2024 Anadromous Fish Counts at Woodland Dam

Introduction

From 1991-2011 and 2015-2023, the St. Croix International Waterway Commission (SCIWC) 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. Before the beginning of the 2024 river herring migration, MGS and the fishway were decommissioned, and the section surrounding Salmon Falls was restored to its natural state (Figure 10).

Since 2013, the river herring population in the St. Croix has been increasing, with 841,357 fish counted in 2023 at Milltown. Following the removal of Milltown, river herring numbers attempting to ascend the next dams located at Woodland and Grand Falls were expected to increase dramatically. Current fish passage at the Woodland Dam is poor (an estimated 25% arriving at the dam of fish can pass the structure), and with the proposed fish lift construction and completion at least several years away, monitoring fish passage at this dam will be vital in monitoring the recovering river herring population.

This report represents the first anadromous fish count conducted by SCIWC at a new location along the mainstem of the St. Croix. Approximately 15 kilometers upriver from where MGS once stood, the Woodland Dam is now the first dam on the St. Croix River mainstem and is next to a pulp and paper facility on the international waterway boundary between Maine and New Brunswick. The facility, owned and operated by Woodland Pulp LLC, and the fishway are located on the American side of the river. With the removal of the Milltown Dam and planned fish passage construction improvements at both the Woodland and Grand Falls dams, abundance estimates and fish pathway choice must continue to be assessed in the St. Croix to inform agencies in both countries.

All data collected during this project will be made available to federal, state/provincial agencies, tribal governments, and other parties or stakeholders interested in the restoration and management efforts that support the ever-evolving restoration plans for the international St. Croix River.

Materials and Methods

Woodland Pulp LLC activated the fishway on April 26 and operated it throughout the river herring run in 2024. Counting was conducted using an underwater camera system loaned to the SCIWC by the Sipayik Environmental Department (SED), which was installed near the upstream exit of the fishway. SCIWC operated the camera throughout the season and reviewed the collected footage. Installation and technical guidance were supplied by SED, having had previous experience deploying the camera at this location. SCIWC staff visited the fishway approximately twice a week from late April to mid-July to offload recorded video onto a Toughbook laptop and make general observations regarding the fish migration. Staff were outfitted with handheld clickers and were responsible for manually counting fish passing the fishway field-of-view during the first ten (10) minutes of every hour. When a fish was observed descending downstream past the fishway field-of-view, it was subtracted from the count. Ten (10) minute counts were multiplied by six (6) to get estimated hourly counts.

Figure 3 Lethal alewife sample collected by SCIWC.

Hours covered by video review during the study period were from 07:00h to 19:00h (EST), representing a minimum count window. The count hours conducted at Woodland differ from the historical Milltown count hours due to the lack of lighting within the fishway. 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 25, 2024, with video review beginning that same day and the last count being completed on July 11. In total, the study period covered 77 calendar days. Staff recorded weather conditions, operating conditions at the dam, water temperatures within the fishway, and general observations.

In addition to the fish counts, SCIWC was scheduled to collect 100 lethal samples of river herring using collection permits issued through the Maine Department of Marine Resources (DMR). Samples were acquired using a dipnet at the downstream entrance of the Woodland fishway. The lethal sample analysis by SCIWC included determining species (blueback herring/alewife), sex, weight (grams), and fork length (millimeters). Scales were collected from each sample and were sent to DMR for aging.

Weekly fish count reports were distributed to a mailing list of 176 participants representing various federal/state/provincial agencies and departments, tribal governments, organizations, and stakeholders. Included in these reports were data on counts, other encountered species, water flows from the downstream Baring, ME (USGS) gauge, water temperature recorded by a logger positioned at the downstream entrance to the fishway, general weather conditions, and the operational status of the dam's seven turbines.

