Atlantic Whitefish Recovery Project

Andrew Breen
Bluenose Coastal Action Foundation
March 2015
Atlantic Whitefish Recovery Project
Report on 2014 Field Activities

Andrew Breen, Fisheries Technician
Bluenose Coastal Action Foundation
Table of Contents

Acknowledgements................................................................................................................................. 1

Goals and Objectives................................................................................................................................. 2

Methodology.................................................................................................................................................. 2
  Study Area.................................................................................................................................................. 2
  Outreach and Education.............................................................................................................................. 3
  Smallmouth Bass and Chain Pickerel Biological and Catch per Unit Effort (CPUE) Study ....................... 4
  Rotary Screw Trap Study............................................................................................................................... 5
  Spring and Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility .......... 6

Results - Invasive Species Monitoring...................................................................................................... 8
  Smallmouth Bass Catch per Unit Effort (CPUE) Study ............................................................................. 8
  Chain Pickerel Catch per Unit Effort (CPUE) Study .................................................................................. 13
  Smallmouth Bass Biological Study ........................................................................................................... 15
  Chain Pickerel Biological Study ............................................................................................................... 24
  Rotary Screw Trap Study.............................................................................................................................. 29
  Spring Monitoring and Sampling Activities at RST – Milipsigate Dam ..................................................... 29
  Fall Monitoring and Sampling Activities at RST – Milipsigate Dam ........................................................... 31
  Spring Monitoring and Sampling Activities at Hebb Lake Dam Fish Passage Facility ............................ 33
  Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility ........................... 37

Discussion..................................................................................................................................................... 38
  Outreach and Education ............................................................................................................................. 38
  Invasive Species Monitoring ...................................................................................................................... 38
  Rotary Screw Trap....................................................................................................................................... 39
  Spring/Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility ................ 40

Conclusion and Recommendations ............................................................................................................ 40
  Recommendations for 2014 from the 2013 Report .................................................................................. 40
  Recommendations for 2015 ......................................................................................................................... 41
Acknowledgements

Bluenose Coastal Action Foundation would like to extend its gratitude and appreciation to those who contributed to the successful completion of the 2014 field season. The following individuals played a critical role in supporting the Atlantic Whitefish Recovery Project (AWRP):

- 2014 Field Crew: Philip Longue and Ian Manning
- Fisheries and Oceans Canada Staff: Dr. Rod Bradford
- Nova Scotia Department of Fisheries and Aquaculture, Inland Fisheries Division: Jason LeBlanc
- Bridgewater Public Service Commission: Larry Hood
- University of Windsor: Edmund Halfyard
- Members of the Atlantic Whitefish Conservation and Recovery Team
- Bluenose Coastal Action Foundation summer staff
- Many various volunteers, students, and community members that helped with field activities
Goals and Objectives

Bluenose Coastal Action Foundation’s Atlantic Whitefish Recovery Project (AWRP) had several goals and objectives for the 2014 field season. These goals and objectives included the following:

1. To continue to address knowledge gaps surrounding the migratory behaviour of Atlantic whitefish, including upstream and downstream migration patterns.
2. To increase Atlantic whitefish awareness within the community.
3. To continue to assess the impact of smallmouth bass (SMB) and chain pickerel (CP) on the existing Atlantic whitefish population.
4. To establish catch per unit effort (CPUE) records for SMB and CP in the vicinity of Milipsigate Dam and compare results with 2013 data.
5. To conduct a stomach content survey and analysis of SMB and CP from the upper Petite Rivière lakes.
6. To operate and monitor the Hebb Lake Dam fishway and trap.
7. To operate and monitor a rotary screw trap (RST) at the base of Milipsigate Dam.
8. To assist with a boat electrofishing study of invasive species in the upper Petite Rivière lakes.
9. To confirm the existence of Atlantic whitefish in Minankeak Lake.

Methodology

Study Area

All sampling took place within the Petite Rivière watershed (Figure 1) between April and December 2014. All data was collected from three lakes; Minamkeak, Milipsigate, and Hebb, as well as the main branch of the Petite Rivière, and the upper and lower tributaries that feed into the main river.
Figure 1: Map of the Petite Rivière watershed showing the three lakes (i.e., Minamkeak, Milipsigate, and Hebb), which contain the existing wild Atlantic whitefish population, as well as the dams that currently impede fish passage.

