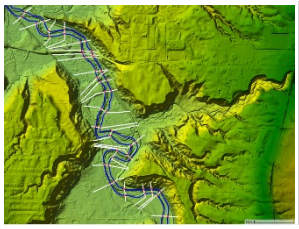
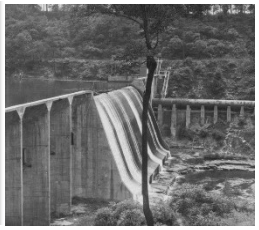
Report of the
Lake Erie Habitat Task Group
2024–2025



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Presented to:

Standing Technical Committee, Lake Erie Committee
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Contents

Charges to the Habitat Task Group 2025

1. Maintain a list of functional habitats and impediments for species specified by the LEC Fish Community Objectives (FCOs) that can be used to identify and evaluate status of:
    a. Priority management areas (PMA) that support LaMP, LEC Lake Erie Environmental Objectives (LEEOs) and FCOs
    b. Identify data needs to better identify and describe functional habitats (e.g. improved bathymetry).
    c. Documentation of key habitat and research projects as related to priority management areas.
    d. Use GIS techniques to refine PMA mapping, coordination, and scale.
2. Support other task groups by compiling metrics of habitat use by fish.

Charge 1: Maintain a list of functional habitats and impediments for species specified by the Lake Erie Committee (LEC) Fish Community Objectives (FCOs)

Charge 1a: Priority management areas (PMA that support Lakewide Action and Management Plans (LaMP), LEC Lake Erie Environmental Objectives (LEEOs) and FCOs

In 2021-22 the Habitat Task Group (HTG) defined a 4-phase process to better capture the progress to-date and communicate future work needed to finish developing a functional, systematic, adaptive, cumulative, and collaborative approach for identifying Priority Management Areas (PMAs; Figure 1). Phase 1 was the initial proof of concept including the initial PMA data collected, management prioritization and scoring. Work completed during Phase 1 was presented in the 2019 HTG report (HTG 2019). Phase 2 was defined as the proof of concept for moving the original flat file PMA dataset (Phase 1) into a GIS framework. This phase included the creation of functional GIS layers and a geospatial data viewer to help data visualization. Phase 2 was completed in 2022-23 and will be updated in more detail under Charge 1d. Phase 3 was the development of a user friendly, backward-facing portal that will allow the underlying PMA data to be easily updated and refined as new information becomes available. This phase also includes development of a forward-facing viewer that will facilitate end-user analysis of the data and broad communication of Lake Erie's Environmental priorities. Phase 3 is ongoing with a pilot viewer developed for LEC use. Finally, Phase 4 is the ongoing phase in which the HTG will operationalize the PMA exercise allowing for updating and refinement of the PMA data, re-prioritize as required, and report out on progress within PMAs. The framework for this final phase is being developed through the Great Lakes Habitat Framework (https://hub.glahf.org/) to identify the workflows for the review/analysis of data, research needs, knowledge gaps, and delivery of the PMA and its products. Potential updates to the PMA will have to address the long-term viability of

the data and its accessibility, along with the flexibility to address future research needs and technology changes.

