Bottom trawl assessment of Lake Ontario's benthic prey fish community, 2025

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Abstract

Since 1978, bottom trawl surveys in Lake Ontario have provided information on the status and trends of the benthic prey fish community related to Fish Community Objectives that include understanding prey fish population dynamics and community diversity. Beginning in 2015, the benthic prey fish survey expanded from only U.S. sites to incorporate Canadian sites, increasing the survey's spatial coverage to a lake-wide scale. Additionally, sampling in the eastern U.S. embayments (Black River, Chaumont, Guffin, and Henderson Bays), that were historically sampled during a September bottom trawl survey to index Yellow Perch (*Perca flavescens*; 1978-2007), resumed in 2015. The current survey provides abundance indices for sculpins, Round Goby (*Neogobius melanostomus*) and Bloater (*Coregonus hoyi*) using techniques, gear, and timing comparable to surveys on Lake Michigan. This alignment provides a necessary biological reference point for evaluating Lake Ontario Bloater reintroduction. In 2025, the benthic prey fish survey completed 100 bottom trawl sites across main lake and embayment habitats at depths from 6 to 168 m. Sampling in US waters was limited in 2025 compared to previous years. In total, the 2025 survey sampled 59,870 fish from 23 species. No Bloater were detected in the 2025 survey. Round Goby was the most common species comprising 46% of the total catch by number, followed by Deepwater Sculpin (*Myoxocephalus thompsonii*), White Perch (*Morone americana*), and Alewife (*Alosa pseudoharengus*) at 23%, 9%, and 9% respectively. Slimy Sculpin (*Cottus cognatus*) lake-wide biomass density continues to be lower than when lakewide sampling began in 2015; zero Slimy Sculpin were detected in US waters, however sampling in the main lake within US waters was limited to the southeastern area of Lake Ontario. Deepwater Sculpin biomass has remained high since population recovery began in 2010. Embayment sampling in 2025 was limited to only Chaumont Bay.

Data Availability

Data associated with this report are currently under review and will be publicly available in 2026 at: Stahl SD, O'Malley BP, Sunderland L, Goretzke J, Mitchinson OM, and Weidel BC. 2026. Lake Ontario Benthic Prey Fish Bottom Trawl Survey, 1978-2025: U.S. Geological Survey data release, https://doi.org/10.5066/P1N7LVGJ.

Introduction

Lake Ontario Fish Community Objectives (herein FCOs) established by the Great Lakes Fishery Commission's Lake Ontario Committee call for maintaining predator-prey balance and for maintaining and restoring pelagic and benthic (bottom–oriented, demersal) prey fish diversity (Stewart et al., 2017). Collaborative bottom trawl surveys conducted by the U.S. Geological Survey (USGS), the New York State Department of Environmental Conservation (NYSDEC), and the Ontario Ministry of Natural Resources (OMNR) have annually assessed Lake Ontario prey fish community status and trends since 1978 to provide information for decision-making relative to those objectives.

During 1978–1980s, Lake Ontario's benthic prey fish community was dominated by Slimy Sculpin (*Cottus cognatus*), with fewer Trout-perch (*Percopsis omiscomaycus*), Johnny Darter (*Etheostoma nigrum*), and Spottail Shiner (*Notropis hudsonius*). Recent bottom trawl surveys have documented a decline in Slimy Sculpin abundance and an increase in non-native Round Goby (*Neogobius melanostomus*) beginning in 2005, as well as a resurgence in native Deepwater Sculpin (*Myoxocephalus thompsonii*), once considered extirpated (O'Malley et al. 2024; Weidel et al. 2017). These considerable changes in benthic prey fish composition exemplify the importance of monitoring populations and improving survey design to provide the best information possible to track population changes through time. Moreover, Lake Ontario prey fish surveys have routinely sampled the same lake areas across different seasons from April to October over multiple years, which allows for quantifying seasonal migrations of fish populations to better understand ecosystem structure and function and how habitats are coupled by different species (Ives et al. 2019; Pennuto et al. 2021).

Bottom trawl surveys also measure the progress of native species restoration. Bloater (*Coregonus hoyi*), a native coregonine that inhabits deep, offshore habitats, was considered extirpated from Lake Ontario by the 1980s (Weidel et al. 2022). Since 2012, Bloater have been reintroduced through stocking, and bottom trawl recaptures allow for tracking the progress of the restoration program (Holey et al. 2021; Weidel et al. 2022). In 2015, Bloater were caught in Lake Ontario bottom trawl surveys for the first time since their last capture in 1983 (Weidel et al. 2022). Additionally, using similar gear types and trawling at similar times of year to other surveys conducted throughout the Laurentian Great Lakes has allowed managers to interpret Lake Ontario prey fish dynamics at a basin-wide scale, as well as across different habitats (e.g., main lake vs. embayments) and depth strata. This provides a relevant biological reference point to evaluate progress toward restoration within a contemporary Lake Ontario ecosystem.

This report describes the status and long-term trends of the Lake Ontario benthic prey fish community, with an emphasis on information addressing the binational (OMNR and NYSDEC) FCOs (Stewart et al. 2017). Here, we summarize recent findings from the fall (September-October) 2025 Lake Ontario benthic prey fish survey, in context with long-term trends from 1978 to 2025. In addition to presenting long-term results from the benthic prey fish survey, we also leverage bottom trawl data from a survey that sampled northeastern Lake Ontario embayments from 1978 to 2007. This additional dataset helps us describe community changes in embayments, which were added to the benthic prey fish survey in 2015.

Methods

Benthic prey fish survey

From 1978 to 2011, the benthic prey fish survey sampled six to ten transects along the southern shore of Lake Ontario from Olcott to Oswego, NY. Daytime trawls were typically 10 minutes and sampled depths from 8–150 m (26–495 ft). The original survey gear was a Yankee bottom trawl with an 11.8 m (39 ft) headrope and was spread with flat, rectangular, wooden trawl doors (2.1 m x 1 m). The survey typically occurred during October but also included sampling from September to November (O'Malley et al. 2024). Abundant dreissenid (*Dreissena* spp.) mussel catches in the early 2000s led to the survey abandoning the standard trawl and experimenting with a variety of alternate polypropylene bottom trawls and metal trawl doors (2004-2010). Comparison towing indicated that alternate trawls caught fewer demersal fishes and the alternative trawl doors influenced net morphometry (Weidel and Walsh 2013). Since 2011, the survey has used the historically standard Yankee trawl and doors but has reduced tow times to reduce mussel catches. Typical trawl tows in recent years have been 5 minutes, and in nearshore areas or those where mussel catches are high, as indicated by the preceding trawl site, tow times have been reduced to 2.5-4 minutes. Experimental sampling at new transects and in deeper habitats began in 2012. In 2015, the spatial extent of the survey was doubled to include Canadian waters and embayment sites in the eastern basin. At that time, the NYSDEC and OMNR research vessels joined the survey, which greatly expanded the spatial extent and diversity of habitats assessed. We used results from the benthic prey fish survey from 1978 to develop time series plots for trend inference. No adjustments are available for data when the alternative trawls were used.

