St. Clair – Detroit River System Initiative Annual Meeting

"Charting the Course for Action in the St. Clair-Detroit River System"

March 2, 2017

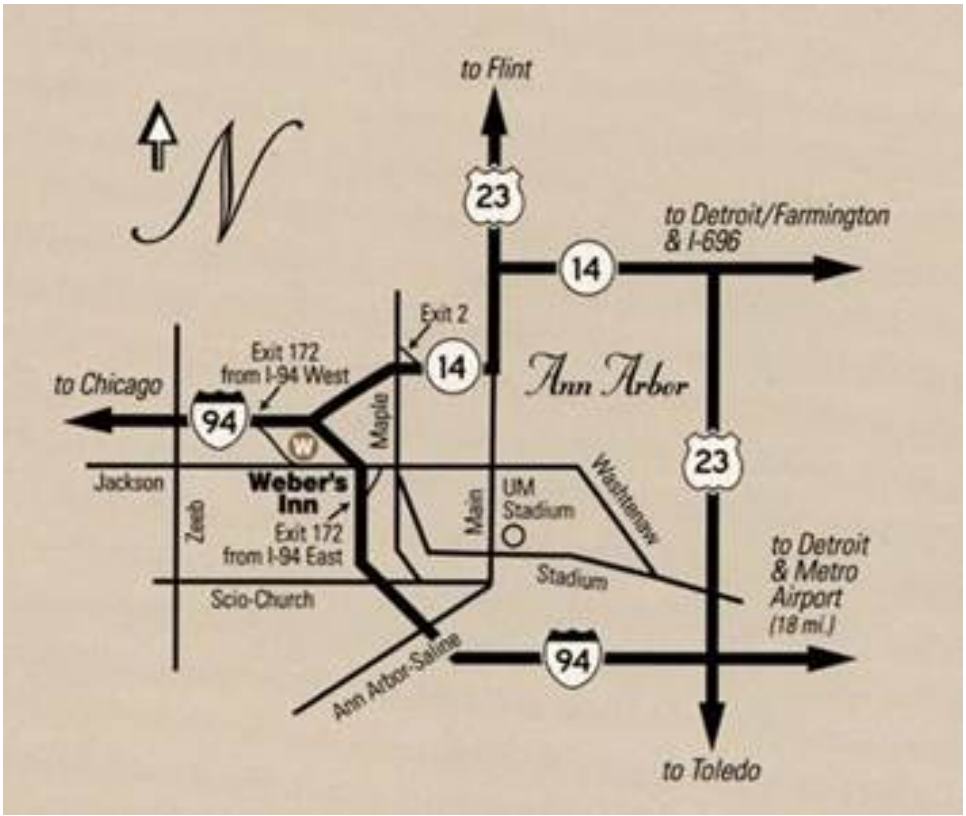
Weber's Inn

Ann Arbor, Michigan

Briefing Updates

2017 Annual Meeting

"Charting the Course for Action in the St. Clair-Detroit River System"
Thursday March 2, 2017
Weber's Inn
3050 Jackson Avenue, Ann Arbor, MI 48103
9:00 a.m. - 5:00 p.m. EST



Thank you to our 2017 SCDRS Initiative Meeting sponsors.

St. Clair – Detroit River System Initiative Annual Meeting Agenda

March 2, 2017, Weber's Inn, Ann Arbor MI

8:00 – 9:00	Registration and networking (Continental breakfast)
9:00 – 9:10	Welcome/housekeeping (Jim Boase, SCDRS Initiative Chair and USFWS)
9:10 – 9:20	Steering Committee Report, Discussion/Input from members (Jim Boase)
9:20 – 9:30	Communication Subcommittee (Michelle Selzer, MI OGL)
9:30 – 10:00	Societal Satisfaction Discussion (Heather Triezenberg and Mary Bohling, MSU Ext; Jim Francis, MI DNR; Rich Drouin, OMNRF)
10:00 – 10:30	**BREAK**

10:30- 4:45 SCDRS Priority Objectives, Indicators Status Update & Discussion

10:30-10:40	Introduction to SCDRS Priority Objectives Updates (Ed Roseman, USGS; Justin Chiotti, USFWS)
10:40 – 11:05	Improved Detection of AIS (Lindsay Chadderton, TNC)
11:05 – 11:30	Preventative Strategies for Aquatic Invasive Species (AIS) (Lindsay Chadderton)
11:30 – 12:00	Remove Loss of Fish and Wildlife Beneficial Use Impairments – U.S./CAN St. Clair River (Melanie Foose, MI OGL; April White, ECCC)
12:00 – 12:30	Remove Loss of Fish and Wildlife Beneficial Use Impairments – U.S./CAN Detroit River (Melanie Foose; Claire Sanders, DRCC)
12:30-1:45	**LUNCH (Networking, Poster Session, Group Photo)**
1:45-2:10	Increase Riparian Complexity (David Mifsud, HRM)
2:10 – 2:35	Functional Wetlands (Brad Potter, UFWS, LCC Coastal Wetlands Working Group)
2:35 – 3:00	Functional River Spawning Habitat (Ed Roseman)
3:00 – 3:30	**BREAK** (P.M. snacks)
3:30 -3:55	Contaminants of emerging concern (Mandy Annis, USFWS)
3:55 – 4:20	Reduce Total Phosphorus and Dissolved Reactive Phosphorus (Craig Stow, NOAA)
4:20 – 4:45	Protect Native Rare Species (Dave Zanatta, Central Michigan University)
4:45 – 5:00	Closing remarks, Next Steps (Sue Doka, DFO)
5:00 – 7:00	Social and Poster Session

St. Clair - Detroit River System Initiative

List of Briefing Updates

Maumee River Lake Sturgeon Restoration Program

Study of grass carp movement in Western Lake Erie using acoustic telemetry and targeted egg and larval fish sampling.

Northern Madtom (Noturus stigmosus) use of artificial reefs in the St. Clair – Detroit River System

Physical habitat assessment in the St. Clair/Detroit River Systems Update

St. Clair River Shoreline Restoration Project Assessments Update

Stony and Celeron Islands Restoration

Controlling Invasive Species Around Lake St. Clair

Early Warning Program to Detect and Identify Contaminants of Emerging Concern and Their Effects to Fish and Wildlife

Rouge River Mystery Oil Spill Restoration Projects

Larval fish studies in the St. Clair-Detroit River System

Coastal Resilience Decision Support Tool

Detroit River-Western Lake Erie Cooperative Weed Management Area

Ecosystem Services Valuation of Coastal Wetlands

Adult Fish Community Assessments Associated with the Reef Projects in the St. Clair-Detroit River System

Sea Lamprey Assessment of the St. Clair- Detroit River System During 2016 and Proposed Action for 2017

St. Clair River Shoreline Habitat Restoration Monitoring

St. Clair River Coastal Wetland Habitat Restoration Wildlife Monitoring

Mudpuppy Assessment and Habitat Restoration along the St. Clair-Detroit River System

I-75 Corridor Conservation Action Plan in Monroe County

U. S. Fish and Wildlife Service Early Detection Monitoring for Non-native Aquatic Species

2017 SCDRS Juvenile Lake Sturgeon Update

2017 Adult Lake Sturgeon Setline Assessments

Lake Okonoka Restoration with River Connection and Shoreline Restoration

Assessment Program Summary for 2016 – Lake St. Clair Fisheries Research Station (LSCFRS)

Zooplankton Surveys in the St. Clair-Detroit River System

Healthy Urban Waters

NCCA Great Lakes Connecting Channels Assessments

Update on BUI Status and Planned Activities for the Detroit River AOC (Canadian side)

Metabarcoding Assays to Identify Invasive Mollusk Species from Environmental DNA Samples

High-Throughput Sequencing Assays to Simultaneously Identify and Assess Fish and Mollusk Communities from Environmental Samples

Genetic patterns across an invasion's history: change versus stasis for the Eurasian round goby in North America and new Metagenomic assays

Egg deposition in the St. Clair – Detroit River System

Invasion Population Genetics of the Eurasian Ruffe over Time and Space

VHS Fish Virus is Still in the Great Lakes and Mutating!

Population genetic structure and comparative diversity of smallmouth bass

Suspended Sediment Quality in the SCDRS

Invasive Species Prevention from Bait Store Retailers via Metagenetics, Supply Chains, and Public/Stakeholder Engagement

Great Lakes Connecting Channel Monitoring: St.Clair River Upstream/Downstream Study

Michigan's Western Lake Erie Collaborative Agreement Implementation Plan Summary

Assessing the Sources and Management Options for Detroit River Nutrient Loads to Lake Erie

Combining monitoring, advanced molecular techniques and near real-time instrumentation to investigate the response of cyanoHABs in Lake Erie and Lake St. Clair to different environmental conditions

Distribution of Nutrients, Suspended Sediment, and Velocities in the Trenton Channel, Detroit, Michigan 2014-2015

Contaminants of Emerging Concern in Great Lakes Tributaries

Mapping and Monitoring Aquatic Vegetation in Lake Erie for Grass Carp Risk Assessment

An Update on Spawning Reef Construction Projects

St. Clair - Detroit River System Initiative

2017 Briefing Update

Agency

U.S. Fish and Wildlife Service, Alpena FWCO - Waterford Substation, Toledo Zoo, Ohio Department of Natural Resources, Ontario Ministry of Natural Resources and Forestry, Michigan Department of Natural Resources, University of Toledo

Contact

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Title

Maumee River Lake Sturgeon Restoration Program

SCDRS Initiative Objective(s)

Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs

Update

Lake sturgeon recruitment in the Lake Erie basin is currently supported by two connecting channels, the St. Clair – Detroit River System and Niagara River. Historically, there were 16 other spawning populations in Lake Erie. In an effort to delist this endangered species in the State of Ohio and throughout the Lake Erie basin, efforts are underway to rehabilitate lake sturgeon populations in suitable river systems. The Maumee River, located in western Lake Erie, historically supported large runs of lake sturgeon, but currently are considered functionally extirpated from this system. A habitat suitability model for spawning adult and age-0 lake sturgeon indicates sufficient habitat is present in the Maumee River. Therefore, the river is a strong candidate for a lake sturgeon reintroduction. A lake sturgeon restoration plan has been drafted for the system and is in review by the Ohio Department of Natural Resources and Great Lakes Fishery Commission Lake Erie Committee. Lake sturgeon will be reared by the Toledo Zoo and Genoa National Fish Hatchery. The habitat suitability model and restoration plan will provide the foundation for the Maumee River Lake Sturgeon Restoration Program, a multi-agency, international effort leading towards the restoration of the lake sturgeon population in Lake Erie.

The lake sturgeon rearing facility will look similar to the hellbender facility operated by the Toledo Zoo.

St. Clair - Detroit River System Initiative

2017 Briefing Update

Agency
MSU, Michigan DNR, Ohio DNR

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Title
Study of grass carp movement in Western Lake Erie using acoustic telemetry and targeted egg and larval fish sampling.

SCDRS Initiative Objective(s)
Develop surveillance monitoring for AIS based on habitat requirements and availability

Update
Efforts to gain more insight into the life history of grass carp in Western Lake Erie continued in 2016. Through the use of bongo nets and light traps we targeted juvenile grass carp and eggs in the River Raisin. The bongo net efforts were an attempt to collect grass carp eggs while the light traps are used to at-tract and capture juvenile grass carp shortly after hatching. There have been no observances of grass carp in any of the samples so far, but not all samples have been processed yet. We did not observe any grass carp eggs or juveniles while in the field, but the samples need to be processed in the lab for reliable evaluation.

This is a collaborative study with MSU, Michigan DNR, and Ohio DNR, looking at tributary use by grass carp in western Lake Erie. At the start of 2016 only 12 grass carp had been tagged with acoustic transmitters, but by the end of 2016 the sample size was increased to 32 grass carp tagged and released. While tagging more fish, 10 tributaries to western Lake Erie were monitored with acoustic receivers, adding to the large network of receivers already in Lake Erie through the Great Lakes Acoustic Telemetry Observation System (GLATOS). The monitoring of these 10 additional streams increased the number to 13 tributaries where acoustic arrays were deployed and listen for the 32 tagged grass carp. The findings from 2016 are being analyzed and will direct efforts of this study in 2017.

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service, Alpena FWCO – Waterford Substation

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Title
Northern Madtom (Noturus stigmosus) use of artificial reefs in the St. Clair – Detroit River System

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase river spawning habitat, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs

Update
The Detroit and St. Clair rivers historically supported an abundant fishery; however like many river systems, these rivers have been greatly altered. The creation of navigation channels and other anthropogenic disturbances have resulted in the decline of native fish populations and loss of fish and wildlife habitat. In order to restore these beneficial use impairments, artificial fish spawning reefs have been constructed in the Detroit and St. Clair rivers. Currently 7 reefs have been constructed adding over 16 acres of spawning habitat to the system. While Walleye, Lake Sturgeon, and Lake Whitefish were the target species, other lithophilic species could also be benefiting from the reefs. One species to potentially benefit from the construction of artificial reefs is the Northern Madtom (Noturus stigmosus). Northern Madtom are a small Ictalurid catfish listed as globally vulnerable and endangered in the state of Michigan and Province of Ontario. Like other catfish species, these fish are cavity nesters; yet, not much else is known about this species as it is historically found in small, isolated populations.

In the summer of 2016, we sampled artificial reefs and nearby control sites in the Detroit and St. Clair rivers to compare the relative abundance of Northern Madtom and other small benthic fishes. Minnow traps were deployed overnight at three reef and three control sites in each river. A total of 429 minnow traps were deployed using four different bait types (cheese, night crawlers, dog food, no bait) to determine bait preference. Water quality data, current velocity, and substrate information was collected at each site.

A total of 51 Northern Madtom were captured, 47 of which were caught in the St. Clair River. Northern Madtom were captured at all reef and controls sites in the St. Clair River with reef sites having higher catch rates. Relative abundance, nonetheless, did not differ statistically between reef and control sites. Northern Madtom were captured in each of the four bait types. Thirty-four out of the 51 were captured with night crawlers making it the statistically preferred bait type. Other species caught during this study included Burbot, Logperch, Mottled Sculpin, Rock Bass, Round Goby, Sand Shiner, Silver Lamprey, Smallmouth Bass, Stonecat, and Yellow Perch. Seven unique species were captured in the Detroit River

and nine different species in the St. Clair River. Round Gobies were the most abundant fish and were caught at every site. Water quality data, current velocity, and substrate information have not been analyzed at this time.

Future sampling will occur over a greater time period to identify seasonal patterns in habitat use. This work will enable us to develop a better sampling strategy for Northern Madtom in large river systems.

Figure 1. A Northern Madtom captured during minnow trap surveys of the St. Clair River. Credit: USFWS

Figure 2. Northern Madtom captured in a minnow trap survey of artificial reefs in the St. Clair River. Credit: USFWS

2017 Briefing Update

Agency
U.S. Geological Survey Great Lakes Science Center and Michigan Department of Natural Resources

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Title
Physical habitat assessment in the St. Clair/Detroit River Systems Update

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase river spawning habitat

Update
Physical habitat assessments were conducted to assist with the development of two artificial fish spawning reef restoration projects in the Detroit River (Belle Isle Reef Complex and Fort Wayne Reef) and to evaluate maturation of artificial spawning reefs constructed in previous years. Assessment included the mapping of water depths and velocities with an acoustic Doppler current profiler (ADCP) to determine the availability of appropriate water depths (> 4.5 m), velocities (> 0.5 m/s), and identify areas of deposition that should be avoided. Pre-construction surveys also included substrate mapping with side-scan sonar, underwater video, and extensive dive surveys of substrate composition at the Belle Isle and Fort Wayne candidate sites. A small (15 x 15 m) test reef constructed at the Fort Wayne site in late 2015 was also evaluated through a series of dive surveys, which indicated the high velocities and freighter traffic did not displace the reef and that fine sediments were not accumulating within the test reef. These pre-construction assessments were used to determine placement of the Belle Isle Reef Complex, which was constructed in December 2016 and the Fort Wayne Reef, which is slated to be constructed in 2017. Additionally, post-construction evaluations of the Hart's Light, Point Aux Chenes, Middle Channel, 2004 Belle Isle, Grassy Island and Fighting Island reef projects was conducted with ADCP, side-scan sonar, underwater video, and dive surveys. Dive surveys of the Belle Isle Reefs constructed in 2004 show some sedimentation has occurred at these sites, however, coarse spawning substrates remain available over a decade after reef construction. Underwater video and side-scan sonar surveys of the Hart's Light, Point Aux Chenes, and Grassy Island Reefs indicate the reefs have remained free of fine substrate and changed little since construction in 2014 (Hart's Light and Pointe Aux Chenes) and 2015 (Grassy Island). Plans for 2017 include the continuation of post-construction evaluation of Hart's Light, Point Aux Chenes, Middle Channel, Belle Isle, Grassy Island and Fighting Island reef projects. Evaluation will focus on quantifying substrate composition and maturation of the reefs with side-scan sonar and underwater video surveys.

Presentations:

Fischer, J.L., E.F. Roseman, G.W. Kennedy, J. Craig, B.A. Manny, D.H. Bennion, and C. Mayer. 2016. Utilizing Velocity and Substrate Mapping to Guide Habitat Restoration. "Workshop for the Future of Baltic Sea Whitefish Stocks - Heading for Sustainable Resources and Natural Reproduction." Natural Resources Institute of Finland (Luke), Helsinki, Finland. November 29-December 1, 2016.

Fischer, J., E.F. Roseman, G. Kennedy, J. Craig, B. Manny, D. Bennion, and C.M. Mayer. 2016. Getting Physical: Guiding Habitat Restoration with Velocity and Substrate Mapping. 59th Annual Meeting of the International Association of Great Lakes Research, Guelph, Ontario. June 2016.

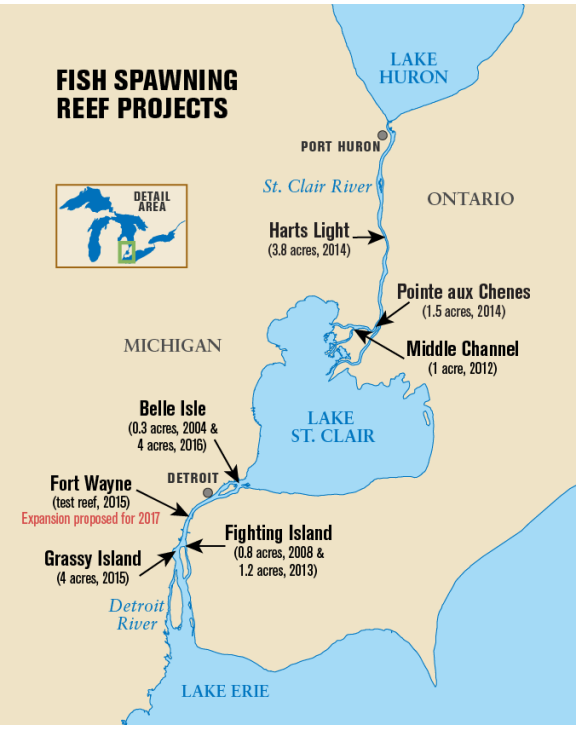

Figure 1. Locations of artificial fish spawning reefs in the St. Clair-Detroit River System. Credit: MI Sea Grant

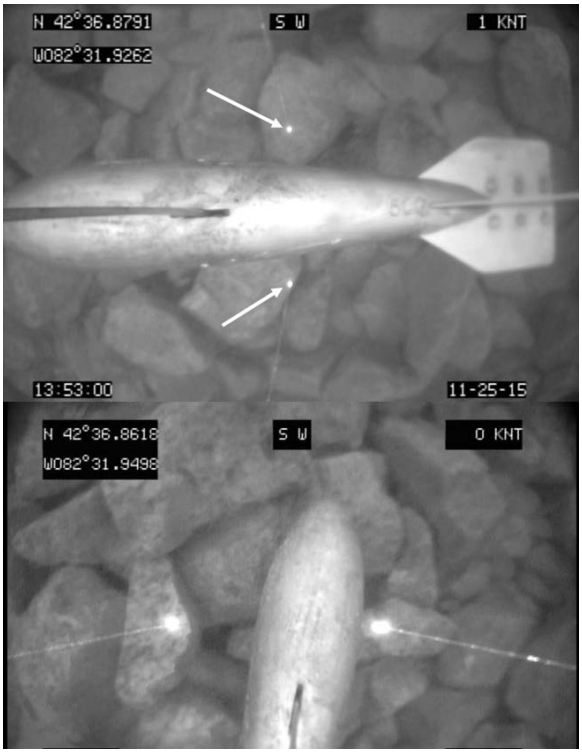

Figure 2. Frames from underwater video at the Pointe Aux Chenes Reef in 2015 (top panel) and 2016 (bottom panel) showing reef rock has remained free of fine sediment since the reef's construction in 2014. The two laser points, highlighted by the white arrows in the top panel, are 22.4 cm and are used to provide a size reference. The sounding weight in the image was used to keep the camera stable and near the riverbed.

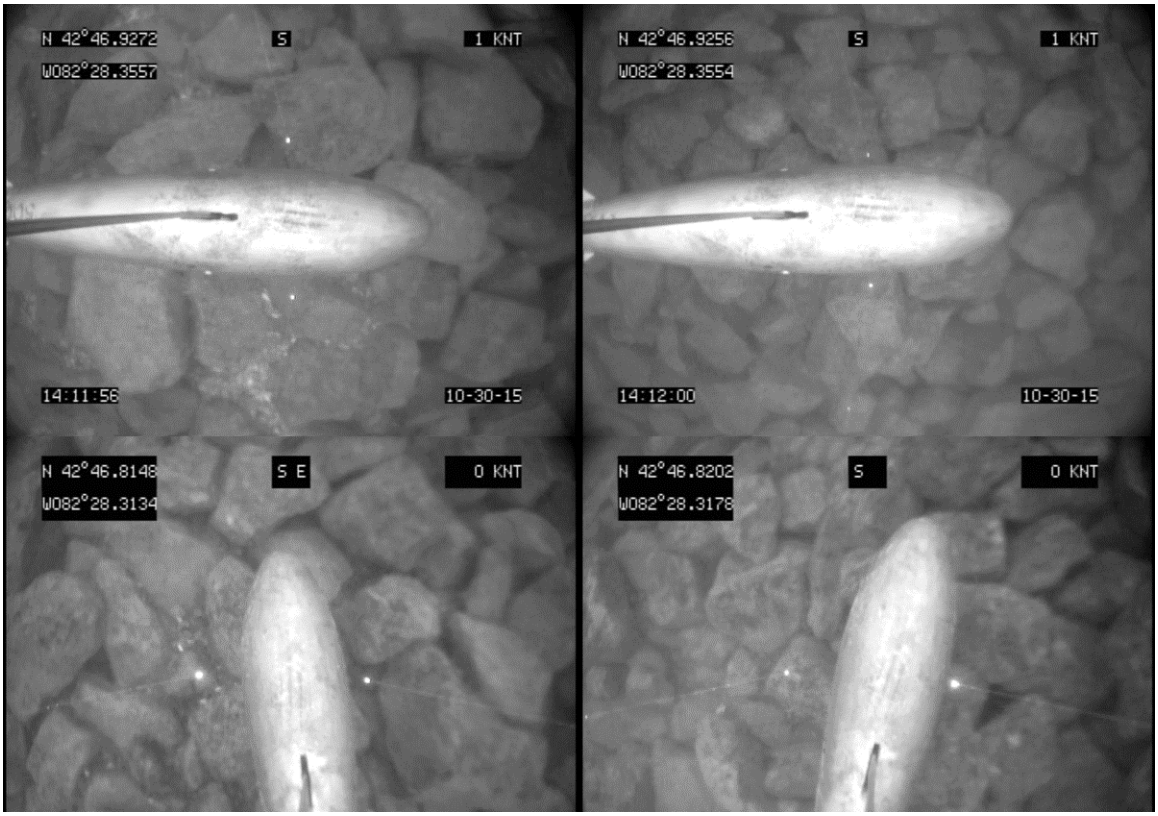

Figure 3. Frames from underwater video at the Hart's Light Reef in 2015 (top panels) and 2016 (bottom panels) showing reef rock has remained free of fine sediment since the reef's construction in 2014. The two laser points are 22.4 cm and are used to provide a size reference. The sounding weight in the image was used to keep the camera stable and near the riverbed.

