LaHave River Invasive Species Project

2018 Final Report

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Coastal Action

Contents

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Introduction

Coastal Action

Coastal Action is a community-based charitable organization with a mandate to address environmental concerns along the South Shore region of Nova Scotia. Coastal Action's goal is to promote the restoration, enhancement, and conservation of our environment through research, education, and action. Over the past 25 years, Coastal Action has successfully completed a vast number of projects within the South Shore region of the province. One of Coastal Action's greatest ongoing concerns is healthy watersheds. The organization has a great amount of experience in successfully conducting several fish habitat related projects in various watersheds within the area. These projects have included fish habitat and river restoration (i.e., digger logs, rock sills, deflectors, crib walls, etc.), fish passage and connectivity assessments and restoration projects (i.e., culvert remediation, installation of proper crossings, etc.), water quality monitoring, as well as habitat monitoring (i.e., redd counts, habitat suitability index surveys, habitat surveys, riparian health assessments, and electro-fishing). The organization has also been conducting fisheries research activities targeting the SARA listed endangered Atlantic whitefish and COSEWIC listed threatened American eel since 2008, as well as a new focus on the COSEWIC listed endangered Southern Uplands Atlantic Salmon starting in 2017. For the past five years, Coastal Action's work on the Atlantic whitefish and Atlantic salmon have targeted the threat of invasive species, namely smallmouth bass and chain pickerel, and their impacts on native species.

Problem

Atlantic salmon (*Salmo salar*) are threatened throughout most of their Canadian range by non-native fish species. In Nova Scotia, two species threaten the survival of Atlantic salmon in their freshwater migration as smolt: smallmouth bass (*Micropterus dolomieu*) and chain pickerel (*Esox niger*).

Invasive Species

Smallmouth Bass (*Micropterus dolomieu*):

Smallmouth bass are a freshwater sunfish native to the Great Lakes/Saint Lawrence River region of Canada. They have been observed using both lacustrine and riverine habitat type during multiple life stages. The ability to survive in a variety of habitats within a watershed allows smallmouth bass to access a large portion of that watershed. This also allows smallmouth bass to spread quickly through new watersheds when introduced. The first authorized introduction of smallmouth bass in Nova Scotia occurred in 1942 in Yarmouth County. Smallmouth bass currently occupy 180+ lakes in Nova Scotia due to countless authorized and unauthorized introductions since the 1940's (Leblanc, 2010). Once established, smallmouth bass alter ecosystems through direct predation and habitat competition.

Chain Pickerel (*Esox niger*)

Chain pickerel are a freshwater fish in the pike family native to lakes in Eastern North America, north to Maine. Authorized introductions occurred in three locations in southern Nova Scotia in 1945 (Mitchel et

al., 2011). Due to their high catchability and desired fight when caught, they have been illegally introduced into 95+ lakes in Nova Scotia since their initial introductions in the mid 1900's (Mitchell et al., 2011). Chain pickerel prefer lacustrine habitat with dense vegetation. They use this vegetation for spawning and hunting purposes. They are considered burst predators, waiting for prey to enter burst distance before they strike. The preference of lacustrine habitat slows, but does not stop, their spread through watersheds. Chain pickerel can drastically alter ecosystems when introduced. In certain cases, they can eradicate all other fish species until they are the only species that remain.

Goals and Objectives:

The 2018 field season goals and objectives comprise the first portion of a two-year research project. They address the problem of predation on Atlantic salmon (*Salmo salar*) smolt by two freshwater invasive fish species: smallmouth bass and chain pickerel. The 2018 field season focused on tagging the two invasive species as part of an ongoing mark and recapture study. This population estimate will then be used in conjunction with a diet analysis formed in the 2019 field season to estimate predation on Atlantic salmon smolt by the two predators. Indicators of success for the 2018 field season were as follows:

1. Number of tagged smallmouth bass and chain pickerel.
2. Number of smallmouth bass and chain pickerel measured for length and weight (condition factor).
3. Number of recaptured smallmouth bass and chain pickerel.

Methods

Smallmouth Bass and Chain Pickerel Extraction:

The most cost effective and time efficient method for extraction of smallmouth bass and chain pickerel for analysis and tagging was scientific angling. This method was used throughout the 2018 field season for the majority of sampling. Boat electrofishing was used for one day of sampling in September 2018. Scientific angling was also chosen for its ability to exclude most native species from sampling based on the bait used during sampling. A 14-ft Princecraft aluminum boat was the main sampling station and primary mode of transportation during the extraction of smallmouth bass and chain pickerel. A wide selection of bait was used to target the non-native predators. This was an attempt to mimic what the fish were feeding on at the time of sampling. This was determined by periodic non-lethal stomach content samples from the non-native species and from observations during sampling. Angling took place between May 1, 2018 and September 18, 2018.