Results

River Herring

In total, there were 610,452 river herring recorded passing through the Woodland fishway during the 2024 season. The first river herring caught on video was reported by SCIWC staff on May 6, followed by a single day of zero counts until the run began in earnest on May 8. The last fish counted was on July 10, which followed three days of zero counts from July 6 to 8 and officially ended the fish migration for the season. The highest fish count was observed from the reporting period of May 31 to June 6 (246,762), with the highest daily count recorded on June 3 (43,500). River herring counts conducted at Woodland Dam in 2023 were done by SED using the same recording and processing methods. SED reported that 232,998 herring had ascended the Woodland Fishway successfully last year, equating to a 162% increase year-over-year in the 2024 migration season.

Weather conditions were observed daily during the fish count, accomplished in person and using nearby weather stations in St. Stephen, NB, and Robbinston, ME. Most of May and June were considered average in daily air temperatures with a significant lack of precipitation, with only 42.9 mm occurring in May and 77.6 mm in June. Of the precipitation in June, 66.9 mm of the total occurred during the last week of the month. Historical data states that the average amount of rainfall received in the region for May is 96 mm and 84 mm in June.

River flows during the study period were recorded at the nearest USGS streamflow gauge, located downstream of the Woodland Dam in Baring, Maine, and are visually represented alongside daily fish counts in Figure 4. Streamflow significantly decreased during the last two weeks of April as the spring freshet subsided; however, this decrease did not coincide with a rise in daily alewife counts. The fish run gained momentum on May 8, when river flows reached 1,400 cfs. This was followed by a gradual decline in flow rates throughout the migration period, ending at 921 cfs on the final count day, July 11. Streamflow in the lower mainstem of the St. Croix River is directly influenced by water discharges from upstream hydropower dams at Woodland and Grand Falls and natural rainfall events.

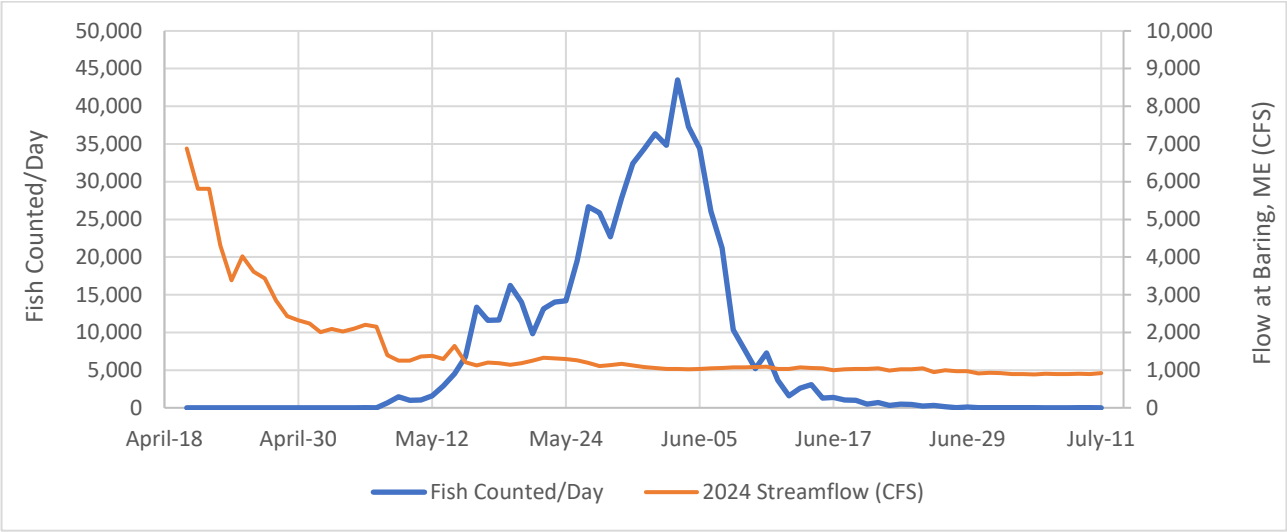

Figure 4 River herring counted per day at Woodland in 2024, showing streamflow at the USGS Baring, ME, gauge.

