

# Benthic Habitat Mapping in the Great Lakes

**Brandon Krumwiede**

Great Lakes Regional Geospatial Coordinator

CSS Inc on contract to NOAA Office for Coastal Management



# Presentation Overview

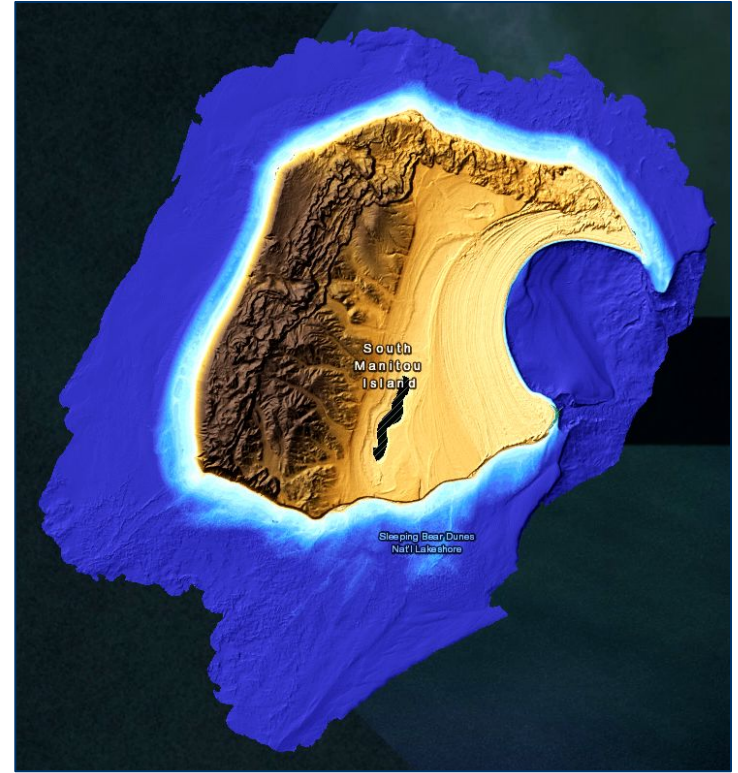
1. Status of Mapping in the Great Lakes
2. Nearshore and Coastal Challenges
3. Coastal and Marine Ecological Classification Standard (CMECS)
4. Completed and Upcoming Projects

# To Get Things Started... Bathymetry

## Marine Geomorphology as Proxy for Marine Habitats

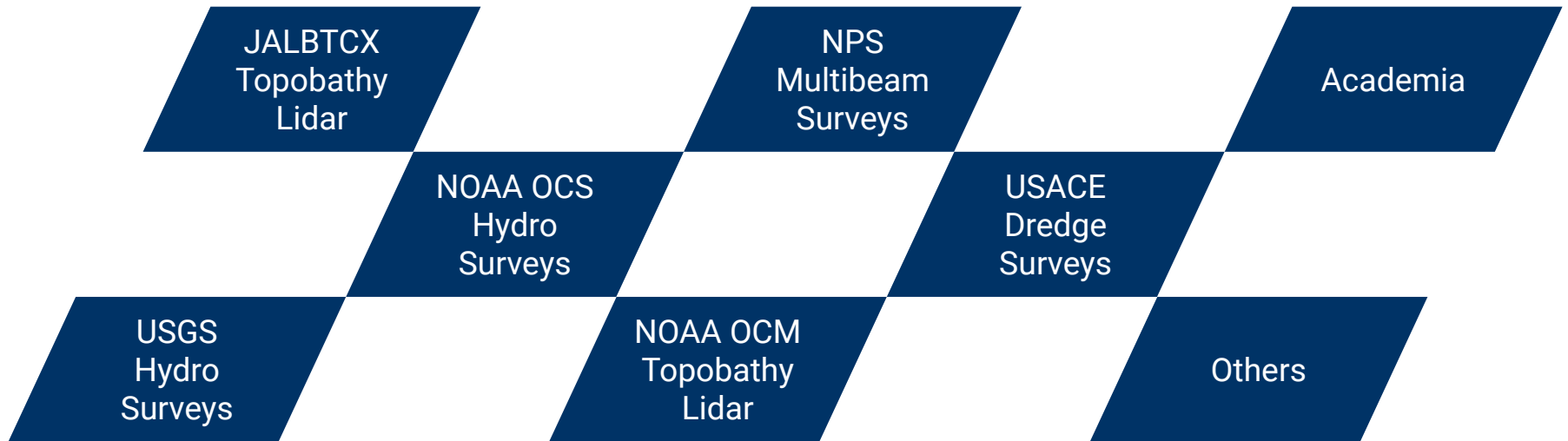
*“Marine environments and their associated biota are dictated by their physical oceanographic and geographic setting at all scales.”*

