Fisheries Research and Monitoring Activities of the Lake Erie Biological Station, 2025[1]

Prepared by (in alphabetical order) Mark R. DuFour, Francesco Guzzo, Corbin D. Hilling, Branden E. Kohler, Richard T. Kraus, Richard C. Oldham, James J. Roberts, and Joseph D. Schmitt.

Department of the Interior, U.S. Geological Survey

Great Lakes Science Center, Lake Erie Biological Station

380 Huron Street, Huron, OH 44839

---

[1] LEBS 2026. Fisheries Research and Monitoring Activities of the Lake Erie Biological Station, 2025. Prepared by Mark R. DuFour, Francesco Guzzo, Corbin D. Hilling, Branden E. Kohler, Richard T. Kraus, Richard C. Oldham, James J. Roberts, and Joseph D. Schmitt. Report of the Lake Erie Biological Station (LEBS) to the Great Lakes Fishery Commission at the Annual Meeting of Lake Committees, Ypsilanti, Michigan 22 pp.

Executive Summary

A comprehensive understanding of fish populations and their interactions is the cornerstone of modern fishery management and the basis for Lake Erie's Fish Community Objectives (FCOs) developed in 2020 (Francis et al. 2020). The 2025 U.S. Geological Survey (USGS) Lake Erie Biological Station Annual Report is responsive to these FCOs and the USGS obligations via a Memorandum of Understanding with the Great Lakes Fishery Commission (GLFC) Council of Lake Committees (CLC) to provide scientific information in support of fishery management. Goals for the USGS Great Lakes Deepwater Fish Assessment and Ecological Studies were to monitor long-term changes in the fish community and track population dynamics of key fishes of interest to management agencies. Specific to Lake Erie, expectations were sustained investigations of native percids, prey-fish populations, and Lake Trout. All work was conducted as part of the Deepwater Science Program under the authority of the Great Lakes Fishery Research Reauthorization Act (16 USC §941h (d)).

The USGS 2025 Deepwater Science Program fieldwork began in Lake Erie in March and concluded in December, using trawl, gill net, hydroacoustic, water quality devices, and acoustic telemetry methods. This work resulted in 82 bottom trawls covering 70 ha of lake bottom and catching 37,223 fish totaling 2,379 kg in the West Basin of Lake Erie, with detailed results described below. Overnight gill-net sets (n=25; 8 km total) for cold-water species were deployed in the East Basin of Lake Erie and caught 183 fish, 110 of which were native cold-water species: Lake Trout, Burbot, and Lake Whitefish. Results from cold-water species assessments are reported in the Coldwater Task Group report to the GLFC and the CLC (CTG 2026) and are used to inform Lake Trout stocking decisions and direct lamprey control measures pursuant 16 USC §935 (b). The USGS hydroacoustic sampling included twenty-seven 5-km transects (135 km total) in the Central Basin as part of a collaborative lake-wide survey with details and results reported by the Forage Task Group (FTG 2026). The USGS assisted the Environmental Protection Agency (EPA) with hypoxia monitoring in the Central Basin collecting 50 water column profiles at 10 fixed locations (May–August), and deployment/retrieval of long-term monitoring devices at 2 locations. The USGS also assisted CLC member agencies with maintenance of the Great Lakes Acoustic Telemetry Observation System (GLATOS) infrastructure throughout Lake Erie basins and multiple tributaries, supporting 11 coordinated telemetry projects. Activities included acoustic telemetry receiver deployments/recoveries at 329 locations requiring 57 days on the water, plus additional in office preparations such as anchor construction, receiver maintenance, and data downloading/handling.

This report presents biomass-based summaries of fish communities in western Lake Erie derived from USGS bottom trawl surveys conducted from 2013 to 2025 during June (spring) and September (autumn). The survey design compliments the August ODNR-OMNR efforts, using a single net and vessel across jurisdictions dispensing the need to apply fishing power corrections when developing basin-wide indices. Analyses herein evaluated trends in total biomass, abundance of dominant predator and forage species, non-native species composition, biodiversity, and community structure. Data from this effort are accessible for download (DuFour et al. 2026).

Introduction

Lake Erie has the most populated watershed of all the Great Lakes and has undergone dramatic anthropogenic changes. Since the 1800s, overexploitation of fish populations, habitat destruction, non-native species proliferation, industrial contamination, and changes in nutrient loading have impacted the fish community including declines in or extirpation of many native species (Regier et al. 1969, Hartman 1973; Leach & Nepszy 1976; Ludsin et al. 2001). Implementation of the Clean Water Act and Great Lakes Water Quality Agreement in the 1970s improved habitat conditions (Reutter 2019), which contributed to several strong percid year-classes (Vandergoot et al. 2019). These strong year-classes also benefited from more restrictive management practices that reduced harvest, ultimately rehabilitating Lake Erie percid stocks (Kayle et al. 2015, STC 2020). Historically, Lake Erie supported a cool water fish community dominated by percids and salmonids. Recently updated FCOs set forth a vision that "Lake Erie will consist of diverse fish communities that support ongoing societal benefits, including thriving commercial and recreational fisheries, improved fish habitat and desirable ecosystem performance, and reduced adverse impacts from invasive fish" (Francis et al. 2020). Today, mixed fisheries resulting from seasonally changing cool and warm water habitats have developed in Lake Erie, and the new FCOs reflect a desire to manage both predator and prey fish communities within them.

Although Lake Erie management agencies have traditionally focused on numerical indices of a few economically important species, aquatic ecosystem models are typically evaluated in terms of entire fish community biomass. As a result, our understanding of fish community structure and ecosystem dynamics from biomass-based models has been limited to short-term investigations and proxy measurements (e.g., length-weight conversion; FTG 2020). Therefore, many Lake Erie fish community databases are now incorporating biomass-based measurements.

In response, USGS revised the Lake Erie trawl program to provide biomass-based measurements for all encountered species (Table 1). The survey design change occurred in 2012, coincident with commissioning of a new research vessel and a change in bottom trawl gear. These modifications already altered the existing time series; therefore, the survey design was also expanded to include greater spatial coverage and increased sample size generating a new time series. The purpose of this report is to develop a comprehensive understanding of the long-term changes and fish community dynamics including population dynamics of key fishes of interest to management agencies, such as native percids and their prey. Here, we summarize survey results for the most recent series of West Basin trawl data from 2013 through 2025.

Note that a detailed description of the sampling process along with traditional numerically-based catch data (e.g., fish/ha) for individual species can be downloaded online (DuFour et al. 2026) or obtained for earlier years (https://doi.org/10.5066/F75M63X0; U.S. Geological Survey, Great Lakes Science Center 2019).

Table 1. Scientific names correspond to the common names of fishes captured during surveys described in this report. Non-native species in **bold**.

Scientific Name	Common Name	Scientific Name	Common Name
Acipenser fulvescens	Lake Sturgeon	*Micropterus salmoides*	Largemouth Bass
Alosa pseudoharengus	**Alewife**	***Morone americana***	**White Perch**
Ambloplites rupestris	Rock Bass	*Morone chrysops*	White Bass
Ameiurus nebulosus	Brown Bullhead	*Moxostoma anisurum*	Silver Redhorse
Aplodinotus grunniens	Freshwater Drum	*Moxostoma erythrurum*	Golden Redhorse
Carassius auratus	**Goldfish**	*Moxostoma macrolepidotum*	Shorthead Redhorse
Carpiodes cyprinus	Quillback	*Moxostoma valenciennesi*	Greater Redhorse
Catostomus commersonii	White Sucker	***Neogobius melanostomus***	**Round Goby**
Coregonus clupeaformis	Lake Whitefish	*Notemigonus crysoleucas*	Golden Shiner
Cyprinus carpio	**Common Carp**	*Notropis atherinoides*	Emerald Shiner
Dorosoma cepedianum	Gizzard Shad	*Notropis hudsonius*	Spottail Shiner
Esox masquinongy	Muskellunge	*Notropis volucellus*	Mimic Shiner
Ichthyomyzon unicuspis	Silver Lamprey	***Oncorhynchus mykiss***	**Rainbow Trout**
Ictalurus punctatus	Channel Catfish	***Osmerus mordax***	**Rainbow Smelt**
Ictiobus cyprinellus	Bigmouth Buffalo	*Perca flavescens*	Yellow Perch
Labidesthes sicculus	Brook Silverside	***Petromyzon marinus***	**Sea Lamprey**
Lepisosteus osseus	Longnose Gar	*Percina caprodes*	Logperch
Lepomis gibbosus	Pumpkinseed	*Percopsis omiscomaycus*	Trout-perch
Lepomis macrochirus	Bluegill	*Pomoxis annularis*	White Crappie
Lota lota	Burbot	*Salvelinus namaycush*	Lake Trout
Macrhybopsis storeriana	Silver Chub	*Sander vitreus*	Walleye
Micropterus dolomieu	Smallmouth Bass		