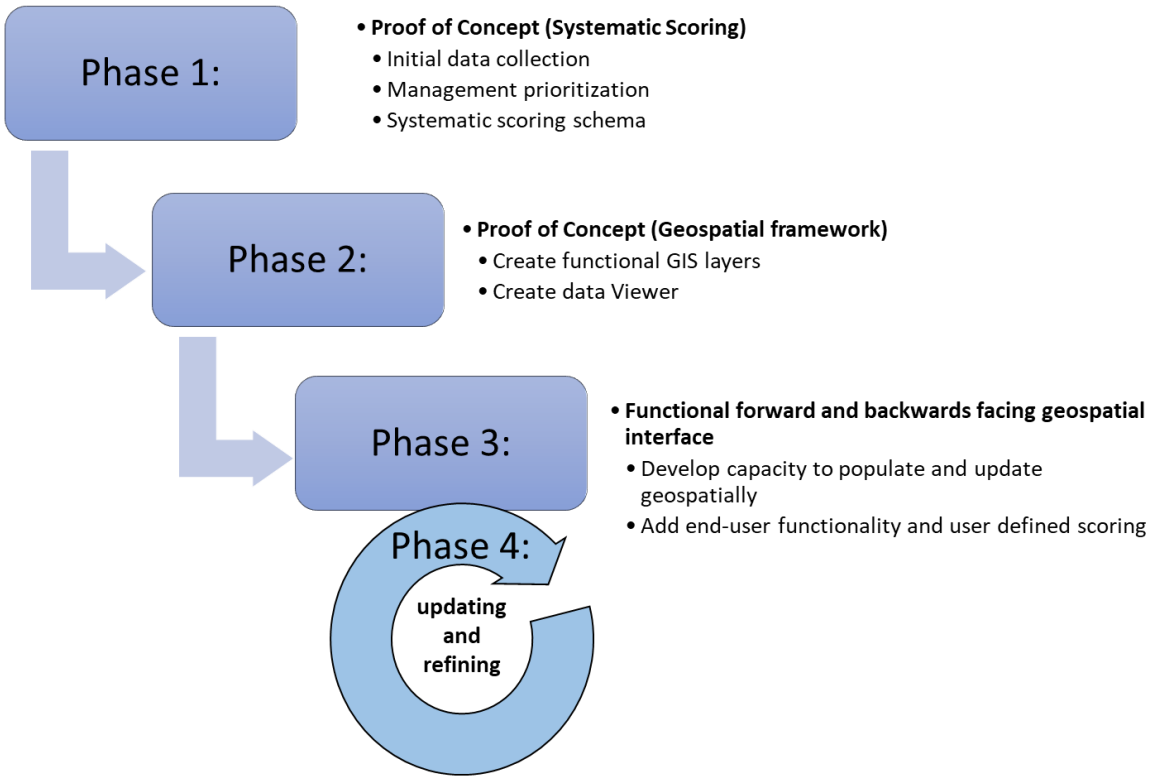

Figure 1. Four phases of PMA development identified by the Habitat Task group.

Hotspot Analysis

In 2024, HTG members began collaborating on a new project to aid identification of high importance habitats in Lake Erie. The foundation of this work is Dr. Silviya Ivanova's (University of Windsor/Michigan State University) Hotspot Analysis of Lake Ontario. To perform this analysis, acoustic telemetry data for 19 fishes were collated for all of Lake Ontario through projects facilitated by the Great Lakes Acoustic Telemetry Observation System (GLATOS). Habitat data were also assimilated, including bathymetry, substrate, lake surface temperature, and Chlorophyll-a. Ivanova (et al., not yet published) created Species Distribution Models for each species and each season, then combined the spatial outputs from each model to define "hotspots": areas of high use for multiple species of fishes, especially those where offshore and nearshore groups overlap in space and time (Figure 2).

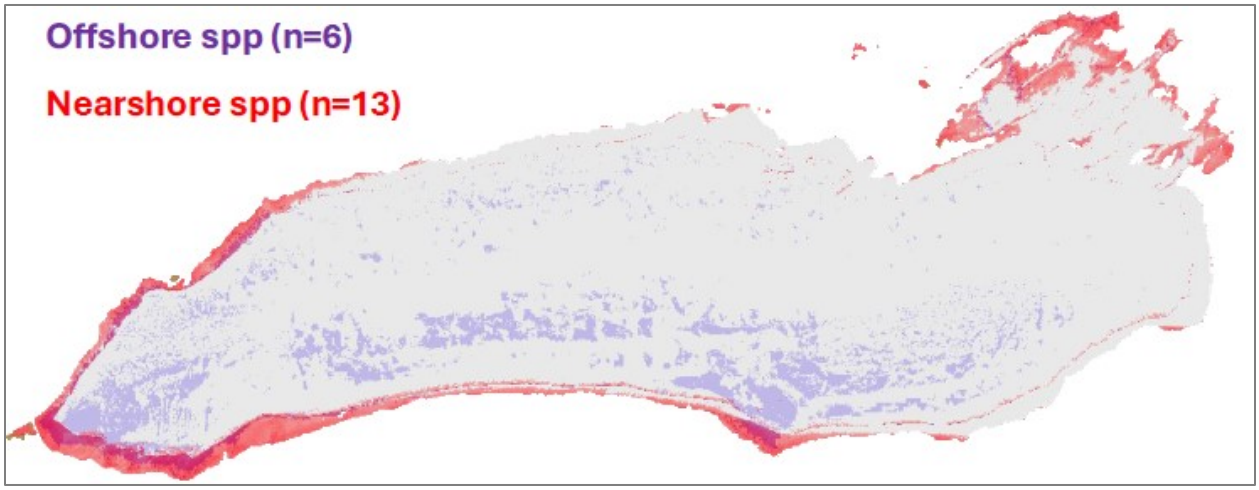

Figure 2. Example output of Hotspot Analysis for Lake Ontario. Habitat most used by nearshore species are highlighted in red, while offshore species areas are purple. Areas where these layers overlap indicate hotspots of habitat use by multiple groups.

