Evaluation of Habitat Expansion Outcomes on Upper Terra Nova River, 2018

Freshwater-Alexander Bays
Ecosystem Corporation (FABEC)

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Project Report

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1.0 Introduction

Terra Nova River is the fourth largest river on the island of Newfoundland. Since the early 1900's various initiatives have been undertaken to expand accessible habitat and increase the river's Atlantic salmon population. Permanent infrastructure now includes fishways at Grant Falls (11 km from the ocean), Terra Nova River Falls (22 km from the ocean) and Mollyguajeck Falls (56 km from the ocean).

Between 1985 and 2002 the Terra Nova-Alexander Bay Development Association, in partnership with the Department of Fisheries and Oceans, managed a salmon enhancement program to establish a salmon population in the watershed above Mollyguajeck Falls, which until 1985 had been largely inaccessible for salmon migration. The newly opened habitat upstream from Mollyguajeck is estimated to represent sixty percent of the river's salmon production capacity above Grant Falls (Bourgeois, 2002). Initially the enhancement program involved the construction of a fishway around Mollyguajeck Falls, then the transfer of 1,412 spawners from the lower river to locations above Mollyguajeck, and finally from 1995 to 2002, the release of 2.5 million salmon fry incubated at a hatchery in Terra Nova in various locations of the upper watershed.

In 2015 the Freshwater-Alexander Bays Ecosystem Corporation obtained assistance to evaluate the outcomes of these efforts to establish a foothold from which to grow a natural population of salmon in the upper watershed. The project had two main goals:

(1) To assess the effectiveness of the Mollyguajeck fishway in accommodating the passage of salmon around Mollyguajeck falls.

(2) To determine the proportion of total salmon returns upstream of Grant Falls fishway that passed through Mollyguajeck to the upper watershed. This would provide an indicator of spawning escapement to the upper watershed relative to its spawning capacity and the resulting contribution to the growth of the river's overall salmon population.

The 2015 project was followed up by a similar project in in 2016, modifications to the Mollyguajeck fishway in 2017, and the 2018 project, which is addressed in this report.

2.0 Partners

FABEC would like to express our appreciation to the partners who made this project possible. We thank the Atlantic Salmon Conservation Foundation for its financial contribution, Terra Nova National Park for its donation of materials, equipment, and helicopter time, and DFO's Salmonids Section and Regional Headquarters, which provided various materials as well as professional expertise.

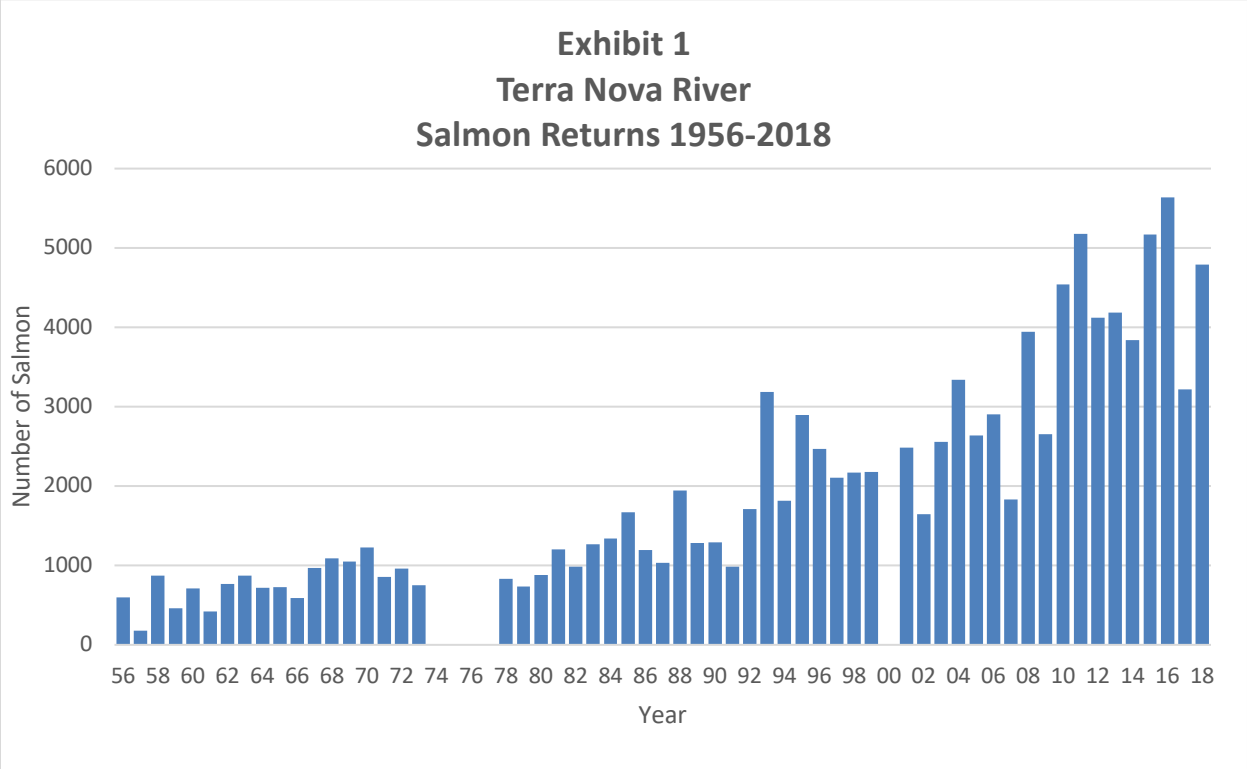
Especially we would like to acknowledge the major investment made by DFO in the design and construction of the permanent water diversion dam at Mollyguajeck Falls. If the 2018 results are any indication, this new infrastructure will certainly prove its worth in the years and decades to come.

3.0 Background

3.1 Terra Nova River Salmon Returns - 1956 to 2018

Exhibit 1 shows the history of Atlantic salmon returns through the lower Terra Nova River Fishway since 1956. It should be noted that these counts take place at Grant Falls located 11 kilometres from the ocean, therefore do not account for salmon that spawn in the lower section of the main river and in the Maccle's Brook tributary. As the graph shows, the stock has improved dramatically over the 52-year period.

Returns began a noticeable improvement in the years after the commercial salmon fishery closed in 1992. This period coincided with the early days of the Terra Nova River salmon enhancement program. As reflected in the graph, the average annual return from 1956 to 1991 was 952, then increased to 2,334 from 1992 to 2001, 3,123 from 2002 to 2011 and 4,421 from 2012 to 2018.



