted through the facility for the first time (Cleveland, 2004). This initiative benefited Skeena salmon management by providing accurate annual counts of sockeye, chinook, pink, chum and coho salmon returning to the Kitwanga River, a middle Skeena indicator stream.

In conjunction with counting fences, GFA initiated various studies to research potential limiting factors to Kitwanga sockeye production. Efforts to rebuild the stocks have been ongoing. These include spawning habitat assessments and restoration projects (Kingston 2008, 2009) and Kitwanga sockeye enhancement (Cleveland 2007, 2009 and McCarthy and Cleveland 2012). In addition, a reduction in exploitation on Kitwanga sockeye was promoted by GFA for both the ocean and inland fisheries during peak migration periods for Kitwanga sockeye. DFO has implemented fishing regimes to protect and rebuild Kitwanga sockeye. Annual average total exploitation rates in the last 5 years are estimated to be about 20-25%. These compare positively to the more historical exploitation rates, which averaged over 45-50%.

In addition, the KSEF is a key assessment tool used to assess the relative successes of the coho reproduction, which is a key component of the KSEF program that includes the recovery of Coded Wire Tags (CWT) initiated by GFA in 2009. Recovering CWT's help fishery biologists / managers understand migration and harvest patterns of coho salmon in Canada and Alaska. CWT recoveries also provides important information related to salmon ocean production, information used throughout northern BC to better understand overall salmon survivals.

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 2014 season marks the 12th year of obtaining accurate results at the KSEF. The 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 2014, the KSEF was operated with funding contributions from Fisheries and Oceans Canada, Pacific Salmon Foundation, Pacific Salmon Commission and the Gitanyow Hereditary Chiefs – AFS program. This report summarizes the sampling results and findings for the KSEF program in 2014.

2. DESCRIPTION OF THE STUDY AREA

The Kitwanga River (BC Watershed Code 400-364900) is a fifth order stream that drains into the Skeena River about 250 km northeast of Prince Rupert, B.C.. It supports all 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 supports populations of resident rainbow trout (O. mykiss), cutthroat trout (O. clarki), Dolly Varden char (Salvelinus malma), bull trout char (S. confluentus), mountain whitefish (Prosopium williamsoni) and various other species of coarse fish (BC Fisheries Information Summary System, or FISS).

The drainage encompasses an area of about 83,000 hectares and has a total mainstem length of about 59 kilometres (Cleveland 2000). Gitanyow Lake separates the Upper and the Lower Kitwanga River. The Upper Kitwanga is located directly north of Gitanyow Lake and has a main stem length of about 23 km. The Lower Kitwanga River flows south for about 36 km between Gitanyow Lake and the Skeena River. The Lower Kitwanga River has four major gazetted tributaries: Tea Creek, Deuce Creek, Kitwancool Creek and Moonlit Creek . The Upper Kitwanga River has no major tributaries and exhibits a multi-channel meandering configuration, with intensive beaver activity along its lower reaches.

The KSEF is located on the Kitwanga River about 4 km upstream from its confluence with the Skeena River (Figure 1). It is situated on private property and a Statutory Right of Way permit has been granted for the site to the Gitanyow Fisheries for salmon research until 2036. Because there are Gitxsan (Gitwangak) First Nation interests near the KSEF site, fishery personnel from the Gitwangak community are trained and employed annually by GFA to help operate the facility.

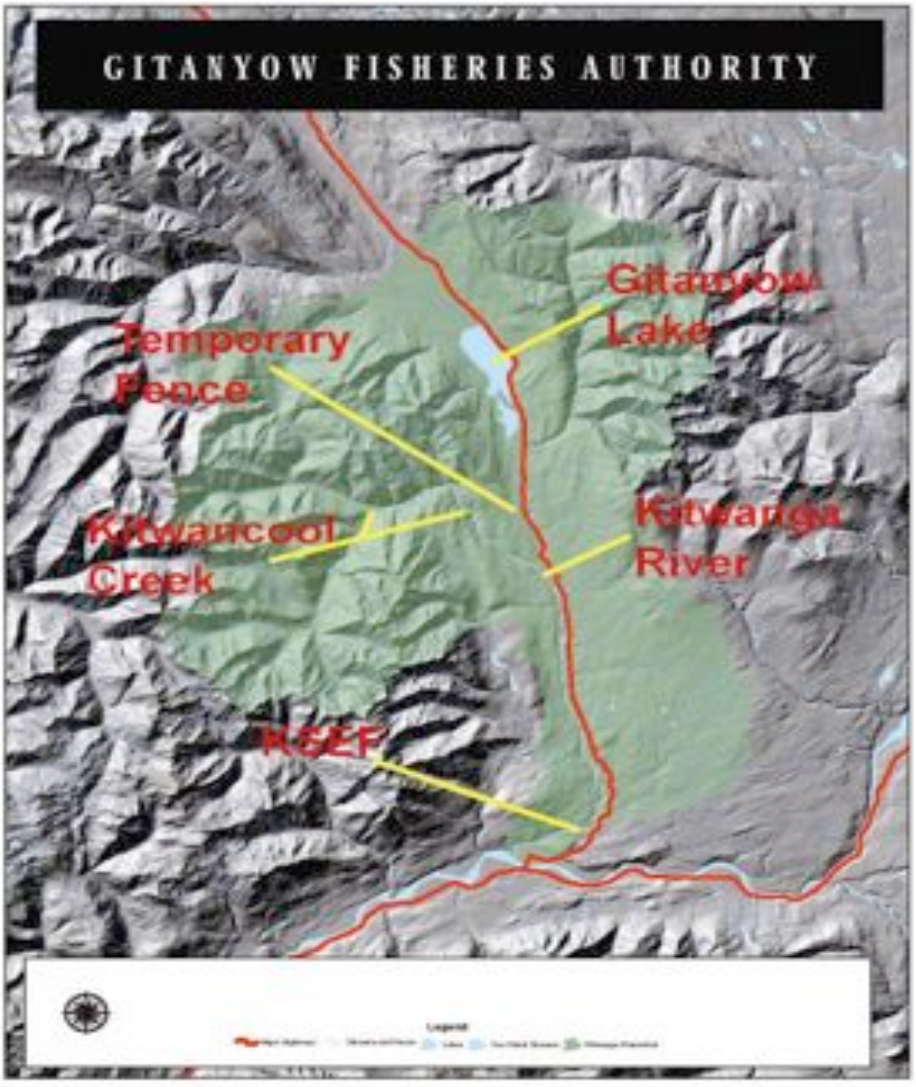

Figure 1: Map of the Kitwanga Watershed including the KSEF (operating from 2003-2014) and the temporary fence sites (operating from 2000-2002).

3. KSEF DESIGN AND OPERATING METHODS

The counting fence is located about 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 (Figure 2; photo series of KSEF design). 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 about 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 Figure 2). 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.

Figure 2: Photo series of 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.

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. 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, as

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 2012 and 2013 GFA tested three experimental rotating panels 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 upstream. The new panel design was used during regular fence operations and proved much easier and quicker to clean. The new design allowed staff to safely rotate and clean the panels from the overhanging bridge without having to enter the river. The GFA have received funding from the Pacific Salmon Commission to convert the KSEF over to the new rotating panel design and will be implementing the new fence design in the 2015 salmon season.

