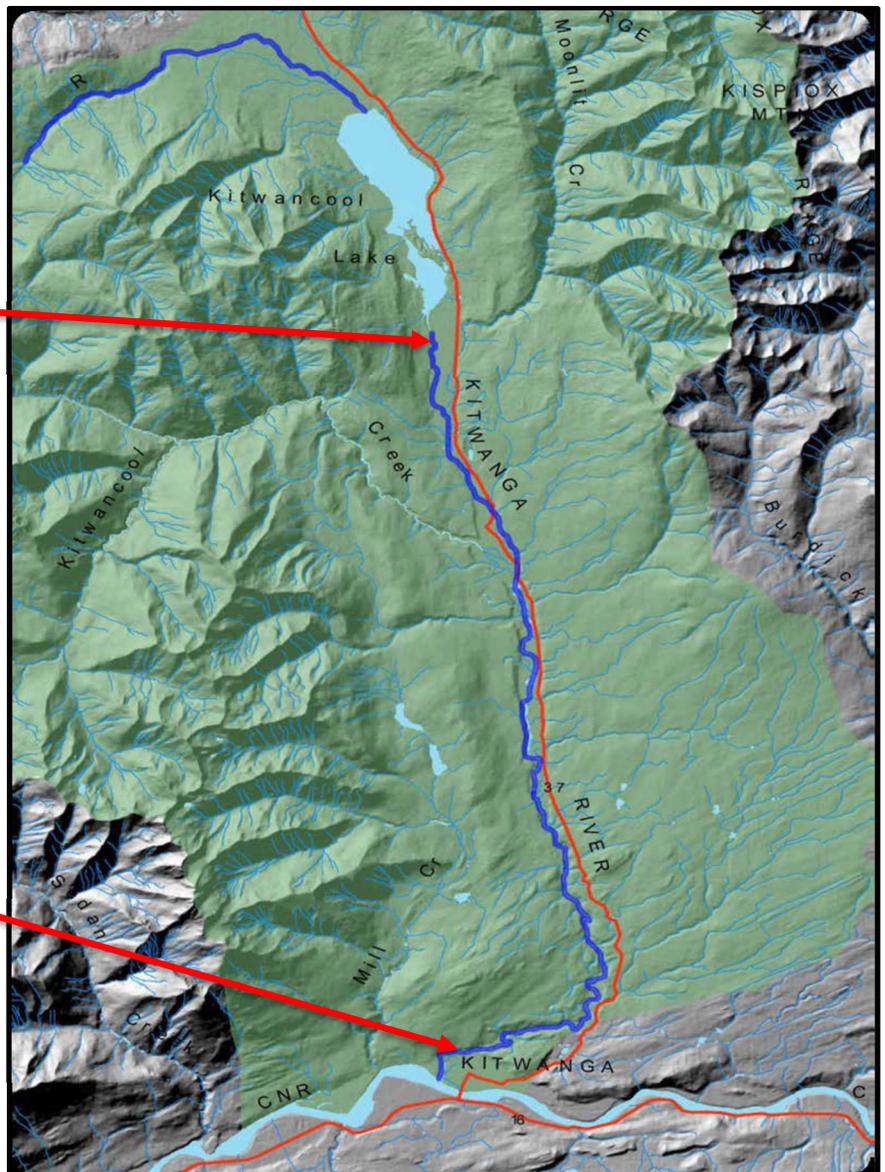




November 29, 2017

Kitwanga River Salmon Studies Post-Season Update - 2017

As in other years the Gitanyow Fisheries Authority (GFA) operated both their Kitwanga River Salmon Smolt Enumeration Facility (KsF) and their Kitwanga River Adult Salmon Enumeration Facility (KSEF) in 2017. This document summarizes the results collected through both programs in 2017 and the findings from some radio telemetry work that was conducted on Kitwanga sockeye.



KsF Operations

GFA operated the KsF for the 10th consecutive year in 2017 (2008-2017), with funding from DFO's Stock Assessment program, Pacific Salmon Foundation and the Gitanyow Aboriginal Fisheries Strategy program. The purpose of the project annually is to fully enumerate and biologically sample a portion of Kitwanga sockeye leaving Gitanyow Lake in any given year. GFA also samples Kitwanga coho salmon smolts leaving the upper part of the Kitwanga Watershed annually. A portion of all coho smolts caught are adipose fin clipped and coded-wire tagged (CWT) annually for fisheries management tracking purposes. The KsF is a key assessment tool for the Kitwanga Sockeye Rebuilding Program.

The KsF smolt weir was installed at the beginning of April and was operational by April 13th, 2017. Smolt enumeration, sampling and CWT tagging (coho only) occurred uninterrupted from April 13th to June 26th, 2017.