The new Lake Erie project aims to complete a similar task using as many species as possible from existing GLATOS projects. Silviya Ivanova and Rylie Robinson (researcher in Dr. Aaron Fisk's Lab, University of Windsor) are currently obtaining access to and formatting GLATOS data from multiple Lake Erie projects. While more funding is needed, some Department of Fisheries and Oceans Canada funding was obtained to begin the process. Zak Slagle is the acting liaison between the HTG and the Hotspot working group; they are currently pursuing Great Lakes Fishery Commission funding to complete the project. Once it is completed, Hotspot outputs will be used to compare, refine, and update PMA definitions, with the eventual goal of much-improved understanding and quantitative assessment of key habitats for important fishes in the Lake Erie basin. Project results will inform future habitat restoration, protection, and enhancement projects, helping agencies to prioritize limited habitat funding.

Charge 1b: Identify data needs to better identify and describe functional habitats.

In 2021, developments made while updating the PMA dataset into a spatial dataset identified numerous data needs required to detect and describe additional functional habitats. With the completion of Phase 2, the HTG has developed a sound list of data needs. Continued work in Phase 3 and process developments for Phase 4 will allow the HTG to identify the process to further address those needs (Figure 1).

Charge 1c: Documentation of key habitat and research projects as related to priority management areas.

Habitat Suitability Index Updates

Habitat suitability index (HSI) models are used to identify and quantify suitable habitat for various fish species by comparing habitat characteristics (e.g., substrate, water

depth, and flow) to species' optimal tolerance ranges at various life stages (e.g., spawning, and juvenile; USFWS 1981). Based on literature reviews, a species tolerance range is used to convert each habitat characteristic into a rating of "good", "moderate", or "poor" which are assigned numerical values such as 1, 0.5, and 0, respectively. For example, juvenile Lake Sturgeon (*Acipenser fulvescens*) are most successful in habitats containing silt, sand, gravel, and/or cobble substrates therefore areas with these substrates would be rated as "good". Ratings for all habitat characteristics are then combined to create an HSI map identifying suitable habitat for that species. This information can be used to protect and/or restore suitable habitats of native fish species, as well as identify risks of invasive species. In Lake Erie, there are several initiatives working to develop HSI.

Juvenile Lake Sturgeon Habitat Suitability Index in the Upper Niagara River
J. Johnson, I. Mustafa, K. Morton, C. Farrell, D. Gorsky

PMA linkage			
Functional Habitat:	Niagara River – Rivers/Tributaries	Priority:	Medium

The U.S. Fish and Wildlife Service Lower Great Lakes Fish and Wildlife Conservation Office is conducting a Habitat Suitability Index (HSI) project focused on juvenile Lake Sturgeon in the Upper Niagara River.

This project combines high-resolution (400 kHz) multibeam surveys obtained with a Norbit iWBMSh multibeam unit, data from the HEC-RAS model produced by the U.S. Army Corps of Engineers Buffalo District and drop camera footage. Backscatter data was ground-truthed with drop camera footage to determine substrate type. Benthic velocity, bathymetry, and substrate type will be incorporated into the final HSI model. Thus far, 460 hectares of multibeam data and 689 drop camera videos have been collected and processed (Figure 3).

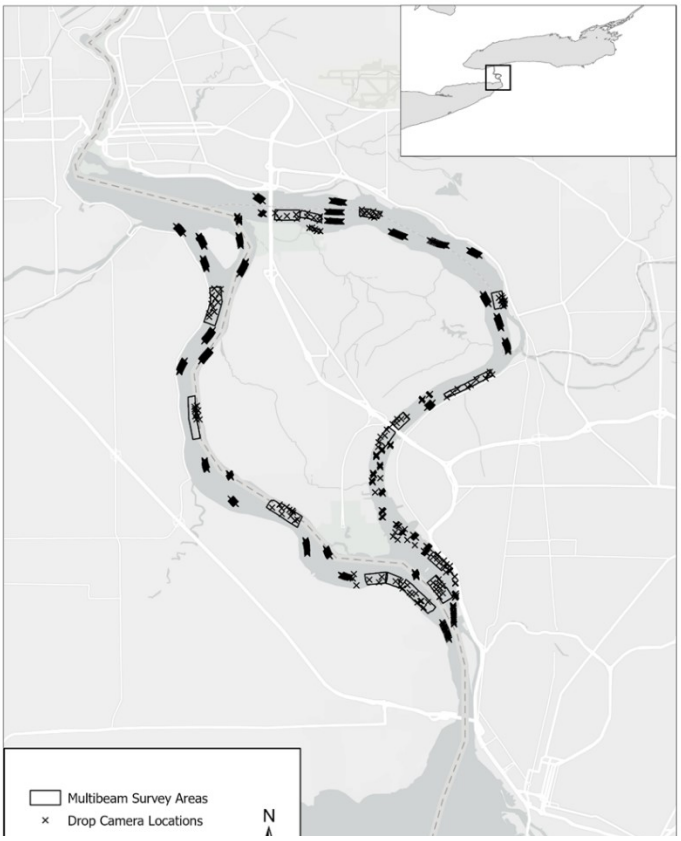

Figure 3. Multibeam survey areas (polygons) and drop camera locations (x) in the upper Niagara River used for juvenile Lake Sturgeon Habitat Suitability Index.

