Upper Great Lakes Management Unit
Lake Huron Office, PS-LHA-BM15-800s

Ontario

Ministry of Natural Resources and Forestry

Ministère des Richesses naturelles et des Forêts

Broadscale Smallfish Community Assessment Program Summary Report 2015

Introduction

The study of the nearshore areas of lakes is vital to fish community assessment programs because of their high vulnerability to impact from human activities and their role as fish nurseries and feeding grounds (Lazzari et al. 1999). The Ministry of Natural Resources's Upper Great Lakes Management Unit has monitored the nearshore fish community since 2003. In 2015 the traditional smallfish community assessment program (MNRF 2015) was supplemented with funding from Environment Canada. The overall purpose of this funding was to describe any differences between 'degraded' and 'less degraded' locations. This project contributed by:

- Gathering relative abundance and species composition data about the nearshore fish community.
- Tracking the distribution and relative abundance of exotic fish and invertebrate species.

Information about the offshore fish community at these locations was gathered from our 2015 Broadscale Monitoring Program (project codes LHA_IA15_802, 803, 804, 805, and 808). The results of that program will be summarized in a separate document.

Materials And Methods

The project ran between June 29 and August 28 on the Canadian portion of Lake Huron using a variety of fishing gear. Fyke nets and Ontario Small Mesh Index nets were used. The Ontario Small Mesh Index nets (hereafter referred to simply as gill nets) used in this project were 10 m long and 0.9 m high. To duplicate the length of the historically used Nordic net, three gangs were tied together to form one 30 m strap. A complete description of all of the gear types mentioned here is found in the Smallfish Community Assessment Program Summary Report 2008 (MNR 2008).

Site Selection

Six locations were sampled (Figure 1), all of which were in eastern Georgian Bay. Deep Bay, Severn Sound, and Sturgeon Bay were identified as 'degraded' while the French River, Shawanaga River, and Shebeshekong River were identified as 'less degraded'. In all locations, only areas less than one kilometer away from the location's center were sampled. A square grid scaled to 100 m per side was applied to a map of the location to divide the shoreline into discrete sample sites. Each site was classified into one of three habitat

types based on the Environmental Sensitivity Atlas for Lake Huron's Shoreline (Environment Canada 1994):

- Consolidated: bedrock, harbours (Sensitivity Index 1A-3).
- Coarse: boulders to sand (Sensitivity Index 4-10).
- Fine: mud, vegetated areas (Sensitivity Index 11-13B).

Sites from each habitat type were chosen randomly. Fishing gear was set less than 150 m from shore and fished for approximately 24 hours.

Each gear type was fished in a different way. Fyke nets were rarely set on the consolidated habitat type because of the difficulty in doing so. One Fyke net was set in each of the other two habitat types each day and moved to another site of the same habitat type after one day of fishing. One gill net was set perpendicular to the depth contours in each of two sites of the same habitat type each day and moved to another site of a different habitat type after one day of fishing in such a way that all 3 habitat types were sampled equally. Thus in a given week there were 8 Fyke net sets (2 sets per day for 4 days) and 6 gill net sets (2 sets per day for 3 days). Gill nets were not set on the last set day because processing gill net catch is very time-consuming; the time saved on the following lift day was required for travel back to the office.

Biological Sampling

The catch from all gear types was biologically sampled every 24 hours. All individuals were identified to species and counted. Total length and fork length were recorded from the first 20 individuals of each species from each mesh size. Round weight was also recorded from these first 20 individuals of each species from each mesh size if they were an exotic species or a sport fish. Sport fish consisted of Salmonids, Esocids, bass (*Micropterus sp.*), Yellow Perch (*Perca flavescens*), and Walleye (*Sander vitreus*).

Statistical Analyses

Fish communities were compared using biodiversity and species composition. Biodiversity was measured using PIE, the probability of interspecific encounter (Hurlbert 1971). PIE is simply the chance that two fish randomly drawn from a catch will be different species. This statistic combines the two components of biodiversity; the number of species and their abundance relative to each other (Hurlbert 1971). Higher values of PIE indicate greater biodiversity. Hierarchical cluster analysis based on percent similarity (Guy and Brown 2007) was used to quantify differences in species composition and relative abundance between locations.