Sockeye Smolts

The majority of the sockeye smolts migrated through the weir between April 28th – May 10th, 2017 with a peak of 4,247 sockeye coming out the night of May 3rd. Sockeye smolt run timing seemed slightly delayed in 2017 with the peak migration occurring approximately a week later than normal (usual peak date April 24). A total of 5% (n=550) of the total sockeye run was randomly sampled for length, weight and age (scale smears). The total number of sockeye smolts counted through the facility was **11,914** in 2017. The overall production of sockeye for the year was estimated at 5 smolts per female assuming most smolts were one year olds (to be determined by smolt aging when ages become available in early 2018). Usually, Kitwanga sockeye smolts are one year olds and if true this year they would have originated from the 2015 brood year. The long-term average for smolts per female is 84 (2008-2017) and the short-term average is 35 (2012-2017 – Table 1).

Table 1: Sockeye smolt production in 2017 compared to results from the KsF from 2008 to 2017

Year	Smolt Estimate	Female Spawners	Smolts per Female
2008	226,273	2,643	86
2009	34,970	125	280
2010	113,044	684	165
2011	83,717	1,615	52
2012	400,907	9,778	41
2013	84,294	1,230	69
2014	46,955	2,574	18
2015	12,165	277	44
2016	33,423	7,123	5
2017	11,914	2,272	5*
Average	104,766	2,832	84

*With assumption that most smolts came from 2015 brood year.

Lower than expected smolt per female production in recent years may be linked to reduced freshwater production. GFA and DFO (Cultus Lake Research Group) have been studying Gitanyow Lake for the last few years to investigate this issue but no obvious limiting factors to juvenile production have been found. To date monitoring has focused on dissolved oxygen/temperature profiling at long-term monitoring stations in Gitanyow Lake, the only sockeye nursing area, and egg-to-fry survival analysis.

Potential projects to be undertaken in 2018 and beyond include, more detailed lake studies, reconnaissance and mapping of aquatic vegetation to monitor the encroachment onto sockeye spawning grounds (originally conducted in 2002 – Cleveland and McCarthy 2003). In addition, looking at potential heightened predation pressure by Northern Pikeminnow.

In most years Kitwanga sockeye have been found to be mostly 1-year-old smolts and overall Gitanyow Lake sockeye smolts are relatively large when compared to three other high-profile BC sockeye producing lakes (approximately 20 years of data for Babine, Cultus, and Chilko Lakes; in Groot and Margolis 1991). The 2017 results (116 mm, 15 g – Table 2) show that 2017 smolts were once again for the second years in a row much larger than the long-term average (107 mm, 12 g – Table 3).

Table 2: Length and weight statistics for 1-year-old sockeye sampled in 2017 (n=500)

Statistic	Length (mm)	Weight (g)
Mean	116	15
Standard Deviation	6	2
Sample Variance	34	5
Minimum	93	8
Maximum	129	22
Count	500	500

Table 3: Lengths and weight statistics for one-year-old sockeye sampled since 2008 at the KsF

Year	Sample Size (N)	Mean Fork Length (mm)	Min. / Max. Fork Length (mm)	Mean Weight (g)	Max. / Min. Weight (g)
2008	1,224	102.8	76 / 122	9.9	4.9 / 28.5
2009	320	112.1	86 / 132	13.4	5.7 / 21.3
2010	2,490	106.4	77 / 128	11.5	4.1 / 21.5
2011	740	106.6	85 / 151	11.8	6.1 / 32.7
2012	1,680	96.7	64 / 124	8.5	2.3 / 15.5
2013	684	101.3	71 / 123	10.1	3.5 / 17.8
2014	444	104.1	80 / 124	11.0	5.7 / 18.8
2015	505	112.0	94 / 126	13.5	7.2 / 19.0
2016	637	114.0	87 / 135	15.0	6.0 / 26.0
2017	500	115.8	93 / 129	15.2	8.0 / 22.0
Average 2008 - 2017		107.2	64 / 151	11.9	2.3 / 32.7

Coho Smolts

Coho smolts were also counted and randomly sampled through the facility in 2017. The first coho smolt was enumerated on April 13th, with the run picking up on May 21st. A total of **3,887** coho smolts were counted at the weir when it was shut down on June 26th, 2017, of which 625 were sampled for length, weight and age. In addition, 3,299 coho smolts were implanted with a CWT in 2017. Annually, GFA tries to implant 10,000 coho with CWT's, but lower than expected smolt counts hampered operations.