The results of this HSI project will provide crucial insights into the habitat requirements of juvenile Lake

Sturgeon, supporting conservation efforts aimed at enhancing their populations in the Upper Niagara River. By establishing a detailed understanding of habitat suitability, we hope to inform future management strategies and contribute to the rehabilitation of this important species within the ecosystem.

Lake Sturgeon Habitat Suitability in the Cuyahoga River
J. Fischer

PMA linkage			
Functional Habitat:	Central Basin – Rivers/Tributaries	Priority:	Medium

Assessments of lake sturgeon habitat suitability have moved into a new phase in 2024 with 60 fingerling Lake Sturgeon (~ 200 mm) being stocked into the Cuyahoga River in October 2024, in coordination with ODNR, Cuyahoga Valley NPS, USGS, Cleveland and Summit Metro Parks, and others Figure 4. Twenty fish were released at three locations, Rivergate Park in Cleveland, OH near river kilometer (rkm) 2; Peninsula, OH near rkm 43; and Cascade Valley Metro Park in Akron, OH near rkm 70. Each fish was implanted with an acoustic transmitter and individuals will be tracked over the life of the tags (>200 days) to assess movement and space use throughout the river and into Lake Erie. Survival will also be estimated and compared across the three release locations to guide future reintroduction efforts.

Figure 4. Ohio Division of Wildlife, Cuyahoga Valley National Parks Service, and U.S. Fish and Wildlife staff release Lake Sturgeon into the Cuyahoga River.

Habitat assessments in the Cuyahoga River have been completed, substrate maps and the 1-D flow model used to estimate depths and water velocities are available on ServCat and Data.gov (https://ecos.fws.gov/ServCat/Reference/Profile/175571; https://ecos.fws.gov/ServCat/Reference/Profile/178665). Additionally, we developed an R package, groundTruther (https://github.com/USFWS/groundTruther), to assist with estimating accuracy of side-scan sonar substrate classifications or other remote sensing patch classifications. The package allows users to account for GPS error when matching ground truthing data to patch classifications, estimate the accuracy of patch

classifications, and propagate classification uncertainty for use in subsequent analyses, such as habitat suitability indices.

Sauger Habitat Suitability in the Sandusky River
B. Schmidt

PMA linkage			
Functional Habitat:	Western Basin – Rivers/Tributaries	Priority:	Very High

The Ohio DNR-DOW is working with a Master's student, Elizabeth Anderson, at the University of Toledo to create a Sauger (*Sander canadensis*) spawning HSI for the Sandusky and Maumee rivers to determine if stocking could feasibly result in self-sustaining populations. Sauger supported a historically important commercial and recreational fishery in Lake Erie until a complete population collapse in the 1950s (Hartman et al. 2019). In addition to overfishing, habitat degradation and construction of dams on tributary rivers were seen as contributing to their decline. A restocking effort in the 1970s also failed to reestablish the species (Hartman et al. 2019).

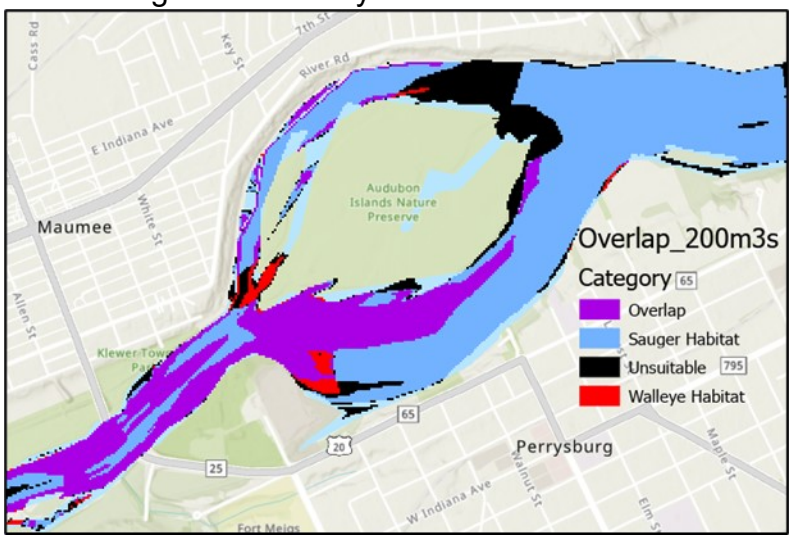

Figure 5. Example of spawning HSIs for Walleye and Sauger in the Maumee River, showing spatial overlap (purple) and spawning habitats unique to each species (Sauger in blue, Walleye in red).

