2009

NSTC In-Season Salmon Abundance and Health Indicator Program

A Report on the Churn Creek Fishwheel Feasibility Study: Enumeration, Assessment and Tagging

From the marine areas to the headwaters of the Fraser, the rapid decline in salmon species and stocks has illustrated the critical need for greater understanding of the environment and physiological characteristics of the salmon. The inherent responsibility to ensure that salmon are maintained for the enjoyment of future generations dictates the highest level of involvement by First Nations in all aspects of the management of our Fraser River sockeye salmon (Oncorhynchus nerka).

This NSTC fisheries project is a component of the involvement and the data collected could prove invaluable in piecing the puzzle on the diminishing salmon stocks that return to and/or pass through the traditional territories of the Northern Secwepemc te Qelmucw (NStQ). The data being collected could inform future fisheries as well as illustrate and verify theories on run dynamics. The success of this year's project comes with the collection of necessary biophysical data and the successful completion of the five goals of the project, as follows: 1. Deploy and test the fishwheel at a new site 1km upstream from the Gang Ranch Bridge; 2. Review the comprehensive catch monitoring regime and implement changes recommended in 2008 to determine the feasibility of utilizing a traditional fishery as an indicator of stock abundance. 3. Compare the fishwheel and standardized dipnet fishery Catch Per Unit Effort (CPUE) for similarities and differences, 4. Continue testing the feasibility of utilizing the fishwheel as a live capture and release platform for tagging and the collection of biophysical information of sockeye, chinook and coho and 5. Increase the capacity of the Northern Shuswap Tribal Council Fisheries Program through training, employment, project management and project tasks associated with the successful completion of this project. These goals were successfully accomplished, adding to the ongoing compilation of information gathered by the NSTC fisheries program that continues to shape the resources' future management.

As for data collected; in 2009, the fishwheel successfully live captured 692 sockeye (323 female, 364 male and 5 unknown) during the study period. Other species captured were 6 chinook, 37 pink and 1 White Sturgeon. Additionally the wheel captured approximately 900 pink salmon and 1 coho in a late season deployment of the fishwheel in a effort to live capture and tag some Interior Fraser Coho.

Fisheries
Northern Shuswap Tribal Council
11/6/2009

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Introduction

The rapid decline in salmon species and stocks has illustrated the critical need for greater understanding of the environment, biology and associated life histories of the salmon. The inherent responsibility to ensure that salmon are maintained for the enjoyment of future generations dictates the highest level of involvement by First Nations in all aspects of the management of our Fraser River Salmon including sockeye (*Oncorhynchus nerka*).

Not to diminish the management difficulties with all species returning to the Fraser River, however, the management of sockeye is highly complicated, and often relies on the collection and sharing of vast amounts of information between diverse groups, often with dissimilar interests. While steps are being taken by First Nations, as well as through federal and provincial legislation and other interests, to somewhat converge interests and ensure a sustainable resource through better and more open communication on how to manage fisheries, there is clearly more work to be done. The recent situations can be viewed as an opportunity to get the "work done" and have allowed us to create initiatives which can be deemed instrumental in assessing the situation the fish are faced with and inform future work. Initiatives such as assessing stock composition, abundance and incorporating tools to better understand sockeye behaviour and provide check points for in-season management; including the effects of environmental conditions on the salmon as they migrate to their natal streams and spawn. Along with this comes a better understanding of the intricacies our ecosystems and interconnections between those, the salmon and priority harvest rights, as well as relations amongst First Nations along the migration routes. A step beyond that is the

importance of sockeye to the economics of our region, which not only includes commercial food fishing but recreational fishing and commercial recreational fishing as well. The cumulative harvest pressure on Fraser Salmon, combined with the somewhat unknown effects of changing environmental conditions, further complicates an already difficult management regime for the fishery.

2009 was, perhaps more than any other year, a true test for how we manage fisheries. We witnessed a massive decline in the overall expected return of Fraser sockeye, combined with a steady decline in chinook stocks produced another frustrating year for First Nations who have relied on the returns for millennia; as well as another frustrating year for the sectored fisheries and the communities that have sprung out of those fisheries. The common difficulties faced are forcing people to have an increased interest, awareness and perhaps most importantly progressive involvement of the grass roots communities into the future management of sockeye populations.

One model of the progressive involvement in fisheries management and increasing awareness around the need for better information arises from the implementation of the NSTC Churn Creek Fishwheel Project. This project, funded by the Fraser Salmon Watersheds Program is viewed as an important tool in collecting essential data; as well as in building NStQ capacity, through training of individuals for the progression towards renewed efforts in the rightful role as active managers of fisheries and protection of salmon migrating through and returning to spawn in the NStQ territory. The project has been implemented by the Northern Shuswap Tribal Council (NSTC) to gain more specific understanding of the migration, strength and condition of the migrating salmon stocks in the upper river. With the nearest standardized test fisheries and in-season

tools to measure salmon abundance existing hundreds of kilometres downstream of the NStQ territory, at Mission (Hydro-acoustic and LGL Fishwheel) fisheries planning for upper Fraser River First Nations seems to further complicate the overall process. Projects like this NSTC project, in the Upper/Mid Fraser areas can fill the knowledge gaps and are vital if Wild Salmon Policy objectives are to be met and improvements to management and conservation are to be made.

In 2009, the NSTC project allowed the NSTC's fisheries program access to near real time information on run strength and timing in the area that was passed on to the Northern Secwepemc te Qelmucw (NStQ) fishers, and helped inform the requirement for conservation measures to be taken by the NStQ, when the sockeye run failed to materialize. The project also illustrated its usefulness in informing the developing economic fisheries, by providing a checkpoint on the location/timing/strength of the run in the Upper Fraser and tributaries. By continually refining the goals and objectives of the project and ensuring those objectives (listed below) are being met, it is projects like this fishwheel that will aid in the sustainable management of the salmon.

The Project Objectives were as follows:

- To deploy and test the fishwheel at a new site one kilometre up river from the Gang Ranch Bridge in the mainstem Fraser River within the southern portion of the Northern Secwepemc te Qelmucw traditional territories.
- To look at the comprehensive catch monitoring regime and implement changes suggested from the study done in 2008 for the Soda Creek Band

traditional dipnet fishing site in order to determine the feasibility of utilizing a traditional fishery as an indicator of stock abundance.

- To compare the fishwheel and standardized dipnet fishery Catch Per Unit Effort (CPUE) for similarities and differences.
- The continuation for testing the feasibility of utilizing the fishwheel as a live capture and release platform for T-Bar tagging and the collection of biophysical information of sockeye, Chinook, and Coho.
- To increase the capacity of the Northern Shuswap Tribal Council Fisheries Program through training, employment, possible economic opportunities, project management and project tasks associated with the successful completion of this project.

Methods

Fishwheel Project Site Selection and Deployment

With the success of the 2008 fishwheel project, NSTC fisheries program decided to pursue the continued use of this selective and non-lethal capture method for in-season/in-river sampling, tagging and gathering of biological data on the sockeye stocks migrating through the NStQ traditional territories. These stocks include the Early Stuart sockeye, Early Summer sockeye (Bowron, Nadina and possibly Taseko downstream of the Chilcotin confluence), and Mid-Summer sockeye (Quesnel, Chilko, Stellako, Late Stuart) as well as summer chinook stocks and Interior Fraser coho stocks.

Figure 1. Sampling of a sockeye salmon for biophysical data.

Due to the down time incurred from vandalism and natural incidents during the 2008 fishwheel study a new location for the Churn creek fishwheel was selected. The new location, 1km up river from the Gang Ranch Bridge, was based on suitability criteria such as depth, flow, river structure, anchoring points and accessibility. Another important factor in selecting an appropriate site was cultural sensitivity to the traditional dipnet fishing downstream. The Fraser mainstem at the proposed site is approximately

100 metres wide, of varying velocities and water depths. The process of selecting a specific site for the deployment of a fishwheel is critical, as it has been shown that even slight changes and variation in fishing position can have an influence on fishing success (Smith 2008).

The new site, (Figure 2), allows for boat access for the crew and has a small trail of about 800 meters, ideal as a backup access route for safety concerns, which leads from the fishwheel to the main Gang Ranch road.

