Gitanyow Fisheries Authority

Kitwanga River Sockeye Salmon Enumeration, 2006

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Date:	January 22, 2007

Abstract

In 2006, the Kitwanga River Salmon Enumeration Facility (KSEF) operated for 108 continuous days and remained unbreached during the entire sampling period. The Gitanyow Fisheries Authority (GFA) operated the permanent fence from July 10th to October 24th, 2006 to enumerate salmon escaping to the Kitwanga River. A total of 5,139 sockeye, 3,014 chinook, 11,534 pink, 685 chum, and 2,566 coho salmon were counted through the facility. The 2006 sockeye salmon escapement was the largest on record since GFA started counting sockeye in 2000. Sockeye in 2006 were smaller than normal and females were slightly more dominant than males. All five species of salmon appeared to migrate to the KSEF at a later date than was observed in previous years. Increasing water levels were correlated with upstream migration to some degree for all species except for chinook salmon.

Acknowledgements

The Gitanyow Fisheries Authority would like to thank the Pacific Salmon Commission, Fisheries and Oceans Canada and the Gitanyow Hereditary Chiefs for providing the funds to operate the Kitwanga River Salmon Enumeration Facility in 2006. GFA would also like to acknowledge the hard work of the Gitanyow Fisheries field staff whose dedication to the project made it a success again this year.

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Executive Summary

The Gitanyow Hereditary Chiefs and their people have inhabited northwestern British Columbia for thousands of years. The main settlement of Gitanyow is located within the Kitwanga Watershed along the "Grease Trail" between the Skeena and Nass Rivers. It is strategically located there because historically the Kitwanga River supplied the Gitanyow with an abundance of salmon, which was the staple of their diets (Rabnett et.al. 2002). The system was particularly rich with sockeye salmon that originated in Gitanyow Lake and even today it is not uncommon to hear Gitanyow Elders speak of how the lakeshore used to turn red in the late summer as the sockeye congregated to spawn. However, Native fishers observed drastic declines in Kitwanga sockeye abundance in the first half of the 20th Century. Therefore, most fishing sites along the river were abandoned by the 1960's (Rabnett et.al. 2002). The reasons for the stock decline are not completely understood, however it is believed that over-exploitation in the commercial fishery and habitat deterioration in Gitanyow Lake are the main contributors to the stock collapse. Fishery re-constructions for the last 40 years show average exploitation rates on Kitwanga sockeye of over 50%, reaching highs of over 65% in some years. Furthermore, the Kitwanga Watershed was heavily logged beginning in the 1960's and it is believed that both spawning and rearing areas in the lake have been negatively impacted by road building and harvesting activities.

For much of the 20th Century salmon escapement to the Kitwanga River was poorly documented. In most years, salmon spawner surveys were not performed, and if they were conducted, the quality of the data was questionable because surveys usually consisted of one time visual spot checks at known spawning grounds. The sketchiness of historical North coast salmon escapement data for streams such as the Kitwanga became evident upon review of the DFO historical Salmon Escapement Data System (SEDS).

In the 1990's, under pressure from a Supreme Court of Canada Ruling (R vs. Sparrow), DFO established a program entitled the Aboriginal Fisheries Program (AFS). This program essentially created a mechanism to allow First Nation Groups to partake in fisheries management projects. This has helped address some of the local fisheries conservation concerns. The Gitanyow have always promoted the long-term sustainability of Kitwanga sockeye, and with the establishment of the AFS program, the Gitanyow were finally in a position to address the problem. In 1999, the Gitanyow Fisheries Authority (GFA) tasked themselves with the development of a program to determine the limiting factors to sockeye production in the Kitwanga, in order to develop rebuilding options that could restore the stock to more historical levels.

A key component of GFA's Kitwanga River Sockeye Rebuilding Program has included the establishment of a means to accurately estimate sockeye escapement to the river on a yearly basis to:

- Establish the present abundance of the sockeye population,
- To monitor the health of the stock on an annual basis,

- To gauge the effectiveness of their rebuilding efforts.

In the programs infancy a temporary enumeration facility was established in the upper reaches of the Kitwanga River, directly below Gitanyow Lake. The temporary fence proved effective at enumerating sockeye escapement in the years 2000 (Cleveland & Kingston 2001), 2001 (Cleveland 2002) and 2002 (Kingston & Cleveland 2003). Sockeye returns were found to be low (averaging less than 500 fish annually) confirming for the first time that Kitwanga sockeye were at risk of extirpation.

The use of the temporary fish fence in the upper waters of the Kitwanga River proved to be an effective tool to monitor sockeye salmon escapement (Figure 1.). However, the data collected was limited in scope to sockeye and to some extent coho abundance. The problems associated with the temporary fence were due to spatial constraints associated with the location of the structure. Essentially, the temporary enumeration structure could not effectively operate under high water conditions because the foundation of the structure was constructed of wood and steel rebar materials. Therefore, it was located directly below Gitanyow Lake where water levels were buffered by the lake properties. This limited the number of fish that could be counted as most chinook, pink and chum salmon spawn below the fence.

In an attempt to enumerate all six species of salmon in the Kitwanga River (including steelhead), plans for the construction of a permanent enumeration facility near the confluences of the Kitwanga and Skeena Rivers were developed. It took three years of intensive planning to design an adequate facility, select an appropriate site, to acquire land and secure the capital for the project. Finally, during the winter 2003, the Kitwanga River Salmon Enumeration Facility (KSEF) became a reality and construction was completed during the spring of 2003 (Cleveland 2003).

The KSEF became operational for the first time in 2003 and accurate measures of sockeye, chinook, pink, chum and coho salmon escapement were determined between July and October. The operation of the facility in 2003 was deemed a huge success, with some minor setbacks, and a total of 345,725 salmon were counted during the sampling period (Cleveland 2004).

1.0 Introduction

The primary objective of any fishery is to maximize harvest at sustainable levels. Maximizing harvest is usually achieved with little effort thanks to modern day fishing techniques; however ensuring an adequate number of fish return to their respective spawning sites is difficult to achieve. In the Skeena Watershed there are very few reliable salmon escapement estimates for smaller systems such as the Kitwanga River, making it extremely difficult to manage for individual salmon stocks. Prior to 2003, salmon enumeration methods utilized in the Kitwanga River consisted of stream counts, mark / recapture studies, aerial surveys and the use of temporary fish fences. These methods have proven to be good estimates of salmon abundance, however the data is often limited in scope due to uncontrollable temporal and environmental factors encountered in stream settings such as the Kitwanga River. In summary, these salmon escapement methods are logistically difficult because the Kitwanga River, like most systems, consists of an open-ended stream where fish migrate in and out under varying water and turbidity levels.

Therefore, to obtain reliable escapement numbers a permanent counting fence was installed in the lower Kitwanga River to enumerate salmon and a resistivity counter was installed to enumerate steelhead. The duel design structure is titled the *Kitwanga River Salmon Enumeration Facility* (KSEF). The KSEF complements other existing escapement estimates within the Skeena Watershed and allow fishery managers to better manage Skeena River salmon and in turn better manage Kitwanga salmon.

The KSEF became operational for the fourth consecutive year during the summer and fall of 2006. This report will describe the undertakings of the project and present the results for the 2006 season. It does not include reporting on the efforts to enumerate steelhead in 2006, those results are part of a separate program that will not be discussed in this report. This project was made possible by financial contributions from the Pacific Salmon Commission, Fisheries and Oceans Canada, and the Gitanyow Hereditary Chiefs.

2.0 Study Area

The Kitwanga River is a fifth order stream that drains into the Skeena River approximately 250 kilometres east (upstream) 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 char (*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). The river can be divided into two sections, the Upper and the Lower Kitwanga River. The Upper Kitwanga is located directly north of Gitanyow 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.

Gitanyow Lake is the only lake found within the Kitwanga Watershed. The lake is considered mesotrophic with a mean depth of approximately 5 meters and a maximum depth of 15m (Shorteed *et al*., 1998). It is relatively clear and the euphotic zone encompasses the entire water column in most areas of the lake. Gitanyow Lake is considered one of the most productive sockeye nursery lakes in British Columbia mainly due to its extremely high macrozooplankton biomass, which is composed mostly of *Daphnia Sp.,* the main food source of juvenile sockeye salmon (Shorteed *et al*., 1998). Through lake and stream reconnaissance surveys completed by the GFA it has been determined that Kitwanga sockeye utilize six key shoreline areas in Gitanyow Lake for spawning (Cleveland & McCarthy, 2003). Therefore, Gitanyow Lake plays a vital role in the life cycle of Kitwanga sockeye for spawning and juvenile rearing purposes.

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 is provided through a private road owned by Cher-Noble Enterprises Ltd. (owners Marcus and Don Halvorson). The actual enumeration facility is also constructed on private property (owned by Marcus and Don Halvorson). Therefore, to ensure long-term access to the site the Gitanyow Hereditary Chiefs have secured a Statutory Right of Way to both the access road and the site where the enumeration facility is constructed. The Right of Way was granted on March 26, 2003 for both parcels of land and is legally in effect until 2028 (Cleveland, 2003). The Permanent fence also falls within the Gitwangak Eagle Clan Traditional Territory. Permission was granted to the GFA from the Eagle Clan (Hereditary Chief - Calvin Hyzimsz) to conduct yearly enumeration operations on their territory.