KSEF Operations

In 2017, the GFA operated the Kitwanga River Salmon Enumeration Facility (KSEF) for the 15th consecutive year, with funding from the Pacific Salmon Commission, DFO's Stock Assessment program, Gitanyow Aboriginal Fisheries Strategy program and the Gitanyow Huwilp Sustainability Fund. Operation of the KSEF is a key assessment tool for the Kitwanga Sockeye Rebuilding Program, and also provides:

- In-season assessment of sockeye, chinook, pink, chum and coho
- Middle Skeena index of yearly salmon returns
- Important information to support management decision making
- Only accurate count of pink and chum in the entire North Coast

The fence was operational from July 10th to September 11th, 2017 under normal water conditions. On the morning of September 11th, the KSEF was breached due to extremely high water levels, which forced the closure of the project approximately 6 weeks earlier than anticipated. Within 5 hours of the KSEF going down, GFA staff were able to set-up and modify the KsF (upper smolt fence) and count sockeye and coho until November 1st, 2017.

Water temperatures were within range as seen in previous years: 9 °C to 16 °C (Figure 1).

Water levels were within the 2004-2016 averages for July, August and the beginning of September, up to the extreme flooding event, which forced the early closure of the facility (Figure 2).

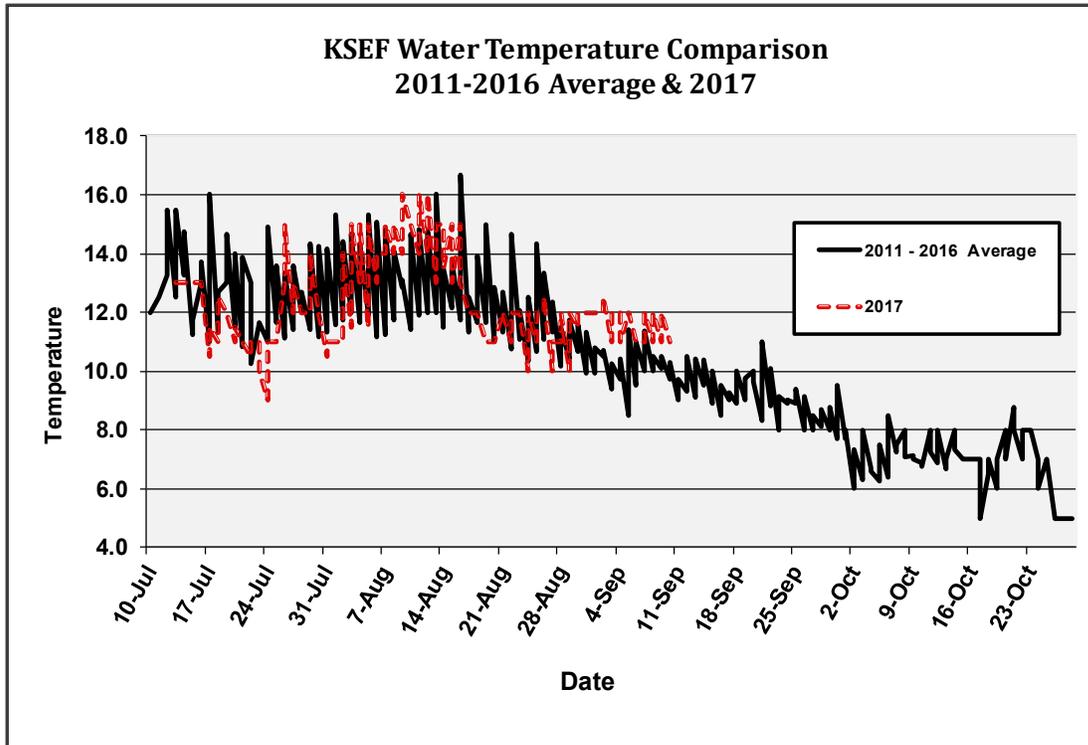


Figure 1: Water temperature at the KSEF, 2004-2016 average and 2017 recordings. Note: in 2017, KSEF was shut down on September 11