Tagging:

Once a fish was angled it was placed in a live well attached to the boat. This was constructed of a circular piece of foam wrapped in a net to form an in-lake live well. The fish was then placed in a solution of clove oil, ethanol, and lake water. The measurements for the clove oil and alcohol solution were 9-parts ethanol to 1-part clove oil. Once that mixture was formed, a concentration of 40 mg/L of lake water was used for in-field anaesthesia. A temperature was taken of the solution and the lake water to assure there was not

more than a 5°C difference. If a difference of more than 5°C was noted, the solution was discarded, and a new solution was formed with fresh lake water.

The fish were placed in the solution until they began to lose equilibrium (started to lose balance in the water column). Once the fish had lost equilibrium, weight and length measurements were taken. Weight was taken using a wet mesh bag and a hanging scale, length measurements were taken using a semi submerged trough measuring board. After the measurements were recorded, while still in the trough, the fish was tagged with a T-bar Floy tag below the dorsal fin and a PIT tag behind the pectoral fins in the stomach cavity. The fish was then placed in a separate live well to recover and then released. This entire process lasted approximately 2-4 minutes per fish from time of placement on anaesthesia to time of release. If any fish did not recover within 5 minutes or showed signs of being foul hooked it was euthanized after anaesthesia with a sharp knife into the brain cavity.

Area of study:

Wentzells Lake is located outside of Bridgewater, Nova Scotia within the LaHave River watershed. This site was chosen due to the combination of the Main River and North Branch of the LaHave feeding into the lake. With two major branches of the LaHave entering this lake, the likelihood of Atlantic salmon smolt using this as a migratory pathway is higher than any other lake in the LaHave. The lake supports populations of both smallmouth bass and chain pickerel, which are the non-native fish that this study is targeting. The lake also has two boat launch sites making access easy.

The lake was split into three sections based on habitat and lake morphology. These sections are W1, W2, and W3. W1 is the area in which the North Branch of the LaHave River enters the lake. This area is shallow and densely vegetated with pickerel weed and rush species. W2 has a shoreline with coves that have gradual increases in depth and are vegetated with water lily species and pond-weed. Finally, W3 is the shoreline that borders the main road and is sparsely vegetated with rush species, contains steep depth increases, and little to no lake bottom habitat.

Results

Table 1. Total effort and smallmouth bass caught during the 2018 field season. CPUE is shown as number of fish caught/effort in hours.

Location	Effort (hrs)	# Fish Caught	CPUE (#fish/hr)
W1	43	35	0.81
W2	47.5	82	1.73
W3	37.4	66	1.76
Total	127.9	183	1.43

Table 2. Total effort and number of chain pickerel caught during the 2018 field season. CPUE is shown as number of fish caught/ effort in hours.

Location	Effort (hrs)	# Fish Caught	CPUE (#fish/hr)
W1	43	143	3.32
W2	47.5	130	2.73
W3	37.4	88	2.35
Total	127.9	361	2.82

Chain pickerel had a higher catch per unit effort overall and, in individual sections, higher than smallmouth bass with 2.82 fish per hour and 1.43 fish per hour, respectively. The total CPUE for both smallmouth bass and chain pickerel was higher in 2018 than in 2017; for chain pickerel this increase was more than 1 fish per hour. In contrast of 2017, W3 yielded the lowest CPUE for chain pickerel.

Table 3. Total smallmouth bass and chain pickerel tagged and recaptured during 2018 sampling season.

Species	Tagged	Recaptured
Smallmouth Bass	178	20
Chain Pickerel	313	23

Even though there were 135 more chain pickerel tagged throughout the sampling season than smallmouth bass, there were only 3 more chain pickerel recaptured.

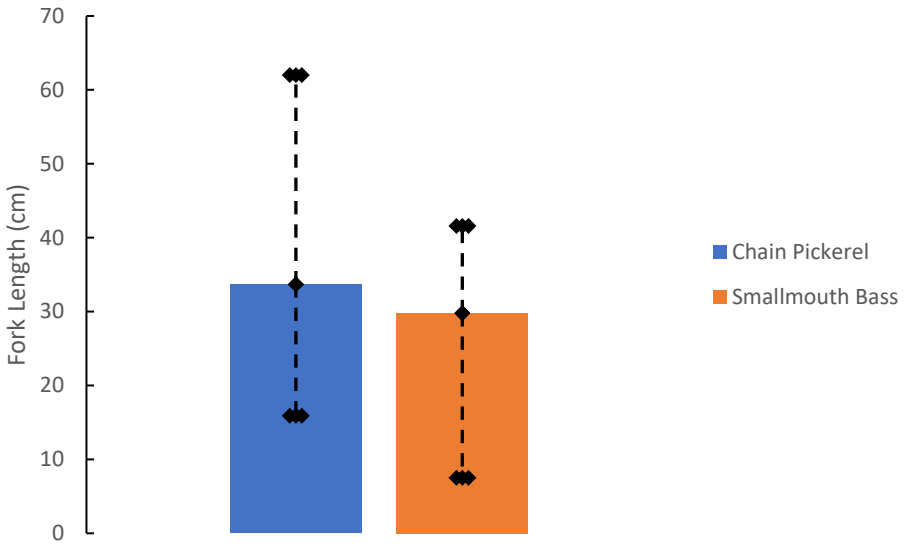

Figure 1. Average fork length of chain pickerel and smallmouth bass. Error bars indicate maximum and minimum size sampled.