In 2014, random 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 which provided a constant supply of fresh river water during sampling (Figure 3; Photo series showing sampling stations and sockeye and chinook specimens). Samples were taken from all species except from pink salmon. Fish were also 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. This method presents ages using a two-number sequence with the first number representing the fresh water occupation period and the second number representing the salt-water occupation period.

GFA fisheries staff were instructed on proper fish handling techniques to reduce the stress on the fish. Crews of two fisheries technicians visually enumerated and tallied salmon as they swim 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. The KSEF is closed nightly preventing upstream migration between dusk and dawn.

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. Daily water temperatures, rain gauge measurements and air temperature are also recorded throughout the salmon migration period in 2014.

Figure 3: Photo series of counting and sampling stations used at the KSEF.

4. RESULTS

The operation of the KSEF in 2014 marked the 12th consecutive year. The project was operated for a total of 99 days in 2014, from July 10th to October 16th. Based on average run timing

through the KSEF (2003-2013), GFA assumes that all of the chinook, pink, and chum, and most of the sockeye and coho runs would have moved through KSEF by the end of the project. The fence was only breached once for approximately 12 hours during the operation from the late evening of September 28 to the early afternoon of September 29th, 2014 due to an extreme high water event and counts were missed for that timeframe only (Figure 4). The fence was closed about 10 days earlier than planned due to an extreme high water event on October 17th and a small portion of the sockeye run and an unknown number of coho run may have missed. A total of 95,727 adult salmon were counted through the fence during the 2014 operational period (Table 1).

Figure 4: Photo series of the high water event and breaching of the fence on September 29th, 2014 (left) and the dismantling of the fence following the high water event and fence closure on October 16th, 2014 (right).

The average water levels during July and August in 2014 were lower than the overall seen on average previously (2004-2013). From early September to early October water levels were relatively normal, and throughout October until fence closure, water levels were well above expected. The highest water level occurred on October 17th peaking at 1.35m, which was a significant rise from the previous day's level of 0.95m. October 16th marked the end of the 2014 sampling season due to damage and breaching of the fence on October 17th (Figure 5).

Water temperatures began at 12° Celsius at fence opening on July 10th, peaked at 18°C on August 2nd and 3rd and ended at 7°C on October 16th and was considered favorable for salmon during the fence operation.

Table 1: Run timing and total escapement for all species counted through the KSEF in 2014.

Species	Run Start	Mid Run	Run end	Peak Run Range	Total Escapement
Sockeye	July 11th	August 29th	October 16th	August 11th – October 4th	13,699
Chinook	July 12th	August 10th	September 8th	July 29th - August 25th	967
Pink	August 8th	September 4th	October 4th	August 11th – September 14th	75,416
Chum	August 16th	September 10th	October 4th	September 2nd – September 20th	423
Coho	August 9th	September 12th	October 16th	September 9th to October 12th	5,222

Note: One final chinook (outlier) was counted on Sept. 30th after a 21-day absence from above "Run end" date.

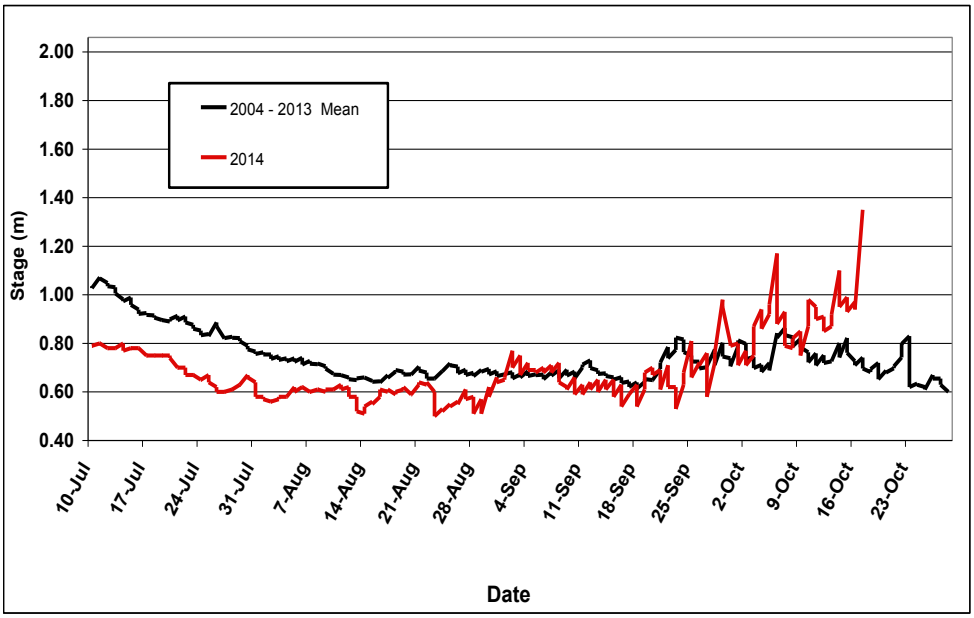

Figure 5: Water Stage at the KSEF, 2004-2013 average and 2014 recordings.

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

4.1 Sockeye

A total of 13,699 sockeye were counted at the KSEF in 2014. Sockeye escapement in 2014 was the second highest recorded at the KSEF since the year 2003 (highest was 20,804 in 2010), and showed a remarkable improvement compared to the last 3 years (Figure 6). The current running average escapement from 2003 to 2014 now stands at 4,865 sockeye, which is a notable increase from the 4,062 sockeye per year average calculated for years 2003 to 2013.

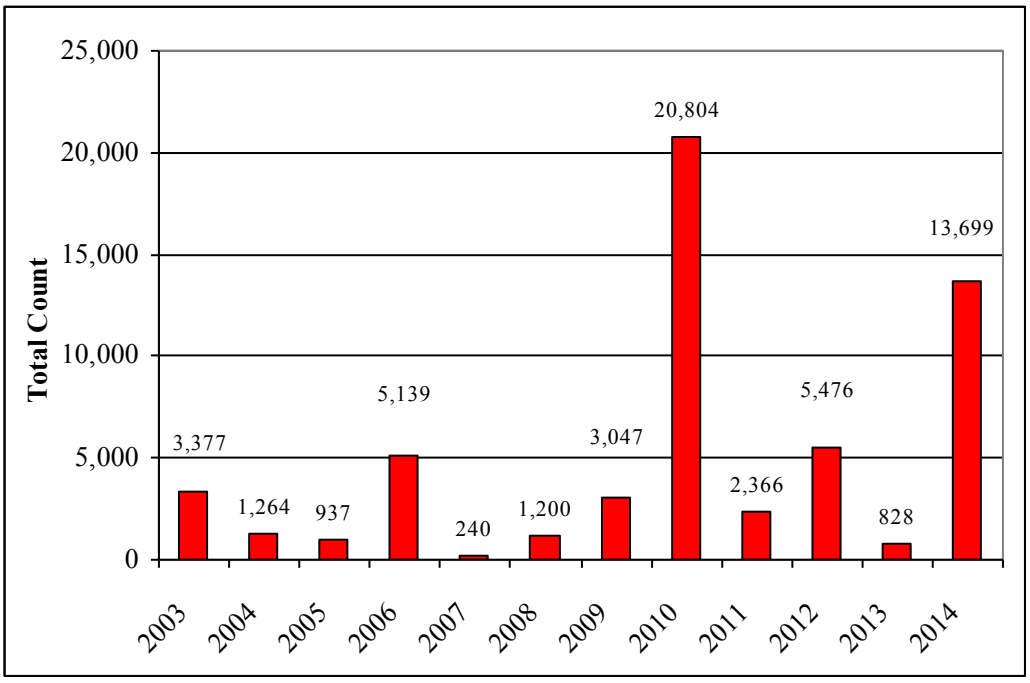

Figure 6: Annual Sockeye escapement into the Kitwanga River through the KSEF from 2003 to 2014.