Using side-scan sonar and physical assessment to quantify substrate and a HEC-RAS model to estimate water velocity and depth, initial results suggest there would be substantial spawning habitat for Sauger in both the Maumee and Sandusky rivers (Figure 5). Model results suggest that more spawning habitat is available for Sauger (388 ha and 148 ha in the Maumee and Sandusky rivers, respectively) than for Walleye, however there are varying degrees in spatial overlap with Walleye (*Sander vitreus*) in both systems. The Sandusky River has more unique Sauger spawning habitat than the Maumee and may be more suitable for stocking considering unknown interactions in areas of habitat overlap. Genetic analysis indicated that the Ohio River population most closely matched the extirpated Lake Erie population and could be used as a stocking source (Hartman et al. 2019). The Ohio DNR-DOW is currently exploring production capabilities within its hatchery system and whether it would be feasible to stock at rates comparable to those suggested in the literature.

Benthic Mapping of Reefs in Eastern Lake Erie
J. Johnson, I. Mustafa, C. Farrell, D. Gorsky

PMA linkage			
Functional Habitat:	Eastern Basin – Open Water Reef/Shoal	Priority:	Medium

The U.S. Fish and Wildlife Service Lower Great Lakes Fish and Wildlife Conservation Office is continuing to scan reefs in eastern Lake Erie with a Norbit iWBMSh multibeam unit. Scanning, ground truthing, and post-processing of portions of the Brocton Shoal reef complex (42.441°N, 79.496°W) was completed in 2023 (Figure 6). Scanning of Woodlawn Bar (42.795°N, 78.864°W) began in October 2024 and is in progress. Future targets for scanning include Seneca Shoal (42.790°N, 78.931°W), Myers Reef (42.7434°N, 78.962°W), Evans Bar (42.659°N, 79.087°W), and the Shorehaven reef complex (42.326°N, 79.663°W). Bathymetry, backscatter, and backscatter derivative datasets produced by this scanning will be used to produce fine-scale bathymetry and substrate maps and can be used to inform future studies.

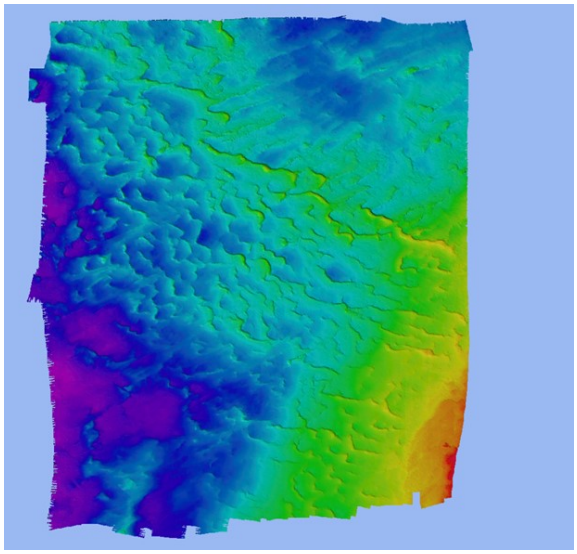

Figure 6. Example of high resolution (20cm) bathymetry data collected at Brocton Shoal reef complex during fall 2023.

Evaluation of Fish Habitat Restoration in the St. Clair-Detroit River System
R. DeBruyne and J. Fischer

PMA linkage			
Functional Habitat:	Detroit River – Rivers/Tributaries St. Clair River – Rivers/Tributaries	Priority:	High

The U.S. Geological Survey Great Lakes Science Center and U.S. Fish and Wildlife Service Alpena Fish and Wildlife Conservation Office continued monitoring fish use and physical maturation of the seven constructed fish spawning reefs in the St. Clair-Detroit River System (SCDRS) in 2024 (Figure 7). Construction and monitoring of these projects has contributed to the achievement of LEEO #3 and #8 (3. rivers and estuaries and 8. fish habitat protection) and LEC fish community objectives (Rehabilitation Species – lake sturgeon objective and Lake Erie Basin Ecosystem). Biological

monitoring of the artificial reefs consisted of egg mat sampling to quantify fish egg deposition on and adjacent to the artificial reefs. Walleye, Catostomidae, Lake Sturgeon, and Lake Whitefish (*Coregonus clupeaformis*) eggs were deposited on or near the reefs in 2024. Lake Sturgeon eggs were collected only in the St. Clair River reefs in 2024, indicating continued use as spawning habitat. A subset of eggs collected on the constructed reefs and control sites were brought to the USGS laboratory and hatched, making them available for future genotyping. A manuscript detailing the relative contributions of Lake Erie and Lake Huron adults to the eggs deposited on the constructed reefs in the Detroit River was recently published (Stott et al., 2024).