3.2 Mollyguajeck Fishway – 2015 to 2017

2015

FABEC's 2015 salmon count at Mollyguajeck Falls was the first to take place since 2001 when 329 salmon migrated through the fishway. DFO adjusted that number to 436 to account for salmon that had been removed in the lower river as brood stock for the hatchery in Terra Nova. The 2015 count was disappointing in that only 297 salmon migrated through the fishway, which was 32% lower than the adjusted number for 2001.

FABEC attributed the low return to the long dry summer and fall experienced in 2015. Water levels fell so low that there was insufficient flow in the fishway for salmon passage from mid-August to early October when the project ended. Of the 297 salmon, over 75% were counted before the middle of August. Between August 21 and October 2, only 17 salmon managed to get through the fishway.

This experience demonstrated a major deficiency with the Mollyguajeck fishway. During long periods without rain, waterflow was too low for salmon to swim through. The 2015 report correlated daily salmon counts to streamflow data at the Terra Nova River gauging station at Glovertown. This comparison showed that after measured streamflow dropped below about 16 or 17 m3/second, very few salmon migrated through Mollyguajeck.

FABEC's 2015 report concluded that the Mollyguajeck fishway was deficient in its ability to facilitate salmon passage during low water flow conditions. The report recommended that modifications be made to the fishway to increase water flow during dry periods.

2016

FABEC received funding for a follow-up project in 2016. Anticipating that the 2015 low-water experience might be repeated, 200 bags of sand were helicoptered to the site and deposited on the river bank at the fishway entrance. Again by mid-August water dropped to a level that impeded fish passage so the sandbags were used to build a dam to divert more water from the main river current into the fishway. This proved successful and kept water high enough for salmon passage. The final count by early October was 965, over three times the 2015 count.

During the 2016 project, DFO staff and a consulting team of engineers and hydrologists visited the site to assess the low water problem. They concluded that the best solution was to construct a permanent water diversion dam similar in design to FABEC'S makeshift dam.

2017

FABEC did not undertake a project at Mollyguajeck in 2017. Nevertheless this was an eventful year in that DFO decided to make the investment to construct a permanent diversion dam. This involved a cost of several hundred thousand dollars in design and engineering fees, contractor costs, helicopter charges, and DFO staff costs. The construction project went smoothly, aided by another autumn of very low water. In order to see if the new dam worked as expected and assess its impact on salmon returns, FABEC applied for funding for another salmon count in 2018.

Exhibits 2 and 3 on the following page shows photos of the diversion dam during and after construction.

Exhibit 2 – Diversion Dam Under Construction, September 2017

Exhibit 3 – Diversion Dam Completed

4.0 Project Description – 2018

The 2018 project got underway at the beginning of July with site preparations and collection of needed materials and supplies. This included a hike to Mollyguajeck to check on the condition of worker accommodations and the fish trap and take an inventory of needed supplies. Materials and equipment were helicoptered to the site on July 25. This included a new catwalk for getting across the fishway, a new outhouse and shower facility, employee belongings such as food and sleeping gear, materials for the fish trap and camp, and fuel for heaters, cook stoves, and generator.

Water levels at this time were too high to put the trap in place, so a fish fence was temporarily installed to hold salmon back until the trap could be installed. On August 7 staff and volunteers hiked back to the site and were able to put the fish trap in place. Monitoring operations began on August 9.

Project staff consisted of four people working in 2-person teams on 4-day rotations. Staff accessed the site by foot from an old logging road 5 kilometres away.

The project involved a daily count from August 9th to October 22nd. Over the 80-day period, 1,148 salmon were counted through the fishway, an increase of 19% from 2016 and almost four times the 2015 count. The new diversion dam made a huge difference. While overall river levels fell as low or lower as they had during the previous counts, the lowest depth recorded in the fish trap was 34.5 cm as compared to a low of zero cm in 2015 and 13.0 cm in 2016. There was not a day in 2018 when fish passage was impeded because of low water in the fishway.

5.0 Fishway Performance

Mollyguajeck is a rustic fishway, which unlike the river's two other fishways, was originally constructed without built infrastructure. Explosives were used to blast a channel through bedrock. Water from the main river above the falls flows into a natural channel lying below the falls. The fishway provided a complete route around the falls for salmon to navigate.

Exhibit 4 shows the location and flow direction of the fishway. The inflow channel receives water from the main river and then turns 90º towards the bottom of the falls. The square in the photo shows where the fish trap was installed. The channel flowing toward the bottom of the photo normally only contained water when flows were relatively high. However in 2018 after the diversion dam was in place, water flowed in this channel throughout the summer. The installation includes a fish fence across this stream to prevent salmon from bypassing the trap.

Exhibit 4 – Fishway Location and Water Flow Direction

The photo in Exhibit 5 below shows the water flow entering the fishway. In the background is the catwalk across the channel that provides staff access to the fish trap.

Exhibit 5 – Water Entering the Fishway

The photo in Exhibit 6 shows the fishway and Mollyguajeck Falls during very high water. The arrows show the flow direction toward the trap and back to the main river flow at the base of Mollyguajeck Falls.

Exhibit 6 – Water Flow Through the Fishway

When the fish trap was installed on August 8, water depth inside the trap measured 48 cm. By August 31 after 539 salmon had been counted through the trap, the depth measured 39 cm. After August 31 the water levels did not drop in significant increments.

On the day of the last count, October 22, after two days of heavy rain, the depth in the trap climbed to 68 cm. The photo in Exhibit 7 was taken on October 23. It shows the fish trap being deluged with stormwater, which made it impossible to safely access the trap.

Exhibit 7 – Fish Trap After Heavy Rainstorm

The table in Exhibit 8 and graphs in Exhibit 9 compare Terra Nova River streamflow data with depth measurements in the Mollyguajeck fish trap for the years 2015 (no diversion dam), 2016 (makeshift dam for part of season) and 2018 (after permanent dam installed).

For 2015 the exhibits show a strong relationship between river streamflow or discharge rates and water levels in the fishway. As discharge rates fell, water in the fishway fell at a proportionately similar rate. By August 23 when the discharge rate had fallen to 14.5 m3/sec, there was only 10 cm of water in the trap. Over the next 45 days, there were only four days when water was high enough for salmon to swim through.

A similar situation unfolded early in the 2016 project. As river discharge rates dropped off, water measurements in the trap fell proportionately. On August 12 sandbags were used to build a diversion wall. This was partially successful but water in the fishway continued to drop to a point where few salmon could get through. On August 20 the dam was extended farther out into the main current. The result was immediate and raised the level in the trap from 13 to 26 cm. Over the next day and a half 104 salmon passed through. Thereafter water levels were no longer a constraint.