In 2025, the benthic prey fish survey consisted of 100 trawl sites completed between three research vessels (USGS R/V *Kaho*, OMNR R/V *Ontario Explorer*, and NYSDEC R/V *Seth Green*) from September 11 to October 10. The 2025 survey had limited spatial coverage along the southern shore in U.S. waters, where approximately 18% of the typical sites were covered (23 of 130 sites). No sampling occurred in deep areas of the lake > 170 m. Trawl catches were sorted by species, counted, and weighed. Subsamples of species in each trawl catch were measured for individual length and weight. Additional samples for growth, diet, reproduction, and genetic analysis were collected for some species. Dreissenid mussels were weighed but not counted or identified to species.

Trawl effort was historically based on tow time, and abundance indices were reported as number or weight per 10-minute trawl. However, area-swept estimates calculated using trawl mensuration sensors and video cameras indicated that trawl effort expressed as area swept differed substantially from tow-time based effort. Trawl results are expressed as biomass densities (kg/ha, kilograms of fish per hectare) and account for depth-based differences in the lake area swept by the trawl (Weidel and Walsh 2013). Time series are still regarded as biomass indices, rather than absolute densities, because we lack estimates of trawl catchability (proportion of the true density within a surveyed area captured by the trawl). Trawl sites were assigned to a country based on the mid-point of start and end trawl coordinates. Historical trawl sites without coordinates were assigned to a country based on the nearest port (only US waters). Annual area-weighted biomass indices expressed as kg/ha were calculated for US waters (1978–2025) and lake-wide (2015–2025) using thirteen 20 m strata within US and Canadian waters (Cochrane 1977; O'Malley et al. 2021). The lake-wide index was calculated assuming 52% and 48% area for Canadian and US waters, respectively.

Perch Survey

From 1978 to 2007, fish communities in northeastern embayments of Lake Ontario (Chaumont, Guffin, Black River, and Henderson Bays) were sampled during late September through early October (O'Malley et al. 2024) to assess Yellow Perch (*Perca flavescens*) and White Perch (*Morone americana*) populations and document long-term trends in the fish communities of these habitats (O'Gorman and Burnett, 2001). We refer to this dataset as the perch survey for convenience. In our analysis, we pooled observations from Guffin and Chaumont Bays, and simply refer to these as Chaumont Bay given their proximity to each other in Lake Ontario. Catch protocols were similar to those described above where species were sorted, counted, weighed, and subsamples were measured for length frequencies. From 1978 to 1997, sampling was conducted by the USGS R/V *Kaho* with a 7.9 m headrope bottom trawl, with a 13 mm stretch nylon mesh cod end. Trawling occurred during the day and typically lasted for 5 minutes at each location. Site depths were between 6 to 20 m, and approximately fifteen sites were sampled each year. In 1996, problems with fouling from large catches of dreissenid mussels led to the adoption of mud rollers in 1997 to reduce fouling. From 1998-2007, the NYSDEC R/V *Seth Green* continued the sampling using an 18 m, 3N1 bottom trawl at the same locations. For detailed descriptions of trawl gear used in Lake Ontario surveys, see Lantry et al. (2007). In 2015, the R/V *Seth Green* resumed sampling these sites annually in early October as part of the benthic prey fish survey using a Yankee bottom trawl. The recent expansion of our annual benthic prey fish survey into these historically sampled habitats has created an opportunity to assess long-term trends for benthic prey fish communities from these embayments.

In addition to the benthic prey fish survey data, we used data from the perch survey to illustrate long-term trends in the benthic fish populations of embayments by combining both datasets. In contrast to lake-wide trends which use an area weighted mean, we report mean biomass density for Yellow Perch and White Perch for the embayments (1978–2025) without weighting by depth strata. We calculated the biomass proportion of benthic prey fish species for each year using the total weight across all trawl sites per embayment. Bay of Quinte was added to the survey in 2021 (using a different trawl type (3N1) to avoid fouling from sediments, O'Malley et al. 2021), however, Upper Bay sites that are most comparable to other perch survey sites were not sampled in 2022-2025. Sodus and Little Sodus Bay were added to the benthic prey fish survey in 2021. These additional embayment sites have generally been sampled in the spring prey fish bottom trawl survey that uses a 3N1 trawl (Weidel et al. 2025). Because of survey logistic constraints, Chaumont Bay was the only embayment sampled in 2025 during the benthic prey fish survey.

Results & Discussion

The 2025 benthic prey fish survey completed 100 trawls in main lake and embayment sites (Figure 1), at depths from 6.5 to 168 m. The survey captured 59,870 fish from 23 species with a total weight of 892 kg, and 4,495 kg of dreissenid mussels (Table 1). Numerically, Round Goby was the most common species comprising 46% of the total catch by number, followed by Deepwater Sculpin, White Perch, and Alewife at 23%, 9% and 9%, respectively.

Slimy Sculpin – Slimy Sculpin biomass density (lake-wide = 0.04 kg/ha) in 2025 continued to be lower than when lake-wide sampling began in 2015 (0.15 kg/ha; Figure 2). Slimy Sculpin were more common at trawl sites in Canadian waters and were absent from US trawl sites 2025. The highest biomass density from individual trawl tows occurred along the northern shore of Lake Ontario between Pickering and Cobourg (Figure 3). Once the dominant demersal prey fish in Lake Ontario when formalized surveys began in 1978, Slimy Sculpin declines in the 1980s were attributed to Lake Trout predation (Owens and Bergstedt 1994). Subsequent declines in their population in the 1990s were attributed to collapse of their preferred prey, the amphipod *Diporeia* (Owens and Dittman 2003). Further declines of Slimy Sculpin that occurred in the mid-2000s appear to be related to negative interactions associated with Round Goby expansion (Volkel et al. 2021); however, the continued declines experienced from 2015 to present remain largely unexplained. The absence of Slimy Sculpin in US waters during 2025 may in part be explained by the limited number of trawl tows completed, which may have limited the likelihood of detecting rare species.

Deepwater Sculpin – Deepwater Sculpin was the second most abundant fish in trawl catches during the 2025 benthic prey fish survey. Deepwater Sculpin biomass has increased since 2010. In 2025, lake-wide biomass (3.3 kg/ha) was lower compared to all-time highs and suggests the rate of increase observed during the recovery period may be slowing down as the population approaches its carrying capacity (Figure 2). Deepwater Sculpin were present in more trawl tows than Slimy Sculpin in 2025 (Figure 3).