Outreach and Education

An important component of the AWRP is to provide the local community with information about the plight of the Atlantic whitefish and ongoing recovery efforts. Coastal Action staff presented and/or had a project booth available at the following community festivals and events during the 2014-15 AWRP project year.

- Nova Scotia Community College – Lunenburg Campus Sustainability Expo
- Lunenburg, Bridgewater, and Mahone Bay Farmers Markets
- Michelin Seniors Expo
- Michelin Health & Safety Fair
- YMCA Healthy Kids Day
- Mahone Bay Pirate Festival and Regatta
- Bridgewater Growing Green Sustainability Festival
- Bridgewater Children’s Fair
- White Point Beach March Break Programming Activities
- Lunenburg County Fish Friends Program (10 local schools participate in this program)
Smallmouth Bass and Chain Pickerel Biological and Catch per Unit Effort (CPUE) Study

A biological study and catch per unit effort (CPUE) survey were conducted in Hebb, Milipsigate, and Minamkeak Lakes, with special focus paid to the Milipsigate Outlet. All angling took place between April 25, 2014 and October 21, 2014. Using a 14-ft Princecraft aluminum boat and a four-stroke Yamaha motor, two or three anglers fished a range of habitats, but concentrated on several habitat types found in the Milipsigate Outlet. These habitats included rocky drops, vegetated areas, and areas with flowing water at the base of the Milipsigate Dam.

As part of the CPUE study, the following details were recorded:

- Total angling time at each site (in minutes)
- Number of anglers
- Weather conditions
- Water temperature (°C) – Measured using a digital thermometer
- Type of lure used (i.e., Artificial worm)
- Catch data: species, fork length (cm), weight (g)
- Stomach content (fish, invertebrate, or empty)
- Sex of fish

Figure 2: Aerial view of the Milipsigate Outlet.
The estimated CPUE value was calculated by dividing the number of angled smallmouth bass or chain pickerel by the total amount of time spent fishing in each body of water.

All invasive species angled during the CPUE study, as well as any captured in the rotary screw trap, trap net, and fishway trap, were retained and analysed in the biological component of the study. All fish were placed on ice in a cooler and were sampled within a few hours of their capture. Several details and measurements were taken for each fish; including weight (g), fork length (cm), sex, stomach content, and scale samples. Scale samples were taken from of the left side, posterior to the pectoral fin, and below the lateral line using tweezers.

![Figure 3: Preferred area to remove scales from smallmouth bass.](image)

The samples were cleaned, mounted on slides, and examined using a microfiche reader. The age of each fish was determined by counting the number of bands and circuli. Feeding preferences were determined by examining stomach contents, which were extracted using a filet knife. Stomach content was recorded as being either fish, invertebrate, or empty.

The stomach contents were removed by making an incision in the fish and exposing the stomach. The stomach was carefully removed from the body cavity and its contents were inspected for the presence of fish or invertebrates. Furthermore, an inspection was carried out to check if the bass had regurgitated any of its stomach content.

**Rotary Screw Trap Study**

A rotary screw trap (RST) (developed by EG Solutions, Inc., Corvallis, Oregon, USA) was installed directly below Milipsigate Dam. Rotary screw traps are most commonly used to capture downstream migrating salmon smolts in the spring to estimate the Atlantic salmon population size. In this case, the trap was operated with the intent to monitor Atlantic whitefish which were known, historically to congregate below Milipsigate Dam during May. The trap was assembled in a cove close to the site and positioned in the outflow from Milipsigate Lake. The corner of each pontoon was secured to the bank using polypropylene rope. The trap consists of a 5-ft diameter rotating conical shaped drum, which is partly submerged and suspended on two 16-ft long pontoons. Adequate depth and sufficient water flow are required to keep the drum rotating and to guide fish through the drum into a live holding box at the rear of the trap.
The RST operated between April 24, 2014 to June 10, 2014 and again from September 24, 2014 to December 1, 2014. The trap was checked on a daily basis. Each fish was removed from the holding tank using a dip net and placed in a bucket for sampling. Each fish was identified, measured to fork length (cm), and released (with the exception of smallmouth bass and chain pickerel, which were sacrificed as part of the biological study). Physical data, including water temperature (°C), weather conditions, and drum rotations per minute (RPM), were also collected daily. Once all fish had been sampled and released, all debris was removed from the holding tank, and the external surface of the drum was cleaned using a hard brush.