Results And Discussion

Effort

A total of 84 gear lifts were completed during this project, all of which were uncompromised (Table 1). Four lift days were performed at each location. The median set duration was 21 hours and ranged between 18 and 24 hours. Set depth was dependent on the gear type used. Fyke nets were set at an average depth of 0.8 m. The set depth of gill nets were set in an average of 3.0 m of water (Table 1).

Catch

In traditional smallfish locations within Georgian Bay, catch composition is normally split between Cyprinids and another family (MNRF 2015). This result is repeated in the Shawanaga and Shebeshekong rivers; locations relatively close to the open waters of Georgian Bay (Figure 2). Centrarchids are the 'other' family at these locations. However, Centrarchids were the 'main' family at locations further away from these open waters; Sturgeon Bay, Deep Bay, and the French River. These locations have more in common with Blackstone Harbour, a traditionally-sampled area also fairly removed from Georgian Bay proper. Catch in the French River remains somewhat unusual in that it has had a high proportion of Ictalurids for two years in a row. Finally, catch in Severn Sound is similar to that within Midland Bay, both of which are characterized by high Percid abundance.

Round goby were caught in three locations; Severn Sound, the Shawanaga River, and the Shebeshekong River. Even then, catch per unit effort was very low (~1/net).

Statistical Analyses

Biodiversity, as measured by the probability of interspecific encounter, was relatively high in all locations (Figure 3). The range of biodiversity in gill nets tended to be greater in Deep Bay, related directly to the high proportion of alewife caught in some sets. Surprisingly, there was little difference in biodiversity between degraded and less-degraded locations.

Hierarchical cluster analysis further defined the similarities and differences in fish communities hinted at using the probability of interspecific encounter (Figure 4). In the Fyke net community, the French River is again dominated by bullhead. The prominence of bluntnose minnow grouped the Shawanaga and Shebeshekong rivers together, with Shawanaga standing apart based on the abundance of bowfin. The presence of largemouth bass grouped the final three locations together; Severn Sound, Sturgeon Bay, and Deep Bay. High catches of black crappie made Deep Bay stand out, while the presence of redbelly dace in Sturgeon Bay made it unique. Finally, Severn Sound had the highest yellow perch catch.

Less variation was observed in the gill net community, which was largely dictated by the relative abundance of yellow perch. The lowest proportions were observed in Sturgeon and Deep bays, which stood out by having a high proportion of black crappie and alewife, respectively. The Shebeshekong and Shawanaga rivers had the next highest proportion of perch. They separated from each other based on the high proportion of mimic shiners and rock bass, respectively. Severn Sound had the highest proportion of perch, separating it from the French River, which was made unique by the abundance of spottail shiners.

Conclusions

This project was successful at achieving all of its goals. Fish communities were similar to those sampled during our traditional smallfish program; back bays were dominated by Centrarchids while locations closer to the open waters of Georgian Bay had a high abundance of Cyprinids. Round goby were rarely caught. If they were encountered, density was very low.

Biodiversity was relatively high in all locations. While biodiversity range was slightly greater in the Deep Bay gill net community, this was the result of an unusually high catch of alewife in a few nets. For the Fyke net catch, the proportion of bluntnose minnow, largemouth bass, and brown bullhead were responsible for identifying to which location a fish community belonged. In the gill net catch, the relative proportion of yellow perch was the identifying factor.