Round Goby – Round Goby was the most abundant fish in trawl catches during the 2025 survey (Table 1). Round Goby biomass in 2025 (1.4 kg/ha) was slightly higher than the lake-wide average in 2024 (1.2 kg/ha; Figure 2). Round Goby biomass density has been trendless, and highly variable, since lake-wide sampling began in 2015 (Figure 2; $F_{1,9} = 2.52$, $P = 0.09$, $R^2 = 0.20$). Estimating Round Goby abundance using bottom trawls can be complicated by the species preference for rocky substrate and seasonal changes in depth distribution (Ray and Corkum, 2001; Pennuto et al. 2021). Higher Round Goby catches are typically associated with shallower depths during the survey compared to native sculpin species (Figure 3).

Coregonines – Lake Ontario historically had several coregonine species within the *Coregonus* genus, two of which, Cisco (*C. artedi*) and Lake Whitefish (*C. clupeaformis*) still have self-sustaining populations. Bloater is a benthopelagic species native to Lake Ontario that historically inhabited deeper, offshore habitats. While records are sparse, commercial fishery catches suggest Bloater was historically abundant in Lake Ontario but rare by the 1970s (Christie 1973). Catches have been sporadically low since restoration stocking began in 2012 but are reasonable based on our power to detect species at low abundance (Weidel et al. 2022). In 2025, no Bloater were captured in the survey. Cisco is rarely encountered in the benthic prey survey (Figure 4). In 2025, Cisco was caught in trawls from the Adolphus Reach and Kingston Basin. Since 2015, catches of Cisco in the survey have been limited to the eastern half of Lake Ontario including sites along the southern shore between Rochester and Oswego. Lake Whitefish are considered a benthic species and have been historically rare in the benthic prey fish survey. In 2025, Lake Whitefish was caught in trawls from the Adolphus Reach and Hamilton (Figure 5). Since 2015, catches of Lake Whitefish have mainly occurred in the western part (Toronto and Hamilton) and eastern parts of Lake Ontario (Adolphus Reach south to Oswego). Average density of Lake Whitefish was notably high in 2025 from the eastern basin, driven by high density observed at Adolphus Reach (Figure 6). Length frequency data suggest catches at Adolphus Reach are represented by multiple age classes including juveniles and adults (Figure 7).

Lake Trout – Lake Trout rehabilitation has been ongoing for decades and the goal is to achieve a self-sustaining population (Lantry et al. 2014). Bottom trawl surveys can be used to inform production of wild-produced juvenile Lake Trout. Wild-produced Lake Trout have occasionally been detected in the benthic prey fish survey. In 2025, catches of presumably wild age-0 Lake Trout (< 100 mm TL) were detected at Adolphus Reach (Figure 8).

Embayments – Trawl catches at embayment sites sampled in recent years represent species that are not common at main lake sites. Since 2015, these habitats, especially Black River Bay, are the only sites where trawls routinely capture Trout-perch, Darters (*Etheostoma* spp.), and Spottail Shiner, native species that were once common in the main lake portion of Lake Ontario in the 1970-1990s (Figure 9). Since 2015, benthic prey fish biomass in embayments sampled has been primarily dominated by Yellow Perch, White Perch, and bullheads (Figure 9). In 2025, Chaumont Bay was the only embayment site sampled during the benthic prey fish survey and prey fish composition was dominated by Yellow Perch, Bullheads, and White Perch. During 2015-2025, Yellow Perch biomass was generally higher in Chaumont, Henderson, Little Sodus, and Sodus bays compared to Black River Bay and Upper Bay of Quinte (Figure 10). Biomass estimates for White Perch are typically higher in Black River Bay compared to other embayments.

Acknowledgements

We thank all the vessel, biological, and support staff for their effort conducting the 2025 Lake Ontario benthic prey fish survey. We thank Dr. Amanda Ackiss for genetic confirmation of Bloater in previous years. We thank Kevin Keretz and Collin Farrell for their helpful reviews. Funding for U.S. Geological Survey sampling and analysis is from the Ecosystems Mission Area Species Management Research Program. Provincial funding to implement OMNR sampling was from the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health and Ontario's Great Lakes Strategy. NYSDEC funding was from the Federal Aid in Sport Fish Restoration Program. USGS fish handling was carried out in accordance with guidelines from the American Fisheries Society. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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Table 1. Number and weight (kilograms) of fish caught in the 2025 benthic prey fish survey. Lake Sturgeon and Common Carp were counted but not weighed. Dreissenid (*Dreissena* spp.) mussel catch was weighed but individuals were not counted.

Common name	Scientific name	Number caught	Weight caught (kg)
Round goby	*Neogobius melanostomus*	27,560	89.630
Deepwater sculpin	*Myoxocephalus thompsonii*	13,903	351.978
White perch	*Morone americana*	5,400	45.218
Alewife	*Alosa pseudoharengus*	5,302	90.055
Yellow perch	*Perca flavescens*	2,921	86.094
Rainbow smelt	*Osmerus mordax*	2,158	10.710
Gizzard shad	*Dorosoma cepedianum*	1,067	19.414
Trout-perch	*Percopsis omiscomaycus*	564	4.810
Slimy sculpin	*Cottus cognatus*	244	1.898
Lake whitefish	*Coregonus clupeaformis*	233	35.633
White sucker	*Catostomus commersonii*	147	63.507
Pumpkinseed	*Lepomis gibbosus*	94	5.356
Spottail shiner	*Notropis hudsonius*	72	0.885
Brown bullhead	*Ameiurus nebulosus*	61	23.301
Walleye	*Sander vitreus*	50	10.142
Freshwater drum	*Aplodinotus grunniens*	23	13.363
Lake trout	*Salvelinus namaycush*	23	6.593
Common carp	*Cyprinus carpio*	20	
Quillback	*Carpiodes cyprinus*	12	33.289
Cisco	*Coregonus artedi*	9	0.079
Lake sturgeon	*Acipenser fulvescens*	3	
Threespine stickleback	*Gasterosteus aculeatus*	2	0.003
White bass	*Morone chrysops*	2	0.488
Dreissenid	*Dreissena* spp.		4494.862

