Ontario

Ministry of Natural Resources and Forestry

Ministère des Richesses naturelles et des Forêts

Broadscale Smallfish Community Assessment Program Summary Report 2014

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 2014 the traditional smallfish community assessment program (MNRF 2014) 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 2014 Broadscale Monitoring Program (project codes LHA_IA14_801, 802, 803, and 804). The results of that program will be summarized in a separate document.

Materials And Methods

The project ran between July 03 and August 29 on the Canadian portion of Lake Huron using a variety of fishing gear. Bottle traps, Fyke nets, and Ontario Small Mesh Index nets were used. Bottle traps were used to capture only the exotic bloody red shrimp (*Hemimysis anomala*). 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

Four locations were sampled (Figure 1), all of which were in eastern Georgian Bay. Deep Bay and Severn Sound were identified as 'degraded' while Britt and the French 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. Bottle traps were only set on consolidated habitat, as this is the only habitat likely to house shrimp (2 sets per location).

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 62 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 19 hours and ranged between 16 and 25 hours. Set depth was dependent on the gear type used. Fyke nets were set at an average depth of 0.7 m. The set depth of the bottle traps averaged 1.4 m and the gill nets were set in an average of 3.1 m of water (Table 1).

Catch

In traditional smallfish locations within Georgian Bay, catch composition is normally split between Cyprinids and another family (MNRF 2014). This is easily seen in Britt, a traditional location (Figure 2). Centrarchids are the 'other' family at this location. However, Centrarchids were the 'main' family at the other three locations. In the case of Deep Bay and Severn Sound, the secondary family was Percids. While Ictalurids appear to be the 'other' family in the French River, nearly all of those fish were captured in a single net. If those fish are removed, the remaining composition looks very similar to Deep Bay and Severn Sound.

Round goby were only caught in two instances; in Fyke nets in Severn Sound and in gill nets in the French River. Even then, catch per unit effort was very low (~0.5/net).

No red shrimp were caught. This is expected given that none of the locations sampled were known to house red shrimp.

Statistical Analyses

Biodiversity, as measured by the probability of interspecific encounter, was relatively high in most locations (Figure 3). The French River was slightly lower in the Fyke net community, but this is expected given the large number of bullhead caught in one of the net 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 set Britt apart while the presence of longear sunfish made the Severn Sound community unique. Less variation was observed in the gill net community. The high abundance of perch separated Deep Bay and Severn Sound from other locations in Georgian Bay. Longear sunfish again made Severn Sound stand out. The presence of black crappie was the defining characteristic in Deep Bay, while rainbow smelt were more common in the French River.

Conclusions

This project was successful at achieving all of its goals. In contrast to traditional smallfish locations in Georgian Bay, the locations sampled during this project were dominated by Centrarchids, followed by Percids. Round goby were rarely caught. If they were encountered, density was very low. Red shrimp were not captured at any location.

Biodiversity was relatively high in all locations. While biodiversity was lower in the French River Fyke net community, this was the result of an unusually high number of bullheads caught in a single net set. The presence of longear sunfish separated the Severn Sound fish community from the others, while the relatively high abundance of black crappie made Deep Bay unique.

Acknowledgements

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Figure 1. Locations sampled during the 2014 broadscale smallfish assessment program.

Table 1. The number, date, and set depth characteristics of all fishing gear used during the 2014 broadscale smallfish assessment program. Only uncompromised ('Good') efforts are used in the analyses summarized in this document. Median set duration was 19 hours.

| | Number of Gear Sets | | | | | | All Gear | Lift Day (2014) | |
| | Fyke Net | | Gill Net | | Bottle Trap | | | | |
Location	All	Good	All	Good	All	Good	Good	First	Last
Britt	8	8	6	6	2	2	16	Jul. 04	Jul. 07
Deep Bay	8	8	6	6	2	2	16	Jul. 29	Aug. 01
French River	8	8	6	6	0	0	14	Aug. 26	Aug. 29
Severn Sound	8	8	6	6	2	2	16	Aug. 12	Aug. 15
Total	32	32	24	24	6	6	62	Jul. 04	Aug. 29
Depth* - Minimum (m)		0.5		1.1		1.0			
Depth* - Average (m)		0.7		3.1		1.4			
Depth* - Maximum (m)		1.2		6.5		2.3			