In 2014, the first sockeye passed through the KSEF on July 11th, which was normally expected compared to previous years. Sockeye were still migrating through the fence in low numbers immediately prior to the unintended fence closure on October 16th (Figure 7). No distinct trend was observed in the run data. Most of the sockeye run was spread out over an 8-week period from August 11th to October 4th with triple-digit or greater counts mixed with single or double digit counts throughout this extended period. Significantly high counts were observed on August 25th (2171 fish), September 2nd (1042 fish) and September 19th (1792 fish), and when combined accounted for 37% of the total run.

Preliminary exploitation rates for 2014 were estimated at 35 percent (8% Alaskan Marine, 25% Canadian Marine, and 5% In-river; pers. comm. Steve Cox-Rogers, 2014), which was the highest rate observed since 2008 (Table 2). Without exploitation (estimated 8,396 sockeye removed), the estimated total return for would have been about 22,095 sockeye.

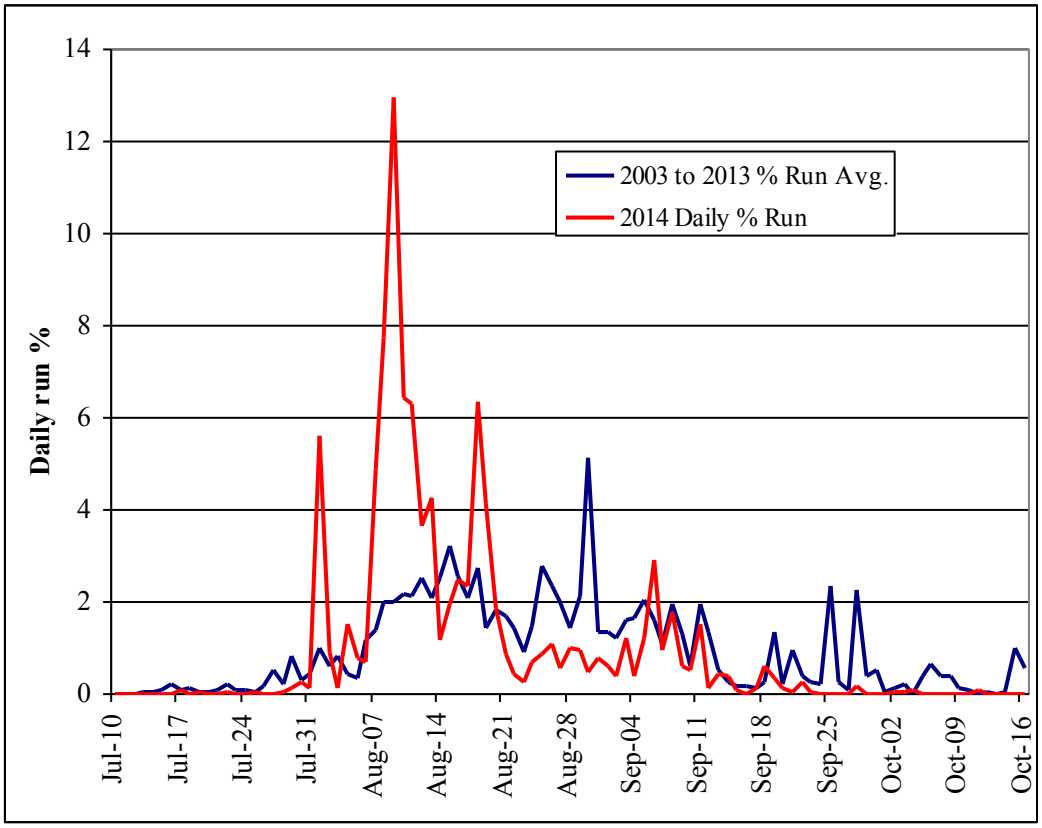

Figure 7: Kitwanga River sockeye salmon average run timing (daily run percent) for 2003-2013 vs. run timing for 2014 at the KSEF.

Table 2: Kitwanga sockeye salmon escapements from 2000 – 2014 with estimated Exploitation Rates from the Alaskan Marine and In-River fisheries. Total exploitation rate estimates were provided by the Prince Rupert – DFO.

Return Year	Escapement	Exploitation Rate				Total Return
		Alaska	Can Marine	In-River	Total	
2003	3,377	0.07	0.28	0.03	0.38	5,447
2004	1,264	0.11	0.22	0.05	0.38	2,047
2005	937	0.16	0.05	0.07	0.28	1,300
2006	5,139	0.06	0.42	0.06	0.54	11,208
2007	240	0.18	0.40	0.03	0.61	619
2008	1,200	0.05	0.40	0.05	0.50	2,400
2009	3047	0.08	0.02	0.05	0.15	3,585
2010	20,804	0.02	0.08	0.05	0.15	24,344
2011	2,366	0.05	0.17	0.05	0.27	3,241
2012	5,476	0.05	0.22	0.05	0.32	8,053
2013	828	0.05	0.00	0.50	0.10	920
2014	13,699	0.08	0.05	0.25	0.38	22,095
Average	**4,865**	**0.07**	**0.19**	**0.07**	**0.34**	**7,105**

Complete fork length measurements, age and sex data were collected from 438 sockeye (3.2 percent of the run). Of these samples, female composition was similar to males at 222 females (50.1%) and 216 males (49.9%). Average fork lengths were slightly greater for males and females showed a wider range in size than males (Table 3). Size class (5 cm) histogram for combined sexes showed a uni-modal distribution, dominated by fish in the 51 to 55 cm size class (41%) followed by fish in the 56 to 60 cm size class (35%; Figure 8). When male and female average length was compared to previous years, the 2014 results fell within the historical range (Table 4). Average length recorded since 2003 were similar and within a narrow 5-cm size range for males (55 to 60 cm), and females (52 to 57 cm).

Table 3. Sockeye salmon fork length statistics at the KSEF in 2014.