William D. Heyman & Dawn J. Wright (2011) Marine Geomorphology in the Design of Marine Reserve Networks, *The Professional Geographer*, 63:4, 429-442, DOI: [10.1080/00330124.2011.585074](https://doi.org/10.1080/00330124.2011.585074)



# Status of Mapping in the Great Lakes

Piecing things together...



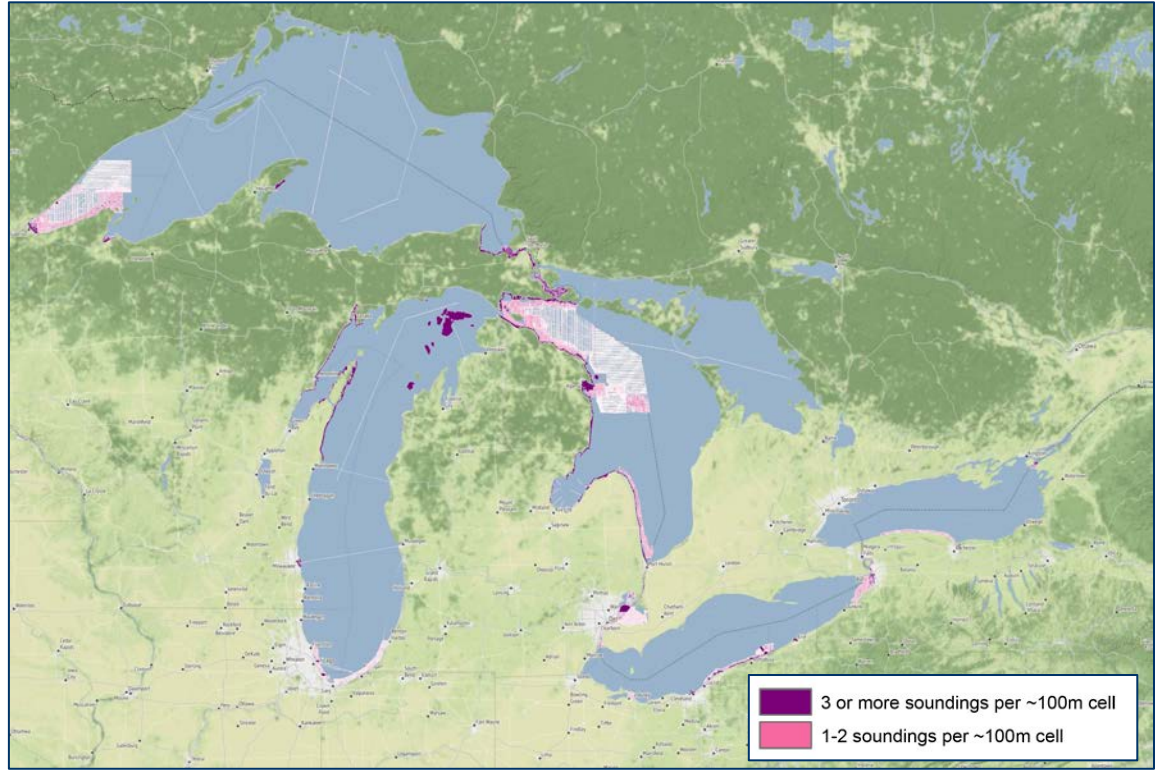
# Status of Mapping in the Great Lakes

## NOAA NCEI Coastal Waters Bathymetry Gap Analysis

Only 4% mapped with 1 sounding per 100 meter grid cell  
(6,860km<sup>2</sup>/159,833km<sup>2</sup>)