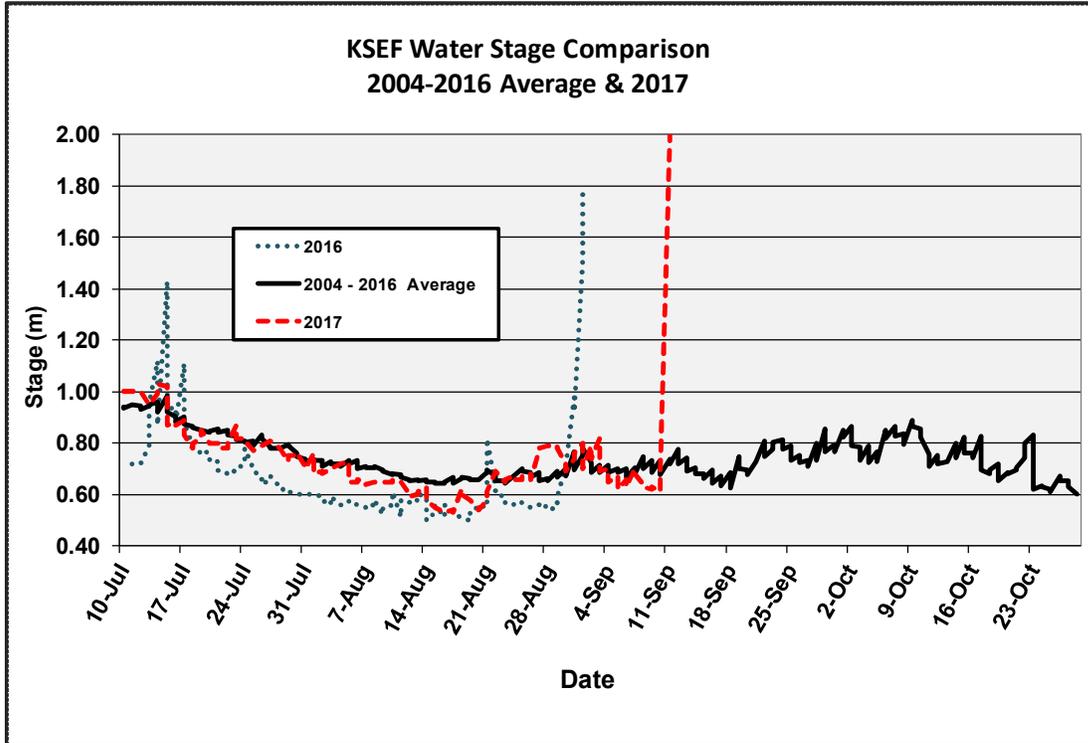


Figure 2: Water stage at the KSEF, 2004-2016 average and 2017 recordings. Note: in 2017, KSEF was shut down on September 11

Salmon counts by species through the KSEF on September 11, 2017 are presented in Table 4 below. Using the average run timing through the KSEF between 2003-2016 we were able to ESTIMATE the total salmon returns by species to November 1, 2017 and the results are also presented below. Please keep in mind that these estimates are not true counts but an attempt to approximate overall returns by species for 2017. The values should be used with caution taking into account the assumptions that run timings seen in 2017 are similar to average run timings seen previously by species through the KSEF (2003-2016).

Table 4: Estimated returns in 2017 based on average percent run

Salmon Species	2017 Returns to Sept.11	Avg. % Run through KSEF to Sept. 11 (2003-2016)	Est. Return for 2017 based on Avg. % run through KSEF to Sept. 11 (2003-2016)
Sockeye	257	72.0%	357 (counted 397)
Chinook*	585	99.9%	586
Pink	169,043	94.4%	179,071
Chum	226	66.8%	338
Coho	315	20.2%	1,559

*Excluding jack chinook (n=186) counted this year.

Sockeye

Up to September 11, 2017, the closure of the KSEF, we counted 140 additional sockeye through the KsF (total sockeye counted through the KSEF and KsF - 257+140 =397), indicating that the 2017 total Kitwanga sockeye return is less than 400 spawners.

It should be noted that some sockeye that migrated through the KSEF earlier in the year when it was operational were likely double counted because of the timing when they went through the KSEF and the time it would have taken them to reach the KsF. This indicates that ~ 400 spawners is likely the high end of the range, as the KsF was fish tight within five hours of the lower fence closing and no sockeye were observed from Moonlit Creek (4km section below KsF) to the KsF during a stream walk performed by GFA on September 8. Therefore, for the purposes of this update we estimate that the total return of Kitwanga sockeye in 2017 was approximately **375** spawners. This is down from the long-term average from 2003 to 2016 (4,580) as seen in Figure 3.