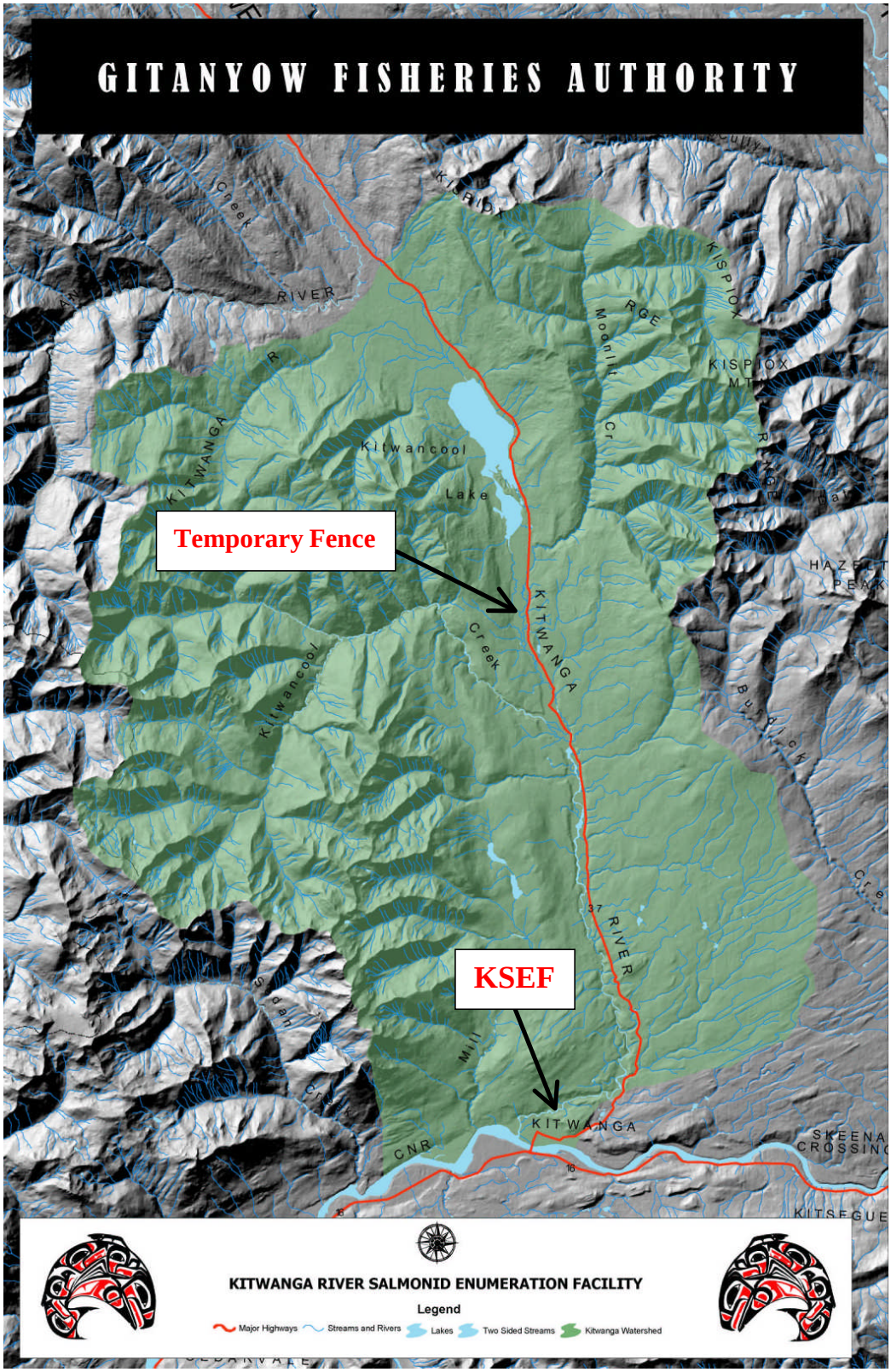


Figure 1. Illustration of the Kitwanga Watershed, making specific reference to the location of the Kitwanga River Salmonid Enumeration Facility (KSEF) and the temporary fish fence.

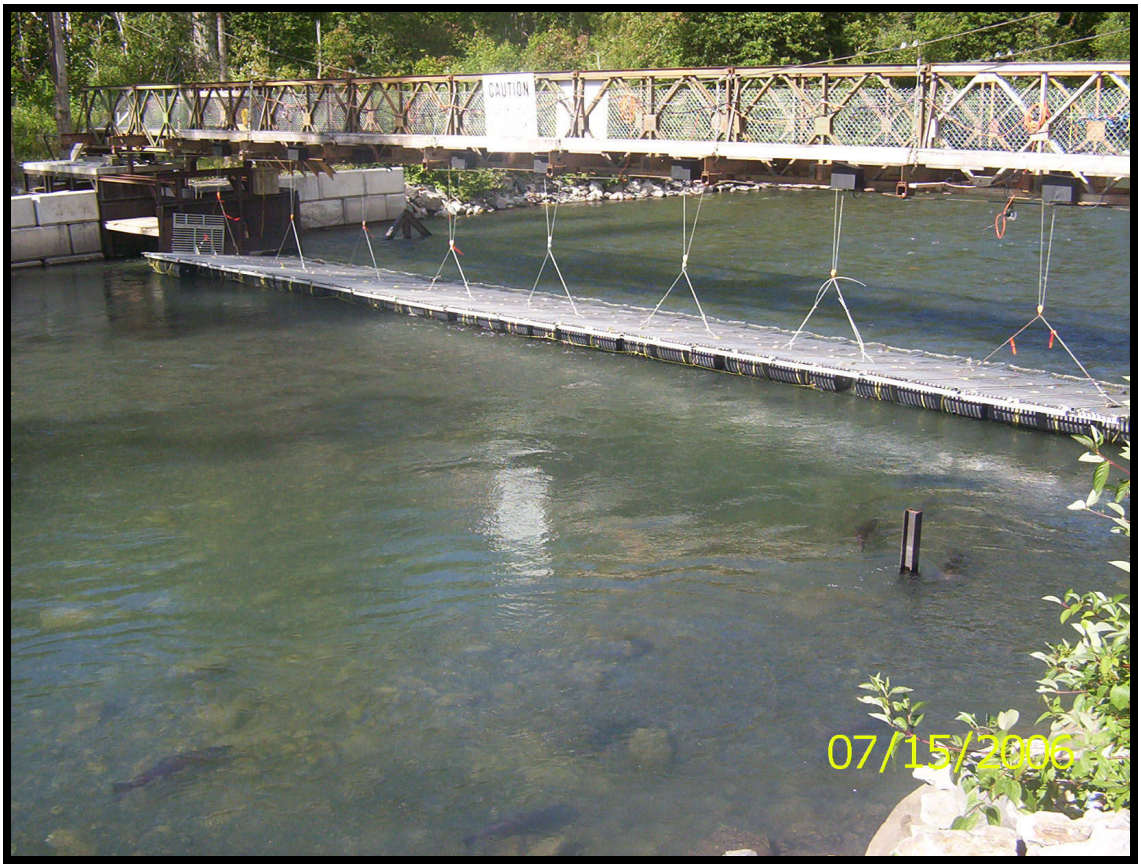
3.0 Methods

To efficiently and accurately enumerate salmon returning to the Kitwanga River each year the GFA utilizes a permanent enumeration facility that was constructed on the Kitwanga River in the spring of 2003 (Photograph 1). The enumeration facility is located near the mouth of the Kitwanga River and it has been determined that most salmon spawn above the site which provides an accurate measure of escapement for all species in any given year (Cleveland, 2004). During the summer and fall months the permanent facility utilizes aluminium panels that span the river to funnel fish through counting boxes to enumerate sockeye, chinook, pink, chum and coho salmon. In the winter and spring the panels are removed and a resistivity counter is used to enumerate steelhead escapement to the Kitwanga River.

Photograph 1. Aerial view of the Kitwanga River Salmon Enumeration Facility.

The permanent enumeration facility is approximately 30 m in length and runs perpendicular to the riverbanks. The upstream ends of the aluminium floating panels are secured in river by attaching them to metal hooks. The metal hooks are permanently secured with hilti bolts to a cement sill that spans the entire width of the river. The hooks allow the floating panels to hinge up and down with fluctuating water levels. In total there are eighteen aluminium panels spanning the river. Large polyethylene floats are attached to the downstream end of the aluminium panels to help keep the panels suspended above the water level. It has been GFA's experience that floats alone do not provide enough lift during high water events to keep the fence operational. Therefore, as a secondary method to ensure the fence remains above the water, panels are secured with

3/8” aircraft cables to eight 1500 lb winches hung on an overhead walkway (Photograph 2). The winches and adjoining cables provide added floatation to the aluminium panels.



Photograph 2. Floating panels attached to overhead walkway bridge.

The aluminium panels are heavy (175 lbs) and awkward to handle. Therefore, the overhead winch attached to a guideline helps field crews to lower and raise the panels safely and position them into the river (Photograph 3).

Photograph 3. Overhead winch used to lower and raise aluminium panels in and out of the river.

Once the aluminium panels are secured in the river, trap boxes are installed on the left and right banks so that fish can be counted as they migrate past the fence. As the salmon migrate upstream they encounter the aluminium fence panels and swim to the left or right banks of the river. Once they are positioned near the riverbanks they can passively swim through a trap box (Photograph 4). The fisheries technician stationed at the trap box can then visually identify and tally all fish as they swim through. The trap boxes are separated into two sides to allow fish to swim up both sides. A white Teflon reflective background is used on the bottom of the trap boxes to make fish identification easier (creates more contrast). A floating view box with a plexiglass bottom is also used on top of the water column to cut the waters glare making visual observations easier (Photograph 5). The entire trap box can be lowered or raised with a hand winch depending on the water level and clarity.

Photograph 4. View of the left bank trap box.

Photograph 5. Plexiglass viewing box used to identify fish as they swim through traps.

A portion of the 2006 sockeye and chum salmon were randomly sampled to determine run sex ratios and overall size distribution and condition. Sampling consisted of trapping fish in viewing boxes by lowering overhead trap doors. Once trapped the sockeye and chum were dip netted and placed in "V" troughs filled with fresh river water where they were visually inspected to determine sex and overall body condition (Photograph 6.). Fork length measurements (in centimetres) were collected for yearly analysis of size distribution. Once fish were sampled they were quickly returned to the trap boxes where they were allowed to swim upstream.

Unlike other years, no sockeye scales were collected in 2006. Instead sockeye ages were determined by collecting sockeye otoliths at Gitanyow Lake in conjunction *The Kitwanga Sockeye Salmon Enhancement Program, 2006*.

An Aquarod data logger is located directly below the permanent enumeration fence to monitor water stage and water and air temperature throughout the salmon migration season. This data logger has been in place since May 2, 2003, and data is collected every 30 minutes. The information collected by the Aquarod is used to compare river water conditions from year to year and to observe the effects of these parameters on Kitwanga salmon migration.

Photograph 6. Sockeye salmon being sampled in "V" trough.

