Upper Great Lakes Management Unit
Lake Huron Office, PS-LHA-BM16-800s

Ontario

Ministry of Natural Resources and Forestry

Ministère des Richesses naturelles et des Forêts

Broadscale Smallfish Community Assessment Program Summary Report 2016

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 (van der Lee & Koops 2016). The Ministry of Natural Resources's Upper Great Lakes Management Unit has monitored the nearshore fish community since 2003. In 2016 the traditional smallfish community assessment program (MNRF 2016) 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.
- Determine the distribution of the exotic red shrimp (*Hemimysis anomala*).

Information about the offshore fish community at these locations was gathered from our 2016 Broadscale Monitoring Program (project codes LHA_IA16_801, 802, 805, 808, and 809). The results of that program will be summarized in a separate document.

Materials And Methods

The project ran between July 04 and August 12 on the Canadian portion of Lake Huron using a variety of fishing gear. Fyke nets and Ontario Small Mesh Index nets were used. Bottle traps were used to capture only shrimp. The Ontario Small Mesh Index nets (hereafter referred to simply as gill nets) used in this project were 10.6 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 31.9 m strap. A complete description of all of the gear types mentioned here is found in the Smallfish Community Assessment Program Summary Report 2008 (Ontario Ministry of Natural Resources 2008).

Site Selection

Four locations were sampled (Figure 1, Appendix 1), all of which were in eastern Georgian Bay. Parry Sound (Deep Bay portion) and Sturgeon Bay were identified as 'degraded' while the Shawanaga and Shebeshekong rivers 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

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.

Catch per unit effort and biomass per unit effort were calculated for several key sub-populations of the nearshore fish community:

- Invasive Species: gobies
- Preybase: alewife, cyprinids, darters, rainbow smelt, stickleback, trout-perch
- Sport Fish: black basses (smallmouth, largemouth), panfish, salmonids, walleye, yellow perch

Biomass for each species, mesh size, and gear was established by extrapolating the average weight of the sampled fish to the total number of fish. If no weights were recorded, the average weight from the

most recent and similar gear type and/or species was used.

Results And Discussion

Effort

A total of 64 gear lifts were completed during this project, all of which were uncompromised (Table 1). Four lift days were performed at each location. Overall, the median set duration was 21 hours and ranged between 16 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 the bottle traps averaged 2.5 m and the gill nets were set in an average of 3.3 m of water (Table 1).

Catch

Georgian Bay

In traditional smallfish locations within Georgian Bay, catch composition is normally split between Cyprinids and another family (MNRF 2016). However, only the Shawanaga River displayed this pattern amongst the locations sampled in this project (Figure 2). In 2015, Cyprinids dominated both this location and the Shebeshekong River. However, high catches of Cyprinids were absent from the Shebeshekong River in 2016, making Centrarchids the most common family. This in turn has made catch in the Shebeshekong River very similar to that in Deep Bay, where Centrarchids once again dominated. Centrarchid dominance is seen in similar locations within the traditional smallfish locations fairly removed from Georgian Bay proper such as Blackstone Harbour (MNRF 2016). Once outlier catches of large bullhead family groups are removed, catch in Sturgeon Bay is similar to historical catch in Midland Bay, where Percids are very common (MNRF 2016). However, catch in 2015 in Sturgeon Bay was dominated by Centrarchids, making it more similar to Deep Bay at the time.

Red Shrimp

Red shrimp have never been caught during this project, and this year was no different. Historically, Goderich has been the only location where they were captured. Shrimp were last caught at this traditional smallfish location in 2015.

Statistical Analyses - Biodiversity

Biodiversity, as measured by the probability of interspecific encounter, remains high (PIE > 0.5) throughout most of the locations sampled (Figure 3). Fyke net biodiversity tends to be lower as this gear type is susceptible to large catches of round goby or a single Cyprinid species. In contrast, gill net biodiversity tends to be high as it tends to capture fewer individuals but more species.

Fyke net biodiversity was high in Deep Bay, which showed high diversity within the Centrarchid and Cyprinid families. Gill net biodiversity tended to be very similar across all locations, with no single location especially high or low.

Statistical Analyses - Sub-populations

Catch tends to be highly variable for most sub-populations of the nearshore fish community (Appendix 2). Shorelines are generally diverse, offering a variety of different habitats over a relatively small distance. Many species have small home ranges and strong habitat preferences. Thus catch composition can differ significantly between adjacent sections of shoreline. However, given sufficient sampling intensity some trends become

evident. These trends are discussed in the following sections.

Goby

Goby remain a very minor component of the catch in all locations. In 2015 goby represented less than 2 % of the catch in the three locations that caught any goby at all. This result was repeated in 2016; goby were caught in half of the locations visited and their representation in the catch was less than 1 %.

Preybase

Preybase biomass was relatively low in most locations. The only exception was the Shawanaga River. High Cyprinid catch in this location is responsible for the high preybase biomass. While the catch of preybase species was high in Deep Bay, they were too small to contribute much to overall biomass.

Sport Fish

In general, the abundance of sport fish varied significantly between locations. Black bass were most abundant in Deep Bay, with more smaller fish observed in the Shawanaga River. Panfish were fairly abundant in all locations, especially so in Sturgeon Bay and the Shawanaga River. These two locations are also the only spots in which walleye were captured. The abundance of yellow perch varied the most among the locations, with Sturgeon Bay and the Shawanaga River again standing out as relatively high abundance areas. However, a greater frequency of smaller fish were caught in the Shebeshekong River.

Conclusions

This project was successful at achieving all of its goals. Fish communities sampled during this project tended to have a lower frequency of Cyprinids and a higher frequency of Centrarchids and Percids than traditional smallfish program locations run in nearby areas.

While biodiversity remains similar and fairly high across most of the locations sampled, there was one notable exception. The diversity of the Fyke net catch in Deep Bay was elevated due to the capture of many different Cyprinid and Centrarchid species.

Catch remains variable for most sub-populations of the nearshore fish community. Round goby were rarely caught. If they were encountered, density was very low. With the exception of the Shawanaga River, preybase biomass is generally low as well. While the sport fish community was the most variable, the most abundant and diverse sport fish sub-populations tended to be in the Sturgeon Bay and Shawanaga River locations.

Acknowledgements

I would like to thank our field crew for collecting the data used in this report: Valerie Davey, Chris Johnson, Chandler Perry, Lawrence Skinner, Tyler Sutter, and Melanee Worth.

Prepared by Jeff Speers
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For further information contact:

Upper Great Lakes Management Unit
1450 Seventh Ave. E., Owen Sound, ON
Phone: 519-371-0420