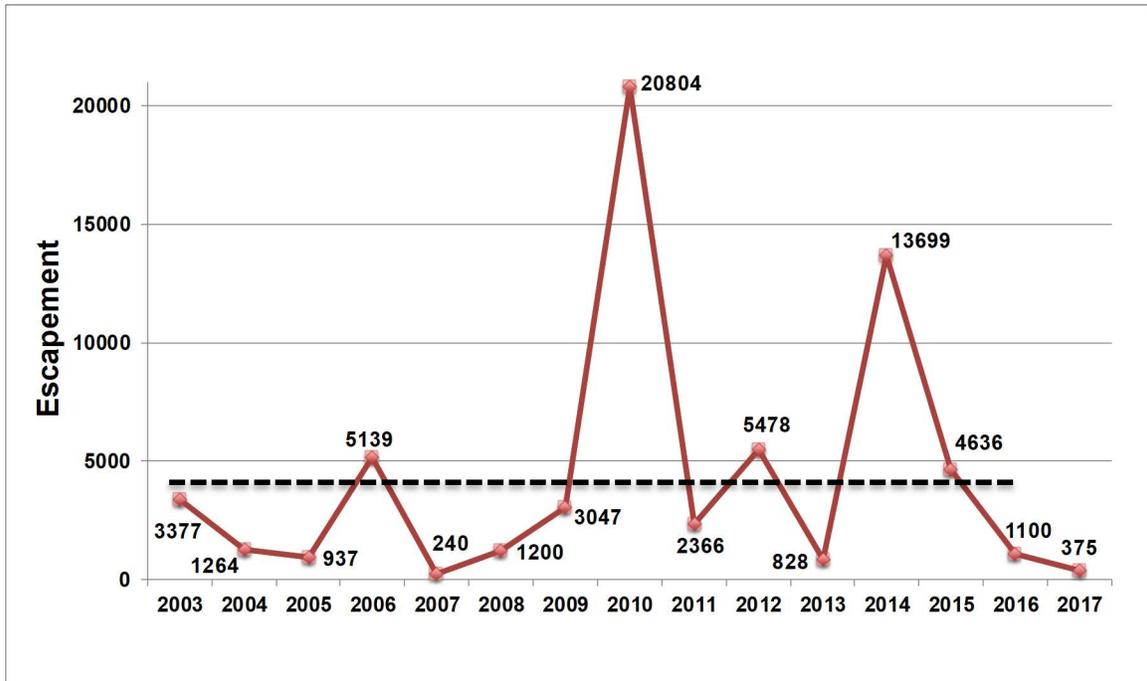


Figure 3: Kitwanga Sockeye Escapements 2003-2017

In 2017, the first sockeye passed through the KSEF on August 5th, which is almost a month later than normal historical timing of first entry. Furthermore, although it is not possible to compare overall run timing from 2017 to historical run timing between 2003-2015¹ because the KSEF was only operational for roughly two-thirds of the season, it would appear that overall the 2017 sockeye run was approximately three weeks later than normal.

Overall, 2017 Kitwanga sockeye were 53% 4-year-olds and 47% 5-year-olds fish based on 45 readable scales (11% of the total run). Table 5 shows the age composition percentages for return years 2002 to 2017.

Length frequencies for the 4-year-olds are: females 51-59 cm (n=13), and males from 51-63 cm (n=10). Length frequencies for the 5-year-olds sockeye are: females 55-64 cm (n=10), and males from 49-64 cm (n=12).

Table 5: Age composition % of Kitwanga sockeye

Return Year	Age Composition %		
	3	4	5
2002	0%	97%	3%
2003	0%	98%	2%
2004	2%	66%	32%
2005	5%	77%	18%
2006	0%	97%	3%
2007	10%	22%	67%

¹ In 2016, the KSEF was also shut down early due to high water

Return Year	Age Composition %		
	3	4	5
2008	4%	89%	8%
2009	0%	88%	12%
2010	0%	99%	1%
2011	1%	69%	30%
2012	0%	95%	5%
2013	0%	64%	36%
2014	1%	96%	3%
2015	0%	67%	33%
2016	2%	86%	12%
2017	0%	53%	47%
Average	2%	79%	20%

Chinook

As of Sept. 11, 2017 when the KSEF went down, we estimate we would have counted 99.9% of the Kitwanga River chinook run (based on run timing through the KSEF 2003- 2016). The estimated returns for Chinook in 2017 is **586**. This is down from the long-term average from 2003 to 2016 (1,438) as seen in Figure 4, and slightly down from the more recent average from 2009 to 2016.

