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Community stability within the St. Marys River fish community: Evidence from trawl surveys

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ABSTRACT

A trawl survey was conducted in the Saint Marys River during 2010–2011 and we compared our results to a prior trawl survey conducted during 1979–1983 to look for long-term changes in the fish community, especially in terms of changes induced by invasive species. We found no substantive temporal differences in fish density, fish biomass, or fish diversity; lower trawl biomass during 2010–2011 was likely a result of day versus night trawling. The Saint Marys River remains a center of high fish diversity, invasive species remain rare, and the system continues to exhibit overall long-term stability. Trawling captured a wide range of fish species, but was likely not an effective stock assessment tool for managed game fish because catch rates were low or variable for all game species except yellow perch. Trawling appeared to be an effective tool for sampling connecting channel diversity, especially when large numbers of individuals are needed for directed studies, but annual sampling would be needed to use data to assess recruitment.

Introduction

Great Lakes connecting channels are among the largest rivers on earth in terms of flow and are centers for both regional biodiversity and fishing (Hondorp et al., 2014). A growing body of evidence suggests that conditions in connecting channels have direct effects on main-lake fish communities, especially in terms of spawning habitat and dispersal of recruits (Brodnik et al. 2016; DuFour et al., 2015). Thus, health and stability of connecting channel fish communities are of great interest to resource managers for both the connecting channels proper and their lakes. But, fisheries assessments that allow insight into connecting channel community trends are infrequent; therefore, managers often rely on data comparisons that are isolated temporally, spatially, or collected using different methods. This is especially true for the St. Marys River (SMR), a 112-km river that connects Lake Superior with Lake Huron.

The SMR is managed as a distinct international system by neighboring countries with regional coordination by the Great Lakes Fishery Commission's Lake Huron Committee (LHC) (Fielder 2002); regulations and assessments along the river vary according to varied management authorities. The only comprehensive river-wide assessment is a periodic open-water gill net survey conducted by the international LHC's St. Marys River Fishery Task Group (SMRFTG) and supplemented by spatially fragmented creel surveys. Data from those surveys suggest long-term stability within the fish community (Schaeffer et al., 2011) and that periodic gill net surveys are adequate to assess adult fish diversity. But, they are insufficient for stock assessments (Schaeffer et al., 2011; Schaeffer et al., 2014). Furthermore, existing surveys focus exclusively on adult fish, thus, knowledge about trends in the juvenile prey fish community is lacking, and scarcity of those data has been identified as an important missing component needed for effective fisheries management (Gebhardt et al. 2002; Pratt and O'Connor, 2011; Schaeffer et al., 2011). Managers wanted to know if apparent fish community stability observed in the periodic gillnet surveys that sample predators and adult fish is also evident in the prey juvenile/prey fish community.

The only SMR quantitative historical data that exist are from a night trawl survey conducted during 1979–1983 as part of an environmental impact assessment for proposed winter navigation (Liston et al. 1986). Ten trawl tows were conducted as a pilot study during 1979, and then a full study consisting of monthly night trawling was conducted May through November of 1982 and 1983 that resulted in 111 tows in total (hereafter referred to as the Liston Survey). The Liston Survey suggested that the SMR nearshore community was diverse and dominated by native species with relatively few invasive species. Their 1979–1983 results were compared with results of an electrofishing survey taken during 2006–2008 by Pratt and O'Connor (2011) who, while acknowledging that direct comparisons were not possible due to gear and location differences, concluded that the nearshore fish community had not changed appreciably over 23 years. However, while the electrofishing

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survey did a thorough job of documenting nearshore diversity, it was different enough from the Liston survey in that some uncertainty regarding main-channel trends remained among resource managers, and especially among those concerned with invasives. One key species of interest was the invasive round goby *Neogobius melanostomus* that had been documented sporadically from the SMR, but was not sampled via the electrofishing survey. Because round gobies reduce nearshore fish diversity in the Great Lakes (Poos et al. 2010), knowledge of their abundance within the SMR was considered important. However, their absence from the electrofishing survey was equivocal because it could have resulted from either true low abundance or low catchability.

During 2010–2011, support from the Great Lakes Restoration Initiative (GLRI) made it possible to re-survey the SMR using the same trawl used in the Liston Survey. The primary survey objective was to attempt to replicate the original Liston Survey with an identical trawl at the same channel sampling locations. Additional data at eleven other locations near periodic gill net assessments conducted by the SMRFTG would expand spatial coverage among different habitats not sampled by the Liston Survey, and sample gill net locations to capture juvenile and prey species not well represented during that survey.

The Liston Survey could not be replicated fully for three reasons: 1) current agency safety protocols allowed small-vessel trawling during the day, but not at night, 2) lower water levels during 2010–2011 did not allow the exact Liston trawl locations to be sampled because sites were much shallower than during 1979–1983, and 3) funding was sufficient to sample during late August-early September only, but not monthly during May–November as was done by Liston et al. (1986). However, adjacent sites in close proximity could be sampled, and the day trawling was consistent with U.S. Fish and Wildlife Service aquatic invasive species surveillance protocols, which in the Great Lakes rely heavily on day trawling using small vessels (Schaeffer et al. 2005).