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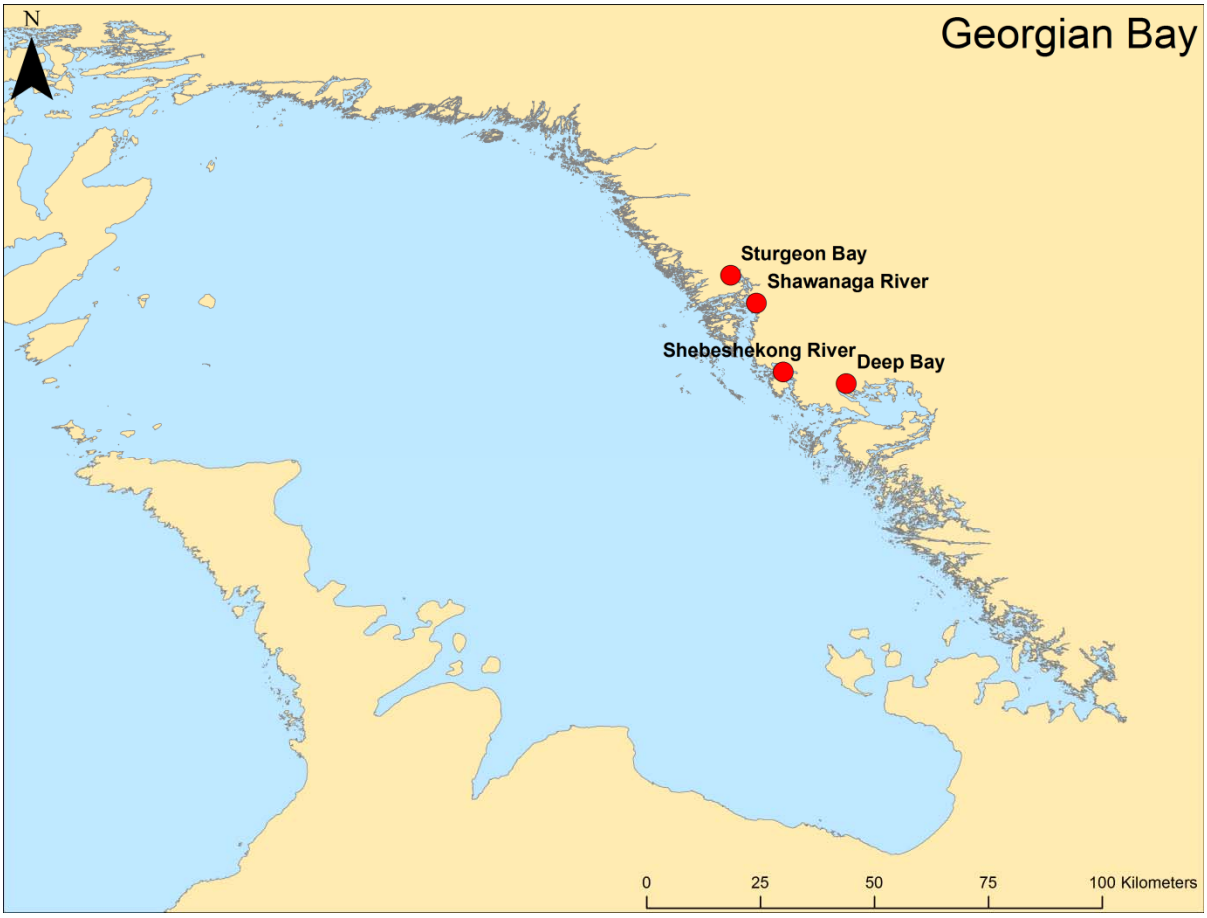


Figure 1. Locations sampled during the 2016 broadscale smallfish assessment program.

Table 1. The number, date, and set depth characteristics of all fishing gear used during the 2016 broadscale smallfish assessment program. Only uncompromised ('Good') efforts are used in the analyses summarized in this document.

	Number of Gear Sets								
	Fyke Net		Gill Net		Bottle Trap		All Gear	Lift Day (2016)	
Location	All	Good	All	Good	All	Good	Good	First	Last
Deep Bay	8	8	6	6	2	2	16	Jul. 25	Jul. 29
Shawanaga River	8	8	6	6	2	2	16	Jul. 11	Jul. 15
Shebeshekong River	8	8	6	6	2	2	16	Aug. 08	Aug. 12
Sturgeon Bay	8	8	6	6	2	2	16	Jul. 04	Jul. 08
Total	32	32	24	24	8	8	64	Jul. 04	Aug. 12
Set Duration - Average (hrs)		20.8		20.7		20.2			
Depth* - Minimum (m)		0.5		0.7		1.2			
Depth* - Average (m)		0.8		3.2		0.0			
Depth* - Maximum (m)		1.2		8.5		5.0			

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

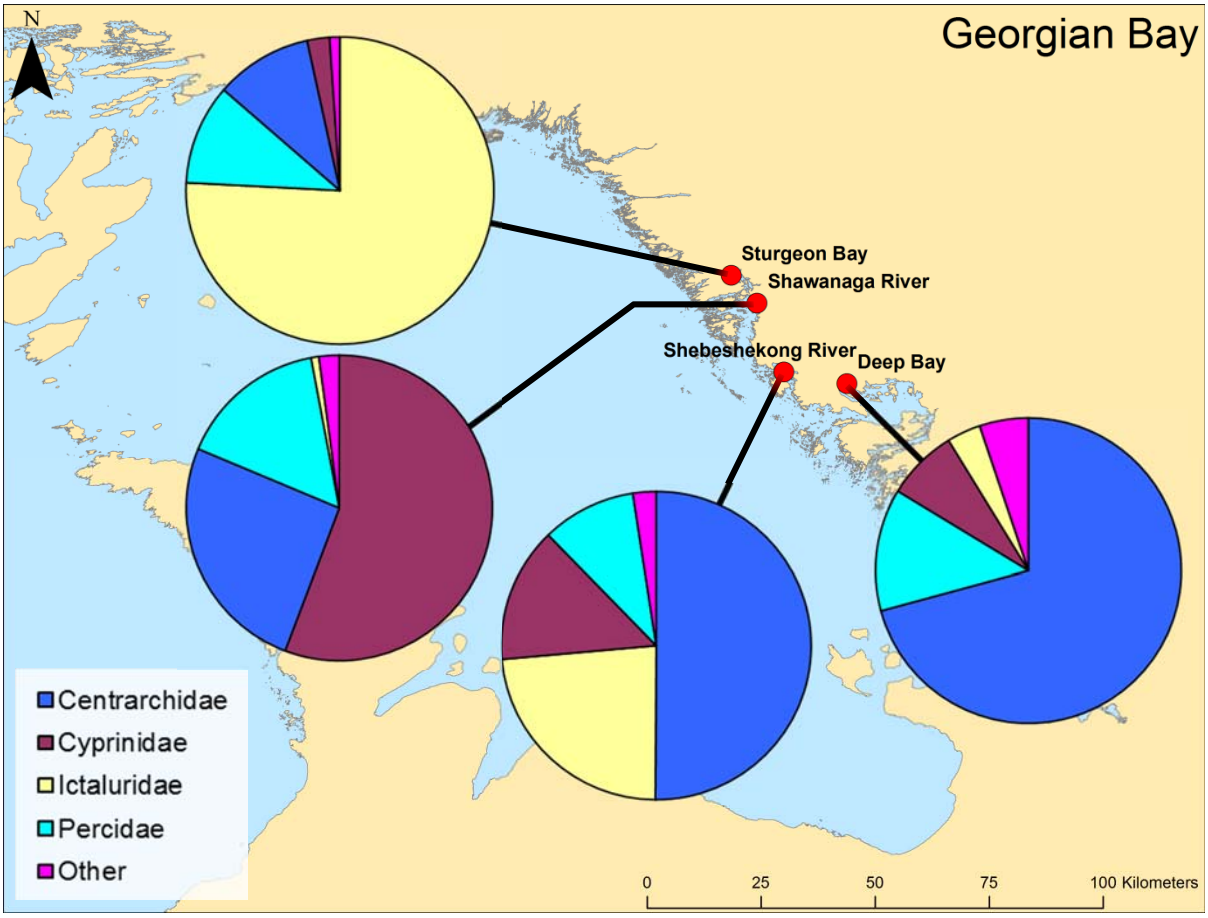
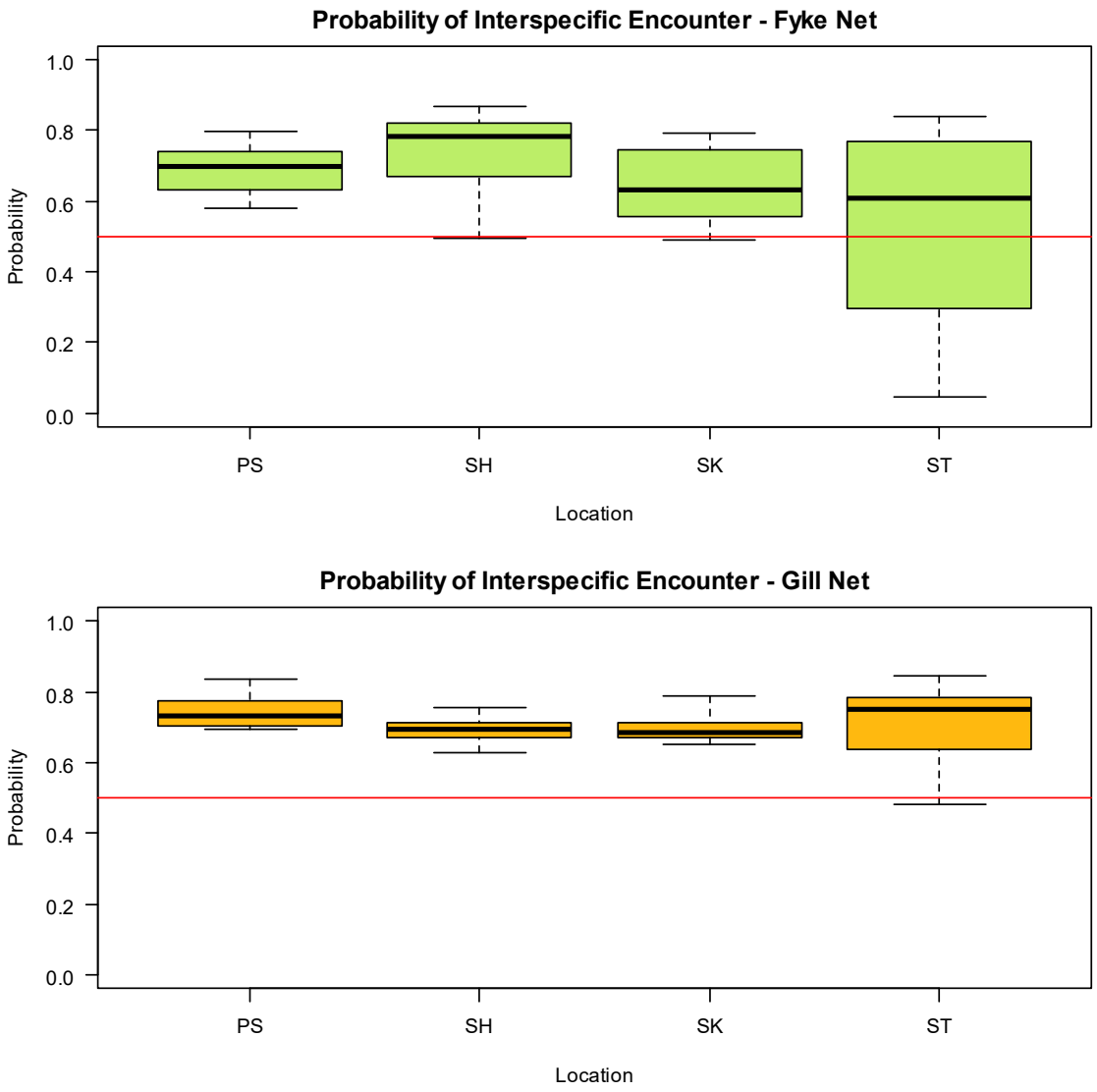