Another count was undertaken in 2018, the year after DFO built the permanent diversion dam. As shown in Exhibit 9C, the proportional relationship between river flow and the trap water level changed significantly. Although streamflow fell to levels experienced in 2015, the water depth in the trap never fell below 34.5 cm.

EXHIBIT 8
Terra Nova River Streamflow Rate vs Depth Inside Mollyguajeck Fish Trap

	2015		2016		2018	
Week Ending	Avg. Streamflow (m3/sec)	Avg. Depth In Trap (cm)	Avg. Streamflow (m3/sec)	Avg. Depth In Trap (cm)	Avg. Streamflow (m3/sec)	Avg. Depth In Trap (cm)
02-Aug	16.9	30.0	24.8	26.0	n/a	n/a
09-Aug	20.6	25.0	18.8	20.0	n/a	n/a
16-Aug	18.1	18.0	13.9	15.5	21.5	45.0
23-Aug	14.8	10.0	9.6	22.0	14.6	41.5
30-Aug	10.9	7.0	10.1	30.0	11.9	39.5
06-Sep	9.4	1.0	13.5	42.0	9.6	39.0
13-Sep	7.0	0.0	19.1	44.0	7.8	35.0
20-Sep	9.4	2.0	21.5	42.0	7.9	37.7
27-Sep	9.0	7.0	22.6	41.0	8.2	38.0
04-Oct	7.3	3.0	29.8	n/a	7.8	38.5
11-Oct	n/a	n/a	n/a	n/a	7.4	40.5
18-Oct	n/a	n/a	n/a	n/a	9.3	43.0
22-Oct	n/a	n/a	n/a	n/a	22.0	70.0
AVERAGE	12.3	8.6	18.8	31.8	11.6	39.3
LO POINT	5.6	0.0	8.5	13.0	7.0	34.5
HI POINT	27.2	20.1	44.3	42.9	53.0	70.0

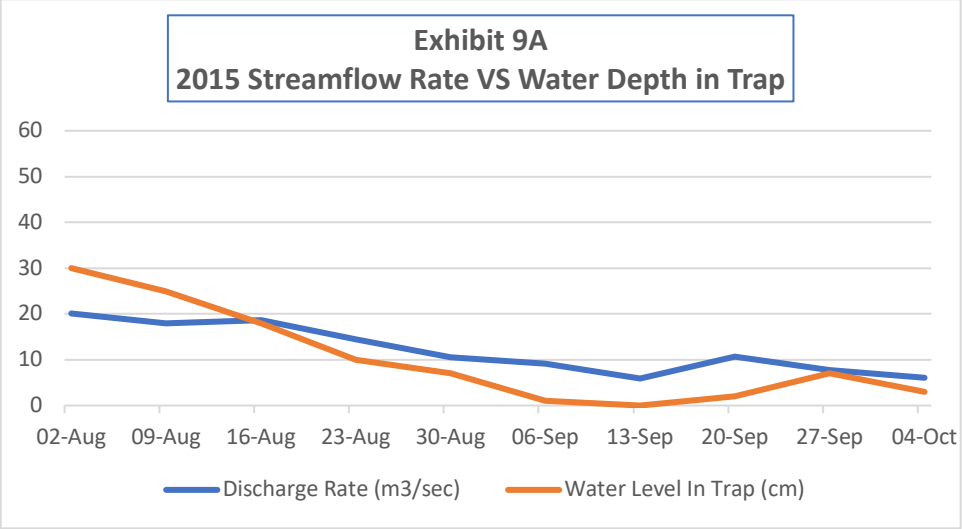


Exhibit 9A
2015 Streamflow Rate VS Water Depth in Trap
60
50
40
30
20
10
0
02-Aug
09-Aug
16-Aug
23-Aug
30-Aug
06-Sep
13-Sep
20-Sep
27-Sep
04-Oct
Discharge Rate (m3/sec)
Water Level In Trap (cm)

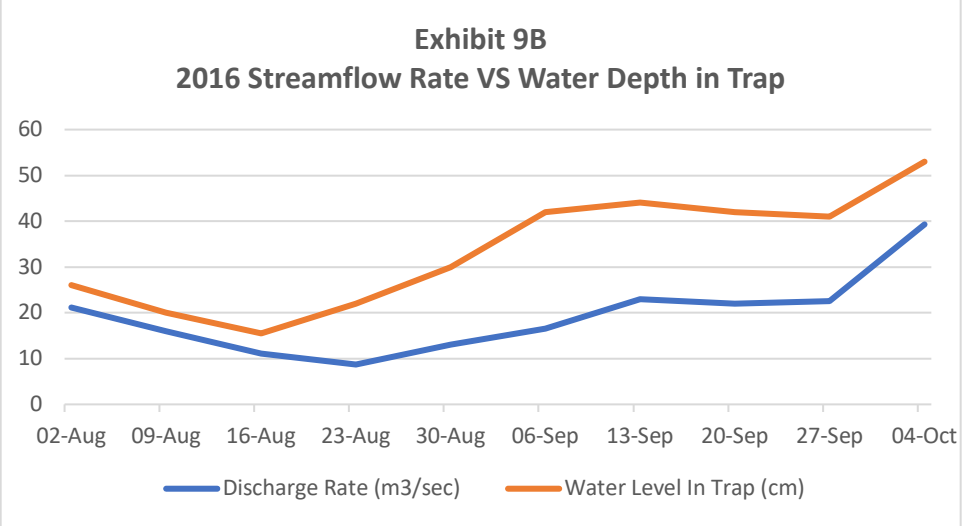


Exhibit 9B
2016 Streamflow Rate VS Water Depth in Trap
60
50
40
30
20
10
0
02-Aug
09-Aug
16-Aug
23-Aug
30-Aug
06-Sep
13-Sep
20-Sep
27-Sep
04-Oct
Discharge Rate (m3/sec)
Water Level In Trap (cm)