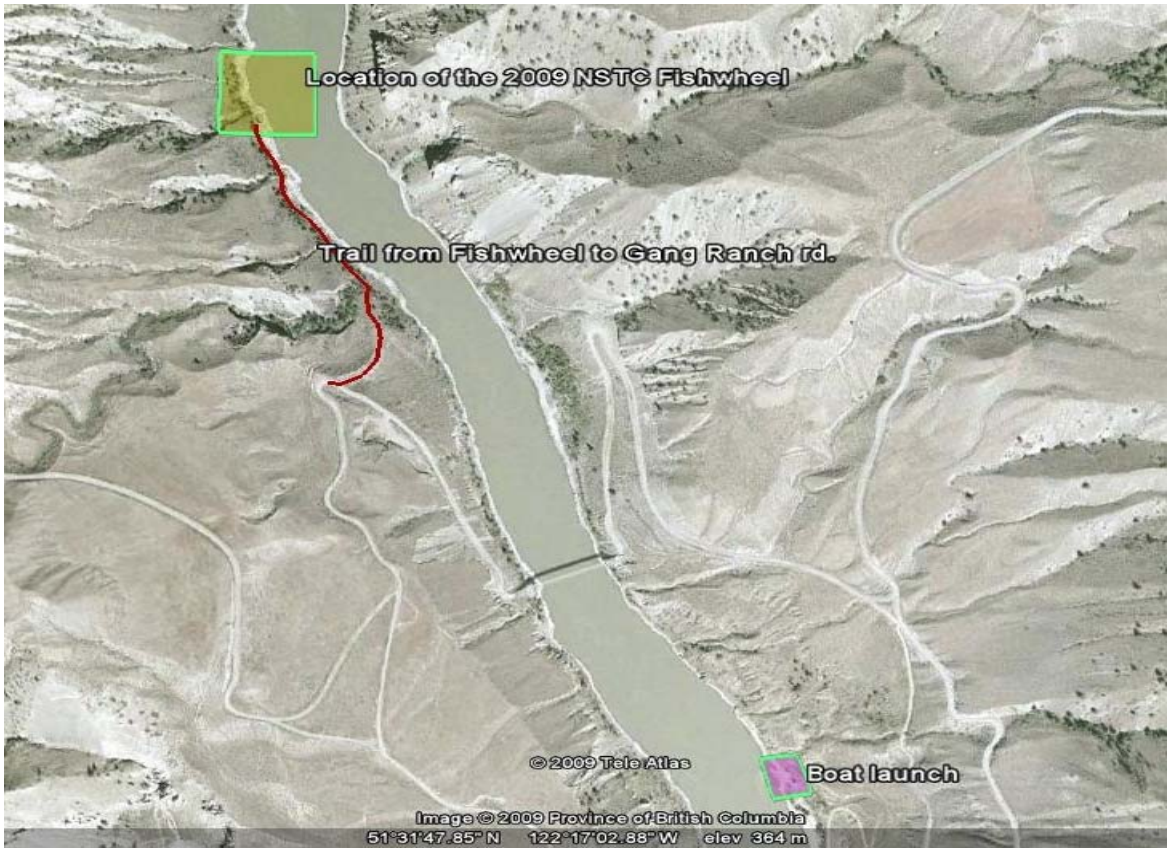

Figure 2 Location of the 2009 NSTC Fishwheel, trail and boat launch. Base map from Google earth.

In selecting this new location, the Churn Creek fishwheel provided the NSTC with a better representation of the fish migration through the NStQ territory as the down time was limited to minor repairs with no vandalism. Reducing the down time this year

increased the potential provided by the assessment platform as it served as an indicator of abundance, biological sampling to improve the knowledge of timing and stock composition, and a tagging facility to improve the knowledge of stock composition.

The fishwheel was anchored using a 5/8'' steel cable and a back up anchor rope both attached to separate Cottonwood trees up river of the fishwheel. To hold the wheel out in the current and at proper depth a 20' foot long 4"x 4" inch aluminium tube beam was anchored to a trailer hitch ball drilled and mounted on large rocks located on shore at different levels (Figure 3). The anchors on shore were made by drilling and inserting four drop anchors directly into the rocks using a Hilti hammer drill. The drop anchors accommodate 5/8 inch bolts that affix the ½ inch thick steel plate that the trailer hitch is attached. This method of attachment allows for water level fluctuations. The use of the original anchor point was attempted during the first water level drops by using another 15 foot 5"x 5" tube beam slide over the original. This worked until the water level dropped further and the need for new anchoring points was evident. As the water level dropped further, another anchoring point was made. Along with this main aluminium beam was a log, salvaged from upstream was used to anchor the rear end of the fishwheel to shore to stabilize the rear end thus preventing it from swinging out into the current and back into shore. This log was about 30' feet long and anchored at both ends by rope.

Figure 3. Anchoring point drilled into the rock.

As was done last year the fishwheel was assembled on shore at the landing across and just up river from Churn Creek by NSTC fisheries technicians, a contracted fisheries biologist in training and the NSTC fisheries manager. New aluminium tubing and netting were used to update older parts that were showing wear and tear. One slider was replaced on shore before deploying the wheel but the other had to be removed and replaced on the water causing the loss of a day of sampling.

Figure 4. The construction of the fishwheel on shore.

The wheel was manoeuvred into place from shore with the use of the Canoe Creek Band backhoe and then towed upriver with the use of the NSTC fisheries program jet-boat. The boat was then used to hold the fishwheel in place while the fishwheel was anchored using the main steel anchor cable and secondary rope anchor. Unlike last year the new site had a natural barrier to floating logs and debris as they were deflected into the main channel by a large rock bar upstream and further protected by a large back eddy, as a result of the rocks there was no need for a boom log.

Figure 5. The side view of the NSTC fishwheel as it is actively sampling.

Once the fishwheel was fully assembled, moved up-river and anchored in place a test run was conducted on July 30th with all crew members on hand. No fish were caught this day but the fishwheel was functioning as it should and was deemed to be ready for full operations.

As operation was started a diversion net was installed on the shore facing pontoon that would help divert salmon migrating along shore, towards the fishwheel. The net was a beach seine net and the depth of this net prevented the migrating sockeye from swimming under or over the lead line on the bottom and the floats on the surface.

Once operational on July 31st, 2009 the fishwheel was in operation for 24 hours per day. The crew manned the wheel from 7pm till 12am, with stoppages recorded for repairs or tightening of bolts and key clamps.

Figure 6. Live well filled with sockeye on the right pontoon

Description of the fishwheel

The fishwheel, referred to as the Shedin Fishwheel as it was run at the junction of the Shedin and Babine rivers since 1994, is the same one that was leased from Gitksan Watershed Authorities last year for the 2008 fishwheel project. This specific fishwheel is a large “Nisga’a” style fishwheel it floats on two pontoons that hold one Live well each for live-caught fish. Both pontoons are 36’ (11.1m.) long by

3’ (0.92m.) wide and made of aluminium to provide the flotation. The live well in the middle section of each pontoon measures approximately 12’ (3.69m.) long, 24” (0.61m.) wide and 48” (1.23m.) deep and hold approximately 80 cubic feet of water (Mikkelsen 2001). Two 22” by 19” aluminium grates on the bottom of the holding tanks provide water flow through the live bins. Three similar vertical aluminium grates divide the holding tanks into four sections provide structural strength and act as baffles to reduce water velocities. The baffles, though not an impediment to fish movement, were noted to make the capture of the fish easier in the tanks. The baskets were constructed of aluminium and can be describe as follows: 1.25” inch schedule 40 pipe aluminium and Kee Clamps™. These strong clamps, made from galvanized steel, are attached to the piping using set screws and are designed to provide maximum strength at the joints. The two basket design was continued in order to reduce the rotational speed of the fishwheel and worked well in the Fraser River at Churn Creek in 2008 but was a bit slow for the new location so a small paddle consisting of two key clamps situated off the baskets perpendicular axis support tubing and a single 1.25” inch piece of aluminium tubing placed the width of the basket helped to increase rotation speed.

For the baskets, green knotless web was used to reduce its visibility and to ensure minimal damage to the fish caught in the wheel. Cross cables were strung from corner to corner of each basket to ensure an even transfer of the rivers force across the basket.

Fishwheel Data Collection

Figure 7. The Fishwheel technicians sampling one of many sockeye

Data collection methods and data sheets were similar to the methods detailed in the 2008 “NSTC In-Season Salmon Abundance and Health Indicator Program” report. The data recording was done with the use of two sheets. An individual data sheet where each fish was recorded for: size by fork length, condition code (a 1-4 rating that was biased on by scale loss), handling time by seconds, the recorded DNA vial number, T-Bar tag number, Scale book and scale number (two scales were pulled per fish), Species of fish recorded by two letter code (sk for sockeye, cn for chinook, Ws for white sturgeon, and ch for coho and pk for pink salmon. All other fish caught were mentioned in comment section), and sex. A column for additional comments was also completed at the discretion of the technician. In this comments section data such as scaring and non-target fish species was recorded. The second data sheet was the daily summary sheet. This form was filled out at the end of a shift and consisted of the following data: water temperature in °C, fishwheel RPM’s (recorded as the time for the wheel to complete 3 full revolutions), start and end times of each shift, fishwheel downtime, number of fish caught (separated into adult, sex, jack, tagged and species), technician information/notes regarding highlights or down time due to maintenance etc. to the wheel along with general comments regarding the wheel, boat or fish.

All data from the raw data sheets were entered into an Excel spreadsheet for analysis and the daily summaries were compiled and distributed every four to five days.

Catch per Unit Effort

The catch per unit effort (CPUE) was calculated as the total catch per day by hours fished by the fishwheel, the downtime was accounted for in the CPUE calculations. The fisheries technicians made certain that they sampled the fish as soon as they reached the fishwheel at approximately 19:30 hours and then again around 23:20 hours each evening so as to ensure that all fish caught within a full 24 hour day were sampled and the live bins were empty at the onset of the next sample period which commenced at 00:01 hours the following day. The majority of the captured fish were released back into the river after the data were recorded.