Figure 2. Catch composition in each location in Georgian Bay. Only the four most common families are shown; all other families are grouped into the fifth, 'other' category.

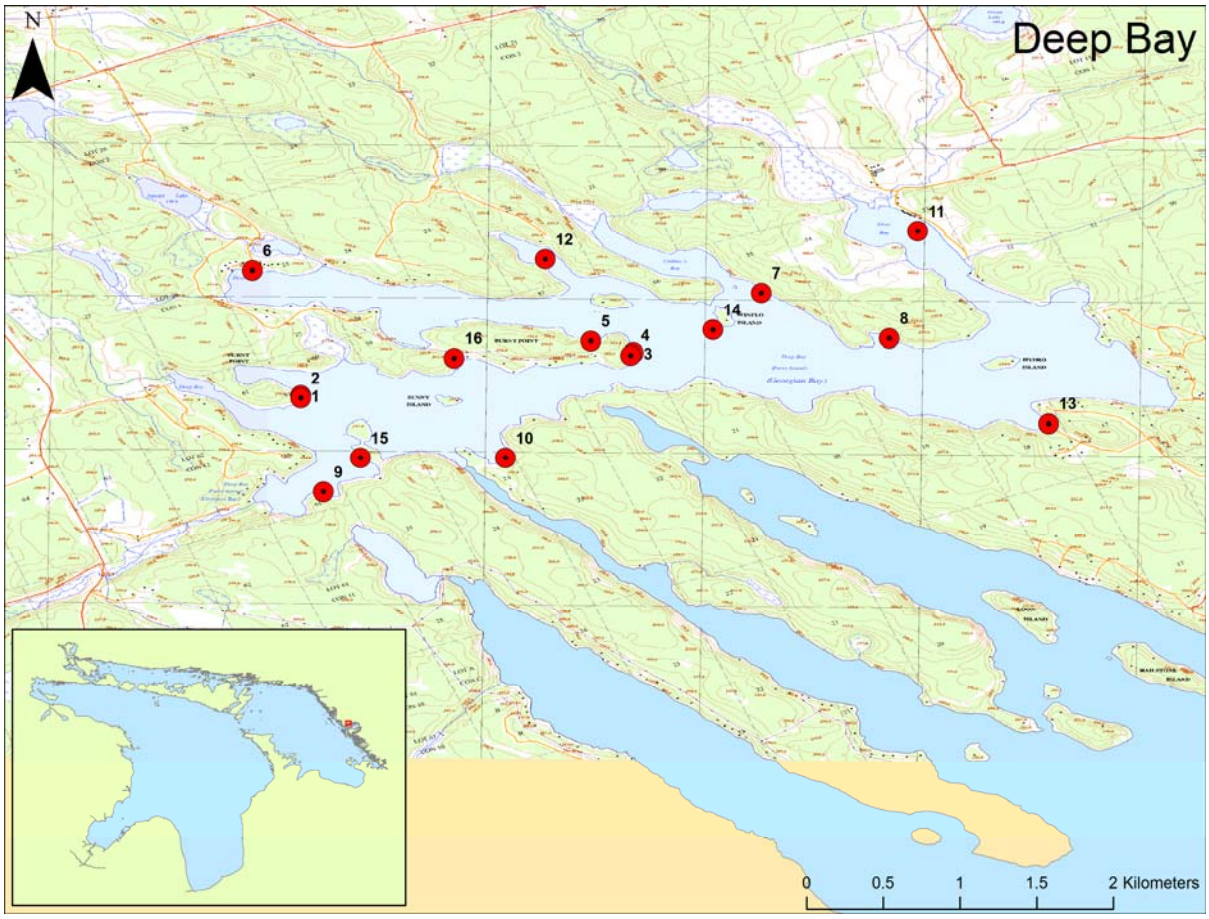


PS = Deep Bay SH = Shawanaga River SK = Shebeshekong River
ST = Sturgeon Bay

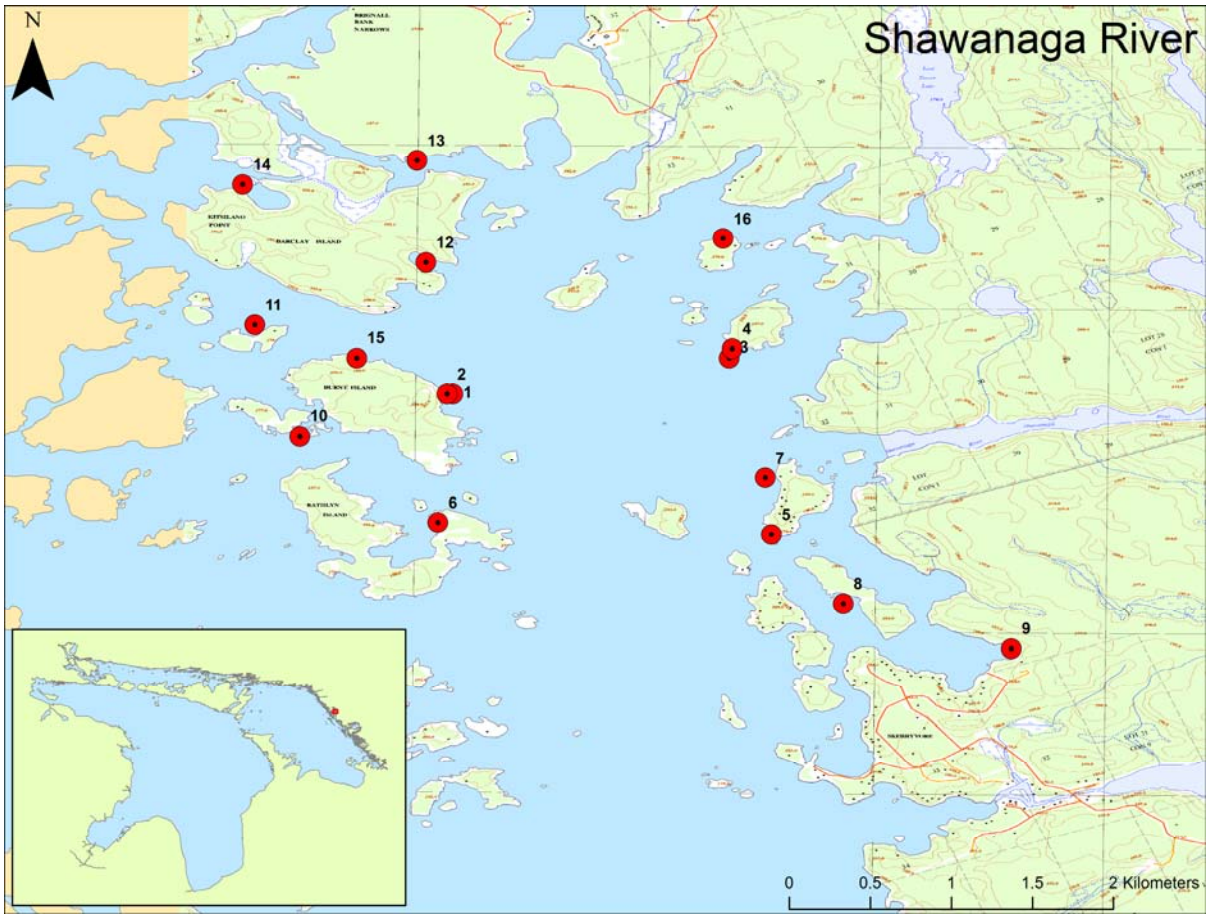
Figure 3. Boxplot of biodiversity as measured by the probability of interspecific encounter for each location sampled during the 2016 broadscale smallfish assessment program. Higher values indicate greater biodiversity. Horizontal line is the point where there is a 50 % chance that the next individual 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.