Methods

Survey Area and Sampling Design

From 2013 to 2025, USGS annually conducted a grid-based benthic prey fish bottom trawl survey (Figure 1) during the third weeks of June (spring) and September (autumn). The sampling domain was west of the Pelee-Lorain Ridge, which acts as a natural boundary between the relatively shallow West Basin and deeper Central Basin. Sampling stations were selected both to accommodate the trawl net deployed from the R/V *Muskie* (no shallower than head-rope height ~3 m), and to effectively evaluate fish populations at all deep-water habitats in the West Basin of Lake Erie, which included areas of the main basin, Lake Erie Islands (Kelleys Island, Pelee Island, the Bass Islands, and several smaller islands) and major river mouths (Detroit, Sandusky, and Maumee rivers).The spacing of the grid was six minutes of longitude (E-W) and latitude (N-S), and sampling took place at the grid center. This spacing was chosen to maximize our spatiotemporal coverage and provide the maximum number of locations that could be sampled within a week (n=41). After the 2013 spring survey, the entire grid was shifted south by 1.85 km to avoid interactions with large vessels using the shipping lanes. The survey design complemented a time series of combined Ohio Department of Natural Resources (ODNR) and Ontario Ministry of Natural Resources (OMNR) bottom trawl efforts conducted annually during August. Together, these surveys provide a foundation for addressing emerging issues and support FCOs detailed in Lake Erie task groups' charges.

Survey coverage was reduced during 2017, 2018, 2020, 2021, and 2024 for various reasons. During spring of 2017, only 36 stations were sampled due to a structural failure of the trawl gallows after the net became snagged on the lake bottom. During spring of 2018, no trawling was conducted as the research vessel was in dry-dock for maintenance and repair. Sampling in 2020 was restricted to September and U.S. waters only due to the SARS-CoV-2 pandemic. All 41 stations were sampled during spring 2021; however, stations were restricted to U.S. waters only due to the SARS-CoV-2 pandemic during autumn 2021. During 2024, hydraulic malfunctions with the vessel's net reel resulted in only partial survey coverage during spring (n=9) and autumn (n=35). All stations were sampled during spring (n=41) and autumn (n=41) of 2025.

Data Summaries

Trawl catches from 2013 to 2025 encountered 43 species, including 8 non-native (Table 1). These species were grouped into multiple categories in this report based on family, life stage (age-0, age-1, age-1+, age-2+, and all stages), functional group (prey fish vs. non-prey fish), morphology (soft-rayed vs. spiny-rayed), and native vs. non-native. The prey fish categories included the family Osmeridae (all stages of Rainbow Smelt), the family Clupeidae (age-0 Gizzard Shad and all stages of Alewife [max total length = 220 mm]), soft-rayed fishes (all stages of Brook Silverside, Emerald Shiner, Golden Shiner, Mimic Shiner, Round Goby, Silver Chub, Spottail Shiner, Trout-perch, and unidentified Leuciscidae), and spiny-rayed fishes (age-0 Freshwater Drum, Walleye, White Perch, White Bass, and Yellow Perch). The remainder of the species and life stages were grouped by family (Catostomidae, Ictaluridae, Moronidae, Percidae, Sciaenidae) or lumped into an "Other" category. Species

were also grouped by native and non-native (the latter group included Alewife, Goldfish, Common Carp, White Perch, Round Goby, Rainbow Trout, Rainbow Smelt, and Sea Lamprey).

Biomass (kg/ha) and catch (fish/ha) were calculated by first summing across groups within a sample (i.e., individual trawl station), and then averaging across samples within years and seasons. Annual diversity was calculated using the Shannon Diversity Index (Morris et al. 2014) and numerical catch (fish/ha), where the catches from all life stages of an individual species were summed across stations within year and season. This generated a total catch (fish/ha) for each species, year, and season. Average size for age-0 sportfish was calculated from individual total length (mm) and weight (g) measurements using species-specific length thresholds for autumn catches (i.e., Walleye < 190 mm; White Bass < 190 mm; White Perch < 120 mm; Yellow Perch < 120 mm). Maturity status (1 – mature and 0 = immature) and sex (F = female and M = male) for a subset of captured Yellow Perch was determined on vessel by examining gonads. Length at maturity across years was estimated for each sex using a hierarchical logistic regression, and we report total length (mm) at 50% and 90% maturity.
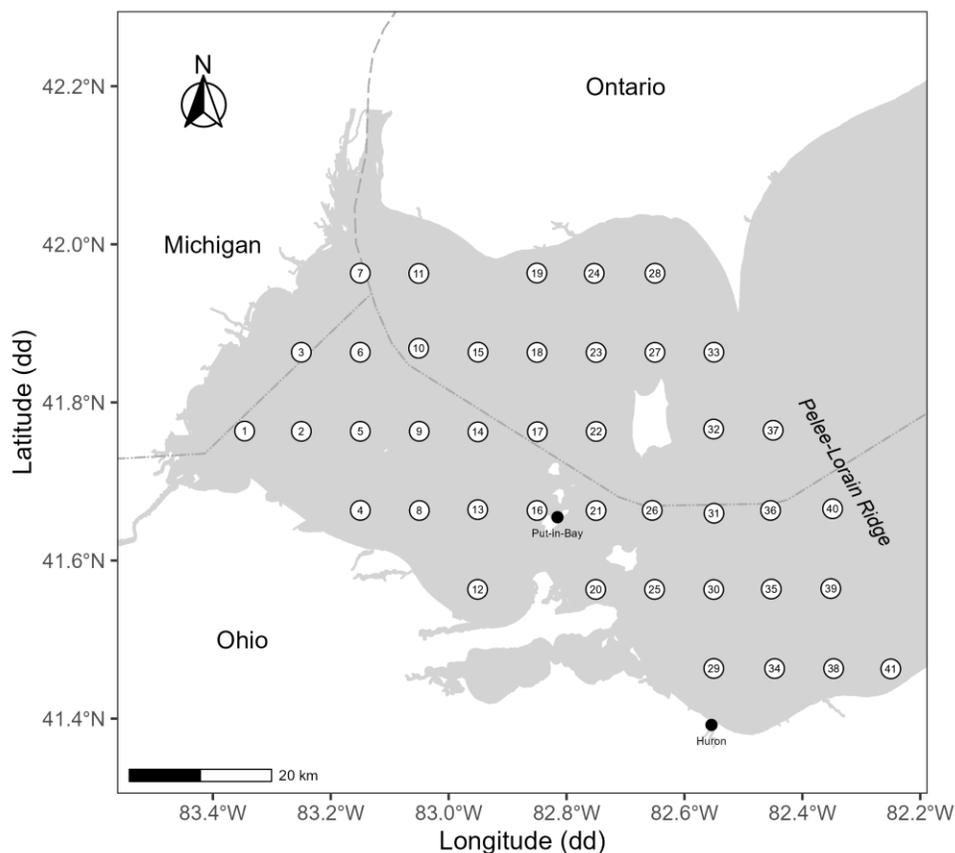

Figure 1. U.S. Geological Survey's benthic prey fish bottom trawl stations (white circles) located in U.S. and Canadian waters of western Lake Erie including home port (Huron, Ohio) and staging port (Put-In-Bay, Ohio).

Results and Discussion

The 2025 bottom trawl surveys were conducted June 8–11 (spring) and September 15–18 (autumn) with all 41 stations sampled each season (n=82). Surveys caught a cumulative fish biomass of 2,379 kg (37,223 fish), with spring biomass totaling 905 kg (3,020 fish) and autumn biomass totaling 1,474 kg (34,203 fish). The increase in catch and biomass during autumn can be attributed to an increase in the production of young-of-year fishes, and their recruitment to survey gear.

