

**Evaluation of Habitat Expansion Outcomes
on Upper Terra Nova River, 2016**

Project Report

Submitted by:

Freshwater-Alexander Bays Ecosystem Corporation (FABEC)

January 2017

TABLE OF CONTENTS

1.0	Introduction	1
2.0	Partners.....	3
3.0	Project Description	3
4.0	Fishway Performance	4
5.0	Assessment of Salmon Returns.....	6
6.0	Conclusions and Recommendations	8

Exhibits

Exhibit 1 – TNR Salmon Returns, 1956-2016.....	2
Exhibit 2 – Fishway Photo	5
Exhibit 3 – TNR Water Discharge Rates	5
Exhibit 4 – Weekly Salmon Returns; 2016, 2015, 2001 & 1992	6
Exhibit 5 – 2016 Escapement Compared to Conservation Requirements.....	7

Appendix – Fishway Daily Logsheet, 2016

References

1.0 Introduction

In 2016 FABEC was again successful in obtaining assistance to monitor fishway performance and salmon returns at Mollyguajeck Falls on Terra Nova River, following up on a similar project in 2015.

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 was destined to the upper watershed. This would provide an indicator of spawning escapement to the upper watershed relative to its spawning capacity and its contribution to the overall health of the river's salmon population.

The need for the 2016 project arose because the 2015 project was inconclusive in quantifying spawning escapement to the upper watershed. Because of 2015's dry weather, water flow through the fishway was insufficient to accommodate salmon passage for most of the season. It was evident that the 2015 count of 297 was significantly lower than the actual number that attempted to migrate to the upper watershed. An undetermined number of salmon either became stranded below Mollyguajeck or managed somehow to navigate over the falls when water flow resistance was down.

However the 2015 project was opportune in that it took place in a dry year. It demonstrated a major deficiency in the fishway. Below a given water level, it has insufficient water for salmon passage. FABEC concluded that the fishway infrastructure needs be modified to capture more water from the main river during low-flow conditions. Based on this information, Fisheries and Oceans is now planning to construct a permanent diversion dam at the fishway entrance to increase water flow into the fishway during low-flow conditions.

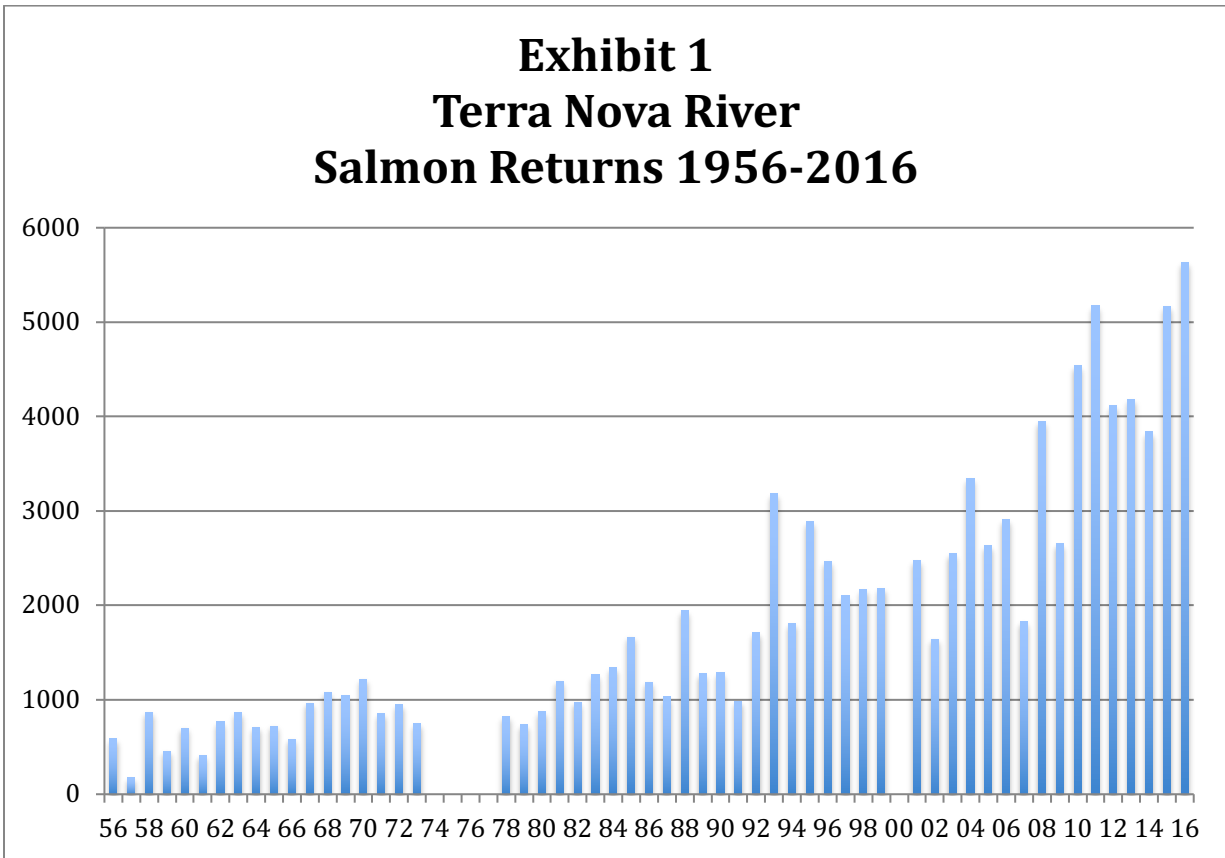
Terra Nova River is the fourth largest river on Newfoundland Island. Various projects since the early 1900's were undertaken to increase accessible habitat and enhance the river's salmon population. This included construction of three fishways at Grant Falls (11 km. from ocean), Terra Nova River (Big) Falls (22 km. from ocean), and Mollyguajeck Falls (56 km. from the ocean), as well as the salmon enhancement program that operated from 1985 to 2002 aimed at colonizing the watershed above Mollyguajeck Falls.