Only 2% mapped with 3 soundings per 100 meter grid cell

Source: NOAA NCEI



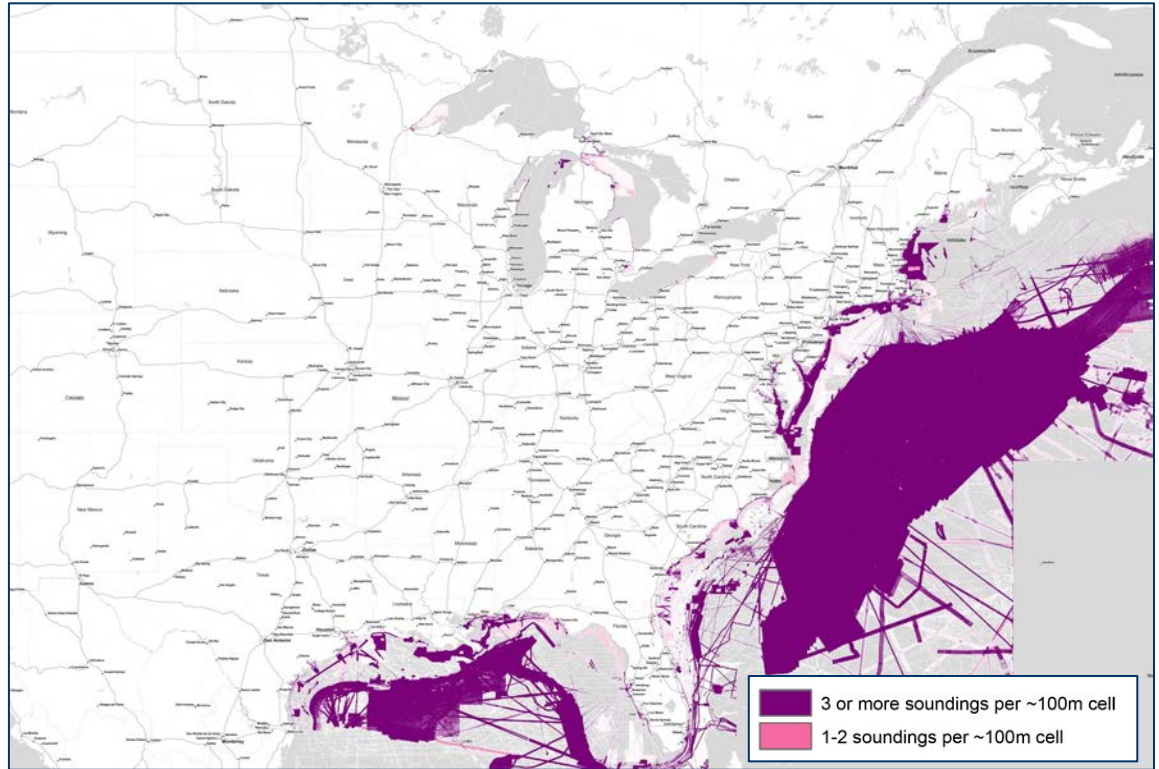


# Status of Mapping in the Great Lakes

## NOAA NCEI Coastal Waters Bathymetry Gap Analysis Comparison

1 sounding per 100 meter grid cell  
Great Lakes - 4%  
Atlantic and Gulf of Mexico - 42%