Figures

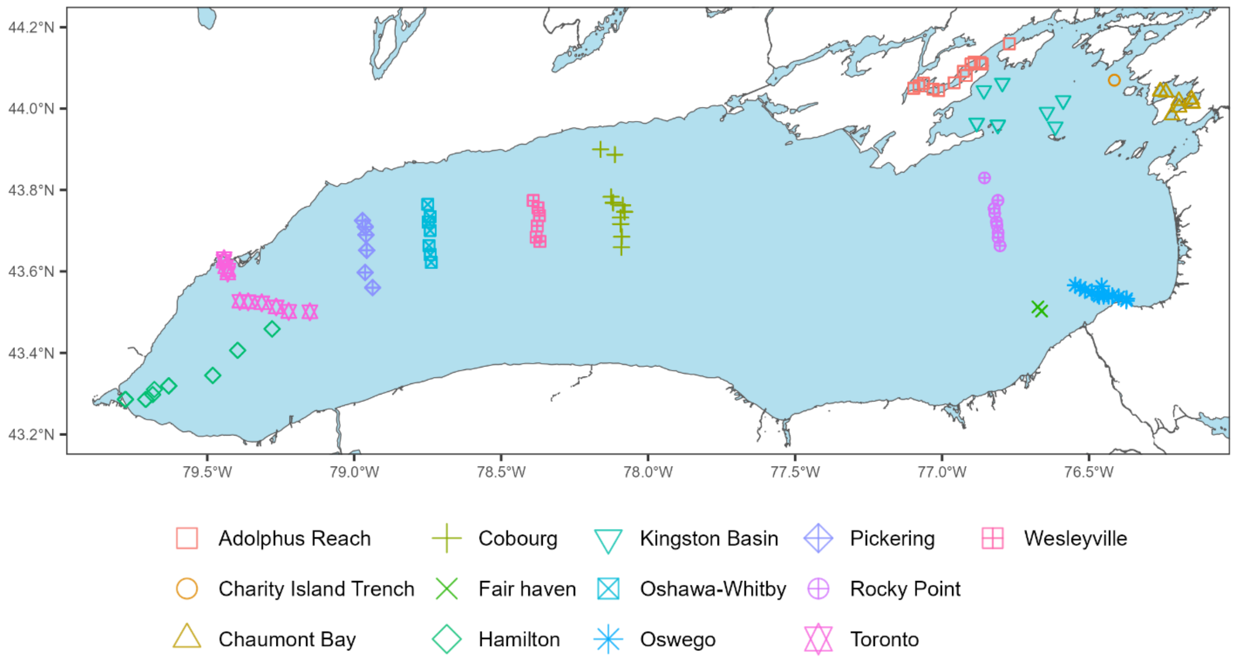

Figure 1. Lake Ontario bottom trawl sites during the 2025 benthic prey fish survey collectively sampled by the U.S. Geological Survey (USGS) R/V *Kaho*, New York State Department of Environmental Conservation (NYSDEC) R/V *Seth Green*, and the Ontario Ministry of Natural Resources (OMNR) R/V *Ontario Explorer* during 11 September – 10 October 2025.

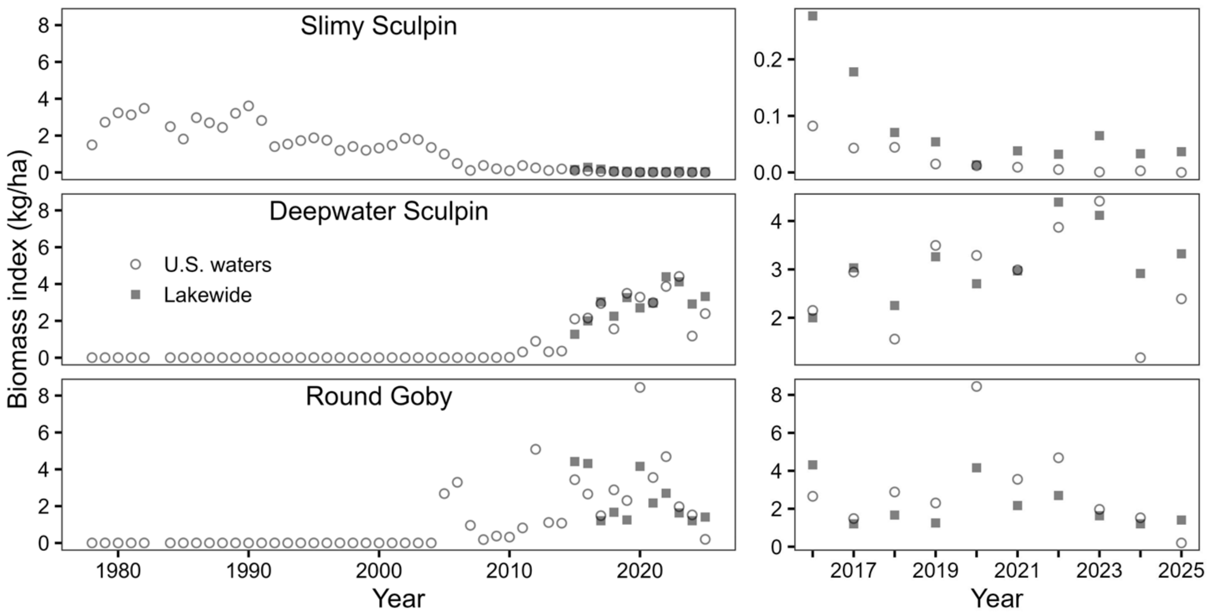

Figure 2. (Left) Area-stratified biomass density (kg/ha) for Slimy Sculpin (*Cottus cognatus*), Deepwater Sculpin (*Myoxocephalus thompsonii*), and Round Goby (*Neogobius melanostomus*) in the Lake Ontario benthic prey fish survey, 1978–2025. Open symbols represent the index for US waters only, and closed squares represent lake-wide values that include trawl sites from both US and Canadian waters. (Right) A subset of the time series representing only 2016–2025 to illustrate recent trends over the past 10 years that may not be apparent when viewing the entire time series. Note the difference in scale between the two time periods.