Appendix 1: Net Set Locations

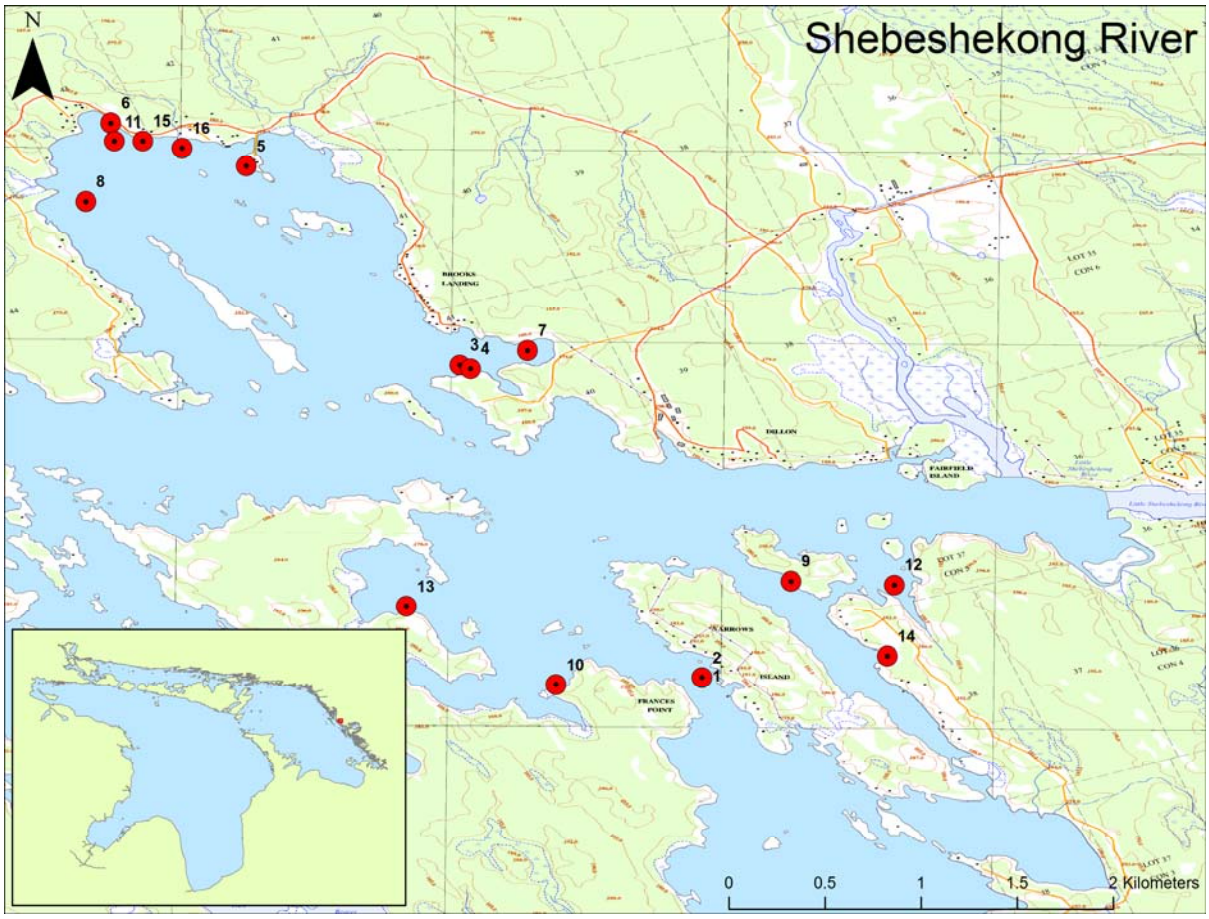
Location: Deep Bay
Project Code: LHA_BM16_802