2017 Briefing Update

Agency
U.S. Geological Survey Great Lakes Science Center

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Title
St. Clair River Shoreline Restoration Project Assessments Update

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg.

Update
Post-construction evaluation of five shoreline restoration projects and four control sites in the St. Clair River continued in 2016 and marked the completion of our two year assessment. Evaluation of use by early life stages in 2016 included weekly spring egg mat and egg pump sampling for fish eggs at the restoration sites, weekly light trap sampling for larval fish at restoration and control sites from March thru August. Juvenile and adult fishes were targeted with minnow traps, backpack electrofishing, and gillnets. In 2016, minnow trap sampling took place every other week, beginning in March and ending in November, backpack electrofishing and gillnetting was conducted monthly from April thru November. Despite extensive effort targeting fish eggs, only 11 eggs have been collected since 2015, none were viable post-transport to our rearing facility. Based on these efforts, we found no evidence of fish spawning at these sites. However, larval fish from eight taxonomic families were collected in light trap samples, including Catostomidae, Centrarchidae, Cottidae, Cyprinidae, Esocidae, Gobiidae, Percidae, and Umbridae. Collection of larval fish was greatest at the Anchor Bay control site in 2015 and the Cottrellville restoration site in 2016, although, invasive Gobiidae species (round and tubenose gobies) composed the largest percentage of the catch. A greater number of species were collected with gear targeting adult and juvenile fishes. A total of 60 species was collected with minnow traps, backpack electrofishing, and gillnets over the two year study period, 43 species were collected with backpack electrofishing, 32 species were collected with gillnets, and 29 species were collected in minnow traps. Based on these efforts, the shoreline restoration sites are supporting a diversity of juvenile and adult fishes, including sport fish, rare, and sensitive species. However, continued evaluation is required to gauge the long-term efficacy of these projects. Results from this survey have been summarized in six presentations given at local and regional meetings.

Table 1: Frequency of sampling for each gear used to collect fish and fish eggs at St. Clair River shoreline monitoring sites. Number of replicates at each site are in parentheses.

Site	Site Type	Egg Mat	Egg Pump	Light Trap	Minnow Trap	Backpack Electrofishing	Gillnet
Port Huron North	Restoration	Weekly (1)		Weekly (1)	Bi-weekly (1)	Monthly (1)	
Port Huron South	Restoration			Weekly (1)	Bi-weekly (1)		
Blue Water River Walk	Restoration	Weekly (3)	Weekly (3)	Weekly (3)	Bi-weekly (3)	Monthly (1)	Monthly (1)
Marysville Beach	Control					Monthly (1)	
Marysville Riprap	Control			Weekly (1)	Bi-weekly (1)		
Marysville Living Shoreline	Restoration	Weekly (2)	Weekly (3)	Weekly (2)	Bi-weekly (2)	Monthly (1)	Monthly (1)
Marine City Beach	Control					Monthly (1)	
Cottrellville	Restoration	Weekly (2)	Weekly (3)	Weekly (2)	Bi-weekly (2)	Monthly (1)	Monthly (1)
Algonac State Park	Control			Weekly (1)	Bi-weekly (1)	Monthly (1)	Monthly (1)
Anchor Bay	Control			Weekly (1)	Bi-weekly (1)		

Figure 1. Shoreline restoration and monitoring sites along the St. Clair River.

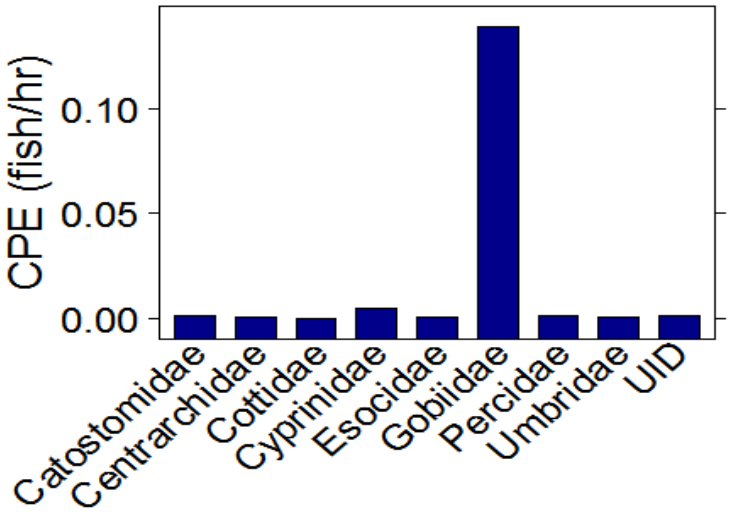

Figure 2. Catch-per-effort (CPE) by taxonomic family. Gobiidae (round and tubenose goby) composed the largest percentage of the total number of larvae caught. Cyprinidae was the next highest followed by Percidae, Catostomidae, Centrarchidae, Umbridae, Esocidae, and then Cottidae. UID=unable to identify.

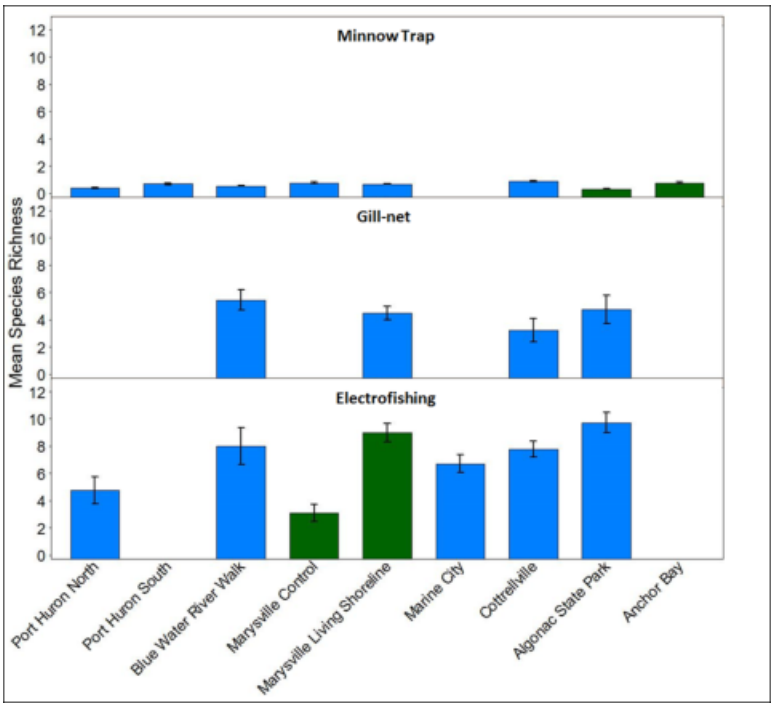

Figure 3. Mean number of species collected with minnow traps, gillnets and backpack electrofishing at shoreline restoration (blue bars) and control (green bars) sites in the St. Clair River. Error bars show one standard error.

2017 Briefing Update

Agency
Friends of Detroit River, NOAA - Restoration Center

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Title
Stony and Celeron Islands Restoration

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase continuous area of functional wetlands and their connectivity to the SCDRS, Increase river spawning habitat

Update
The purpose of the proposed projects is to restore historic shoals and create additional shoals that will protect Stony and Celeron Islands from farther erosion and provide backwater area while restoring coastal wetland habitat. The implementation of these projects is the first step in completing a major habitat re-construction among the islands in the lower part of the Detroit River.

Stony Island - The Island's wetlands are owned by the State of Michigan, and are under the jurisdiction of the Pointe Mouille State Game Area. The island's two major coastal wetland areas, known locally as the upper and lower bays, historically have been protected by the two limestone dikes which provided the necessary protection from the river's currents and wave surges. The dikes that protect the coastal wetlands have disappeared under the effects of decades of erosion and through for the wetland areas have degraded.

The project is currently under construction and includes the restoration of 350 LF of shoal in the upper bay, creation of 600 LF of habitat shoal island in the upper bay, creation of 1375 LF of habitat shoal along the west side of the lower bay, and restoration of 1250 LF of shoal at the lower bay. Additionally, a series of depressed areas to provide deeper water habitat and a variety of habitat elements will be constructed. Currently construction of the North Shoal and North Shoal islands is 95% complete, work on the west shoal began last fall, and some of the upland habitats (herbinaculars, turtle nesting areas and other structural habitats) have been completed. Work on the west and south shoals will continue in 2017.

Celeron Island - The Island's wetlands are owned by the State of Michigan, and are under the jurisdiction of the Pointe Mouille State Game Area. The island has remnants of emergent and submergent aquatic plants. These areas are important spawning, nursery and refuge areas for sport, commercial and forage fish species. It is also situated within a major flyway and is therefore an important resting spot for migratory birds and waterfowl.

The loss of the protective shoreline has led to the loss of much of the complex wetland associations that lined the outer shoreline and the inner bay, at the center of the island and a reduction in the once abundant beds of submergent aquatic vegetation.

The proposed project includes the creation of a series of habitat shoals, totaling 2800 LF near the southern shore of Celeron Island. A depressed area will be created to provide deeper water habitat. Material from the depressed areas will be placed along the backside of the shoals, providing shoreline habitat at the shoals. Additionally, about 800 lft of barrier beach will also be reestablished. A variety of habitat elements have been incorporated to provide multiple niche habitats in support of existing fish and wildlife species. The project is scheduled to begin construction in spring 2018.

http://www.detroitriver.org/

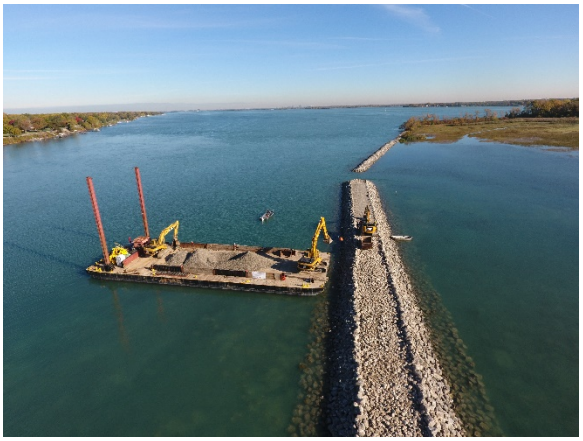

Figure 1. Aerial construction of shoal.

Figure 2. Shoal construction operation.

Figure 3. Upper bay shoal aerial.

2017 Briefing Update

Agency
Southeast Michigan Council of Governments

Contact
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Title
Controlling Invasive Species Around Lake St. Clair

SCDRS Initiative Objective(s)
Adaptively manage invasive plants (e.g., Phragmites, European frogbit) at a system landscape scale

Update
The Lake St. Clair CISMA has been established within the boundaries of the Lake St. Clair Watershed in Southeast Michigan. This includes St. Clair County, Macomb County and the Oakland County portion of the Clinton River Watershed. The Oakland County portion of the Clinton River is now a shared locality between the Oakland County CISMA and the Lake St. Clair CISMA.

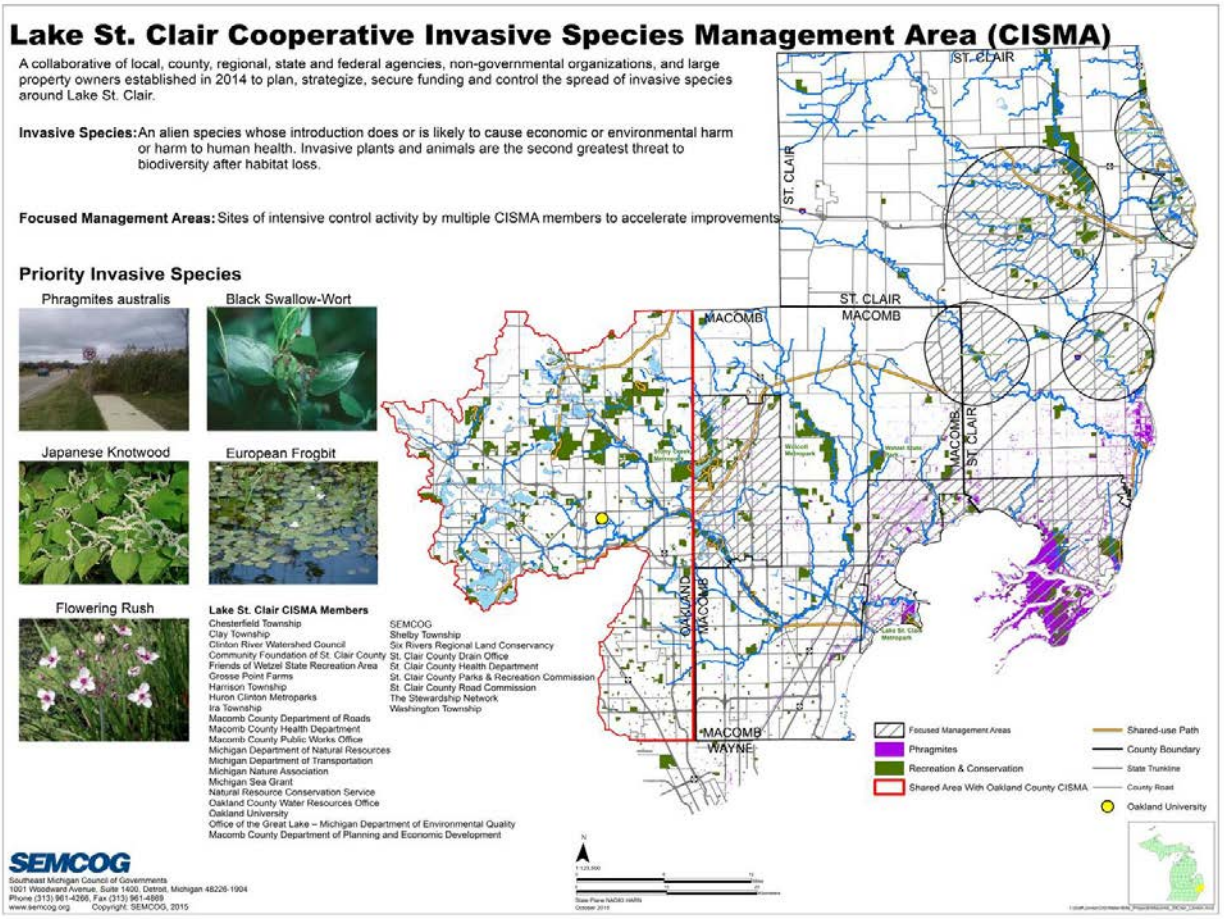
Phragmites control around Lake St. Clair began in 2009. Partners included the Department of Natural Resources, Department of Environmental Quality, Ducks Unlimited, Inc, Michigan Sea Grant, Huron Clinton Metroparks, St. Clair Flats Waterfowlers, St. Clair County Drain Office, Clay Township, Ira Township, Harrison Township and SEMCOG. Two federal grants funded this effort which managed about 3,500 acres of Phragmites in Anchor Bay – at a cost of approximately $1.4 million. Federal funds ran out in 2014, and efforts immediately shifted to establishing a Cooperative Invasive Species Management Area. A priority objective in establishing the CISMA is to extend ecological restoration including invasive species management farther inland and up into Lake St. Clair's watershed.

The CISMA was formally established in early 2015 and its development continues. There are approximately 25 members of local, county, state, and federal government, and non-profit organizations that comprise the Lake St. Clair CISMA. The CISMA is focused on managing the spread of five priority invasive species such as Phragmites australis, Black Swallow-Wort, Japanese Knotweed, European Frogbit and Flowering Rush.

The CISMA is taking an aggressive stance toward invasive species. In Fall 2015, the Lake St. Clair CISMA applied for and received state Michigan Invasive Species Grant Program funding through the Michigan Department of Natural Resources (MISGP).
Initial control along roads focused on eradicating small colonies that are public safety hazards (i.e. sightline blockages at intersections, and fire threat, etc.) Project funds will also be used to support CISMA partners priority invasive species control efforts on public and private land. Higher priority was assigned to priority invasive species control in the following areas:

• Areas with high ecological value,
• Areas with high recreational and tourism value, and
• Primary pathways where priority invasive species spread (i.e., roads and drains).

The first year treatment strategy focused management in smaller geographic areas known as FMAs or Focused Management Areas. FMAs are smaller geographic areas in which numerous agencies and organizations combine their management efforts to make a noticeable decline in the invasive species population. Approximately Seventeen partners of the CISMA mapped and treated approximately 2,400 acres of Phragmites along county roads, non-motorized trails, drains and stormwater detention basins. Planning is now going on for the 2017 treatment season.



2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Michigan Ecological Services Field Station

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Title
Early Warning Program to Detect and Identify Contaminants of Emerging Concern and Their Effects to Fish and Wildlife

SCDRS Initiative Objective(s)
Identify contaminants of concern (e.g. pharmaceuticals and personal care products, microplastics) determine sources, and develop load reduction strategies

Update
Funded by the Great Lakes Restoration Initiative (GLRI), the U.S. Fish and Wildlife Service (USFWS) Regions 3 Division of Ecological Services are studying contaminants of emerging concern (CECs) within the Great Lakes. CECs are a diverse suite of chemicals which may impact the environment in a number of known and unknown ways. These chemicals include pharmaceuticals, personal care products, current use pesticides and wastewater treatment plant byproducts. In an effort to understand the scale and extent of CECs within the Great Lake, USFWS biologists have sampled fish, water, and sediments from Areas of Concern including the Detroit River and other Great Lakes' watersheds. In the first five years of the project (2010-2015) the USFWS began to identify possible contaminant sources, the most frequently detected CECs, and areas most at risk for exposure to fish, and wildlife.

In addition to site characterization the USFWS and their partners have begun to evaluate how ecologically relevant CEC concentrations could impact fish and wildlife populations. Laboratory studies which expose generations of fish to chemical mixtures mimicking Great Lakes area concentrations determined in previous USFWS environmental sampling concluded in 2016. In 2017, fish health and reproduction assessments include the continuation of streamside fish exposures to validate previous caged and resident fish evaluations. Similar biological endpoints were analyzed during field based mussel and host fish health and reproductive fitness assessments which were conducted in the summer of 2016. In 2017 laboratory exposures which evaluate the impacts of ecologically relevant chemical mixes on the fitness and reproduction of mussels by studying mussel and fish health and their interactions are planned. In 2017 lake sturgeon streamside rearing facilities will be evaluated to determine if CECs are present and if so what impacts they may cause. Additional 2017 plans include sampling fish eating birds to determine the extent of their CEC exposure.

These investigations will provide information which is currently lacking on how CECs could impact fish and wildlife populations including threatened and endangered species and inform management practices

for the Great Lakes natural resources. The first of several expected USFWS reports resulting from these efforts, “Contaminants of Emerging Concern in the Great Lakes Basin: A Report on Sediment, Water, and Fish Tissue Chemistry Collected in 2010-2012” was completed this winter (https://digitalmedia.fws.gov/cdm/ref/collection/document/id/2181). This report characterizes CECs in environmental and fish tissue samples collected from throughout the Great Lakes Basin including the Detroit River

https://www.fws.gov/midwest/es/ec/Investigations/2011CoEC.html

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Michigan Ecological Services Field Office

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Title
Rouge River Mystery Oil Spill Restoration Projects

SCDRS Initiative Objective(s)
Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS, Adaptively manage invasive plants (e.g., Phragmites, European frogbit) at a system landscape scale

Update
On April 9 and April 12, 2002, a mixture of diesel fuel and used motor oil was discharged from the Baby Creek Outfall into the Rouge River near Dearborn, Michigan. Oil was observed along three miles of the Rouge River from the Dix Street Bridge to the Detroit River and along 17 miles of the Detroit River from its confluence with the Rouge River to western Lake Erie. The Rouge River Mystery Oil Spill Trustees have conducted a Natural Resource Damage Assessment to determine the extent of injuries resulting from the discharge of oil and are seeking compensation in the form of restoration projects. Fifty-six proposed restoration projects were initially evaluated for compensatory restoration. The Trustees chose four projects which best meet restoration criteria under the Oil Pollution Act. A restoration claim has subsequently been prepared for submission to the National Pollution Fund Center.

Trustees are requesting $4.5 million from the NPFC to implement and maintain the following projects: Humbug Marsh/Monguagon Creek Bank Habitat Improvements Humbug Marsh habitat improvements and invasive species control will restore and protect over 100 acres of vital marsh habitats designed to promote wildlife recovery. Rehabilitation and stabilization of 2,200 linear feet of frontage along Monguagon Creek will provide erosion control for the creek and associated wetland habitat, while restoring native riparian forest habitat. This project also includes invasive species management over the 30 year duration of the project. Gibraltar Wetland Restoration This project will provide invasive species management within 70 acres of marsh habitats in the Detroit River International Wildlife Refuge. A hydrology survey will provide managers with the information needed to formulate best management practices of this vital habitat. Invasive species management will occur over the 30 year duration of the project. Great Lakes Marsh Restoration 62 This project will support continued management of invasive plants within 350 acres of emergent marsh and provide invasive species management for an additional 63 acres of coastal marsh edge, Lake Erie shoreline, and interspersed lakeplain prairie habitats. Invasive species management will occur over the 30 year duration of the project. Pointe Mouillee Wetland Restoration This project will enhance, restore, and provide for invasive species management on up to 925

acres of wetlands associated with the Pointe Mouillee State Game area for 30 years. This project will also include the replacement of an aging pump system and repair of hydrologic control structures to more effectively manage water levels, allowing for better management of native plants and control of invasive species.

Additional details can be found in the Rouge River Mystery Oil Spill Final Damage Assessment and Restoration Plan on the Service's website. Restoration is expected to begin by 2018.

http://www.fws.gov/midwest/es/ec/nrda/RougeRiver/

2017 Briefing Update

Agency
U.S. Geological Survey Great Lakes Science Center

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Title
Larval fish studies in the St. Clair-Detroit River System

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase river spawning habitat

Update
Objectives: Assess and measure the community composition, phenology, species abundances, spatial extent, movement, and production of larval fishes in and transported through the system.

Milestones: During 2016, 876 bongo net samples were collected from the Detroit River (DR). To sample lake sturgeon larval drift, 60 D-frame sets and 240 depth-stratified conical sets were fished in the DR near the Grassy Island reef and 70 D-frame sets were fish in the St. Clair River (SCR) in the vicinity of Harts Light and Pointe aux Chenes reefs.