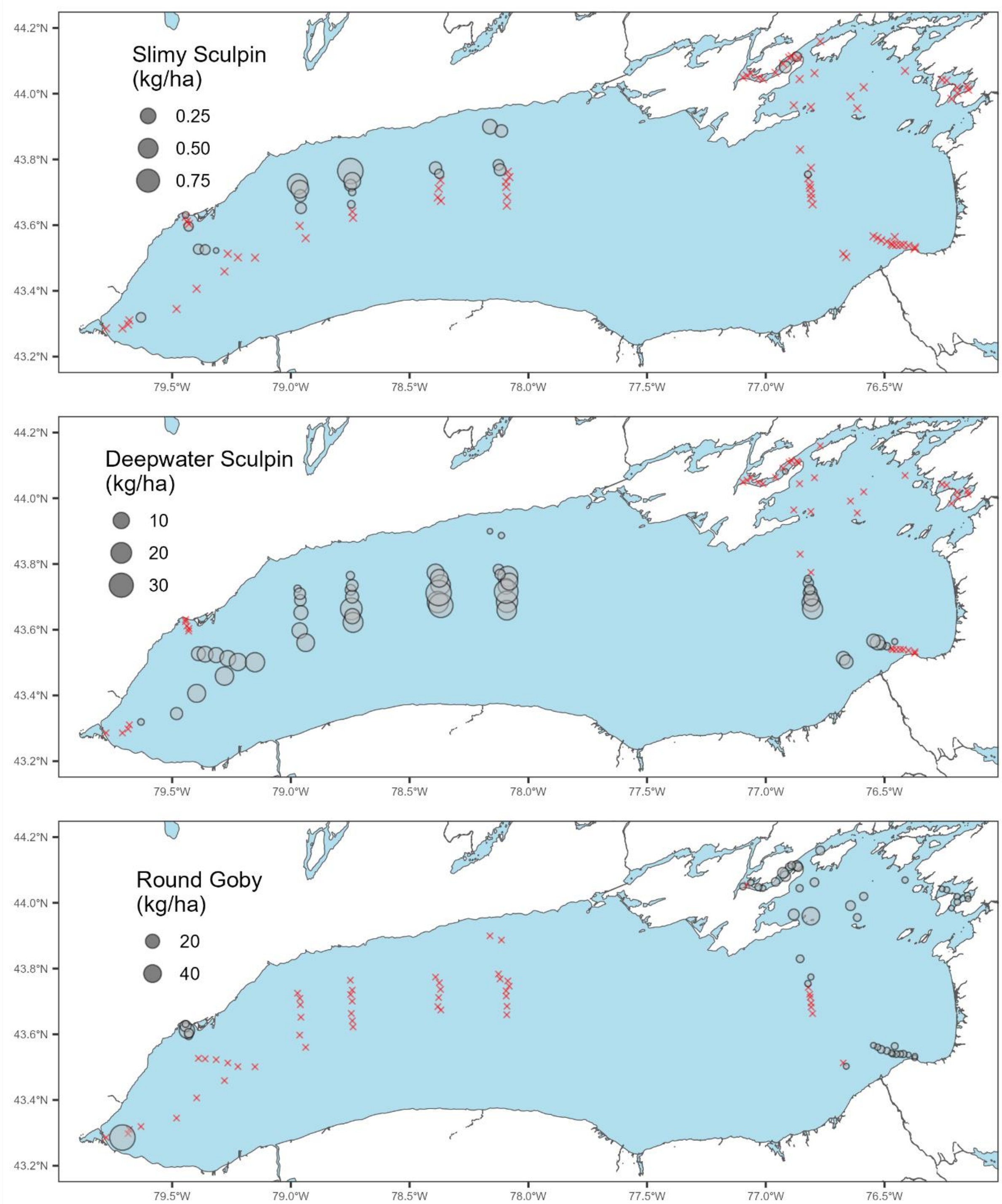

Figure 3. Spatial distribution of biomass density (kg/ha) from individual trawl tows for Slimy Sculpin (*Cottus cognatus*), Deepwater Sculpin (*Myoxocephalus thompsonii*), and Round Goby (*Neogobius melanostomus*) in Lake Ontario, 2025. Note the difference in biomass scales among maps. Bottom trawl locations where the species was not captured (i.e., 0 kg/ha) are marked with a red X.

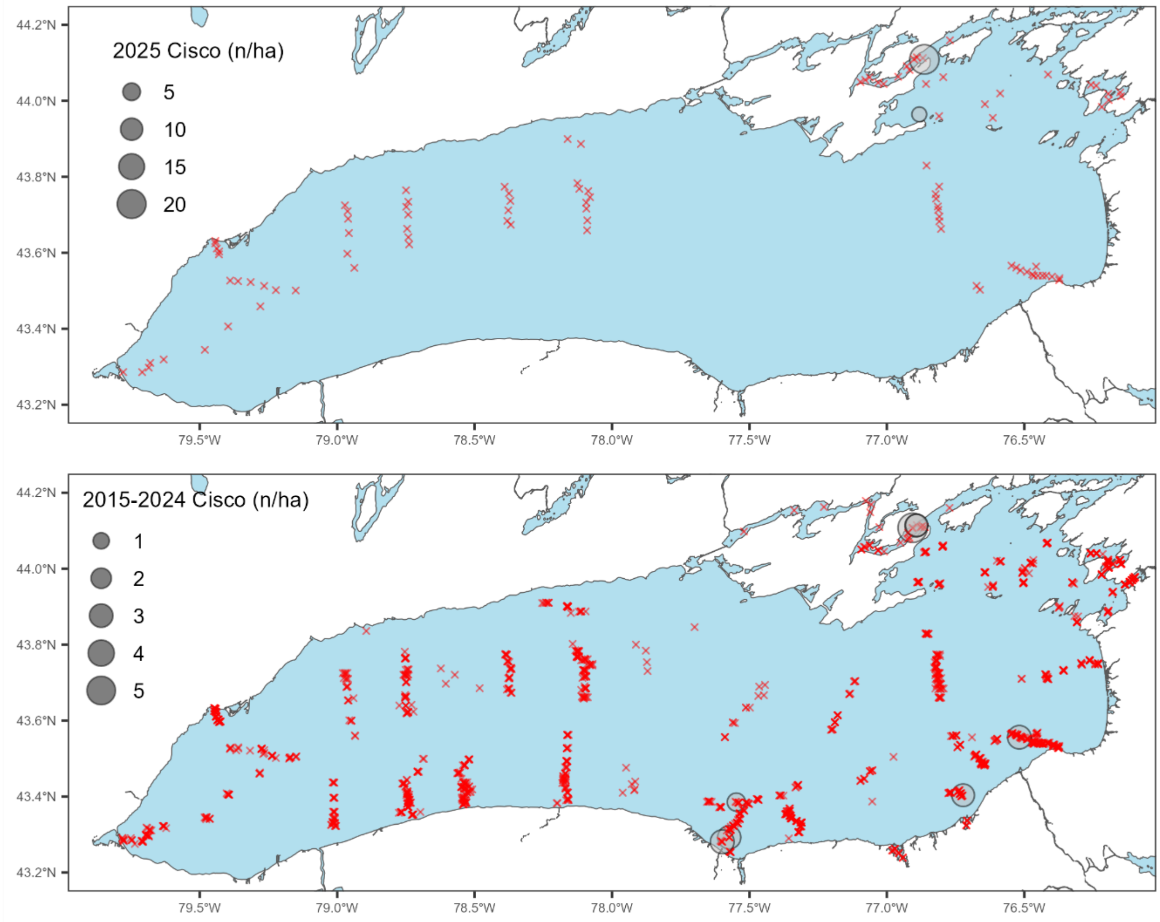

Figure 4. Spatial distribution of Cisco (*Coregonus artedi*) density (n/ha) from individual trawl tows in Lake Ontario from the benthic prey fish survey in 2025 (top) and 2015-2024 (bottom). Bottom trawl locations where the species was not captured (i.e., 0 kg/ha) are marked with a red X.