Location: Shawanaga River
Project Code: LHA_BM16_805



Location: Shebeshekong River
Project Code: LHA_BM16_808



Location: Sturgeon Bay
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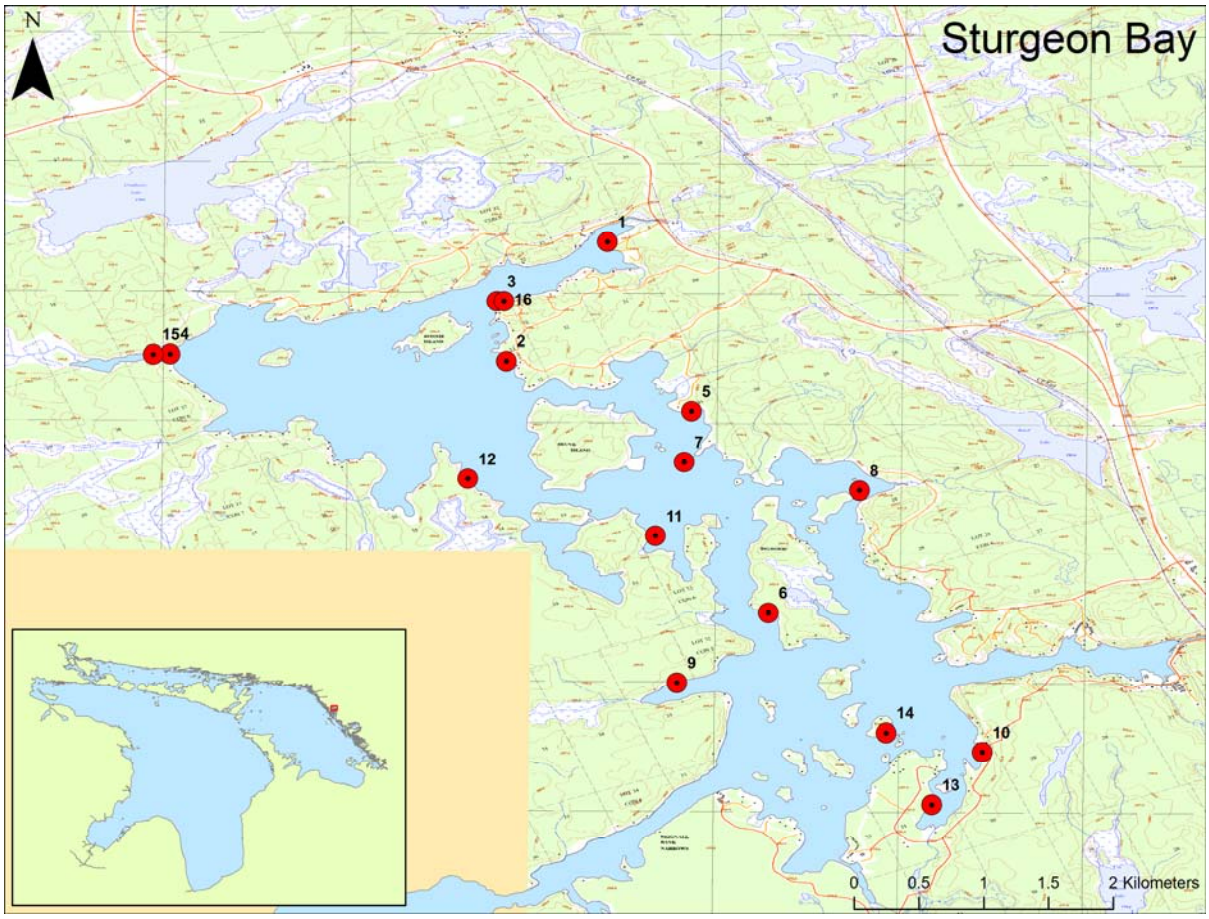
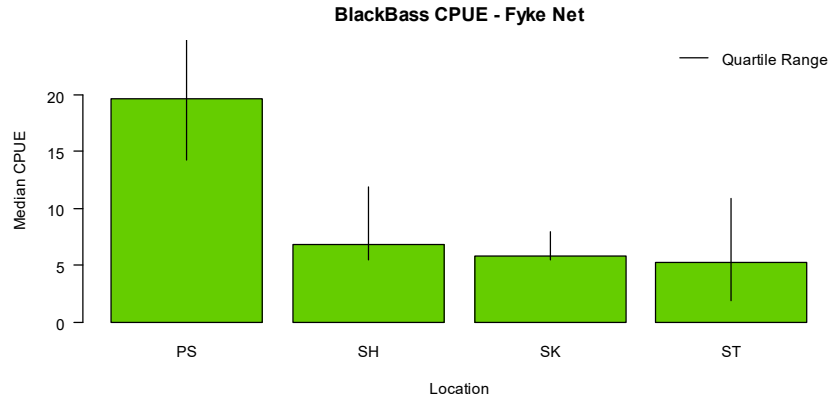
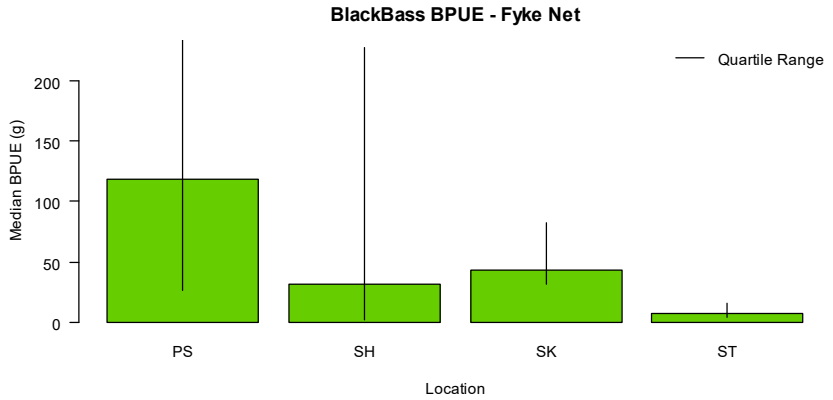
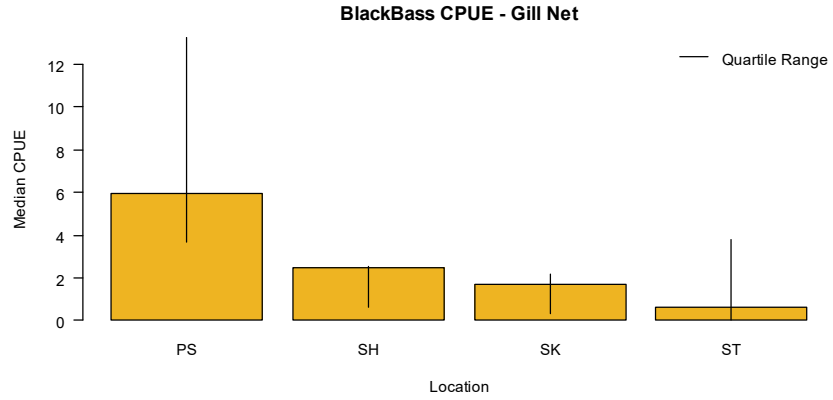


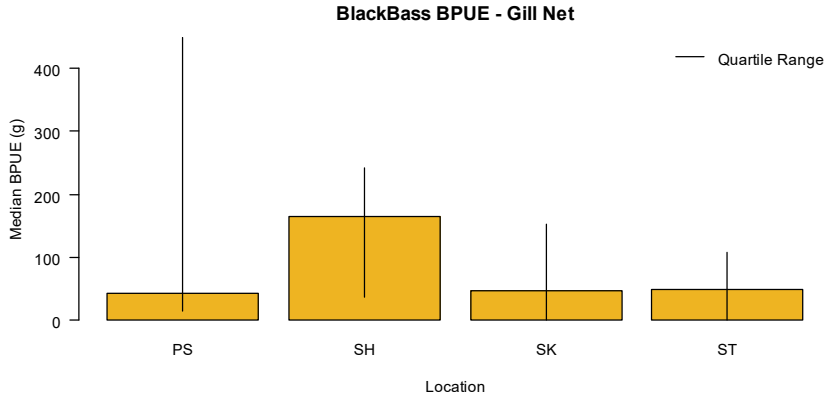
Appendix 2: Catch and Biomass Across Locations

Black Bass









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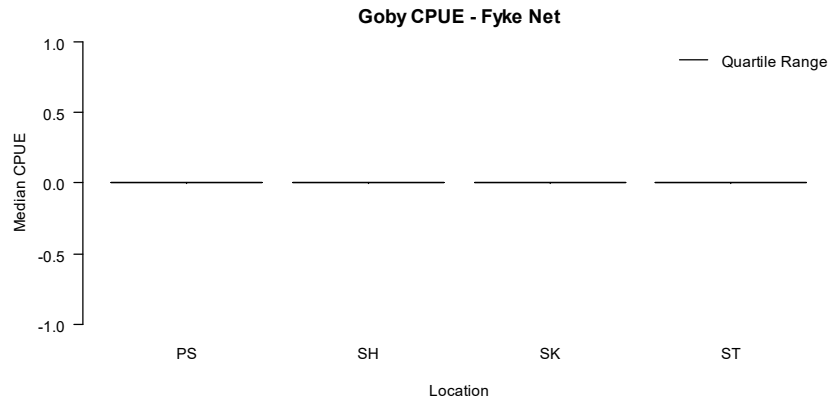
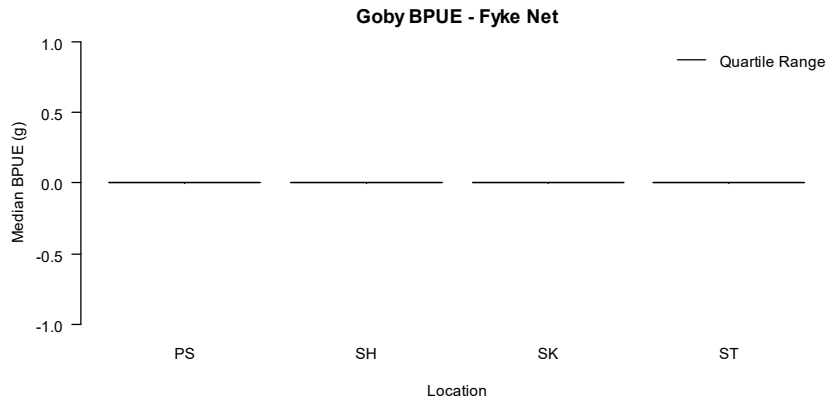
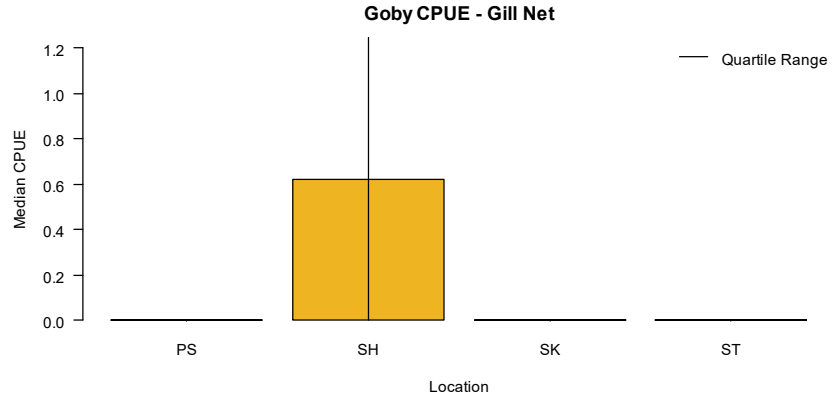
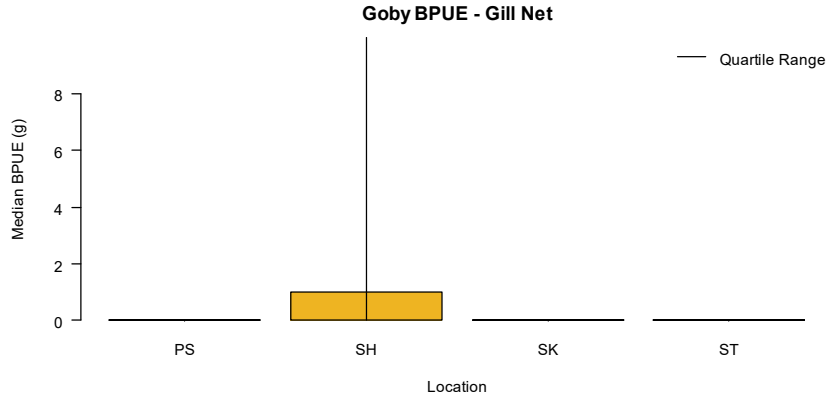
Goby