Results Overview: Results below are based on the samples completed, not all larval identifications have not been completed at the time of this update. In the DR bongo samples identified to date, species found include lake whitefish, walleye, yellow perch, Morone spp. (white bass/white perch), suckers, and several native forage fish species, among others. In the DR D-frame samples identified to date, species found include lake sturgeon, mottled and deepwater sculpin, lake whitefish, yellow perch, catostomids, walleye, rainbow smelt, and gobids. Lake sturgeon were collected above and below the Grassy Island reef and in the Trenton Channel. Lake sturgeon were collected in the middle and bottom stratified conical nets. The only species identified from the SCR D-frame samples is lake sturgeon, which was found upstream and downstream of the Harts Light and Pointe aux Chenes reefs.

2017 Plans: Larval sampling will continue in the DR with an emphasis on post-construction assessments of constructed habitats near Belle Isle and Grassy Island reefs. In the DR and river mouth area, intensive bongo collections will occur. Sampling for larval lake sturgeon is scheduled to occur in the DR near Grassy Island and Belle Isle reefs.

2017 Briefing Update

Agency
The Nature Conservancy - Michigan Chapter

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Title
Coastal Resilience Decision Support Tool

SCDRS Initiative Objective(s)
Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS

Update
The Nature Conservancy in Michigan is working with its Coastal Resilience staff to develop the first Great Lakes application on the Conservancy's global CoastalResilience.org mapping platform. The tool will allow a user to select lake level and riparian flood level to display impacts on agricultural fields (acres inundated) and built infrastructure (value of loss, displaced population). The tool will also show Western Lake Erie Coastal Conservation Vision priority areas that may be affected by flooding and water level changes or that could – through planned conservation or restoration – provide options for reducing impacts to other values. The website describing the project is at http://coastalresilience.org/project/western-lake-erie/. The Conservancy expects this will be an important resource for WLE coastal decision makers.

http://coastalresilience.org/project/western-lake-erie/
https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/wholesystems/greatlakes/coasts/wle/Pages/default.aspx

2017 Briefing Update

Agency
The Nature Conservancy

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Title
Detroit River-Western Lake Erie Cooperative Weed Management Area

SCDRS Initiative Objective(s)
Adaptively manage invasive plants (e.g., Phragmites, European frogbit) at a system landscape scale

Update
Detroit River-Western Lake Erie CWMA (Monroe and Wayne counties) was established in 2011 and currently has 16 members from local, state, and federal government, land conservancies, academic institutions, and other entities. The goal of the CWMA is to manage invasive plants (primarily non-native Phragmites) in coastal wetlands from the Detroit River down to the Michigan-Ohio state line (Figure 1). During 2016, partners treated 550 acres of Phragmites, and surveyed 8,831 acres for a suite of 13 invasive plants, which resulted in 3,943 invasive locations for future action. Reports and other information about the DRWLE CWMA are online at http://driwr.emich.edu/driwr/?q=node/3.

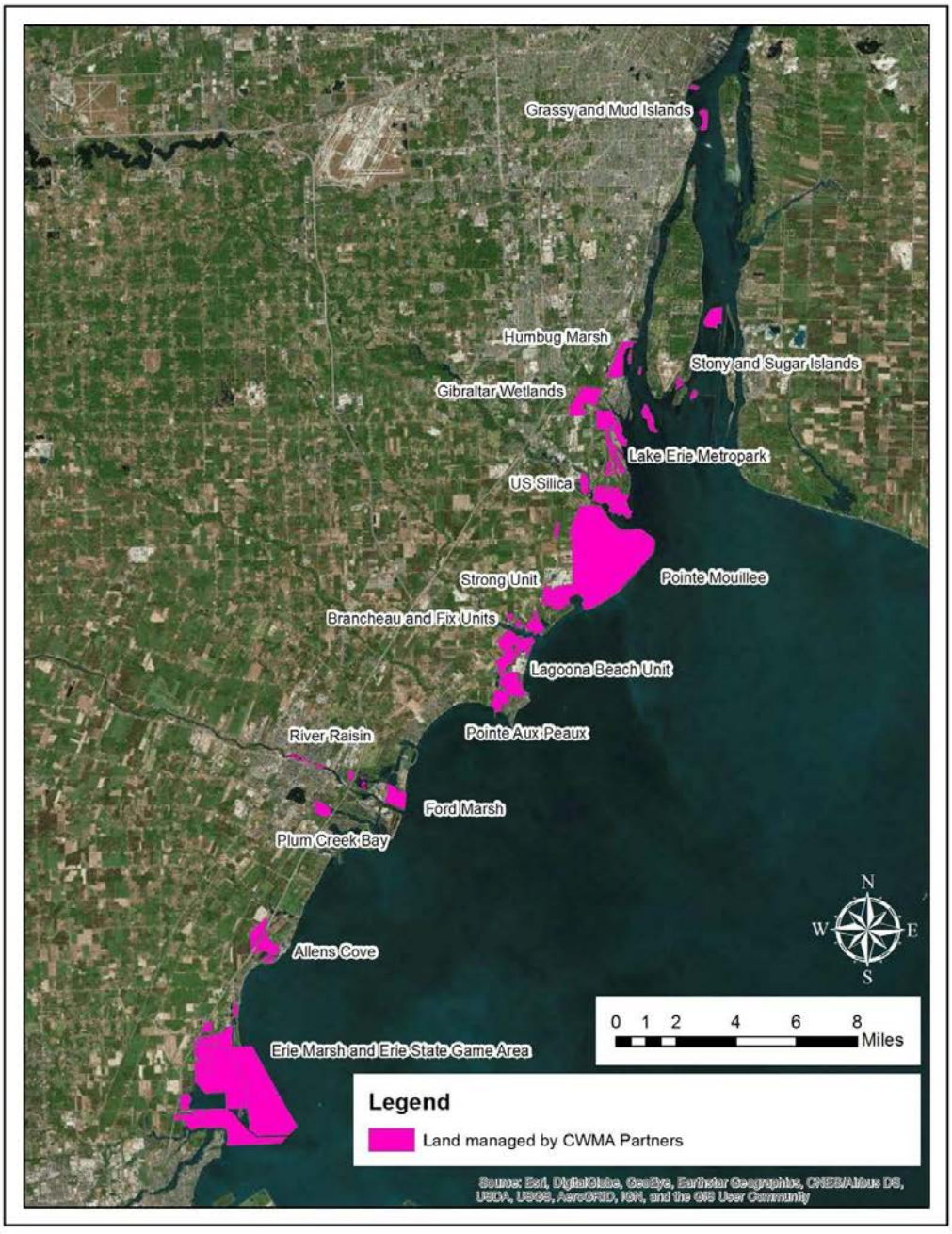

Figure 1. Priority survey and treatment areas for the Detroit River–Western Lake Erie CWMA.

St. Clair - Detroit River System Initiative

2017 Briefing Update

Agency
The Nature Conservancy

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Title
Ecosystem Services Valuation of Coastal Wetlands

SCDRS Initiative Objective(s)
Increase continuous area of functional wetlands and their connectivity to the SCDRS, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs

Update
The Conservancy is involved with partners in the Upper Midwest and Great Lakes Landscape Conservation Cooperative to estimate the value of various ecosystem services provided by coastal wetlands in Saginaw Bay and Western Lake Erie. Data from this project will be incorporated into existing decision support tools to estimate socioeconomic value of wetlands and restoration. Such information can be useful for guiding decisions on a range of topics such as wetlands restoration, recreation access, and protecting communities from storm damage.

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service

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Title
Adult Fish Community Assessments Associated with the Reef Projects in the St. Clair-Detroit River System

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase river spawning habitat

Update
The U.S. Fish and Wildlife Service (Service) has been deploying gill nets to monitor the adult fish community before and after the construction of reefs within the St. Clair-Detroit River System. In 2016, experimental gill nets were fished bi-weekly in the spring and fall at several locations in the St. Clair and Detroit Rivers. Locations in the St. Clair River include: Middle Channel Reef, North Channel Control Site, Hart's Light Reef, and Algonac Reef. Locations in the Detroit River include East Belle Isle Reef, Fort Wayne, Fighting Island Reef, and Grassy Island Reef. Beginning in fall 2014, two minnow traps were attached to the gill nets in an effort to monitor the benthic fish community.

Spring species richness based on gill net catch at the St. Clair River sites in 2016 was highest at Algonac Reef (5), Hart's Light Reef (5), and Middle Channel Reef (5), and with the lowest being North Channel Control Site (4). White sucker were the most common fish captured at Algonac Reef (0.8/hour), Middle Channel Reef (0.23/hour) and the North Channel Control site (0.03/hour), while walleye was the most common at Hart's Light Reef (0.23/hour). Minnow traps captured round goby (0.06/hour) and emerald shiner (0.25/hour) at Hart's Light Reef. Only round goby were captured at Algonac Reef (0.5/hour). Spottail shiner (0.004/hour), round goby (0.01/hour) and logperch (0.01/hour) were captured at the North Channel Control Site (0.004/hour). Round goby (0.02/hour) and logperch (0.004/hour) were captured at Middle Channel Reef and no fish were captured at Hart's Light Reef.

Spring species richness based on gill net catch at the Detroit River sites in 2016 was highest at Belle Isle Reef (10), followed by Fighting Island Reef (9), Grassy Island Reef (6), and Fort Wayne (4). Walleye were the most common species captured at East Belle Isle Reef (0.34/hour), Grassy Island Reef (0.72/hour), and Fort Wayne (0.42/hour), while quillback were the most common species at Fighting Island Reef (0.18/hour). Minnow traps captured round goby at Fort Wayne Reef (0.02/hour) and Fighting Island Reef (0.02/hour). Logperch (0.05/hour) and round goby (0.28/hour) were captured at Belle Isle Reef and no fish were captured at the Grassy Island Reef.

Fall species richness based on gill net catch at the St. Clair River sites in 2016 was highest at the Algonac Reef (4), followed by Hart's Light Reef (3), Middle Channel Reef (3), and North Channel Control (3). Walleye were the most common species captured at Hart's Light Reef (0.29/hour) and Middle Channel Reef (0.12/hour). Minnow traps captured round goby (0.1/hour) and rock bass (0.2/hour) at Algonac Reef. Only round goby were captured at Middle Channel Reef (0.04/hour). Spottail shiner (1.03/hour), round goby (0.03/hour) and bluntnose minnow (0.011/hour) were captured at the North Channel Control site. Only spottail shiners were captured at North Channel Control Site (0.088/hour).

Fall species richness based on gill net catch at the Detroit River sites in 2016 was highest at Fort Wayne Reef (10), followed by Fighting Island Reef (9) and Grassy Island Reef (3). Belle Isle Reef was not sampled due to reef construction taking place. White bass were the most common species captured at Fort Wayne (0.75/hour). While gizzard shad were the most common species at Fighting Island Reef (0.07/hour) and walleye were the most common at Grassy Island Reef (0.08/hour). Minnow traps caught round goby (0.03/hour) and logperch (0.01/hour) at the Grassy Island Reef and smallmouth bass (0.004/hour) at the Fighting Island Reef. No fish were captured at the Fort Wayne Reef and the Belle Isle Reef was not sampled due to reef construction.

Figure 1. USFWS fisheries technician measuring a walleye that was captured in a gill net.

Figure 2. USFWS biologist retrieving a gill net.

Figure 3. USFWS biologist releasing a gizzard shad from a gill net.

Photo credit: USFWS

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Sea Lamprey Control Program

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Title
Sea Lamprey Assessment of the St. Clair- Detroit River System During 2016 and Proposed Action for 2017

SCDRS Initiative Objective(s)
Apply integrated pest management for sea lampreys in the SCDRS

Update
Background:
U.S. Fish and Wildlife Service (FWS) and Department of Fisheries and Oceans, Canada, (DFO) work as agents of the Great Lakes Fishery Commission to deliver integrated control of sea lampreys throughout the Great Lakes. Adult sea lamprey (SL) abundance in Lake Erie has steadily declined since record-high levels were estimated in 2009. However, the 2016 index of adult SL abundance was 4,788, which is well-above the Lake Erie target level of 3,039. These elevated abundances continue to persist despite considerable treatment effort in the past decade, including consecutive treatments of all SL-producing tributaries to Lake Erie during 2008-2010, and in 2013. During 2015, five SL-producing streams were treated in Lake Erie, in addition to two tributaries to Lake St. Clair. Three stream treatments were conducted in Lake Erie during spring 2016. The SCDRS is known to harbor a larval SL population within the confines of the St. Clair River (SCR) as well as in the delta of Lake St. Clair. Previous assessment of this population suggested that density was low, infestation widespread, SL production likely minimal, and that SL mortality during migration through the SCDRS would result in a minimal contribution of parasitic SL to the Lake Erie basin. Because assessment information from other tributaries to Lake Erie could not identify an untreated source of SL production, the control agents intensified assessment effort on the SCDRS during 2011-2014. During 2015 and 2016, a baseline effort of larval surveys was applied along with alternative sampling for outmigrating juvenile SL. Survey findings continue to indicate a significant larval SL population persists in the SCR.

2016 results:
During the 2016 field season, 32 granular Bayluscide (GB) surveys covering 16,000 m² were conducted in the upper river and three main delta channels for the purpose of discovering previously undetected larval hotspots. An additional 16 GB surveys were conducted at index sites (split evenly between upper and lower river) to monitor relative abundance through time. The total catch of 35 SL larvae was scattered throughout the river, and no new high density areas were detected. There were no surveys conducted in the Detroit River during 2016. Based on previous surveys, the Detroit River continues to have no larval

SL production. The second year of a partnership between the DFO and Walpole Island First Nation (WIFN) to collect outmigrating juvenile lampreys continued in November 2016 – January 2017. Volunteers from WIFN monitored floating fyke nets which were affixed to navigational buoys. The netting project resulted in 202 SL juveniles collected along with several Ichthyomyzon juveniles.

Plans for 2017 and beyond:
Sea Lamprey control agents from the FWS and DFO will continue gathering data to prepare for potential SCR plot treatments during 2018. The agents will also continue preparation of information to acquire the appropriate treatment permits, and will revise the SCDRS SL Plan with updated larval, juvenile, and adult population and habitat information. Exploration of alternative SL control methods will continue. Larval assessment efforts in the SCR for 2017 will likely increase beyond baseline levels in order to further refine and delineate potential treatment areas. The partnership between DFO and WIFN to monitor fyke nets in the SCR will continue during winter 2017, with the goal of setting up a long-term index of outmigrating juveniles. The Detroit River will not be surveyed with GB in 2017, but may be surveyed again in 2018.

http://www.glfc.org/sealamp/how.php
http://www.fws.gov/midwest/fisheries/sea-lamprey.html
http://www.dfo-mpo.gc.ca/species-especes/lamprey-lamproie-eng.htm

2017 Briefing Update

Agency
Herpetological Resource and Management

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Title
St. Clair River Shoreline Habitat Restoration Monitoring

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI

Update
Herpetological Resource and Management (HRM) was contracted by the U.S. Geological Survey Great Lakes Science Center to conducted habitat restoration monitoring within portions of the St. Clair River system beginning in 2015. Follow up monitoring was conducted again in 2016 with efforts continuing to focus on the collection of plant, amphibian, reptile, and aquatic macroinvertebrate data to help evaluate the condition of the restoration sites for these target groups. Part of larger scale restoration efforts along the St. Clair River, HRM monitored a total of three locations including Kiefer Park and Blue Water River Walk in Port Huron, and Cottrellville located in Cottrellville Township. Survey crews conducted photographic monitoring, botanical, aquatic macroinvertebrate, and herpetological assessments, as well as wetland assessments using the Michigan Rapid Assessment Method (MiRAM). Two season worth of preliminary post-restoration results have provided a solid baseline of data from which future habitat assessments can be compared to track the progress at each site.

Detectable improvements in site conditions were observed immediately following restoration activities and results from 2016 monitoring demonstrated that habitat is increasing in quality and functionality. Between 2015 and 2016 sampling, scores for the MiRAM assessments increased at each of the three sites with Cottrellville displaying the most significant change. Aquatic macroinvertebrate samples from each project site supported a higher proportion of pollution sensitive species compared to the previous year. No Herpetofauna species have been documented at the Kiefer Park site to date; however, amphibian and reptile diversity increased at both Cottrellville and the Blue Water River Walk.

Several of the metrics used to assess the restorations indicate that these areas support overall lower quality habitat conditions ranking when compared to high quality, undisturbed reference sites. When factoring the historic disturbances and current surrounding land uses of the area, these results are not unexpected and the improvement of every metric between sites and years is highly encouraging. Although restoration measures have already made detectable improvements in ecosystem quality of each project area, wetland restorations typically take several years to approach natural conditions and it is likely that these areas will take additional time to reflect conditions expected from high quality reference

sites. Overall these sites are providing critical habitat for wildlife and have been shown to be of ecological value to several groups of organisms.

www.herprman.com

Figure 1. Eastern Spiny Softshell Turtle observed in 2016 basking on rock structures placed at Cottrellville restoration site. (Photo credit: Herpetological Resource and Management)

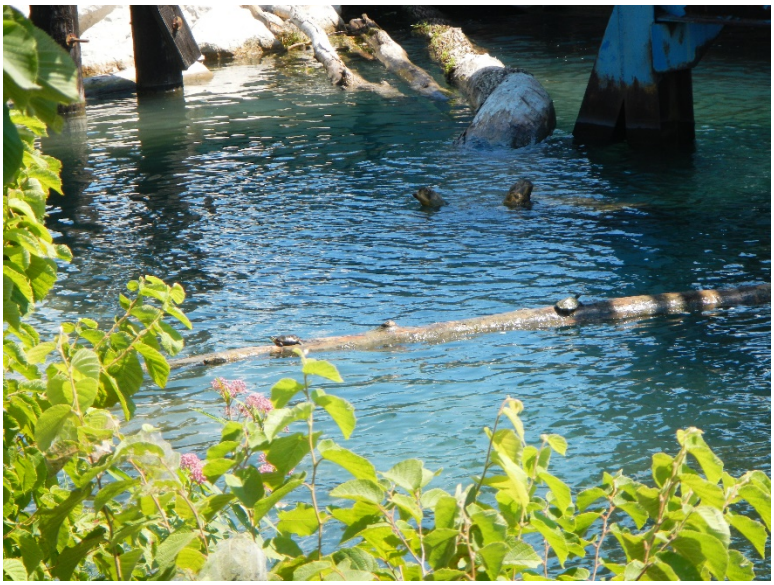

Figure 2. Midland Painted Turtle and Northern Map Turtle observed in 2016 basking in the St. Clair River at the Blue Water River Walk restoration site. (Photo credit: Herpetological Resource and Management)

2017 Briefing Update

Agency
Herpetological Resource and Management

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Title
St. Clair River Coastal Wetland Habitat Restoration Wildlife Monitoring

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI

Update
In 2014, Herpetological Resource and Management (HRM) was contracted by SmithGroup JJR as part of a Great Lakes Restoration Initiative Grant awarded to St. Clair County Parks and Recreation. Beginning in 2015, HRM conducted wildlife monitoring and assisted in habitat restoration design within a portion of the Upper St. Clair River. The project targeted wetland habitat creation and shoreline restoration. Monitoring, which continued into 2016 was focused on several groups of target wildlife taxa including amphibians, reptiles, birds, and aquatic macroinvertebrates.

This project expanded on previous restoration efforts along the Blue Water River Walk in Port Huron and has continued to transform degraded portions of the St. Clair River by improving existing habitat and creating new wetland communities. The site now supports habitat that was previously absent or considerably very limited.

Initial sampling results indicated a relatively low number of herpetofauna, bird, and aquatic macroinvertebrate species. Follow up monitoring in 2016 demonstrated a noticeable increase in diversity and spatial distribution of species, as well as a detectable overall improvement in quality and function of the created and restored habitat. Results from 2016 monitoring have shown an increase in avian richness and the wetlands ponds have supported breeding waterfowl. Macroinvertebrate sampling conducted during follow up monitoring included a substantial increase in the diversity and abundance and included a higher proportion of pollution sensitive species. The number of herpetofauna present within the wetlands increased as well between sampling seasons with 2 species observed in 2015 and 5 in 2016. Amphibians continue to use the ponds for reproduction and breeding. In 2016, Northern Leopard Frogs established and successfully reproduced. This is significant as Northern Leopard Frogs are typically sensitive to disturbed habitats and presence of pollutants.

This project has provided significant wetland habitat, absent for decades within this region. The wetlands formed through this project are likely particularly successful because they were created with separation from the fast flowing St. Clair River to provide areas of refugia and habitat for species with more sensitive

habitat requirements. Achieving long-term restoration success will require efforts focused on maintaining this separation between the different habitat types. The completion of this large scale ecosystem restoration will likely continue to increase the number of wildlife species present as well as increase the species currently present.

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Figure 1. Northern Leopard Frogs were observed for the first time at the coastal wetland site and were documented breeding within the created wetlands. (Photo credit: Herpetological Resource and Management)

Figure 2. Juvenile Midland Painted Turtle observed in 2016 basking on the wetland shoreline. (Photo credit: Herpetological Resource and Management)

2017 Briefing Update

Agency
Herpetological Resource and Management

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Title
Mudpuppy Assessment and Habitat Restoration along the St. Clair-Detroit River System

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI

Update
In 2014, Herpetological Resource and Management in collaboration with Eastern Michigan University was awarded a Great Lakes Fish and Wildlife Restoration Act (GLFWRA) grant to conduct an assessment of Mudpuppy (Necturus maculosus) populations along the St. Clair-Detroit River System (SCDRS). Mudpuppies serve important roles in local ecosystems as indicators of environmental health as well as obligate hosts to the State Endangered Salamander Mussel. This multi-year study was initiated to evaluate Mudpuppy distribution, health, and genetic structure along the SCDRS to determine effects of restoration and habitat fragmentation as well as restore habitat. The project supports a wide range of partners including USGS, USFWS, MDNR, Michigan Sea Grant, Huron-Clinton Metropolitan Authority, Belle Isle Aquarium, and University of Michigan.

During 2016, near shore sampling has been conducted at 31 separate sites with over 187 trap locations. In total, over 9,000 trap hours were recorded. Thus far, monitoring data from 2014 through 2016 has provided insight into the distribution and abundance of Mudpuppies within the SCDRS demonstrating areas of higher density and areas warranting greater attention for the lack of detection including the Huron River. During this round of sampling, utilizing eDNA to determine presence of Mudpuppies in the project area was further tested and water samples from the project area will be analyzed in the near future. Also occurring in 2016, habitat restoration was completed at Lake Erie Metropark.

The project will continue through 2017 with future objectives including additional mapping of Mudpuppy spatial distribution, completion of genetic and eDNA analyses, and targeted monitoring of completed habitat restorations. The project team is actively seeking additional funding to continue this project and further Mudpuppy conservation in the SCDRS.