	Female	Male	Combined
Mean	52.6	55.9	54.2
Min	34	43	34
Max	66	68	68
Count	222	216	438

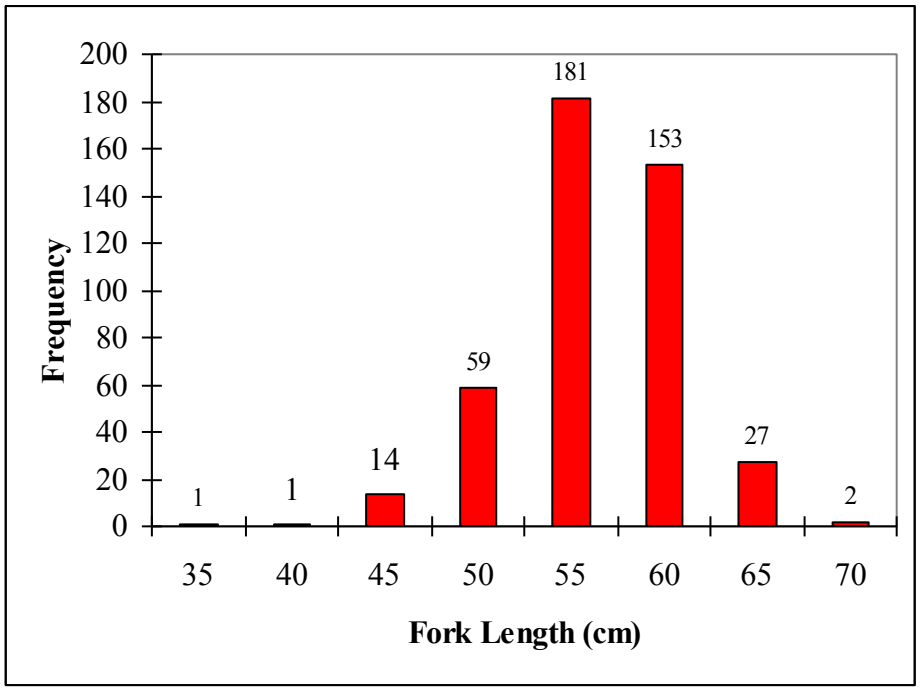

Figure 8: Fork length distribution for sockeye salmon in 2014 (n=438); X axis labels are 5 cm length class upper boundaries.

Table 4: Average length (cm) for sockeye female, male and combined sexes from 2003 to 2014.

Year	Female	Male	Total
2003	55.3	58.8	56.6
2004	56.4	58.3	57.1
2005	57.2	57.5	57.4
2006	52.6	55.3	53.8
2007	53.5	52.2	53.3
2008	54.9	58.3	56.3
2009	54.3	57.4	55.8
2010	53.9	56.5	55.3
2011	56.0	59.0	57.5
2012	55.0	58.0	56.0
2013	54.0	58.0	57.0
2014	52.6	55.9	54.2

In 2014, 438 scale samples were collected from adult sockeye complete with sex and length data and submitted to Carol Lidstone of Birkenhead Scales Analysis for age determination. Of these, 360 samples were confidently readable providing a 2.6 percent sample of the total run (181 females and 179 males; Table 5). Age 4 fish (aged 1.2; or 1 year in fresh water and 2 years in salt water post-hatch), and originating from the 2010 broodyear, were the dominating age class for both females (94%) and males (97%). Mean size for age 4 fish differed slightly for females and males at 52 and 56 cm respectively. The remaining female sockeye were 3-year old fish (n=3; 2%; 40 cm average length) originating from the 2011 brood year and 5-year old fish (n=7; 4%; 59 cm average length) originating from the 2009 broodyear. The remaining male sockeye were all 5-year old fish (n=5; 3%; 61 cm average length) originating from the 2009 broodyear.

Table 5. Sockeye salmon age, sex and fork length statistics at the KSEF in 2014 (CL = mean variance at 95% confidence).

All Years					
Sex	**Count**	**Mean (cm)**	**CL (95%)**	**Min (cm)**	**Max (cm)**
Male	179	58	0.5	43	68
Female	181	52	0.7	34	66
Total	360	54	0.5	34	68
1.1 (3- Year Old Returning Sockeye; 2011 broodyear)					
Sex	**Count**	**Mean (cm)**	**CL (95%)**	**Min (cm)**	**Max (cm)**
Male	n/a	n/a	n/a	n/a	n/a
Female	3	40	5.2	38	42
Total	3	40	5.2	38	42
1.2 (4- Year Old Returning Sockeye; 2010 broodyear)					
Sex	**Count**	**Mean (cm)**	**CL (95%)**	**Min (cm)**	**Max (cm)**
Male	174	56	0.5	43	68
Female	171	52	0.7	34	63
Total	345	54	0.4	34	68
1.3 (5- Year Old Returning Sockeye; 2009 broodyear)					
Sex	**Count**	**Mean (cm)**	**CL (95%)**	**Min (cm)**	**Max (cm)**
Male	5	61	3.1	58	63
Female	7	59	3.7	54	66
Total	12	60	2.1	54	63

4.2 Chinook Salmon

A total of 967 adult chinook salmon returned to the KSEF in 2014. The 2014 return is well below the highest return of 3,225 chinook in 2007 and marks only a slight increase to the extremely low counts observed since 2009 (Figure 9). The 2014 chinook return is 36% below the running average from 2003 to 2013, which was 1,595 fish; the running average since 2003 now stands at 1,542 fish/year.

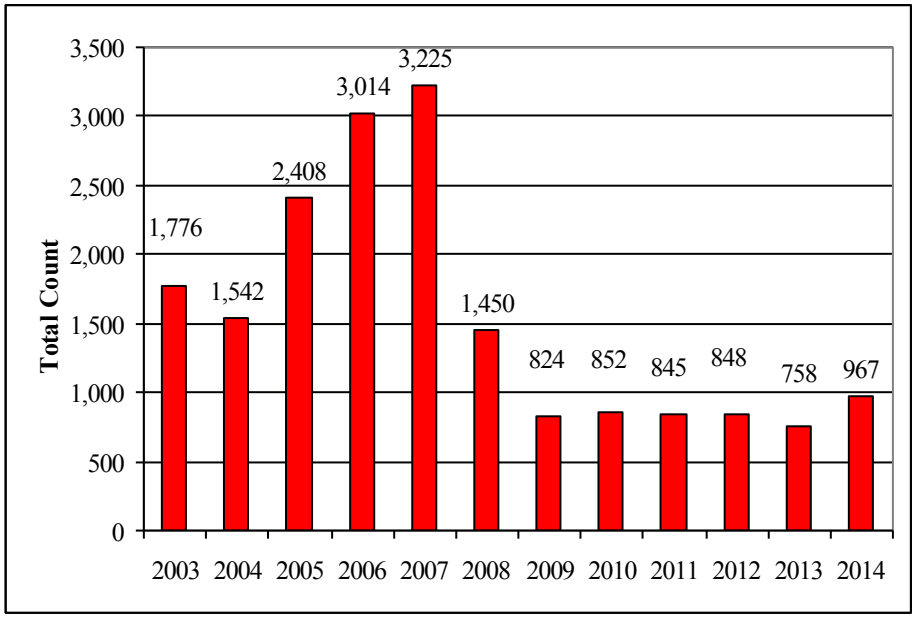

Figure 9: Annual escapement for chinook salmon from 2003 to 2014.

In 2014, the first chinook salmon was counted at the KSEF on July 12th and the last on September 30th. As noted above, the final observation of one fish on September 30th was preceded by 21 days of zero counts (considered an outlier), and for the purpose of this report the run end was on September 8th. The 2014 main run timing range was sporadically spread out from July 29th to September 2nd (96% of the total run). Relatively high counts were observed on three dates: August 5th (144 fish), August 13th (98 fish), and August 25th (105 fish). When combined these three dates represented 36% of the total run and in general, the bulk of the run arrived about 1-2 weeks later (mid-late August) than the 2003-2013 average (early-mid August; Figure 10).

