2023 Anadromous Fish Counts at Milltown Dam

Introduction

From 1991-2011, and 2015-present the St. Croix International Waterway Commission (SCIWC) has conducted anadromous fish counts at the New Brunswick Power Milltown Generating Station (MGS), primarily to enumerate alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring/gaspereau/siqonomeq, passing through the fishway heading to upstream spawning habitat. Data collected at MGS is provided to federal, state/provincial agencies, tribal governments, and other interested parties/stakeholders.

MGS is the first dam on the St. Croix River and is located near the head-of-tide, on the international waterway boundary between Maine and New Brunswick. It is owned by the New Brunswick Power Corporation (NB Power) and the fishway and research trap are located on the Canadian side of the river. The fishway is operated under the jurisdiction of the Department of Fisheries & Oceans Canada (DFO).

Figure 1: Tailrace of the Milltown dam looking downstream from the fishway entrance.

As of July 1st, 2023, MGS and the fishway are being decommissioned with the intention to restore this section of river to its natural state. This 2023 report represents the last anadromous fish count to be conducted at this site.

Materials and Methods

NB Power activated the MGS fishway on April 14 and operated it throughout the river herring run as prescribed by DFO. Counting was conducted via in-person clicker counts, and through review of video monitoring footage. Staff were outfitted with handheld clickers, and manually counted fish passing the fishway field-of-view during the first ten (10) minutes of every hour when onsite. When a fish was observed descending downstream past the fishway field-of-view, it was subtracted from the count. Ten (10) minute counts were then multiplied by six (6) to get estimated hourly counts. When staff were not present at the fishway, a video monitoring setup was used to record a section of the fishway from directly overhead with a whiteboard placed underneath to see fish crossing the field-of-view as they enter the research trap inside the fishway (Figure 2).

Figure 2: Video monitoring still showing river herring passing over the installed whiteboard.

Video monitoring review counts were conducted in the same manner as the in-person counts. Hours covered by in-person/video review during the study period were from 06:00h to 22:00h (ADT). Once all hourly counts of each day were reviewed, data was inputted into spreadsheet form to enumerate all hourly/daily count totals. Video footage was stored on an external hard drive until processed, and then deleted to free up space due to the size of the files.

The video monitoring system was set up and operational on April 13, 2023, with in-person counts beginning on April 24 and the last day of counts completed on June 30. In total, the study period covered 68 calendar days. Staff recorded weather conditions, operating conditions at the dam, water temperatures within the fishway, as well as general observations. The Department of Fisheries and Oceans Canada research trap was utilized in 2023 by staff to aid in both live and lethal fish capture, as well as assisting with fish counts during the beginning and end periods of the fish migration when runs are slower.

Figure 3: Lethal alewife sample collected by SCIWC.

In addition to the fish counts, 100 lethal samples of river herring were collected using DFO permit #343928. Analysis included species (blueback herring/alewife), sex, weight, length, and age (scale).

Weekly fish count reports were distributed to a mailing list of 155 participants representing various federal/state/provincial agencies and departments, tribal governments, organizations, and stakeholders. Included in these reports were data on counts, species, PIT antenna detections (as part of a separate project), water flows from the Baring, ME (USGS) gauge, water temperature recorded by staff at the fishway, general weather conditions, operation of MGS turbine 7, and weekly count comparisons from previous years.

Results

River Herring

In total, there were 841,357 river herring recorded passing through the Milltown fishway during the 2023 season. A group of 17 river herring were first reported by NB Power staff on April 20, followed by a period of zero daily counts until the run began in earnest on May 3. The last fish counted was on June 30, as the fishway was dewatered due to decommissioning activities beginning on July 1. Highest counts were observed during the week of May 31 to June 6 (181,122), with the highest daily count recorded on June 2 (64,302). The counts for river herring in 2023 represent an 18% increase from 2022 (712,878), and the highest recorded counts since 1990 (1,531,250).

Table 1: Historical river herring counts at the Milltown fishway research trap from 1981 to 2023.