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Figure 1. HRM team taking measurements from a juvenile Mupduppy captured on Belle Isle in the Detroit River during 2016 sampling. (Photo credit: Herpetological Resource and Management)

Figure 2. As part of monitoring Mudpuppy population health within the SCDRS, captured invididuals are examined for physical abnormalities or injuries, such as this adult captured from the St. Clair River displaying signs of a spinal deformity. (Photo credit: Herpetological Resource and Management)

Figure 3. Adult Mudpuppy observed in 2016 using newly restored habitat at Cottrellville on the St. Clair River. (Photo credit: Herpetological Resource and Management)

2017 Briefing Update

Agency
Michigan Department of Transportation (MDOT), Southeast Michigan Council of Governments (SEMCOG), and Michigan Natural Features Inventory (MNFI)

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Title
I-75 Corridor Conservation Action Plan in Monroe County

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Reduce loading from regulated and unregulated sources of TP/DRP, Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs, Increase hydrological lateral connectivity between main channel habitats (e.g., islands) and shallow water habitat, Adaptively manage invasive plants (e.g., Phragmites, European frogbit) at a system landscape scale, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.)

Update
I-75 in Monroe County will undergo complete reconstruction over a 20-year timeframe. The first five-mile segment began in 2015. The Michigan Department of Transportation (MDOT), in partnership with SEMCOG, the Southeast Michigan Council of Governments, and Michigan Natural Features Inventory (MNFI), a program of Michigan State University Extension, received funding through the Federal Highway Administration's Strategic Highway Research Program (SHRP2) to develop an overarching conservation plan that supports local environmental protection and restoration priorities while implementing the Eco-Logical approach. Eco-Logical is an ecosystem approach to developing infrastructure projects that address ecosystem priorities on a landscape scale during planning. Specifically, this conservation action plan identifies conservation and mitigation opportunities very early in the planning process to support cost and time savings for the long-term reconstruction of I-75.

The conservation planning process has brought various federal, state, and local stakeholders together to look for efficiencies and partnering opportunities. Additionally, local stakeholders helped identify local priorities and provided direction on potential partnership opportunities. Finally, the plan identifies high-impact environmental challenges and specific strategies for partnering agencies and organizations to pursue in the future to achieve long-term success. Conservation targets within the plan include migratory fish, coastal wetlands, coastal tributaries, globally rare natural communities, herpetofauna connectivity, and aerial migrants. Strategies to improve the viability of the targets focus on addressing invasive

species, poorly functioning road stream crossings, urban development and runoff, and agricultural drainage and runoff.

This I-75 Corridor Conservation Action Plan in Monroe County represents a compendium of existing environmental conditions, goals, and strategies for implementation, along with actions that MDOT can pursue through the reconstruction process to enhance strategic environmental outcomes for the region. Just as important, the successful completion of this pilot project in Michigan may be used as a template to integrate environmental planning early in the long-range transportation planning process. This will advance transportation, economic, and ecological outcomes across the entire seven-county SEMCOG region.

Photo credit: Michigan Department of Transportation, 2015.

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Alpena Fish and Wildlife Conservation Office

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Title
U. S. Fish and Wildlife Service Early Detection Monitoring for Non-native Aquatic Species

SCDRS Initiative Objective(s)
Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.)

Update
In keeping with priorities described in the Great Lakes Restoration Initiative Action Plan, the U. S. Fish and Wildlife Service collected field samples in 2013-2016 as part of a new early detection monitoring program focusing on non-native fishes, amphipods and bivalves. In the St. Clair-Detroit River System, collections were made in the Detroit River and Maumee Bay of Lake Erie due to the high risk of first introduction of priority non-native species.

Ichthyoplankton sampling in Maumee Bay occurred at night, in late May and July 2016. A total of 22 bongo net tows in open water areas were completed and eight light traps were deployed in backwater areas and near macrophyte-covered nursery areas. Samples have been taxonomically identified by U.S. Geological Survey staff at the Great Lakes Science Center. Morone species and Gizzard Shad were the most common species caught in bongo nets while Pomoxis species were the most common in light traps.

Juvenile and adult fish sampling occurred during July through October 2016. Sampling in the Detroit River occurred during July-October and Maumee Bay during August-October. A total of 2,928 fish representing 43 species were collected in the Detroit River among all traditional sampling gears (minnow trapping, electrofishing, and paired fyke nets). Minnow trapping (n = 15 sets) resulted in the capture of 304 total fish and nine species. Electrofishing (n = 15 transects) captured 573 fish and 35 species. Paired fyke nets (n = 15 sets) collected 2,051 total fish representing 25 species. In Maumee Bay, 37 species were identified from 6,830 total fishes collected among traditional sampling gears (electrofishing, paired fyke nets, and trawling). Electrofishing (n = 15 transects) captured 726 fish and 22 species. Paired fyke nets (n = 15 sets) collected 3,045 fish representing 30 species. Bottom trawling (n=15 trawls) captured 3,059 fish representing 18 species. Fish were identified to species and released, while some reference species were kept. Fin clips were taken from all Yellow Perch, Walleye, Alewife and Round Goby for genetic verification of field identifications, as some priority non-native fishes (e.g., European Perch, Zander, Caspian Shad, Monkey Goby) are morphologically very similar to these species.

One goal of this project is to estimate, using rarefaction, how much sampling effort and time is required to achieve at least a 95% detection rate of species present at a location using the current suite of sampling gears. In the Detroit River and Maumee Bay for 2013-2016 for all gear types combined, we have reached an estimated 95% and 94% sampling efficiency for juvenile and adult fishes, respectively.

Amphipod traps and Hester-Dendy colonization samplers were used in late May and July and August – October, respectively, in 2016 in Maumee Bay. This represents year four of the benthic monitoring portion of the early detection monitoring program. A total of 21 amphipod traps were set overnight with 9 of them being lighted. Five gangs of Hester-Dendy colonization samplers were set for 53 days each. Benthos samples are currently in the process of being identified by Badger Technical in Duluth, MN.

U.S. Fish and Wildlife Service early detection monitoring activities were conducted in cooperation with the USEPA, U.S. Geological Survey, Ohio and Michigan departments of natural resources, Ontario Ministry of Natural Resources and Forestry, and the University of Toledo.

http://www.fws.gov/midwest/alpena/programs.html

Figure 1. Jessica Loughner and Janine Lajavic of the Alpena FWCO - Waterford Substation hold Spotted Suckers caught in a paired fyke net in the Detroit River. (Photo credit: Paige Wigren, USFWS)

Figure 2. Jessica Loughner of the Alpena FWCO - Waterford Substation scrapes organisms and organic matter off of a Hester-Dendy trap that was set in Maumee Bay, Lake Erie. (Photo credit: Andrew Briggs, USFWS)

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Alpena FWCO- Waterford Substation

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Title
2017 SCDRS Juvenile Lake Sturgeon Update

SCDRS Initiative Objective(s)
Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs, Increase hydrological lateral connectivity between main channel habitats (e.g., islands) and shallow water habitat

Update
Update: The U.S. Fish and Wildlife Service (Service) has been conducting juvenile lake sturgeon assessments in the St. Clair-Detroit River System (SCDRS) since 2010 to evaluate habitat restoration efforts and gain better understanding of juvenile distribution and abundance in the system. In past years, juvenile lake sturgeon have been targeted using otter trawls (4.9 and 6.1 m head rope; 3 mm and 32 mm cod end, respectively) and monofilament gill nets (small mesh nets - 25, 38 and 51 mm mesh, 91 m in length; basin wide nets - 114, 203, and 254 mm mesh, 305 m in length). In 2015, the Service set experimental multifilament gill nets (mesh ranging from 76 to 152 mm, 107 m in length) in western Lake Erie to target juvenile lake sturgeon and in the Detroit and St. Clair Rivers at locations where juvenile lake sturgeon have been captured historically.

Despite high sampling effort, catches from bottom trawls and small mesh monofilament gill nets were low with six young-of-year and six juvenile sturgeon captured prior to 2015. In 2015, small mesh monofilament nets captured one juvenile lake sturgeon (72 net sets, 1,625 hours of effort), whereas multifilament gill nets captured five juvenile lake sturgeon (24 sets, 552 hours of effort).

As a result of higher catch rates in 2015 using the multifilament nets, effort using this gear type was increased in 2016. Forty-two (941 hours of effort) experimental multifilament gill nets were set in western Lake Erie to target juvenile lake sturgeon. Nets were set between September 13th and October 27th, when water temperatures were between 10.5°C and 22.5°C. Four juvenile lake sturgeon (619-754 mm) were captured. All four fish were captured on September 13th when water temperatures were approximately 22°C. Three individuals were captured in 127 mm mesh, and one individual was captured in 101.6 mm mesh.

In 2015 and 2016, nine juvenile lake sturgeon (574-890 mm) have been captured in 66 experimental

multifilament net sets (1493 hours of effort) for a CPUE of 6.02 fish per 1,000 net hours. Compared to the CPUE of juvenile lake sturgeon in captured in small mesh monofilament nets in 2015 of 0.61 fish per 1,000 net hours. Given the relative success of the experimental multifilament gill nets, the Service will continue to use experimental multifilament gill nets in 2017. In addition, we caught one juvenile lake sturgeon (774 mm) on our 1/0 hooks in the Detroit River during our spring setline survey.

2017 Field Plans: The Service plans to further refine juvenile lake sturgeon assessments in the summer and fall of 2017. Juvenile lake sturgeon will be targeted in western Lake Erie and Maumee Bay August – October using experimental multifilament gill nets. In addition, habitat attributes will assessed through the collection of various water chemistry and physical habitat parameters including substrate, water flow, water temperatures, dissolved oxygen, etc.

Assessments conducted in cooperation with: Michigan DNR, University of Michigan, Ontario Ministry of Natural Resources, and U.S. Geological Survey

2017 Briefing Update

Agency
U.S. Fish and Wildlife Service Alpena FWCO- Waterford Substation

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Title
2017 Adult Lake Sturgeon Setline Assessments

SCDRS Initiative Objective(s)
Increase river spawning habitat, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs

Update
Detroit River Update: The U.S. Fish and Wildlife Service (Service) has been conducting setline assessments in the Detroit River annually since 2002 to obtain information on adult and subadult lake sturgeon. This data is used to obtain growth information, genetics, distribution, potential spawning sites, and population demographic information. To date, the Service has tagged 436 lake sturgeon in the Detroit River. Using mark-recapture data, the estimated population size of adult and subadult lake sturgeon in the Detroit River is approximately 6,380 individuals. In the spring of 2016, 78 lake sturgeon were captured during setline assessments including four recaptures. Since 2012, 76 lake sturgeon captured in the Detroit River have received transmitters as part of a larger project funded by the Great Lakes Fishery Trust to monitor movement throughout the St. Clair-Detroit River System, though no additional fish were implanted with transmitters in 2016.

Southern Lake Huron Update: Beginning in 2012 the Service began deploying setlines in the upper St. Clair River and southern Lake Huron near Port Huron to collect lake sturgeon as part of the Great Lakes Fishery Trust lake sturgeon movement project. Since 2012, 307 lake sturgeon have been captured and tagged during these assessments with 75 being captured in 2016 including 11 recaptures. In 2014, the Service began to tag lake sturgeon captured as bycatch in the commercial trap nets of Purdy Fisheries, LTD. To date, 276 lake sturgeon have been tagged and/or checked for tags as part of this project (106 in 2016). Based on mark-recapture data collected since 2012, the population estimate of lake sturgeon in the upper St. Clair River/southern Lake Huron is 14,791 individuals. Since 2012, 120 lake sturgeon captured in southern Lake Huron have received transmitters as part of the Great Lakes Fishery Trust funded lake sturgeon movement project, though no additional fish were tagged with transmitters in 2016.

Ultrasound: An ultrasound unit was purchased by the Service in 2012 to evaluate the utility of this gear to determine sex and maturity status of lake sturgeon in the field. The Great Lakes Fishery Trust Lake Sturgeon movement project provided the opportunity to test the ultrasound on fish of known sex since a small incision would be needed to insert transmitters. In 2016, ultrasound images were taken of 200 lake

sturgeon. Since 2012, ultrasound images have been collected from 645 adult lake sturgeon in the St. Clair-Detroit River System (Chiotti et al. 2016).

2017 Field Plans:
The Service plans to continue lake sturgeon mark-recapture assessments in the Detroit River and southern Lake Huron to provide information regarding lake sturgeon demographics.

This work is conducted in cooperation with: US Geological Survey Great Lakes Science Center, Michigan Department of Natural Resources, Great Lakes Fishery Commission, and Ontario Ministry of Natural Resources and Forestry.

2017 Briefing Update

Agency
Friends of the Detroit River

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Title
Lake Okonoka Restoration with River Connection and Shoreline Restoration

SCDRS Initiative Objective(s)
Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS, Increase river spawning habitat, Identify and protect critical habitat areas for rare species, including river mouth habitats & connectivity within tribs, Increase hydrological lateral connectivity between main channel habitats (e.g., islands) and shallow water habitat

Update
Belle Isle is positioned at the “gateway” to the Detroit River. This project will make advancements in reconnecting Belle Isle’s internal waterways to the river and restoring the wet-mesic flatwoods forest to enhance habitat for a great diversity of animal and plant species. A hydrology analysis/pre-design could lead to habitat restoration of 286 acres for fish and wildlife within a dense urban area. Tasks include: 1.) A hydrologic assessment and pre-design of Belle Isle’s interconnected lakes / canals and 200-acre wet-mesic flatwoods forest. 2.) Design and engineering for improving the hydrologic function of Lake Okonoka by enhancing connectivity with the Blue Heron Lagoon and Detroit River coupled with habitat enhancements along Belle Isle’s south shore adjacent to the South Fishing Pier – through permitting. The project is necessary for removal of the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations Beneficial Use Impairments in the Detroit River Area of Concern.

In 2014, NOAA awarded a GLRI grant to Friends of the Detroit River (FDR) to complete this project. The hydrology/pre-design work was completed in 2015. SmithGroupJJR published a final report that documents the analysis work and outlines conceptual recommendations for restoration strategies in October of 2016. Design and engineering for improving Lake Okonoka’s hydrologic connectivity to the Blue Heron Lagoon, along with making a new connection from the lake to the Detroit river, and making habitat enhancements along the isle’s south shore was completed in June of 2016, and a joint permit application was submitted to the MDEQ and USACE. A permit was issued by MDEQ in September of 2016. The USACE permit is still under review, although it is anticipated soon.

In 2015, NOAA awarded FDR with funding to complete final engineering for the bridge and culvert structures associated with Lake Okonoka’s connections to the Blue Heron Lagoon and the Detroit River,

which require the seal of a professional engineer certified by MDOT for bridge and culvert design. Bidding documents are being completed with this funding as well in anticipation of soliciting to contractors during the summer of 2017. Funding from NOAA is secured to construct the project, which will likely begin in the fall of 2017.

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Figure 1. Lake Okonoka habitat restoration project master plan. (Credit: SmithGroup JJR)

Figure 2. Aerial view of Belle Isle, looking downstream. (Photo credit: Friends of the Detroit River)

2017 Briefing Update

Agency
Michigan Departmtent of Natural Resources Lake St. Clair Fisheries Research Station

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Title
Assessment Program Summary for 2016 – Lake St. Clair Fisheries Research Station (LSCFRS)

Update
Most assessment activity scheduled for LSCFRS staff in 2016 was completed. A brief description of individual surveys follows.
1. Lake St. Clair fish community trap net survey – This survey consists of small mesh trap nets fished from late April through mid-May at 4 sites in Anchor Bay, Lake St. Clair. The principal species typically captured include smallmouth bass, rock bass, channel catfish, northern pike, muskellunge, white bass, white perch, yellow perch, freshwater drum, and various species of suckers. This survey was not completed in 2016 due to the R/V Channel Cat being in dry dock for repower.
2. Lake St. Clair fish community trawl survey – This survey includes 10m headrope bottom trawling in Anchor Bay, Lake St. Clair during late May and early September. Total effort ranges from 6 to 16 trawl tows per year. This gear is most efficient at capturing small fish and provides an index of abundance for many of the forage species. The September trawls also provide an index of year-class strength for yellow perch and smallmouth bass as age 0 fish each year. The late May survey was not completed in 2016 due to the R/V Channel Cat being in dry dock for repower.
3. St. Clair River sturgeon setline survey – The sturgeon setline survey has been conducted annually since 1997, except for 2003. This survey is conducted each year beginning in late May and continuing for 3 or 4 weeks. The survey gear includes 8 setlines (each with 25 hooks) baited with round gobies. Annual effort typically ranges from 80 to 100 overnight sets. Two hook sizes have been used to sample a broader size range of lake sturgeon. This survey is the principal source of mark-recapture data used in estimating the abundance of lake sturgeon in the St. Clair River. Minnow traps baited with earthworms were found to be productive for documenting presence of northern madtom when fished on the setlines in 2016.
4. Lake Erie fish community trawl survey – This was the 3rd year of a new that survey includes 10m headrope bottom trawling in the Michigan waters of Western Lake Erie during early to mid-August. Total effort is expected to approach 8-10 trawl tows per year and index and randomly selected survey grids previously sampled by the USGS. This gear is most efficient at capturing small fish and provides an index of abundance for many forage species as well as age 0 yellow perch and walleye.
5. Lake Erie walleye fall gill net survey – This survey consists of 1300' experimental multifilament gill nets fished overnight at 2 index locations twice during early October in Michigan waters of Lake Erie. The gill net gangs are canned on 6' strings to sample the upper portion of the water column. Walleye are generally the dominant species in the catch, but gizzard shad, white perch, and white bass, are also caught in substantial numbers. This survey provides an annual index of abundance by year-class for

walleye in the Michigan waters of Lake Erie and is also used in estimating walleye abundance for interagency quota allocation purposes. In 2016, yearling walleye catch rates were the highest observed since 1986.

6. Reef sonar surveys – This work consists of side-scan and single-beam sonar surveys at artificial reefs constructed in the SCDRS to annually document reef conditions. Side scan surveys were completed at the Middle Channel, Point Aux Chene, Harts Light, Grassy Island, and Fighting Island reef sites in 2016.

7. Cormorant nest survey – LSCFRS staff have conducted visual counts of cormorant nests by boat on Lake St. Clair on an intermittent basis beginning in 2004. Nests have only been documented on the navigational structures along the shipping channel near the head of the Detroit River. No cormorant nests in trees or on the ground have been observed around LSC or in the St. Clair River delta. This is a one-day survey with the small vessel. In 2016, 6 navigation structures combined for a total of 180 nests, a 34 nest increase from the 2015 survey total.

http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_10951_11304---,00.html

2017 Briefing Update

Agency
U.S. Geological Survey Great Lakes Science Center

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Title
Zooplankton Surveys in the St. Clair-Detroit River System

SCDRS Initiative Objective(s)
Increase river spawning habitat

Update
Zooplankton collections of the St Clair-Detroit River System in 2016 were reserved to intensive sampling of the western basin of Lake Erie in collaboration with Michigan State University. This effort will continue to provide linkages between larval fish and lower trophic levels of the system. Samples from the comprehensive 2015 field season are near completed and are undergoing analysis. This dataset will be combined with previous intensive monitoring years for a baseline of crustacean zooplankton within the St. Clair-Detroit River System following other monitoring and restoration efforts. A collaborative project with Central Michigan University also began this past year to compare larval fish diets with available zooplankton to determine diet selectivity within the system. A partnership with the University of Windsor and Environment Canada included the assessment of nearshore zooplankton composition and abundances in the Detroit River. While providing important delisting information for the Canadian Section of the Detroit River Area of Concern, comparison of these samples to GLSC collected samples gives insight into nearshore to offshore zooplankton dynamics within a riverine system.

2017 Briefing Update

Agency
Wayne State University, Healthy Urban Waters

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Title
Healthy Urban Waters

SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP, Identify contaminants of concern (e.g. pharmaceuticals and personal care products, microplastics) determine sources, and develop load reduction strategies, Reduce biological contamination (e.coli, pathogens, virus impacts on wildlife), Reduce loadings from legacy contaminant sources (including groundwater at known locations in DR), Adaptively manage invasive plants (e.g., Phragmites, European frogbit) at a system landscape scale

Update
Researchers from the Wayne State University Healthy Urban Waters (HUW) Program have continued their research, education, and outreach activities within the Huron to Erie corridor. Most activities were focused at one of the three field stations at: Belle Isle, Lake St. Clair Metropark (LSCMP),and the Great Lakes Water Authority Water Works Park (WWP) drinking water pilot plant.
Examples of HUW projects in 2016 include:
• Drinking Water Intake Monitoring – Redesign and implementation of the data platform for the suite of intakes along the Huron-Erie corridor. Partners include the Michigan Office of the Great Lakes, SEMCOG, and the municipal water utilities. HUW worked with OGL and SEMCOG to create a strategic plan for future improvements to this drinking water monitoring system.
• Nearshore Microbial Communities - The LSCMP laboratory investigates methods for rapid nearshore aquatic microbe DNA detection through quantitative polymerase chain reaction (qPCR) procedures. These technological advances positively impact public safety and economic activity through timely detection of indicator bacteria and the avoidance of unnecessary and costly beach closures. HUW is working with Oakland University on this project.
• Green Infrastructure – HUW researchers and staff are working with various green infrastructure implementation groups throughout the metro Detroit region. Specific designs for reduction in extent of urban flooding and CSO discharges.
• Invasive Species Research - Researchers have evaluated and improved detection/treatment systems for a major source of aquatic invasive species, ship ballast water, and are developing and testing related automated technology.
• Water Infrastructure Modeling – Several tools developed by HUW researchers are being piloted at water utilities in the metro Detroit region, and throughout the Great Lakes basin, for the optimization of water transmission and distribution for multi-objective goals – including cost, energy consumption, and

environmental pollutants.
• Erie Hack – Collaborating with TechTown and Cleveland Water Alliance in the delivery of the Detroit Erie Hack challenge, which seeks to engage a wide range of participants in the development of tools to address the most compelling challenges within the Lake Erie western basin.
• Water@Wayne – hosting this popular seminar series at WSU, which brings in local and national speakers on current topics of water resources concern.

https://uwerg.wayne.edu/

2017 Briefing Update

Agency
US EPA ORD Mid-Continent Ecology Division

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Title
NCCA Great Lakes Connecting Channels Assessments

SCDRS Initiative Objective(s)
Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.)

Update
The EPA Office of Water's National Aquatic Resources Surveys assess wetlands, lakes, rivers, and coastal areas (including the Great Lakes) on 5-year cycles to help satisfy the reporting and anti-degradation provisions of the Clean Water Act. Measuring extant conditions is a prerequisite for measuring change in conditions. Surveys are challenged to adequately sample small areas of poor conditions as targets for remediation and good conditions as targets for protection. In 2010, the National Coastal Condition Assessment (NCCA) found the majority of the coastal Great Lakes (as % area) to be in "good" condition for water (60%) and sediment quality (51%) (https://www.epa.gov/national-aquatic-resource-surveys/national-coastal-condition-assessment-2010-great-lakes-technical). As part of the 2014 Lake Erie CSMI field year, the EPA's Great Lakes National Program Office, working with the Office of Research and Development, began pilot research to integrate connecting channels into the NCCA. The Huron-Erie corridor (HEC; 2014, 2015; Fig. 1) and St. Marys River (2015, 2016) were sampled using probabilistic designs and NCCA protocols.