Length, age, and sex data was collected from 38 chinook salmon (3.9 % of the total run) in 2014. Male and female sex ratios were 62 and 38 percent respectively. Fork length histogram (5cm intervals) showed a bimodal distribution, dominated by fish in 76-80cm class (29%) and followed by the 86-90cm class (16%; Figure 11). Average fork length of the total sample was 80.8 cm and

males and females were 79.6 and 82.1 centimeters respectively (Table 6). The 2014 length results fell with the normal range of results observed since 2008 (Table 7). Age results for the 2014 chinook samples were not available for inclusion in this report but will be presented in the 2015 KSEF Annual Report. Based on previous year's results, the majority of chinook are usually 5-year old followed by 4-year old fish (McCarthy, 2014

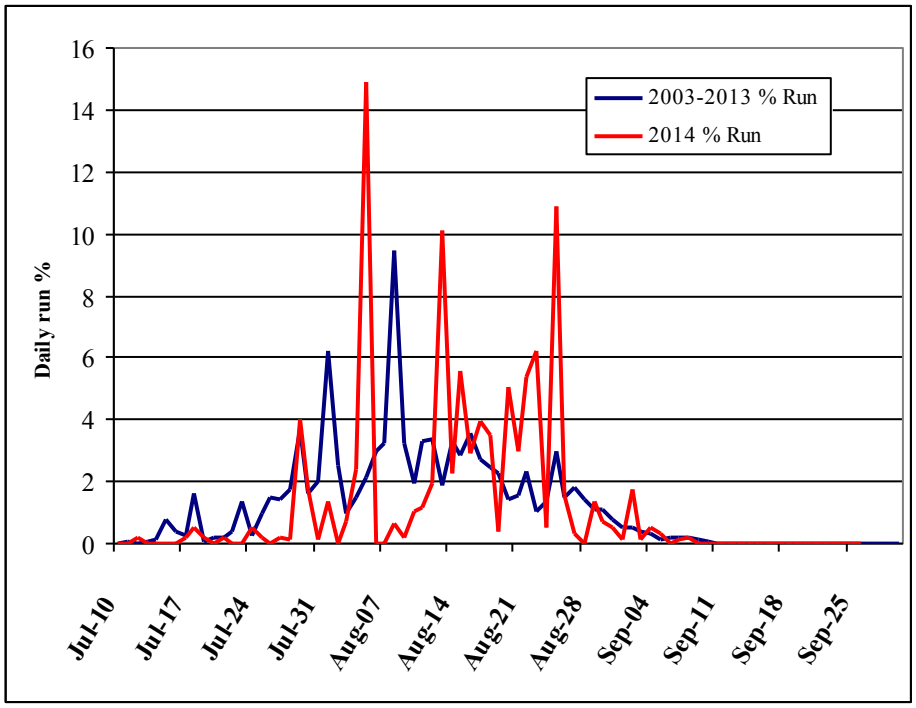

Figure 10: Kitwanga Chinook % Run past KSEF by day for 2003-13 vs. 2014.

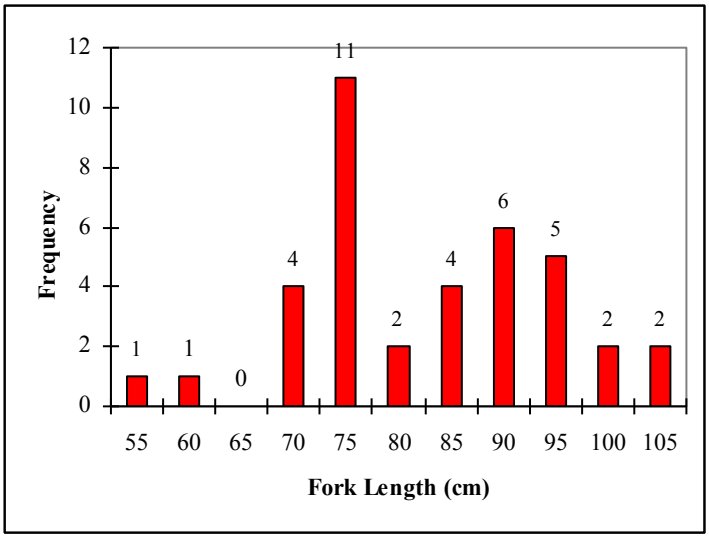

Figure 11: Fork length distribution for chinook salmon in 2014 (n=38); X axis is 5 cm length class upper boundaries.

Table 6: Average, minimum, and maximum fork lengths (cm) for chinook salmon sampled in 2014 at the KSEF (n=38).

	Male	Female	Combined
Mean	79.6	82.1	80.8
Minimum	56	54	54
Maximum	104	96	104
Count	23	15	38

Table 7: Average length (cm) for chinook male, female and combined sexes from 2008 to 2014.

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
2013	79.0	84.8	81.3
2014	79.6	84.8	81.3

4.3 Pink Salmon

A total of 75,416 adult pink salmon migrated past the KSEF in 2014. This return surpassed the maximum even year return of 71,070 fish in 2004 and well above the minimum return of 4,245 fish in 2008 (Figure 12). The 2014 even-year pink return is 3-fold greater the running average from 2004 to 2012, which was 23,764 fish; the running average for even-year runs now stands at 32,373 fish/year. Since pink salmon are exclusively 2 year olds, all of the run would have originated from the 2012 broodyear, which had an escapement of 16,320 fish, meaning the 2014 return more than quadrupled replacement.

The bulk of the pinks migrated through the KSEF occurred over a 4-week period between August 12th and September 12th (98% of the run; Figure 13). Peak counts occurred on August 21st (9,075 fish) and September 2nd (7,396 fish), which when combined represented 22% of the total run. The run timing in 2014 was similar to that of other even year returns.

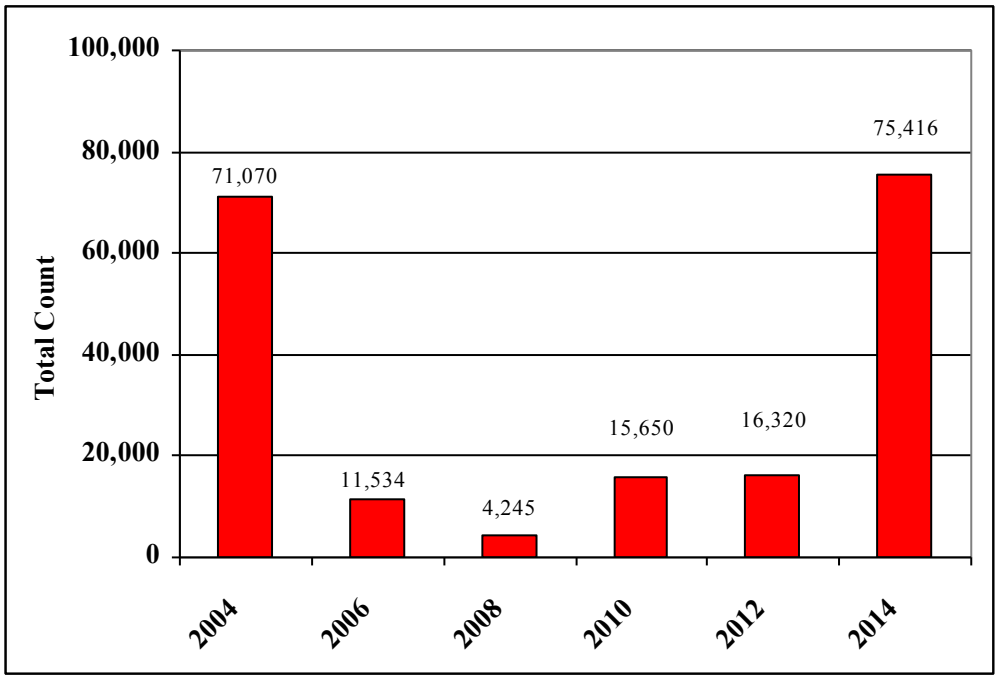

Figure 12: Annual escapement for even year pink runs at the KSEF from 2004 to 2014.