Habitat upstream of Mollyguajeck is estimated to have 60 percent of the river's salmon production capacity above Grant Falls (Bourgeois, 2002). The enhancement program initially involved the transfer of 1,412 spawners from the

lower river between 1985 and 1989, and, between 1995 and 2002, the stocking of 2.5 million salmon fry incubated at a hatchery in Terra Nova.

The most recent investment to facilitate salmon migration was DFO's 2010 construction of a new \$2 million fishway at Terra Nova River Falls.

The graph below shows the growth of the river's salmon population above Grant Falls since 1956. The most significant growth took place after the 1992 moratorium on the commercial fishery, which happened concurrently with the early days of the Terra Nova River salmon enhancement program. As can be seen in the graph, the average count from 1956 to 1991 was 952. It then increased to 2,334 from in the ten years from 1992 to 2001, and to 3,123 from 2002 to 2011. Between 2012 and 2016, the average climbed to 4,589 salmon - 47 percent higher than the 2002-11 average.



FABEC's 2016 project was made possible with financial and in-kind assistance from the Atlantic Salmon Conservation Foundation, the Department of Fisheries and Oceans, and Terra Nova National Park. Based on the assumption that 2015 was an outlier year in terms of the low water experienced, the project's main goals were to again assess the performance of the fishway in accommodating

fish passage and to quantify salmon spawning escapement to the upper Terra Nova watershed.

2.0 Partners

FABEC expresses gratitude to the partners who made this project possible. We thank the Atlantic Salmon Conservation Foundation and the Department of Fisheries and Oceans (Grants and Contributions Program) for their financial contributions. Terra Nova National Park lent equipment and donated helicopter time to transport equipment, sandbags, and operating supplies to the site. DFO's Salmonids Section donated the fishtrap as well as staff time for its installation. The Salmonids Section also provided valuable information and feedback in FABEC's analysis of the project results. Officials with DFO's offices in Glovertown and Clarenville helped as well whenever the need arose.

We also wish to thank the Towns of Glovertown, Traytown, and Terra Nova, who contributed to the Mollyguajeck project in 2015.

3.0 Project Description

The project got underway in mid-July with site preparations and the flying of materials and equipment to Mollyguajeck. This included the delivery of 200 sandbags to the site to build a water diversion dam if that became necessary. The sandbags were helicoptered to the site on July 14 along with other materials, equipment, and employee belongings such as food and sleeping gear. Water levels were too high to immediately place the trap so a fish fence was temporarily installed across the fishway to hold salmon back until the trap could be installed.