Water, sediment, and benthic quality data from the 2014 HEC survey were compared to 2010 NCCA data from the adjacent Great Lakes. HEC water quality rated as "good" (as % area) was 18% using Lake Huron thresholds and 73% using western Lake Erie thresholds. The sediment quality index (sediment chemistry + toxicity) was estimated to be 49% good, which was intermediate to the adjacent lakes. Rocky bottoms and swift currents meant that 6% of the HEC area could not be assessed. While this was less than the 22-25% of Great Lakes nearshore area left unassessed in 2010, sediment, benthos, and fish sampling success represents an ongoing challenge for connecting channels assessments.

The survey design allowed separate estimation of conditions in the Detroit River. The sediment quality index estimated river area as 12% good, 63% fair, 7% poor, and 18% missing (unassessed; Fig. 2). A comparison between survey results and data from the Detroit River Sediment Characterization Project (SCDRS Initiative 2015 update) found similar spatial patterns of good sediment quality within the river channel and upstream of Detroit. Fair conditions were more common downstream of Detroit. While

targeted sampling focused on areas of suspected contamination, the system-wide survey showed that these areas represented only a small portion of the total river area. However, the survey clearly underestimated the extent of poor conditions compared to targeted data. This may improve when 2015 data become available. Both the population-based estimates and site-based spatial patterns were consistent with the river's situation within a highly urbanized region. Overall, NCCA's probabilistic design allows us to evaluate the entire Detroit River and HEC system providing valuable context for management decisions. Results from the 2014-2015 HEC and 2015-2016 St. Marys River assessments will be included in the 2015 NCCA reports.

https://www.epa.gov/national-aquatic-resource-surveys/ncca

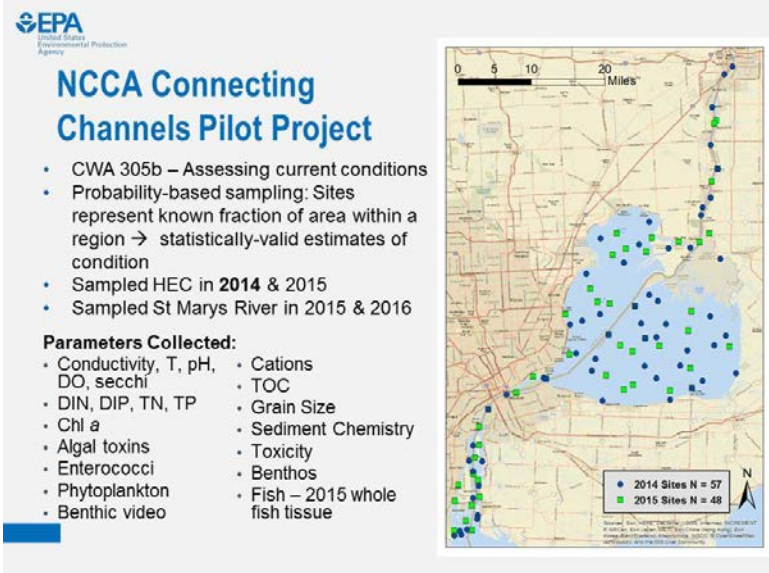

Figure 1: This map shows the sites assessed in 2014 (blue circles) and in 2015 (green squares) in the Huron-Erie Corridor. Using this design, subpopulations including waterbody and country can also be assessed individually.

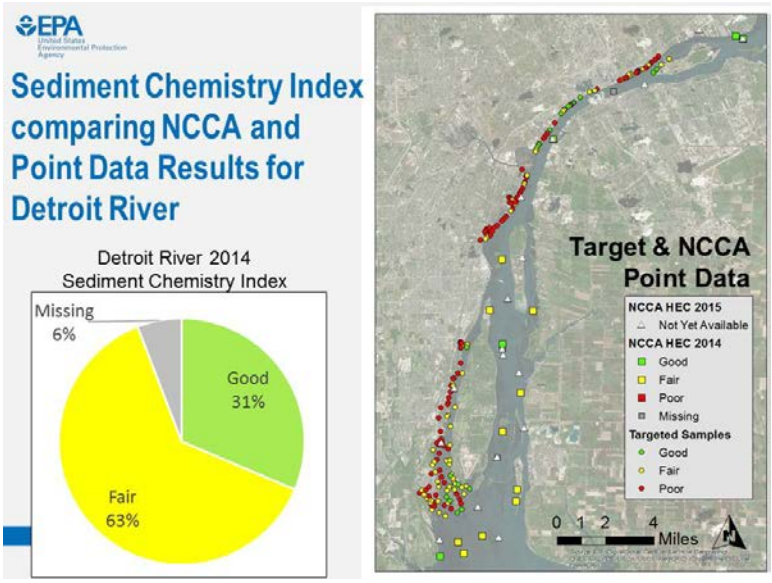

Figure 2: The 2014 NCCA sediment chemistry index point data for the Detroit River subpopulation were compared to targeted sampling for conducted in the Area of Concern to characterize sediment remediation needs. The results of the Detroit River sediment chemistry index population estimate indicated no portion of the system was in poor condition, missing the poor conditions identified through targeted sampling.

2017 Briefing Update

Agency
Detroit River Canadian Cleanup, Environment and Climate Change Canada; Ontario Ministry of the Environment and Climate Change

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Title
Update on BUI Status and Planned Activities for the Detroit River AOC (Canadian side)

SCDRS Initiative Objective(s)
Remove contaminated sediments to remove degradation of benthos BUI, Complete remedial actions to remove fish tumors and other deformities BUI, Complete remedial actions to remove restrictions on fish and wildlife consumption BUI, Complete remedial actions to remove bird or animal deformities or other reproductive problems BUI, Complete habitat improvement projects to remove loss of fish and wildlife habitat BUI, Integrated landscape contaminant source assessment, Increase riparian complexity/connectivity through increased softened shorelines and native riparian veg., Increase continuous area of functional wetlands and their connectivity to the SCDRS, Increase river spawning habitat

Update
The Detroit River Canadian Cleanup (DRCC) implements the Canadian Remedial Action Plan on behalf of a partnership between federal, provincial and municipal government, local industries, scientific researchers, and local environmental organizations. Environment and Climate Change Canada (ECCC), the Ontario Ministry of the Environment and Climate Change (MOECC) and other agency partners supporting the RAP for the Detroit River continue to focus scientific research and monitoring efforts to inform and restore the remaining seven BUIs. They include restrictions on fish and wildlife consumption, degradation of fish and wildlife populations, fish tumours or other deformities, bird and animal deformities or reproductive problems, degradation of benthos, restrictions on dredging activities, and loss of fish and wildlife habitat.

Remedial actions led to the re-designation of two BUIs in 2016: beach closings, and degradation of aesthetics. The information presented below provides a brief summary of progress to date and future actions for the remaining BUIs.

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BUI	RAP Stage 1 – 1991 Status	RAP Stage 2 - 2010 Status	Current 2017 Status	Progress and Accomplishments
Restrictions on Fish and Wildlife Consumption (BUI 1)	Impaired for Fish	Impaired for Fish	Impaired for Fish	- In 2015 & 2016, GLIER undertook a statistical assessment of tissue residues in MOECC sport fish & indicator fish with focus on PCBs and mercury as priority pollutants. Additional fish were collected in 2016 for this assessment - GLIER and University of Michigan conducted mercury isotope analysis, to "fingerprint" sediment mercury sources. - GLIER has been synthesizing and analyzing geospatial data in order to develop new probabilistic models. A geodatabase was developed to populate, store, query, share, and view BUI related data.
Tainting of Fish and Wildlife Flavour (BUI 2)	Not Impaired	Requires Further Assessment	Not Impaired (2014)	- A survey conducted on both the Canadian and American sides of the Detroit River showed that over 95% of anglers that eat Detroit River fish report that it tastes and smells good.
Degraded Fish and Wildlife Populations (BUI 3)	Impaired	Impaired	Impaired	- A number of reports have been published that provide results on population dynamics of waterfowl, marsh birds, and fish; Criteria for this BUI is being refined.
Fish Tumours or Other Deformities (BUI 4)	Impaired	Impaired	Impaired	- ECCC collected an additional 35 Brown Bullhead from the Lower Detroit River for liver tumour to add to previous samples (total of ~100 samples). Analysis underway.
Bird or Animal Deformities or Reproductive Problems (BUI 5)	Not Impaired	Impaired	Impaired	- ECCC erected 25 Tree Swallow nest boxes at four locations & data collected on reproductive success and contaminants in eggs including PCBs, mercury, and PBDEs - Reproductive health and development of Snapping Turtles was monitored in the Canadian Detroit River AOC in 2001/02, 2014, 2015 and 2016. - Colonial nesting bird trend data being collected and examined for this BUI as well (Herring Gulls, Coromorants).
Degradation of Benthos (BUI 6)	Impaired	Impaired	Impaired	- Currently examining several lines of evidence to evaluate biomagnification potential, sediment toxicity, and benthic community structure. A draft status assessment for this BUI is currently under review.
Restrictions on Dredging Activities (BUI 7)	Impaired	Impaired	Impaired	- A draft status assessment report is under review and recommends re-designation to 'not impaired'.
Eutrophication or Undesirable Algae (BUI 8)	Not Impaired	Not Impaired	Not Impaired	

Restrictions on Drinking Water Consumption or Taste and Odour Problems (BUI 9)	Impaired	Not Impaired (2009)	Not Impaired	
Beach Closings (BUI 10)	Impaired	Impaired	Not Impaired (2016)	- Significant upgrades to wastewater treatment plants along the river and the installation of the Windsor Retention Treatment Basin led to a decrease of E. coli levels at Detroit River beaches. This BUI was re-designated in 2016.
Degradation of Aesthetics (BUI 11)	Impaired	Impaired	Not Impaired (2016)	- Visual surveys were conducted at 11 sites along the Canadian shoreline from 2011 to 2013 for presence/absence of variables that may indicate local pollution problems (e.g., colour, odour, debris). The results indicated that there was no significant, persistent degradation of aesthetics on the Canadian side of the Detroit River. This BUI was re-designated in 2016.
Added Costs to Agriculture or Industry (BUI 12)	Not Impaired	Not Impaired	Not Impaired	
Degradation of Phytoplankton and Zooplankton (BUI 13)	Not Impaired	Requires Further Assessment	Requires Further Assessment	- Zooplankton samples from DR were analyzed in 2016. An assessment of this BUI is underway.
Loss of Fish and Wildlife Habitat (BUI 14)	Impaired	Impaired	Impaired	- In 2016, the feasibility of several proposed fish habitat restoration projects was examined. This study will provide opportunities for restoration actions and form part of a long-term plan for Fish & Wildlife Management in the AOC beyond delisting. - Since 2000, over 350 hectares of terrestrial habitat and 8.5 hectares of wetlands have been restored in the AOC. 8 shoreline projects have been completed as well as an assessment of shoreline condition for the length of the river. Sturgeon reef construction and expansion at Fighting Island have been completed.

2017 Briefing Update

Agency

University of Toledo and NOAA PMEL (Pacific Marine Environmental Lab), Great Lakes Genetics Lab (UT) now G3 (Genetics and Genomics Group) at NOAA PMEL

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Title

Metabarcoding Assays to Identify Invasive Mollusk Species from Environmental DNA Samples

SCDRS Initiative Objective(s)

Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.), Develop integrated pest management for established AIS (e.g., common carp, Dresseinid mussels, gobies, grass carp)

Update

Describing and monitoring biodiversity comprise integral parts of ecosystem management. Recent research coupling metabarcoding and environmental DNA (eDNA) indicates that these methods can serve as important tools for surveying biodiversity, significantly decreasing the time, expense and resources spent on traditional survey methods. The literature emphasizes the importance of genetic marker development, as the markers dictate the applicability, sensitivity and resolution ability of an eDNA assay. The present study developed two metabarcoding eDNA assays using the mtDNA 16S RNA gene with Illumina MiSeq platform to detect invertebrate fauna in the Laurentian Great Lakes and surrounding waterways, with a focus for use on invasive bivalve and gastropod species monitoring. One assay is a general mollusk assay and the other is specific to species within the Sphaeridae family (i.e., pea clams). Although focused was on the detection of invasive mollusks, these assays will identify native and non-native species. We tested our assays with mock community samples designed in the lab, as well as with samples taken from lab aquaria and samples from the Maumee River in coordination with Ohio EPA's samplings of fishes and macroinvertebrates.We employed careful primer design and in vitro testing with mock communities to assess ability of the markers to amplify and sequence targeted species DNA, while retaining rank abundance information. In our mock communities, read abundances reflected the initial input abundance, with regressions having significant slopes ($p < 0.05$) and high coefficients of determination ($R2$) for all comparisons. Tests on field environmental samples revealed similar ability of our markers to measure relative abundance. Due to the limited reference sequence data available for these invertebrate species, care must be taken when analyzing results and identifying sequence reads to species level. These markers extend eDNA metabarcoding research for molluscs and appear relevant to other invertebrate taxa, such as rotifers and bryozoans. Furthermore this sphaerid mussel assay is group specific, exclusively amplifying bivalves in the Spaheridae family and providing species-level identification. Our assays provide useful tools for managers and conservation scientists, facilitating early

detection of invasive species as well as understanding of local mollusc species diversity. (Manuscript from this study is in review as Klymus, Marshall, and Stepien).

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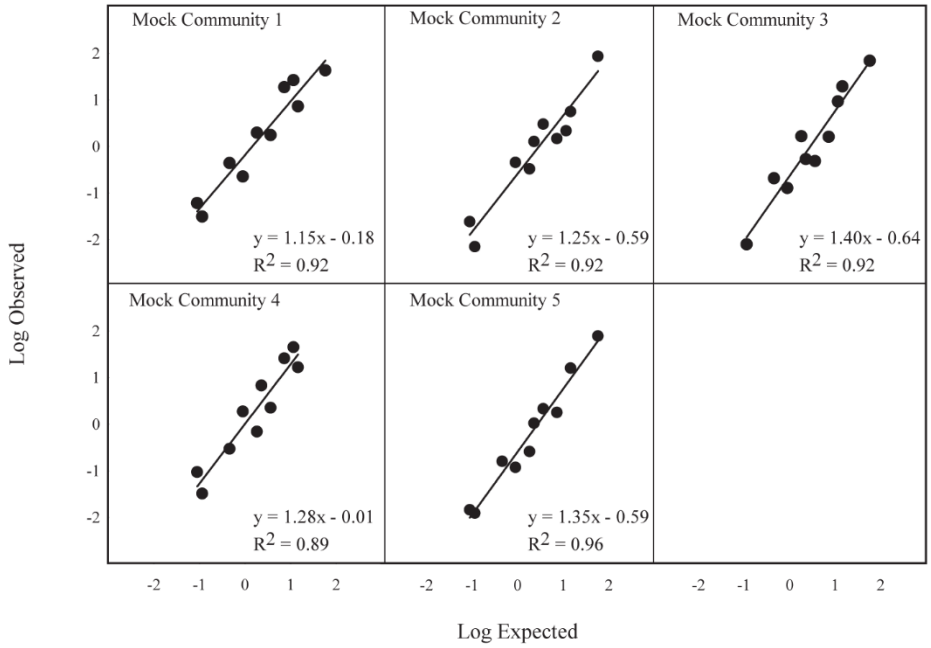

Figure 1. Regressions of log 10 transformed observed read percentages versus log 10 transformed expected read percentages for each of the five mock communities run with our mollusk assay.

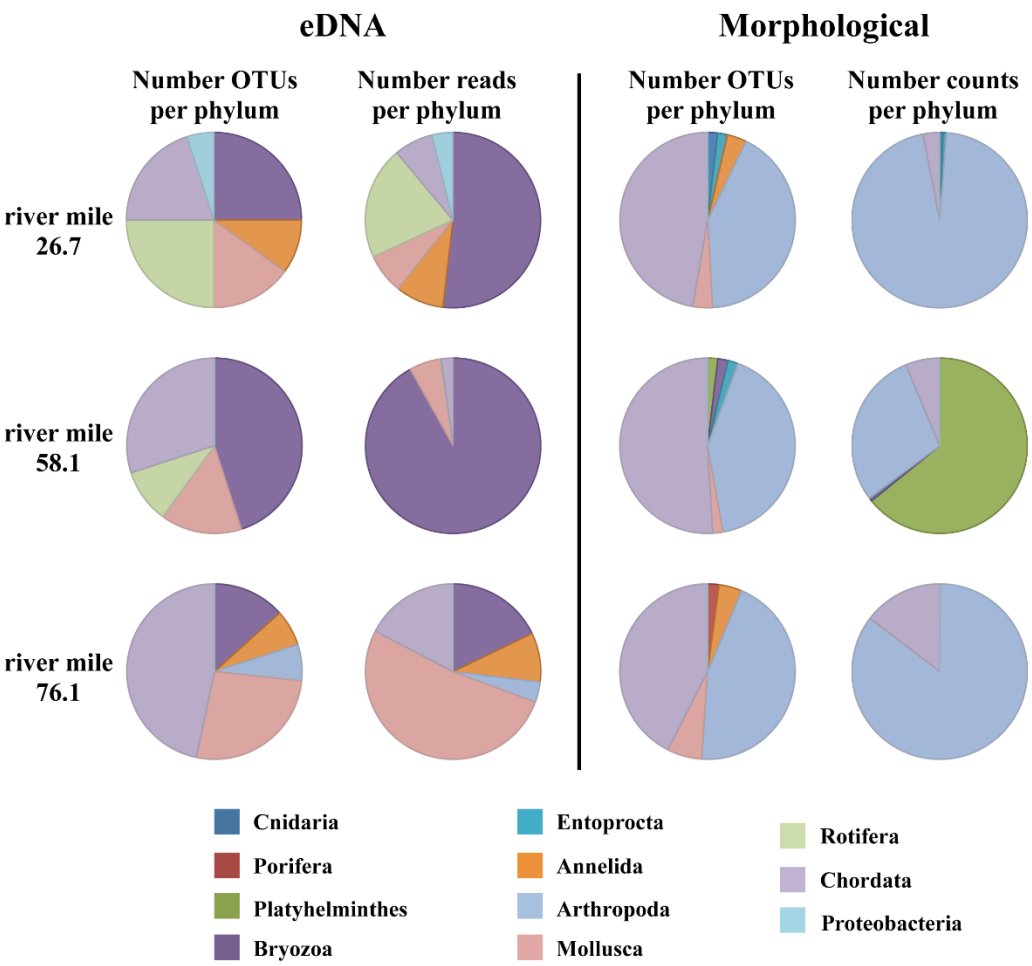

Figure 2. Pie charts comparing the molecular and morphological/ visual species identification methods from three different water samples taken on the Maumee River.

2017 Briefing Update

Agency

University of Toledo and NOAA Pacific Marine Environmental Lab (PMEL), Great Lakes Genetics/Genomics Lab (UT Dept. Env. Sci), G3 Lab (Genetics & Genomics Group, NOAA PMEL)

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Title

High-Throughput Sequencing Assays to Simultaneously Identify and Assess Fish and Mollusk Communities from Environmental Samples

SCDRS Initiative Objective(s)

Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.), Develop integrated pest management for established AIS (e.g., common carp, Dresseinid mussels, gobies, grass carp)

Update

Environmental (e)DNA (genetic material shed from organisms via urine, mucus, filter feeding, etc.) is a powerful technique to assess the presence/absence of invasive species. However, most eDNA assays just reveal single species presence/absence, lacking information about their relative abundances and genetic diversity. Advances in high throughput sequencing (HTS) technology now provide the ability to identify multiple species from a single sample. This metagenetic approach increases the applicability and feasibility of eDNA tools for wildlife managers to detailing an entire community. We are developing/testing diagnostic assays thaat simultaneously identify to species and estimate relative quantities of high-risk invasive fish and invertebrate species from environmental DNA samples (e.g. water and sediment) and biological samples (e.g., plankton tows) using HTS.

Separate assays are designed to target all fishes, invasive and potentially invasive gobies, invasive and potentially invasive carps, invasive dreissenid mussels, and all mollusks. Targeted assays also assess select population genetic variability (i.e., haploytpes). Accuracy was evaluated with, i) Illumina sequencing of a series of mock communities containing known, varying concentrations of tissue DNA extractions for species of interest, and ii) aquaria experiments containing varying proportions of mixed species/haplotype composition. Results showed that observed relative abundances are highly correlated with expected relative abundances, confirming the assays' performance (Fig. 1). The assays then were tested with iii) water and plankton samples from the field, in reference to traditional sampling, including water samples taken in conjunction with the Ohio EPA's samplings of fishes and macroinvertebrates. The mollusk assay revealed unidentified invertebrates missed by the EPA traditional sampling, however the assay was not designed to identify some species, such as unionids (Fig. 2). These results demonstrate the need to pair sampling techniques for accurate description of the entire community. The dreissenid specific assay was

used to evaluate community composition changes in plankton throughout a reproductive season in western Lake Erie (Fig. 3).

We also collected water samples from a number of bait shops, pet stores, and pond supply shops along the SCDRS and Lake Erie shoreline, and will test them with our assays to determine whether DNA from any targeted AIS species are found. This will allow us to determine if these stores are possible vectors for invasive species. Findings are projected to be useful in addressing foundational ecological and population genetic questions, as well as informing management agencies about the population trends of invasive taxa.

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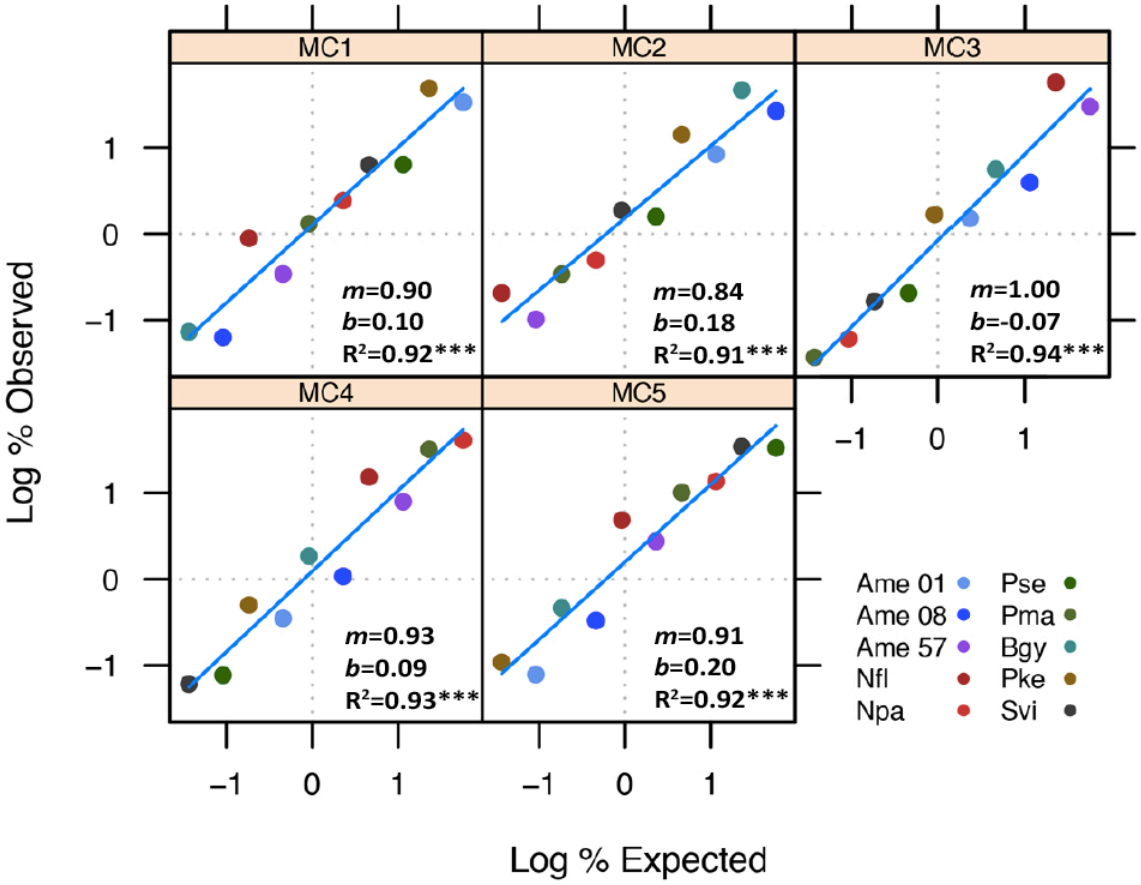

Figure 1. Results of mock community tests of goby eDNA assay. Results show an excellent relationship of observed to expected proportions of sequence reads (mean slope=0.91+/-0.02, mean R^2=0.92+/-0.01). Ame 01, 08, and 57 are the three most common Great Lakes' Round Goby *Neogobius melanostomus* haplotypes. Nfl=*N. fluviatilis* (Monkey Goby), Npa=*N. pallasi* (Caspian Sea Monkey Goby), Pse=*Proterorhinus semilunaris* (Tubenose Goby), Pma=*P. marmoratus* (Marine Tubenose Goby), Bgy=*Babka gymnotrachelus* (Racer goby), Pke=*Ponticola kessleri* (Bighead Goby), and Svi=*Sander vitreus* (Walleye as an outgroup). All assays tested demonstrated a high correlation between expected and observed proportions.