### Spring and Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility

The Hebb Lake Dam Fish Passage Facility opened on May 12, 2014 and operated until July 2, 2014, to allow for the migration of Alewife and then again from September 29, 2014 until December 4, 2014, to allow for the monitoring of Atlantic whitefish. A suspended 6’0” x 6’8” x 7’8” aluminum trap was set and monitored daily during these time periods (Figure 6). The purpose of the trap was to monitor and sample any upstream migrating fish. All fish were sampled and released according to the protocols outlined in DFO’s Hebb Lake Dam Fish Passage Facility Interim Monitoring Plan. The following species were permitted to pass upstream; White sucker, Brown bullhead, Gaspereau, Brook trout, and American eel. All other species, with the exception of smallmouth bass and chain pickerel which were sacrificed for the biological study, were released downstream. The monitoring plan protocols ensured that any fish entering the lake did not pose a risk to the endangered Atlantic whitefish population. In addition, the lake level was recorded using a gauge attached to the fishway (Figure 5) and water temperatures were recorded on a daily basis.
Each day a minimum of two staff lifted the trap out of the water using a chain pulley system. The trap was opened, and each fish was netted and placed in a holding tank. All Atlantic whitefish would have been held in a plexiglass aquarium to facilitate examinations for any signs of hatchery rearing (i.e., fin clips, fin/snout erosion, tags, and general health) and to allow photos to be taken while keeping handling to a minimum. Each fish was measured to fork length (cm), weighed (g) in water using a digital hanging scale or balance scale, and examined to ensure good health. Scale samples and DNA samples would have been extracted from Atlantic whitefish if any were captured; five to ten scales removed from the left side of the fish just behind the dorsal fin and above the lateral line using a small clean knife. All scale samples would have then been mounted on slides using fine tweezers and examined with a microscope or microfiche reader.
Results - Invasive Species Monitoring

Smallmouth Bass Catch per Unit Effort (CPUE) Study

A total of 513 smallmouth bass were angled and removed from the watershed during the CPUE study. All fish were angled using an artificial worm; however, the majority of smallmouth bass were angled using an artificial worm lure (Figure 7).

![Artificial worm lure](image)

Figure 7: Artificial worm lure.

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of bass angled</th>
<th>Total time spend angling (Hrs)</th>
<th>Estimated CPUE (# bass/hour)</th>
<th>Other species angled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hebb Lake</td>
<td>44</td>
<td>16.25</td>
<td>2.7</td>
<td>White perch; chain pickerel;</td>
</tr>
<tr>
<td>Milipsigate Outlet</td>
<td>294</td>
<td>92.58</td>
<td>3.18</td>
<td>White perch; chain pickerel;</td>
</tr>
<tr>
<td>Milipsigate Lake</td>
<td>31</td>
<td>5.5</td>
<td>5.6</td>
<td>Chain pickerel</td>
</tr>
<tr>
<td>Minamkeak Lake</td>
<td>34</td>
<td>22.25</td>
<td>1.52</td>
<td>White perch</td>
</tr>
<tr>
<td>Hebb Dam to Fancy Lake</td>
<td>97</td>
<td>9.5</td>
<td>10.2</td>
<td>Chain pickerel</td>
</tr>
<tr>
<td>D/S Fancy Lake</td>
<td>13</td>
<td>2</td>
<td>6.5</td>
<td>None</td>
</tr>
<tr>
<td>Total</td>
<td>513</td>
<td>148.1</td>
<td>4.95</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Number of smallmouth bass angled from six fishing areas, the total amount of time spent angling, the estimated catch per unit effort (CPUE), and other incidentally angled species.
Between April 25, 2014 and October 9, 2014 approximately 148.1 hours were spent angling in the Petite Watershed. Over 62% of the total angling effort was concentrated in the Milipsigate Outlet area. CPUE was assessed on a monthly basis in this area to determine the viability of angling as a control method in a sensitive habitat area. (Note: The base of Milipsigate Dam was an area that traditionally, pre-2010, would be known to support a population of Atlantic whitefish during the month of May. They would congregate in this area to feed on White sucker eggs.)

Figure 8: Number of smallmouth bass angled from six fishing areas, the total amount of time spent angling, and the estimated catch per unit effort (CPUE).
Figure 9: A comparison between the number of Smallmouth bass angled from Milipsigate Outlet in 2013/2014

Figure 10: A comparison of angling CPUE for smallmouth bass between 2013/2014 at Milipsigate outlet.
Figure 11/Table 2: Number of smallmouth bass angled from Milipsigate Outlet, the total amount of time spent angling, the estimated catch per unit effort (CPUE).