4.0 Results and Discussion

The Kitwanga River Salmon Enumeration Facility was rendered operational for the 2006 season on July 9th. Salmon counting commenced on July 10th, 2006 and continued uninterrupted until October 24th, 2006. Gitanyow Fisheries staff counted fish during daylight hours for a total of 108 continuous days. In total 23,390 fish were enumerated through the facility in 2006. Fish encountered were identified to the species level, while chinook salmon were further broken down as being either mature adults or jacks (adult males retuning after only one year at sea). Chinook jacks were not included in the overall escapement reporting to DFO in 2006 because they are not believed to significantly contribute to future returns to the system. Sockeye, chinook, pink, chum and coho salmon contributed the bulk of the returns while Rocky Mountain whitefish (*Prosopium williamsoni*), cutthroat trout (*Salmo clarki*), and bull trout / Dolly Varden char (*Salvelinus malma*) made up a small portion of the 2006 counts. The final escapement results for the various salmon species enumerated through the KSEF in 2006 are presented in Table 1. In addition, 11 chinook jacks, 142 Rocky Mountain whitefish, 46 cutthroat trout, and 253 bull trout / Dolly Varden char were counted in 2006.

Table 1. Kitwanga salmon run timing and total escapement, 2006

Species	Start of Run	Midpoint of Run	End of Run	Run Peaks	Total Escapement
Sockeye	July 11th	September 11th	October 24th	September 25th	**5,139**
Chinook	July 11th	August 8th	September 19th	August 8th	**3,014**
Pink	July 22nd	September 4th	September 27th	September 9th	**11,534**
Chum	August 21st	September 17th	October 5th	September 22nd	**685**
Coho	September 1st	September 25th	October 24th	September 23rd	**2,566**

Weather conditions in and around the Kitwanga Watershed in 2006 were somewhat dryer than normal, which resulted in reduced flow conditions in the streams and rivers. According to statistics posted on the Environment Canada Website for Terrace BC (closest weather station) total precipitation levels in 2006 were significantly less than the average observed between 1971-2000. These findings were also supported by Aquarod stage data collected on the Kitwanga River over the last three years at the KSEF (Figure 2.).

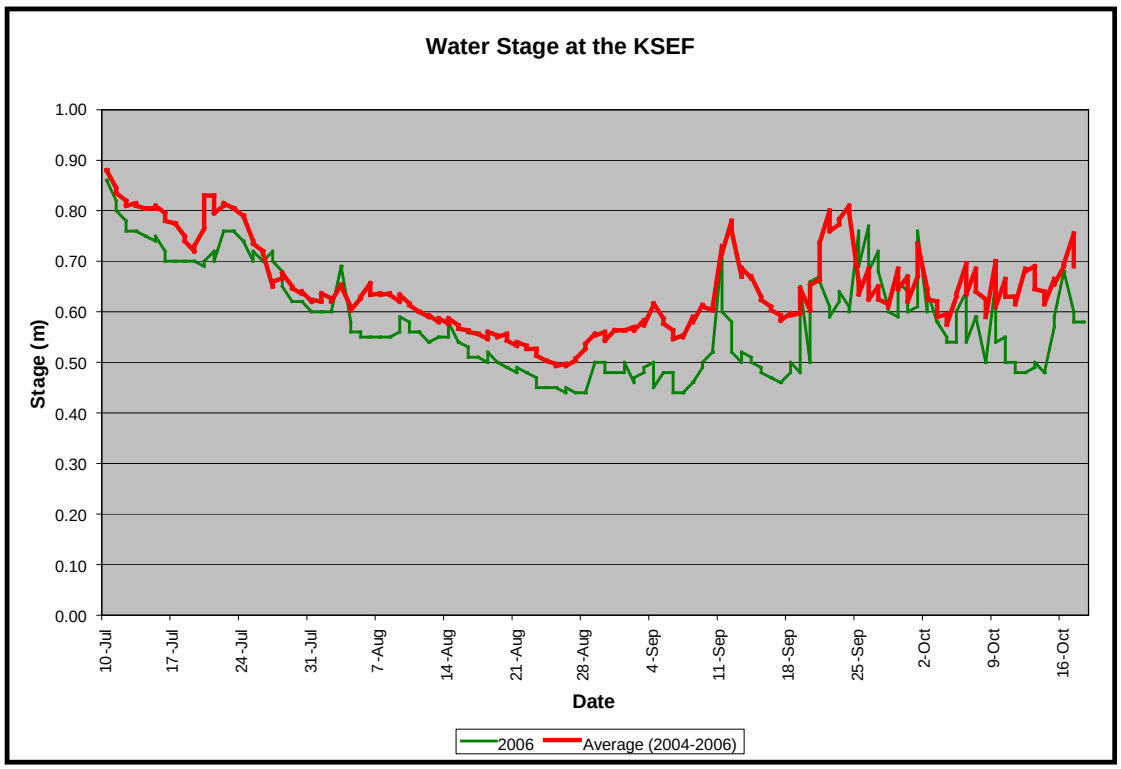


Figure 2. Water stage comparison for 2006 and the average between 2004 and 2006.

4.1 Sockeye Salmon

A total of 5,139 sockeye salmon migrated past the permanent fence in 2006. This escapement is the highest seen since accurate enumeration of Kitwanga sockeye was initiated in 2000 (Figure 3.). Previous escapement counts of Kitwanga sockeye were: 937 in 2005 (Kingston, 2006), 1,264 in 2004 (Cleveland, 2005), 3,377 in 2003 (Cleveland 2004), 971 in 2002 (Kingston and Cleveland 2003), 227 in 2001 (Cleveland 2002) and 260 in 2000 (Cleveland and Kingston 2001). The sockeye escapement results from years 2000 to 2002 were recorded at a temporary fence installed approximately 4-km below Kitwancool Lake (Figure 1.). The escapement results from 2003 to 2006 were collected at the KSEF (Figure 1.). Given that Kitwanga sockeye are mostly 4 (41%) and 5 (51%) year old fish when they return to spawn, the 2006 production was extremely good. The 2006 production would have come off of fairly low parent broodyear escapements (2002 = 971 & 2001 = 227) meaning that the 2006 escapement was more than five times that of replacement.

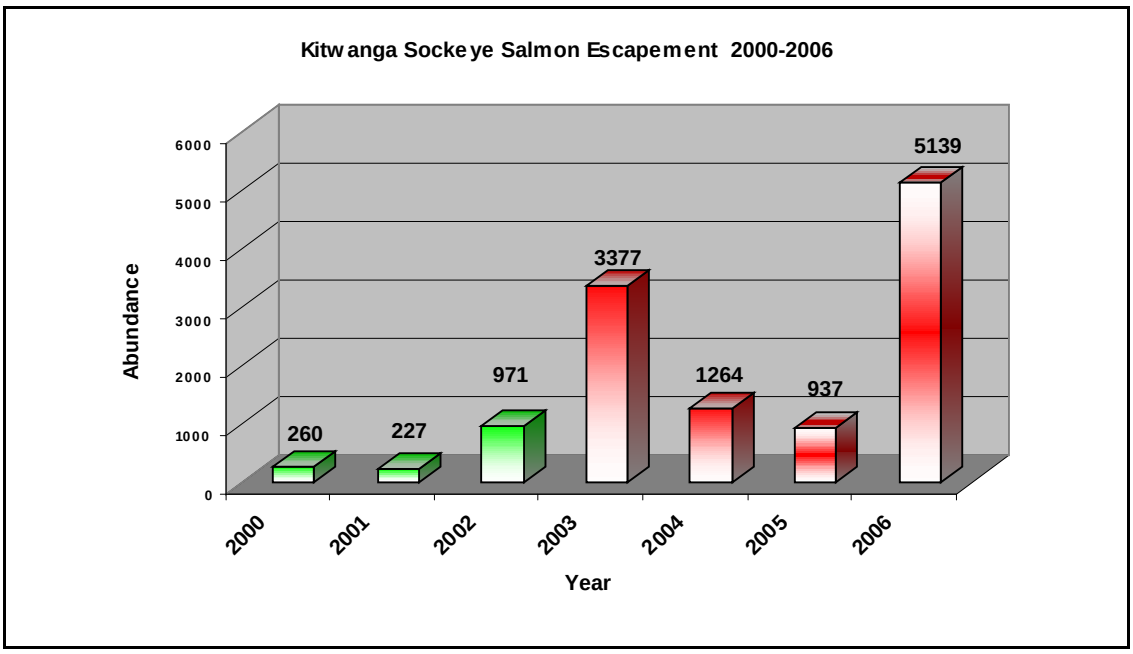


Figure 3. Kitwanga River sockeye salmon escapement results from 2000 to 2006. Please note that green bars represent years when counts were performed at the Kitwanga River temporary fence, while red bars represent years where counts were performed at the KSEF.

In 2006, the first sockeye was enumerated at the KSEF on July 11th and the last sockeye migrated through the fence on October 24th. The peak of the run occurred on September 25th, while the mid point of the run was observed on September 11th (Table 1.). Overall, the 2006 Kitwanga sockeye run timing was approximately one month later than what has been observed in the previous 3 years (Figure 4.).

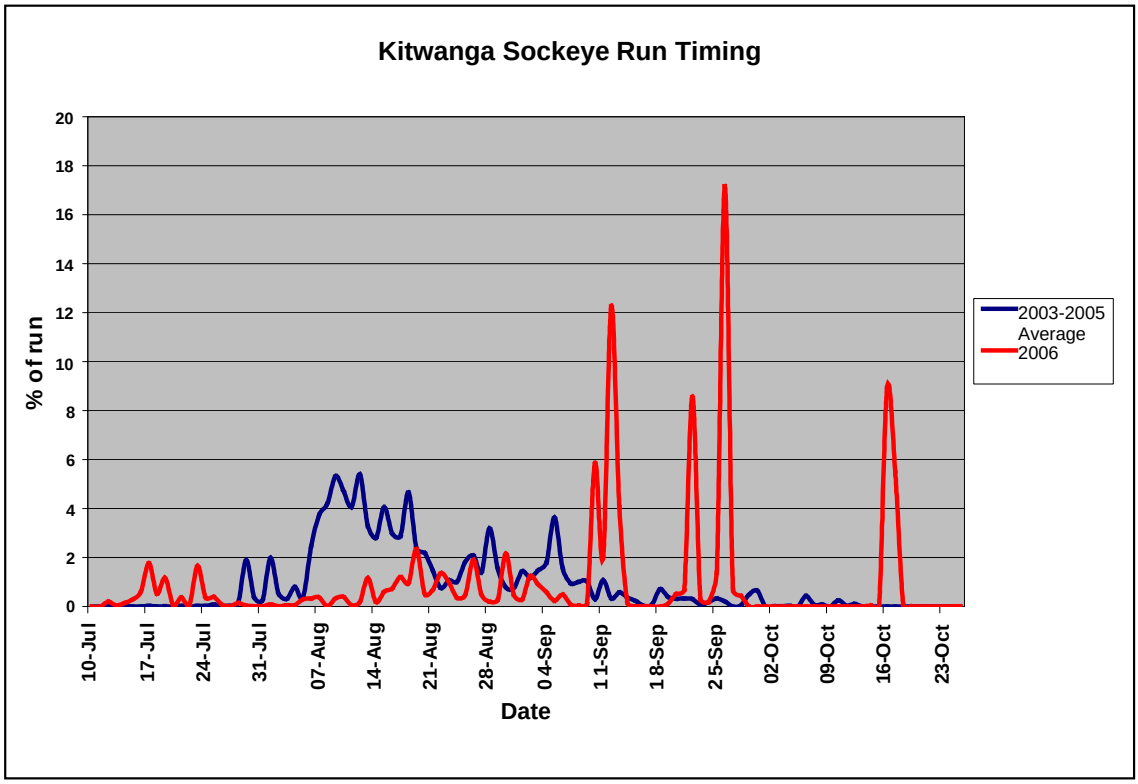


Figure 4. Kitwanga River sockeye salmon run timing expressed in percent run for 2006 verses the average for 2003-2005.