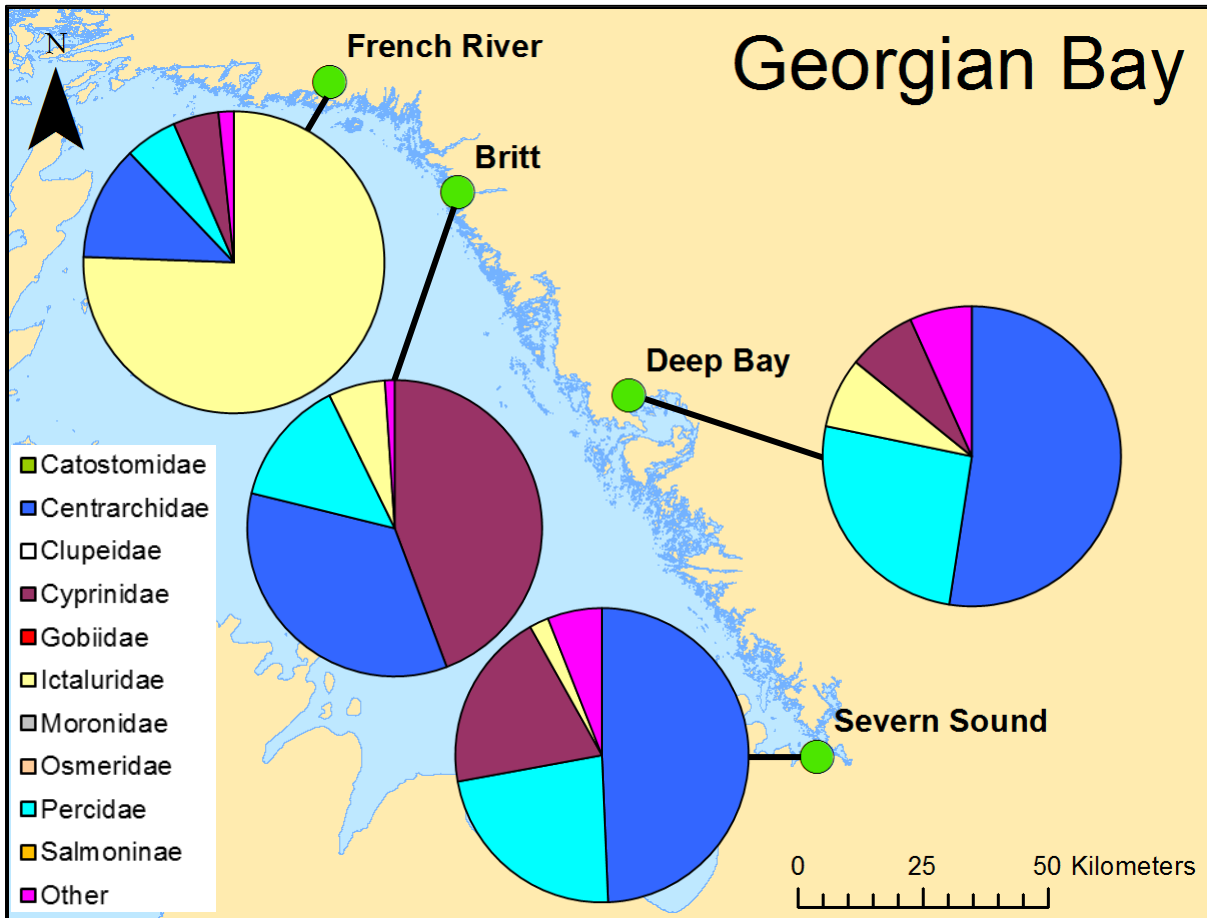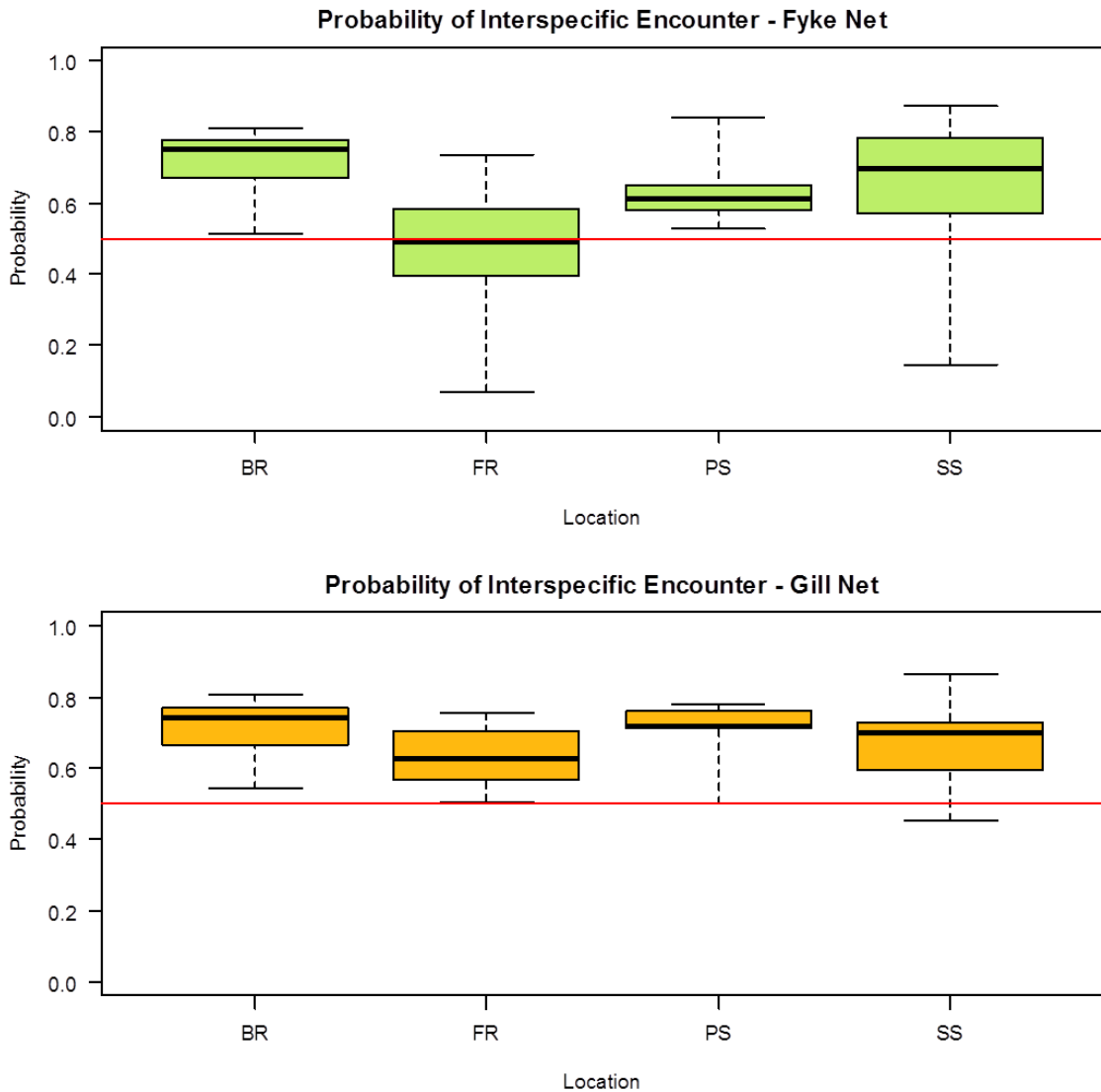*mid-point depth for gill nets and bottle traps, mouth depth for Fyke nets