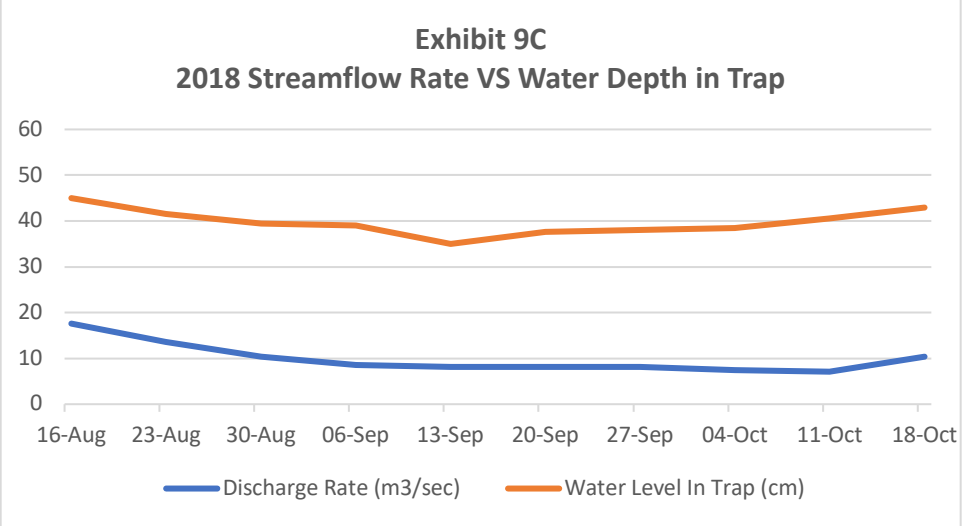


Exhibit 9C
2018 Streamflow Rate VS Water Depth in Trap
60
50
40
30
20
10
0
16-Aug
23-Aug
30-Aug
06-Sep
13-Sep
20-Sep
27-Sep
04-Oct
11-Oct
18-Oct
Discharge Rate (m3/sec)
Water Level In Trap (cm)

6.0 Assessment of Salmon Returns

Exhibit 10 shows 2018 weekly salmon returns at Mollyguajeck Falls compared to the previous counts. 2018's count of 1,148 spawners compared to 329 in 2001, 297 in 2015, and 965 in 2016. The table compares weekly salmon counts for each project with average weekly discharge rates at the Glovertown water station. Exhibit 11 shows the same information graphically. These comparisons display the nature of the relationship between river flow conditions and salmon movement through the Mollyguajeck fishway.

EXHIBIT 10
Average Streamflow Rates (m3/sec) VS Salmon Returns

	2001		2015		2016		2018	
Week Ending	Streamflow Rate	Salmon Returns	Streamflow Rate	Salmon Returns	Streamflow Rate	Salmon Returns	Streamflow Rate	Salmon Returns
02-Aug	23.8	7	16.7	8	24.8	137		
09-Aug	18.7	5	20.6	93	18.0	150		
16-Aug	12.4	0	18.1	160	13.2	29	21.5	205
23-Aug	8.6	0	14.8	22	9.3	121	14.6	173
30-Aug	9.6	0	10.9	0	10.7	183	11.9	150
06-Sep	10.9	0	9.4	3	14.0	103	9.6	155
13-Sep	8.8	0	7.0	0	20.1	109	7.8	129
20-Sep	15.1	56	9.4	7	21.3	60	7.9	117
27-Sep	23.0	58	9.0	0	22.7	62	8.2	44
04-Oct	30.6	14	7.3	4	33.3	11	7.8	55
11-Oct	27.6	97					7.4	60
18-Oct	22.3	87					9.3	14
25-Oct	18.2	4					22.0	46
Avg/Total	17.5	328	11.9	297	18.8	965	11.4	1148

The 2001 count took place over a period of 90 days from July 30 to October 27. Exhibit 11A shows the correlation of salmon returns through Mollyguajeck to river discharge rates. Returns were zero for a period of 40 days during which time average river streamflow was 10.7 m3/second. After mid-September streamflow began to rise and over the next 36 days averaged 24.0 m3/second. During this period 313 salmon passed through the fishway for an average of 8.7 per day.

In 2015 the Mollyguajeck count lasted for 70 days. As reflected in Exhibits 10 and 11B, 281 salmon passed through the fishway in the first 21 days for an average of 13.4 per day. This correlated to an average discharge rate of 19.0 m3/second at the Glovertown water station. Over the remaining 7 weeks of the project, average streamflow fell to 9.2 m3/second and only 21 salmon, or an average 0.4 per day, migrated through the fishway.

The 2016 project operated for 69 days and saw a total of 965 salmon migrate past Mollyguajeck for an average of 14.0 salmon per day. This corresponded to an average streamflow of 12.6 m3/second. While river levels were somewhat higher in 2016, a significant factor that summer was FABEC's installation of a temporary dam using sandbags and plywood to divert more water into the fishway as river levels fell. Our first attempt on August 12 made only a slight difference. But on August 20 the dam was extended farther out into the main current and succeeded in rising the water in the fishway by 10 cm. Over the next day and a half, 104 salmon were released from the counting trap. The following week after a major rainstorm, 143 salmon were released from the trap in a single day.

With data provided from the 2015 and 2016 projects, DFO made a decision to build a permanent concrete diversion dam at the entrance to the fishway. Construction was completed in October 2017. FABEC's 2018 project lasted for 75 days over which time the discharge rate was less than 20 m3/second for 69 days and average was 11.4 m3/second, which was comparable to conditions in 2015. In the face of these dry conditions, the new dam did its job and water flow in the fishway never became a problem. Over the 75-day period 1,148 salmon were released from the fish trap for an average of 15.3 salmon per day.

Prior to the construction of the diversion dam, the Mollyguajeck fishway's effectiveness in allowing salmon passage declined after discharge rates dropped much below 20 m3/second. While this might not have been a problem in years with only a short rainless period, in ten of the last 24 years discharge rates remained below 20 m3/second for more than forty days during the main salmon run. The driest years experienced between August 1 and October 31 included 2001 (57 days below 20 m3/second), 2002 (94 days), 2003 (68 days), 2015 (86 days), 2017 (92 days) and 2018 (69 days).

Based on knowledge gained from the 2001, 2015, and 2016 salmon counts, it is a fairly safe conclusion that salmon were held back from reaching the upper watershed in low rainfall years because of low water in Mollyguajeck fishway.

While 2018 was another dry year, a record 1,148 Atlantic salmon were counted through the fishway. This represented almost a quarter of the 4,794 salmon counted through the lower fishway at Grant Falls. There is no doubt this success was because of the new diversion dam. Average streamflow in 2018 was slightly lower than 2015, when for a significant period the fishway was all but dry. Water depth in the trap in 2018 never fell below 34.5 cm.