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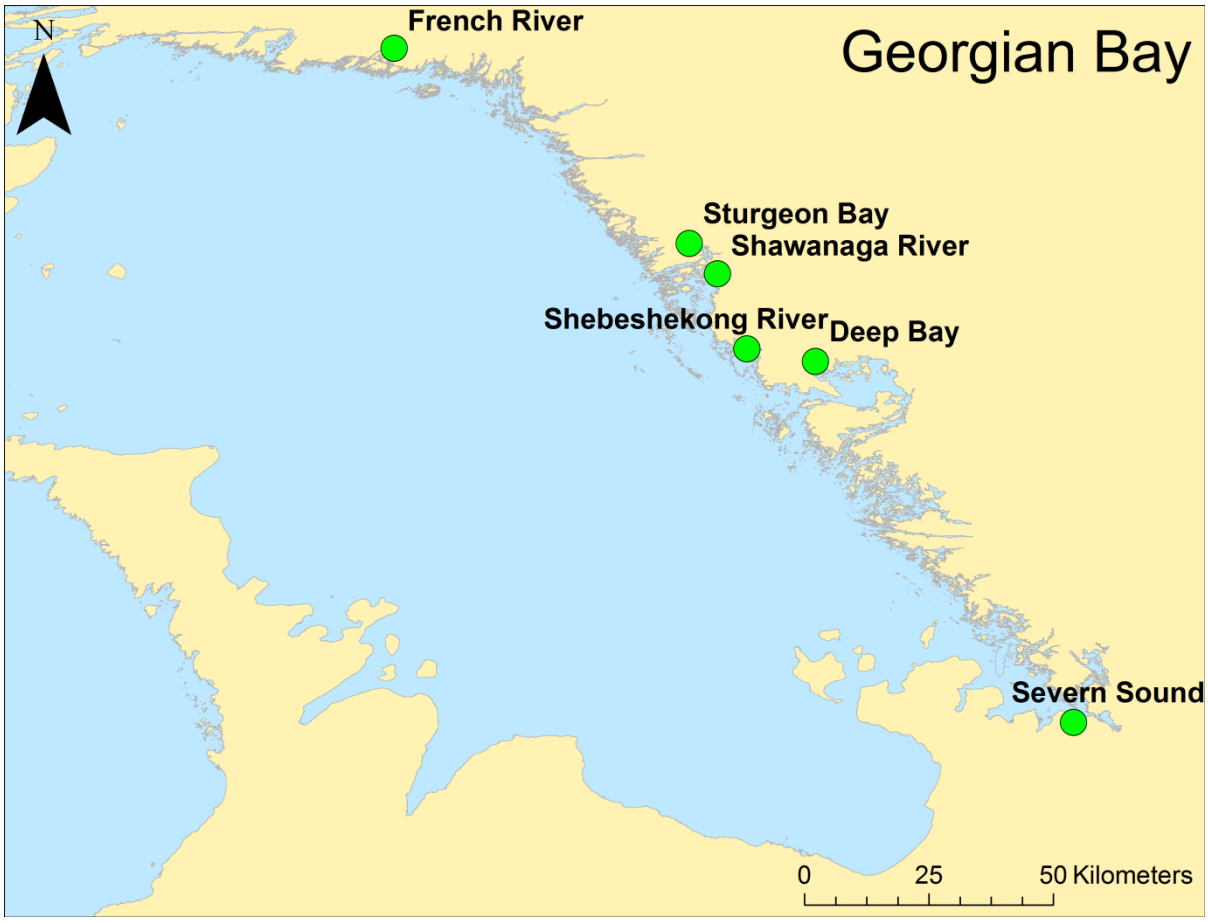


Figure 1. Locations sampled during the 2015 broadscale smallfish assessment program.

Table 1. The number, date, and set depth characteristics of all fishing gear used during the 2015 broadscale smallfish assessment program. Only uncompromised ('Good') efforts are used in the analyses summarized in this document. Median set duration was 21 hours.

	Number of Gear Sets						
	Fyke Net		Gill Net		All Gear	Lift Day (2015)	
Location	All	Good	All	Good	Good	First	Last
French River	8	8	6	6	14	Aug. 24	Aug. 28
Deep Bay	8	8	6	6	14	Jul. 27	Jul. 31
Shawanaga River	8	8	6	6	14	Jul. 08	Jul. 12
Shebeshekong River	8	8	6	6	14	Jun. 29	Jul. 03
Severn Sound	8	8	6	6	14	Aug. 10	Aug. 14
Sturgeon Bay	8	8	6	6	14	Jul. 12	Jul. 16
Total	48	48	36	36	62	Jun. 29	Aug. 28
Depth* - Minimum (m)		0.4		1.2			
Depth* - Average (m)		0.8		3.0			
Depth* - Maximum (m)		1.3		7.8			