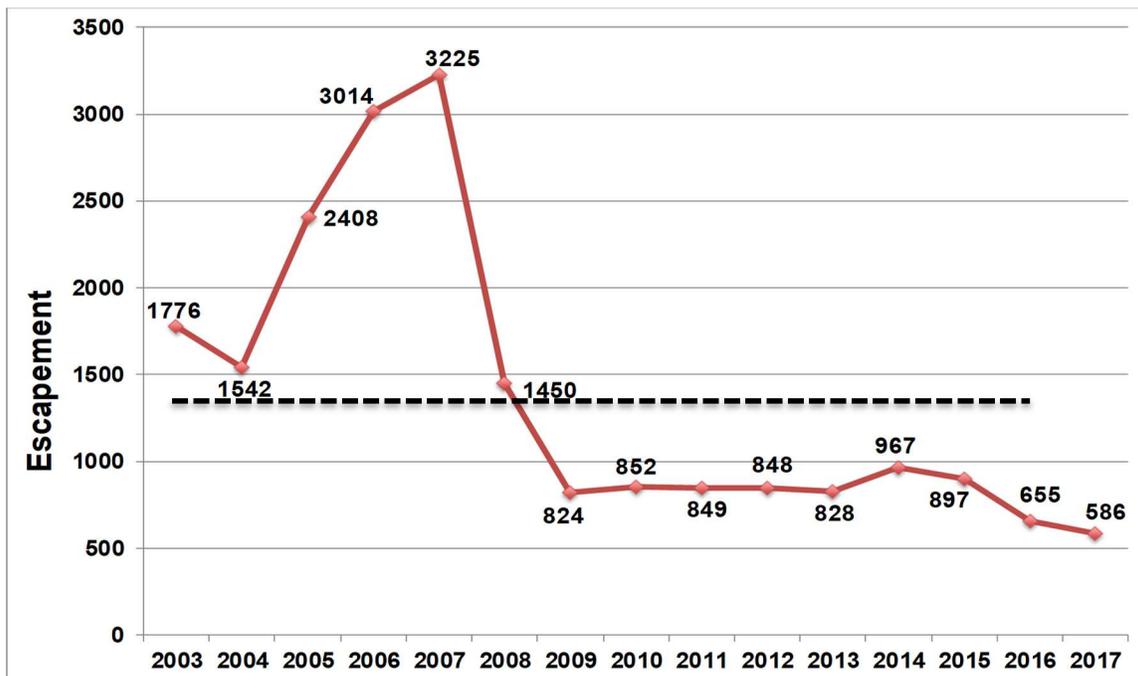


Figure 4: Kitwanga Chinook Escapements 2003-2017

Pink (Odd-year)

As of Sept. 11, 2017 when the KSEF went down, we estimate we would have counted 94.4% of the odd-year pink run (based on run timing through the KSEF 2003-2016). The estimated returns for pink salmon in 2017 is **179,071**. This is just down from the long-term average from 2003 to 2016 (229,417) as seen in Figure 5.

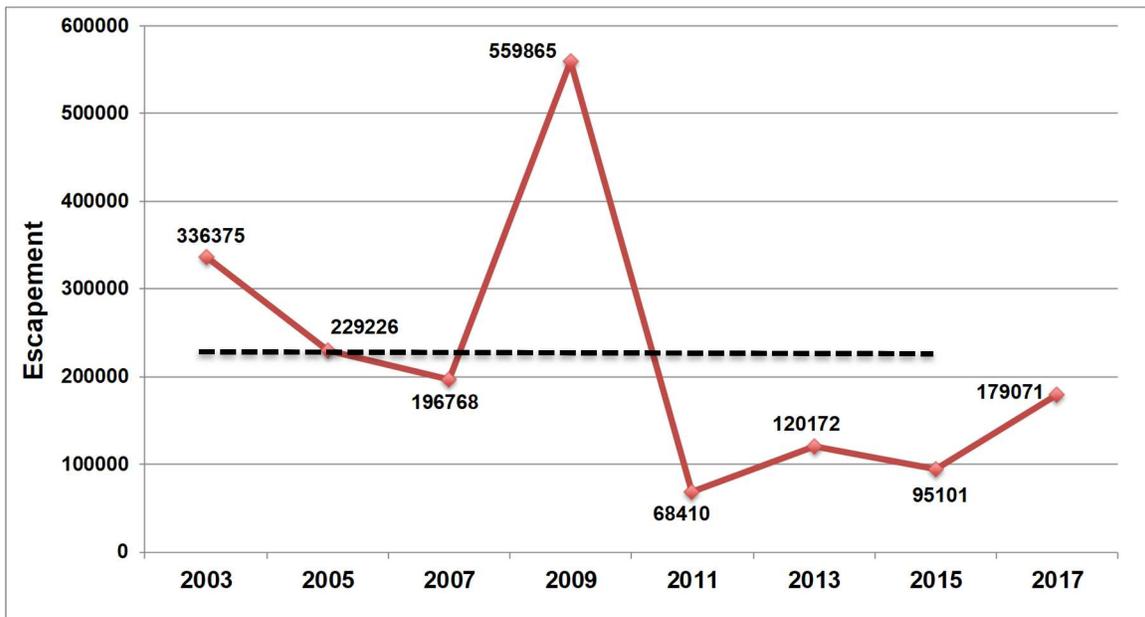


Figure 5: Kitwanga Pink Odd-Year Escapements 2003-2017

Chum

As of Sept. 11, 2017 when the KSEF went down, we estimate we would have counted 66.8% of the run (based on run timing through the KSEF 2003-2016). The estimated returns for chum salmon in 2017 is **338**. This is down from the long-term average from 2003 to 2016 (727) as seen in Figure 6.