YEAR	RIVER HERRING TOTAL	YEAR	RIVER HERRING TOTAL	YEAR	RIVER HERRING TOTAL	YEAR	RIVER HERRING TOTAL
1981	169,620	**1992**	203,750	**2003**	7,901	**2014**	27,312
1982	233,102	**1993**	297,720	**2004**	1,299	**2015**	93,503
1983	151,952	**1994**	350,154	**2005**	11,632	**2016**	33,016
1984	152,900	**1995**	274,079	**2006**	11,829	**2017**	157,750
1985	368,900	**1996**	645,978	**2007**	1,294	**2018**	270,659
1986	1,984,720	**1997**	225,521	**2008**	12,261	**2019**	486,500
1987	2,624,700	**1998**	177,317	**2009**	10,450	**2020**	611,907
1988	2,590,750	**1999**	25,327	**2010**	59,145	**2021**	550,123
1989	1,164,860	**2000**	8,569	**2011**	25,142	**2022**	712,878
1990	1,531,250	**2001**	5,202	**2012**	36,168	**2023**	841,357
1991	586,910	**2002**	900	**2013**	16,677		

Weather conditions were observed for each day the fish count was done in-person. The month of May was considered average in daily air temperature but experienced a significant lack of precipitation, with only a total of 67.8 mm occurring throughout. The remainder of June was generally cold and rainy, with an average air temperature of 16.5°C and 153.5 mm of total precipitation.

River flows from the study period were recorded from the closest available USGS streamflow gauge located upstream of MGS at Baring, Maine, and is represented visually alongside daily fish counts in Figure 4. Streamflow decreased sharply in the two last weeks of April as the spring freshet began to subside, however this did not appear to correspond with increasing daily alewife counts. A spike in streamflow took place beginning in early June, which continued for the remainder of the month due to consistent rains. This streamflow increase seemed to correspond with a sharp increase in alewife counts. Stream flow in the lower mainstem of the St. Croix River is directly influenced by water discharges from upstream hydropower dams at both Woodland and Grand Falls dams, as well as natural rainfall events.

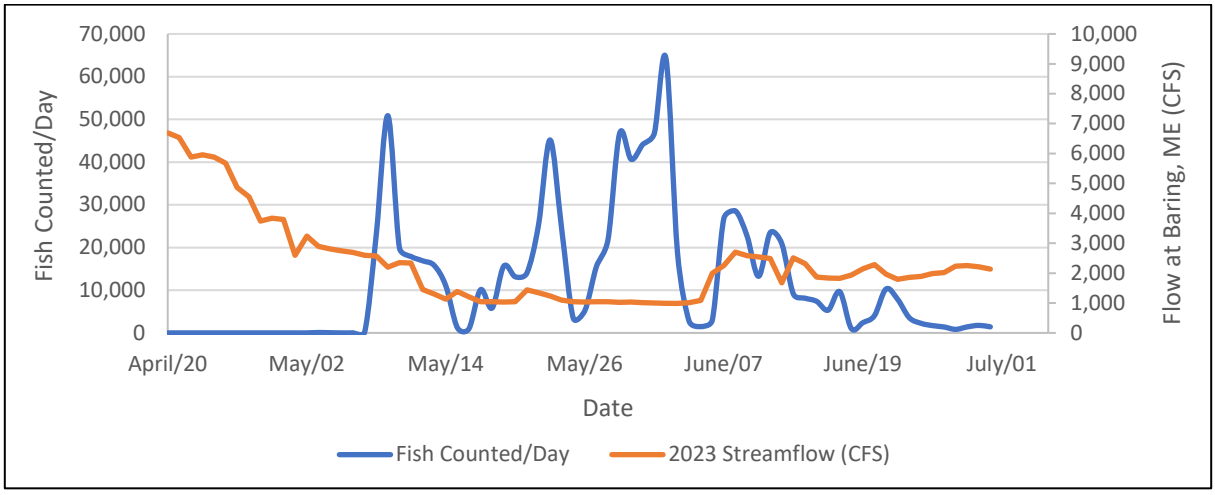

Figure 4: River herring counted per day at MGS in 2023, showing streamflow at the USGS Baring, ME, gauge.

Water temperature was recorded directly from within the fishway when staff were present (Figure 5). The water temperature rose steadily from the onset of the study period, reaching a high of 22.5°C on June 2. Coincidentally, this day also held the largest daily fish count for the season at 64,302 river herring reported passing the MGS fishway. Following these simultaneous season highs, both water temperature and fish counts dropped to 14.2°C and 1,482, respectively, on June 5.