Water temperature was recorded next to the downstream entrance of the Woodland fishway using a wireless data logger (HOBO TidbiT MX400) set to read in 30-minute increments (Figure 5). The water temperature rose steadily from the onset of the study period, reaching its highest value of 26.7°C on June 21. Water temperature has the most significant effect on the migration of river herring. Migration for spawning alewives typically occurs when water temperatures range from 10–18°C (50–64°F) and temperatures range from 14–25°C (57–77°F) for blueback herring (Klauda et al. 1991). Once temperatures had approached 20°C, occurring first on June 4, a significant drop in fish ascending the Woodland fishway occurred and continued until the end of the study period on July 11.

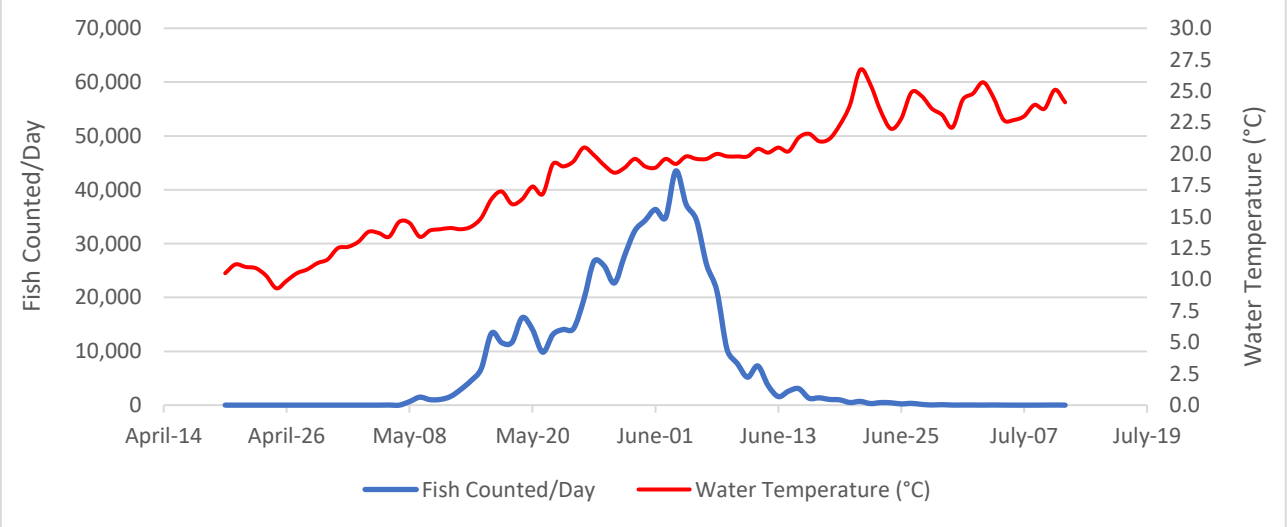

Figure 5 River herring counted per day with water temperatures recorded from within the fishway.

Other Species

Several freshwater fish species were also ascending or present within the Woodland fishway in 2024, as seen in Table 2. There were numerous smallmouth and largemouth bass, with one landlocked Atlantic salmon recorded on June 4. Both species of bass were observed in the fishway throughout the entire alewife migration, though they were much more prevalent during the tail-end of the run, coinciding with the downstream passage of YOY herring.

Table 2 Counts of inbound fish in the Woodland fishway, St. Croix River, April 20 to July 11, 2024.

Species	2024 Fishway Count
River herring: alewife (*Alosa pseudoharengus*) & blueback herring (*Alosa aestivalis*)	610,452
Smallmouth bass (*Micropterus dolomieu*)	83
Largemouth bass (*Micropterus salmoides*)	22
Landlocked Atlantic salmon (*Salmo salar*)	1

Lethal Sampling

One hundred (100) river herring were scheduled to be lethally sampled at Woodland; however, only 60 samples could be obtained due to mistiming of run distribution. The sex, species, age, weight, and fork length of the collected specimens were determined and recorded. The sampling efforts occurred throughout the spawning migration, with more sampling associated with higher count days to get a representative sample of the spawning population. All 60 lethal samples will be aged by DMR using the collected scales. Preliminary results from the 2024 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 2024 lethally sampled river herring, including average fork length, weight, and determined sex.