<table>
<thead>
<tr>
<th></th>
<th>Effort (Hrs)</th>
<th>SMB Angled</th>
<th>CPUE (Fish per hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>4.4</td>
<td>4.0</td>
<td>0.9</td>
</tr>
<tr>
<td>May</td>
<td>29.8</td>
<td>109.0</td>
<td>3.7</td>
</tr>
<tr>
<td>June</td>
<td>19.8</td>
<td>62.0</td>
<td>3.1</td>
</tr>
<tr>
<td>July</td>
<td>20.3</td>
<td>52.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Aug</td>
<td>14.1</td>
<td>51.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Sept</td>
<td>2.8</td>
<td>12.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Oct</td>
<td>1.5</td>
<td>4.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>92.6</td>
<td>294.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Figure 12: A comparison of total catch of SMB and total effort in 2013/2014 at Milipsigate Outlet.

Figure 13: A comparison of overall smallmouth bass CPUE in 2013/2014 at Milipsigate Outlet.
Chain Pickerel Catch per Unit Effort (CPUE) Study

**Figure 14:** A comparison of CPUE for chain pickerel angled from Milipsigate Outlet in 2013/2014.

**Figure 15:** Location of chain pickerel capture throughout the entire watershed 2014.
Figure 16: Number of chain pickerel angled from Milipsigate Outlet in 2013, total amount of time spent angling, estimated catch per unit effort (CPUE).

Figure 17: Number of chain pickerel angled from Milipsigate Outlet in 2014, total amount of time spent angling, estimated catch per unit effort (CPUE).
Smallmouth Bass Biological Study

A total of 544 smallmouth bass were retained for a biological stomach content analysis. This total includes 513 (of the) SMB angled during the CPUE survey, 28 caught in the fishway, and 3 caught in the RST. (Note: 38 additional SMB were caught and tagged as part of a boat electrofishing marked recapture project.)

Figure 18: Total SMB biologically sampled from all collection methods.

The stomach content report concentrates on the analysis at Milipsigate Outlet between April and October 2014. It includes all fish that were angled as well as those caught in the RST located at the base of Milipsigate Dam.

Figure 19: A smallmouth bass complete with its stomach content - 14 YOY Gaspereau.
Figure 20: Stomach content analysis of 543 SMB captured in 2014 from all locations.

Figure 21: Stomach content analysis of 4 SMB captured in April 2014 from Milipsigate Outlet.
Figure 22: Stomach content analysis of 181 SMB captured in May 2013 from Milipsigate Outlet.

Figure 23: Stomach content analysis of 109 SMB captured in May 2014 from Milipsigate Outlet.
Figure 24: Stomach content analysis of 10 SMB captured in June 2013 from Milipsigate Outlet.

Figure 25: Stomach content analysis of 62 SMB captured in June 2014 from Milipsigate Outlet.
Figure 26: Stomach content analysis of 47 SMB captured in July 2013 from Milipsigate Outlet.

Figure 27: Stomach content analysis of 52 SMB captured in July 2014 from Milipsigate Outlet.
Figure 28: Stomach content analysis of 93 SMB captured in August 2013 from Milipsigate Outlet.

Figure 29: Stomach content analysis of 51 SMB captured in August 2014 from Milipsigate Outlet.
Figure 30: Stomach content analysis of 36 SMB captured in September 2013 from Milipsigate Outlet.

Figure 31: Stomach content analysis of 12 SMB captured in September 2014 from Milipsigate Outlet.
Figure 32: Stomach content analysis of 4 SMB captured in October 2014 from Milipsigate Outlet.

Figure 33: Length comparison of SMB at Milipsigate Outlet. Note: In 2013 ~ 368 SMB and in 2014- 301 SMB.
Figure 34: Similar length distribution comparison except size frequency is 2cm.

Figure 35: Length comparison (x axis represents % of total catch for that year).
Chain Pickerel Biological Study

A total of 129 chain pickerel were removed by angling, at the fishway, and using the RST between May 6, 2014 and October 9, 2014. This represents a significant increase in the amount of chain pickerel caught especially in the Milipsigate Outlet (an increase of 600%). Note: Additional chain pickerel were removed from Hebb Lake using the electrofishing boat.