The reasons for the later sockeye run timing are not well understood but it may be due to lower than average water levels in the Kitwanga River in 2006. These lower water conditions may have resulted in sockeye holding in the Skeena River while they awaited higher flows. The bulk of the sockeye in 2006 seem to pulse into the Kitwanga River in fairly large numbers in response to increasing water flows (Figure 5.). The period when the bulk of the sockeye moved through the KSEF was moderately correlated with water flow regimes ($r^2 = 0.56$).

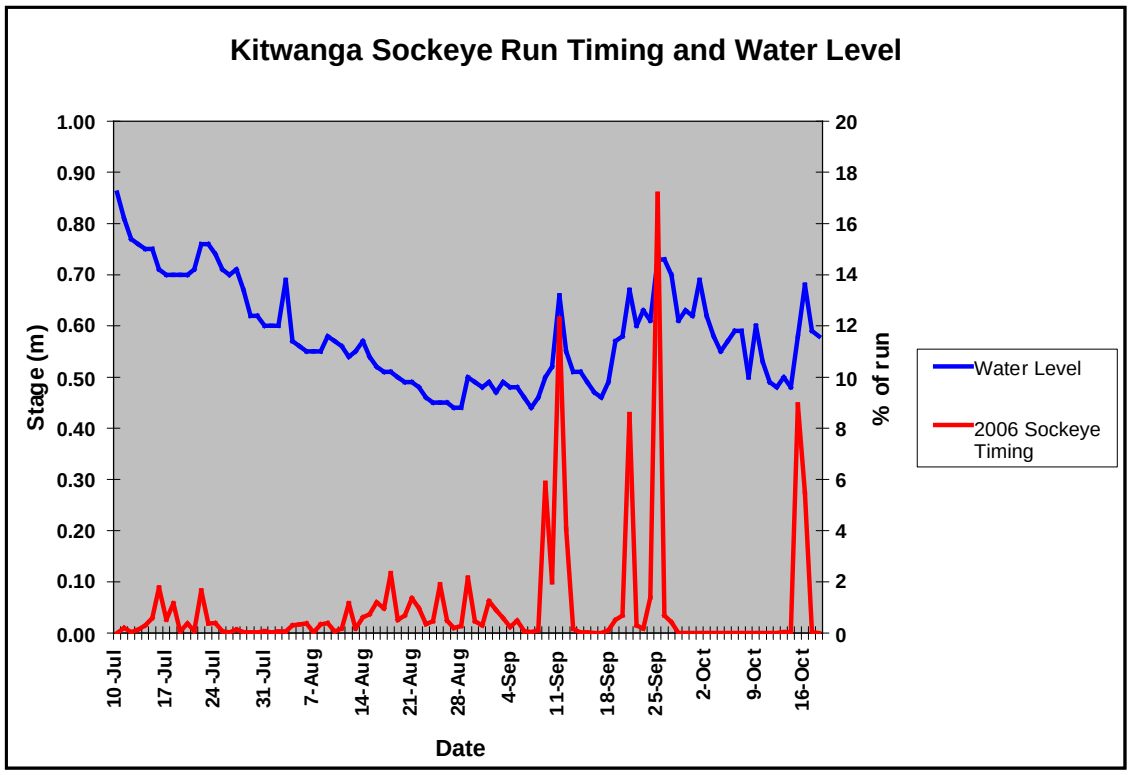


Figure 5. Kitwanga River sockeye salmon run timing and water levels (stage) for the sampling period at the KSEF.

Periodic fork length measurements and visual sex determination were conducted on sockeye randomly throughout their entire 2006 run. A total of 399 sockeye salmon were sampled. Female sockeye comprised 52.2% of the population while males made up the remaining 47.8% of the population (Figure 6). In the last four years female have been slightly more dominant than males with sex ratios ranging from 53% to 63% (Cleveland, 2005, Kingston, 2006). A 1:1 sex ratio indicates that the sex ratios are normal. The 2006 results fall well within what is determined to be a healthy sex ratio. Fork length measurements were taken from 299 sockeye salmon in 2006. Male sockeye exhibited a mean fork length of 55.3 cm (n= 156), ranging from 44cm to 61 cm (Table 2.). Female sockeye in 2006 exhibited a mean fork length measurement of 52.6 cm (n=214), ranging from 36cm to 73cm (Table 2.). Mean fork length measurements for male sockeye salmon were larger than female sockeye. In all years from 2001 to 2006 the fork length difference between the two sexes ranged from 0.3 cm to 4.5 cm (Table 3.) Overall, 2006 Kitwanga River sockeye were the smallest on record. Small sockeye were also observed in the rest of the Skeena River seeming to indicate an ocean production problem.

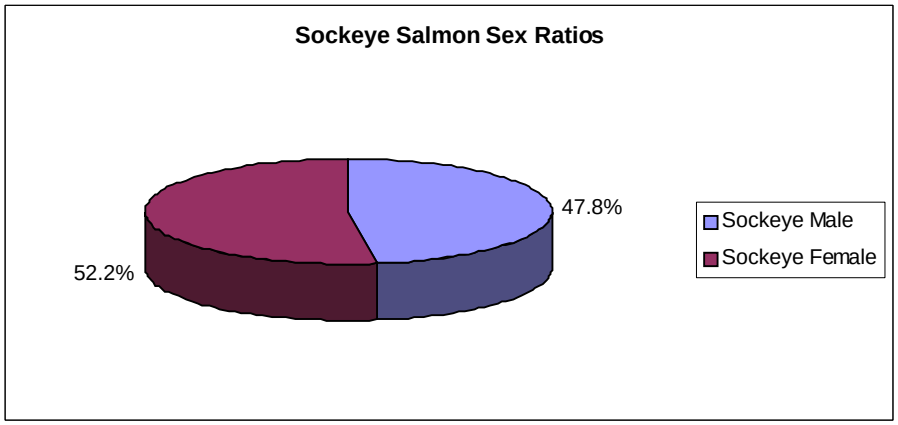


Figure 6. Sockeye salmon sex ratios for 2006 from random sampling at the KSEF.

Table 2. Sockeye salmon fork length statistics for 2006 from random sampling at the KSEF.

Sex	Mean (cm)	Range (cm)	Standard Error	Sample Size
Male	55.3	36 - 73	0.36	143
Female	52.6	44 - 61	0.23	156

Table 3. Sockeye salmon male and female mean fork length measurements from 2001-2006, showing averages for the last 6 years.

Year	Mean Male Fork length (cm)	Mean Female Fork length (cm)
2006	55.3	52.6
2005	57.5	57.2
2004	58.3	56.4
2003	58.8	55.3
2002	59.1	54.6
2001	60.8	58.4
Average	**58.3**	**55.8**

4.2 Chinook Salmon

A total of 3,014 adult chinook salmon migrated past the KSEF in 2006, which was the highest recorded for Kitwanga River chinook salmon since accurate salmon enumeration was initiated in 2003. The 2006 escapement value is also the highest ever documented in the DFO SEDS database (values dating back to 1950) and more than five times the 50 year average returns for the stock (Morrell, 2000).

The Kitwanga River chinook salmon escapement for the previous six years was: 2,408 in 2005 (Kingston, 2006), 1,542 in 2004 (Cleveland, 2005), 1,776 in 2003 (Cleveland, 2004), 1,563 in 2002 (Kingston et. al., 2003), 1,307 in 2001 (McCarthy et. al., 2002) and 1,121 in 2000 (Hamelin et. al., 2001) (Figure 7.). The chinook escapement results from years 2000 to 2002 were recorded by a combination of stream walks and helicopter flights performed during the peak-spawning season. The chinook escapement results from 2003 to 2006 were collected at the KSEF. This trend of increasing escapements of

Kitwanga chinook salmon seems to indicates that the stock is doing well and present management of the stock is adequate to sustain the stock at a healthy state.

However, it should be noted that a portion of the increase in chinook abundance could likely be attributed to the construction of the KSEF in 2003 allowing for a more reliable escapement estimate of chinook abundance. Before 2003 most counts were acquired by helicopter flights and a large portion of the chinook could have been missed depending on weather conditions, observer efficiency and water clarity.