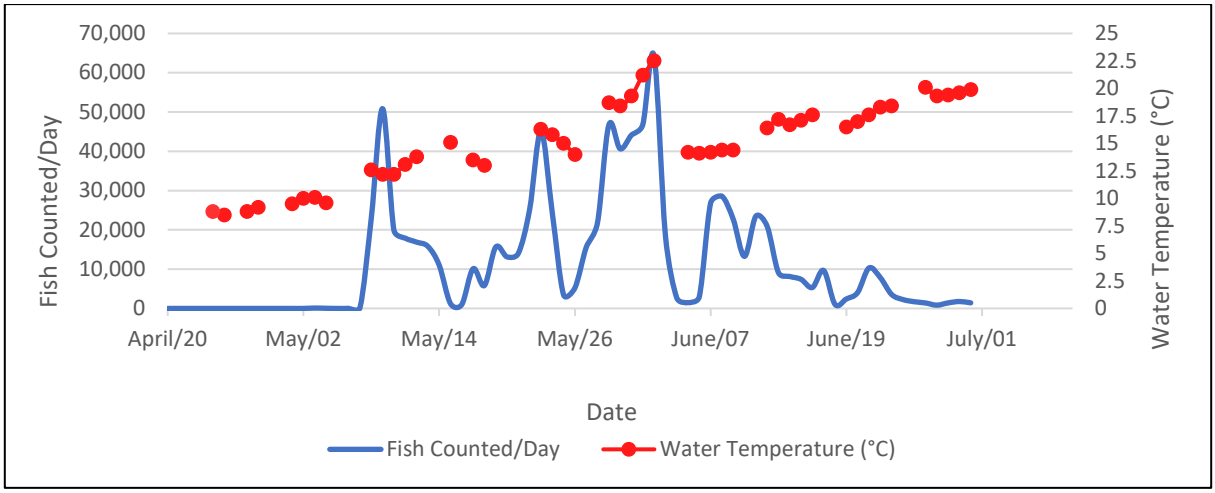

Figure 5: River herring counted per day with water temperatures recorded from within the fishway.

Other Species

There were 675 American shad counted in 2023, the highest count ever recorded for this species at MGS. Most shad were recorded during the period of June 7-June 13, with 331 recorded during that time span. Many individuals were observed in poor condition at the research trap.

One mature American eel was recorded at the fishway in 2023 on June 21st.

A variety of other freshwater fish were also recorded ascending the fishway in 2023, as seen in Table 2. Fallfish, white sucker, and one (1) unidentified fish were noted in the beginning of the season from April to early May. Additionally, brown bullhead and smallmouth bass were observed in late May and throughout the month of June.

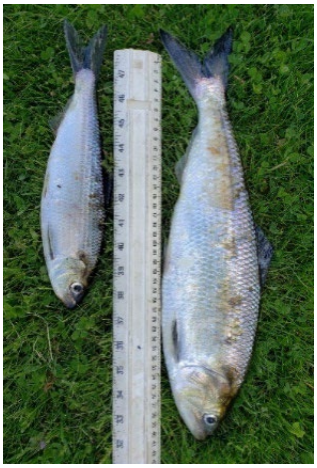

Figure 6: Alewife (left) and American Shad (right).

Table 2: Counts of inbound fish at the MGS research trap, St. Croix River, April 20 to June 30, 2023.

Species	2023 Trap Count
River herring: alewife (*Alosa pseudoharengus*) & blueback herring (*Alosa aestivalis*)	841,357
American shad (*Alosa sapidissima*)	675
Smallmouth bass (*Micropterus dolomieu*)	13
White sucker (*Catostomus commersoni*)	13
Fallfish (*Semotilus corporalis*)	4
Brown bullhead (*Ameiurus nebulosus*)	1
Unidentified fish	1

Lethal Sampling

One hundred (100) river herring were lethally sampled at Milltown to determine sex, species, and age. Weight and fork length were also recorded. The sampling efforts took place throughout the spawning migration, with more sampling effort associated with higher count days to get a representative sample of the spawning population. All 100 lethal samples are to be aged from collected scales by the Maine Department of Marine Resources. Preliminary results from the 2023 lethal samples are shown below in Table 3. Once the aging data is available the updated database will be presented to stakeholders.

Table 3: Basic biological data of 2023 lethally sampled river herring including average fork length, weight and determined sex.

	Lethal Sampled Alewife	Lethal Sampled Blueback Herring
Average Fork Length (mm)	256.8 (96 samples)	224.5 (4 samples)
Average Weight (g)	225.6 (96 samples)	137.4 (4 samples)
Males (n)	42	2
Females (n)	54	2

Of the 100 river herring fish lethally sampled, 96 were determined to be alewife, and 4 being blueback herring. A comparison showcasing the subtle external differences between the two river herring species can be seen in Figure 7. Species confirmation is typically done post lethal sampling by observing the abdominal cavity (peritoneum) lining, alewife being pale pink in colour and blueback herring—black. Lethal sampling efforts in 2023 will contribute to the long-term biological dataset of river herring present within the St. Croix watershed.

Figure 7: Comparison of alewife (bottom) and blueback herring (top).