***Trends in Biomass and Community Composition***

Average spring biomass declined from 157 kg/ha during 2013 to 48 kg/ha in 2017 (Table 2; Figure 2) and has fluctuated between 26 and 65 kg/ha since, with 26 kg/ha observed during 2025. Average autumn biomass declined from 118 kg/ha during 2013 to 23 kg/ha during 2017 and has fluctuated between 20 and 49 kg/ha since. The lowest recorded average biomass (20 kg/ha) occurred during autumn 2024 but increased to 43 kg/ha during 2025. Although declines in prey fish have occurred, total biomass declines and subsequent fluctuations can be attributed to loss and variability in biomass across taxa.
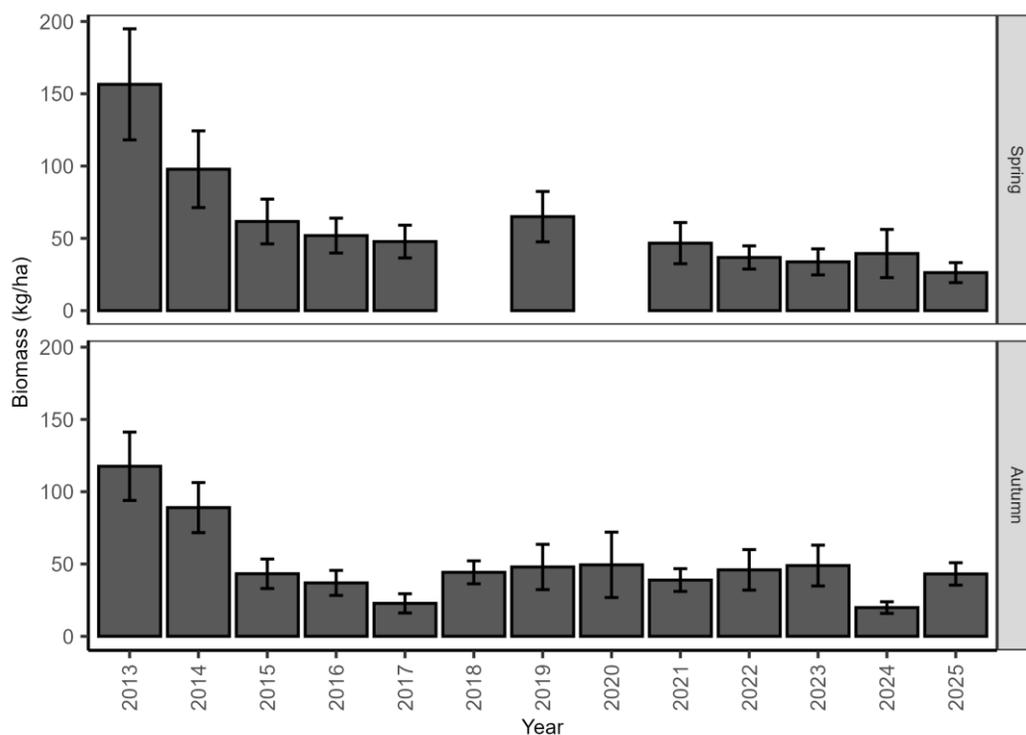
Figure 2. Average biomass (kg/ha) through time (2013–2025) for all species (± 2 SE) from bottom trawls in the West Basin of Lake Erie conducted during spring (upper) and autumn (lower). Bottom trawl samples were not collected during spring 2018 or spring 2020.

Average spring prey fish biomass was primarily comprised of soft-rayed fishes (e.g., Emerald Shiner and Rainbow Smelt Osmeridae) and declined precipitously between 2013 and 2015 (Table 2; Figure 3). Since 2015, spring prey fish biomass has been low, averaging

8

only ~0.4 kg/ha. Decreases in spring prey fish biomass were attributed mostly to declines in age-1+ Emerald Shiner and Rainbow Smelt (Figure 4). Autumn prey fish biomass was primarily comprised of Clupeidae (age-0 Gizzard Shad and all stages of Alewife) and age-0 spiny-rayed fishes, averaging 7.1 kg/ha between 2013 and 2024. Fluctuations in autumn prey fish biomass have been driven by variable age-0 Gizzard Shad abundance, periodic emergence (2013, 2023, and 2024) of age-0 Alewife (Figure 4), and variable production of age-0 spiny-rayed fish (Sciaenidae, Percidae, and Moronidae). Average autumn prey fish biomass increased during 2025 to 8.9 kg/ha, and was bolstered by age-0 spiny-rayed fishes (70%) in particular age-0 Yellow Perch. Despite the overall low abundance of soft-rayed fishes, we did observe a substantial increase in age-0 Emerald Shiner biomass (0.08 kg/ha) during autumn 2025 (Figure 5).
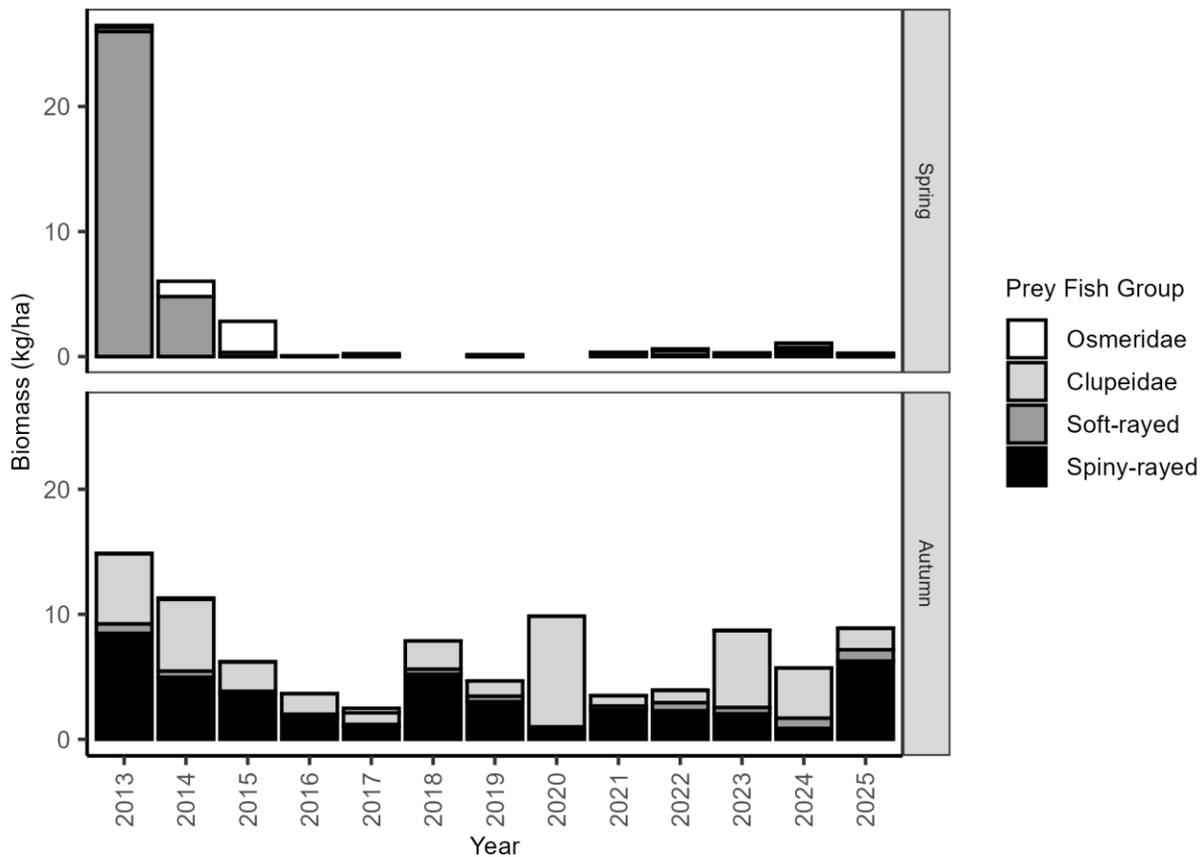