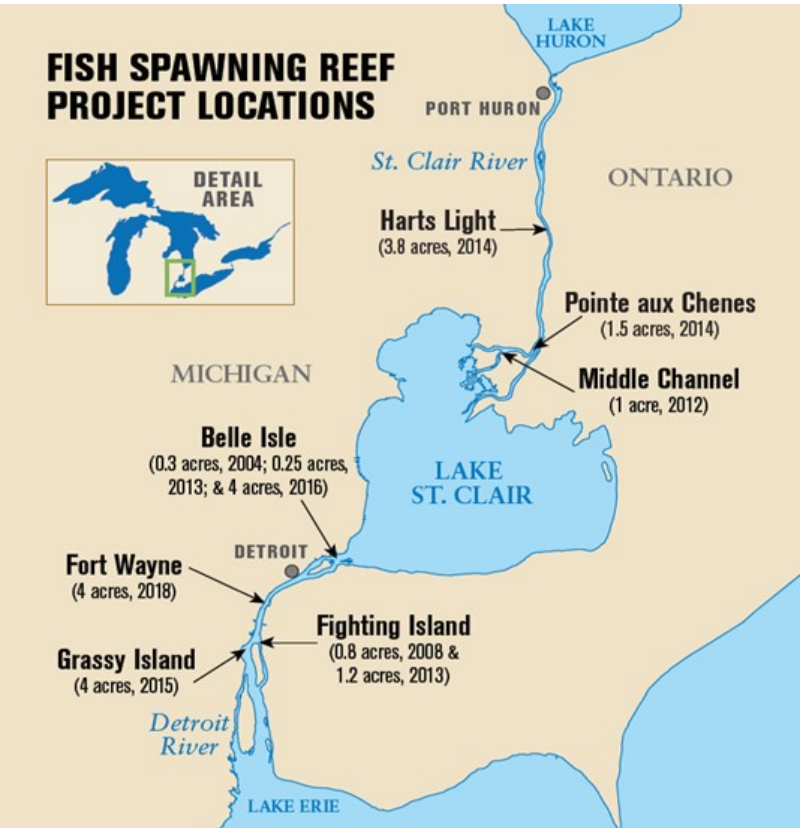

Figure 7. Locations of artificial spawning reef restoration projects in the St. Clair-Detroit River System. Map provided by Michigan Sea Grant.

Monitoring reef maturation consisted of underwater video surveys of all constructed reefs used to quantify changes in surficial sediment composition and the degree of infilling by fine sediments on the reefs. Analysis of these video surveys are ongoing.

Influence of Ice Cover on Fish Spawning Reef Hydrodynamics
C. Hilling, R. DeBruyne

PMA linkage			
Functional Habitat:	West Basin – Open Water Reef/Shoal	Priority:	Very High

Lake ice cover may reduce wind-driven currents, thereby possibly protecting Lake Whitefish eggs from physical disturbance, displacement from preferred habitats, and burying with sediments. An interdisciplinary team of scientists recently initiated fieldwork to understand the relationship of ice cover and hydrodynamics on Lake Erie spawning reefs. U.S. Geological Survey scientists and university partners deployed three bottom-moored hydrodynamic monitoring stations near Niagara Reef, part of Lake Erie's west basin reef complex, on December 10, 2024. The research team deployed two monitoring stations along an east-west axis near the apex of Niagara Reef and a third in deeper water north of the reef (Figure 8). Each monitoring station houses an acoustic Doppler current profiler which uses sound waves to measures characteristics of water movement at preset intervals, including current speed and direction, turbulence, wave period and height, and characteristics related to ice cover. Sensors measuring temperature, water depth, turbidity, and light were also appended to monitoring stations to collect additional environmental data. The instruments will measure hydrodynamics and environmental parameters throughout the winter and early spring to better understand relationships of ice cover, lake hydrodynamics, and fish reproductive success. The data collection is planned to continue through the walleye spawning and emergence period to also understand hydrodynamic conditions during the Walleye hatch. Given above average lake ice coverage on Lake Erie during winter 2024/2025, the research team is excited to begin data analysis once monitoring stations are retrieved in May 2025.

Figure 8. USGS R/V Muskie crew members lower an acoustic Doppler current profiler and other environmental data loggers housed within a tripod mooring near Niagara Reef in Lake Erie's west basin in December 2024.