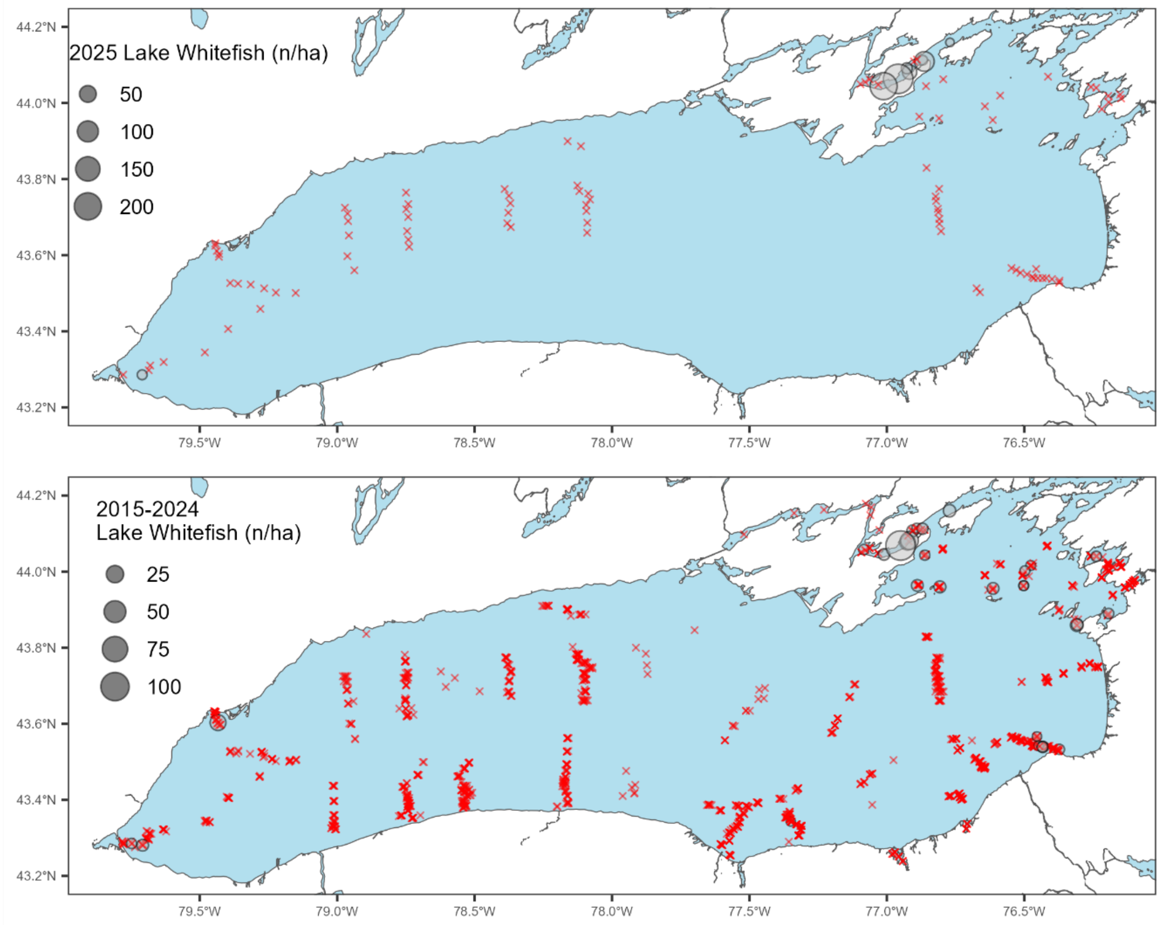

Figure 5. Spatial distribution of Lake Whitefish (*Coregonus clupeaformis*) density (n/ha) from individual trawl tows in Lake Ontario from the benthic prey fish survey in 2025 (top) and 2015-2024 (bottom). Bottom trawl locations where the species was not captured (i.e., 0 kg/ha) are marked with a red X.

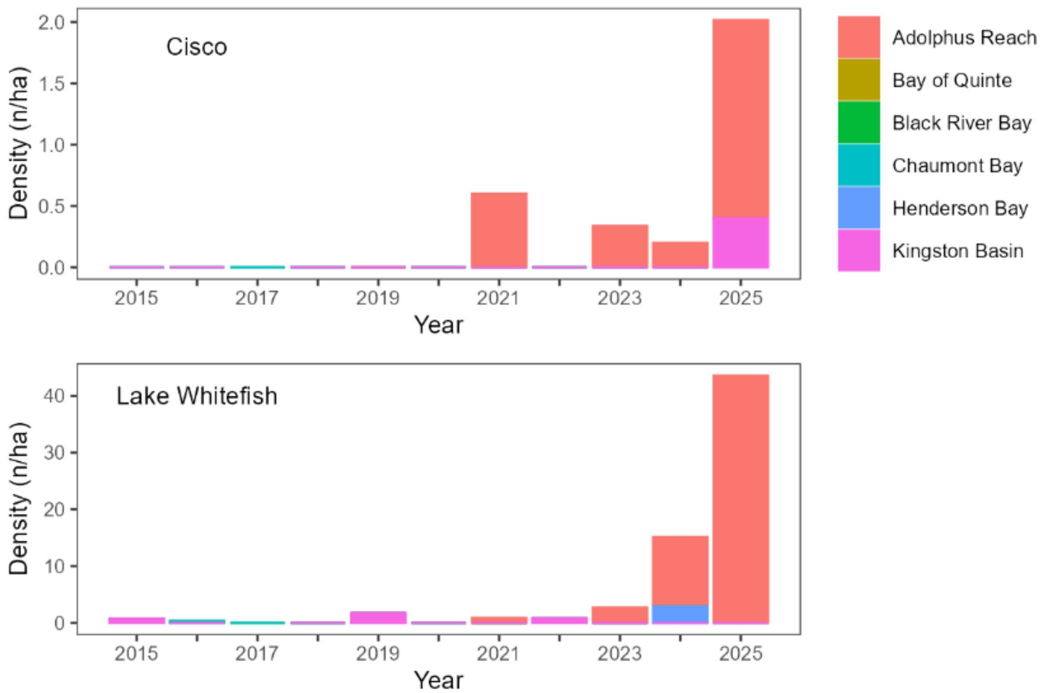

Figure 6. Average density (n/ha) by location and year of Cisco (*Coregonus artedi*) and Lake Whitefish (*Coregonus clupeaformis*) in the eastern basin of Lake Ontario during the benthic prey fish survey 2015-2025.