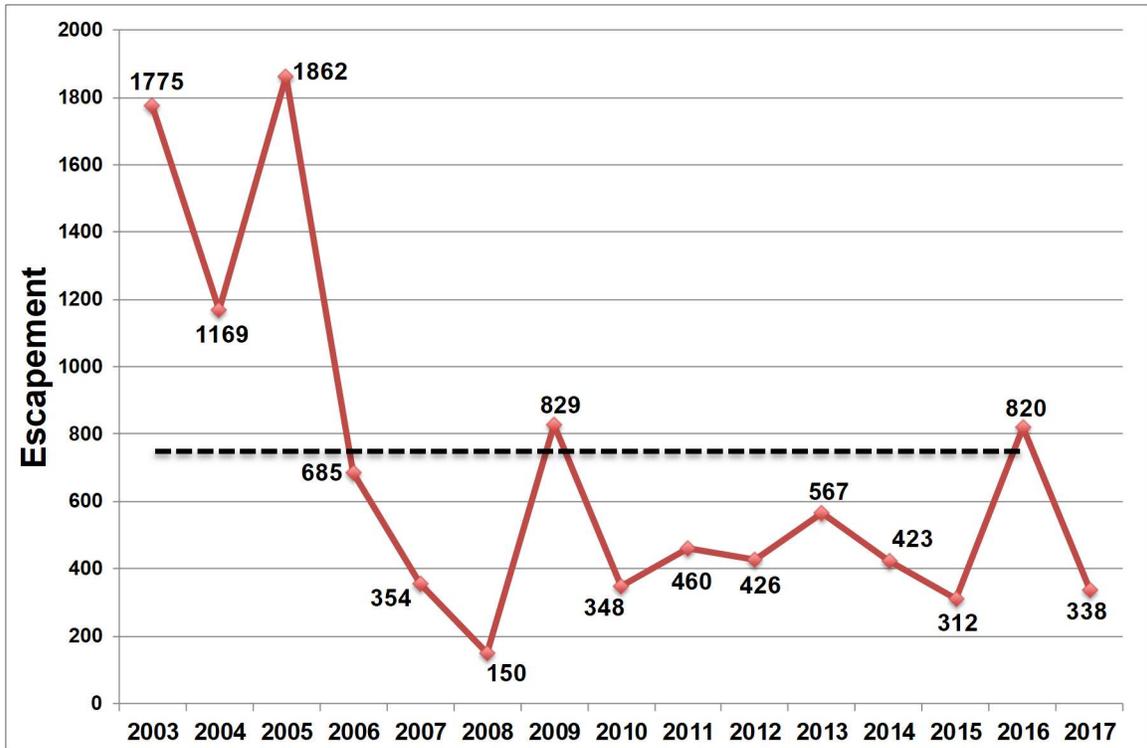


Figure 6: Kitwanga Chum Escapements 2003-2017

Coho

On September 11, 2017 when the KSEF went down, we had counted 315 coho and estimated this to be 20.2% of the coho run (based on run timing through the KSEF 2003-2016). Accordingly, the total estimate for the entire coho run was scaled up to 1,559 to account for missed fish (315×0.202). GFA also performed stream counts of the main coho spawning areas in the Kitwanga River in 2017 during the regular peak of spawning and these stream observations provided confidence in the conservative estimate of 1,559. This is down from the long-term average from 2003 to 2016 (4,076) as seen in Figure 7.