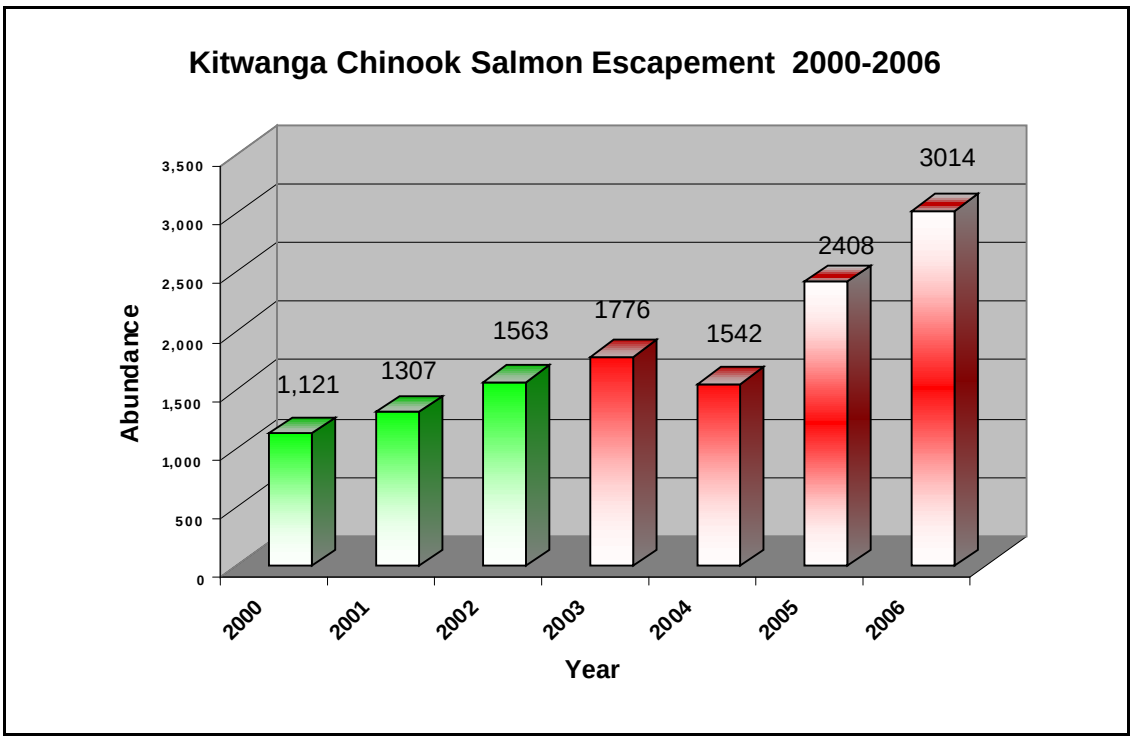


Figure 7. Kitwanga River chinook salmon escapement results from 2000 to 2006. Please note that green bars represent years when counts were performed through aerial helicopter surveys, while red bars represent years where counts were performed at the KSEF.

In 2006, the first chinook salmon was counted on July 11th and the last on September 19th. The peak and the mid-point of the run occurred on August 8th (Table 1.). Overall, the Kitwanga chinook run timing for 2006 exhibited a bi-modal distribution, with the first peak occurring between July 14 and July 26 and the second occurring between August 5 and August 19 (Figure 8). This varies slightly from the average run timing seen previously where few chinook enter the Kitwanga River in July and more during the first week of August. As discussed earlier water levels in the Kitwanga River in 2006 were lower than usual. By plotting water levels and chinook run timing there is no distinct pattern that would seem to suggest that water flow influenced chinook salmon upstream migration in 2006 (Figure 9.).

In the last three years, the DFO stock assessment division based in Prince Rupert has been utilizing chinook escapement data collected through the KSEF as a calibration tool

for chinook helicopter aerial surveys. By knowing the exact amount of chinook that are in the river above the enumeration fence at the time of a flight, the observers can determine how many fish they missed during the flights. This correction factor is also being applied to historical chinook helicopter counts to get a more accurate escapement estimate of previous counts.

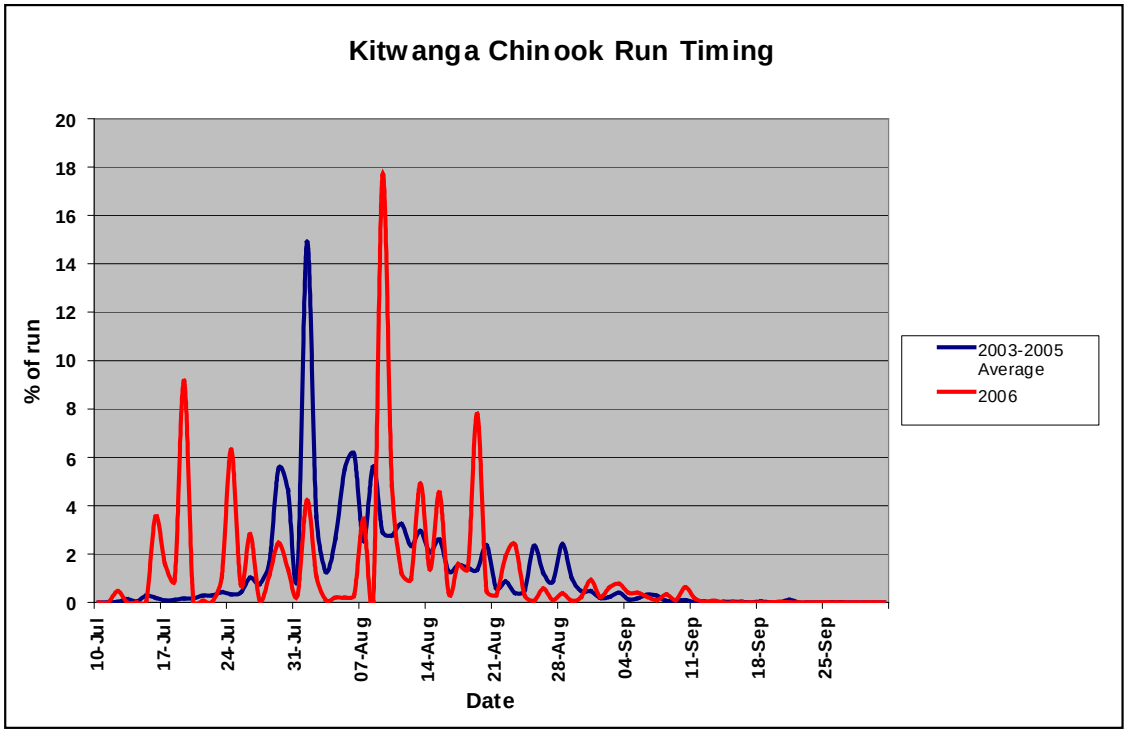


Figure 8. Kitwanga River chinook salmon run timing expressed in percent run for 2006 verses the average for 2003-2005.

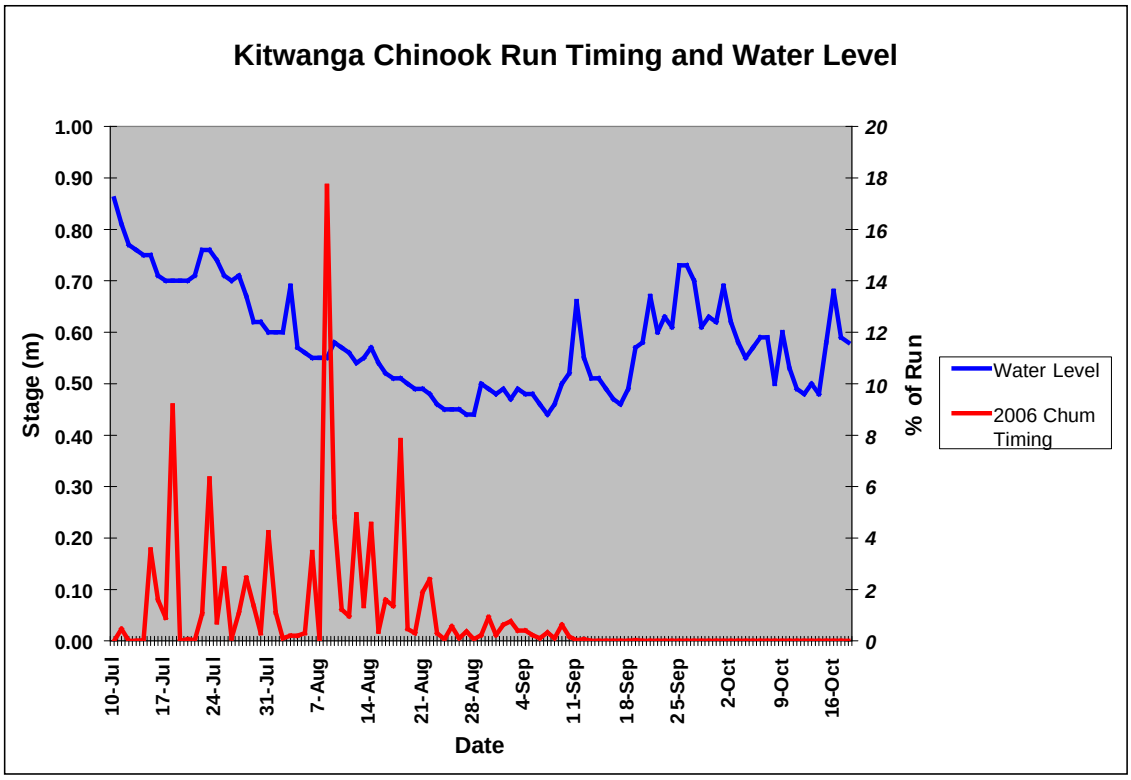


Figure 9. Kitwanga River chinook salmon run timing and water levels for the sampling period at the KSEF.

4.3 Pink Salmon

A total of 11,534 adult pink salmon migrated past the permanent fence in 2006 (Table 1.). This estimate is the lowest escapement ever recorded by GFA since they started enumerating pink salmon at the KSEF in 2003 (Figure 10.). The Kitwanga River pink salmon escapement for the previous three years was: 229,226 in 2005 (Kingston, 2006) 71,070 in 2004 (Cleveland, 2005) and 336,375 in 2003 (Cleveland, 2004).

Most pink salmon return to spawn as two-year-old fish, therefore odd and even year populations do not interbreed. In the Kitwanga system odd year pink salmon runs show a clear dominance. The 2006 escapement estimate is approximately one sixth less than the 2004 escapement, suggesting that a significant decline has occurred in the even year run. This decreasing trend was also evident in 2005 when the pink run returned at only one third the size of their broodyear escapements.