Tagging

As with the 2008 project the T-Bar anchor tagging of the sockeye and chinook was designed around the understanding of attempting to tag a suitable portion of the years catch. It was decided that only five fish from each day were to be tagged as the number of tags for this year were limited. The tags were applied with a pistol grip tagging gun directly below the dorsal fin to ensure a good hold.

Figure 8. Sockeye salmon being sampled with the tag in place below the dorsal fin

The tags were blue in color and printed with individual identification numbers that allow for each tagged fish recaptured at a later date to be linked to the fishwheel and the biophysical data.

Prior to tagging fish, NSTC fisheries technicians reviewed how to properly tag salmon and then later refreshed on how to apply the tags on a live sample once fish were being caught and sampled. By the end of the shift changes all NSTC fishwheel fisheries technicians were experienced in using the tagging gun and able to tag the sockeye in accordance to procedure, which are as follows:

1. Ensure all needed sampling materials and instruments were at hand to limit fish handling/sampling time.
2. Retrieve fish (via dip net) from the live well and carefully transferred to the measuring box.
3. Species, sex and length of the fish was recorded by the technician who would,
4. Apply tag. Tags were applied to the left side of the fish under the dorsal fin to ensure proper fastening and then,
5. The fish was carefully released off the side of the pontoons facing up river and let go after the fish showed signs of recovery.

Standardized Fishery - *Xat'súll Fishing Site, Jejeba7*

In 2008, catch monitoring at the Xat'súll fishing site was increased as per objective 2 of this project. Catch monitoring coverage of the fishing site was increased from a four day a week regime, to a seven day a week regime. This year the catch monitors went back to a four day a week monitoring process. To stick with the objective, two technicians were hired to dipnet fish at the Soda Creek (Jejeba7) site for six hours a night five days a week. The data acquired from this component of the project should allow for

comparisons to the dipnet fishery and that of the fishwheel as to their CPUE and fish pulse timing.

PROJECT RESULTS

Water temperature and rotation speed

The Fraser rivers temperature at the fishwheel site varied from a high of 20.8°C on August 2nd and a low of 15°C on August 26th 2009. These are almost 3°C greater than the high and low of 2008 (18.3°C Aug 8, 2008 and 12°C on Sept 1, 2008). Figure 9 displays the water temperature at the fishwheel site. The rotation speed of the fishwheel varied from 1.5 rpm up to a speed of 4 rpm, the addition of a single paddle aided in this increase of rotation speed.

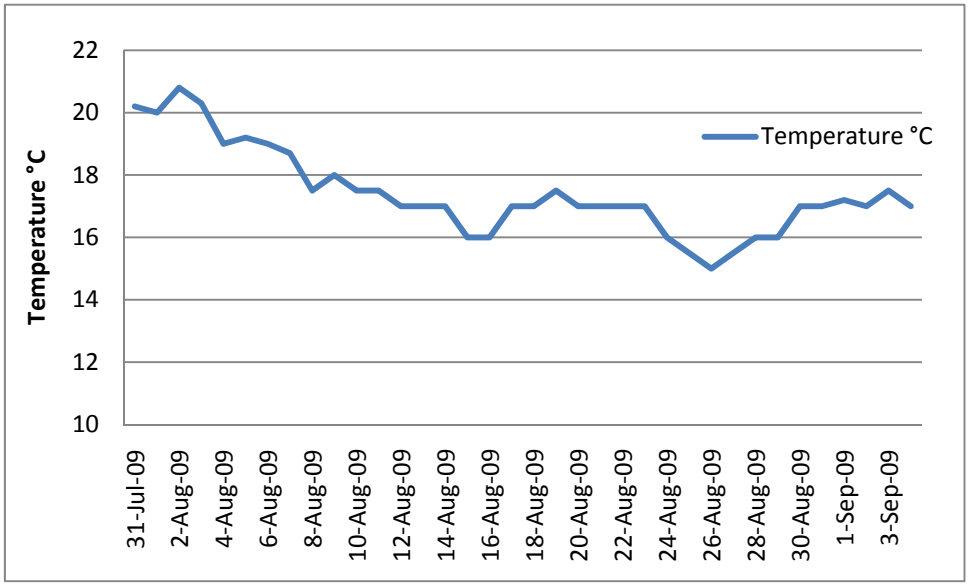

Figure 9. Daily water temperature at NSTC Churn Creek Fishwheel site

Operation Period

The 2009 NSTC Churn Creek Fishwheel was in operation for sockeye from July 31, 2009 till September 4, 2009 with a total time fished of 755 of a possible 864 hours. Down time for this project was minimal with the largest stoppage being due to a major failure of one slider on August 5th. Additional stoppages were caused mainly by the rapid drop in water level (Figure 10 and 11), thus causing the fishwheel to be repositioned further out from shore to prevent the wheel baskets from hitting bottom and becoming damaged or destroyed. The closure of the wheel for data collection on the sockeye salmon run on September 4th was decided due to another drop in water level. The fishwheel remained floating in the water till October 20th. Prior to this time the wheel was used for a week between Sept 21-25 in an attempt to capture coho and possibly radio tag them.

Figure 10. Water level change from August 01 to August 22, 2009.

Figure 11. Water level change from August 22 till September 30, 2009.

Fishwheel Catch Summary

The fishwheel was successful in catching four species of fish: sockeye, chinook, pink, and white sturgeon. The single white sturgeon was caught and released on September 1st. Table 1 describes the summary of the catch from July 31st till September 4th 2009. Figure 12 illustrates the total catch and Figure 13 displays the total catch by species for the same period of time.

Table 1. Catch from July 31 till September 04, 2009

			Sex			Average fork length		
Common Name	**Latin name**	**Total**	Female	Male	Unknown	Total	Female	Male
Sockeye	*Oncorhynchus nerka*	692	323	364	5	58.5	57.5	59.7
Chinook	*Oncorhynchus tshawytscha*	6	2	2	2	55.5	80.0	66.1
Pink	*Oncorhynchus gorbuscha*	37	17	20	0			
White Sturgeon	*Acipenser transmontanus*	1			1	113.6		
Total Caught		698						