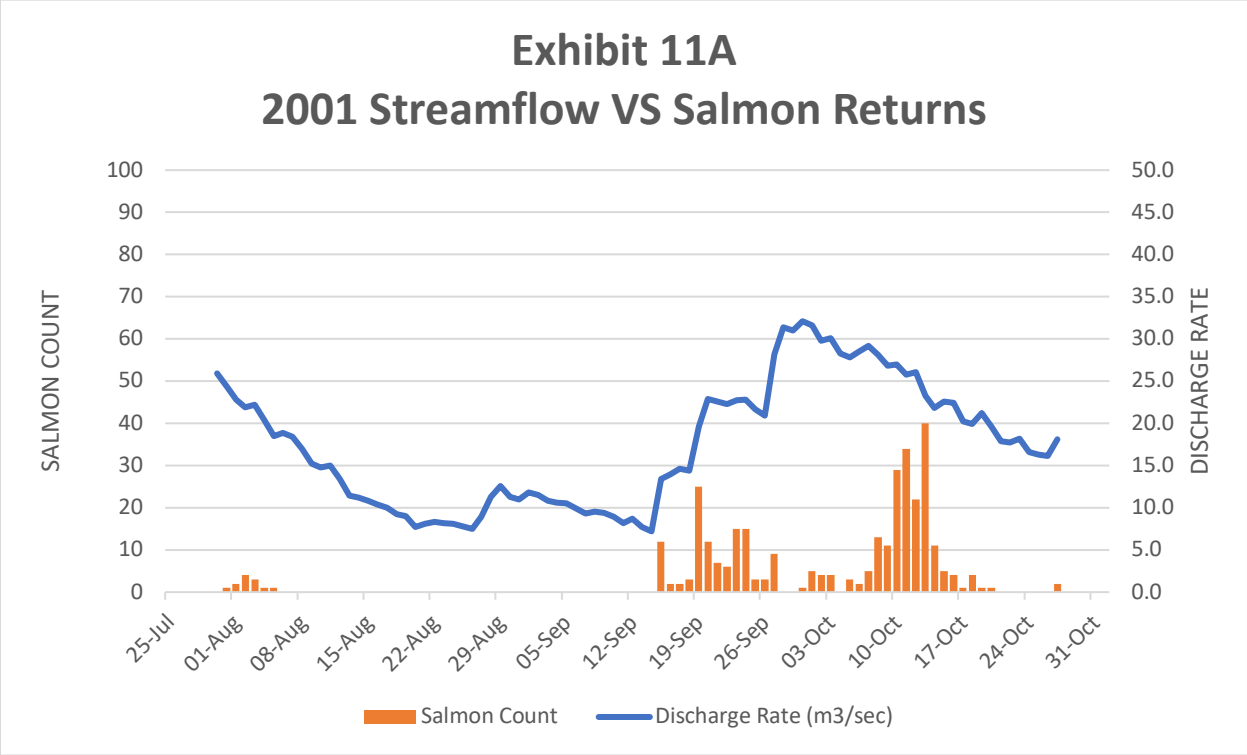


Exhibit 11A
2001 Streamflow VS Salmon Returns
SALMON COUNT
DISCHARGE RATE
100
90
80
70
60
50
40
30
20
10
0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
25-Jul
01-Aug
08-Aug
15-Aug
22-Aug
29-Aug
05-Sep
12-Sep
19-Sep
26-Sep
03-Oct
10-Oct
17-Oct
24-Oct
31-Oct
Salmon Count
Discharge Rate (m3/sec)

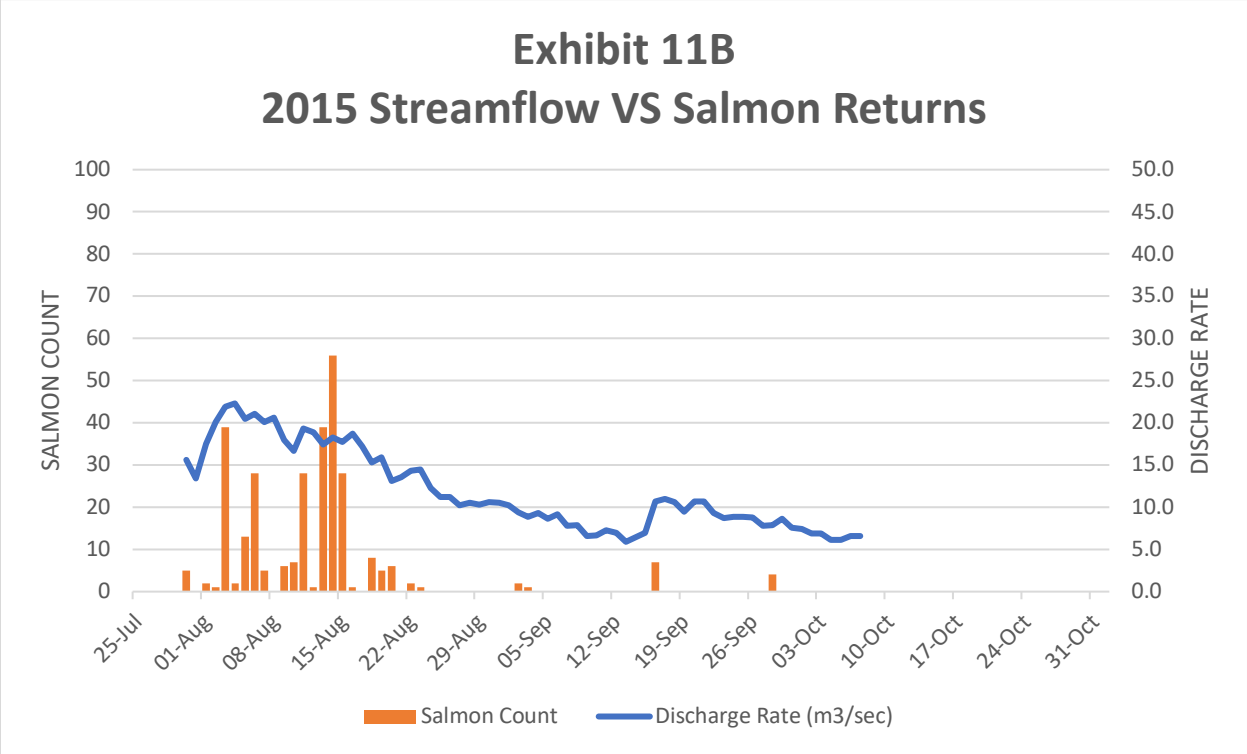


Exhibit 11B
2015 Streamflow VS Salmon Returns
SALMON COUNT
DISCHARGE RATE
100
90
80
70
60
50
40
30
20
10
0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
25-Jul
01-Aug
08-Aug
15-Aug
22-Aug
29-Aug
05-Sep
12-Sep
19-Sep
26-Sep
03-Oct
10-Oct
17-Oct
24-Oct
31-Oct
Salmon Count
Discharge Rate (m3/sec)