	Lethal Sampled Alewife	Lethal Sampled Blueback Herring
Average Fork Length (mm)	250.4 (59 samples)	202.0 (1 sample)
Average Weight (g)	213.0 (59 samples)	100.0 (1 sample)
Males (n)	26	N/A
Females (n)	33	1

Of the 60 river herring fish lethally sampled, 59 were determined to be alewife, and one 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, with alewife being pale pink in color and blueback herring having a black lining. Lethal sampling efforts in 2024 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 (the week with the highest recorded counts) occurred between May 17 and June 6 when counts were conducted at Milltown, with the mode being the week of May 24 to May 30. The highest weekly count at Woodland in 2024 was the week of May 31 to June 6, with 246,762 river herring counted, aligning with historical trends from the Milltown dataset, despite the counting station's location further upstream. The single-day peak occurred on June 3, with 43,500 river herring counted, and no other significant spikes were observed for the remainder of the season. Figure 8 compares the count distribution at Milltown from 2020-2023 with the 2024 distribution at Woodland.

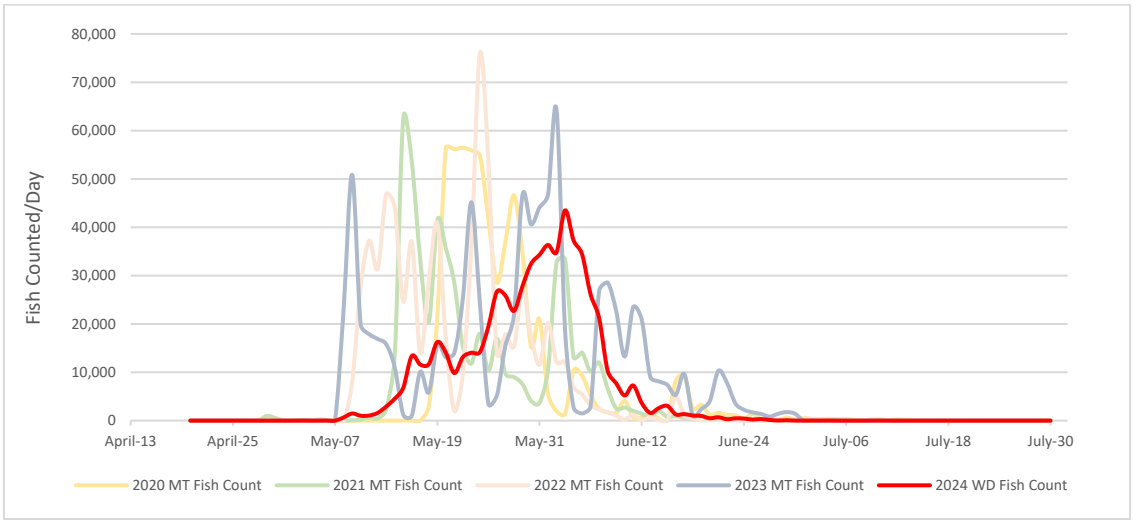

Figure 8 Daily river herring counts at Woodland in 2024, compared to the 2020-2023 daily counts at Milltown.