![Figure 36: Total chain pickerel capture in 2014.]

![Figure 37: Length distribution of all chain pickerel captured in 2014.]

---

2014 [ATLANTIC WHITEFISH RECOVERY PROJECT]
Figure 38: Length distribution of all chain pickerel caught in Milipsigate Outlet in 2013.

Figure 39: Length distribution of all chain pickerel caught in Milipsigate Outlet in 2014.
Figure 40: Number of chain pickerel angled from Milipsigate Outlet in 2013, total amount of time spent angling, estimated catch per unit effort (CPUE).

Figure 41: Number of chain pickerel angled from Milipsigate Outlet in 2014, total amount of time spent angling, estimated catch per unit effort (CPUE).
Figure 42: Comparison of catch per unit effort (CPUE) for chain pickerel at Milipsigate Outlet 2013/2014.

Figure 43: Chain pickerel caught at Milipsigate Outlet with stomach content - 5 YOY Gaspereau.
Figure 44: Stomach content analysis for chain pickerel in 2014 caught at all locations.

Figure 45: Large chain pickerel (specimens up to 60cm have been encountered in Hebb Lake).
Rotary Screw Trap Study

A rotary screw trap (RST) was deployed and monitored at the base of the Milipsigate Dam from April 25, 2014 to June 10, 2014 and then again from September 24, 2014 to December 1, 2014.

Spring Monitoring and Sampling Activities at RST – Milipsigate Dam

**Figure 46:** Total captures by species from rotary screw trap at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).
Figure 47: Daily total fish captured in rotary screw trap and water temperature at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).

Table 3: Total monthly captures by species from rotary screw trap at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).

<table>
<thead>
<tr>
<th>Species</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Eel</td>
<td>5</td>
<td>156</td>
<td>59</td>
<td>220</td>
</tr>
<tr>
<td>Brown Bullhead</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Banded Killifish</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Black-Nosed Dace</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Creek Chub</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Chain Pickerel</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Gaspereau</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Golden Shiner</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Lake Chub</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Smallmouth Bass</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>White Perch</td>
<td>5</td>
<td>53</td>
<td>17</td>
<td>75</td>
</tr>
<tr>
<td>White Sucker</td>
<td>1</td>
<td>23</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>Yellow Perch</td>
<td>0</td>
<td>10</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Captured</strong></td>
<td><strong>11</strong></td>
<td><strong>258</strong></td>
<td><strong>110</strong></td>
<td><strong>379</strong></td>
</tr>
</tbody>
</table>
Fall Monitoring and Sampling Activities at RST - Milipsigate Dam

![RST Species Totals - Fall 2014](image)

**Figure 48**: Total captures by species from rotary screw trap at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).

**Table 4**: Total monthly captures by species from rotary screw trap at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).

<table>
<thead>
<tr>
<th>Species</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Eel</td>
<td>117</td>
<td>91</td>
<td>4</td>
<td>212</td>
</tr>
<tr>
<td>Brown Bullhead</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chain Pickerel</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Gaspereau</td>
<td>5</td>
<td>82</td>
<td>0</td>
<td>87</td>
</tr>
<tr>
<td>White Perch</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total Captured</strong></td>
<td><strong>128</strong></td>
<td><strong>179</strong></td>
<td><strong>6</strong></td>
<td><strong>313</strong></td>
</tr>
</tbody>
</table>
Figure 49: Gaspereau at Milipsigate Outlet. Note: It should be noted that all fall Gaspereau were 2014 YOY.

Figure 50: Daily total fish captured in rotary screw trap and water temperature at Milipsigate Outlet, Hebb Lake, Lunenburg County. Data collected by Coastal Action staff members (Apr 25 to Jun 10, 2014).
Spring Monitoring and Sampling Activities at Hebb Lake Dam Fish Passage Facility

The Hebb Lake Dam Fish Passage Facility monitoring trap was fished daily from May 13, 2014 to July 1, 2014. A total of 3,006 fish were intercepted comprising of seven different species. In 2013, Gaspereau were permitted to access the upper watershed for the first time in over 40 years. In 2014, they were the most abundant species totaling 97% of the catch. The Gaspereau (Alewife) spawning migration peaked in two waves; first on June 2, 2014 and then again on June 9, 2014. Of the seven species caught, Gaspereau, American eel, Creek chub, White sucker, and Brook trout were allowed to continue into Hebb Lake. The lone lamprey was released downstream and all invasives were removed.