Figure 3. Stacked bar plots through time (2013–2025) including average prey fish group (Osmeridae, Clupeidae, Soft-rayed, and Spiny-rayed) biomass (kg/ha) from trawls in the West Basin of Lake Erie during spring (upper) and autumn (lower). Bottom trawl samples were not collected during spring 2018 or spring 2020.
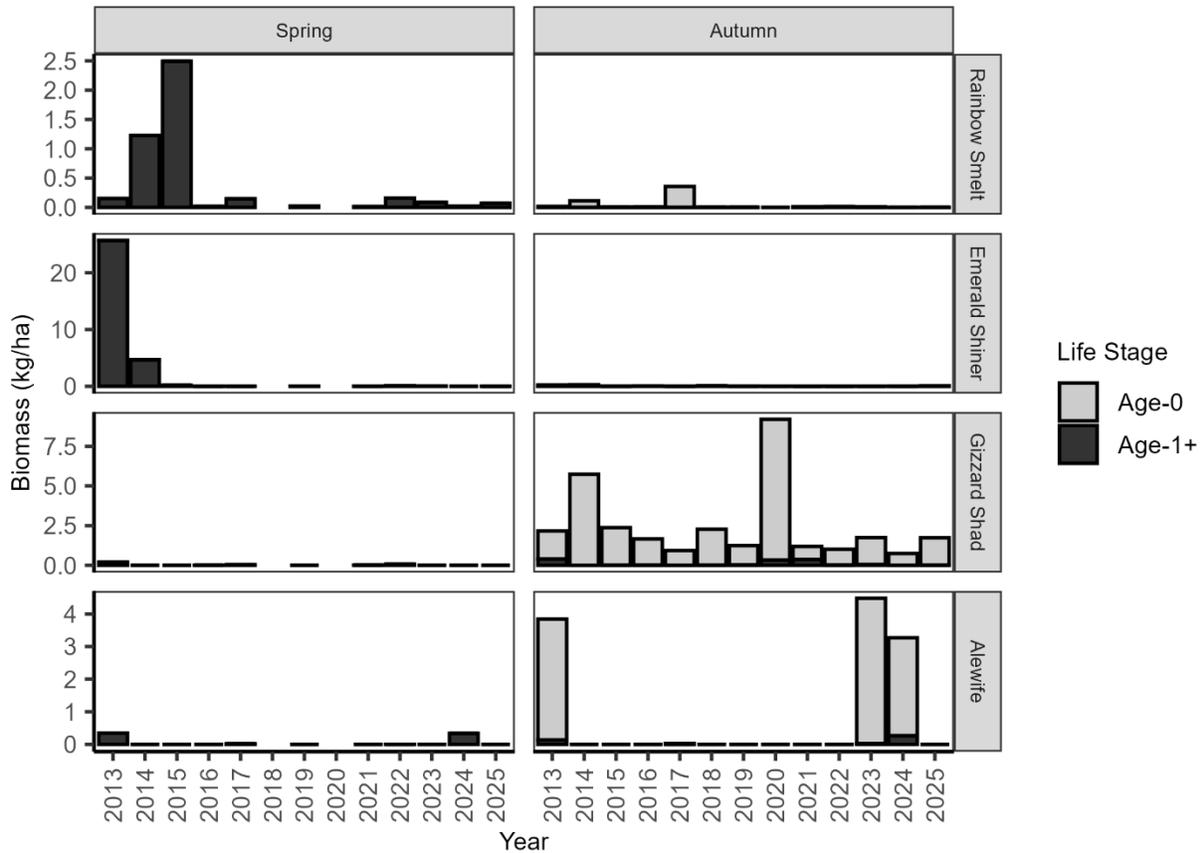
Figure 4. Stacked bar plots through time (2013–2025) including life stage (age-0 and age-1+) average biomass (kg/ha) for Rainbow Smelt, Emerald Shiner, Gizzard Shad, and Alewife from trawls in the West Basin of Lake Erie during spring (left) and autumn (right). Bottom trawl samples were not collected during spring 2018 or spring 2020.
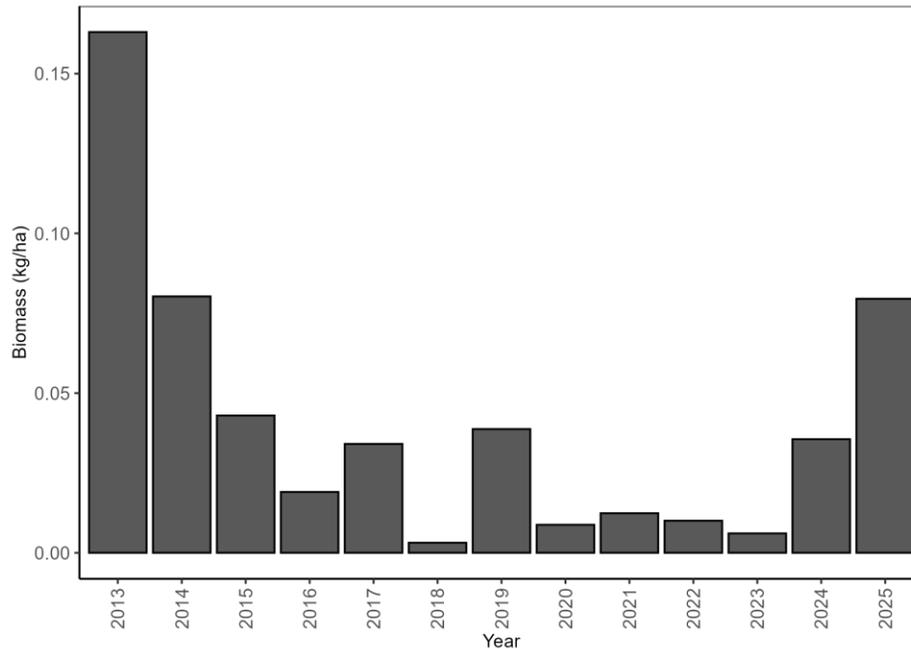
Figure 5. Bar plot through time (2013–2025) including average biomass (kg/ha) for age-0 Emerald Shiner from trawls in the West Basin of Lake Erie during autumn.

Despite the decrease in total biomass, proportions by species groups have followed similar patterns through time (Figure 6 - left). During spring and autumn, Sciaenidae (age-1+ Freshwater Drum), Percidae (primarily age-1+ Walleye and Yellow Perch), and Moronidae (age-1+ White Bass and White Perch) have dominated the catch averaging 86% and 71% of total biomass across years during spring and autumn, respectively. However, there is typically an increase in the proportion of Ictaluridae, Catostomidae, and prey fish biomass during autumn, averaging 12% and 24% of total biomass across years during spring and autumn, respectively. "Other" low abundance species make up a smaller proportion of total biomass with a slight increase during autumn, averaging 2% and 5% of total biomass across years during spring and autumn, respectively.

The biomass proportion of non-native species was generally low and fluctuated without trend, ranging between 4–17% during the spring and 11–26% during autumn (Table 2). The dominant non-native species included Alewife, White Perch, and Common Carp while other non-native species (Round Goby, Goldfish, Sea Lamprey, etc.) were captured in low abundances. Increased proportions of non-native species during autumn are driven by within-year production of age-0 Alewife and White Perch. After two years of high Alewife abundance (2023–2024; Figure 4), none were captured during 2025 surveys.

Biomass (kg/ha) provides a unique perspective on the benthic fish community relative to catch (fish/ha). As a comparison, community composition by group (Figure 6 - right) show that prey fish make up a much greater proportion of the catch suggesting they dominate fish community structure. In contrast, large benthic or semi-pelagic species (Sciaenidae, Percidae, Moronidae, Ictaluridae, and Catostomidae) were not numerically dominant, but they accounted for > 75% of biomass during nearly every sampling season and year (Figure