Source: NOAA NCEI



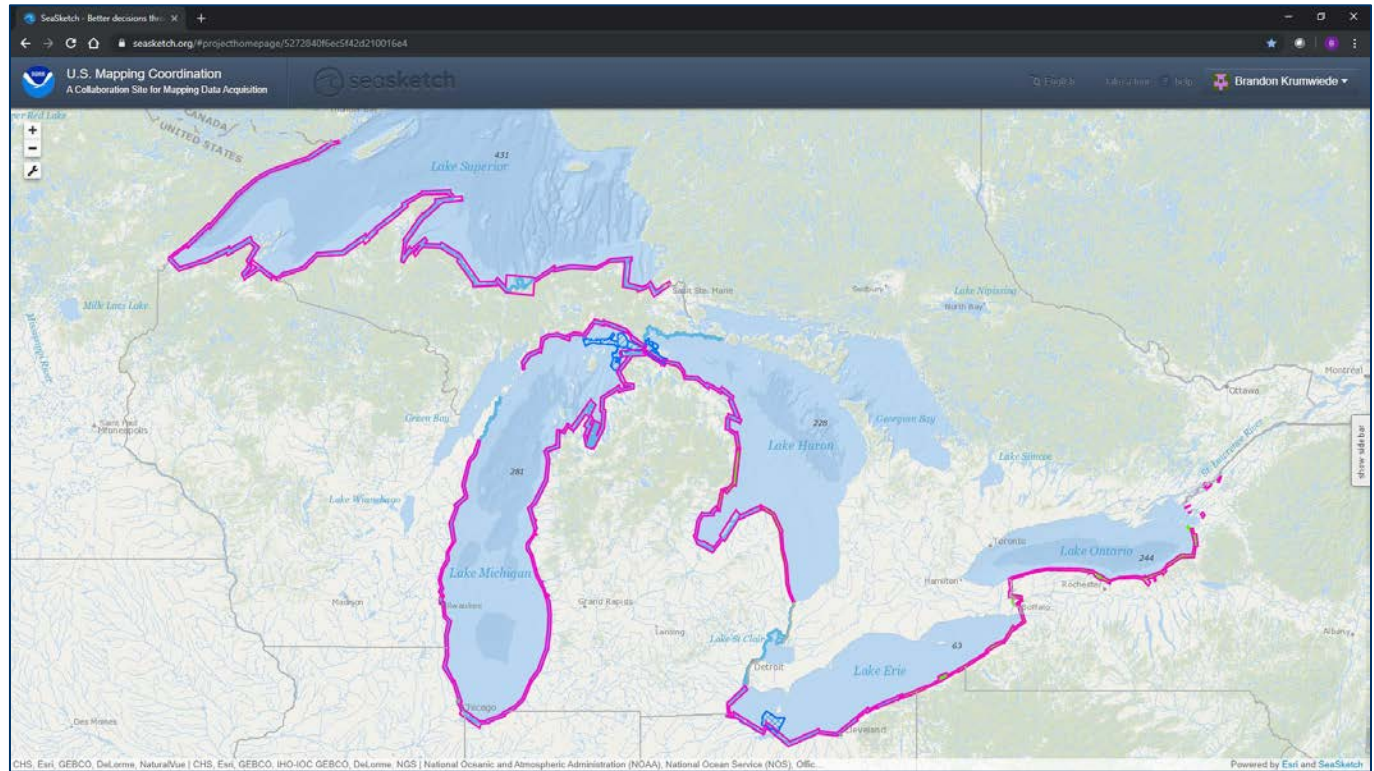
# Status of Mapping in the Great Lakes

## Upcoming Data

Primarily  
JALBTCX in the  
coastal areas

Some offshore  
NOAA OCS  
hydro surveys

NPS national  
parks and  
lakeshores MB