We present results of a day trawl survey conducted during 2010–2011, and compare findings directly with the Liston night trawl survey. We also compare results qualitatively with gill net assessments (Schaeffer et al. 2011) and the electrofishing survey conducted by Pratt and O'Connor (2011). We discuss what those surveys tell us about the SMR nearshore fish community, and offer suggestions on how to move forward with future nearshore fish community assessments.

Methods

Site selection and description

Sampling locations (Fig. 1) were chosen based on 18 trawl site recommendations identified in the St. Marys River Fisheries Assessment Plan (Gebhardt et al., 2002; Great Lakes Fishery Commission, 2016) and included seven sites originally surveyed by Liston et al. (1986) in both U.S. and Canadian waters of the St. Marys River. Eleven additional locations were added to provide more comprehensive spatial coverage in habitats proximate to on-going SMRFTG gill net assessments (which had been located based on habitat). Sampled sites included channels of the St. Marys River, embayments, and tributary mouths. Sites included both submerged vegetated or non-vegetated habitats over sand, clay, or small cobble substrates.

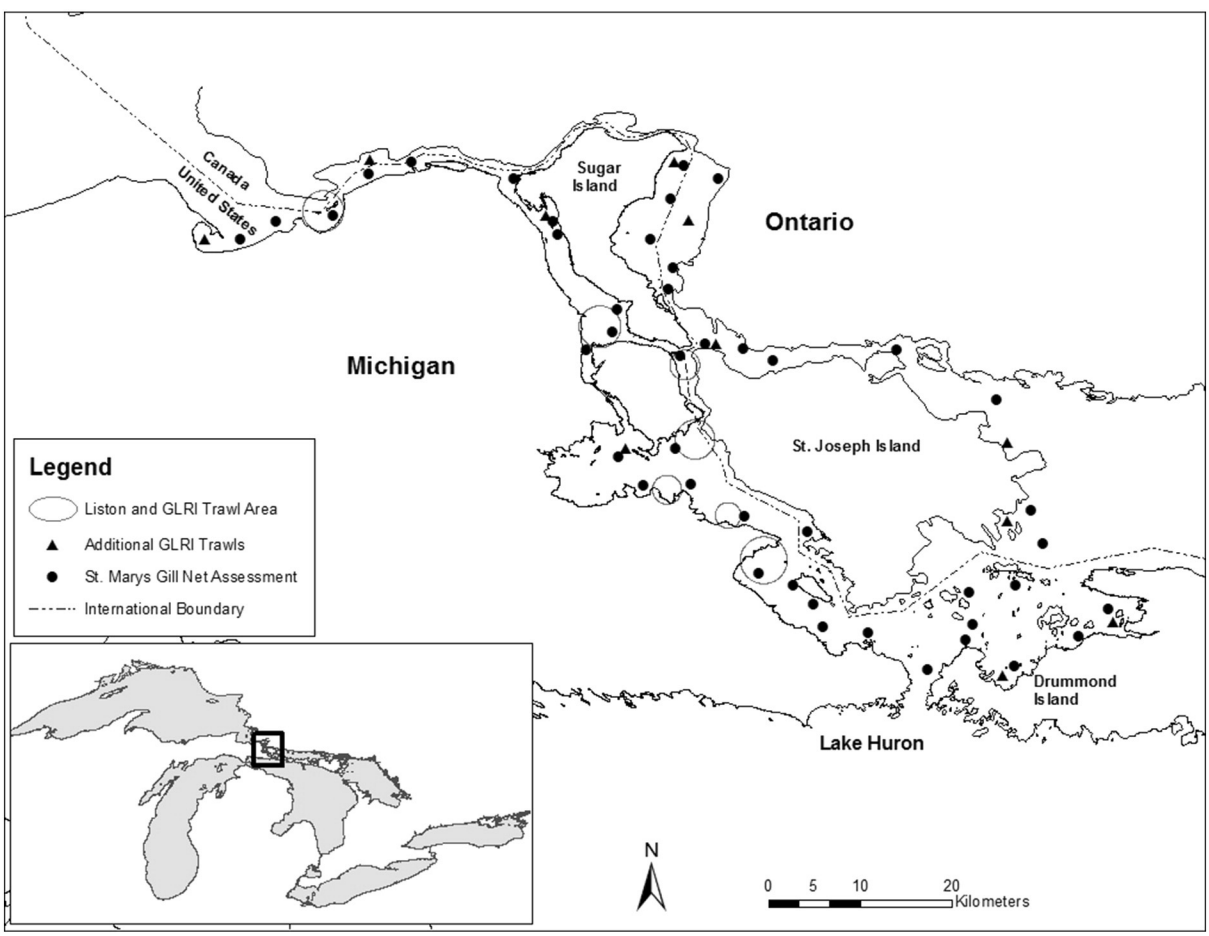

Fig. 1. Map of Saint Marys River, Michigan-Ontario, showing approximate trawl locations sampled by the Liston Survey, 1982–1983, and resampled during 2010–2011, and new additional SMRFTG trawl sites.

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