6 - left). Biodiversity, calculated from catch (fish/ha) using Shannon's Diversity Index (Morris et al. 2014, Table 2), was variable and ranged between 0.35–2.12 during the spring and between 1.77–2.02 during autumn. Diversity, on average, was higher during spring (1.48) compared to autumn (1.65), with reductions in diversity attributed to high abundances of individual species in 2013 (i.e., Emerald Shiner) and 2024 (i.e., Yellow Perch).
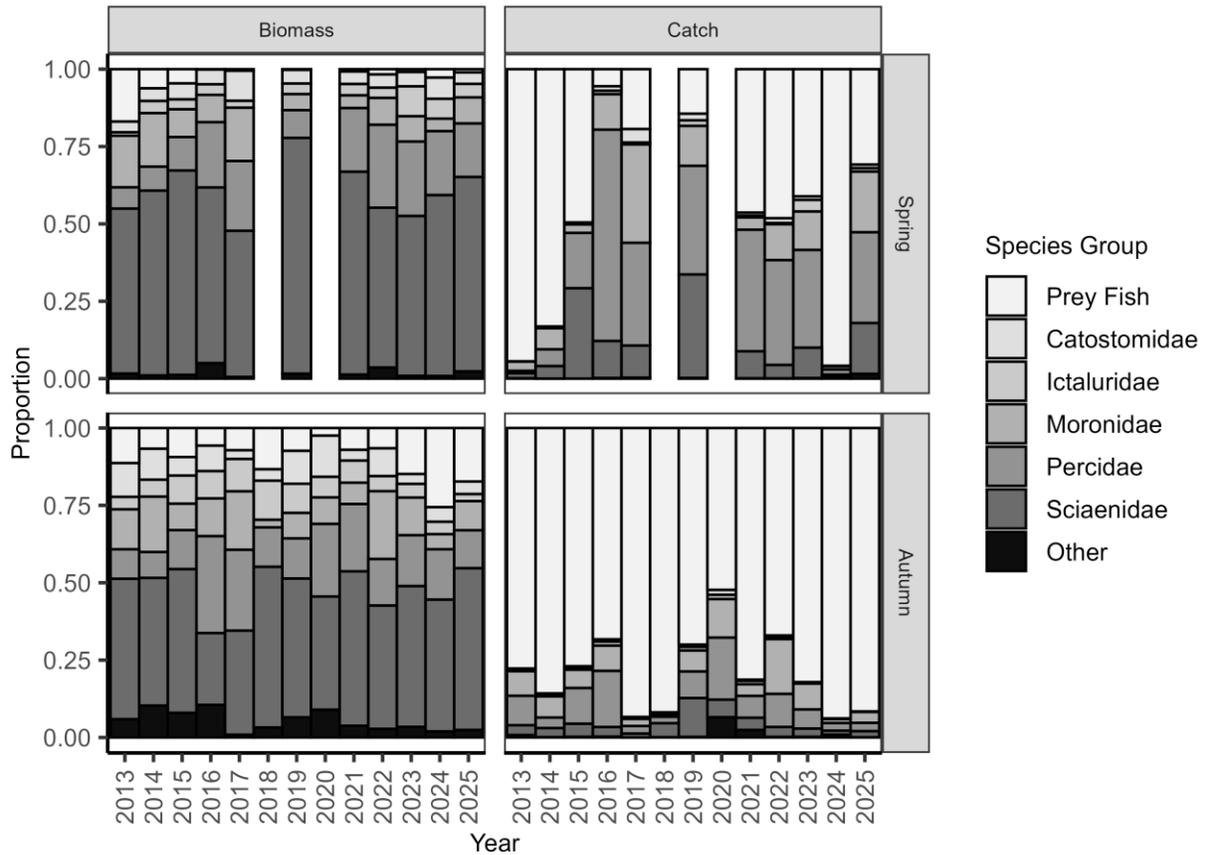
Figure 6. Species group composition (Proportion) through time (2013–2025) for biomass (kg/ha) and catch (fish/ha) from bottom trawls in the West Basin of Lake Erie conducted during spring (top) and autumn (bottom).

Table 2. Summaries for bottom trawls in the West Basin of Lake Erie (2013–2025) including number of stations surveyed (N), biomass summaries (kg/ha) for total and prey fish species (± SE), percent non-native biomass (%), and Shannon Diversity Index (Morris et al. 2014) values.

Year	Season	N	Total (SE)	Prey Fish (SE)	Non-native (%)	Diversity
2013	Spring	41	156.5 (19.6)	26.5 (8.7)	12	0.35
2014	Spring	41	97.8 (13.5)	6 (2)	13	1.09
2015	Spring	41	61.7 (7.9)	2.8 (1.5)	9	1.41
2016	Spring	41	51.9 (6.2)	0.1 (0)	9	1.65
2017	Spring	36	47.8 (5.8)	0.2 (0.1)	17	1.97
2018	Spring					
2019	Spring	41	65 (8.9)	0.1 (0)	5	1.89
2020	Spring					
2021	Spring	41	46.7 (7.3)	0.3 (0.1)	4	1.6
2022	Spring	41	36.8 (4.1)	0.6 (0.1)	11	1.72
2023	Spring	41	33.7 (4.6)	0.3 (0.1)	7	2.06
2024	Spring	9	39.5 (8.5)	1.1 (0.4)	4	0.43
2025	Spring	41	26.3 (3.5)	0.3 (0.1)	10	2.12
Avg.	Spring	37.6	60.3 (8.2)	3.5 (1.2)	9	1.48
2013	Autumn	41	117.6 (12.1)	14.9 (3.3)	24	1.63
2014	Autumn	41	89 (8.8)	11.3 (1.8)	25	1.63
2015	Autumn	41	43.3 (5.2)	6.2 (0.9)	15	1.9
2016	Autumn	41	36.9 (4.4)	3.7 (0.6)	23	2.02
2017	Autumn	41	22.8 (3.4)	2.5 (0.4)	20	1.22
2018	Autumn	41	44.3 (4)	7.9 (1.9)	11	1.64
2019	Autumn	41	48 (8)	4.7 (0.8)	15	1.9
2020	Autumn	26	49.4 (11.5)	9.9 (7)	13	1.16
2021	Autumn	26	38.9 (4)	3.5 (0.7)	12	1.75
2022	Autumn	41	46 (7.1)	3.9 (0.8)	26	1.72
2023	Autumn	41	48.9 (7.2)	8.7 (3.8)	25	1.68
2024	Autumn	35	19.9 (2.1)	5.7 (1)	24	1.56
2025	Autumn	41	43.1 (4)	8.9 (1.4)	18	1.59
Avg.	Autumn	38.2	49.9 (6.3)	7.1 (1.9)	19	1.65

Sportfish Size at Age-0

Size-at-age is a metric used by the Lake Erie Forage Task Group to evaluate sportfish growth and condition from autumn catches. Presumably, larger size-at-age suggests profitable growing conditions, including adequate food availability and/or reduced density dependent growth effects. Larger size at age-0 during autumn may correlate with overwinter survival to age-1 and is viewed as favorable for fishery production (Madenjian

et al. 1996). Average total length and weight of age-0 Walleye (121.0 mm; 14.0 g) and White Bass (112.0 mm; 18.1 g) decreased from 2024 to 2025, but have shown an upward trend since 2019 (Figure 7). Walleye size was below the time series average (140.6 mm; 23.0 g), while White Bass size was near the time series average (112.1 mm; 19.0 g). Average total length and weight of age-0 White Perch (88.3 mm; 9.5 g) and Yellow Perch (84.3 mm; 6.8 g) increased from 2024 to 2025, and have varied annually around the time series average. White Perch size (total length and weight) was above the time series average (83.1 mm; 7.3 g), while Yellow Perch size was near the time series average (84.5 mm; 6.5 g).
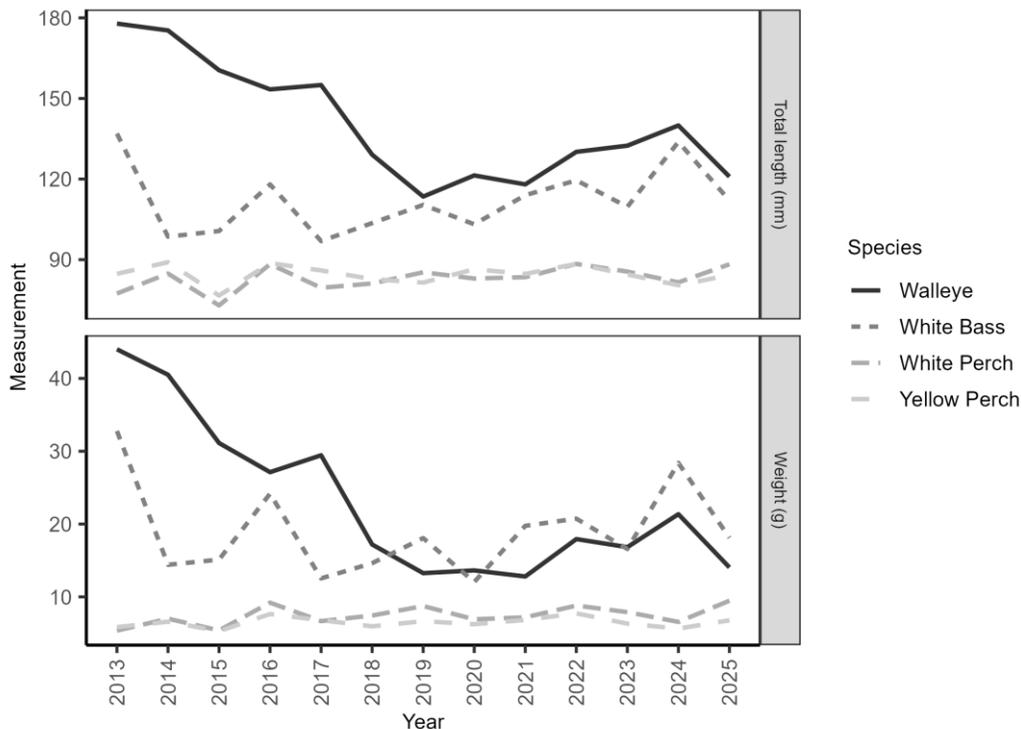

Figure 7. Average autumn total length (mm) and weight (g) for age-0 sportfish (Walleye, White Bass, White Perch, and Yellow Perch) from bottom trawls in the West Basin of Lake Erie (2013–2025).