Assessing Walleye spawning habitat at nearshore reefs in the Central Basin of Lake Erie

A. Gable, A. Popovich, S. Truckly

PMA linkage			
Functional Habitat:	Central Basin Nearshore	Priority:	Medium

Walleye spawning locations in Lake Erie are documented in the West Basin including offshore reefs, the Maumee River, and the Sandusky River. However, Walleye spawning locations in the Central Basin are understudied. Only two Walleye spawning locations have been identified in the Central Basin including the Grand River and Hardy Point Reef (Knight et al., *submitted to the Journal of Great Lakes Research 2024*). Hardy Point Reef (HPR) is located 3 km east of Fairport Harbor, Ohio, is approximately 1.5 ha in size, and ranges from <0.3 m to 4.5 m deep. While Central Basin spawning stocks are likely smaller than those in the Western Basin, stock portfolio theory (DuFour et al. 2015) suggests that diversity in spawning populations is important. A better understanding of Central Basin spawning habitat would allow managers to better conserve these small but consequential stocks. The objectives of this project are to 1) create bathymetry maps of the HPR complex to describe the quantity and quality of Walleye spawning habitat, 2) compare the quantity and quality of the physical habitat at HPR to other reefs in Great Lakes literature, and 3) use the bathymetry data and protocols produced from HPR to locate additional Central Basin reefs that are suitable for Walleye spawning.

Figure 9. Recently developed bathymetry of Hardy Point Reef, near Fairport Harbor, OH.

In 2024, side scan and depth data were collected at the HPR complex and several other potential reefs (Lake Erie Bluffs and Madison) using a Lowrance HDS-12 head unit paired with a Lowrance Active Imaging 3-in-1 transducer. Transducer settings were set to 455 kHz with a swath range of 100 m (50 m on each side of vessel). Transects were conducted parallel to shore and 50 m apart to achieve 100% overlap of sonar images. Side scan images were processed using SonarWiz 7 and depth data were merged with coordinates collected from a Trimble R1 receiver to create a bathymetric map with accurate positioning (≤1 m) in ArcGIS. In fall 2024, side scan images and bathymetric maps from HPR complex, Lake Erie Bluffs and Madison reefs were successfully created (Figure 9). Conclusions from the side scan images and delineated substrate map show that similar substrate classifications exist between the HPR complex, Lake Erie Bluffs, and Madison reefs. Additional efforts to collect more robust depth data at the Madison

and Lake Erie Bluffs reef sites will be conducted to better understand and visualize the bathymetry at those sites. Delineated substrate maps will be ground-truthed using a 1m x 1m quadrat and GoPro imagery to determine substrate classification accuracy. ODNR-DOW staff plan to assess the HPR complex for Walleye reproduction through adult, egg, and larval sampling efforts in March–May 2025.

Gorge Dam Removal on the (Cuyahoga River)
Z. Slagle

PMA linkage			
Functional Habitat:	Central Basin Rivers/Tributaries	Priority:	Medium

The Gorge Dam Removal Project appears to be behind schedule in 2024-25. In 2024, contaminated sediment was scheduled to removed from the dam pool, with completion scheduled in 2025. However, project updates have been sparse in recent months and funding may be delayed with the new U.S. federal administration. Approximately 669,000 m^3 of contaminated sediment must be removed prior to dam demolition, at a cost of around $100 million. Project partners include the Environmental Protection Agency, the Northeast Ohio Regional Sewer District, the City of Akron, FirstEnergy/Ohio Edison Company, and the Ohio EPA. The actual dam removal was to take place in 2026. This project will open ~18 rkm to freely flow to Lake Erie and is expected to improve water quality downstream throughout the Cuyahoga River Area of Concern, potentially leading to delisting. Fish population connectivity continues to be examined via acoustic telemetry and genetic techniques, led by Matthew Acre (USGS).

Great Lakes Coastal Wetland Framework
J. Kerns

PMA linkage			
Functional Habitat:	Entire Lake Erie basin – Coastal wetlands	Priority:	Very High to Low

The U.S. and Canada are collaborating on a Great Lakes Coastal Wetland Framework for Lake Erie and the Huron-Erie Corridor, led by the Great Lakes Coastal Assembly. This effort aims to 1) map the current extent of coastal wetlands, 2) assess the extent and condition of coastal wetlands needed for healthy Great Lakes and communities, and 3) identify priority areas for coastal wetland conservation. The National Oceanic and Atmospheric Administration (NOAA) is updating geospatial products to better classify and map wetland types, while the U.S. Fish & Wildlife Service (USFWS) is establishing the desired extent and condition of coastal wetlands developing a decision support tool to help prioritize conservation efforts. A Steering Committee and Technical

Team of experts are guiding the project. Progress was shared at the 2024 Great Lakes Coastal Symposium in Rochester, NY. The project team led a workshop that drew 79 participants representing the eight Great Lakes states and Ontario. Participants reflected on how human health and well-being can be incorporated into wetland conservation decisions, important drivers for determining where to work, and how the Framework can help them prioritize their work.