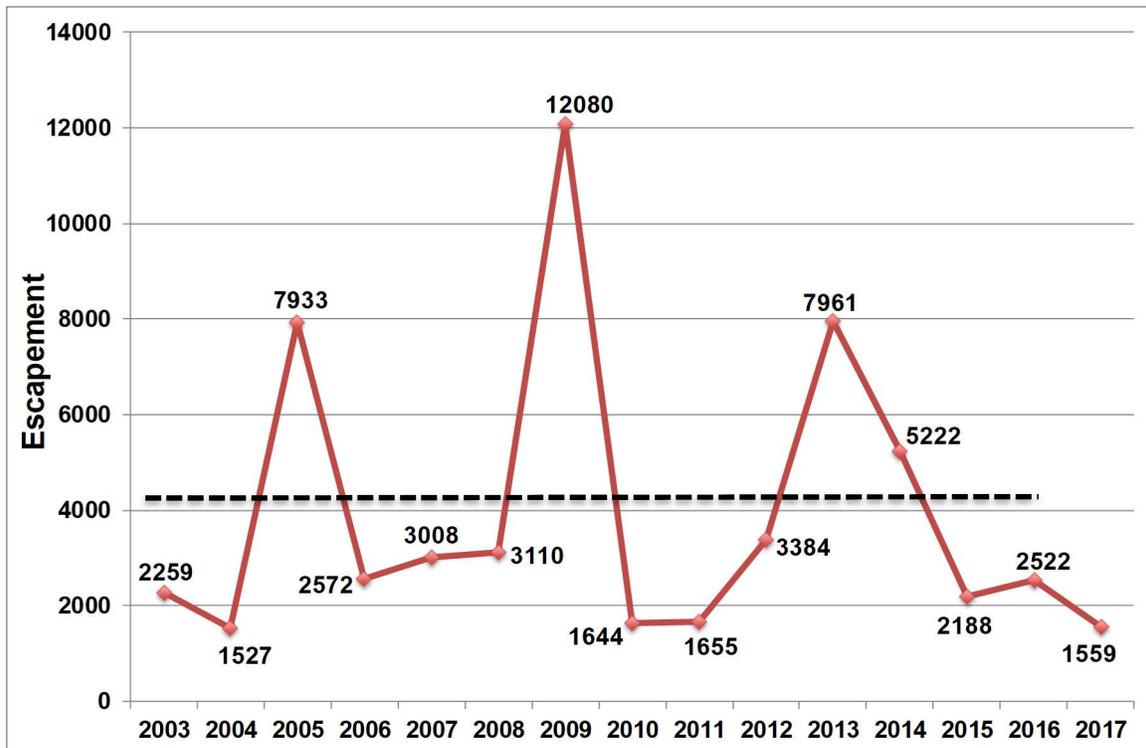


Figure 7: Kitwanga Coho Escapements 2003-2017

Kitwanga Sockeye Telemetry 2017

In 2017, GFA applied gastro-intestinal radio tags to Kitwanga sockeye salmon at the KSEF to track them from the site (~4km from the mouth of the Kitwanga River) to known spawning areas approximately 30km upriver in Gitanyow Lake. It was GFA's intent to apply 30 tags in total evenly across the run, but only 22 tags were applied because the KSEF sustained damage during a flooding event on September 11, 2017, and was shut down early. Tags were applied between August 18 and September 8, 2017 and Kitwanga sockeye were subsequently tracked throughout the Kitwanga River and Gitanyow Lake weekly following tag application. Radio tagged sockeye were tracked using a mobile receiver and one stationary receiver which was set-up at the outlet of Gitanyow Lake (KsF site). Mobile tracking was performed a total of 11 times by vehicle, boat and on foot and stationary receiver information was downloaded weekly from August 28 to November 5.

The primary objectives of the Kitwanga sockeye telemetry study was to confirm and identify any new spawning locations and to see if on-route mortality was observed.

Some key study findings were:

- Of the 22 sockeye radio tagged at the KSEF, 14 (64%) entered Gitanyow Lake and were tracked to two known sockeye spawning areas along the westerly

shoreline of the lake. The remaining 8 (36%) did not make it to Gitanyow Lake known spawning areas.

- Most (n=13) of the tagged fish that were tracked to Gitanyow Lake were found congregated at one location. This location was within 50m of the shoreline just north of an area known locally as the narrows. None of these fish could be observed actively spawning because they were located at depths of between 4-6m, but it is likely that this area made up most of the active spawning area in 2017. This site extended over an area of approximately 600m.
- One other tagged sockeye was tracked to another known spawning area in the lake just south of the narrows, but once again could not be seen because it was actively moving around at a depth that prevented visual observations of active spawning.
- Other observations showed that one tag was likely regurgitated immediately after being applied (found ~5m upstream of the KSEF site). One tagged fish died and washed up on the fence within a couple of days, another was found to have dropped downstream of the KSEF site and was last tracked near the Kitwanga / Skeena River Confluence (Note: this tagged fish moved downstream during the flooding event observed on September 11).
- The 5 remaining tagged sockeye were tracked into the Kitwanga River actively moving for several weeks before the tags became stationary. More specifically, 2 tagged sockeye were found halfway to the lake (one carcass recovered on the river bank, another in a log jam), another 2 found trapped in off-river habitat (beaver ponds) adjacent to the river (likely accessed at high water) and 1 other in the Kitwanga River canyon (~10km above the KSEF). All of these tagged fish were presumed to have died on-route and did not contribute to spawning in 2017.
- Also of note, the tagged fish that entered the lake took on average 23 days to travel the 30km between the KSEF and the Lake. The quickest fish made it in 10 days and the longest took 57 days.

Please Note: 2017 Kitwanga sockeye telemetry information provided in this post-season review document should be considered preliminary. GFA is still actively reviewing and analyzing the data and will provide a final assessment of the results by March 31, 2018, after reviewing the findings with DFO.