Exhibit 11C
2016 Streamflow VS Salmon Returns

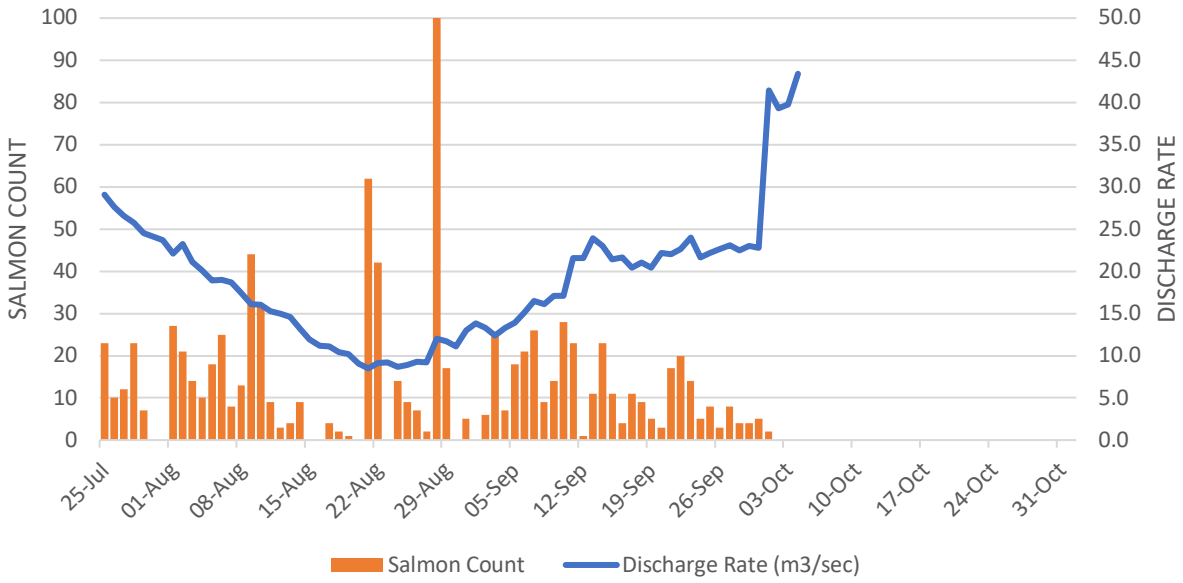
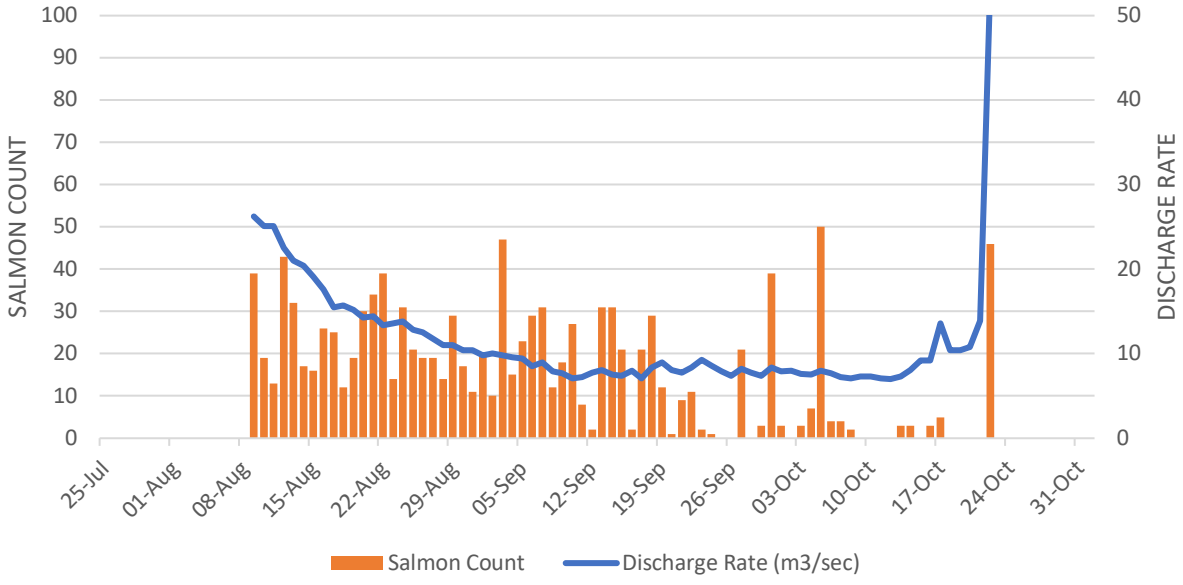


Exhibit 11D
2018 Streamflow VS Salmon Returns



The Mollyguajeck counts of 965 in 2016 and 1,148 in 2018 provide compelling evidence that the program to establish a spawning population in the upper watershed was successful. In 2018 almost a quarter of the 4,794 salmon that migrated through the lower fishway continued their journey to the upper watershed. Along with the Terra Nova River's strong conservation program, FABEC feels that the enhancement program has been a significant factor in the river's population growth since 1985. The 2018 count of 4,784 salmon was 2.8 times higher than the 1985 count of 1,669 and 1.9 times higher than the 2001 count of 2,481.

It is noteworthy that this growth was achieved despite the operational deficiency of Mollyguajeck fishway during extensive periods of low water. Based on our correlation of streamflow data with fishway water levels, it can be argued that there were a number of years when many - probably most - of the salmon destined for the upper watershed became stranded below Mollyguajeck Falls.

7.0 Stock Conditions Compared to Conservation Requirements

As shown in Exhibit 12, in 2018 the river as a whole achieved 53.6% of its spawning capacity of 8,937 salmon. With the higher returns in 2015 and 2016, conservation levels reached 57.8% and 63.1% respectively. This more than doubled the conservation level of 27.8% achieved in 2001. It should be noted that 2017 was a less productive year when the count of 3,215 comprised not much more than a third of the conservation requirement. In general, however, the size of the population has increased enormously against historic levels.

Exhibit 12
Salmon Escapement Compared to Conservation Requirements

		From Grant Falls to Mollyguajeck	Above Mollyguajeck	Entire River above Grant Falls
Conservation Requirement*		3,575	5,362	8,937
2001	Spawning Escapement	2,152	329	2,481
	Conservation Level Achieved	60.2%	6.1%	27.8%
2015	Spawning Escapement	4,871	297	5,168
	Conservation Level Achieved	136.3%	5.5%	57.8%
2016	Spawning Escapement	4,670	965	5,636
	Conservation Level Achieved	130.6%	18.0%	63.1%
2018	Spawning Escapement	3,646	1,148	4,794
	Conservation Level Achieved	102.0%	21.4%	53.6%

* (C. E. Bourgeois, J. Murray and G. Clarke, A *review of Atlantic salmon enhancement activities on Terra Nova River*, 2002)

This improvement has taken place despite the evidence that in years of low rainfall large numbers of salmon were stranded below Mollyguajeck Falls. Now that the fishway is no longer a constraint, all else being equal, there is room for optimism that the river's population will grow toward its spawning potential more quickly in future years.