Trends in Percid Catch and Biomass

Age-0 and age-1 percid indices are used by the Lake Erie Walleye and Yellow Perch task groups to inform stock assessment models and establish recommended allowable harvest, annually. Percid indices are typically generated from catch data and reported as fish/ha. Here, we include biomass (kg/ha) based indices which take into account both numerical abundance and weight-at-age (g). Biomass-based indices may reduce index variability by buffering against annually variable growth conditions and survey timing. Here, percid indices were generated from the autumn survey which occurs near the end of the growing season and is most likely representative of age-0 recruitment (Figure 8; Table 3). Walleye age-0 catch rates increased substantially during 2025 (56.89 fish/ha) compared to 2024 (4.90 fish/ha), while biomass-based indices suggest a less substantial increase in 2025

(0.73 kg/ha) when compared to 2024 (0.21 kg/ha). Walleye age-1 catch rates were similar in 2025 (3.36 fish/ha) when compared to 2024 (3.90 fish/ha), while biomass-based indices were also similar in 2025 (0.54 kg/ha) when compared to 2024 (0.56 kg/ha). Yellow Perch age-0 catch rates increased dramatically during 2025 (310.4 fish/ha) compared to 2024 (24.77 fish/ha), while biomass-based indices followed suit in 2025 (1.7 kg/ha) when compared to 2024 (0.13 kg/ha). Yellow Perch age-1 catch rates increased during 2025 (10.02 fish/ha) when compared to 2024 (3.13 fish/ha), while biomass-based indices increased in 2025 (0.52 kg/ha) when compared to 2024 (0.23 kg/ha). All 2025 age-0 Percidae indices were above time series averages (Age-0 Walleye = 33.5 fish/ha and 0.72 kg/ha; Age-0 Yellow Perch = 157.34 fish/ha and 0.77 kg/ha), whereas, all 2025 age-1 Percidae indices were below the time series averages (Age-1 Walleye = 10.41 fish/ha and 1.83 kg/ha; Age-1 Yellow Perch = 26.88 fish/ha and 0.64 kg/ha).
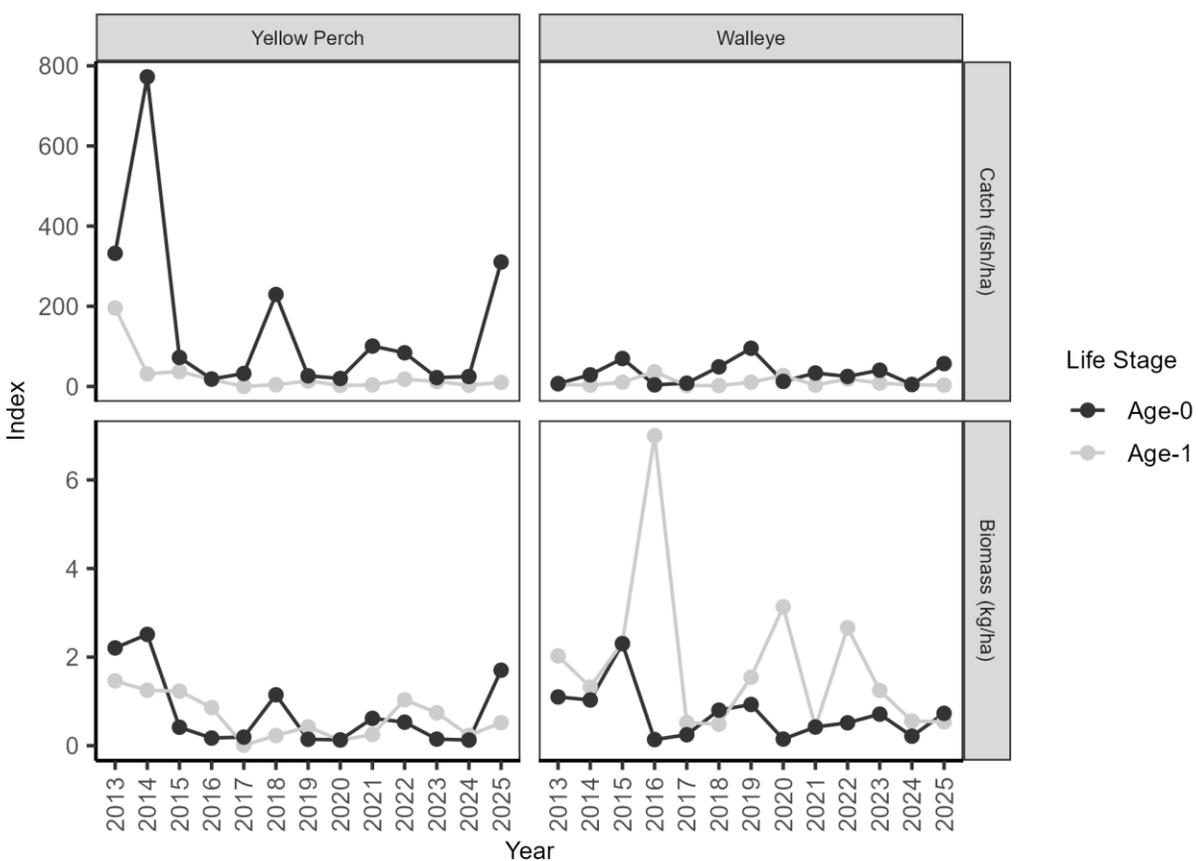

Figure 8. Average autumn catch (fish/ha) and biomass (kg/ha) of age-0 and age-1 Walleye and Yellow Perch from bottom trawls in the West Basin of Lake Erie (2013–2025).

Lake Erie Biological Station Annual Report 2025

Table 3. Age-0 and age-1 Walleye and Yellow Perch indices from autumn bottom trawls in western Lake Erie including number of stations surveyed (N), average catch (fish/ha) and average biomass (kg/ha).

Year	Species	N	Age-0 Catch	Age-0 Biomass	Age-1 Catch	Age-1 Biomass
2013	Walleye	41	7.2	1.10	5.0	2.03
2014	Walleye	41	28.9	1.03	3.12	1.32
2015	Walleye	41	69.7	2.30	10.51	2.33
2016	Walleye	41	4.0	0.14	36.5	7.00
2017	Walleye	41	8.1	0.25	2.2	0.52
2018	Walleye	41	48.9	0.80	2.1	0.48
2019	Walleye	41	95.2	0.93	10.5	1.54
2020	Walleye	26	12.6	0.15	27.3	3.14
2021	Walleye	26	33.5	0.42	3.4	0.42
2022	Walleye	41	24.9	0.52	18.9	2.66
2023	Walleye	41	40.6	0.71	8.5	1.25
2024	Walleye	35	4.9	0.21	3.9	0.56
2025	Walleye	41	56.9	0.73	3.4	0.54
Avg.	Walleye	38.2	33.5	0.72	10.4	1.83
2013	Yellow Perch	41	332.2	2.21	195.7	1.46
2014	Yellow Perch	41	772.4	2.51	31.3	1.25
2015	Yellow Perch	41	72.3	0.42	37.2	1.23
2016	Yellow Perch	41	18.5	0.17	17.1	0.86
2017	Yellow Perch	41	32.3	0.19	0.2	0.01
2018	Yellow Perch	41	229.4	1.15	4.3	0.23
2019	Yellow Perch	41	26.6	0.14	13.7	0.43
2020	Yellow Perch	26	19.9	0.13	2.6	0.12
2021	Yellow Perch	26	100.7	0.62	3.7	0.25
2022	Yellow Perch	41	84.0	0.53	18.1	1.04
2023	Yellow Perch	41	22.0	0.15	12.2	0.74
2024	Yellow Perch	35	24.8	0.13	3.1	0.23
2025	Yellow Perch	41	310.4	1.70	10.0	0.52
Avg.	Yellow Perch	38.2	157.0	0.77	26.9	0.64