Table 5: Total Spring capture results of fish from Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff members (April 16 – June 28, 2013) and (May 13 – July 1, 2014).

<table>
<thead>
<tr>
<th>Species</th>
<th>Abundance Spring-2013</th>
<th>Abundance Spring 2014</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Eel</td>
<td>3</td>
<td>1</td>
<td>(2)</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>1</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Chain Pickerel</td>
<td>0</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Chub Spp.</td>
<td>5</td>
<td>0</td>
<td>(5)</td>
</tr>
<tr>
<td>Gaspereau</td>
<td>2,120</td>
<td>2,924</td>
<td>804</td>
</tr>
<tr>
<td>Shad</td>
<td>1</td>
<td>0</td>
<td>(1)</td>
</tr>
<tr>
<td>Sea-Lamprey</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Smallmouth Bass</td>
<td>18</td>
<td>35</td>
<td>17</td>
</tr>
<tr>
<td>White Sucker</td>
<td>174</td>
<td>37</td>
<td>(137)</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>2323</strong></td>
<td><strong>3009</strong></td>
<td><strong>686</strong></td>
</tr>
</tbody>
</table>

Table 6: First and last arrivals at the Hebb Dam Fishway – Spring 2014.

<table>
<thead>
<tr>
<th></th>
<th>American Eel</th>
<th>Brook Trout</th>
<th>Chain Pickerel</th>
<th>Gaspereau</th>
<th>Smallmouth Bass</th>
<th>White Sucker</th>
</tr>
</thead>
<tbody>
<tr>
<td># of fish</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>2924</td>
<td>35</td>
<td>37</td>
</tr>
</tbody>
</table>
**Figure 51:** Water temperature and total Gaspereau captures at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff members (May 13 – July 1, 2014).

**Figure 52:** Water temperature and total smallmouth bass captures at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (May 13 – July 1, 2014).
Figure 53: Comparison of Gaspereau runs at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (April 16 – June 28, 2013) and (May 13 – July 1, 2014).

Table 7: Smallmouth bass fork lengths (2 cm-classes) of smallmouth bass captured at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (April 16 – June 28, 2013) and (May 13 – July 1, 2014). N=53.

<table>
<thead>
<tr>
<th>Fork Length Range (cm)</th>
<th>2013 (n = 18)</th>
<th>2014 (n = 35)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>20-22</td>
<td>3</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>22-24</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>24-26</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>26-28</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>28-30</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>30-32</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>32-34</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>34-36</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>36-38</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>38-40</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 54: Smallmouth bass fork-lengths (2 cm-classes) of smallmouth bass captured at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (April 16 – June 28, 2013). N = 17.

Figure 55: Smallmouth bass fork-lengths (2 cm-classes) of smallmouth bass captured at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (May 13 – July 1, 2014). N=35.
Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility

The Hebb Lake Dam Fish Passage Facility monitoring trap was fished daily from September 29, 2014 to December 4, 2014. A total of 26 fish were captured at the fishway trap. Unfortunately, unlike 2012, no wild Atlantic whitefish were caught in the Hebb Lake Dam Fishway monitoring trap.

Table 8: Total Fall capture results of fish from Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff members (October 2 – November 29, 2013) and (September 29 – December 4, 2014).

<table>
<thead>
<tr>
<th>Species</th>
<th>Abundance Fall-2013</th>
<th>Abundance Fall 2014</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Salmon</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Brook Trout</td>
<td>2</td>
<td>0</td>
<td>(2)</td>
</tr>
<tr>
<td>Brown Bullhead</td>
<td>1</td>
<td>0</td>
<td>(1)</td>
</tr>
<tr>
<td>Chain Pickerel</td>
<td>2</td>
<td>0</td>
<td>(2)</td>
</tr>
<tr>
<td>Smallmouth Bass</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>White Sucker</td>
<td>14</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Grand Total</td>
<td>20</td>
<td>26</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 9: Number of species intercepted at the Hebb Lake Dam Fish Passage Facility, as well as the first and last day each species was observed in the fishway.

<table>
<thead>
<tr>
<th></th>
<th>Atlantic Salmon</th>
<th>Smallmouth Bass</th>
<th>White Sucker</th>
</tr>
</thead>
<tbody>
<tr>
<td># of fish</td>
<td>1</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>
Figure 56: Water temperature and total fish captures at Hebb Lake Fishway, Hebbville, Lunenburg County, Nova Scotia. Data collected by Coastal Action staff (Sept 29 – Dec 4, 2014).