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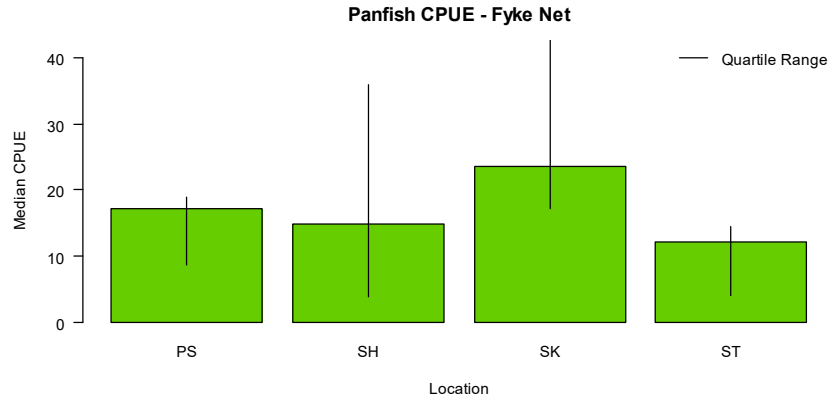
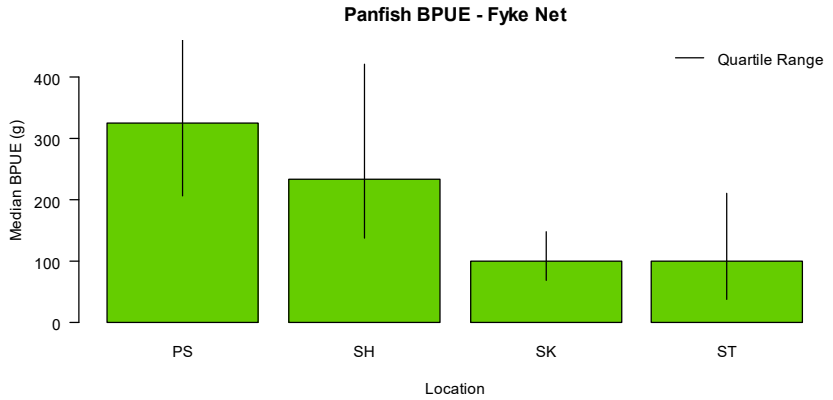
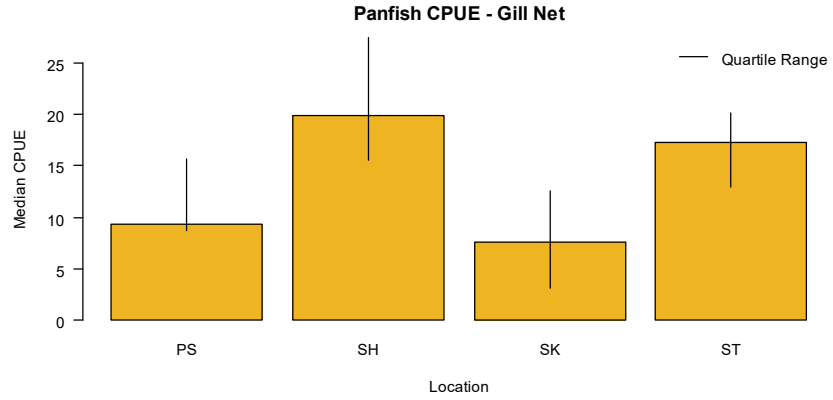
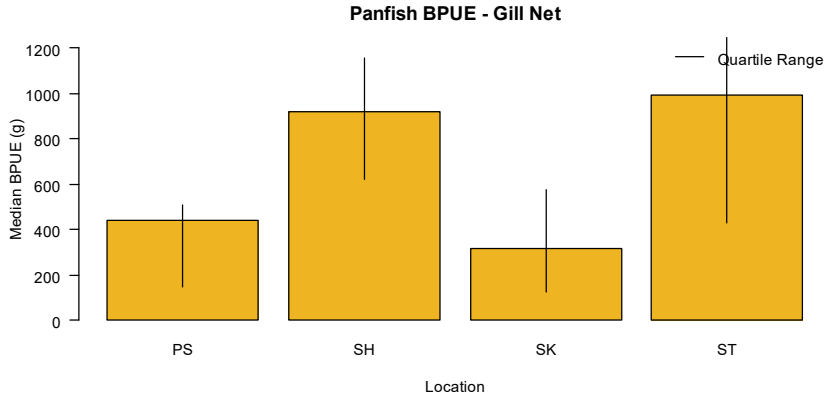
Panfish