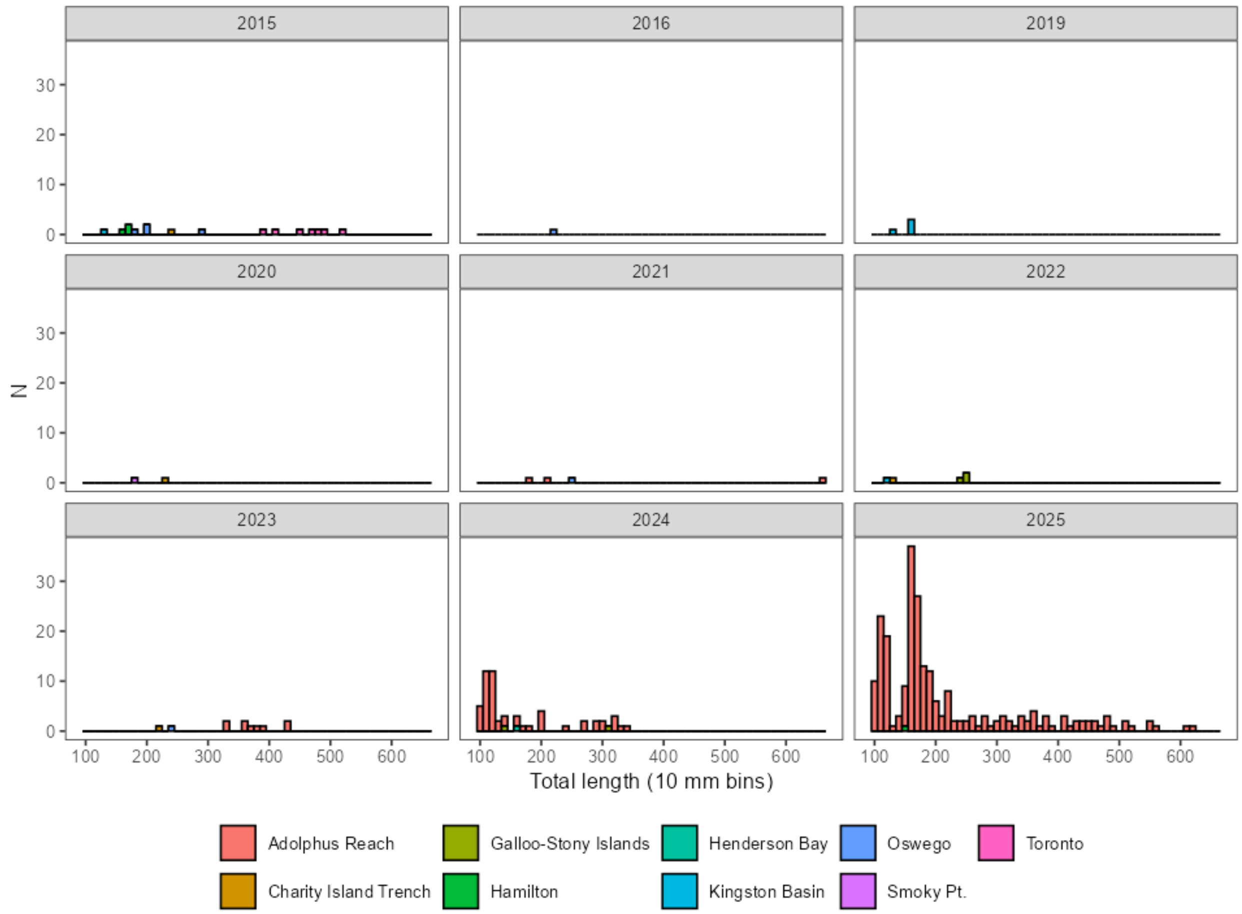

Figure 7. Length frequency of Lake Whitefish (*Coregonus clupeaformis*) by location and year, caught in the Lake Ontario benthic prey fish survey 2015-2025.

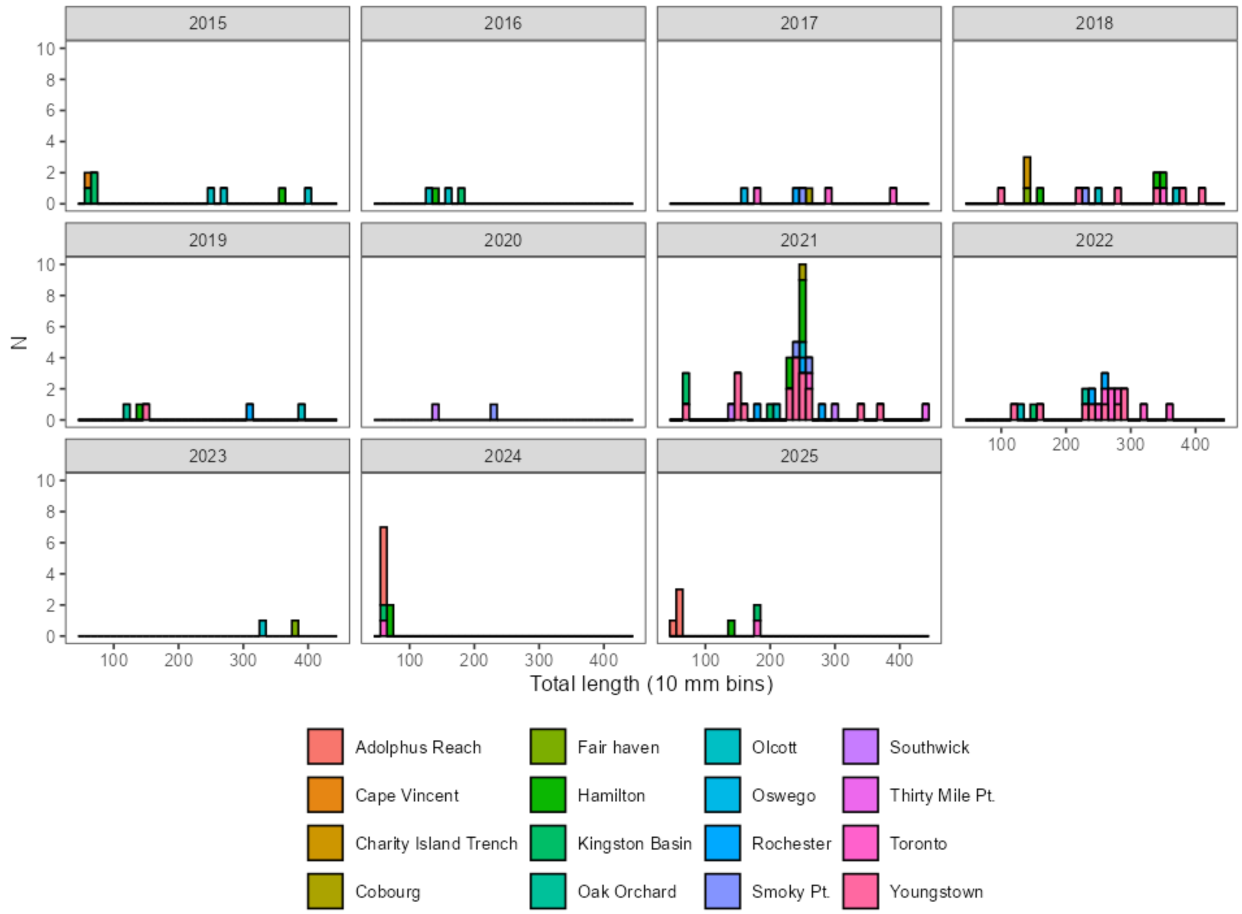

Figure 8. Length frequency of wild Lake Trout (*Salvelinus namaycush*) < 500 mm total length by location and year, caught in the Lake Ontario benthic prey fish survey 2015-2025.