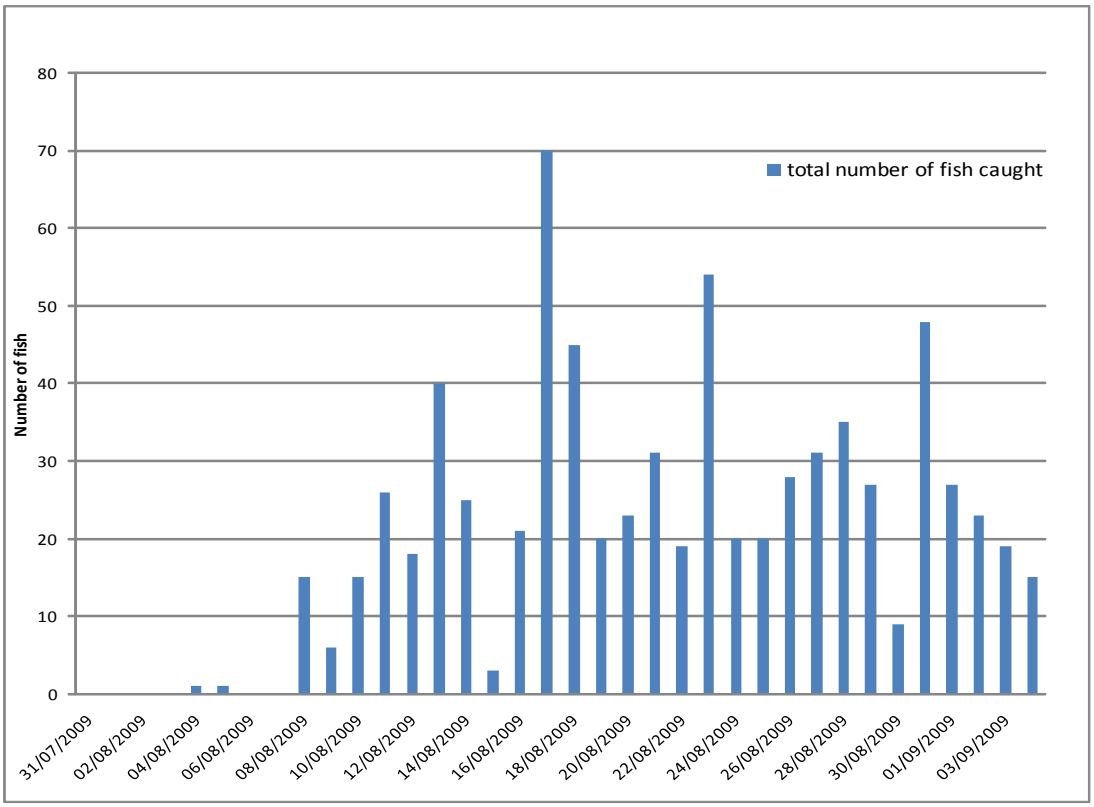

Figure 12. NSTC Churn Creek Fishwheel total catch by day for 2009

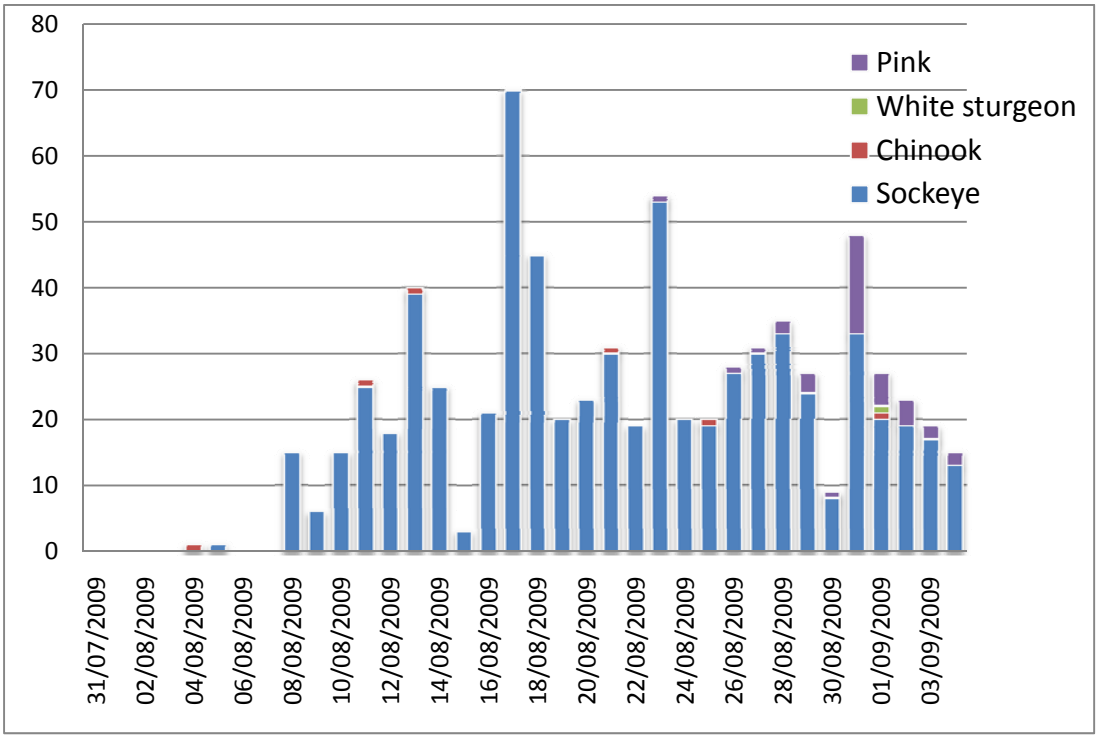

Figure 13. NSTC Fishwheel total catch by species 2009.

In Figures 12 and 13 the absence of fish caught on Aug 6th, 7th, 15th and 30th reflects operational downtime that was required for maintenance of the wheel.

Table 2, displays the total catch by sex and species, which is then broken down to the percentage of catch that is made up by either sex or species. Sockeye constitute 94% of the total catch, with 49% male and 44% female; 0.54% were unknown. The unknown were fish that escaped while dip netting from the live bins, without being sexed, but that portion of sampling that were caught successfully by the fishwheel. Pink salmon made up 5% of the overall catch, six chinook made up 0.81% and one white sturgeon made up 0.14% of the catch.

Figure 14. NSTC Fisheries technician releasing a white sturgeon from the fishwheel.

Length

Along with identification of sex, the length of every fish was also measured and recorded. For the purposes of this study fork length was the recorded measurement. Figure 15 illustrates the daily average fork length by sex for sockeye. The daily average fork length ranges from a minimum average of 55.6 cm to a maximum average fork length of 62.4 cm, these are averages made of the entire daily catch. Figure 16 displays the frequency of catch by size. These data illustrate the Churn Creek Fishwheel's ability to catch a variety of adult sockeye size classes in this stretch of the Fraser River. The findings range from a minimum fork length of 34 cm to a maximum of 71 cm. It is important to note that all chinook, pink and white sturgeon catches are excluded from Figures 15 and 16 in order to avoid skewing of the data.

Table 2. Total fishwheel catch from July 31 till September 4, 2009 displayed by species and sex.

	Sockeye						
	Total	M	F	Unk	Chinook	Sturgeon	Pink
Date							
31-Jul-09	0	0	0	0	0	0	0
01-Aug-09	0	0	0	0	0	0	0
02-Aug-09	0	0	0	0	0	0	0
03-Aug-09	0	0	0	0	0	0	0
04-Aug-09	1	0	0	0	1	0	0
05-Aug-09	1	1	0	0	0	0	0
06-Aug-09	0	0	0	0	0	0	0
07-Aug-09	0	0	0	0	0	0	0
08-Aug-09	15	8	7	0	0	0	0
09-Aug-09	6	4	2	0	0	0	0
10-Aug-09	15	9	6	0	0	0	0
11-Aug-09	17	6	10	0	1	0	0
12-Aug-09	18	8	9	1	0	0	0
13-Aug-09	39	18	20	0	1	0	0
14-Aug-09	25	7	17	1	0	0	0
15-Aug-09	3	2	1	0	0	0	0
16-Aug-09	21	7	14	0	0	0	0
17-Aug-09	71	38	33	0	0	0	0
18-Aug-09	52	27	25	0	0	0	0
19-Aug-09	21	8	13	0	0	0	0
20-Aug-09	25	15	10	0	0	0	0
21-Aug-09	33	21	11	0	1	0	0
22-Aug-09	19	9	10	0	0	0	0
23-Aug-09	53	38	14	0	0	0	1
24-Aug-09	20	12	7	1	0	0	0
25-Aug-09	20	5	14	0	1	0	0
26-Aug-09	28	12	15	0	0	0	1
27-Aug-09	31	15	15	0	0	0	1
28-Aug-09	33	16	14	1	0	0	2
29-Aug-09	27	14	10	0	0	0	3
30-Aug-09	14	7	6	0	0	0	1
31-Aug-09	43	19	9	0	0	0	15
01-Sep-09	27	9	11	0	1	1	5
02-Sep-09	25	12	9	0	0	0	4
03-Sep-09	19	7	10	0	0	0	2
04-Sep-09	15	9	4	0	0	0	2
Total	737	363	326	4	6	1	37
Percent of Total Catch		49.25%	44.23%	0.54%	0.81%	0.14%	5.02%