The trap was installed on July 25 with the assistance of DFO's technician. Monitoring operations began immediately.

Project staff consisted of four people working in teams of 2 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 July 25 to October 1. Over the 69-day period, 965 salmon migrated through the fishway. When low water became a problem, a dam was installed on August 12 to channel more water into the fishway. This proved insufficient so on August 20 the dam was extended farther out into the main water flow, successfully raising water in trap from 13 to 26 cm. This resulted in a run of 104 salmon over the next day and a half. Thereafter adequate water levels were maintained. The count was suspended after October 1 due to a rapid rise in the water level caused by heavy rainfalls. While the plan was to restart the project as soon as waters subsided, this proved impossible after the Hurricane Matthew event on October 10.

FABEC flew to the site on October 21 to inspect the site and try to remove the fishtrap. This proved impossible due to the high water. A visual inspection from the helicopter indicated the trap was intact but part of the fish fence had been pushed over by the floodwaters. This alleviated the concern that salmon passage might be obstructed.

Another attempt was made on December 12 after waters had subsided. We were successful in removing the downed fish fence but the trap proved too difficult to remove. It is hoped the trap will remain intact over the winter so it can be taken from the water next spring.

The project results show a strong correlation between fishway water levels and salmon passage. Over ten days from July 31 to August 9, when the average depth in the trap was 24.9 cm., 185 salmon were counted. Over the following ten days, average depth fell to 17.1 cm. and only 32 were released. In the ten days after the dam was extended, average depth increased to 24.8 cm. and 248 salmon passed through.

FABEC had planned to monitor the fishway well into October but suspended the operation after the heavy rains made this impossible.

4.0 Fishway Performance

Mollyguajack is a rustic fishway, which, unlike the river's two other fishways, does not include built infrastructure. It was constructed using explosives to blast a channel through bedrock. Flowing water from the main river above the falls to a natural channel located below the falls, the fishway provided a complete route around the falls that salmon are able to navigate.

The photograph below shows the location and flow direction of the fishway. The inflow channel receives water from the main river and then turns 90 degrees toward the bottom of the falls. The box in the photo shows where the fish trap was installed. The stream flowing toward the bottom of the photo is an intermittent stream that flows only when water levels are relatively high. The installation includes a fish fence across this stream to prevent salmon from getting around the trap when water levels are high.

This year's project confirmed that the fishway does not perform well when water levels drop below a certain level. While this year was less problematic than 2015, the number of salmon swimming through the fishway dropped to only a trickle when the discharge rate at the Glovertown water monitoring station fell below 16 m³/second. Because we had anticipated and prepared for this problem by bringing sandbags to the site, we were able to mitigate the low water flow by building the diversion dam. This solution worked and water flow was no longer a constraint.

EXHIBIT 2 – PHOTO OF FISHWAY



The table below compares water discharge rates in 2016 with the previous four years, and with 1992 and 2001, when the earlier Mollyguajeck counts took place. It shows discharge rates on selected dates one week apart.

EXHIBIT 3							
WATER DISCHARGE RATES - TERRA NOVA RIVER							
	1992	2001	2012	2013	2014	2015	2016
	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
26-Jul	30.6	30.9	13.2	27.2	14.1	14.7	27.6
02-Aug	35.2	21.9	14.5	29.5	14.0	20.1	21.1
09-Aug	37.1	15.2	14.6	32.4	10.5	18.0	16.0
16-Aug	29.3	10.4	15.1	28.9	22.2	18.7	11.1
23-Aug	25.8	8.2	21.5	21.8	38.3	14.5	8.7
30-Aug	22.7	11.3	29.0	15.6	59.3	10.6	13.0
06-Sep	23.6	9.9	28.0	130.0	45.4	9.2	16.5
13-Sep	38.0	7.7	38.3	74.5	38.4	5.9	23.0
20-Sep	52.1	22.9	47.5	86.8	26.3	10.7	22.0
27-Sep	44.9	28.2	46.1	125.0	16.4	7.8	22.5
04-Oct	37.0	28.3	44.4	95.3	13.7	6.1	42.9
AVERAGE	31.4	16.2	26.0	55.6	24.9	11.4	18.7

Source – Real Time discharge data for Water Station 02YS005, Glovertown

Evaluation of Habitat Expansion Outcomes on Upper Terra Nova River
Project Report 2016

Exhibit 3 shows that over the period as a whole, water flow in 2016 was more favourable than in 2015. Average water discharge at the Glovertown water station over the eleven weeks was 18.7 m³/sec compared to 11.4 m³/sec in 2015.