Yellow Perch maturity at length

Since 2013, LEBS has collected Yellow Perch maturity data to inform harvest assessments, as requested by the Lake Erie Yellow Perch Task Group. During autumn surveys, a sub-sample of captured Yellow Perch are evaluated on vessel for sex (F = female and M = male) and maturity status (1 = mature and 0 = immature) by examining for signs of gonadal development including size, color, vascularity, and gamete presence/absence. During 2025, 117 individuals were added to the analysis including 29 male (TL range: 73–239 mm) and 90 female (TL range: 73–310 mm). Length at maturity across years was estimated for each sex using a hierarchical logistic regression, and we report total length (mm) at 50% and 90% maturity (Figure 9; Table 4). During 2025, total length at 50% maturity was smaller for males (155 mm, 95% CI: 133-180 mm) compared to females (189 mm, 95% CI: 179–198 mm). Likewise, total length at 90% maturity was smaller for males (176 mm, 95% CI: 154–165) compared to females (210 mm, 95% CI: 197–226). Since 2013, there appears to be an increase in size-at-maturity indicating that age-1+ growth has increased or that fish are maturing later, either of which could have implications for harvest management. For example, the increase in size-at-maturity could cause a higher proportion of immature fish to be available for harvest prior to contributing to the spawning stock biomass, and warrants further investigation.
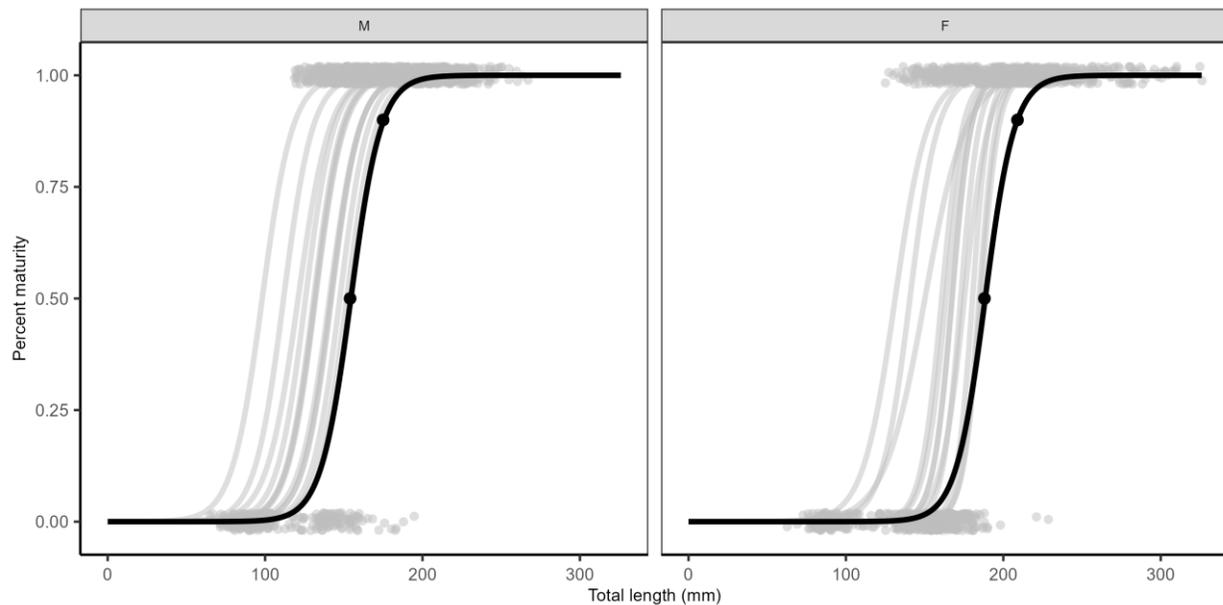
Figure 9. Male and female Yellow Perch size-at-maturity from 2013–2024 (gray lines) and 2025 (black line). Individual data points representing mature (1) and immature (0) are denoted by gray dots. Black dots represent length at 50% and 90% maturity for 2025.

Table 4. Male and female Yellow Perch maturity at length from 2013–2025 including number of samples (N), total length at 50% and 90% maturity, as well as 95% credible intervals.

Year	Sex	N	TL at 50% (CI)	TL at 90% (CI)
2013	Male	166	95 (57—117)	118 (86—136)
2014	Male	129	126 (119—132)	146 (139—153)
2015	Male	66	120 (108—128)	143 (136—152)
2016	Male	141	132 (122—140)	151 (143—159)
2017	Male	65	131 (113—148)	151 (133—168)
2018	Male	68	152 (145—159)	173 (165—181)
2019	Male	90	112 (102—120)	132 (123—141)
2020	Male	76	142 (133—150)	162 (153—171)
2021	Male	76	142 (133—150)	162 (153—171)
2022	Male	132	141 (133—147)	162 (155—169)
2023	Male	176	132 (123—139)	152 (144—159)
2024	Male	185	147 (141—153)	167 (161—174)
2025	Male	27	155 (133—180)	176 (154—205)
2013	Female	130	129 (103—141)	154 (145—165)
2014	Female	72	173 (166—182)	187 (177—199)
2015	Female	50	151 (142—165)	192 (164—231)
2016	Female	133	140 (126—149)	161 (152—170)
2017	Female	49	160 (140—175)	176 (159—193)
2018	Female	64	181 (175—188)	193 (183—204)
2019	Female	69	164 (158—170)	180 (171—191)
2020	Female	76	168 (160—175)	182 (172—193)
2021	Female	76	167 (160—175)	182 (172—192)
2022	Female	142	175 (171—179)	192 (187—200)
2023	Female	106	186 (180—192)	199 (191—208)
2024	Female	108	185 (179—191)	197 (189—206)
2025	Female	90	189 (179—198)	210 (197—226)

Summary

    The USGS western Lake Erie bottom trawl survey provides unique information not immediately available from existing monitoring efforts. Although this survey complements the combined trawling efforts between ODNR and OMNR during August, providing spatially contiguous prey-fish and recruitment indices, it also generates biomass estimates for the entire fish community which support Lake Erie Fish Community Objectives including thriving commercial and recreational fisheries, improved fish habitat, desirable ecosystem performance, and reduced adverse impacts from non-native fish (Francis et al. 2020).

For example, this survey demonstrates the contrast between numerical and biomass-based indices, with numerical indices dominated by small-bodied prey-fish and biomass-based indices dominated by large benthic and semi-pelagic fishes (e.g., Sciaenidae, Percidae, Moronidae, Ictaluridae, and Catostomidae). Due to its prominence, Sciaenidae (i.e., Freshwater Drum) have the potential to reduce dreissenid mussel abundance in Lake Erie's western basin by 23.79 kg/ha, annually (French & Bur 1996; Keretz et al., in press) and likely contribute to phosphorus remineralization (Johnson et al. 2005). In addition, this survey documented the periodic rise and fall of alewife biomass in the West Basin and its likely association with broad-scale climatic conditions (i.e., mild winters; NOAA-GLERL 2025; Warren et al. 2024). Finally, this survey identified increased age-0 Percidae through a biomass-based index that buffers against annually variable growth conditions.

The continued low spring and variable autumn prey-fish biomass highlight the need for top-down and bottom-up approaches (Bunnell et al. 2014) to better understand mechanisms driving abundance. For example, the 2025 autumn prey-fish biomass estimate (8.9 kg/ha) was bolstered (70%) by spiny-rayed fishes (i.e., age-0 Freshwater Drum, Walleye, Yellow Perch, White Perch, and White Bass), whereas the dominate species (i.e., 57% Alewife) from the 2024 estimate (5.7 kg/ha) was completely absent. In addition, despite continued low biomass of spring age-1+ Emerald Shiner, the autumn survey saw an increase to near historic levels (0.08 kg/ha). It remains unclear how or if these exchanges in dominance and resurgence are related. Changes in prey-fish abundance and composition could be related to broad-scale climatic conditions (Warren et al. 2024), prey resources (O'Donnell et al. 2023a, O'Donnell et al. 2023b), and/or depredation pressure (Knight et al. 1984; Schmitt et al. 2024) and warrants continued investigation.