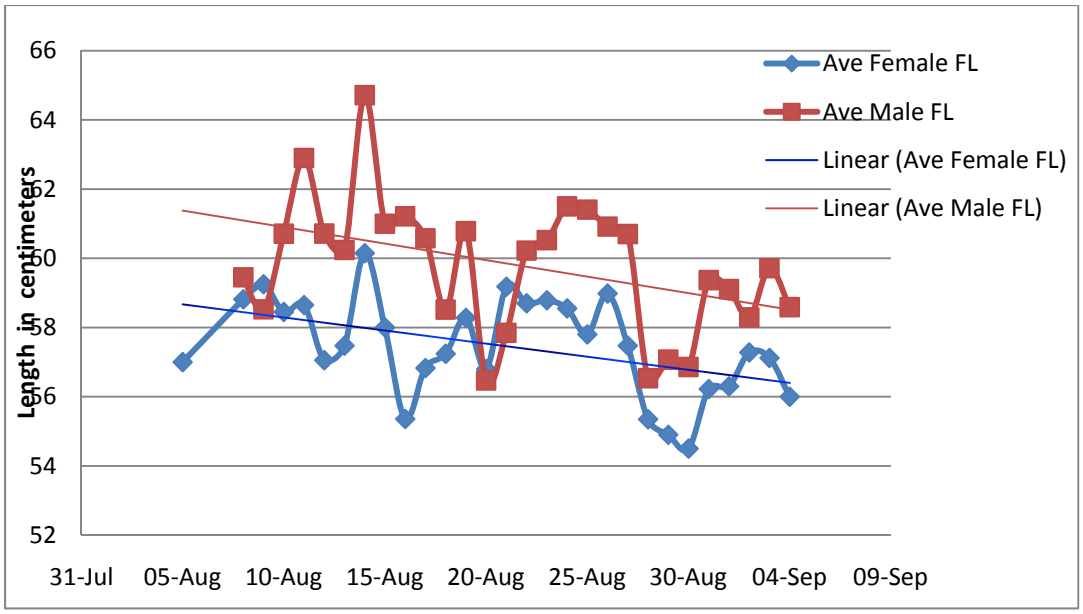

Figure 15. Average fork length male and female sockeye salmon by day

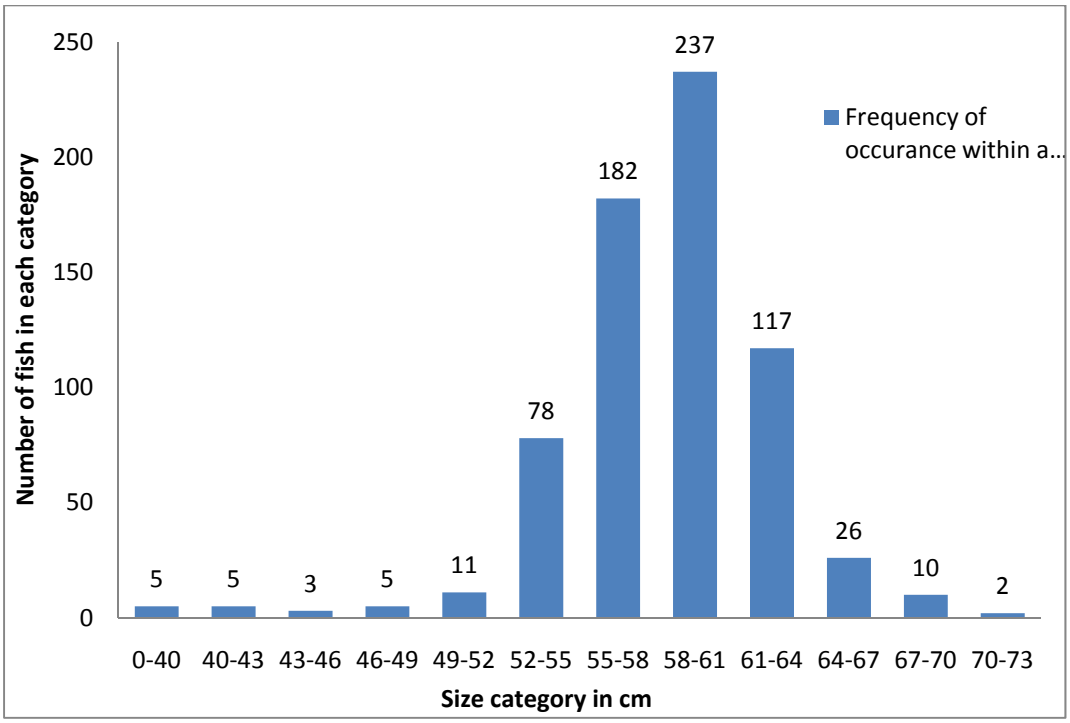

Figure 16. Histogram displaying the number of fish caught in each size category (category changes every 3cm).

Tagging

During the study 76 sockeye and one chinook were tagged using T-Bar anchor tags.

These tag data were recorded and linked to the other data collected for each fish. The

intent was to have the ability to gather catch data and a link to upstream traditional fisheries or to spawning areas if the tag was recovered. Table 3 looks at the number and percentage of catch represented by the tagged salmon.

Table 3. Number of tags issued by date

Date	Sockeye	Chinook	Total
31-Jul-09	0	0	0
01-Aug-09	0	0	0
02-Aug-09	0	0	0
03-Aug-09	0	0	0
04-Aug-09	0	1	1
05-Aug-09	1	0	1
06-Aug-09	-	0	0
07-Aug-09	0	0	0
08-Aug-09	5	0	5
09-Aug-09	4	0	4
10-Aug-09	8	0	8
11-Aug-09	5	0	5
12-Aug-09	5	0	5
13-Aug-09	5	0	5
14-Aug-09	5	0	5
15-Aug-09	3	0	3
16-Aug-09	5	0	5
17-Aug-09	5	0	5
18-Aug-09	0	0	0
19-Aug-09	0	0	0
20-Aug-09	0	0	0
21-Aug-09	0	0	0
22-Aug-09	0	0	0
23-Aug-09	0	0	0
24-Aug-09	5	0	5
25-Aug-09	5	0	5
26-Aug-09	5	0	5
27-Aug-09	5	0	5
28-Aug-09	5	0	5
29-Aug-09	0	0	0
30-Aug-09	0	0	0
31-Aug-09	0	0	0
01-Sep-09	0	0	0
02-Sep-09	0	0	0
03-Sep-09	0	0	0
04-Sep-09	5	0	5
Total	81	1	82
Percent tagged of total caught	12%	17%	12%

Catch per Unit Effort

With the fishwheel's down time recorded and a log of the full time operational time, the catch per unit effort (CPUE) was calculated on a daily basis to give a maximum CPUE of 2.96 and a minimum of 0, due to no fish being caught. This is displayed in Figure 17.

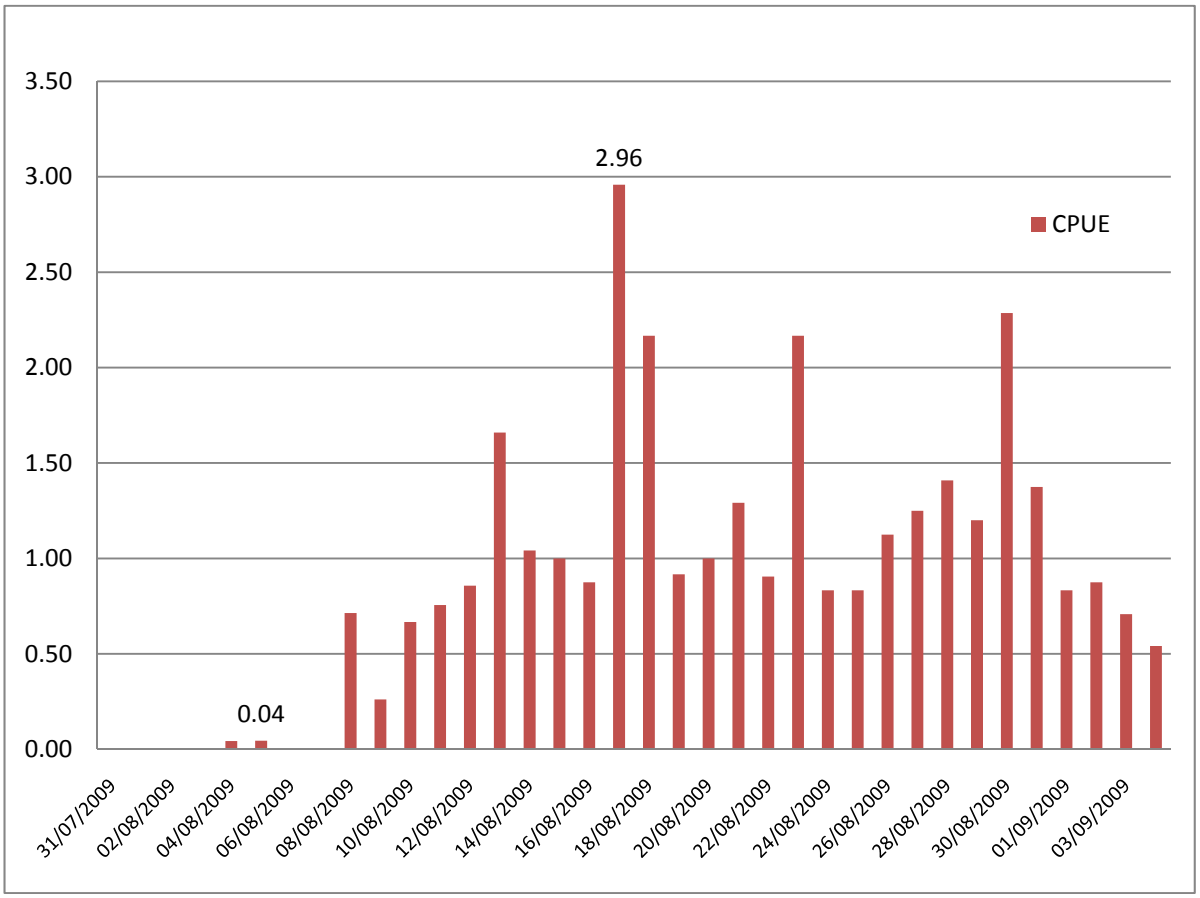

Figure 17. NSTC Churn Creek Fishwheel catch per unit effort for 2009.

When looking at the CPUE of the fishwheel it is also beneficial to compare it to that of the dip net fishery. Table 4 shows the catch and CPUE of the Jejeba7 dip net site for each day and Figure 18 illustrates the CPUE of both the fish wheel and the Jejeba7 site. Within this section the fishwheel is compared to the Jejeba7 traditional site as this site was being standardized this year with the implementation of a NSTC fisheries technician that fished the site six hours a day five days a week.

Table 4 Jejeba7 traditional dip net site catch and CPUE from standardized dip net sampling.