Discussion

Outreach and Education

Each year Bluenose Coastal Action Foundation attempts to highlight the plight of the Atlantic whitefish to the local community. This task was even more important in 2014 with the discovery that chain pickerel were now one of the most abundant species in Hebb Lake. This invasive predator, along with the smallmouth bass, has the potential to extirpate the Atlantic whitefish from its only remaining home. In addition, it is the belief that these predatory species are having an impact on all salmonid species in the Southern Uplands region of Nova Scotia. By continuing to educate all stakeholders, along with the general public, about the interactions between these illegally introduced species and our native Atlantic whitefish, as well as other salmonid species, improved fisheries management procedures may be initiated.

Invasive Species Monitoring

In 2014, a significant amount of time was spent in the Milipsigate Outlet area of Hebb Lake. This area is thought to be “critical habitat” for Atlantic whitefish. The 2014 data indicates a decline in the CPUE for smallmouth bass but an increase in the CPUE for chain pickerel. In 2013, no chain pickerel were angled in the
Milipsigate Outlet until August; however, in 2014, they were active in the area from the very beginning of the angling season. The angling component of the project will continue in 2015 and it will be interesting to see if these current trends continue. Unlike 2013, no Atlantic whitefish were found during the stomach content analysis.

On April 30, 2014, while angling using a rubber worm for invasive species at the Milipsigate Outlet, an Atlantic whitefish was hooked for a short time before managing to ‘shake the hook’. This was an exciting development for project staff as in 2013, after 23 hours of fishing effort and the captures of 164 smallmouth bass along with an additional 36 hour deployment of a trapnet, no Atlantic whitefish had been captured.

Coastal Action staff assisted the NS Department of Fisheries and Aquaculture with the operation of an electrofishing boat in the three Petite lakes (Minamkeak, Milipsigate, and Hebb) during the months of May and September 2014. It is hoped that this activity will continue again in the Spring of 2015, hopefully targeting smallmouth bass prior to and during the nesting period from mid-May to mid-June.

Exceptionally worrying, but not surprising, is the speed at which the chain pickerel are colonizing the watershed. In 2014, Coastal Action staff had several reports of chain pickerel being caught throughout Fancy Lake.

**Rotary Screw Trap**

This was the first year that the rotary screw trap had been deployed at the outflow from Milipsigate Dam. The intent of deploying the RST in this area was two-fold; (1) to remove any invasive species that were caught in the RST and (2) to monitor for any Atlantic whitefish activity. In 2013, no Atlantic whitefish had been observed in this area, except two that were found during the stomach content analysis of smallmouth bass. During May 2014, project staff noticed increased Atlantic whitefish activity directed behind the RST. This activity continued until the first week of June. Unfortunately, staff were unable, and not permitted, to try to obtain an accurate population estimate; however, a quick calculated estimation based on observation was that the population at Milipsigate Dam during late May was between 50 - 100 fish. Coastal Action staff found that the fish would move closer to the RST upon their arrival, probably due to the availability of food; the holding tank of the RST collects large quantities of new emerged invertebrates. On checking the holding tank for fish these invertebrates are cleaned from the holding box and placed in the water behind the RST. In addition, the water current caused by the placement of the RST creates a back eddy which again collects the invertebrates and the fish in the small area directly behind the RST.

During the fall monitoring of the RST, especially in October, a significant number of Gaspereau were caught, 2014 YOY. Some of these fish were up to 12cm FL. It is still unknown if these fish overwinter in the lake.

Finally, the majority of American eel, including some large silver eel (up to 60cm), were caught mainly in the 24 hour period after a rain event.
Spring/Fall Monitoring and Sampling Activities at the Hebb Lake Dam Fish Passage Facility

The Spring monitoring of Hebb Dam fishway began on May 13, 2014. The season started with the usual upstream spawning migration of White sucker. Gaspereau migration reached the fishway on May 18, 2014 and peaked around the second weekend in June. Coastal Action staff were pleased that the number of returning adult Gaspereau had increased from 2,120 fish in 2013 to 2,924 in 2014. It will be interesting to see if this population experiences an increase in 2015 due to the opening of the fishway and consequent increase in available habitat. That being said, that newly available habitat has two highly predatory invasive species that have the potential to neutralize any net benefit.