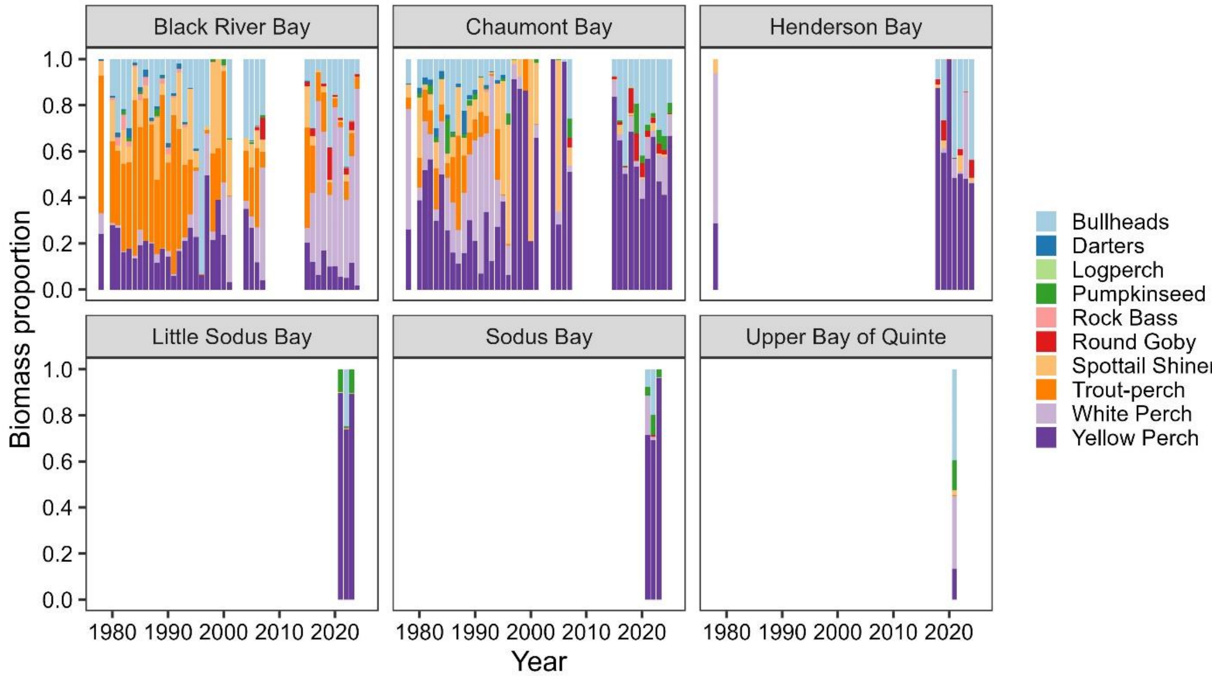

Figure 9. Community composition of benthic prey fish in Lake Ontario embayment catches from the perch survey 1978–2007 (O'Gorman and Burnett 2001), and the benthic prey fish survey 2015–2025. In 2025, Chaumont Bay was the only embayment site sampled during the benthic prey fish survey (Bullheads = *Ameiurus* spp., Darters = *Etheostoma* spp., Logperch = *Percina caprodes*, Pumpkinseed = *Lepomis gibbosus*, Rock Bass = *Ambloplites rupestris*, Round Goby = *Neogobius melanostomus*, Spottail Shiner = *Hudsonius hudsonius*, Trout-perch = *Percopsis omiscomaycus*, White perch = *Morone americana*, Yellow Perch = *Perca flavescens*).

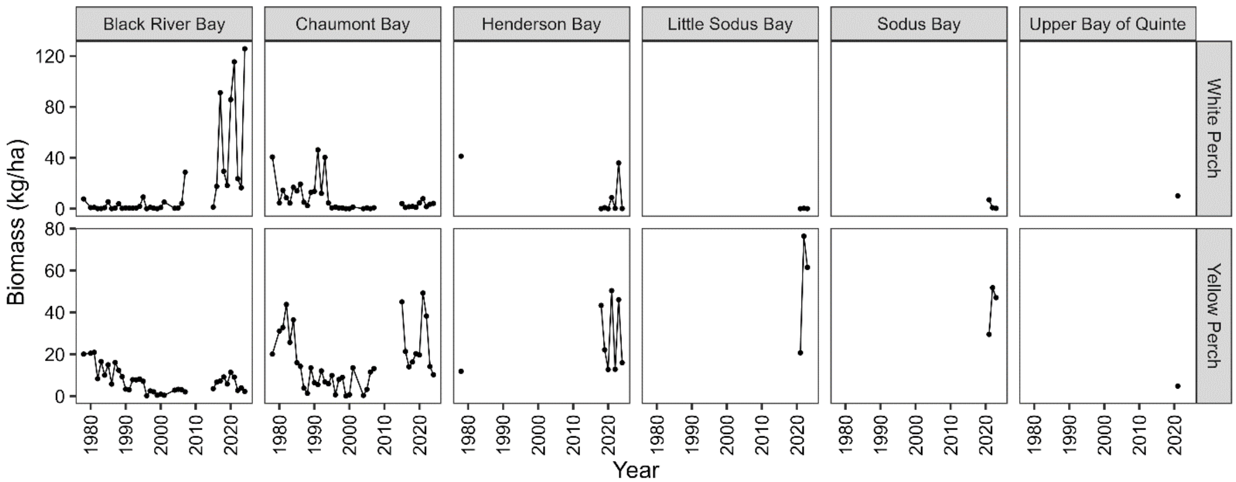

Figure 10. Mean biomass density (kg/ha) of Yellow Perch (*Perca flavescens*) and White Perch (*Morone americana*) from trawl tows in embayments during the perch survey 1978–2007 (O'Gorman and Burnett 2001), and during the Lake Ontario benthic prey fish survey 2015–2025. Note that y-axis scale differs between upper and lower panels. In 2025, Chaumont Bay was the only embayment site sampled during the benthic prey fish survey.