Date	Hours fished	Fish kept	Sockey released	CPUE
06-Aug-09	6	22	0	3.7
07-Aug-09	6	30	0	5.0
08-Aug-09	6	21	0	3.5
10-Aug-09	6	10	0	1.7
11-Aug-09	6	20	0	3.3
12-Aug-09	6	25	0	4.2
13-Aug-09	6	25	0	4.2
14-Aug-09	6	15	0	2.5
17-Aug-09	6	18	0	3.0
18-Aug-09	6	35	0	5.8
19-Aug-09	6	40	0	6.7
20-Aug-09	6	20	0	3.3
21-Aug-09	6	48	0	8.0
24-Aug-09	6	5	5	1.7
25-Aug-09	6	0	10	1.7
26-Aug-09	6	0	15	2.5
27-Aug-09	6	0	20	3.3
28-Aug-09	6	0	15	2.5
31-Aug-09	6	20	5	4.2
01-Sep-09	6	15	0	2.5
02-Sep-09	6	15	0	2.5
03-Sep-09	6	0	25	4.2
04-Sep-09	6	0	30	5.0

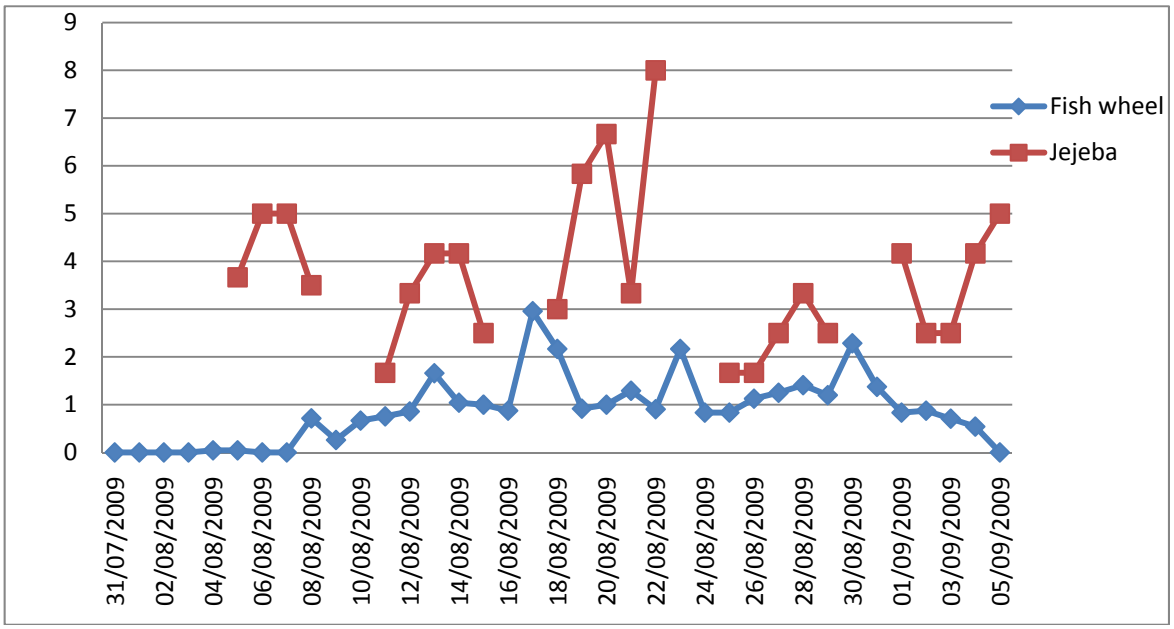

Figure 18. Comparison of Fishwheel CPUE to that of the Jejeba7 traditional dipnet site.

The total catch of 2008 and 2009 is compared in Figure 19 below. Note the difference in run timing 2009 sees a much later increase in catch abundance than that of 2008.

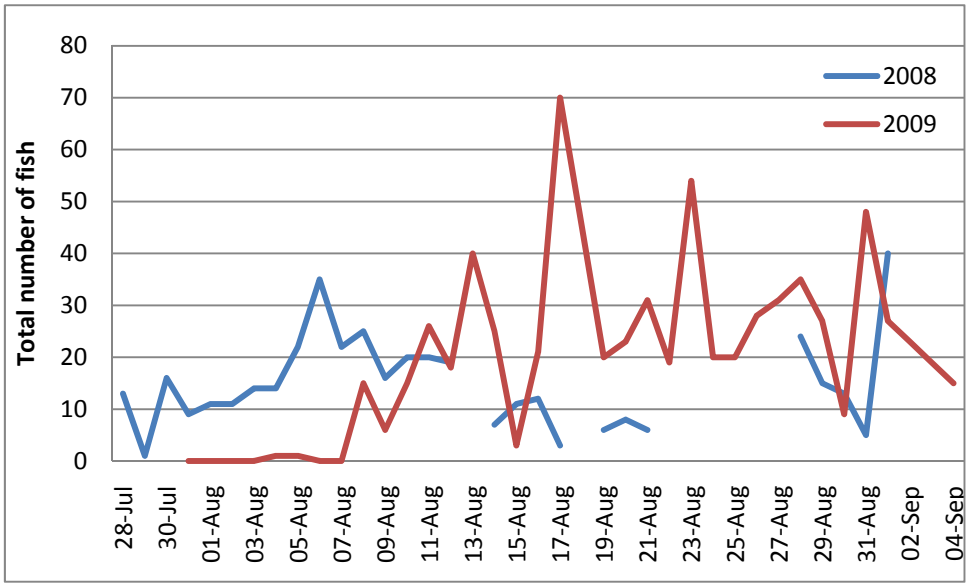

Figure 19. The comparison of total daily catch from 2008 to that of 2009.

Health and Condition

During the 2009 fishwheel project the crews observed fish caught and recorded the physical condition of fish caught. Figure 19 looks at the percent scarring on sockeye for the duration of the fishwheel sampling period. Along with this Figure 20 looks at a possible connection between scarring and a decrease in fishing hours in the south Fraser River (Sawmill Creek to the mouth of the Fraser).

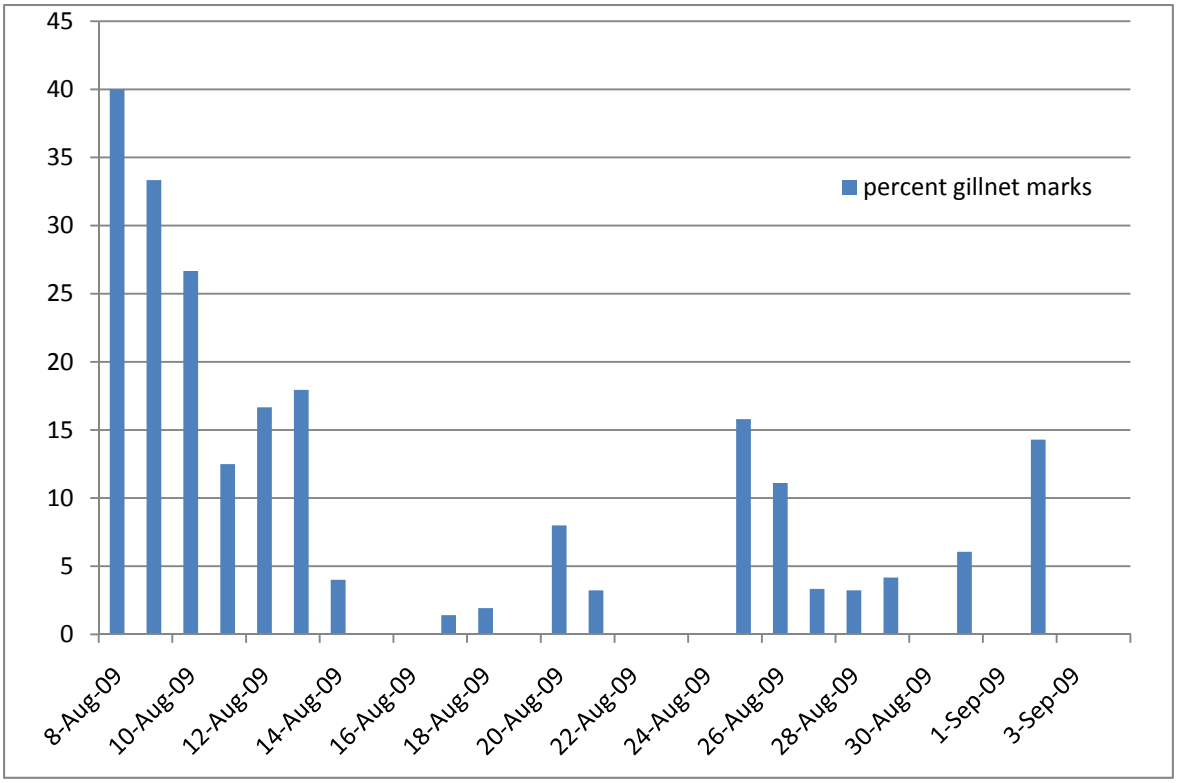

Figure 20. The number of fish, by percent of daily catch, that displayed gillnet scar type markings

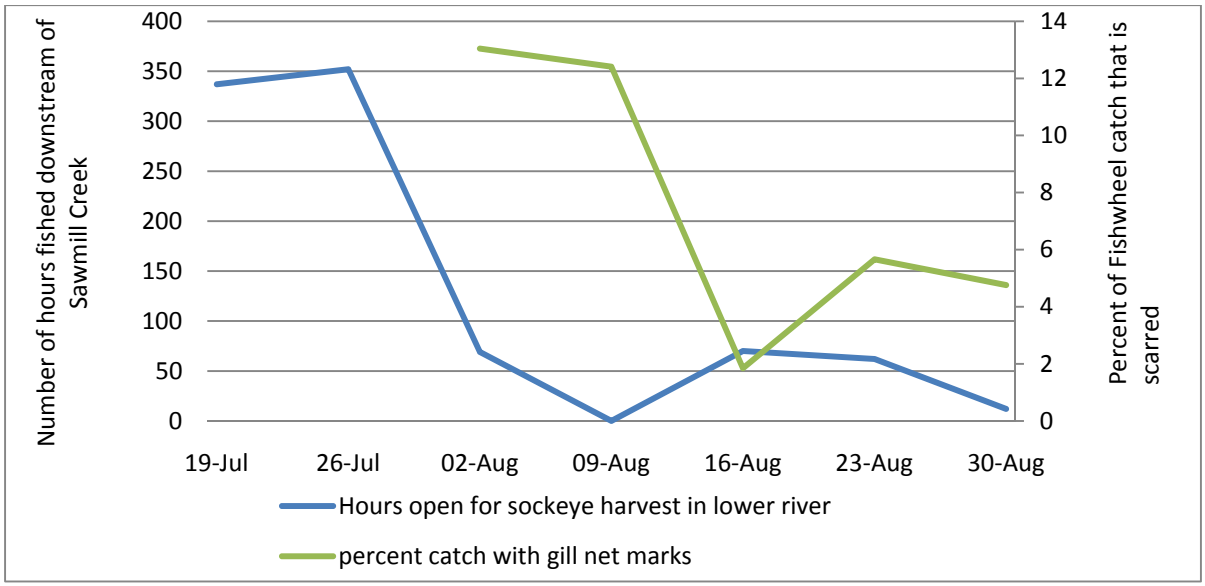

Figure 21. The timing similarities between the reduction in hours fished and the number of scarred fish caught in the fishwheel

Coho Project

During this year's project the ability to utilize the fishwheel for a late season coho project was realized as the wheel was not removed from the sample site till late October. This small scale sample project ran for four days and was in operation from September 21st till the 25th, 2009 the results from this side project are listed in table 4.