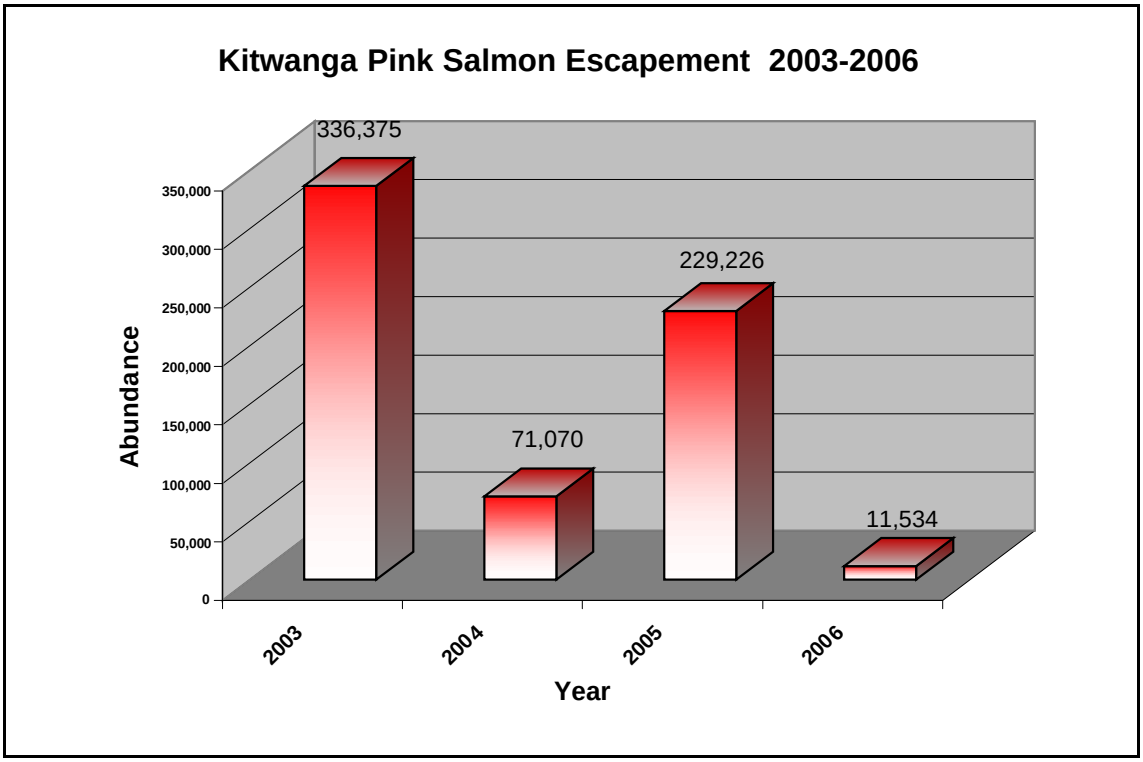


Figure 10. Kitwanga River pink salmon escapement results for 2003-2006.

In 2006, the first pink salmon was enumerated at the permanent fence on July 22nd and the last on September 27th (Table 1.). The mid-point of the run occurred on September 4th and the peak run timing occurred five days later on September 9th (Table 1.). Based on previous years data the majority of pink salmon escape into the Kitwanga River between August 13th and 19th (Cleveland, 2004, Cleveland 2005, Kingston 2006). This indicates that the 2006 run was approximately two weeks later than normal (Figure 11.). The plot of water levels and pink run timing does appear to show a moderate trend of increased upstream migration in response to increasing water levels in 2006 for at least the peak of the run between August 25 and September 12, 2006 ($r^2 = 0.55$), (Figure 12.).

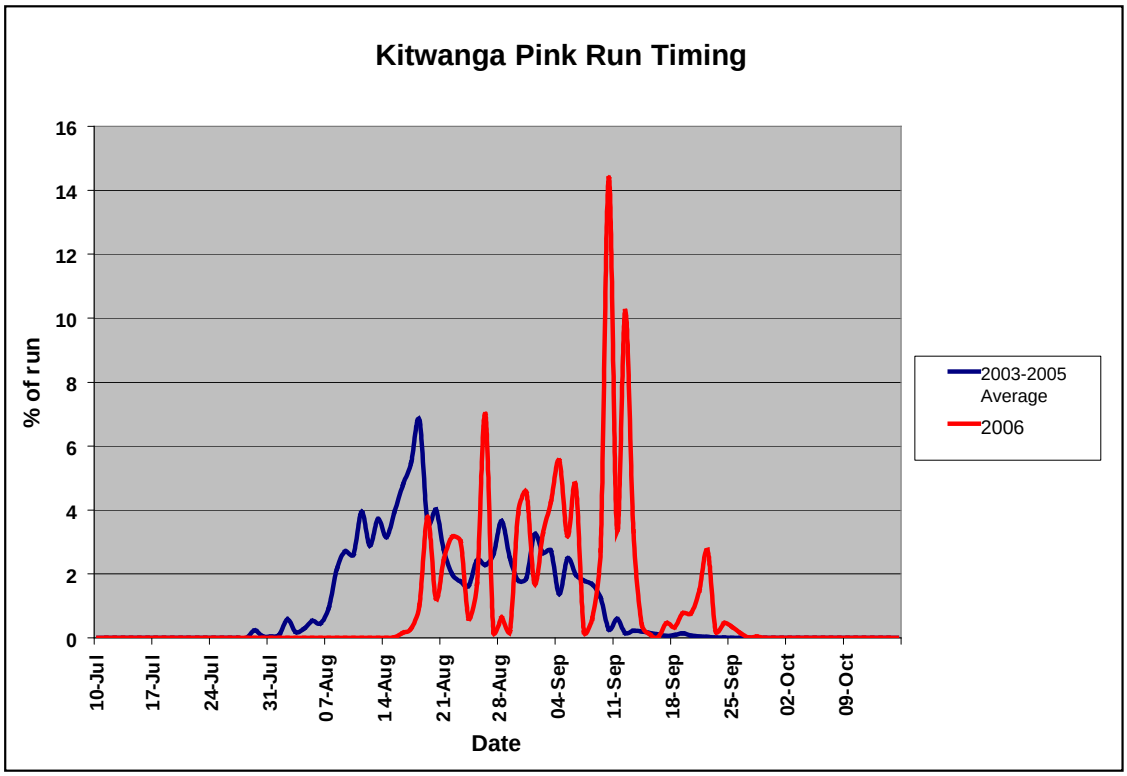


Figure 11. Kitwanga River pink salmon run timing expressed in percent run for 2006 verses the average for 2003-2005.

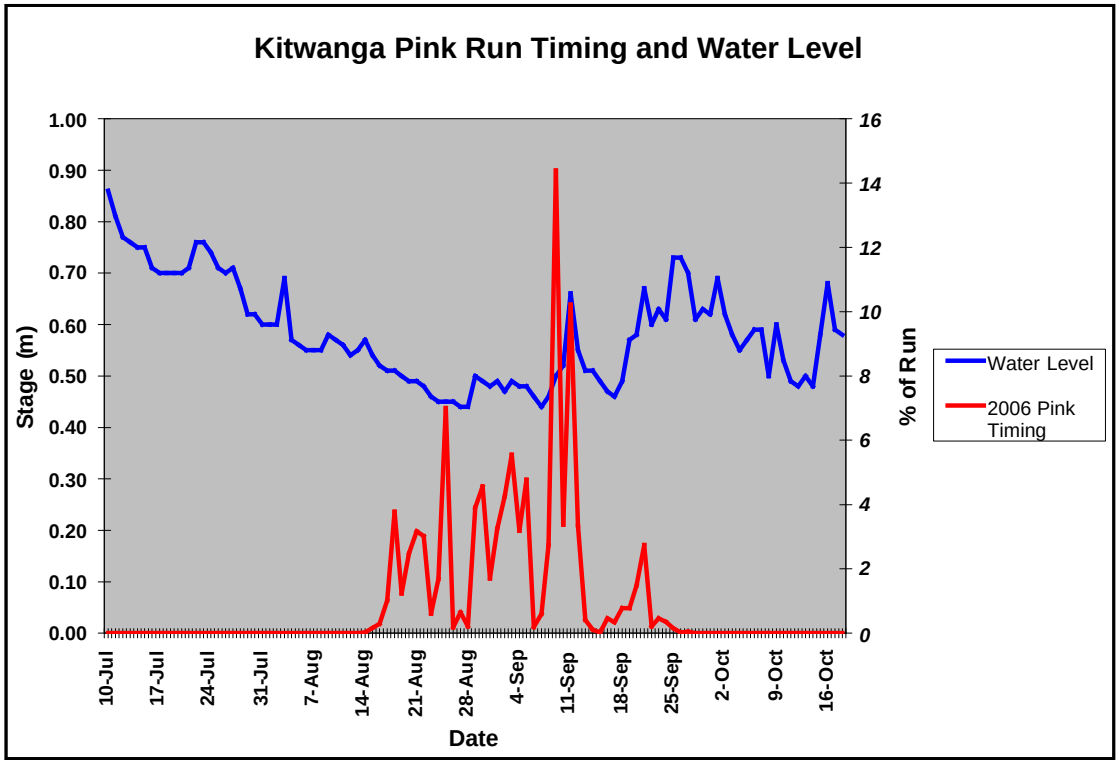


Figure 12. Kitwanga River pink salmon run timing and water levels for the sampling period at the KSEF.

4.4 Chum Salmon

A total of 685 adult chum salmon migrated past the KSEF in 2006 (Table 1.). This chum salmon escapement is the lowest ever recorded by the GFA since they started accurately enumerating chum salmon in 2003. The Kitwanga River chum salmon escapement for the previous three years was: 1,862 in 2005 (Kingston, 2006), 1,169 in 2004 (Cleveland, 2005) and 1,775 in 2003 (Cleveland, 2004) (Figure 13.). Although the 2006 escapement was the lowest seen in the last four years it is still significantly better than the estimated average between 1993 and 1950 of less than 400 per year (Gottesfeld et. al, 2002).

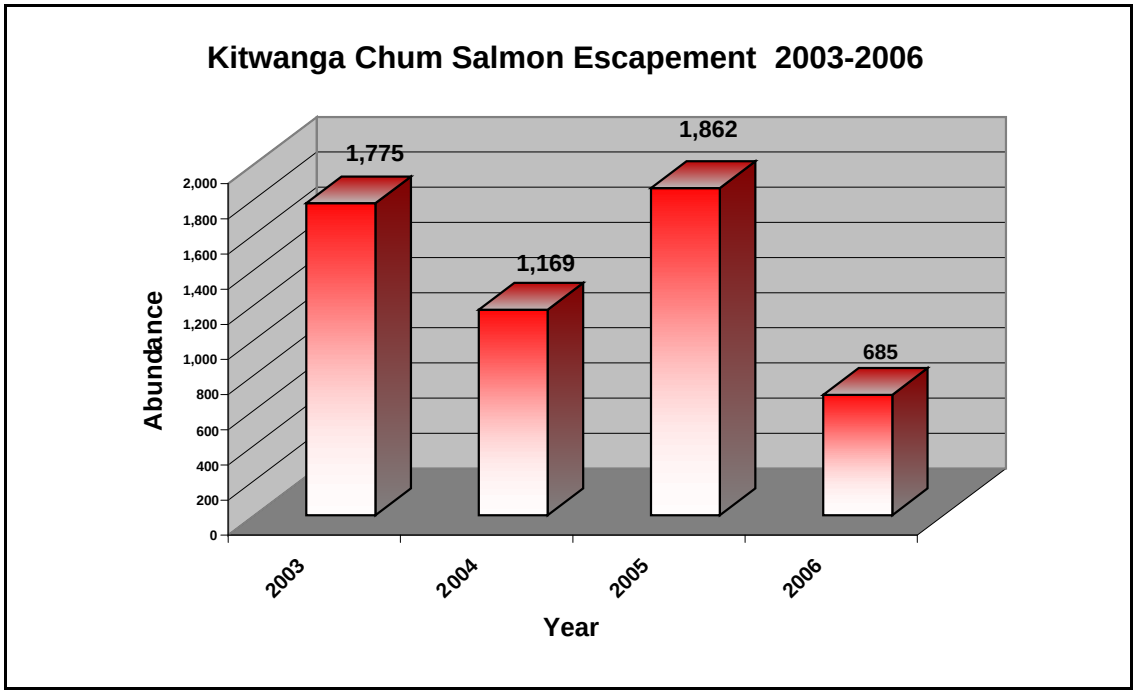


Figure 13. Kitwanga River chum salmon escapement results from 2003-2006.