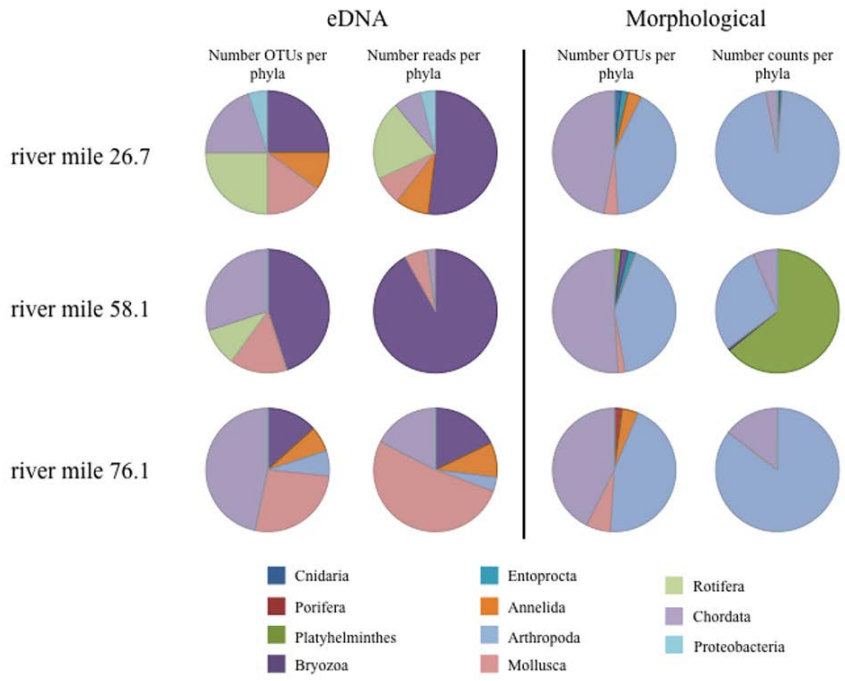

Figure 2. Pie charts comparing the molecular and morphological/ visual species identification methods from three different water samples taken on the Maumee River.

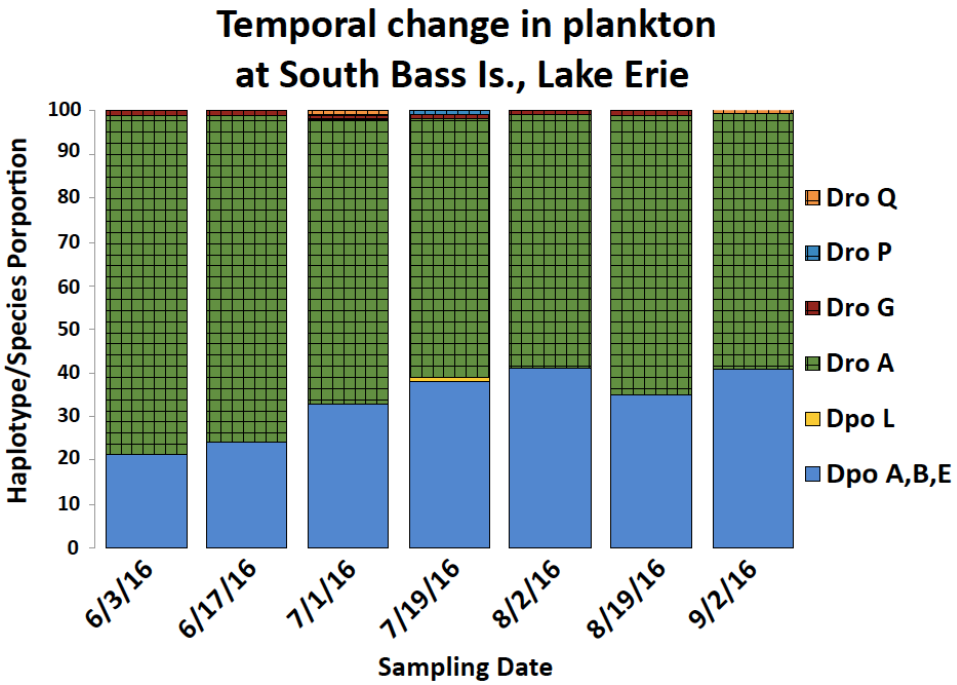

Figure 3. Composition of veliger community in plankton samples collected throughout the summer of 2016 at South Bass Is., Lake Erie.

2017 Briefing Update

Agency

University of Toledo and NOAA Pacific Marine Environmental Lab (PMEL), Great Lakes Genetics/Genomics Lab (UT Dept. Env. Sci), and G3 (Genetics & Genomics Group; NOAA PMEL)

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Title

Genetic patterns across an invasion's history: change versus stasis for the Eurasian round goby in North America and new Metagenomic assays

SCDRS Initiative Objective(s)

Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.), Develop integrated pest management for established AIS (e.g., common carp, Dresseinid mussels, gobies, grass carp)

Update

Biological invasions comprise accidental evolutionary experiments, whose genetic compositions underlie relative success, spread and persistence in new habitats. However, little is known about whether, or how, their population genetic patterns change temporally and/or spatially across the invasion's history. Theory predicts that most would undergo founder effect, exhibit low genetic divergence across the new range and gain variation over time via new arriving propagules. To test these predictions, we analyzed population genetic diversity and divergence patterns of the Eurasian round goby Neogobius melanostomus across the two decades of its North American invasion in the Laurentian Great Lakes, comparing results from 13 nuclear DNA microsatellite loci and mitochondrial DNA cytochrome b sequences (Fig. 1). We tested whether 'genetic stasis', 'genetic replacement' and/or 'genetic supplement' scenarios have occurred at the invasion's core and expansion sites, in comparison with its primary native source population in the Dnieper River, Black Sea. Results revealed pronounced genetic divergence across the exotic range (Table 1), with population areas remaining genetically distinct and statistically consistent across two decades, supporting 'genetic stasis' and 'founder takes most' (Fig. 2). The original genotypes continue to predominate, whose high population growth likely outpaced the relative success of later arrivals. The original invasion core has stayed the most similar to the native source (Table 1). Secondary expansion sites indicate slight allelic composition convergence towards the core population over time, attributable to some early 'genetic supplementation' (Fig. 2). The geographic and temporal coverage of this investigation offers a rare opportunity to discern population dynamics over time and space in context of invasion genetic theory versus reality. These results are published in Molecular Ecology (doi: 10.1111/mec.13997).

Environmental (e)DNA assays have the potential to identify introduced species before they establish and become invasive. If properly designed, these assays also can estimate population genetic diversity,

evaluating the relative numbers of introduced propagules. An eDNA assay was designed that can discern the introduced round goby (including among the most common haplotypes) and tubenose gobies, as well as eight other potentially invasive Eurasian gobies (identified by GLANSIS). The assay was tested with mock communities comprised of 10 taxa having varying proportions of DNA copy numbers. Results show an excellent relationship between observed versus expected proportions of sequence reads (mean slope=0.91±0.02, mean R2=0.92±0.01). See SCDRS update “High-Throughput Sequencing Assays to Simultaneously Identify and Assess Fish and Mollusk Communities from Environmental Samples” for a detailed figure. This assay will be further tested on water samples from aquaria containing varying numbers of round (including the haplotypes discernable by this assay) and tubenose gobies. Water samples taken from Lake St. Clair and South Bass Island, Lake Erie, (two sites determined to be significantly divergent in round goby cytochrome b haplotypic composition in the above study; Fig. 1) as well as those from the genetic source of the Great Lakes invasion and another non-native round goby population in the Baltic Sea will be analyzed and compared using this assay.

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2017 Briefing Update

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Title
Egg deposition in the St. Clair – Detroit River System

SCDRS Initiative Objective(s)
Evaluate habitat improvement projects to remove loss of fish and wildlife habitat BUI, Increase river spawning habitat

Update
Objectives: Assess and measure the community composition, phenology, and spatial extent of egg deposition by lithophilic broadcast spawning fishes in the Detroit (DR) and St. Clair (SCR) rivers.

Milestones: Intensive longitudinal studies of fish egg deposition using eggmats on natural habitat have been occurring in the DR since 2007 and in the SCR since 2010. Multiple habitat types were sampled in each river including main channels, channel fringes, shallow island margins, rivermouths, and open lake areas. In addition, spawning reefs were constructed in the DR at Belle Isle (2004 and expanded 2016), Fighting Island (2008 and expanded in 2013), Grassy Island (2015), and upstream of Belle Isle (2016), and in the SCR at Middle Channel (2012), Hart's Light, and Pointe aux Chenes (both in 2014). Studies of egg deposition occurred at the reefs sites, and at control sites upstream and downstream, during both pre- and post-construction years. Spring egg collection and rearing focused on walleye, suckers, and lake sturgeon, while fall collection and rearing has focused on lake whitefish.

Results Overview, 2016
Spring
The full length of the DR was sampled in the spring; however, the majority of our effort was centered around spawning restoration reef sites listed above. Eggmats were placed at reef areas for both pre- and post-assessment. Pre-assessment sites included upstream Belle Isle and Fort Wayne; post-assessment sites were Belle Isle (2004), Fighting Island, and Grassy Island reefs. Non-reef (natural habitat) sites included sites in the Trenton channel near the north end of Grosse Isle and long-term monitoring sites near the mouth of the river, including the head of Livingstone Channel, Hole-in-the-Wall (HIW), and Sugar Island. Walleye eggs were collected at all sites except for the lower Trenton channel site. The greatest densities of walleye eggs continue to be collected at HIW and Grassy Island. Sucker eggs were collected in low densities throughout the river, except for Fighting Island which collected much higher densities. Lake sturgeon eggs were collected at Fighting Island and (for the first time) Grassy Island reefs. Overall egg density followed trends seen in previous years.

The sampling sites in the SCR followed the same design as in the DR, with the focus primarily on restoration reef post-assessment, and included offshore assessment at shoreline habitat restoration sites (see related shorezone briefing for nearshore results). Post-assessment sites were at Middle Channel, Hart's Light, and Pointe aux Chenes reefs. Non-reef sites were located downstream of Port Huron, in the North Channel near Algonac, and near Pearl Beach/Dickinson Island (Mazlinka's reef). Walleye were collected in relatively low densities throughout the river, but not at all locations, with the greatest densities at the upstream Algonac (non-reef) and Hart's Light reef sites. Sucker eggs were collected at fewer sites than walleye, but also showed higher densities at the upstream Algonac and Hart's Light reef sites. Lake sturgeon eggs were collected (in order of decreasing density) from Hart's Light, Pointe aux Chenes, and Mazlinka's reefs.

Fall

Fall sampling for fish eggs in the DR were in the same geographic areas as spring. All eggs collected were lake whitefish, most sites collected eggs, and the greatest densities were at Grassy Island non-reef sites. Sampling in the Belle Isle area was interrupted due to construction of the new upstream Belle Isle reefs, limiting access to the area.

Fall sampling for fish eggs in the SCR were in the same geographic areas as spring. No lake whitefish eggs were collected at any of the SCR fall sample sites in 2016.

2017 Plans: Future plans for studying egg deposition as a measure of spawning habitat quality include: DR – pre-assessment at the Fort Wayne reef, post-assessment at Belle Isle (2004) and new Belle Isle expansion reefs (A, B, and C), Fighting Island, and Grassy Island reefs, and continue sampling index stations in the lower river. SCR –Effort in the SCR will be reduced to just the Hart's Light and Point aux Chenes artificial reefs with limited control sites (upstream Algonac and Mazlinka's).

2017 Briefing Update

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Title

Invasion Population Genetics of the Eurasian Ruffe over Time and Space

SCDRS Initiative Objective(s)

Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.), Develop integrated pest management for established AIS (e.g., common carp, Dresseinid mussels, gobies, grass carp)

Update

Invasive species are a leading cause of worldwide biodiversity decline, with the Laurentian Great Lakes experiencing at least 186 aquatic species introductions, of which several have exerted significant ecological impacts. Among them, the Eurasian ruffe fish Gymnocephalus cernua was introduced to Lake Superior in ~1986 via ballast water discharge from transoceanic vessel(s) arriving from the Baltic Sea region. The ruffe also was introduced independently to Bassenthwaite Lake in northern England ~1991 via bait bucket introduction from its native southern England range. The present investigation aimed to: (1) discern diversity and divergence patterns between invasive versus native ruffe populations and (2) analyze for temporal changes/trends in genetic compositions using 10 nuclear DNA microsatellite loci and mitochondrial DNA control region sequences. Results reveal that (1) both invasions had different sources and underwent initial founder effects, with the native Baltic Sea and Great Lakes populations being similar in composition, (2) native populations analyzed from the Baltic Sea region differ slightly (Elbe River versus Vistula Lagoon), with the former being genetically closest to the Great Lakes invasion, in agreement with previous work that identified this location as the likely founding source, (3) genetic compositions of the invasions have remained consistent over time (early 1990s-present) showing no new supplements, and (4) there is no population distinction across the Great Lakes distribution, denoting range expansion of the initial colonists without additional introductions. Slow movement and lack of expansion of ruffe into the lower Great Lakes may stem from a limited genetic diversity reservoir due to founding from a single invasion source and lack of supplementary propagules from other areas, in marked contrast to the more diverse and extensive invasions of the round goby and dreissenid mussels. This lack of genetic diversity and population structure may restrict success of the ruffe invasion.

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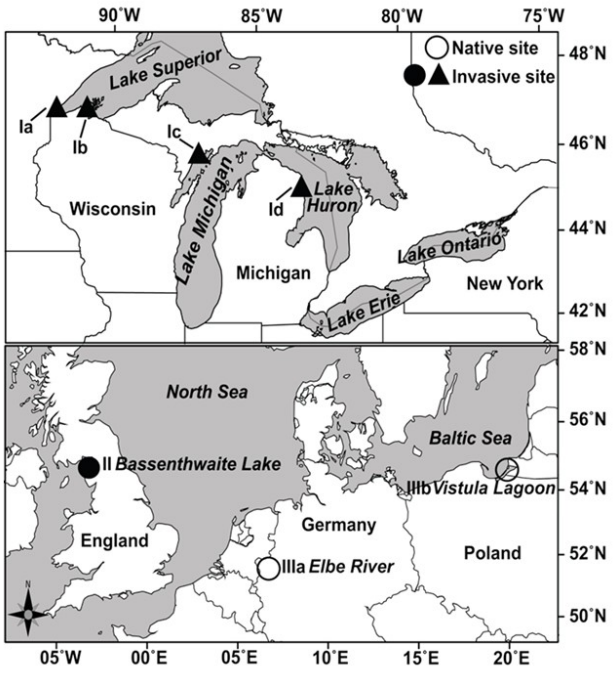

Figure 1. Location of samples from the Great Lakes and Europe, totaling 462 individuals across 7 locations.

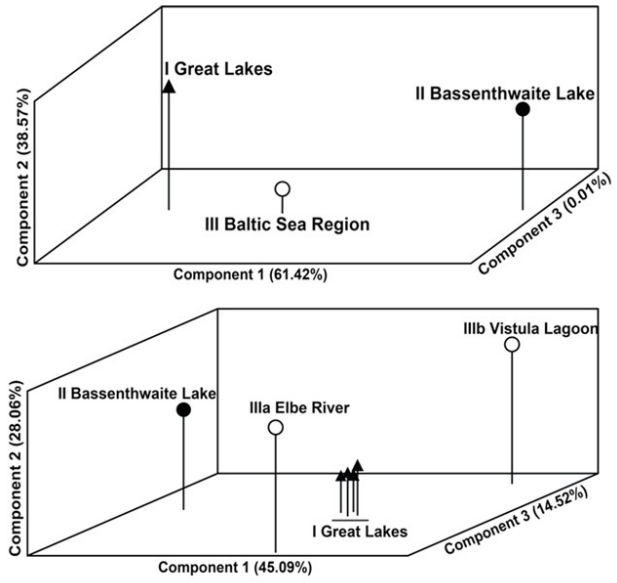

Figure 2. Bayesian Structure analysis supports 2 population groups (K=2) black and gray; each fish is a thin vertical line with the color(s) indicating its population assignment.

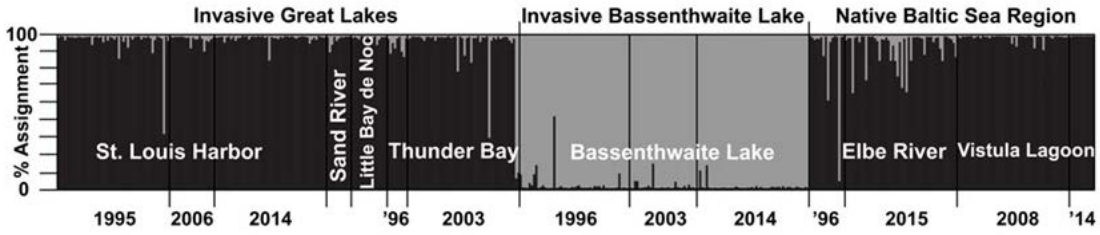

Figure 3. Population structure, 3dFCA; note the close clustering of Great Lakes samples.

2017 Briefing Update

Agency
University of Toledo and NOAA Pacific Marine Environmental Lab (PMEL), Great Lakes Genetics/Genomics Lab (UT Dept. Env. Sci); now G3 (Genetics and Genomics Group), NOAA PMEL

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Title
VHS Fish Virus is Still in the Great Lakes and Mutating!

SCDRS Initiative Objective(s)
Reduce biological contamination (e.coli, pathogens, virus impacts on wildlife), Develop surveillance monitoring for AIS based on habitat requirements and availability

Update
A novel strain (IVb) of Viral Hemorrhagic Septicemia virus (VHSv-IVb) first appeared in the Great Lakes a decade ago, killing ~32 species in 2005, 2006, 2007, and 2009. Since then, it largely has gone "underground". Our laboratory discerned many new genotypes after the 2005-6 outbreaks, approximating a "quasi-species" cloud model of variants. In 2012 we identified and quantified the virus in a largemouth bass and drum from western Lake Erie, which each had separate new genotypes. This new study investigated 37 sites around the Great Lakes, resampling original outbreak areas (Fig. 1) and testing 55 species and 2561 individuals using our high-resolution Start-PCR test (published as Pierce, Stepien et al. 2013a,b). Seven species and 21 individuals (two in 2015, 19 in 2016) tested positive from Lakes Erie (76%) and Michigan (24%); all lacked clinical signs and just 4 were above the minimum detection cell culture level (Fig. 2). Fourteen of the new positives came from Lake Erie, with 13 from Sandusky Bay (9 gizzard shad Dorosoma cepedianum, 2 largemouth bass Micropterus salmoides, 1 emerald shiner Notropis atherinoides, and 1 pumpkinseed Lepomis gibbosus); the remaining sample was a largemouth bass from Ashtabula, OH. Five other VHSv-positive fishes were collected nearshore in Lake Michigan near Milwaukee, WI (4 round goby Neogobius melanostomus and an alewife Alosa pseudoharengus). All from 2012-16 are genetically distinctive (Fig. 3 shows the G-gene evolutionary pattern). The original genotypes appear eradiated, indicating that the virus has continued to evolve to adapt to this relatively new geographical range and the broad range of host species. Our results show that VHSv remains present and is mutating in the Great Lakes ecosystem, possibly presenting a threat to aquaculture and to naïve fish populations in uninfected waterways.

1. Stepien CA, Pierce LR, Leaman DW, Niner MD, & Shepherd BS. (2015) Gene diversification of an emerging pathogen: a decade of mutation in a novel fish viral hemorrhagic septicemia (VHS) substrain since its first appearance in the Laurentian Great Lakes. PLOS One, 10(8). E0135146.

2. Pierce LR, Willey JC, Palsule VV, Yeo J, Shephard BS, Crawford EL, et al. (2013) Accurate detection

and quantification of the Fish viral hemorrhagic septicemia virus (VHSv) with a two-color fluorometric real-time PCR assay.

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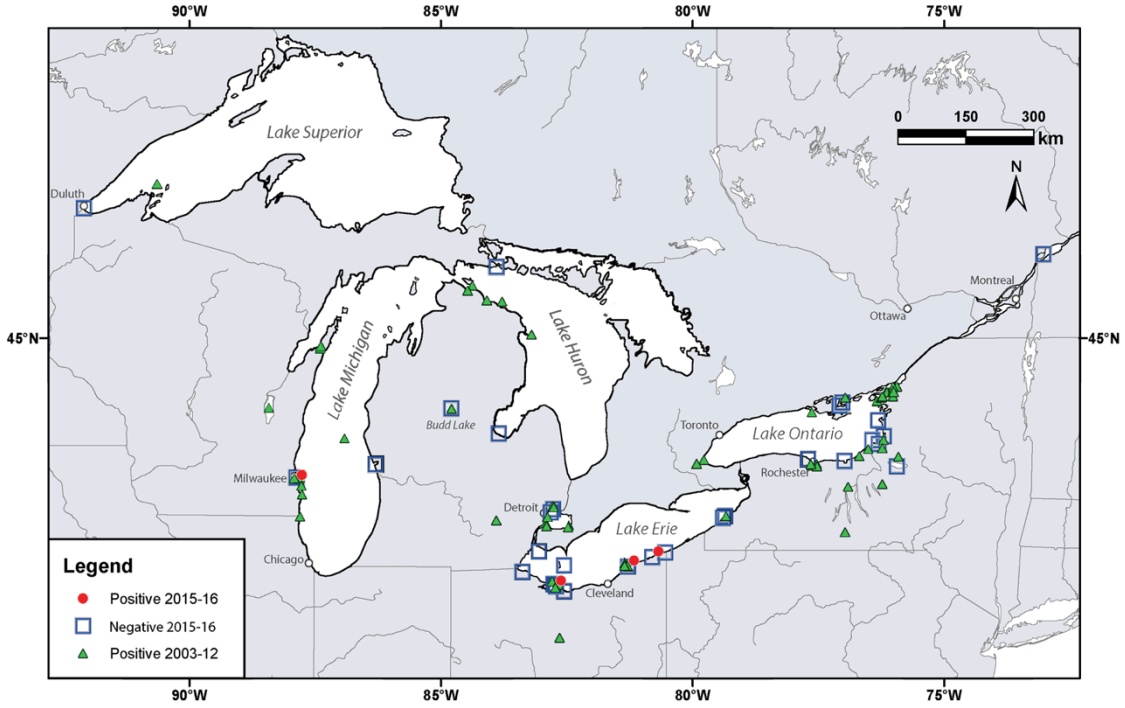

Figure 1. Map of sampling sites showing historical and current prevalence of VHSv-IVb. Closed red circles are positive sites from 2015 and/or 2016, open blue squares are sampled sites that were VHSv free in 2015 & 2016, and green triangles are historical locations of VHSv-IVb positive fishes.