However, for much of August 2016 discharge rates were actually lower than in 2015 although the number of salmon passing through the fishway was higher. FABEC attributes this to the success of the dam in mitigating the low water levels, which we were not able to do in 2015.

5.0 Assessment of Salmon Returns

The following table shows weekly salmon returns in 2016 compared to the previous counts in 2015, 2001 and 1992. The 2016 escapement of 965 spawners compared to 297 in 2015, 329 in 2001 and 108 in 1992. According to Bourgeois (2002), the 2001 count was adjusted to 436 to account for brood stock removed from the lower section of the river as part of the enhancement program.

EXHIBIT 4												
Weekly Fishway Returns - 2016, 2015, 2001 & 1992												
Week Ending	2016			2015			2001			1992		
	≤63 cm	>63 cm	Total	≤63 cm	>63 cm	Total	≤63 cm	>63 cm	Total	≤63 cm	>63 cm	Total
July 31	90	12	102	5	0	5						
Aug 7	100	9	109	82	8	90	9	1	10	15	3	18
Aug 14	89	12	101	119	18	137	1	1	2	18	2	20
Aug 21	106	5	111	42	6	48	0	0	0	16	1	17
Aug 28	164	28	192	3	0	3	0	0	0	5	0	5
Sep 4	50	11	61	3	0	3	0	0	0	6	0	6
Sep 11	107	15	122	0	0	0	0	0	0	13	3	16
Sep 18	65	9	74	7	0	7	0	0	0	17	0	17
Sep 25	65	5	70	0	0	0	46	17	63	1	1	2
Oct 2	23	0	23	4	0	4	47	4	51	1	0	1
Oct 9							16	0	16	6	0	6
Oct 16							109	9	118			
Oct 23							63	3	66			
Oct 30							2	0	2			
Nov 6							2	0	2			
Total Adjusted Total	859	106	965	265	32	297	294	35	329 (436)	98	10	108

The project clearly demonstrated that a significant number of spawners are migrating to the upper watershed. Of the 5,635 salmon counted through the lower fishway at Grant Falls, 965 or 17.1% migrated past Mollyguajeck Falls. This compares to an adjusted count of 436 spawners counted through the fishway in 2001.

The 2016 project confirmed FABEC's 2015 conclusion that the fishway is not able to accommodate salmon passage during low flow conditions. Had preparations not been made to mitigate the problem, low water levels would have impeded fish passage for an estimated 26 days (38%) of the 69-day fish count. In 2015 this condition existed for 50 days (71%) over 70 days.

It is FABEC's opinion that Mollyguajeck fishway, combined with the 16-year salmon enhancement program, has been a significant factor in the increase in the river's population since 1985. As shown in Exhibit 1, the 2016 salmon count of 5,635 salmon at the Grant Falls fishway was 3.4 times higher than the 1985 count of 1,669 and 2.3 times higher than the 2001 count of 2,481.

It is also our conclusion that this growth has been less than optimal, due to the frequent drying-up of the fishway during low-flow periods. While the 2016 count was a record, it remains significantly below the overall conservation requirement of 8,937 spawners for the river above Grant Falls.

The following table shows the 2016 count in relation to the river's conservation requirement.

EXHIBIT 5			
2016 Escapement Compared To Conservation Requirements			
	Conservation Requirement*	2016 Count	Percent Achieved
Between Grant Falls & Mollyguajeck	3,575	4,670	130.6%
Above Mollyguajeck	5,362	965	18.0%
Entire River above Grant Falls	8,937	5,635	63.1%

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

The table shows that the whole river above Grant Falls achieved 63.1% of its conservation requirement in 2016. But it also shows that the distribution of spawners is disproportionately heavy in the lower section where escapement exceeded the conservation requirement by 30.6%. However, even with the record run, the upper watershed achieved only 18.0% of its conservation requirement.