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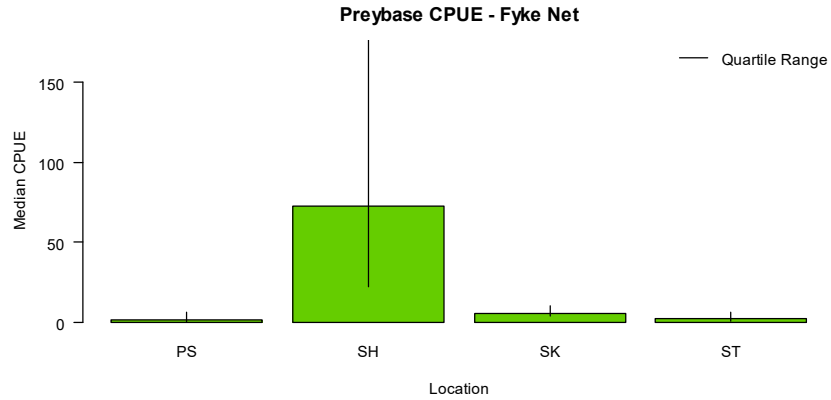
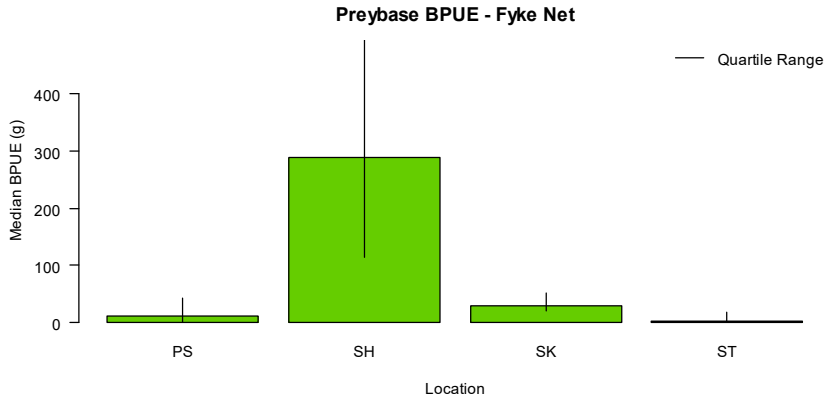
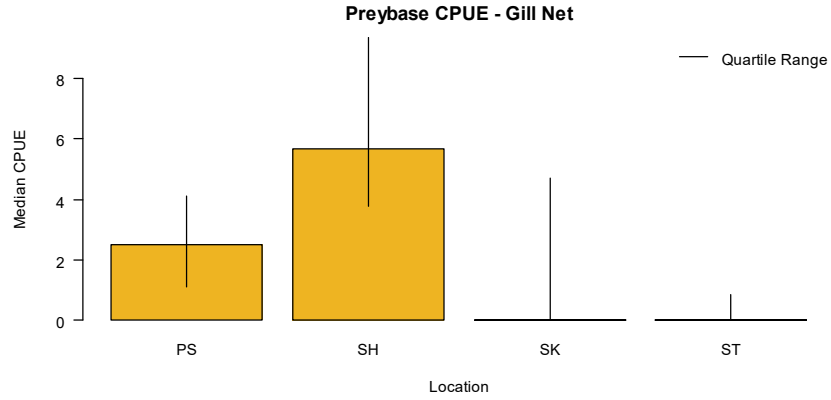
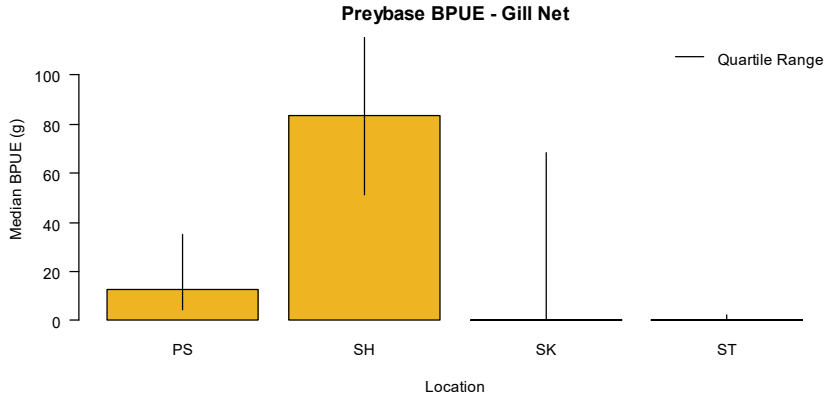
Preybase









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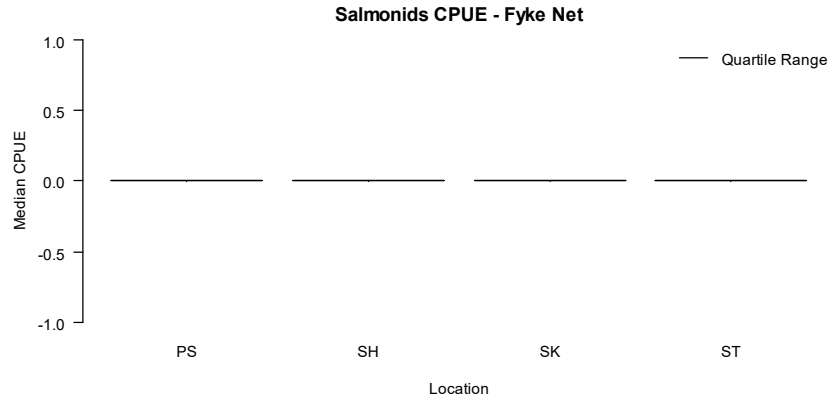
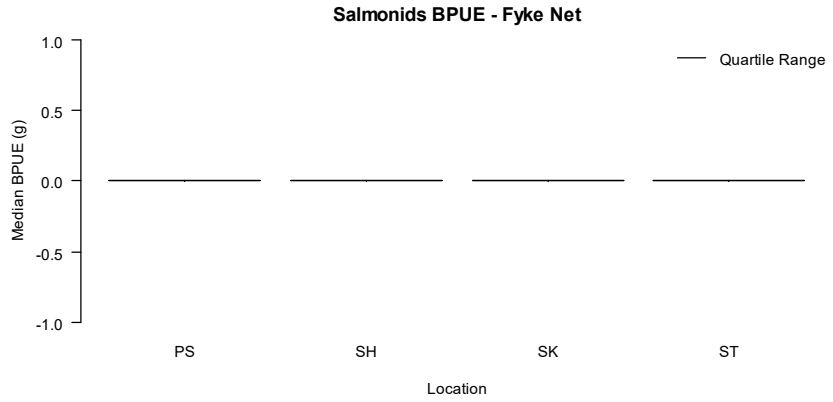
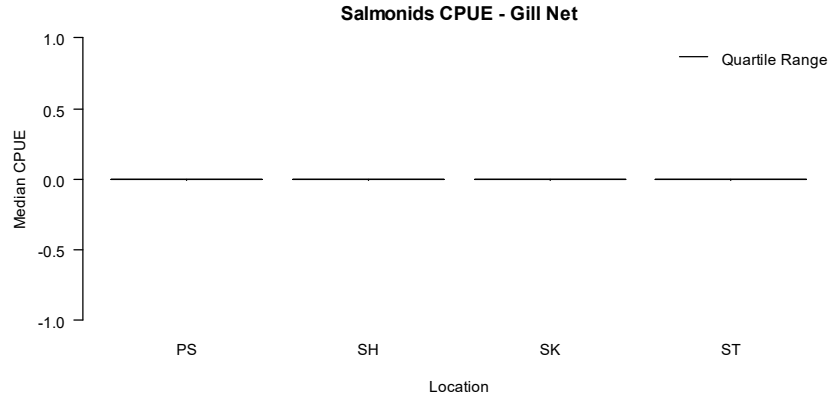
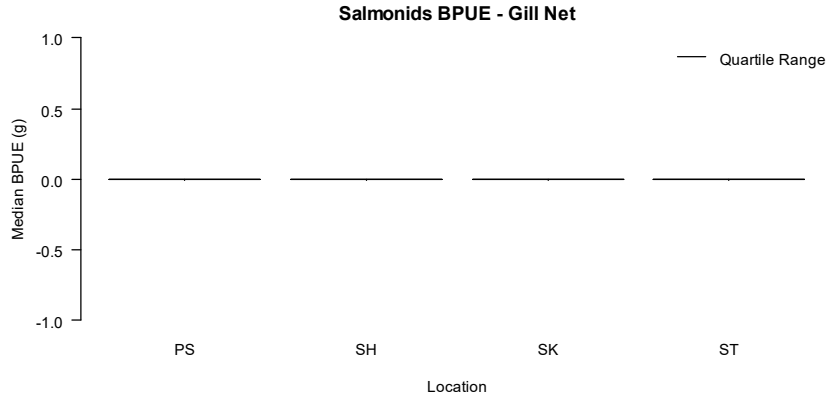
Salmonids