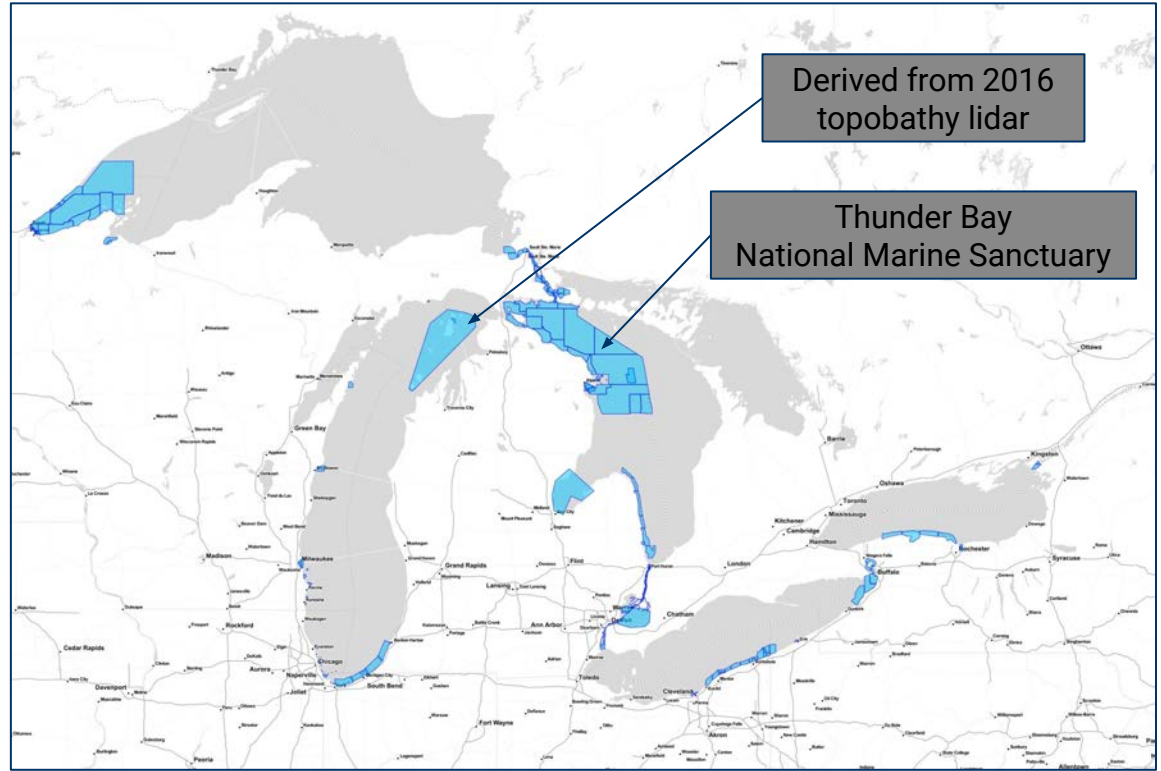
# Status of Mapping in the Great Lakes

## Hydrographic Surveys (1967 - 2017)

Limited recent work has  
been completed

New surveys through the  
Straits of Mackinac and  
Southern Lake Michigan  
(2020)