DFO Real Properties has indicated its intention to carry out necessary improvements to the Mollyguajeck fishway to address the low-flow problem. Essentially, the recommended design is a diversion dam based on the prototype installed by FABEC this year.

6.0 Conclusion and Recommendations

This project was much more definitive on the number of salmon destined to the upper TNR watershed than the 2015 project. It supported our conclusion from the 2015 project that Mollyguajeck Fishway is deficient in that salmon are unable to pass at lower water levels, which occur for varying periods in most years. Although this was mitigated in 2016 by the diversion dam, a permanent solution is required to ensure low water no longer remains a constraint to optimal building of the river's population. FABEC is hopeful this problem will be corrected in 2017 with the construction of a permanent diversion dam

Recommendations

- (1) FABEC's 2015 recommendation on the need for improvements to Mollyguajeck fishway is repeated.
- (2) It is recommended that another evaluation project be undertaken in the year following construction of the permanent dam. This will evaluate the salmon run to the upper watershed in the absence of low water as an impediment to migration. If the dam is built as anticipated in 2017, FABEC plans to submit a proposal to undertake this follow-up evaluation project in 2018.
- (2) Because the river as a whole remains significantly under-seeded, it is recommended that the current conservation plan for Terra Nova River be maintained as is.

APPENDIX

MOLLYGUAJECK FISHWAY DAILY LOGSHEET

2016 Mollyguajeck Fishway Logsheet

Day	Date	Temperature at Trap		Water Level In Trap (cm)	Rain TN Park (mm)	Water Discharge Stn 02YS005 (m3/sec)	Salmon Count			
		Air (°C)	Water (°C)				≤ 63 cm	> 63 cm	Total	Cumul
		1	Mo 25-Jul	30	18	35	0.0	29.1	18	5
2	Tu 26-Jul	25	18	35	0.0	27.6	8	2	10	33
3	We 27-Jul	26°	20	34	0.0	26.6	11	1	12	45
4	Th 28-Jul	27	20	34	0.0	25.7	21	2	23	68
5	Fr 29-Jul	20	19	34	0.0	24.5	6	1	7	75
6	Sa 30-Jul	na	n/a	n/a	1.2	23.7	na	na	0	75
7	Su 31-Jul	25	19	29	2.7	22.1	26	1	27	102
8	Mo 01-Aug	20	20	27	0.0	23.2	21	0	21	123
9	Tu 02-Aug	16	19	26	0.0	21.1	14	0	14	137
10	We 03-Aug	22	19.5	26.5	0.0	20.1	7	3	10	147
11	Th 04-Aug	24	19.5	26	0.0	18.9	18	0	18	165
12	Fr 05-Aug	26	20	26	1.4	19.0	21	4	25	190
13	Sa 06-Aug	20	19.5	25	7.3	18.7	7	1	8	198
14	Su 07-Aug	20	20	21	1.9	17.5	12	1	13	211
15	Mo 08-Aug	22	22	22	0.6	16.1	39	5	44	255
16	Tu 09-Aug	20	20	20	2.0	16.0	27	5	32	287
17	We 10-Aug	17	20	20	0.0	15.3	8	1	9	296
18	Th 11-Aug	26	20	19	0.0	15.0	3	0	3	299
19	Fr 12-Aug	22	19	18	0.0	14.6	3	1	4	303
20	Sa 13-Aug	24	18	21	0.0	13.2	9	0	9	312
21	Su 14-Aug	19	19	19	0.0	11.9	0	0	0	312
22	Mo 15-Aug	25	20	17	0.0	11.2	0	0	0	312
23	Tu 16-Aug	21	20	15.5	4.2	11.1	3	1	4	316
24	We 17-Aug	23	18	15	0.0	10.4	1	1	2	318
25	Th 18-Aug	23	19	13	0.0	10.2	1	0	1	319
26	Fr 19-Aug	16	18	13	0.0	9.0	0	0	0	319
27	Sa 20-Aug	24	19	26	0.0	8.5	60	2	62	381
28	Su 21-Aug	19	18	26	0.0	9.1	41	1	42	423
29	Mo 22-Aug	21	18	24.5	0.8	9.2	0	0	0	423
30	Tu 23-Aug	22	19	22	9.2	8.7	10	4	14	437
31	We 24-Aug	22	18	21	7.2	8.9	6	3	9	446
32	Th 25-Aug	21	18	20	0.0	9.3	6	1	7	453
33	Fr 26-Aug	21	18	20	17.7	9.2	1	1	2	455
34	Sa 27-Aug	13	16	30	17.2	12.0	127	16	143	598
35	Su 28-Aug	18	17	29	0.0	11.7	14	3	17	615
36	Mo 29-Aug	16	16	29	6.9	11.1	0	0	0	615
37	Tu 30-Aug	9	16	30	9.6	13.0	5	0	5	620
38	We 31-Aug	n/a	n/a	n/a	1.0	13.8	0	0	0	620