Cedar Point Causeway Wetlands Project (Sandusky Bay)
Z. Slagle

PMA linkage			
Functional Habitat:	West Basin Nearshore	Priority:	High

The Cedar Point Causeway Wetland Creation Project has been somewhat stalled (HTG 2023). In 2021, a retaining structure was built, forming two cells to accept dredge material along the Cedar Point Causeway in eastern Sandusky Bay; in 2022 and 2023, dredge material from the bay channel was pumped into these structures. Work yet-to-be-completed includes the regrading of retained sediments (dredged material), creation of a flow-through channel within the wetland, installation of additional sediment stabilization and fish & wildlife habitat structures, and planting of native wetland plant species. Some funding remains in the original grant to support the wetland restoration phase, but the estimated project cost requires that supplemental funding is secured. Eventually, the retaining structure will be breached to allow water movement and fish passage between the contained wetland and the bay, adding 13 hectares of new wetland habitat. Partner agencies will continue to monitor changes to water quality and the fish community in future years.

Clark and Delaware/Horseshoe Islands Restoration Projects (Maumee River)
Z. Slagle

PMA linkage			
Functional Habitat:	West Basin Rivers/Tributaries	Priority:	Very High

Clark and Delaware/Horseshoe islands are natural features located ~16 km upstream of the mouth of the Maumee River, Lake Erie's largest watershed; these islands have eroded to around 5% of their size in the 1940s. This restoration project created new hard structures to calm water and create new wetland habitat for the ~25 hectare area, which will absorb nutrients, reduce sedimentation, and add to fish habitat in the river. This is a collaborative project between the Toledo-Lucas County Port Authority, the City of Toledo, with significant input from the Ohio Department of Natural Resources, the Ohio Environmental Protection Agency, and the Maumee Area of

Concern Advisory Committee. Funding is provided by the State of Ohio's H2Ohio Program and GLRI (~$13.5 million). Groundbreaking for the project took place in January 2024 and is on track to be completed by Fall of 2025.

Charge 1d: Use GIS techniques to refine PMA mapping, coordination, and scale.

In 2023, the Habitat Task Group reported on the development of reef layers and river plumes identified as Priority Management Areas. Those layers were further refined and the exercise was used to help develop reef prediction layers for the other Great Lakes. Work will continue with Great Lakes Aquatic Habitat Framework support staff to refine layers and develop workflow processes through PMA phases 3 and 4.

Charge 2: Support other task groups by compiling metrics of habitat use by fish.

There was no new work towards this charge in 2024. There are ongoing efforts targeted at this charge which have been captured in prior reports. One ongoing effort is the Experimental Lake Erie Hypoxia Forecast led by NOAA-GLERL (https://www.glerl.noaa.gov/res/HABs_and_Hypoxia/hypoxiaWarningSystem.html). This system provides a forecast of bottom temperature and dissolved oxygen with the intent to alert users of hypoxic events (including upwelling events) in Lake Erie. The information collected and forecasted through this effort assists fisheries managers as well as a many other stakeholders around Lake Erie. Over the next year, the HTG will continue looking for opportunities to compile habitat metrics which are beneficial for the goals and objectives of the LEC.

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Protocol for Use of Habitat Task Group Data and Reports

- The HTG has used standardized methods, equipment, and protocol in generating and analyzing data; however, the data are based on surveys that have limitations due to gear, depth, time, and weather constraints that vary from year to year. Any results or conclusions must be treated with respect to these limitations. Caution should be exercised by outside researchers not familiar with each agency's collection and analysis methods to avoid misinterpretation.

- All data provided from the PMA exercise is reported with the caveat that it is a working dataset based on the best available information. The intention, as designed, is for the HTG to continuously refine the data as new information becomes available and prioritizations are subject to change. Use of the PMA information should be done with this understanding and consultation with HTG co-chairs to ensure proper interpretation of the most recent dataset is highly advised.

- The HTG strongly encourages outside researchers to contact and involve the HTG in the use of any specific data contained in this report. Coordination with the HTG can only enhance the final output or publication and benefit all parties involved.

- Any data intended for publication should be reviewed by the HTG and written permission received from the agency responsible for the data collection.

Acknowledgements

The HTG would like to acknowledge and thank the many contributors to the work presented in this report. As this report is mostly an overview of projects underway in the Lake Erie basin, it is impossible to identify every project and every individual involved. If you are involved in a habitat-related project in the Lake Erie basin and would like your work to be represented in the project table, please contact a member of the Habitat Task Group.