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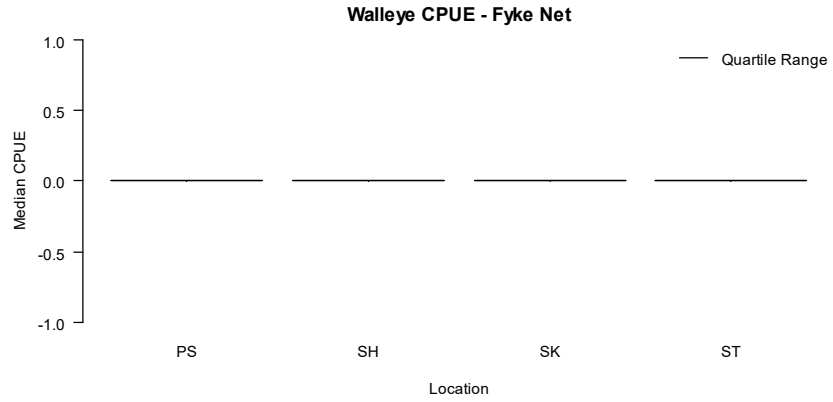
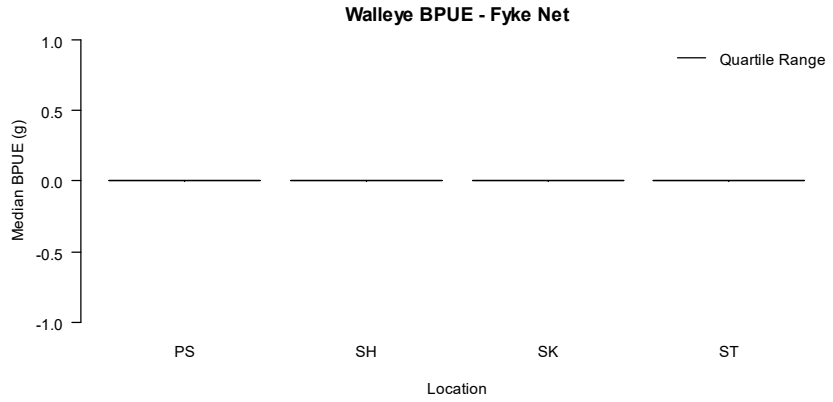
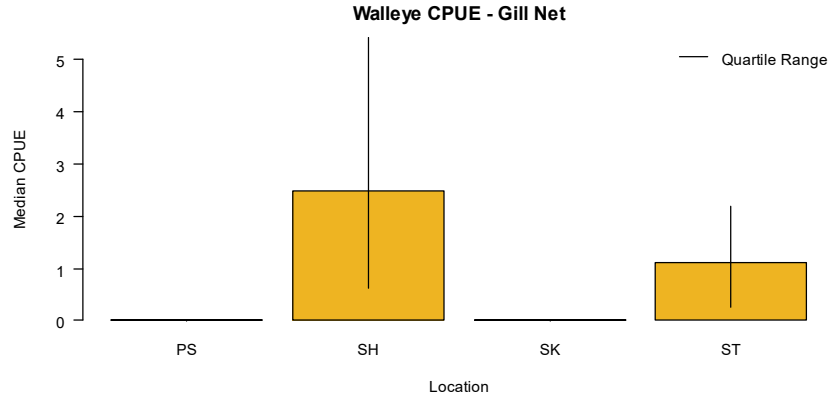
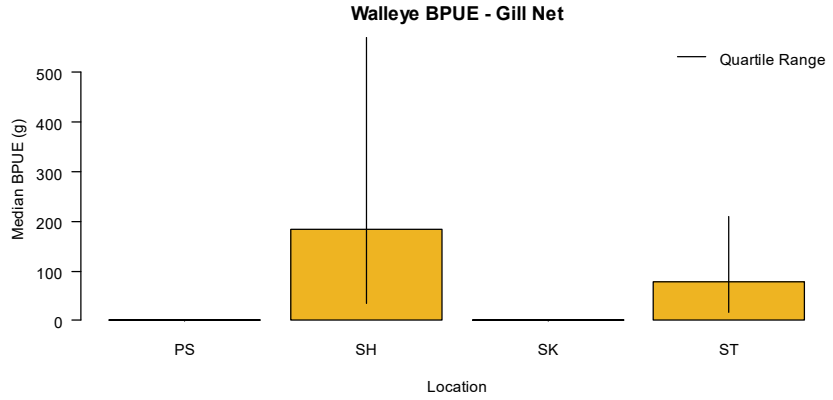
Walleye









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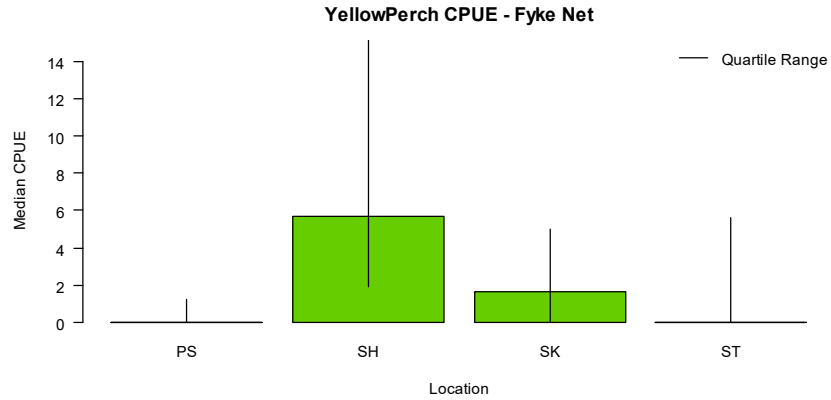
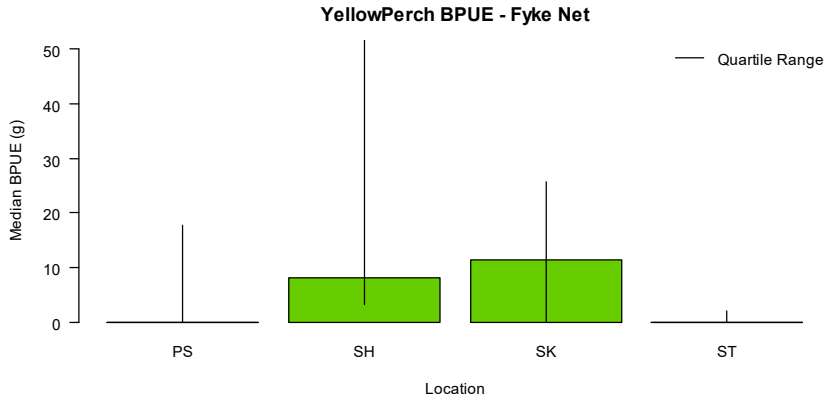
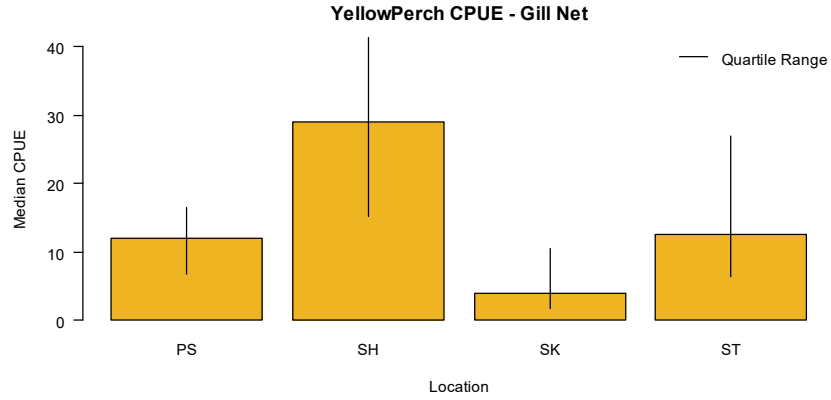
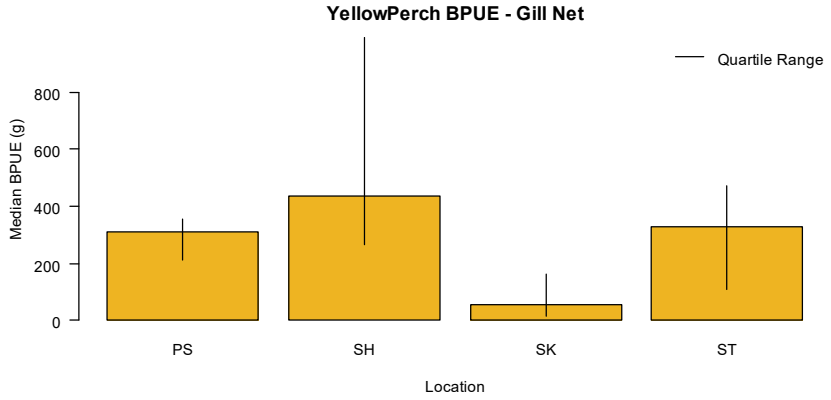
Yellow Perch









PS = Deep Bay SH = Shawanaga River SK = Shebeshekong River ST = Sturgeon Bay