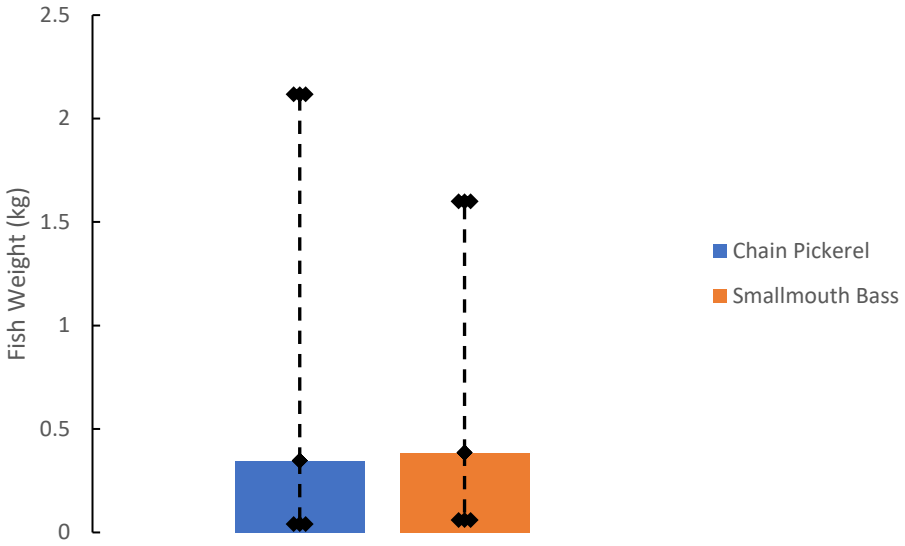

Figure 2. Average weight of chain pickerel and smallmouth bass in kilograms. Error bars indicate minimum and maximum weights during sampling.

Smallmouth bass have more mass than chain pickerel per centimeter of fork length, showing a higher average weight and a shorter average fork length. This is due to the physiology of the fish; chain pickerel having a fusiform shape compared to the oval shape of a smallmouth bass.

Discussion

More chain pickerel were sampled in the early season (May through to late June) than the later season (August/September). There were 246 chain pickerel sampled before the end of June and 67 sampled after June. Smallmouth bass had a more even distribution throughout the sampling period with 93 being sampled before the end of June and 90 being sampled after June. However, for smallmouth bass, the difference between May and June was more significant with May seeing 26 bass sampled and June seeing 67. This means that the chain pickerel within Wentzells Lake are feeding more heavily during the Atlantic salmon smolt migration than in the periods that follow the migration. It also suggests, based on feeding habits, that they are more likely to impact Atlantic salmon smolt through direct predation than smallmouth bass.

Sampling more chain pickerel in the first half of the sampling period was beneficial for overall tagging numbers. However, when it came to recapture numbers, the significant decrease in sampled pickerel after June reduced the likelihood of recapturing those tagged individuals. The relatively even distribution of sampled smallmouth bass throughout the field season aided in gaining a high number of tagged individuals as well as a relatively high number of recaptured individuals.

The removal of chain pickerel and smallmouth bass did not impact the catch per unit effort at any of the sites. CPUE's were higher for chain pickerel in 2018 than those of 2017. Aside from W1, CPUE's were higher for smallmouth bass as well, indicating that the removal of 191 smallmouth bass and chain pickerel had no significant effect on population size in Wentzells Lake.

Due to the increase in water temperature in August and September of 2018, both chain pickerel and smallmouth bass were using deep, cold water refugia. Due to this change in habitat use, using the electrofishing boat in the spring while fish are frequenting the shallow lake regions would be more efficient.

Due to the requirement for sampled fish to be tagged and returned alive, no stomach content analysis was completed during the 2018 field season.

2019 Field Season

Goals and Objectives:

There will be no more tagging of fish in the 2019 field season. The goal of the 2019 field season is to form a comprehensive diet structure for both smallmouth bass and chain pickerel. This will be completed using a live stomach content removal. A gastric lavage technique will be applied to the two non-native fish species for the entire season to form the diet structure. Each fish will have the stomach contents weighed and separated for further analysis. The contents will be identified to the lowest taxonomic level possible. Methods for fish extraction will be similar to the 2018 field season, the only difference being that the tagging process will be substituted with the gastric lavage. The area of study will remain the same

(Wentzells Lake). Measures of success will be number of fish sampled, number of stomach contents extracted, and efficiency of the gastric lavage technique.

References

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