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. Families represented by a single species are listed as that species.
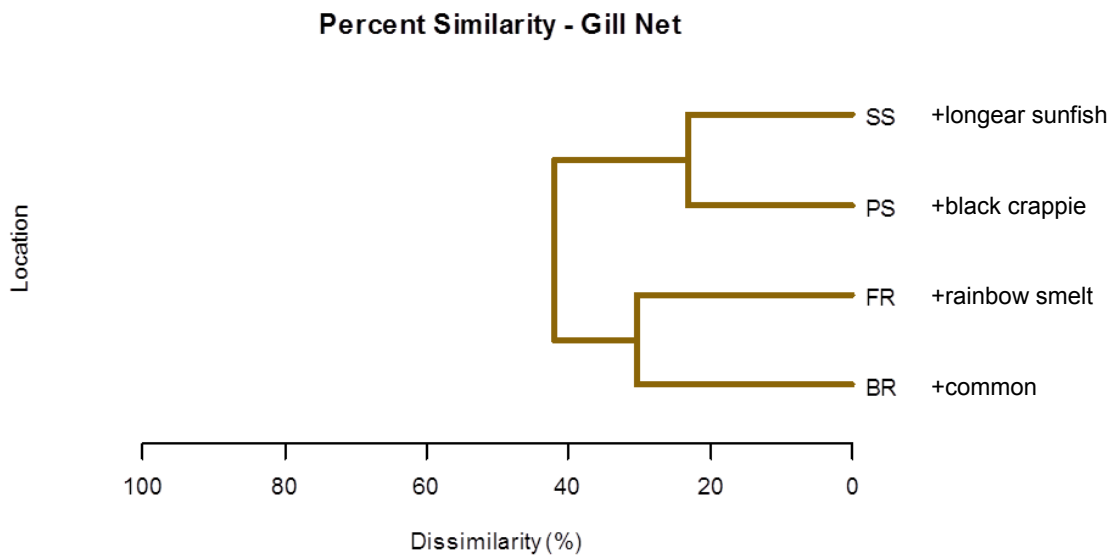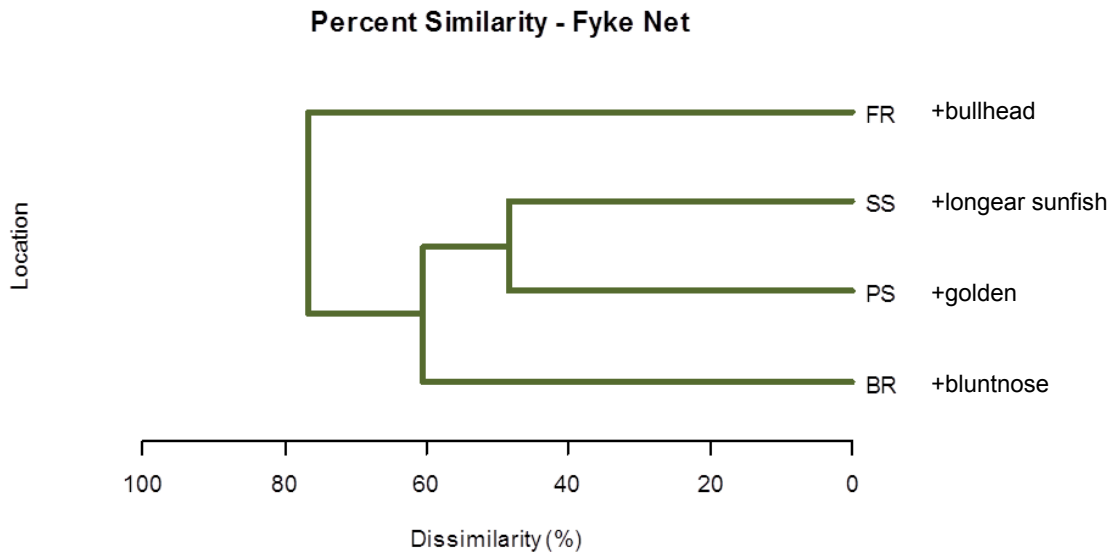
Probability of Interspecific Encounter - Fyke Net

Probability of Interspecific Encounter - Gill Net

BR = Britt   FR = French River   PS = Deep Bay
SS = Severn Sound

Figure 3. Boxplot of biodiversity as measured by the probability of interspecific encounter for each location sampled during the 2014 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.

Percent Similarity - Fyke Net

Location

FR   +bullhead

SS   +longear sunfish

PS   +golden

BR   +bluntnose

100   80   60   40   20   0

Dissimilarity (%)

Percent Similarity - Gill Net

Location

SS   +longear sunfish

PS   +black crappie

FR   +rainbow smelt

BR   +common

100   80   60   40   20   0

Dissimilarity (%)

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BR = Britt              FR = French River       PS = Deep Bay
SS = Severn Sound
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Figure 4. Dendrogram showing the similarity between the nearshore fish communities for each location sampled during the 2014 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.

Broadscale Smallfish Community Assessment Program