In 2005, the first chum salmon was enumerated at the permanent fence on August 21st and the last on October 5th. The peak run occurred on September 22nd while the mid-point of the run occurred on September 17th, 2006 (Figure 1.) In previous years chum run timing through the KSEF almost perfectly coincided, however run timing in 2006 appeared to be 2-3 weeks later (Figure 14.). The plot of water levels and chum run timing does appear to show a moderate trend of increased upstream migration in response to increasing water levels for most of the run between September 7 and September 25, 2006 ($r^2 = 0.51$), (Figure 15.). This is a common occurrence with Kitwanga River chum salmon at the KSEF (Kingston, 2006).

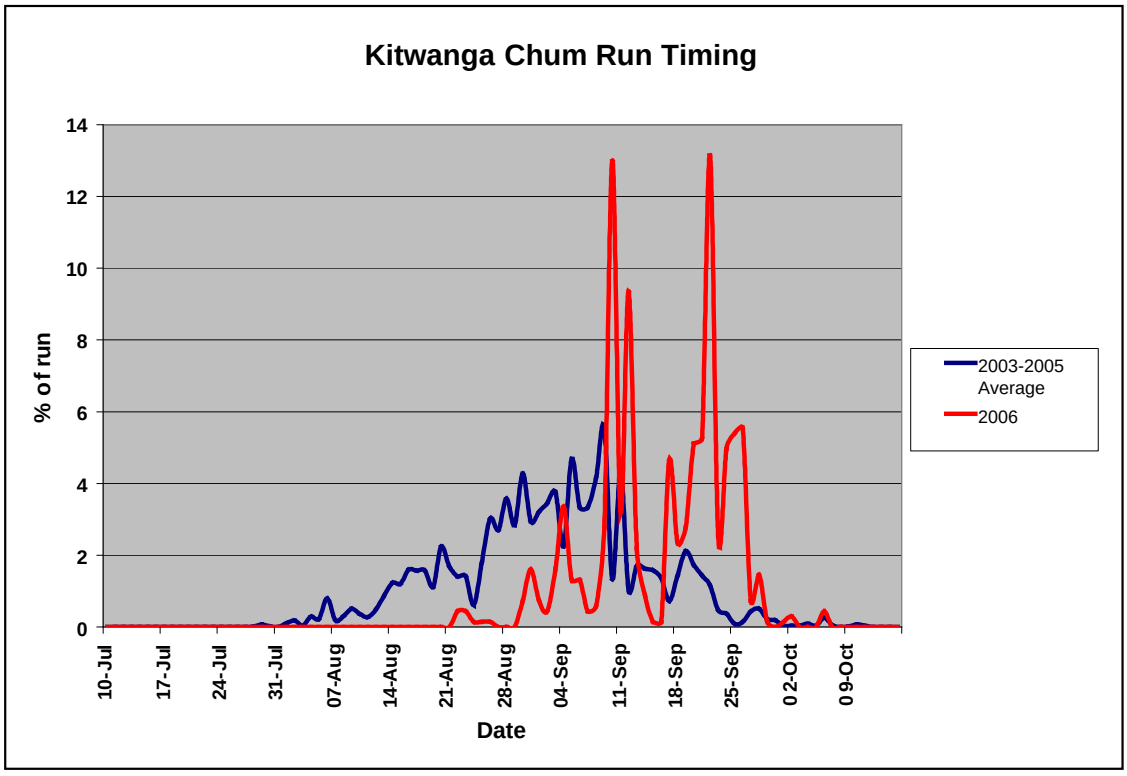


Figure 14. Kitwanga River chum salmon run timing expressed in percent run for 2006 verses the average for 2003-2005.

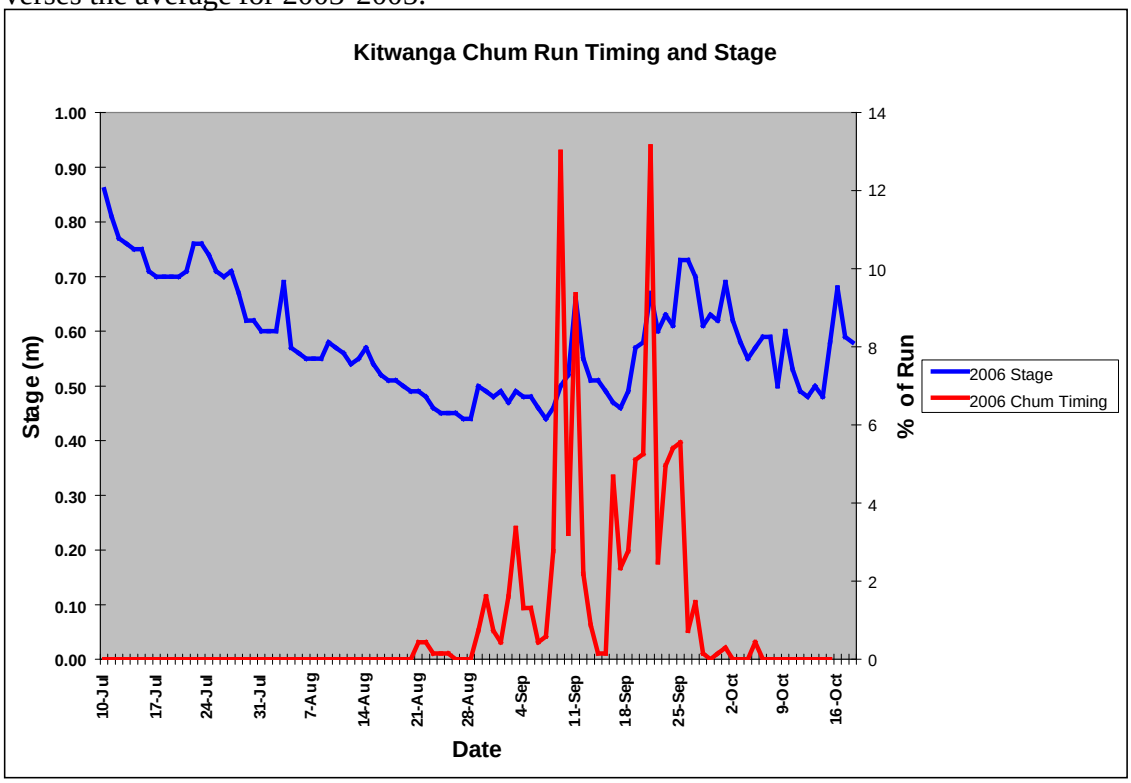


Figure 15. Kitwanga River chum salmon run timing and water levels for the sampling period at the KSEF.

In 2005, otoliths from dead pitch chum salmon were collected at the KSEF to obtain baseline age information. Aging data acquired through the Pacific Biological Station (Nanaimo, BC) indicate that Kitwanga chum return as mostly 4-year-old fish (88%). However, age 3 (4%), 5 (6%) and 6 (2%) year old fish are also present in small numbers. Sex determination, fork length measurements and DNA were collected from 78 Kitwanga chum salmon in 2006. Females showed a slight dominance with their returns making up 56% of the population. Males were slightly larger than females with a mean fork length of 75.7 cm (range 57-91cm), while females had a mean fork length of 73.1cm (54-86cm) (Table 4.).

Table 4. Chum salmon fork length statistics for 2006 from random sampling at the KSEF.

Sex	Mean (cm)	Range (cm)	Standard Error	Sample Size
Male	75.7	57 - 91	1.34	35
Female	73.1	54 - 86	1.02	43

4.5 Coho Salmon

A total of 2,566 coho salmon migrated past the KSEF in 2006, which could probably be considered an average run size (Figure 16.). The coho escapement to the Kitwanga River for the previous 5 years was: 7,100 in 2005 (Kingston, 2006), 690 in 2004 (Cleveland, 2005), 2,022 in 2003, 3,515 in 2002 and 3,226 in 2001 (Cleveland 2004). The coho escapement results from years 2001 and 2002 were recorded during stream walks of the entire Kitwanga River, while results from 2003 to 2006 were recorded at the KSEF. It should be noted that coho escapement results from 2003 and 2004 are probably highly under estimated given that they fence was submerged for a portion of the sampling periods for both years. However, in 2006 the fence remained functional for the entire season resulting in accurate coho escapement counts for the year.

The first coho was enumerated on September 1st and the last on October 24th. The peak of the run was observed on September 23rd while the mid-point was recorded on September 25th (Table 1.). This run timing was significantly different than what was seen in previous years. The most evident feature being that the first fish did not move into the river until the beginning of September over three weeks later than in previous years. Furthermore, the majority of the 2006 coho stock moved into the river in three large peaks with very few fish moving into the system between the peaks (Figure 17.). The plot of water levels and coho run timing showed good correlation for the period between September 20 and October 18th, when the bulk of the 2006 run moved into the system (r^2 = 0.67) (Figure 18.). This is a common occurrence with Kitwanga River coho salmon at the KSEF (Kingston, 2006).