Table 5. Catch totals for the four day coho side project.

			Sex		
Common Name	Latin name	Total	Female	Male	Unk
Sockeye	*Oncorhynchus nerka*	4	1	3	0
Pink	*Oncorhynchus gorbuscha*	983	412	571	0
Coho	*Oncorhynchus kisutch*	1	0	0	1

Discussion

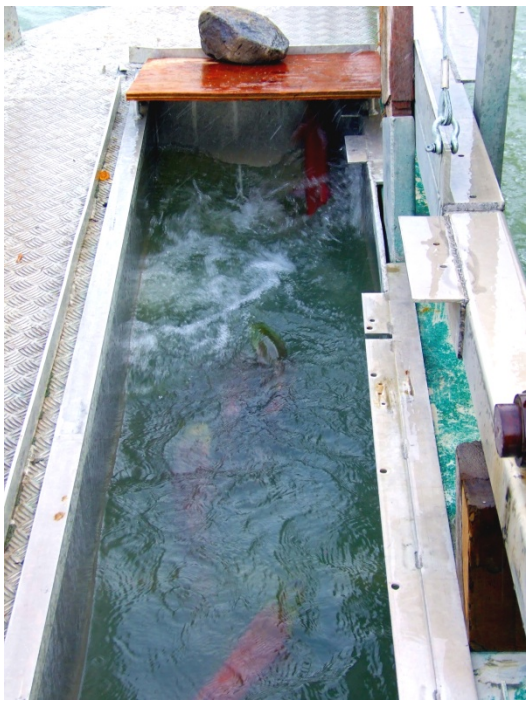

Figure 22. Sockeye attempting to jump out of the live well

The Churn Creek Fish wheel made for a stable and suitable sampling platform that allowed for the collection of important and interesting data on the 2009 sockeye salmon runs. For this reason the fishwheel will prove to be a success for years to come. The wheel was operated on a midnight to midnight 24 hour basis in order to more accurately display daily catch as recommended at the end of the 2008 fishwheel project. This worked well as the exact number of fish per day should have been able to be recorded. Unfortunately on more than one occasion it was observed that sockeye were jumping out of the live bins and into the river avoiding data entry. The other recommendation of relocating the wheel was also followed, as a step to avoid data tampering and down time incurred from vandalism. This worked very well as there was no sign on the fishwheel or the beach that anyone had been near the wheel other than that of the technicians working on it.

This was the first year the construction of the fishwheel, basically, started from scratch other than the pontoons and uprights all other pieces had to be assembled from memory. This caused some delays in the construction as photos and memories had to

be searched to make sure all parts were assembled properly. Past knowledge of the wheel was vital and integral to this construction.

In circumstances similar to last year the fishwheel saw some unexpected problems as the fast drops in water level which caused wheel stoppages due to grounding, forcing the crew to reposition the wheel further out into the river as water levels continued to drop all summer. The longest stop in time was caused by the failure of an older slider that was reused form the year previously. This stoppage prevented the wheel from operating for two days.

Figure 23. Fishwheel collected sockeye ready for sampling.

The ability of the fishwheel, at this new location, to catch fish of all sizes (see Figure 17), and species, (see Figure 13) and serve as a stable and suitable sampling platform displays the capability and usefulness of this tool for the future development of the Northern Shuswap role in providing data and developing capacity for a future in the collaborative management of Fraser River salmon stocks and ultimately the shared decision making in the management activities pertaining to the salmon that return to the traditional territories of the Northern Secwepemc.

The start date of the fishwheel did not occur earlier in July, despite the recommendation made from the year previous. However, as it turned out the 2009 sockeye returns were later in timing, this year than that of last year, which is evident by the 2009 NSTC Churn Creek Fishwheel catch Figures for the first week of operation, see Figure 19. Despite

this the recommendation remains to start the fishwheel up earlier in the coming years in hopes to gain more information on other stocks (Early Stuart) and the chinook runs that migrate past the fishwheel site. Last year proved that a chinook tagged and sampled can turn up in NStQ territory in the chinook spawning grounds as a tag was recovered.

Along with the possibility of an earlier start it is recommended that the wheel be left fishing later into the season in attempt to catch coho. In 2009, the fishwheel was left on the water until October 20th, in attempts to catch some coho, proving the ability of the wheel to have a long standing activity time. It should be mentioned that this small side project was implemented to attempt the capture, radio tagging and tracking of coho salmon on their way up the Fraser. During this sampling period, September 21st till the 25th, 2009 only four days were sampled as the first day involved repositioning the wheel and prepping the wheel for sampling. The outcome of the four days of sampling was the capture and release of over 900 pink salmon. This provided the NSTC fishery program with the unique opportunity to sample the roe and meat of the pinks for quality; twenty pink salmon, ten male and ten female, were shipped to the Siska fish plant for quality assessment.

Figure 24. NSTC fisheries technician releasing one of many pink salmon.

On Sept 23rd, 372 pink salmon were live captured in 24 hours; demonstrating the capacity of the fishwheel itself and while no coho had been captured by the third day

training objectives were realized. The NSTC biologist in training reviewed the proper method for radio tagging a salmon with the NSTC technicians by putting a radio tag in a pink salmon and releasing it back into the live well. Once the fish was secured in the live well, the crew learned how to set up and use the NSTC SRX_400 telemetry receiver. In addition, to better understand the tracking process, the boat was taken down river and the crew was able to learn how the sound of the signal changes as the receiver moves closer to the antenna in the fish.

It should be mentioned that during last minutes on the last day of sampling a silver bright coho was live captured two minutes prior to leaving to deliver the sample pinks to Siska. This coho was left in the live well with the intention of properly recording and tagging the fish upon return to the wheel. Unfortunately, when the crew returned the coho had escaped from the live well.

Throughout the 2009 project season, the NSTC technicians were diligent in the recording the fork length of each sockeye sampled. This recorded length data may go a long way in helping understand the NSTC fishwheel's ability to sample an adequate representation of the run(s). Size selectivity is cause for concern further down river at the Mission fishwheel sites where it is assumed the wheels are capturing only the smaller fish as the larger ones bypass it by using the deeper waters. This problem was indicated in LGL's report on the 2008 Mission Fishwheel project (Smith 2008). The river structure at the NSTC fishwheel site is different from that of the Mission location as the river in this area is narrow and very fast flowing in the center suggesting that the majority of the salmon may travel closer to shoreline; and thus allowing for a better representation of size class as illustrated in Figure 16.

The tracking of the fork length provided two interesting possible findings. First, graphing the average daily fork length (Figure 15), displays a potential representation of the migration of fish of similar size, for example larger males swim with larger females. This could also symbolize the migration of different stocks on different weeks; however, to verify this DNA analysis of samples collected would have to be done. The second is the decrease in fish size as the migration ran longer into the season. This was observed in 2008 as well. This could just be a coincidence but may warrant a focused study in years to come as more information is collected.

The CPUE of the fishwheel for 2009 was calculated on a daily basis to give a maximum CPUE of 2.96 and a minimum of zero, due to no fish being caught, as seen in Figure 17. Taking this CPUE and comparing it to that of the Jejeba7 site is useful in the ability to see similarities in the pulses of fish as they migrate. The comparison to the Jejeba7 traditional sites CPUE was supposed to demonstrate a correlation between that of the traditional fishing method and the fishwheel. Unfortunately there are a couple factors that do not permit for a strong enough correlation to be formed to suggest a true similarity at this time. It is only due to having attempted the comparisons of these sites that has allowed for the understandings of the differences between these methods. If a correlation is to be attempted in the coming years a few things must be done first. Due to the difference in style of fishing, the full 24 hour run time of the fishwheel compared to the six hour targeted night fishery of the dipnet, the standardized dipnet fishing must continue with record of the times fished and number of fish caught. With this the fishwheel should have a process in place to monitor when fish are caught and time stamp each individual fish. This can be accomplished by installing a DVR, with a

camera watching each slider, to record caught fish. This will give us the needed information to compare the two sites at the hours they are being monitored. The reason for doing this is to solve the problem of spreading the catch of the fish wheel over the full 24 hour run time. This will better represent the catch at the peak periods of salmon migration, or time that is dip netted. Another improvement would be to have the dip net site fished seven days a week so as to keep a better track of pulses and avoid gaps in the data that reduce the ability to run a correlation. If a true correlation is requested the bias generated by distance and different waters / runs can be addressed by attempting to find a dip net site closer to the fishwheel on the main stem of the Fraser River. This would make for a full comparison as all the salmon stocks being caught in the fishwheel is available to the dip netter. The current location only sees some of the fish the fishwheel is catching as some stocks do not migrate past the Jejeba7 site. The reason for attempting a better comparison can be seen in Figure 18 as the gaps in data and differences in CPUE can be seen clearly.