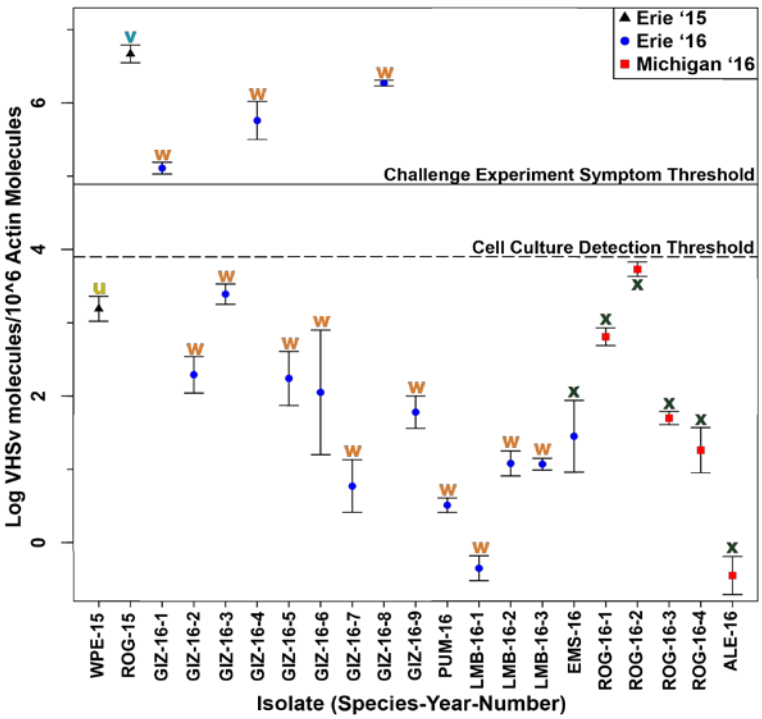

Figure 2. Concentrations of new VHSv isolates with standard error bars. The corresponding haplotype (see *G*-gene network, Figure 3) is listed above or below each isolate.

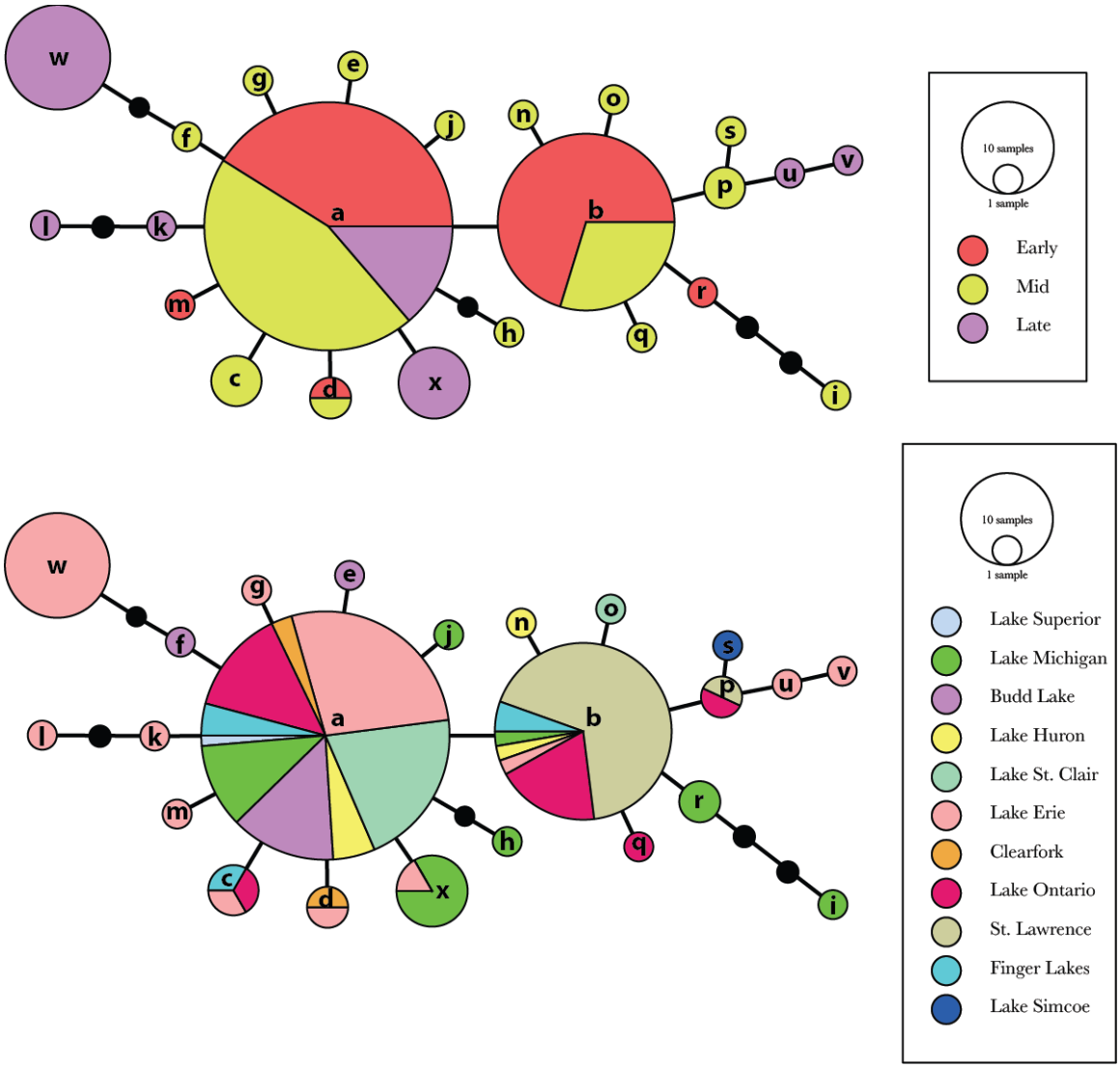

Figure 3. G-gene haplotype networks for time and geographic range. Each lettered circle represents a single G-gene haplotype, lines between haplotypes represent a single nucleotide change, and black circles without letters are placeholders for theoretical haplotypes. The top network displays three time periods of VHSv-IVb in the Great Lakes: early (2003-2006), mid (2007-2010), and late (2011-2016). The bottom network shows the same network, but colored based on the location of the isolates.

2017 Briefing Update

Agency

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Title

Population genetic structure and comparative diversity of smallmouth bass

SCDRS Initiative Objective(s)

Increase river spawning habitat

Update

Genetic diversity and divergence patterns of smallmouth bass Micropterus dolomieu spawning groups are analyzed across its northern native range with mtDNA cytochrome b gene sequences and eight unlinked nuclear DNA microsatellite loci. Results reveal high levels of genetic variability and significant differences in allelic representation among populations (mtDNA: mean HD±SE =0·50±0·06, mean θST±SE = 0·41±0·02 and microsatellites: mean HO±SE =0·46±0·03, mean θST±SE =0·25±0·01). The distributions of 28 variant mtDNA haplotypes, which differ by an average of 3·94 nucleotides (range=1–8), denote divergent representation among geographic areas. Microsatellite data support nine primary population groups, whose high self-assignment probabilities likewise display marked divergence. Genetic patterns demonstrate: (1) high genetic diversity in both genomes, (2) significant divergence among populations, likely resulting from natal site homing and low lifetime migration, (3) support for three post-glacial refugia that variously contributed to the current northern populations, which remain evident today despite waterway connectivity, and (4) a weak yet significant genetic isolation by geographic distance pattern, indicating that other processes affect the differences among populations, such as territoriality and site fidelity. (this paper is accepted and is going into press in Journal of Fish Biology)

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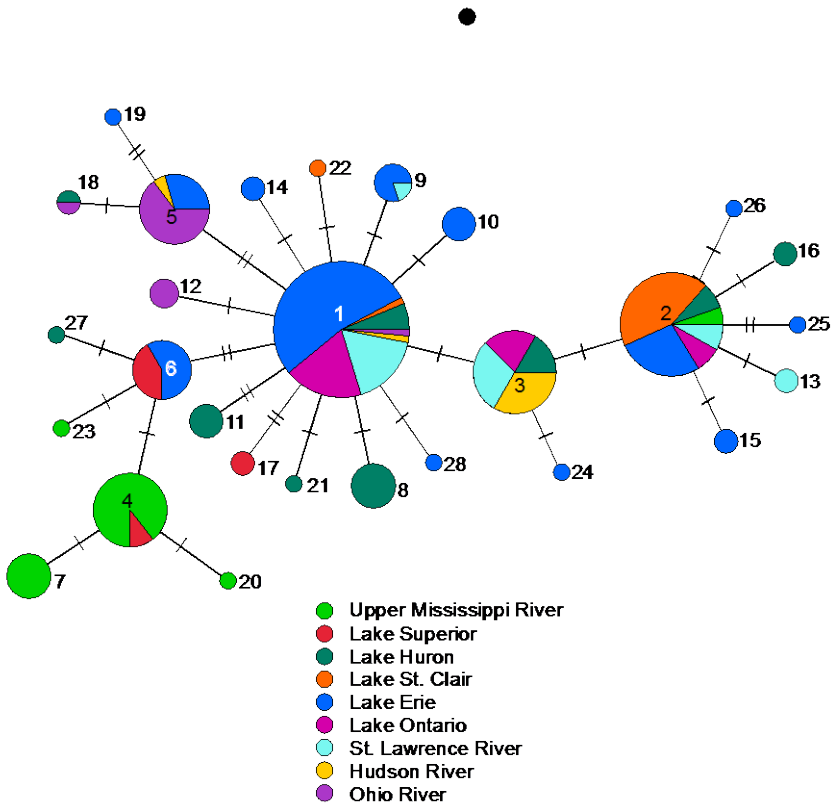

Figure 1. Parsimony network among smallmouth bass *Micrpterus dolomieu* mtDNA cytochrome *b* haplotypes (numbered) constructed using PopART. Circles are sized according to total observed relative frequency of each haplotype across all populations. Hatch marks indicate unobserved single mutational steps between observed haplotypes.

2017 Briefing Update

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Title
Suspended Sediment Quality in the SCDRS

SCDRS Initiative Objective(s)
Remove contaminated sediments to remove degradation of benthos BUI, Complete remedial actions to remove fish tumors and other deformities BUI, Complete remedial actions to remove restrictions on fish and wildlife consumption BUI, Complete remedial actions to remove bird or animal deformities or other reproductive problems BUI, Identify contaminants of concern (e.g. pharmaceuticals and personal care products, microplastics) determine sources, and develop load reduction strategies, Reduce loadings from legacy contaminant sources (including groundwater at known locations in DR)

Update
Assessments of suspended sediment quality in the Detroit River – St. Clair River corridor using sediment traps have been ongoing since 1997. Sediment downstream of industrial sources in the Upper St. Clair River was historically contaminated with mercury (Hg), hexachlorobutadiene (HCBD), hexachlorobenzene (HCB) and octachlorostyrene (OCS). Concentrations of contaminants of concern (COCs) in suspended sediment collected from traps in the late 1990s suggested bottom sediment was mobile and a source of contamination to downstream areas. Post remediation concentrations of COCs in bottom sediment and suspended sediment throughout downstream areas were high, relative to concentrations measured at the upstream reference sites; however, data from sediment traps indicated that concentrations of COCs were trending downward since remediation efforts that were completed in 2005. Concentrations of COCs in suspended sediments in the Detroit River also indicate general reductions in concentrations of COCs over the past 20 years.

2017 Briefing Update

Agency

University of Toledo (Depts. Env. Sci. and Geography & Planning) and NOAA Pacific Marine Environmental Lab (PMEL), Great Lakes Genetics/Genomics Lab (UT Dept. Env. Sci); now G3 (Genetics and Genomics Group), NOAA PMEL, and Dept. Geography & Planning (UT)

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Title

Invasive Species Prevention from Bait Store Retailers via Metagenetics, Supply Chains, and Public/Stakeholder Engagement

SCDRS Initiative Objective(s)

Develop surveillance monitoring for AIS based on habitat requirements and availability, Implement preventive strategies through information/education programs and management of potential sources and pathways (e.g., ballast water, live release, etc.), Develop integrated pest management for established AIS (e.g., common carp, Dresseinid mussels, gobies, grass carp)

Update

Bait retailers along the Great Lakes are potential vectors for introductions of aquatic invasive species. We identified fish species, including non-target and/or invasive taxa, sold by 46 bait shops from the Wabash River in Indiana to the western and southern coasts of Lake Erie. Bait was purchased, and morphologically identified and the eDNA from their water was extracted for later assessment of accompanying taxa (See SCDRS update “High-Throughput Sequencing Assays to Simultaneously Identify and Assess Fish and Mollusk Communities from Environmental Samples”). Just one invasive species was visually identified – goldfish Carassius auratus, and no non-target non-bait were observed (e.g., small walleye Sander vitreus or yellow perch Perca flavescens). The most commonly advertised bait fish were: emerald shiner Notropis atherinoides, golden shiner Notemigonus crysoleucas and fathead minnow Pimephales promelas. However, 17 samples contained non-target bait species (i.e., those unintentionally sold with the target species), which might indicate lack of awareness by retailers (Table 1). Maumee Bay, Lake Erie stores had the fewest non-target bait species (1%). The Michigan region had the most (33%). Results augment knowledge about possible spread of invasive species, and study findings may be useful for developing best practices for retailers and managers.

We surveyed bait shops about where they obtain the bait they sell (Fig. 1). We also surveyed anglers about where they fish, bait type used (Fig. 2), what they do with unused bait (Fig. 3), and awareness and sightings (Fig. 4) of non-native species. 18% of anglers reported dumping unused live bait fish into the environment. Many anglers reported sightings of certain invasive species where they are not known to occur. For example, anglers reported seeing bighead and silver carp in the Great Lakes basin and

Eurasian ruffe in Lake Erie, where none of these species are currently known to be present. This identifies a lack of awareness on the part of anglers about which species are invasive and how to identify them. We are further analyzing water samples from the bait stores in order to assay for environmental (e)DNA of invasive and non-target species.

https://www.pmel.noaa.gov
http://www.utoledo.edu/nsm/lec/research/glgl/index.html

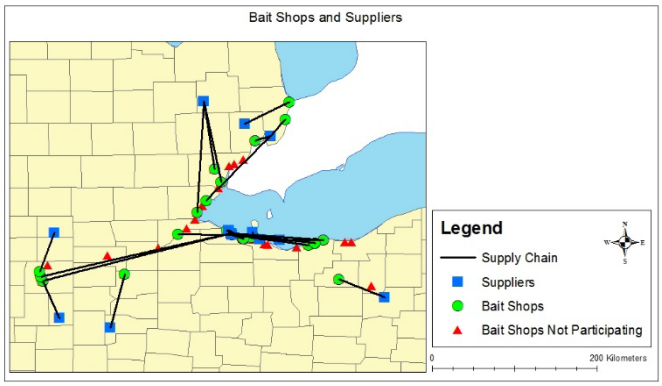

Figure 1. The supply chain of bait used for fishing in the Western Lake Erie Basin Region. The suppliers are marked by blue squares, bait shops participating in the survey are green circles, bait shops that chose not to participate in the survey are red triangles, and the black line connects the bait shops to their suppliers.

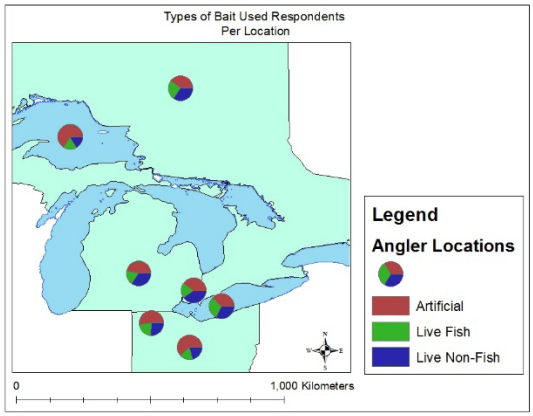

Figure 2. Map illustrating the frequency of different bait types used in various locations.

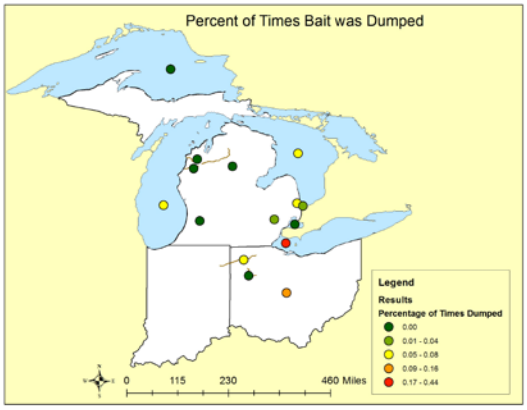

Figure 3. Map depicting the percentage of times unused bait was reported dumped into the environment after fishing. Points not associated with a water body or river indicate inland lakes in that area. Proportions denote the number of times bait was dumped back into the water versus the number of times each location was fished.

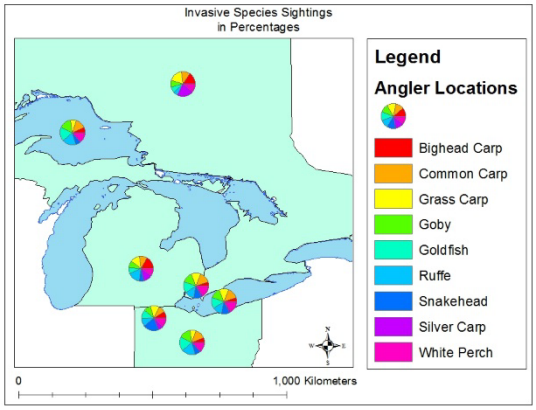

Figure 4. Map showing the percent of anglers at each location who reported that they had observed each of the following invasive species: Bighead Carp, Common Carp, Grass Carp, Goby, Goldfish, Ruffe, Snakehead, Silver Carp, and White Perch.

2017 Briefing Update

Agency
Environment and Climate Change Canada, Water Quality Monitoring and Surveillance (WQMS)

Contact
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Title
Great Lakes Connecting Channel Monitoring: St.Clair River Upstream/Downstream Study

SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP, Identify contaminants of concern (e.g. pharmaceuticals and personal care products, microplastics) determine sources, and develop load reduction strategies, Reduce loadings from legacy contaminant sources (including groundwater at known locations in DR)

Update
The St. Clair River Upstream/Downstream (U/D) Monitoring measures concentrations of chemicals in both whole water and suspended sediment at the head [Point Edward; PE] and mouth [Port Lambton; PL] of the St. Clair River. Monitoring began in 1987 after the discovery of severe contamination in the upper reaches of the St. Clair River. Whole water measurements for trace metals, nutrients and major ions began in 2001. Sampling was conducted biweekly until 2014 and subsequently every four weeks. Annual loads are calculated with USGS flow data from monitoring station "St. Clair river at Port Huron, Michigan" using the Fortran based load estimating program "LOADEST". Other associated WQMS projects are: Great Lakes Connecting Channel Monitoring: Niagara River Upstream/Downstream monitoring; Great Lakes Sediment Monitoring; Great Lakes Water Quality Monitoring and Surveillance; Detroit River Monitoring.

http://www.ec.gc.ca/eaudouce-freshwater/

2017 Briefing Update

Agency
Michigan Department of Environmental Quality

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Title
Michigan's Western Lake Erie Collaborative Agreement Implementation Plan Summary

SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP

Update
Michigan has been proactive in successfully reducing phosphorus loads to Lake Erie and remains committed to addressing current problems. Michigan will focus on the following actions:
1. Maintain the reductions achieved in the Detroit Water & Sewerage Department (DWSD) discharge as a result of the tightened permit limits. This is the largest single point source discharge to Lake Erie.
2. Achieve reductions in the Wayne County Downriver Wastewater Treatment Plant (WWTP) discharge. This NPDES permit will be modified to include phosphorus limits consistent with the limits in the DWSD permit. This modification will be done in 2016 and reductions accomplished by 2020.
3. Achieve the target reductions in the Maumee River basin in Michigan. Michigan will develop a specific plan for these watersheds in 2016 . This plan will include appropriate monitoring, an analysis of target reductions for each watershed, and actions that will be implemented to achieve the target reductions.
4. Help with monitoring and understanding harmful algal blooms regarding presence, timing, and cause in Michigan waters, including the Great Lakes. Harmful algal blooms are currently not well understood. Michigan will develop a strategy to accomplish this and share this strategy with other Great Lakes states and stakeholders.
5. Help with understanding the role of invasive mussels in causing Lake Erie algae blooms and the effect of potential invasive mussel control options.
6. Understand the specifics regarding the Raisin River phosphorus reductions, share this success story, and continue to reduce nutrient loads that may contribute to site-specific watershed or seasonal fluctuations in water quality. This work will include an evaluation of the need to control the Monroe WWTP discharge of phosphorus, as this discharge is located geographically very close to the algal blooms in the WLEB. Michigan will continue to implement actions in the Raisin River watershed to maintain phosphorus reductions.
7. Michigan is trying to sort out the many issues associated with dissolved reactive phosphorus, including the use of different analytical methods, quantification levels, the cycling conversion and uptake of this form of phosphorus, and what source controls and management practices are available for this form of phosphorus. https://www.michigan.gov/documents/deq/wrd-western-lake-erie_503547_7.pdf

2017 Briefing Update

Agency
University of Michigan Water Center

Contact
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Title
Assessing the Sources and Management Options for Detroit River Nutrient Loads to Lake Erie

SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP

Update
This project, funded by the Erb Family Foundation was kicked off in 2016. The project is currently in the model development phase, working closely with a diverse advisory group to inform the baseline modeling and to identify potential load reduction scenarios. We expect to be providing initial assessments of nutrient sources, results on the role of Lake St. Clair, and be running scenarios before the end of 2017.