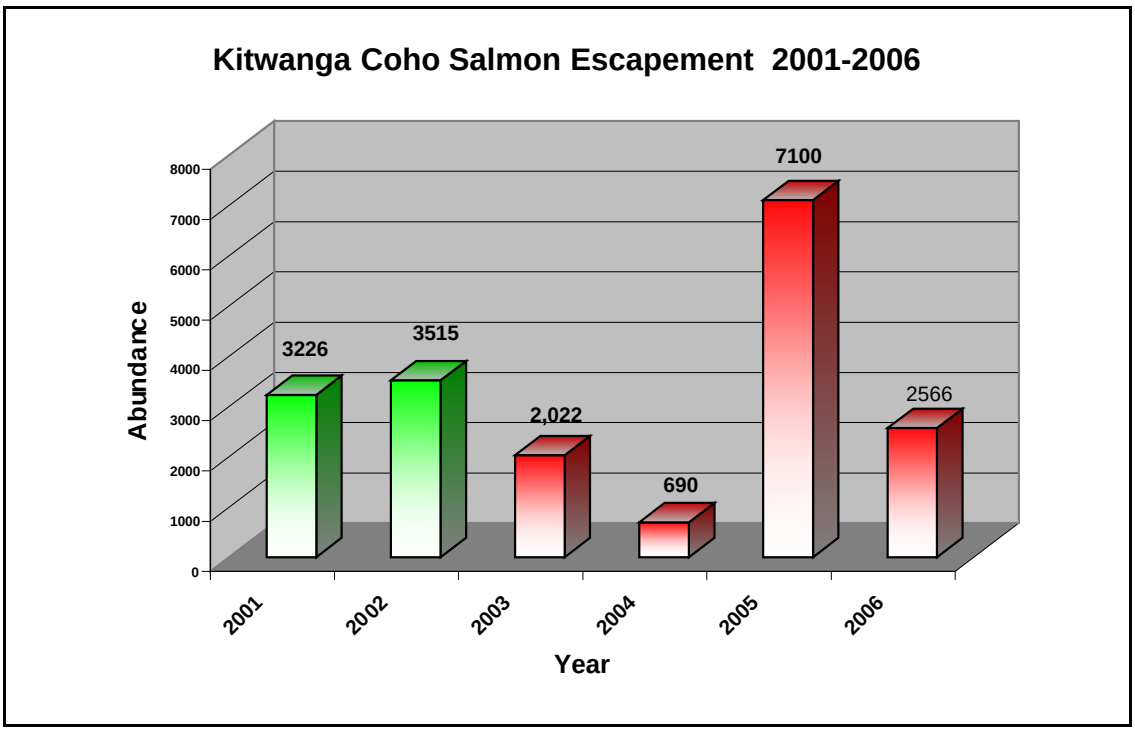


Figure 16. Kitwanga River coho salmon escapement results from 2001 to 2006. Please note that green bars represent years when counts were performed through stream walk surveys, while red bars represent years where counts were performed at the KSEF.

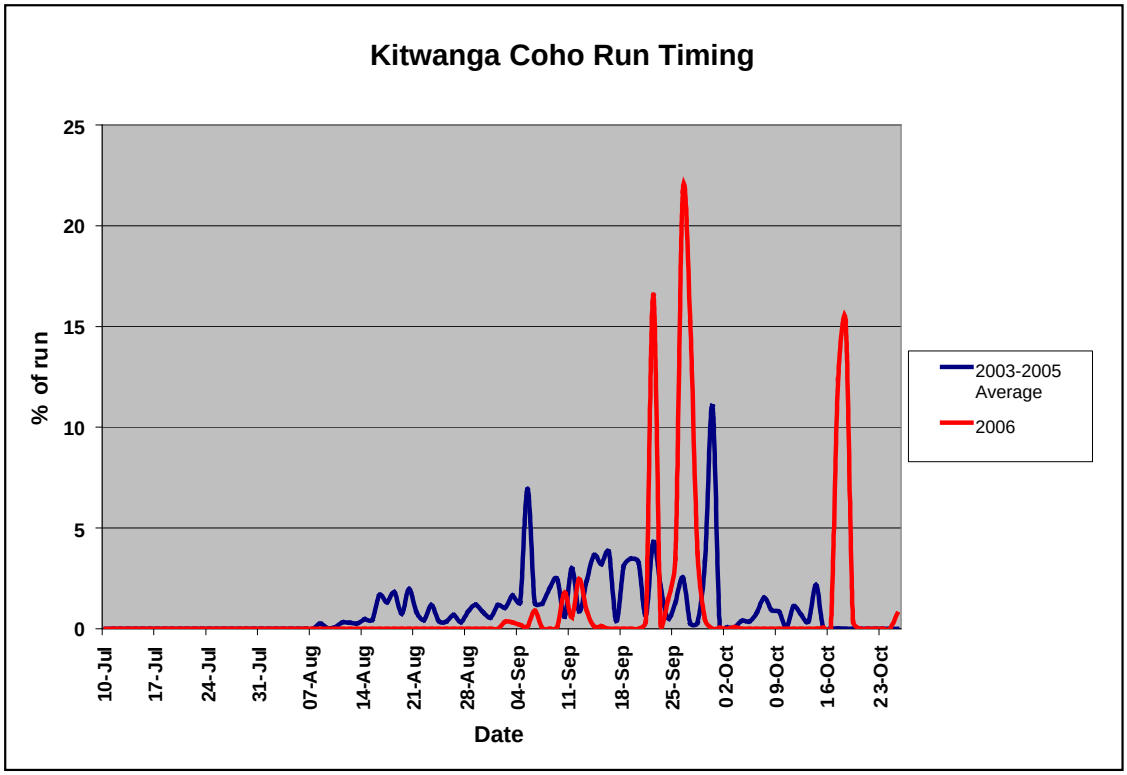


Figure 17. Kitwanga River chum salmon run timing expressed in percent run for 2006 verses the average for 2003-2005.

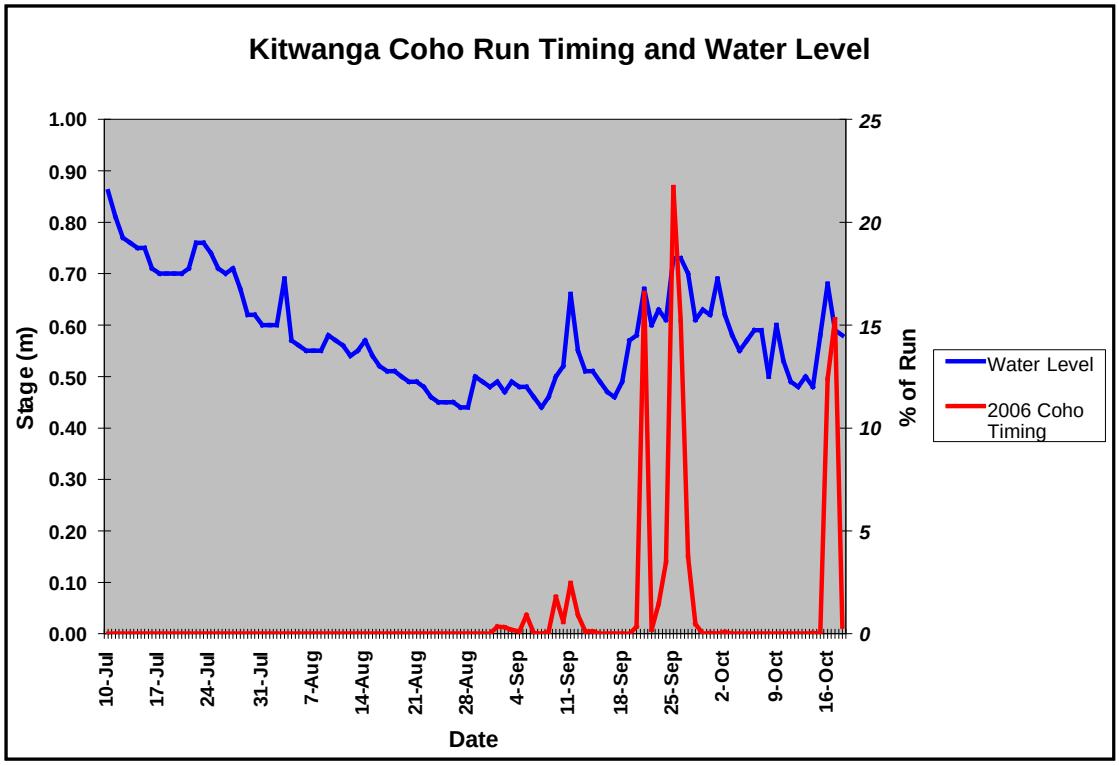


Figure 18. Kitwanga River coho salmon run timing and water levels for the sampling period at the KSEF.

5.0 Conclusions / Recommendations

In 2006 the Gitanyow Fisheries Authority were once again successful in enumerating salmon on the Kitwanga River. Through the operation of the Kitwanga River Salmon Enumeration Facility GFA was able to collect escapement and other biological information on sockeye, chinook, pink, chum and coho salmon.

Sockeye salmon escaped to the Kitwanga River in high numbers in 2006 considering the stock came off of fairly poor broodyear returns. Sex ratios of returning sockeye were distributed evenly and both males and females were smaller than usual. The sockeye run timing appeared to be delayed by almost a month and the majority of the upstream migration appeared to be moderately correlated with increasing water levels. Chinook escapement in 2006 was the highest seen in over 50 years. Unlike previous observations chinook run timing was distributed bi-modally with many fish entering in the middle of July and then again in the later part of August. Water flow regimes did not seem to influence chinook salmon run timing. Pink salmon escapement in 2006 was the lowest on record since accurate counts were initiated in 2003. The pink run was two weeks later than normal and upstream migration appeared to increase with increasing water flows. Chum salmon escapement in 2006 was low, lower than every year except for 2003 when only a partial count was acquired from KSEF. Coho salmon returns were average with most of the fish migrating into the river on three high water events, upstream migration was strongly correlated with increasing water levels.

Salmon escapement results collected through the operation of the Kitwanga River Salmon Enumeration Facility in 2006 are important because they help gauge the overall health of Kitwanga and Skeena River salmon stocks. The information is used in-season and post-season by Federal fishery managers and First Nations fishery managers to better implement sustainable fisheries. The results collected on Kitwanga sockeye salmon are especially important because adult escapement data is a direct measure of the health of the stock and the effectiveness of the Gitanyow Fisheries Authority Kitwanga Sockeye rebuilding efforts.

This project should continue in future years because it is currently the only accurate measure of salmon abundance in the Kitwanga River and the Middle Skeena River, and an important part of the *Kitwanga River Sockeye Recovery Strategy*.

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