Exhibit 12 compares escapement to conservation requirements in the two sections of Terra Nova River lying above Grant Falls – (1) from Grant Falls to Mollyguajeck and (2) above Mollyguajeck. It is useful to point out several aspects related to these numbers.

The first point is that in 2015, when a very healthy 5,168 fish were counted at the lower fishway, only 297 of these managed to pass Mollyguajeck representing a conservation achievement of only 5.5% in the upper watershed. In contrast the lower river achieved 136.3%. This is noteworthy due to the imbalance in distribution of spawning activity that year and can be attributed to the fact that salmon were prevented from moving further upstream by lack of water in the fishway. In 2016 escapement in the river as a whole exceeded the conservation requirement by 30.6% showing that the distribution of spawners was disproportionately heavy in the lower river compared to above Mollyguajeck.

The 2018 results provide an encouraging contrast to 2015. While total river returns were less, escapement past Mollyguajeck was almost four times higher than 2015. Whereas the upper watershed achieved only 5.5% of conservation in 2015, this quadrupled to 21.4% in 2018. Meanwhile the conservation level in the lower river dropped from 136.3% in 2015 to 102.0% in 2018, representing a closer balance in spawning escapement between the two sections of river.

While 2018 returns past Mollyguajeck were encouraging, the1,148 salmon represent less than a quarter of the upper watershed's spawning capacity. Based on 2018 numbers, the river as a whole above Grant Falls is achieving slightly better than half of conservation requirements. Nevertheless, the improvements to Mollyguajeck fishway should facilitate more salmon migration to spawning sites in the upper watershed. This makes FABEC optimistic that overall numbers will continue to improve.

8.0 Conclusion and Recommendation

The 2018 project was encouraging in terms of spawner returns to the upper watershed. With the new diversion dam, low water in the fishway was not an impediment to salmon passage. Until now the fishway was a weak link in the Terra Nova salmon enhancement initiative. Low water levels in the fishway are no longer expected to be a constraint.

Nevertheless with the climate changing rapidly, low water in the river generally appears to be an issue of rising concern.

<u>Recommendation</u>

Terra Nova River is Class 2 (2-fish retention limit) for a small portion of the river and Class 0 (catch and release only) for all of the remainder. While there is reason for optimism

that escapement to the upper watershed will increase, the upper watershed remains less than 25% seeded while the river as a whole remains less than 60% seeded.

FABEC recommends no changes to the current management plan for the river. It is our opinion there is no need for any increase or decrease to conservation limits. The status quo should be maintained for all areas that are designated as Class 2 and all areas that are designated as Class 0.

APPENDIX

MOLLYGUAJECK FISHWAY LOGSHEET - 2018

AUGUST 9 to OCTOBER 22 (75 DAYS)

2018 Mollyguajeck Fishway Logsheet

		Environmental Conditions							Streamflow	Fish Count			
		Temperature (°C)				Water Depth			Glovertown				
		Air		Water		In Trap (cm)		Rain	Water Stn	Daily			Cumu-
Day	Date	Lo	Hi	Lo	Hi	Lo	Hi	(mm)	(m3/sec)	≤ 63 cm	> 63 cm	Total	lative
1	09-Aug	n/a	n/a	n/a	n/a	n/a	n/a	0	26.2	38	1	39	39
2	10-Aug	n/a	n/a	n/a	n/a	n/a	n/a	0.6	25.1	18	1	19	58
3	11-Aug	n/a	n/a	n/a	n/a	n/a	n/a	0	25.1	12	1	13	71
4	12-Aug	25.0	28.0	22.0	23.0	48.0	48.0	0.0	22.5	40	3	43	114
5	13-Aug	14.0	28.0	22.0	23.0	43.0	48.0	0.0	21.0	32	0	32	146
6	14-Aug	18.0	30.0	22.0	24.0	43.0	43.0	0.0	20.4	17	0	17	163
7	15-Aug	18.0	28.0	24.0	24.0	44.0	44.0	0.0	19.1	16	0	16	179
8	16-Aug	15.0	25.0	21.5	23.0	44.5	46.0	10.8	17.6	26	0	26	205
9	17-Aug	12.0	25.0	20.5	21.0	44.5	45.0	0.0	15.5	25	0	25	230
10	18-Aug	12.0	25.0	20.5	21.0	43.5	44.0	0.7	15.7	12	0	12	242
11	19-Aug	13.0	25.0	21.0	21.0	42.0	42.5	0.6	15.2	19	0	19	261
12	20-Aug	21.0	26.0	21.0	23.0	44.0	44.0	0.0	14.3	30	0	30	291
13	21-Aug	14.0	29.0	20.0	23.0	42.5	44.0	0.0	14.4	32	2	34	325
14	22-Aug	17.0	25.0	20.0	21.0	42.0	42.0	0.0	13.4	38	1	39	364
15	23-Aug	21.0	26.0	21.0	22.5	42.0	41.5	0.0	13.6	12	2	14	378
16	24-Aug	15.0	28.0	23.0	23.0	43.0	43.5	0.0	13.8	30	1	31	409
17	25-Aug	20.0	27.0	21.5	22.0	41.0	42.0	0.0	12.8	20	1	21	430
18	26-Aug	20.0	33.0	21.0	23.0	40.5	41.0	0.0	12.5	19	0	19	449
19	27-Aug	17.0	26.0	21.0	22.0	41.0	41.0	0.0	11.8	19	0	19	468
20	28-Aug	27.0	29.0	23.0	24.0	38.5	40.0	0.0	11.0	14	0	14	482
21	29-Aug	16.0	19.0	22.0	23.0	39.0	39.0	0.0	11.0	28	1	29	511
22	30-Aug	10.0	16.0	19.0	20.0	39.0	40.0	18.5	10.4	17	0	17	528
23	31-Aug	12.0	16.0	19.0	19.0	39.0	39.0	1.2	10.4	11	0	11	539
24	01-Sep	21.0	25.0	21.0	21.0	39.0	40.5	0.0	9.8	19	1	20	559
25	02-Sep	14.0	23.0	20.0	21.0	38.5	39.5	0.0	10.0	10	0	10	569
26	03-Sep	16.0	31.0	25.0	31.0	39.0	39.0	0.0	9.8	44	3	47	616
27	04-Sep	17.0	19.0	29.0	29.0	38.0	39.5	0.0	9.6	13	2	15	631
28	05-Sep	19.0	21.0	n/a	n/a	39.0	39.0	0.0	9.4	22	1	23	654
29	06-Sep	10.0	23.0	n/a	n/a	37.5	38.5	0.0	8.5	27	2	29	683
30	07-Sep	13.0	23.0	n/a	n/a	35.5	39.5	0.0	9.0	27	4	31	714
31	08-Sep	10.0	16.0	n/a	n/a	37.0	37.0	0.8	7.9	11	1	12	726
32	09-Sep	14.0	19.0	16.0	17.0	36.0	36.0	0.0	7.7	18	0	18	744
33	10-Sep	6.0	25.0	15.0	17.0	36.5	37.0	0.6	7.1	26	1	27	771
34	11-Sep	9.0	18.0	16.0	17.0	36.0	37.0	0.0	7.2	8	0	8	779
35	12-Sep	15.0	15	16.0	16	35.5	36.5	22.8	7.8	2	0	2	781