Finally, this survey identified increased Yellow Perch length-at-maturity, shifting the spawning stock biomass toward larger sizes. This could impact management which permits harvest as low as 215–230 mm size range, depending on jurisdiction. Gislason et al. (2019) suggested fishery induced evolution may influence this trend, where, under reduced fishing pressure (relative to the 1990's) larger, later maturing fish are selected for. Heino and Dieckmann (2008) explained that phenotypic plasticity and accelerated growth can also lead to increased length-at-maturity, which may be related to environmental conditions. Trends in broad-scale climactic conditions (Collingsworth et al. 2017) coupled with observed diet changes in Central Basin (Schmitt et al. 2024) suggest growth of West Basin Yellow Perch may be changing and could benefit from a detailed analysis.

Acknowledgments

References

Bunnell, D.B., Barbiero, R.P., Ludsin, S.A., Madenjian, C.P., Warren, G.J., Dolan, D.M., Brenden, T.O., Briland, R., Gorman, O.T., He, J.X., Johengen, T.H., Lantry, B.F., Lesht, B.M., Nalepa, T.F., Riley, S.C., Riseng, C.M., Treska, T.J., Tsehaye, I., Walsh, M.G., Warner, D.M., and Weidel, B.C. 2014. Changing ecosystem dynamics in the Laurentian Great Lakes: bottom-up and top-down regulation. BioScience, 64: 26-39.

Coldwater Task Group (CTG). 2026. 2025 Report of the Lake Erie Coldwater Task Group, March 2026. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission, Ann Arbor, Michigan, USA.

Collingsworth, P.D., Bunnell, D.B., Murray, M.W., Kao, Y.C., Feiner, Z.S., Claramunt, R.M., Lofgren, B.M., Hook, T.O., and Ludsin, S.A. 2017. Climate change as a long-term stressor for the fisheries of the Laurentian Great Lakes of North America. Reviews in Fish Biology and Fisheries, 27: 363–391.

DuFour, M.R., Schmitt, J.D., Oldham, R.C., Guzzo, F., and Roberts, J.J. 2026. Lake Erie fish community data, 2013–2025: U.S. Geological Survey data release, https://doi.org/10.5066/P14H3UIY.

Forage Task Group (FTG). 2020. 2019 Report of the Lake Erie Forage Task Group, March 2020. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission, Ann Arbor, Michigan, USA.

Forage Task Group (FTG). 2026. 2025 Report of the Lake Erie Forage Task Group, March 2026. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission, Ann Arbor, Michigan, USA.

Francis, J., T. Hartman, K. Kuhn, B. Locke & J. Robinson. 2020. Fish community objectives for the Lake Erie basin [online]. Available from www.glfc.org/pubs/FisheryMgmtDocs/Fmd20-01.pdf [accessed 10 March 2026].

French, J. R. P. & M. T. Bur. 1996. The effect of zebra mussel consumption on growth of Freshwater Drum in Lake Erie.Journal of Freshwater Ecology 11(3):283–289.

Gislason, D., Heino, M., Robinson, B.W., McLaughlin, R.B., and Dunlop, E.S. 2019. Reaction norm analysis reveals rapid shifts toward delayed maturation in harvested Lake Erie yellow perch (*Perca flavescens*). Evolutionary Applications, 12: 888–901.

Great Lakes Fishery Research Reauthorization Act of 2025 (GLFRRA), S.2878, 119th Congress. (2025). https://www.congress.gov/bill/119th-congress/senate-

bill/2878?hl=great+lakes+fishery+reauthorization+act&s=1&r=1. [accessed 19 March 2026].

Hartman, W. L. 1973. Lake Erie: effects of exploitation, environmental changes, and new species on the fishery resources. Journal of the Fisheries Board of Canada 29: 899–912.

Heino, M., and Dieckmann, U. 2008. Detecting fisheries-induced life-history evolution: an overview of the reaction-norm approach. Bulletin of Marine Science, 83(1): 69–93.

Johnson, T. B., D. B. Bunnell & C. T. Knight. 2005. A potential new energy pathway in Central Lake Erie: the Round Goby connection. Journal of Great Lakes Research 31, Supplement 2(0):238–251.

Kayle, K., K. Oldenburg, C. Murray, J. Francis, and J. Markham. 2015. Lake Erie Walleye Management Plan, 2015–2019.Great Lakes Fishery Commission, Ann Arbor, Michigan.

Keretz, K.R., Kraus, R.T., Hilling, C.D., and Schmitt, J.D. In press. Predatory impact of Freshwater Drum on Dreissenid populations in western Lake Erie. J0urnal of Great Lakes Research.

Knight, R. L., F. J. Margraf & R. F. Carline. 1984. Piscivory by Walleyes and Yellow Perch in western Lake Erie. Transactions of the American Fisheries Society. 113: 677–693.

Leach, J.H. & S.J. Nepszy. 1976. The fish community in Lake Erie. Journal of the Fisheries Board of Canada 33: 622–638.

Ludsin, S. A., M. W. Kershner, K. A. Blocksom, R. A. Stein & R. L. Knight. 2001. Life after death in Lake Erie: nutrient controls drive fish species richness, rehabilitation. Ecological Applications 11: 731–746.

Madenjian, C. P., J. T. Tyson, R. L. Knight, M. W. Kershner & M. J. Hansen. 1996. First-year growth, recruitment, and maturity of Walleyes in western Lake Erie. Transactions of the American Fisheries Society. 125(6): 821–830.

Morris, E. K., T. Caruso, F. Buscot, M. Fischer, C. Hancock, T. S. Maier & M. C. Rillig. 2014. Choosing and using diversity indices: insights for ecological applications from the German biodiversity exploratories. Ecology and Evolution 4(18): 3514–3524.

National Oceanic and Atmospheric Administration - Great Lakes Environmental Research Laboratory (NOAA-GLERL). 2025. Historical Ice Cover [online]. Available from https://www.glerl.noaa.gov/data/ice/#historical [updated 22 January 2026].

O'Donnell, D. R., R. Briland, R. R. Budnik, S. A. Ludsin, and J. M. Hood. 2023a. Trends in Lake Erie phytoplankton biomass and community structure during a 20-year period of rapid environmental change. Journal of Great Lakes Research 49: 672-684.

O'Donnell, D. R., R. Briland, R. R. Budnik, S. A. Ludsin, and J. M. Hood. 2023b. Trends in Lake Erie zooplankton biomass and community structure during a 25-year period of rapid environmental change. Journal of Great Lakes Research 49: 685-6697.

Regier, H. A., V. C. Applegate, and R. Ryder. 1969. The ecology and management of the walleye in western Lake Erie. Great Lakes Fishery Commission, Technical Report 15.

Reutter, J. M. 2019. Lake Erie: past, present, and future. In Encyclopedia of Water, P. Maurice (Ed.). https://doi.org/10.1002/9781119300762.wsts0085.

Schmitt, J. D., A. M. Gorman, C. T. Knight, M. R. DuFour, J. J. Roberts, and T. Hartman. 2024. Multi-decadal trophic shifts in Lake Erie yellow perch *Perca flavescens*. Canadian Journal of Fisheries and Aquatic Sciences 81: 1560-1580.

Standing Technical Committee (STC). 2020. Lake Erie Yellow Perch Management Plan, 2020-2024. Great Lakes Fishery Commission, Ann Arbor, Michigan.

U.S. Geological Survey, Great Lakes Science Center, 2019, Great Lakes Research Vessel Operations 1958-2018. (ver. 3.0, April 2019): U.S. Geological Survey data release, https://doi.org/10.5066/F75M63X0.

Vandergoot, V. S., A. H. Cook, M. V. Thomas, D. W. Einhouse & C. Murray. 2019. Status of Walleye in western Lake Erie, 1985–2006. In Status of Walleye in the Great Lakes: proceedings of the 2006 Symposium. Great Lakes Fishery Commission Technical Report. 69. pp. 1–14.

Warren, L. D., A. E. Honsey, D. B. Bunnell, P. D. Collingsworth, D. W. Hondorp, C. P. Madenjian, D. M. Warner, B. C. Weiderl, and T. O. Hook. 2024. Synchrony of alewife, *Alosa pseudoharengus*, year-class strength in the Great Lakes region. Canadian Journal of Fisheries and Aquatic Sciences 81: 1456-1467.