*mid-point depth for gill nets and mouth depth for Fyke nets

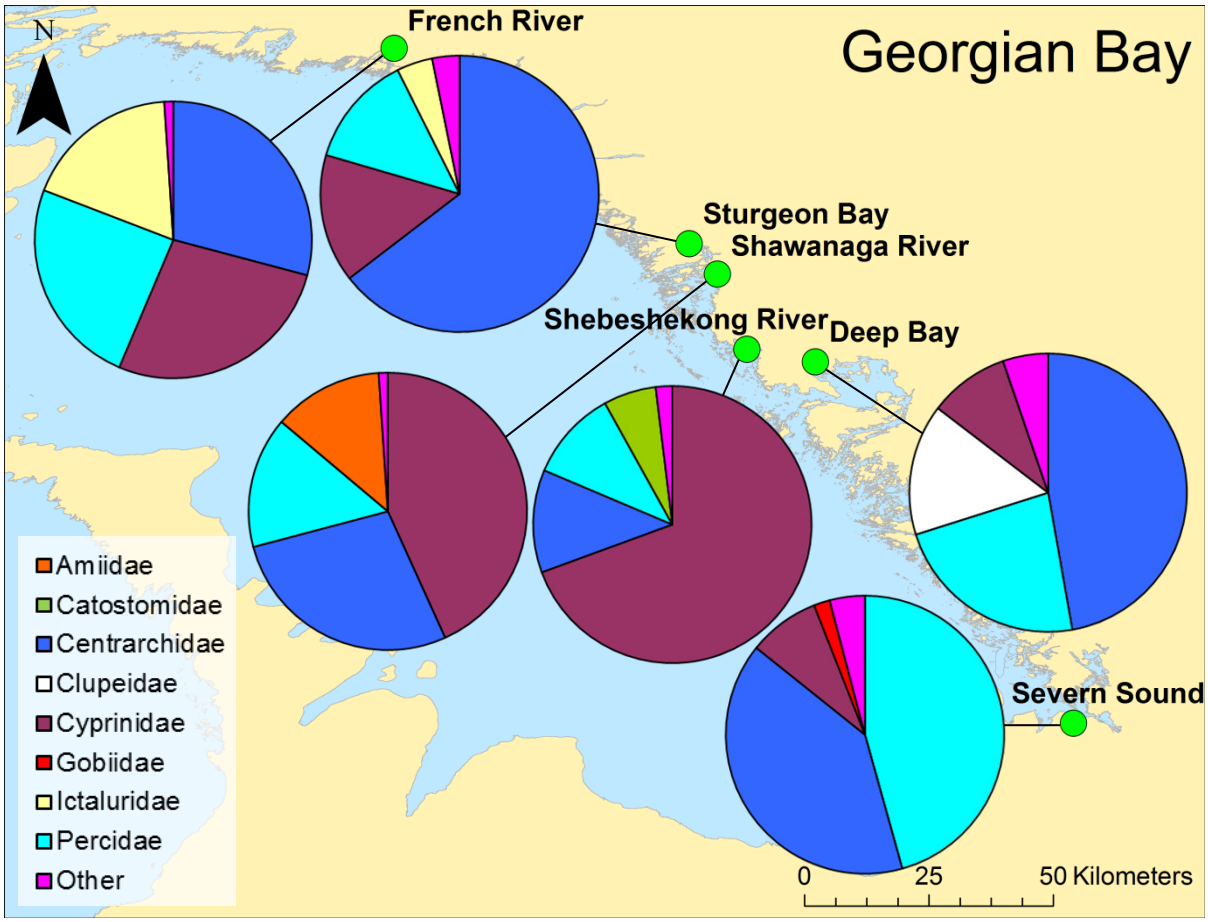
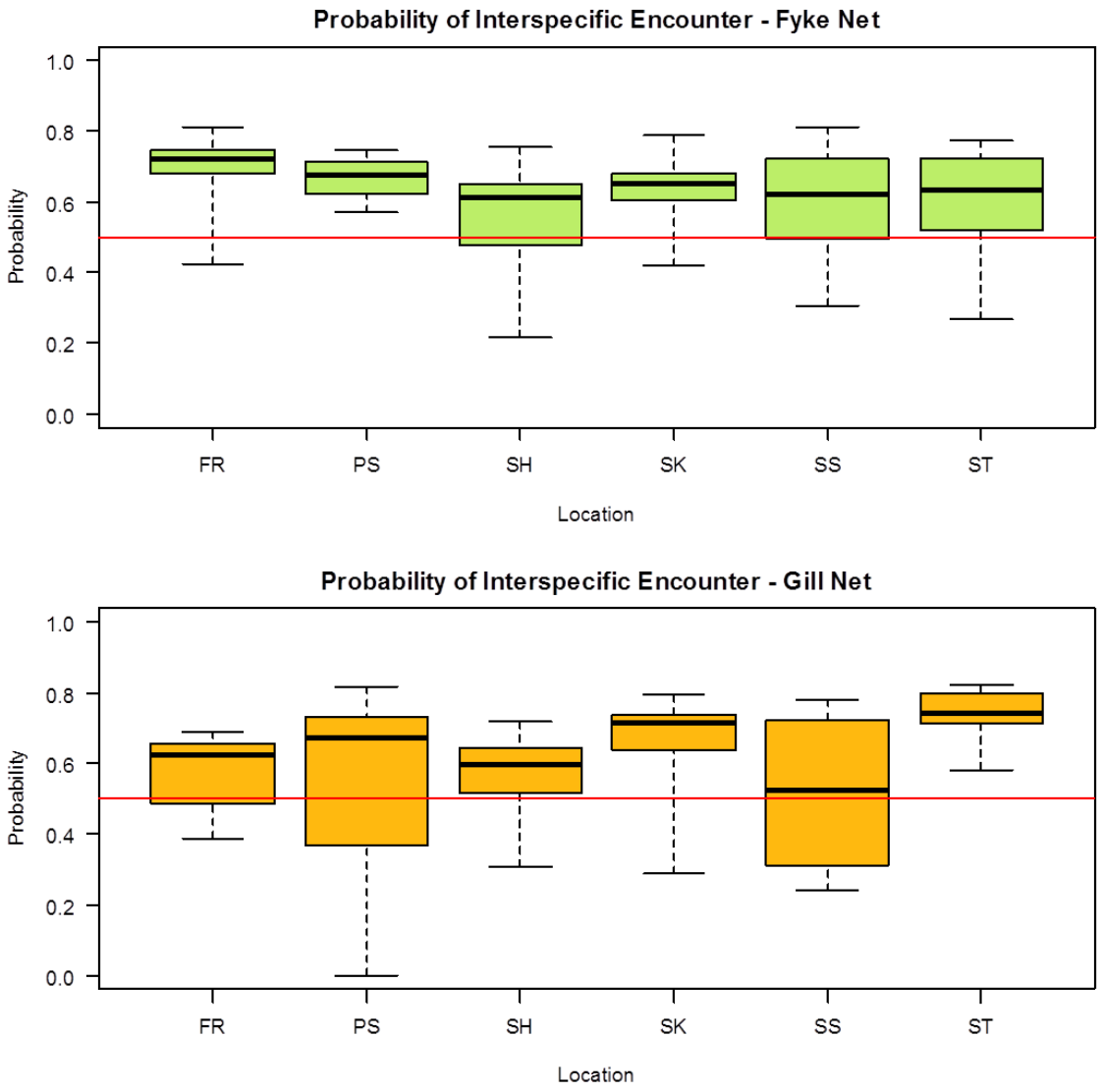
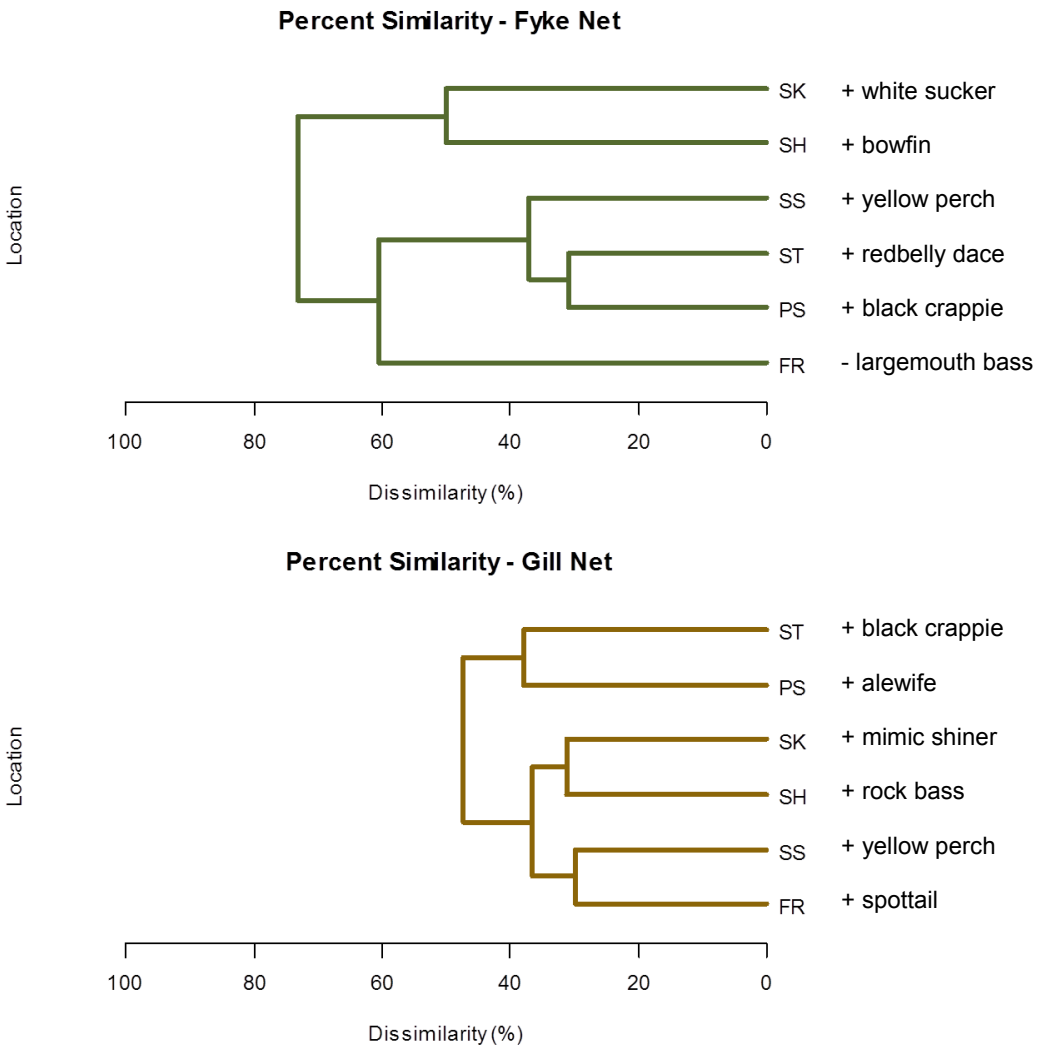


Figure 2. Catch composition in each location in Georgian Bay. Only the four most common families are shown; all other families are grouped into the fifth, 'other' category.



FR = French River PS = Deep Bay SH = Shawanaga River
SK = Shebeshekong River SS = Severn Sound ST = Sturgeon Bay

Figure 3. Boxplot of biodiversity as measured by the probability of interspecific encounter for each location sampled during the 2015 broadscale smallfish assessment program. Higher values indicate greater biodiversity. Horizontal line is the point where there is a 50 % chance that the next individual encountered will be a different species then the last individual encountered. Values differ for each gear type as they sample different portions of the nearshore fish community.



FR = French River PS = Deep Bay SH = Shawanaga River
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Figure 4. Dendrogram showing the similarity between the nearshore fish communities for each location sampled during the 2015 broadscale smallfish assessment program. Shorter branches indicate more similar communities. Branch labels show the defining characteristic of that community versus the others. Dendrogram differs for each gear type as they sample different portions of the nearshore fish community.