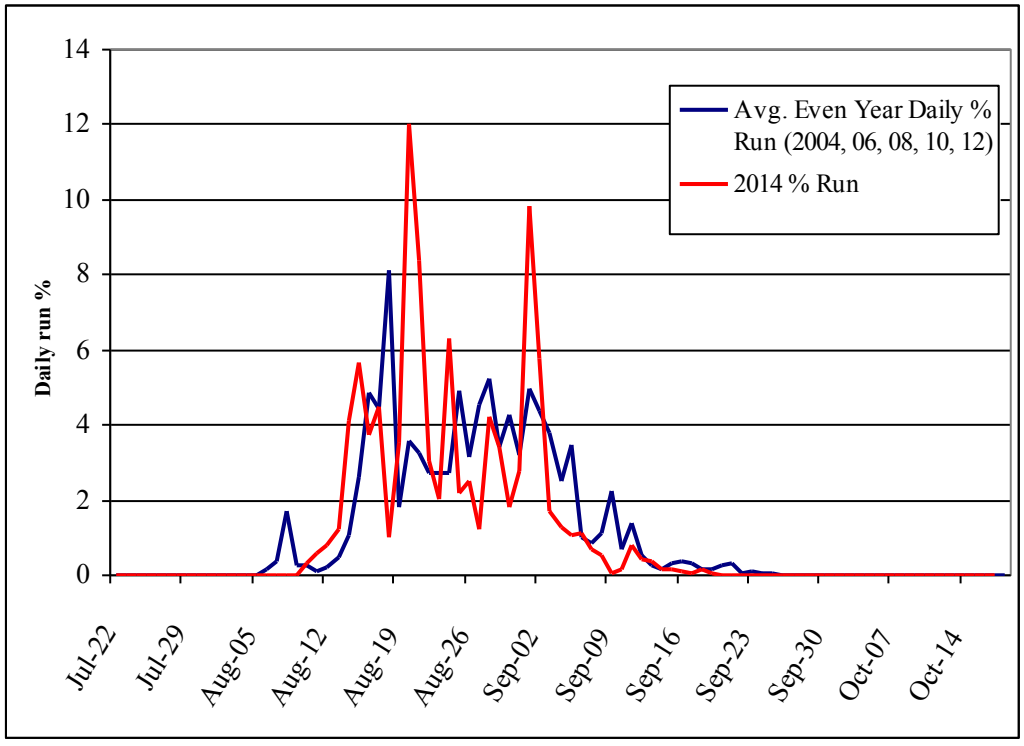

Figure 13: Run timing for pink salmon (daily run %) in 2014 vs. average even year run from 2004 and 2012.

4.4 Chum Salmon

A total of 423 adult chum salmon migrated past the KSEF in 2014. The 2014 run compares to a maximum return of 1,862 fish in 2005 and a minimum return of 150 fish in 2008 (Figure 14). The 2014 chum escapement was 40% below the average escapement of 784 fish recorded from 2003-2013 and there is no sign of recovery to the 1,000+ returns encountered between years 2003 and 2005. The current 2003-2014 average now stands at 754 fish/year.

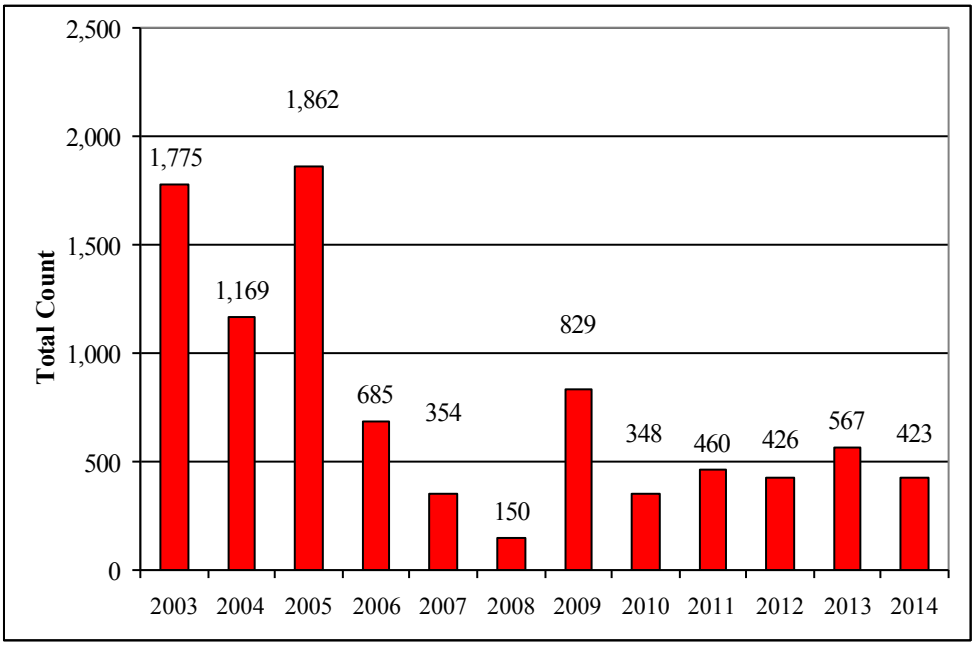

Figure 14: Annual escapement for chum salmon at the KSEF from 2003 to 2014.

In 2014, the first chum salmon was counted at the KSEF on August 16th and the last on October 4th. The bulk of the run occurred over a 3-week period between September 1st and September 20th (82% of the run). Two distinct run pulses were observed from September 1st to 9th (214 fish) and from September 16th to 20th (101 fish; Figure 15).

Fork length, sex and age data was collected from 13 chum salmon in 2014 (3% of the run). Male and female sex ratios were 62 and 38 percent respectively. Fork length histogram (5cm intervals) showed an even distribution of fish in the 66 to 80 cm length classes (4 fish /5cm length class) and one fish in the 61-65cm length class. On average, males were slightly larger than females (76.8 and 74.3cm respectively; Table 8). Compared to length data collected since 2008, the 2014 mean lengths were consistently within the 70 to 80 cm range (Table 9).