Project Details:
In an effort to reduce harmful algal blooms and hypoxia in Lake Erie, the United States and Canada have recently updated total phosphorus load reduction targets set in the Great Lakes Water Quality Agreement. These new targets call for a 40% reduction in loads from all Lake Erie tributaries from their 2008 levels. To best achieve these goals, states and provinces will be developing domestic action plans to address the major sources of phosphorus in the watersheds entering Lake Erie. The Saint Clair-Detroit River System (SCDRS) contributes ~35% of the total phosphorus loads to the Western Basin of Lake Erie and 21% to the Central Basin. Evaluating the major sources of nutrients in SCDRS is complicated given the watershed crosses the U.S. and Canada, has both large urban (20%) and agricultural (50%) areas, and is transected in the middle by a large, shallow water body - Lake St. Clair. The goal of this project is to assess the major sources of phosphorus in the SCDRS watershed by developing watershed, urban, and in-lake models. Once major sources have been identified, the project team will run multiple scenarios informed by our advisory group to help identify pathways to achieve the load reduction targets.

http://graham.umich.edu/project/assessing-detroit-river-nutrient-loads-lake-erie

2017 Briefing Update

Agency
National Oceanic and Atmospheric Administration Great Lakes Environmental Research Laboratory

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Title
Combining monitoring, advanced molecular techniques and near real-time instrumentation to investigate the response of cyanoHABs in Lake Erie and Lake St. Clair to different environmental conditions

SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP, Reduce biological contamination (e.coli, pathogens, virus impacts on wildlife)

Update
Lake Erie is once again experiencing intense cyanobacterial harmful algal blooms (CHABs) in the western basin. While it is well known that cultural eutrophication is a primary driver of these phenomena, there is fierce debate over the roles of nitrogen (N) and phosphorus (P) in stimulating the growth and toxicity of CHABs. While it has been shown that estimates of bloom size can be made using spring P-loading values from the Maumee River to Lake Erie, to date no such model exists for estimating bloom toxicity. Furthermore, the role of N in stimulating CHAB growth and toxicity in Lake Erie has only recently been gaining attention. Several investigators have addressed this issue but to date no clear consensus exists. This lack of understanding is partially due to the fact that the limnological conditions in western basin Lake Erie are highly variable and blooms may be experiencing both P limitation and N limitation simultaneously, therefore sampling bias may skew conclusions. Furthermore, different organisms are responsible for the CHABs in the open lake versus Lake Erie tributaries. For example, Microcystis spp. comprises much of the bloom biomass in the lake proper where as Planktothrix spp. comprises a majority of the biomass in Sandusky Bay and the Maumee River. Both genera have strains that are able to produce toxic microcystins, however, N and P can stimulate bloom growth differently throughout the season. I will present the results from long-term remote and discrete monitoring, microcosm experiments and advanced genetic techniques. All of these data indicate that while P is critical for initiating western Lake Erie CHABs, N may be more important for stimulating growth and toxin production in total, hence both N and P must be considered when developing nutrient mitigation strategies.

https://www.glerl.noaa.gov//res/HABs_and_Hypoxia/

2017 Briefing Update

Agency
U.S. Geological Survey Michigan-Ohio Water Science Center

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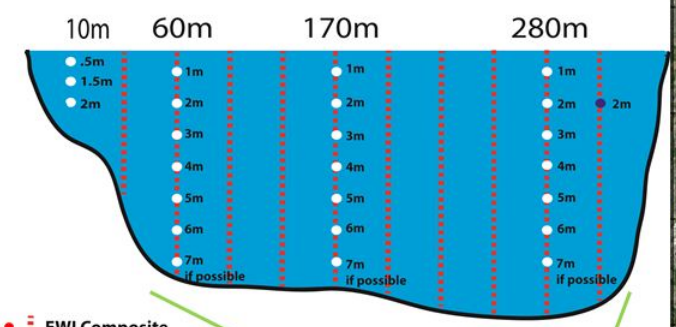
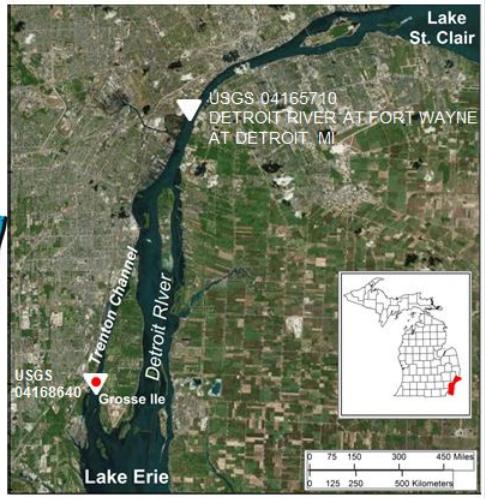
Title
Distribution of Nutrients, Suspended Sediment, and Velocities in the Trenton Channel, Detroit, Michigan 2014-2015

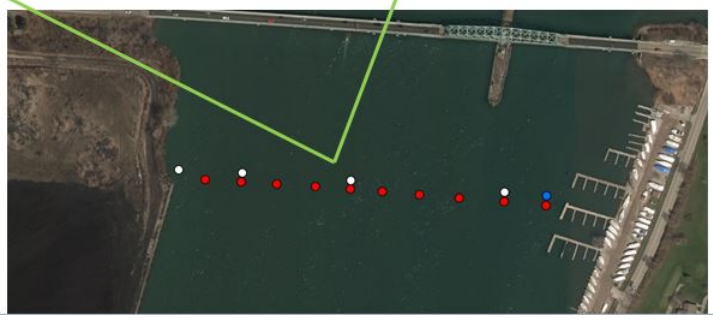
SCDRS Initiative Objective(s)
Reduce loading from regulated and unregulated sources of TP/DRP

Update
The Detroit River is an often under-realized source of nutrient load, even though it contributes approximately 80 percent of the water to Lake Erie. This GLRI-funded study is evaluating a section of the Trenton Channel of the Detroit River where Environment Canada (EC) is currently collecting point samples with an automatic water sampler to determine nutrient concentrations. The U.S. Geological Survey Michigan-Ohio Water Science Center is examining relations of concentrations of nutrients and sediment collected at discrete depths and in composited water samples to ECs point samples. In addition, concurrently collected acoustic Doppler current profilers (ADCPs) will allow us to understand how discrete bin velocity and vector are related to the vertical mixing of the Trenton Channel at this section under different environmental conditions. Samples were collected year round to determine the potential impacts of seasonal variations on the stratification of water in this section. These baseline data will help to contextualize the data being collected for the EC Great Lakes Nutrient Initiative (GLNI) on the Detroit River and will provide information necessary for optimizing future monitoring of the Detroit River.

Sampling Locations







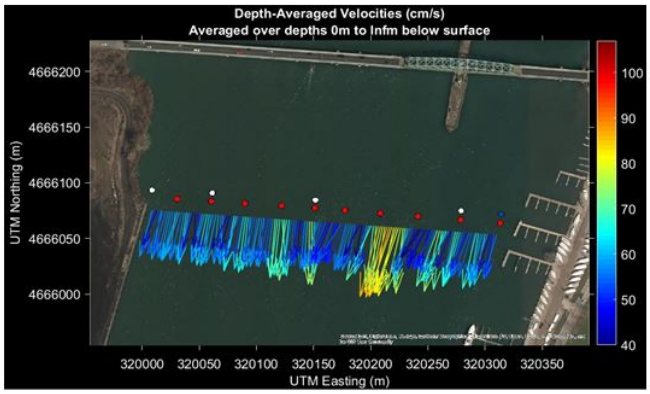
USGS science for a changing world

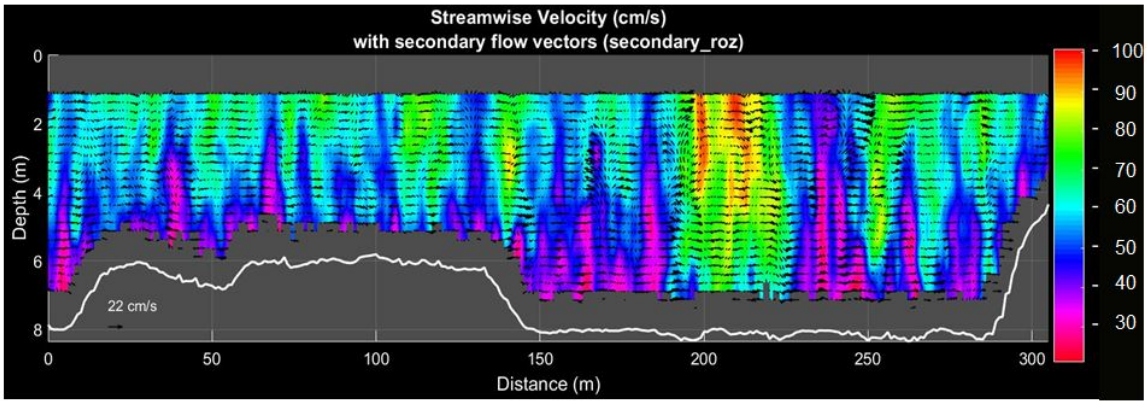
10

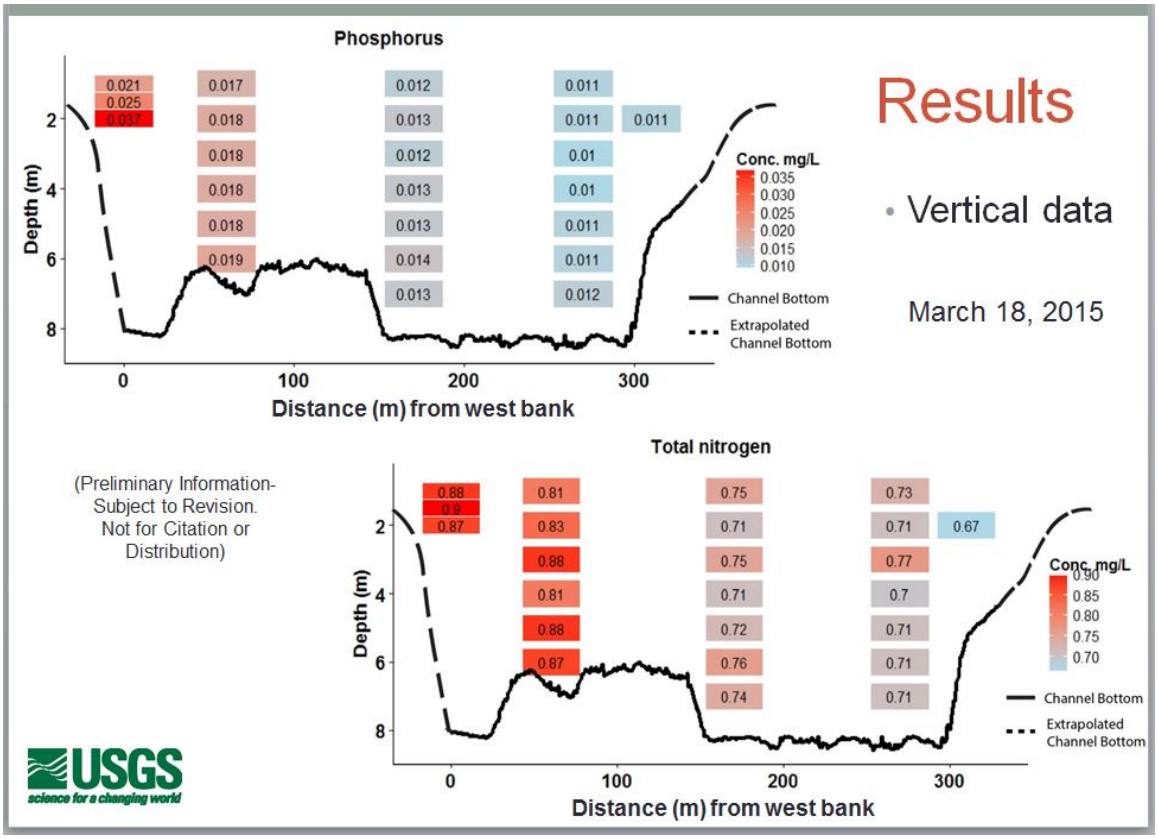
Results

- Velocity vectors and velocity mapping

(Preliminary Information-Subject to Revision. Not for Citation or Distribution)






Phosphorus
0.021
0.025
0.037
0.017
0.018
0.018
0.018
0.018
0.019
0.012
0.013
0.012
0.013
0.013
0.014
0.013
0.011
0.011
0.01
0.01
0.011
0.011
0.012
0.011
Conc. mg/L
0.035
0.030
0.025
0.020
0.015
0.010
Channel Bottom
Extrapolated Channel Bottom
Depth (m)
2
4
6
8
0
100
200
300
Distance (m) from west bank
Results
• Vertical data
March 18, 2015
(Preliminary Information-Subject to Revision. Not for Citation or Distribution)
Total nitrogen
0.88
0.9
0.87
0.81
0.83
0.88
0.81
0.88
0.87
0.75
0.71
0.75
0.71
0.72
0.76
0.74
0.73
0.71
0.77
0.7
0.71
0.71
0.71
0.67
Conc. mg/L
0.90
0.85
0.80
0.75
0.70
Channel Bottom
Extrapolated Channel Bottom
Depth (m)
2
4
6
8
0
100
200
300
Distance (m) from west bank
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2017 Briefing Update

Agency
U.S. Geological Survey Michigan-Ohio Water Science Center

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Title
Contaminants of Emerging Concern in Great Lakes Tributaries

SCDRS Initiative Objective(s)
Identify contaminants of concern (e.g. pharmaceuticals and personal care products, microplastics) determine sources, and develop load reduction strategies

Update
One of the major objectives of the GLRI Action Plan is to "Identify emerging contaminants and assess impacts on the Great Lakes fish and wildlife." There are long-term programs for monitoring of selected contaminants in fish, lake sediments, air, precipitation, and lake water but an analogous program for defining contributions from Great Lakes tributaries in the U.S. did not exist on a spatial scale that could be used to evaluate impacts in tributaries of all five lakes. Further, this project incorporates consistent contaminant surveillance in concert with evaluation of biological effects to provide a biologically-relevant prioritization of contaminants in a systematic manner for multiple watersheds that will inform Great Lakes-wide needs.

The primary project objective of this GLRI-funded project is to implement a surveillance system for identifying emerging contaminants, their potential biological effects, and relative importance in Great Lakes Tributaries. For FY17, samples for organic waste compounds and metabolomics will be conducted quarterly (beginning November, 2016) in Michigan and Ohio. Samples will be collected at 6 sites in Michigan (Saginaw, Rouge, Clinton, St. Joseph, Grand River, and Kalamazoo) and 3 sites in Ohio (Maumee, Rocky, and Cuyahoga). Passive samplers will be deployed in spring 2017 and retrieved approx. 30 days after (currently at 20 sites in Michigan and 14 sites in Ohio). Sediment samples will also be collected at those sites at the time of deployment. Both the passive and sediment samplers will be analyzed for PAHs and other waste indicator compounds.

2017 Briefing Update

Agency
University of Toledo; US Geological Survey Lake Erie Biological Station

Contact
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Title
Mapping and Monitoring Aquatic Vegetation in Lake Erie for Grass Carp Risk Assessment

SCDRS Initiative Objective(s)
Using a 3-tiered observation system (object based image analysis [OBIA], hydroacoustics, rake sampling), map distribution, density, and species composition of aquatic vegetation in Lake Erie for use in Grass Carp risk assessment. Data provides a baseline for any changes in the vegetation community potentially caused by Grass Carp herbivory.

Update
Mapping was completed in 2016 for half of the Western Basin of Lake Erie. Locations included the Sandusky River, Sandusky Bay, Cedar Point area, Kelley's Island and South Bass Island. Locations planned for 2017 include Middle Bass Island, North Bass Island, Catawba/Marblehead west to Maumee Bay, North Maumee Bay, Monroe 'hot ponds' and the western shore of the Western Basin. Other locations may include Dunkirk Harbor and Buffalo Harbor, NY.

Results
Preliminary results indicate submerged aquatic vegetation (SAV) is localized and generally restricted to protected nearshore areas. SAV was generally lacking in the Sandusky River and Sandusky Bay. High densities of SAV were recorded in the Cedar Point and island locations with 14 species of SAV collected among all sample sites. The 3-tier assessment provided the most complete picture of SAV distribution and community composition, each having their own unique pros and cons (see Table 1). OBIA did not efficiently detect patchy and/or low density SAV but is able to map large areas of more obvious SAV. Hydroacoustics more accurately detected SAV but is limited to recorded transects, not large areas. While OBIA and hydroacoustics provide distribution and density data, only rake sampling provides species level data. Because Grass Carp have known food preferences (Table 2), mapping the distribution, density and species composition of SAV communities is of high importance. Analysis is ongoing and will be completed after all sites have been sampled.

Table 1. Methods used in our protocols and associated pros/cons.

Method	Pros	Cons
OBIA	• Large-scale mapping • Provides starting point for likely SAV locations	• Requires existing imagery • No community data
Hydroacoustics	• Accurate detection of SAV • Density estimates	• Several transects needed/time consuming • No community data
Rake	• Community level data	• Time consuming • Point data

Table 2. Grass Carp feeding preferences taken from published literature. Species with multiple preference designations indicates the literature includes mixed results.

SAV Species	Preference
Cladophora	High
Ceratophyllum demersum (Coontail)	Low
Elodea canadensis (Waterweed)	High
Heterantha dubia (Water Stargrass)	?
Myriophyllum spicatum (Eurasian Water Milfoil)	Low Med/High
Myriophyllum spp. (Milfoil)	?
Najas gracillima (Slender Waternymph)	High
Najas guadalupensis (Southern Waternymph)	High
Potamogeton pectinatus (Sago Pondweed)	Med High
Potamogeton pusillus (Small Pondweed)	High
Potamogeton richardsonii (Clasping Leaved Pondweed)	?
Vallisneria americana (Eelgrass)	High
Zannichellia palustris (Horned Pondweed)	?
Sedge spp?	?

2017 Briefing Update

Agency
University of Michigan and partners, Water Center / Sea Grant

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Title
An Update on Spawning Reef Construction Projects

SCDRS Initiative Objective(s)
Increase river spawning habitat

Update
The UM Water Center and Michigan Sea Grant have been working with a number of initiative partners (USGS, USFWS, MDNR, JJRSmithGroup, MI Wildlife Conservancy) to coordinate the construction of a series of spawning reef projects in the St. Clair and Detroit rivers. The projects are designed to compensate for historic losses of fish habitat and remediate associated Beneficial Use Impairments.

In late fall of 2016, the restoration team established a four-acre reef project around the head of Belle Isle in the Detroit River. The project consists of three small reef units, each located in area with high water velocity and stable bottom substrates. Several dive assessments were conducted to ensure there were no signs of active sediment deposition and no live native unionid mussels would be impacted. The reef design is similar to prior projects: each Belle Isle reef unit was made with 4-8 inch quarried limestone, forming a 2-foot thick layer of rock on the river bottom.

The restoration team is currently working on the last spawning reef construction project that falls under the Detroit River AOC remediation plans. The site selected is offshore from the historic Fort Wayne park and parade grounds. A 50 x 50 foot test reef was established at this site in 2015 to help determine if the site is suitable and assess potential risks from freighters.

As indicated in other briefing book entries (USGS, FWS), biological and physical monitoring continues on completed reef projects. Lake sturgeon eggs were found on most of the constructed reef projects in the system in 2016, and viable larvae were found downstream of these projects. The rock for recent projects seems to be in good condition with only moderate levels of sediment accumulation in lower levels.

The team is offering a seminar about reef project planning in conjunction with IAGLR in Detroit, and is planning a larger celebration of Belle Isle restoration over the summer. More involvement in projects is always welcome.

www.miseagrant.umich.edu/restoration

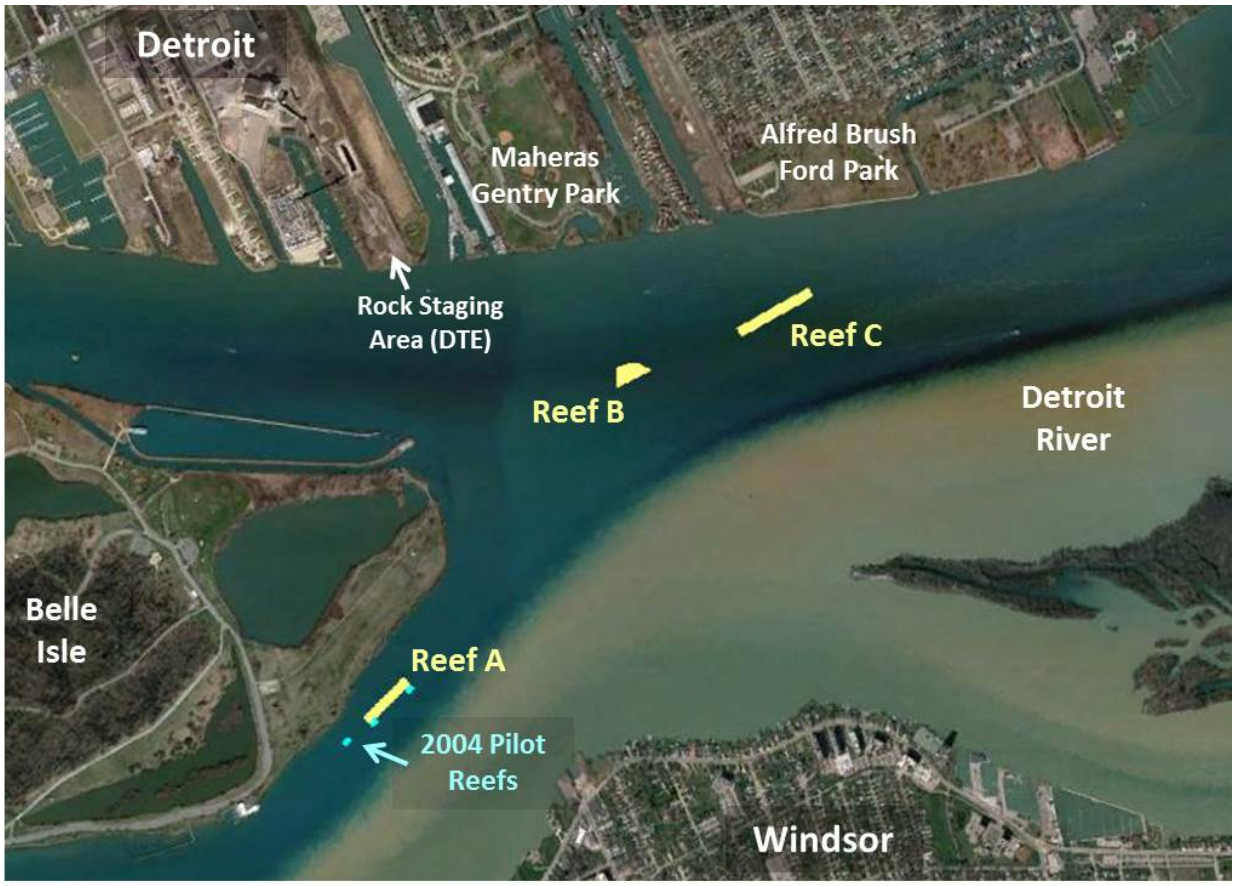

Figure 1. Aerial image showing the layout for the 2016 Belle Isle spawning reef project.