2018 Mollyguajeck Fishway Logsheet (continued)

		Environmental Conditions							Streamflow	Salmon Count			
		Temperature (°C)				Water Depth			Glovertown	Daily			Cumu
		Air		Water		In Trap (cm)		Rain	Water Stn				
Day	Date	Lo	Hi	Lo	Hi	Lo	Hi	(mm)	(m3/sec)	≤ 63 cm	> 63 cm	Total	lative
36	13-Sep	21.0	32.0	22.3	(mm)	35.0	35.0	1.2	8.1	25	6	31	812
37	14-Sep	10.0	20.1	22.2	21.2	36.0	35.5	0.0	7.5	28	3	31	843
38	15-Sep	15.0	28.0	19.2	22.2	34.5	36.0	0.0	7.4	21	0	21	864
39	16-Sep	12.1	12.7	20.1	20.6	34.5	35.0	3.4	8.0	2	0	2	866
40	17-Sep	11.3	13.3	19.4	19.8	36.5	37.0	11.4	7.1	21	0	21	887
41	18-Sep	4.2	5.4	16.5	17.3	36.5	37.0	13.1	8.4	28	1	29	916
42	19-Sep	3.2	13.0	16.4	17.2	37.0	37.0	0.0	9.0	12	0	12	928
43	20-Sep	5.5	9.0	16.2	16.8	37.5	38.0	0.0	8.1	1	0	1	929
44	21-Sep	18.0	18.5	18.0	18.5	37.0	37.0	0.6	7.8	7	2	9	938
45	22-Sep	7.4	14.0	15.2	16.5	37.0	37.0	5.9	8.4	10	1	11	949
46	23-Sep	2.3	20.6	13.7	15.3	37.0	37.5	0.6	9.3	2	0	2	951
47	24-Sep	3.3	21.5	13.2	13.5	36.5	36.5	0.0	8.6	1	0	1	952
48	25-Sep	5.4	11.6	14.2	14.8	37.0	37.0	0.0	7.9	0	0	0	952
49	26-Sep	11.4	18.0	13.1	14.3	36.5	37.0	0.0	7.4	0	0	0	952
50	27-Sep	15.5	17.0	13.8	14.0	38.0	38.0	1.5	8.2	21	0	21	973
51	28-Sep	5.4	12.0	13.2	13.2	37.5	38.0	8.8	7.8	0	0	0	973
52	29-Sep	15.3	16.4	14.4	14.5	37.0	37.0	1.3	7.4	3	0	3	976
53	30-Sep	6.0	19.4	13.5	15.1	37.0	37.0	0.0	8.4	37	2	39	1015
54	01-Oct	2.1	13.6	12.6	14.2	36.0	36.0	0.0	7.9	3	0	3	1018
55	02-Oct	-3.0	10.5	12.4	12.5	36.0	37.0	0.0	8.0	0	0	0	1018
56	03-Oct	13.5	18.0	9.4	12.3	38.0	38.0	0.0	7.6	3	0	3	1021
57	04-Oct	11.0	15.2	12.4	13.3	38.0	39.0	0.0	7.5	7	0	7	1028
58	05-Oct	9.5	16.2	14.2	14.6	39.0	40.0	0.0	8.0	46	4	50	1078
59	06-Oct	2.0	12.1	12.5	13.4	40.0	40.0	0.0	7.7	4	0	4	1082
60	07-Oct	9.2	13.3	13.6	14.5	36.5	37.0	0.0	7.2	0	4	4	1086
61	08-Oct	-3.0	14.0	12.1	14.3	37.5	37.5	0.0	7.1	1	1	2	1088
62	09-Oct	3.0	9.0	12.2	12.3	37.5	37.5	2.0	7.3	0	0	0	1088
63	10-Oct	6.0	7.4	12.0	12.3	37.5	37.5	1.3	7.3	0	0	0	1088
64	11-Oct	2.2	5.5	11.8	12.3	40.0	40.5	0.6	7.1	0	0	0	1088
65	12-Oct	2.6	5.8	11.4	11.6	40.0	40.0	9.9	7.0	0	0	0	1088
66	13-Oct	8.4	8.5	11.3	11.3	41.5	42.0	4.9	7.3	1	2	3	1091
67	14-Oct	5.0	6.0	11.2	11.2	43.0	43.0	2.0	8.1	3	0	3	1094
68	15-Oct	9.4	11.4	9.4	9.4	39.5	39.5	9.0	9.2	0	0	0	1094
69	16-Oct	6.6	13.8	9.6	11.6	38.5	43.5	10.3	9.2	3	0	3	1097
70	17-Oct	4.4	9.4	8.8	9.3	43.0	43.0	0.0	13.6	3	2	5	1102

2018 Mollyguajeck Fishway Logsheet (continued)

		Environmental Conditions							Streamflow	Salmon Count			
		Temperature (°C)				Water Depth			Glovertown	Daily			Cumul-
		Air		Water		In Trap (cm)		Rain	Water Stn				
		Lo	Hi	Lo	Hi	Lo	Hi	(mm)	(m3/sec)	≤ 63 cm	> 63 cm	Total	ative
71	18-Oct	2.5	4.2	9.0	9.4	43.0	43.0	9.7	10.4	0	0	0	1102
72	19-Oct	-1.0	6.2	8.8	9.3	43.0	44.0	1.9	10.4	0	0	0	1102
73	20-Oct	6.0	7.0	9.3	9.3	47.0	48.0	0.0	10.8	0	0	0	1102
74	21-Oct	12.0	16.0	12.0	13.0	58.0	66.0	50.5	13.9	0	0	0	1102
75	22-Oct	7.0	8.0	14.0	14.6	67.0	70.0	7.6	53.0	35	11	46	1148
									TOTAL	**1080**	**68**	**1148**	

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