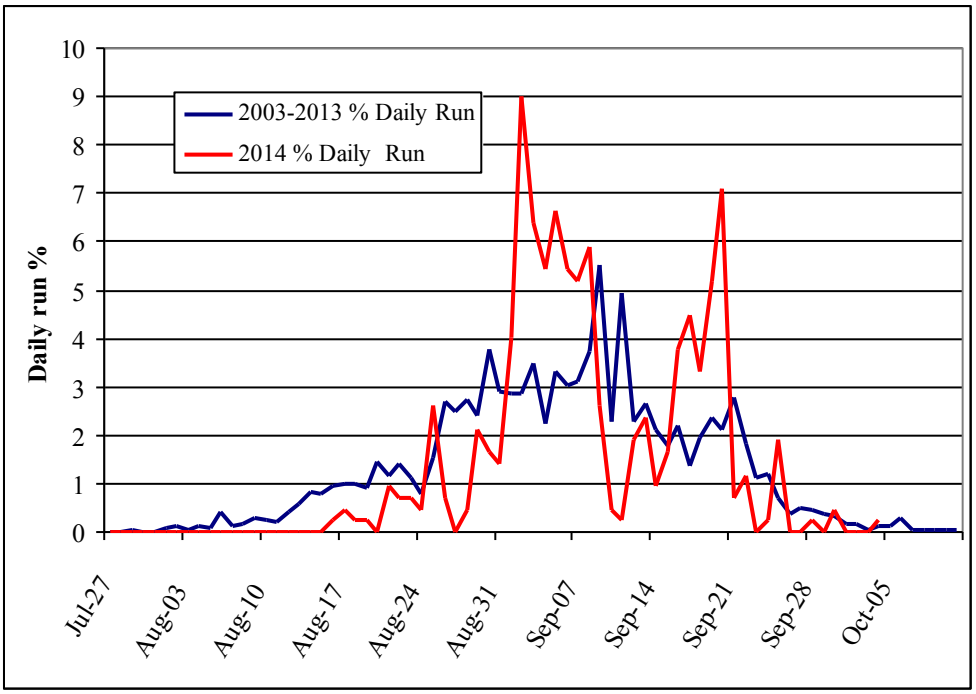

Figure 15: Kitwanga River chum salmon average run timing (daily run %) for 2003-2013 vs. run timing for 2014 at the KSEF.

Table 8: Mean, minimum and maximum fork lengths (cm) for chum salmon sampled in 2014 at the KSEF.

	Male	Female	Combined
Mean	72.1	72.0	72.1
Minimum	65	66	65
Maximum	78	78	78
Count	8	5	13

Table 9: Average length (cm) for chum male, female and combined sexes from 2008 to 2014.

Year	Male	Female	Combined
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
2013	76.8	74.3	75.4
2014	72.1	72.0	72.1

Age results for 2014 chum salmon returns were not available at the time of this report but will be included in the 2015 KSEF Annual Report. Based on previous year's results, the majority of

chum salmon are usually 4 or 5-year old fish, which would have originated from the 2009/2010 broodyear, which were 829 fish and 346 fish respectively. This suggests decreasing or stagnating returns of relatively low chum numbers.

4.5 Coho Salmon

A total of 5,222 adult coho salmon migrated past the KSEF in 2014. The 2014 return is well below the highest return of 12,080 coho in 2009 but well above the 690 fish return in 2004 (Figure 16). The 2014 coho return was 31% above the running average from 2003 to 2013, which was 3,986 fish/year; the running average from 2003 to 2014 now stands at 4,089 fish/year.

In 2014, the first coho salmon was counted at the KSEF on August 9th and the last on October 16th, the last day of counting before the fence closed. The bulk of the run occurred in two large spikes between September 19th and 22nd (1,820 fish) and October 4th and 12th (2,149 fish; Figure 17). When combined these two pulses represented 78% of the total run. Coho runs could have continued well after the KSEF was closed on October 16th as coho were still arriving in double-digit numbers. For the purpose of this report, the run of 5,222 is a minimum number represented by a mid-October end date. Logistical difficulties due to high water did not allow for a full capture of the coho run at the KSEF that could potentially continue into the end of October and the beginning of November. For example in 2008 at the KSEF, 1,112 coho arrived from October 17th to 22nd representing 39% of the total run of 2,882 fish; in 2009 at the KSEF, 3,040 coho arrived from October 17th to 28th representing 25% of the total run of 12,080 fish.

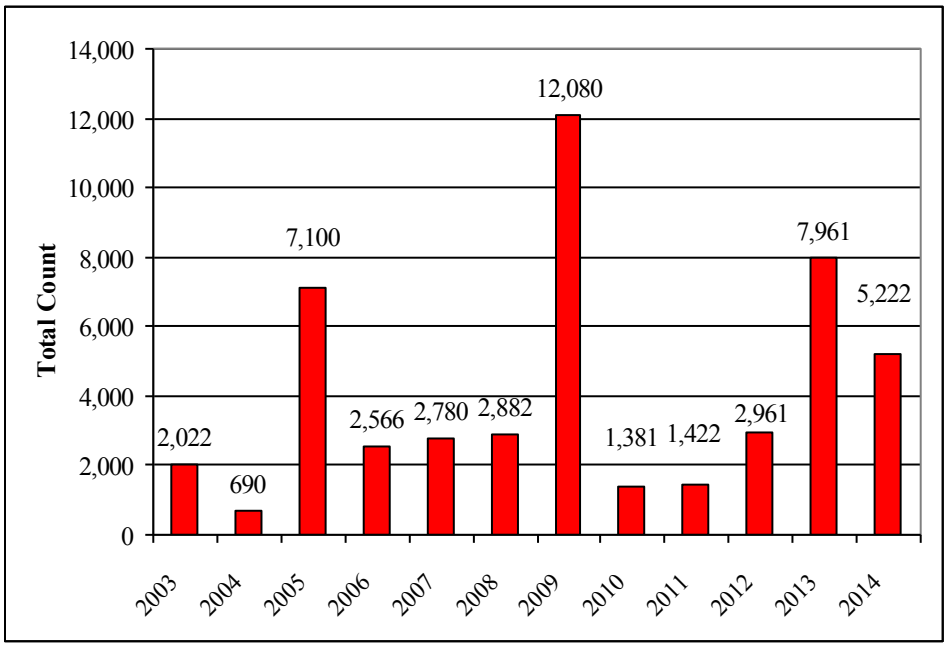

Figure 16: Annual escapement for coho salmon from 2003 to 2014 at the KSEF.

Length, age, and sex data was collected from 66 coho salmon in 2014 (1.3% of the total run). Male and female sex ratios from the samples were 76% and 24% respectively. Average fork length for males and females were similar at 63.6 and 62.9cm respectively (Table 10). Fork length histogram (5cm intervals) showed a uni-modal distribution, dominated by fish in 61to 70 cm length interval (56% of the sample; Figure 18). Compared to length data collected since 2010, the 2014 mean lengths were consistently within the 60 to 65 cm range (Table 11).

Age results for 2014 coho salmon returns were not available at the time of this report but will be included in the 2015 KSEF Annual Report. Based on previous year's results at the KSEF, the majority of coho are likely 3-year old returns, therefore the main 2014 return likely originated from the 2011 broodyear, which was 1,422 fish and suggests an approximate 4-fold increase in stock numbers.