The weather in May was generally hot and dry, with five separate days where the daily highs for air temperature recorded at the Environment Canada weather station in St. Stephen exceeded 25°C. Notably, this station recorded limited rainfall (42.9 mm) in May, with only two significant rainfall events representing 79% of total monthly precipitation (13.8 mm on May 8 and 20 mm on May 28). This combined effect of hot and dry weather conditions created low water levels within the mainstem St. Croix. This did not appear to affect the ability of the river herring to enter and attempt to ascend the fishway at Woodland. Anecdotal observations throughout late May and early June by SCIWC staff noted large schools of river herring below the fishway entrance at the dam's tailrace, seemingly waiting to funnel into the entrance. During peak weeks, overcrowding within the initial section of the fishway leading into the first resting pool resulted in some river herring being ejected back out the entrance. As climate change alters seasonal weather patterns, the timing of the annual river herring migration will likely begin earlier, corresponding with increases in water and air temperatures and an earlier Spring freshet.

Signs of potential downstream movement in Woodland (Figure 9) were observed as early as June 11, with four reports of alewife 'swarming' near the fishway exit in which large schools seemed to hover in front of the camera during the entire 10-minute video. Plausible downward passage by adult alewives was noted on June 14 and June 20, with fish entering the upstream entrance of the fishway and deliberately moving downstream in smaller groups. Young-of-the-year (YOY) alewives were first spotted on June 27, with sightings continuing beyond the official count's end on July 11. During this period, adult alewives periodically travelled downstream alongside the YOY fish. Smallmouth and largemouth bass gathered near the exit throughout this period to feed on passing YOY alewives. The early downstream movement of adults had overlapped with ongoing upstream migration, complicating counts. This overlap highlights a need for more precise monitoring to better differentiate between these movements in future studies.

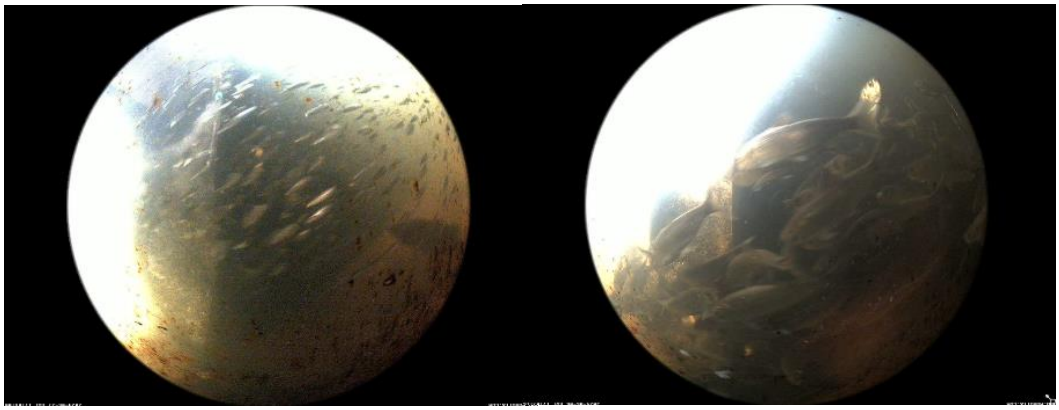

Figure 9 Downward passage of river herring young-of-year (left) and adults (right) within the Woodland fishway in 2024.

During the 2024 fish count period, the only operational turbines were units #10 and #6. Unit #9 (the one closest to the fishway) was not operational. The Woodland Dam consists of seven (7) turbines.

No American shad were noted passing through the Woodland fishway in 2024. The technical design of the current fishway at Woodland likely hinders the movement of shad, as they have been shown to struggle with passage at similar structures throughout the Northeast.

The St. Croix International Waterway Commission would like to acknowledge all the contributions from various government departments and agencies and the contributions from the exceptional individuals and volunteers who helped make the fish count possible throughout 2024. Thank you to the Sipayik Environmental Department for using their camera system and for their technical expertise with installation.

Lastly, we thank the International Joint Commission for their financial and logistical support and Woodland Pulp LLC staff for all their hard work and patience in allowing us to enter the facility and conduct this study.

Figure 10 Milltown Generating Station (MGS) decommissioning and Salmon Falls restoration as of August 28, 2024. Photo credits: Ed Friedman from Point of View Helicopter Services.

Questions regarding this report can be directed to:

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