2016 Mollyguajeck Fishway Logsheets (continued)

Day	Date	Temp. at Trap		Water Level In Trap (cm)	Rain TN Park (mm)	Water Discharge Stn 02YS005 (m3/sec)	Salmon Count			
		Air (°C)	Water (°C)				≤ 63 cm	> 63 cm	Total	Cumul
39	Th 01-Sep	16	15	37	0.7	13.3	4	2	6	626
40	Fr 02-Sep	16	15	37	0.0	12.4	20	5	25	651
41	Sa 03-Sep	14	14	38	0.6	13.3	4	3	7	658
42	Su 04-Sep	14	15	40	na	13.9	17	1	18	676
43	Mo 05-Sep	20	15	42	0.0	15.1	19	2	21	697
44	Tu 06-Sep	23	16	42	0.0	16.5	25	1	26	723
45	We 07-Sep	20	16	42	0.0	16.1	8	1	9	732
46	Th 08-Sep	10	14	46	11.2	17.1	12	2	14	746
47	Fr 09-Sep	11	14	45	17.8	17.1	25	3	28	774
48	Sa 10-Sep	10	14	42	2.0	21.6	17	6	23	797
49	Su 11-Sep	12	14	42	0.0	21.6	1	0	1	798
50	Mo 12-Sep	16	14	42	0.6	23.9	8	3	11	809
51	Tu 13-Sep	16	13	44	0.0	23.0	21	2	23	832
52	We 14-Sep	25	15	44	0.0	21.4	9	2	11	843
53	Th 15-Sep	9	14	44	1.8	21.6	4	0	4	847
54	Fr 16-Sep	14	14	42	0.0	20.4	10	1	11	858
55	Sa 17-Sep	18	14	43	0.0	21.1	9	0	9	867
56	Su 18-Sep	15	14	41	18.7	20.4	4	1	5	872
57	Mo 19-Sep	8	12	43	1.8	22.2	3	0	3	875
58	Tu 20-Sep	9	12	42	0.0	22.0	17	0	17	892
59	We 21-Sep	16	14	44	0.0	22.6	17	3	20	912
60	Th 22-Sep	24	12	42	0.0	24.0	14	0	14	926
61	Fr 23-Sep	15	12	42	5.6	21.7	5	0	5	931
62	Sa 24-Sep		11	42	5.7	22.2	7	1	8	939
63	Su 25-Sep	8	11	41	0.7	22.6	2	1	3	942
64	Mo 26-Sep	8	10	41	4.0	23.1	8	0	8	950
65	Tu 27-Sep	9	10	41	2.2	22.5	4	0	4	954
66	We 28-Sep	10	10	43	0.0	23.0	4	0	4	958
67	Th 29-Sep	7	10	43	43.5	22.8	5	0	5	963
68	Fr 30-Sep	12	8	48	0.0	41.4	2	0	2	965
69	Sa 01-Oct	12	8	53	0.0	39.3	0	0	0	965
TOTAL							859	106	965	

References

Bourgeois, C. E., J. Murray and G. Clarke. *A review of Atlantic salmon enhancement activities on the Terra Nova River (SFA 5), Newfoundland*. DFO, St. John's, 2002.

Environment Canada. *Hydrometric Data for TERRA NOVA RIVER AT GLOVERTOWN (02YS005)*. (www.wateroffice.ec.gc.ca)

Environment Canada. Historical Weather for Terra Nova National Park (https://weather.gc.ca/city/pages/nl-15_metric_e.html)