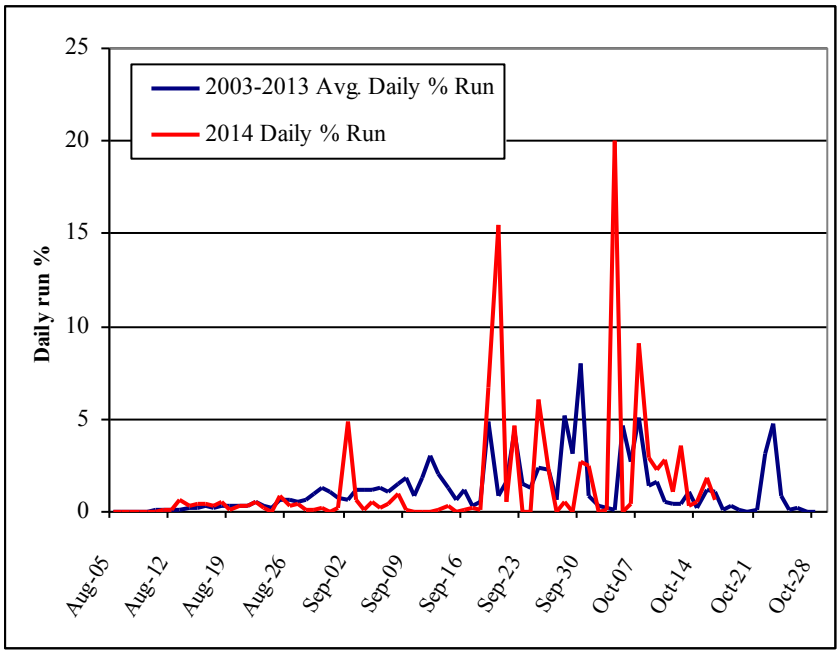

Figure 17: Kitwanga River coho salmon average run timing (daily run %) for 2003-2013 vs. run timing for 2014 at the KSEF.

Table 10: Mean, minimum, and maximum fork lengths (cm) for coho salmon sampled in 2014 at the KSEF.

	Male	Female	Combined
Mean	63.6	62.9	63.4
Minimum	48	46	46
Maximum	91	84	91
Count	50	16	66

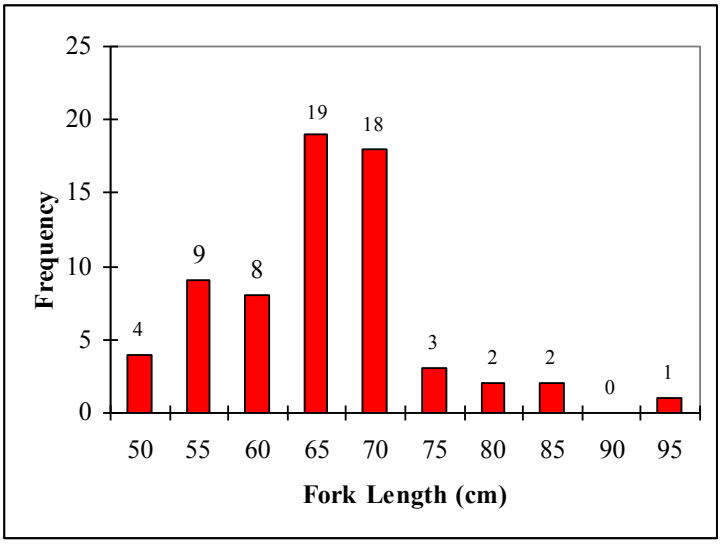

Figure 18: Fork length distribution for coho salmon in 2014 (n=66); X-axis labels are 5 cm length class upper boundaries).

Table 11: Mean length (cm) for coho male, female and combined sexes from 2010 to 2014.

Year	Male	Female	Combined
2010	65.3	64.2	64.8
2011	60.8	62.5	61.4
2012	62.3	60.7	61.2
2013	63.7	60.4	62.7
2014	63.6	62.9	63.4

In the spring of 2013, GFA applied 12,971 CWT's to coho smolts at the Kitwanga Smolt Facility, which is located at the outlet of Gitanyow Lake. Most coho smolts (including CWT implanted fish) generally return to the KSEF 18 months afterwards. The bulk of the 2013 CWT smolts were expected to return as adults in the fall of 2014. A total of 182 CWT fish out of 3,540 examined fish were counted through the KSEF in 2014. Extrapolating to the total run, an estimated 262 tagged fish passed through the fence in 2014 (5.1% recovery). Alaskan and Canadian fisheries recovery 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 2014, along with data not yet submitted by DFO for Canadian fisheries component, a full account of the 2013-2014 CWT coho program cannot be finalized for this report. However, based on previous years results, Kitwanga coho are always vulnerable to Alaska and Canadian Fisheries to some extent and the GFA CWT program provides an element of proof.

5. DISCUSSION AND RECOMMENDATIONS

Since the KSEF construction in 2003, GFA has collected accurate and invaluable data to determine the strength of Kitwanga River salmon stocks against other middle Skeena salmon stocks on an ongoing basis. In 2014, the GFA initiated the KSEF to enumerate and collect biological information for sockeye, chinook, chum, pink and coho salmon returning to the Kitwanga River. GFA is confident that essentially the entire runs of chinook, pink and chum salmon were captured during fence operation. Only a small portion (6%) of the sockeye run and an unknown portion of the coho run may be underestimated due to early fence closure after an extreme high water event.

Most of the 2014 sockeye run of 13,699 fish were 4-year olds originating from the highest return of 20,804 fish in 2010, which shows a concerning set-back in population rebuilding. Overall, a sporadic but positive rebuilding had occurred prior to 2014 since the crash in 2007 (240 fish). This illustrates the importance of continuing of the KSEF program to firstly acquire accurate escapement numbers, exploitation rates on the sockeye stock and to provide in-season salmon forecasts to DFO Fisheries managers.

The 2014 chinook salmon run of 967 fish is considered extremely low compared to relatively high returns observed from 2003 to 2008 (1,450-3,225 fish). Chinook salmon numbers in 2014 were 40% below the running average and marks the 6th consecutive year of counts below 1,000 fish, 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 75,416 adult pink salmon migrated past the KSEF in 2014 and marks the highest even year return since 2003. Odd year runs normally dominate over even year runs. The 2013 return was the second lowest run since 2003 and GFA will be looking forward to the 2015 pink run to determine if both even and odd year returns are trending upwards.

A total of 423 adult chum salmon migrated past the KSEF in 2014, which was 40% below the average escapement recorded from 2003-2013, and marks the 9th consecutive year of numbers well below the running average since 1000+ fish were counted from 2003 to 2005. If escapements do not improve substantially in future years, recovery options may need to be explored.

A total of 5,222 coho were enumerated at the KSEF in 2014, which was 31% above the average escapement recorded from 2003-2013. Based on most years, coho are 3-year old fish, which means this run likely originated largely from a low return of 1,422 fish in 2011 suggesting a positive rebuilding of the 2014 stock. Results of the coded wire tag program were incomplete as capture results from the Canadian and Alaska fisheries were not available in time for this report and the KSEF closed early due to high water before the run was complete.

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