The fall monitoring was again disappointing; with only 1 Atlantic salmon and no Atlantic whitefish being intercepted at the fishway. However, project staff were concerned about the accessibility for fish attempting to reach the fishway. Their concern was around the operation of the spillway to flood some nearby cranberry fields. Staff felt that while these fields were being flooded a barrier to fish upstream migration existed. Hopefully this matter can be resolved before Fall 2015.

Conclusion and Recommendations

Recommendations for 2014 from the 2013 Report

- In 2014, the RST should be installed immediately below the Milipsigate Dam. The objective would be to remove all invasive species from this sensitive area and monitor for the presence of Atlantic whitefish on a 24 hour 7 day a week basis.

In 2014, the RST was indeed deployed below the Milipsigate Dam from April to December. The RST was not particularly effective in the capture of invasive species, although some SMB and CP were removed from the system using the RST. The RST was also ineffective at capturing Atlantic whitefish; however, it did provide a perfect viewing platform to monitor the population of AW that were present at Milpisigate Dam during May 2014.

- Explore all options for invasive species control such as boat electrofishing, angling in key areas such as Milipsigate Outlet, Minankeak Brook Outlet, and Sarty Brook Outlet.

The electrofishing boat, purchased by DFO and operated by NS DFA – Inland Fisheries Division, was used on the upper Petite Lakes primarily Hebb Lake. A report detailing the use of an electrofishing boat for invasive species control will be produced in 2015/16.

- Determine if angling effort to remove SMB in Milipsigate Outlet in 2013 affected SMB population.
This report indicates that angling effort in the Milipsigate Outlet area has decreased the average size of SMB and helped decrease the CPUE.

- Determine if chain pickerel population is increasing using CPUE study.

The number of chain pickerel and the CPUE both increased in 2014.

- Continue with the stomach content analysis of invasive species especially in the key areas then compare with results from 2013.

Completed – Details were outlined in the body of this report.

- A continuation of the outreach and educational activities at local schools and community events.

Ongoing – AW Project displays were set up at ten public events/festivals throughout Lunenburg County in 2014-15.

- Increase efforts to monitor residual population of Atlantic whitefish in the Upper Petite Watershed (i.e., Fancy Lake and Wallace Lake).

Although Coastal Action was not particularly active in these areas in 2014, there were reports of an AW being caught while trolling a rubber worm in Fancy Lake.

- Re-establish a captive breeding program and increase efforts concerning range expansion.

There is currently no plan to implement either of these critically important recommendations.

- Construct two boat ramps for an electrofishing boat at Milipsigate Outlet (i.e., Milipsigate Lake and Hebb Lake).

A boat ramp was constructed for Hebb Lake near the Hebb Dam.

Recommendations for 2015

- To continue with the stomach content analysis of any invasive species captured in the watershed.

- Determine if the chain pickerel population is increasing using CPUE study and determine the extent of their range.

- Determine if angling effort to remove SMB in Milipsigate Outlet in 2013/2014 affected SMB population.
• Increase efforts to monitor residual population of Atlantic whitefish, especially in Wallace and Fancy Lake (using similar techniques to those employed at Milipsigate Outlet).

• A continuation of the outreach and educational activities at local schools and community events.

• Utilize the backpack electrofisher to remove “young of the year” chain pickerel from the shallows during August.

• In 2015, the RST should remain immediately below the Milipsigate Dam. The objective would be to try to use video to try and obtain a population estimate of Atlantic whitefish present at the Milipsigate Dam during May 2015. Also, to remove all invasive species from this sensitive area.

• Deploy a fyke net downstream from Hebb Dam during July and August to monitor the downstream migration of “young of the year” Gaspereau and possibly Atlantic whitefish.

• Use backpack electrofisher to survey areas of the watershed to assist in the creation of a fish habitat restoration plan. (Special interest concerning Minamkeak Brook and Wallace Brook.)

• Implement a reporting system to assist local anglers in recording their catch of invasive species, Brook trout, and Atlantic whitefish.

• Re-establish a captive breeding program and increase efforts concerning range expansion.

• Improve electrofishing boat ramp access on Milipsigate Lake and Minamkeak Lake.

• Obtain clear guidelines concerning the restriction of fish passage to the fishway while the Indian Garden Farm cranberry fields are being flooded.