Discussion

Historically, the peak of the river herring migration (week with the highest recorded counts) has occurred between May 17 – June 6 at Milltown, with the mode being the week of May 24-May 30. In 2023, the week of May 31-June 6 was recorded as being the week with the highest counts, which is consistent in comparison with the historical dataset (Table 4). The days with the highest recorded counts were on June 2 (64,302), and May 9 (50,856). The days in which the highest counts were recorded coincide with the days that had the highest air temperatures recorded during May and June respectively. The weather in May was generally hot and dry, with three separate periods where the daily highs for air temperature recorded at the Environment Canada weather station in St. Stephen exceeded 25°C (May 12-14, and May 27-30). There was also limited rainfall recorded (67.8mm) during May at this station, with only two significant rainfall events, representing 86% of total precipitation for the month (28.5mm on May 1 and 30.1mm on May 21). This combined effect of hot and dry weather conditions created low water levels within the lower St. Croix, potentially explaining the sporadic periods of low fish runs seen throughout May. Anecdotal

observations from SCIWC staff noted large schools of river herring below the fishway entrance, seemingly unable to access the fishway due to the low water level at the tailrace of the dam. It is likely that as climate change alters seasonal weather patterns, the timing of the annual river herring migration will begin earlier, corresponding with increases in water and air temperatures and an earlier Spring freshet.

Table 4: River herring spawning run counts from 2014 - 2023 reported each week, with 7-day peaks and total counts for each season emboldened.

YEARS	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
April 14-29	--	--	0	--	0	--	0	1,003	0	17
April 30-May 2	--	0	0	0	0	--	0	576	0	0
May 3-9	0	0	0	0	4	60	0	528	8,010	74,262
May 10-16	7	16	125	369	13,029	417	0	133,254	**248,964**	83,736
May 17-23	16	126	269	29,946	47,974	13	249,507	**186,180**	148,602	129,102
May 24-30	29	**32,637**	**14,304**	**44,110**	**130,537**	63,941	**258,678**	75,612	221,000	157,698
May 31-June 6	**19,971**	16,875	12,781	42,406	43,647	**252,631**	54,870	117,684	71,562	**181,122**
June 7-13	6,775	27,150	3,038	27,681	29,292	129,387	12,792	28,098	7,282	144,844
June 14-20	95	11,871	2,000	8,790	3,101	34,221	25,122	5,382	6,966	38,034
June 21-27	143	3,817	471	3,787	2,163	4,220	6,084	1,530	354	27,940
June 28-July 4	267	816	27	571	821	809	2,520	252	108	4,602
July 5-11	9	161	1	69	86	743	1,386	24	30	--
July 12-18	--	34	--	21	5	58	786	0	--	--
July 19-25	--	--	--	0	--	0	144	--	--	--
July 26 - later	--	--	--	--	--	--	18	--	--	--
TOTAL RUN	**27,312**	**93,503**	**33,016**	**157,750**	**270,659**	**486,500**	**611,907**	**550,123**	**712,878**	**841,357**

The operation of turbine 7 (turbine nearest to the fishway entrance) in 2023 was consistent with previous years and was as prescribed by DFO. Turbine 7 was operational outside of the regular fish migration period from 20:00 to 08:00 each day, except on June 20th, where the turbine ran from 11:00 to 15:00 for head pond surveying purposes.

Figure 8: A captured American shad at the MGS fishway.

A significant increase in the number of American shad passing the MGS fishway was observed in 2023. A total of 675 shad were counted, the highest ever recorded swimming through the fishway since counts began. American shad presence continues to recover in the St. Croix, having been scarce or absent in the system from 1981 to 2016. Recent counts from the last 7 years are presented below in Table 5, showcasing the variability of their presence within the fishway. Counts for shad likely represent an undercount since shad were only counted during the first ten (10) minutes of each hour, and not for the remaining fifty (50) minutes and count data is not extrapolated as they are for river herring.

Table 5: Shad Counts at the Milltown Generating Station Fishway from 2017 – 2023.

Year	2017	2018	2019	2020	2021	2022	2023
Shad Counts	56	255	29	29	40	17	675

MGS decommissioning is currently underway as of July 1, 2023 (Figure 9). The return to a natural free-flowing river at Salmon Falls will likely allow fish such as the American Shad to be able to arrive at spawning habitat in the river-mainstem in better physical condition, further aiding in their recovery in the St. Croix.

The removal also represents the completion of the last fish count to be held at the fishway. The St. Croix International Waterway Commission would like to acknowledge all the contributions from various government departments and agencies, as well as the contributions from the exceptional individuals and volunteers who helped to make the fish count possible throughout its 32-year duration!

Lastly, we would like to thank NB Power for their financial and logistical support, as well as the excellent staff at the dam for all their hard work and patience towards the fish count project for over three decades at Milltown.

Questions regarding this report can be directed to:

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Figure 9: Milltown Generating Station (MGS) decommissioning as of August 23, 2023