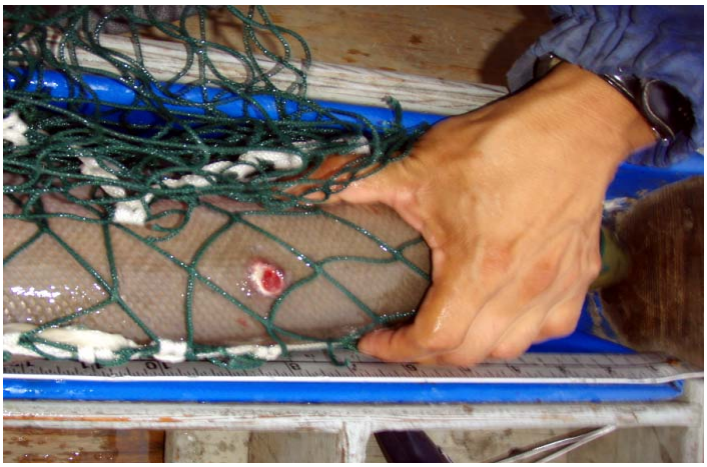

Figure 25. Sockeye salmon having a lamprey type scar.

Figure 26 Sockeye salmon with a heat scar.

Part of the sampling process was to judge the physical condition of the salmon being caught by scale loss and scarring. To do this a value between one and four is given to fish depending on the percent of scales missing and extent of scarring the fish had endured during its migration. Condition Code Key: 1) Fish in good shape, 2) Mild 10-20% descaling / few small scars, 3) Moderate 20-50%descaling /some large scars, 4) Severe 50-100% descaling / large portions of body scared. Also noted was the type of scar when it was possible to determine the cause. Scars that appeared circular and deep cut into the flesh of the fish were considered lamprey scars or LR, seen in Figure 25. White scaring as seen in Figure 26 were considered heat scars, large gash like scars were categorized as scarring, Figure 26 and gill net scars, seen in Figure 28, were called gillnet scars or GN.

Figure 27. Large general scaring to the tail fin and underside of a sockeye salmon.

Figure 28. Gillnet marks on a female sockeye salmon.

The importance of these gill net marks was not from their presence, but of the subsequent absence, for the period of August 13th to the 25th. This period of time seems to coincide with the sockeye closure and reduced hours of fishing in the lower river sockeye net fisheries downstream of the fishwheel site, by allowing for a fourteen day time delay for migration, calculated on a 30km/day migration estimate set by the Fraser River Aboriginal Fisheries Secretariat (FRAFS) in the salmon migrations maps (appendix 1), to adjust for upstream migration. The variation in scarring after the main reduction in hours could be from several sources and a full study would need to be run to understand these sources. It is suggested by Bernard 1999, and Mäkinen 2000 that after a fish has encountered a net or is handled that fish is subject to a 4 to 30 day delay in further upstream migration. The salmon that are interrupted by drift and gill nets will experience this “downstream” migration due to the stress endured from their escape (Mäkinen 2000). Figures 20 is the graph of the gill net scarring day to day as a percent of the catch and Figure 21 displays the similarities found between the hours fished south of Sawmill Creek (Department of Fisheries and Oceans) and the percent scarring found on fish caught in the fish wheel by week. It is not suggested that the fishing hours alone are responsible for these similarities as further information and study would be required and other factors such as net type and targeted species would need to be studied. The lower section of river, south of sawmill, was selected due to the almost complete use of a net fishery in this portion of the river. It is not suggested that it is the effect of this section alone that causes the scaring in the sockeye. As this too would need more information than what was gathered in this project to study properly. The data gathered on the scars present on the fish from the fishwheel is limited in its

predictive value and can only be used to show the presence of scaring in the salmon and the percentage of daily catch that is scarred.

This project's main goal is to increase the Northern Secwepemc role in the aid to management of the salmon stocks that the people depend on, migrate through and spawn within the NStQ traditional territories. It has been suggested both by (Healey 2009 and Robards 2007) that if the salmon, the fisheries and the cultures that depend on both are to ever become viable again new management policies and practices will be needed. Both papers suggest a switch to a co-management where the people that depend on the resources all have a shared responsibility in the stocks future strength. This links to a "back yard" type policy where those that house the habitat, for any stage of the salmon's life cycle, have a shared role in the protection and development of that stocks to its fullest potential so to provide opportunities for the people, salmon and culture to thrive for future generations. This type of management would allow for the conservation of the multiple species of salmon and at the same time preserve the traditions and rights of each community and its people that depend on the salmon the most.

Recommendations

The following is a list of the recommendations for future projects:

- Manufacture and install live bin covers to prevent fish from escaping. These covers should incorporate a funnel type system that would safely catch fish and reduce some stress of capture.
- Prior to the spring melt install anchors at different water levels. As water levels drop the fishwheel can be pushed out faster and easier, thus reducing down time.
- Incorporate lighting and a charging station on the fish wheel to provide adequate light for the operation of the fishwheel at night.
- Bilge pumps that can be hooked up to the lighting system to pump water out of the pontoons, would be an improvement of convenience.
- Develop an onsite dip net fish site that is close to the wheel and monitor the wheel catch and dip net catch during the same time frame to ensure the best possible comparison for CPUE. This may be an alternative to the Jejeba7 site.
- If retaining the Jejeba7 site as a standardized fishery then expand the Jejeba7 standardized dip net fishery to a seven day a week fishing schedule. With this record exact start and stop times along with date to later be compared to the same time fished on the fishwheel if crews are present to monitor catch for same period of time.
- Better recording methods for scarring of the salmon that are caught, either by photo or description.

- Have all the DNA samples that are collected from past and future years analysed and compare it to daily fork length and other biophysical data along with run timing.
- Following up with the Ministry of Environment to see about developing a procedure for sampling White sturgeon and the loan of a pit tag reader in order to perhaps identify already tagged sturgeon.
- Prior to the start up of sampling order an adequate number of T-Bar tags (with NSTC contact information) and a ready supply of DNA vials, all labelled and filled with ethanol for a more comprehensive sample.

Discuss with Dave Patterson the possibility of conducting stress related tests on sockeye caught at the fishwheel throughout the season to look at the levels of stress the salmon are enduring throughout the season.

Summary

The successful completion of another season of the NSTC fishwheel study illustrates the excellent potential of this fishwheel project in becoming a crucial tool in providing information on the in season salmon stocks of the upper Fraser River. This year's project success was due to a dedicated team of technicians and management. With the season over the fishwheel completed its five main goals and showed the ability to exceed expectations during the test run for coho. The five successful objectives of this year's fishwheel project were:

- To deploy and test the fishwheel at a new site one kilometre up river from the Gang Ranch Bridge in the mainstem Fraser River still within the southern portion of the Northern Secwepemc te Qelmucw traditional territories.

  This goal was very successfully completed with the capture of more sockeye than that of last year and the ability to limit down time by relocating the wheel helped to proved itself as a feasible study platform for in season sampling.
- To look at the comprehensive catch monitoring regime and implement changes suggested from the study done in 2008 for the Soda Creek Band traditional dipnet fishing site in order to determine the feasibility of utilizing a traditional fishery as an indicator of stock abundance.

  This objective was completed with the introduction of a technician dedicated to fishing the Jejeba7 traditional site at Soda Creek for six hours a day five days a week.

- To compare the fishwheel and standardized dipnet fishery Catch Per Unit Effort (CPUE) for similarities and differences.

  This goal was completed and does show that there are similarities in fish pulses that can be detected by the two methods of fishing but more research is needed to draw any conclusions from the results.

- The continuation for testing the feasibility of utilizing the fishwheel as a live capture and release platform for T-Bar tagging and the collection of biophysical information of sockeye, chinook and coho.

  This goal, in particular, was most successful. The fishwheel was able to capture sockeye as small as 34cm up to 71cm and other species consisting of: northern pike minnow, pink, coho, chinook and a single white sturgeon were captured. The collection of DNA and tagging of salmon worked well, with a total of 77 (12% of total catch) having T-Bar tags administered and 362 (52% of total catch) having a DNA samples collected, during the sample period.

- To increase the capacity of the Northern Shuswap Tribal Council Fisheries Program through training, employment, possible economic opportunities, project management and project tasks associated with the successful completion of this project.

With the testing of the pinks for quality, the operation of the fishwheel by two crews and the training of the technicians for swift water safety, boat operation and the proper procedures for sampling salmon and the use of radio tags/receiver this objective is well met and a resounding success.

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