Deepwater areas  
primarily 1917 - 1967





# Status of Mapping in the Great Lakes

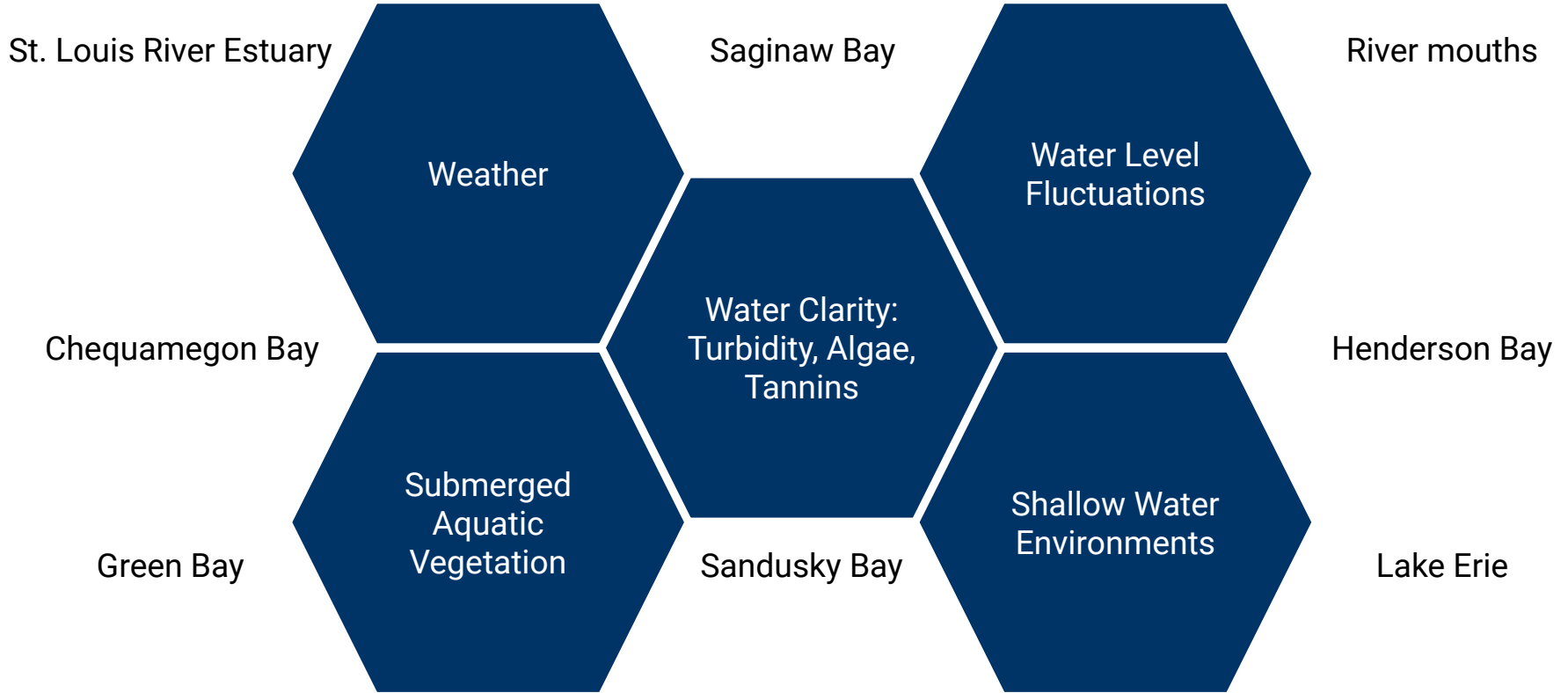
## Topobathy and Bathymetry Lidar Collection (2019 Status)

2001-2016 Vintage

JALBTCX work in 2018, 2019, and hope to finish in 2020 (not shown)



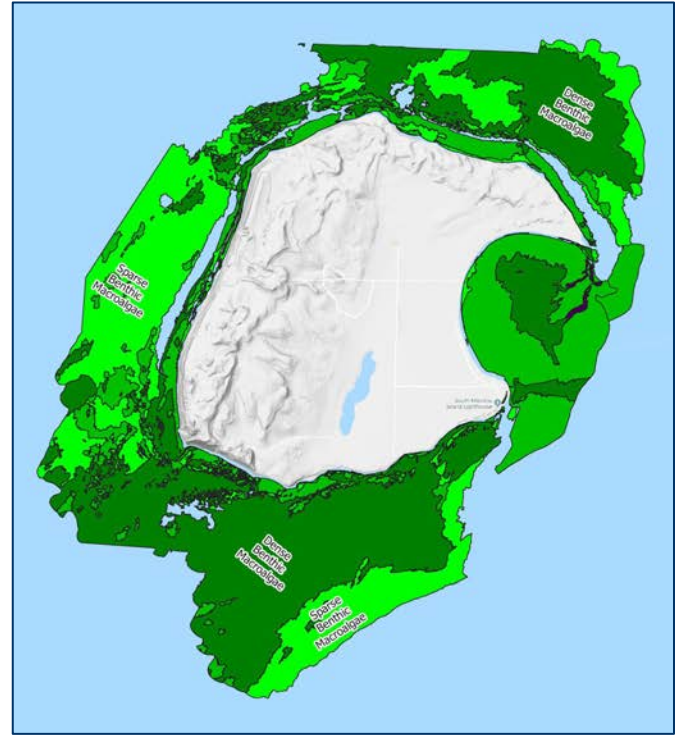
# Nearshore and Coastal Challenges



# Coastal and Marine Ecological Classification Standard (CMECS)

Provides a comprehensive national framework for organizing information about coasts and oceans and their living systems.

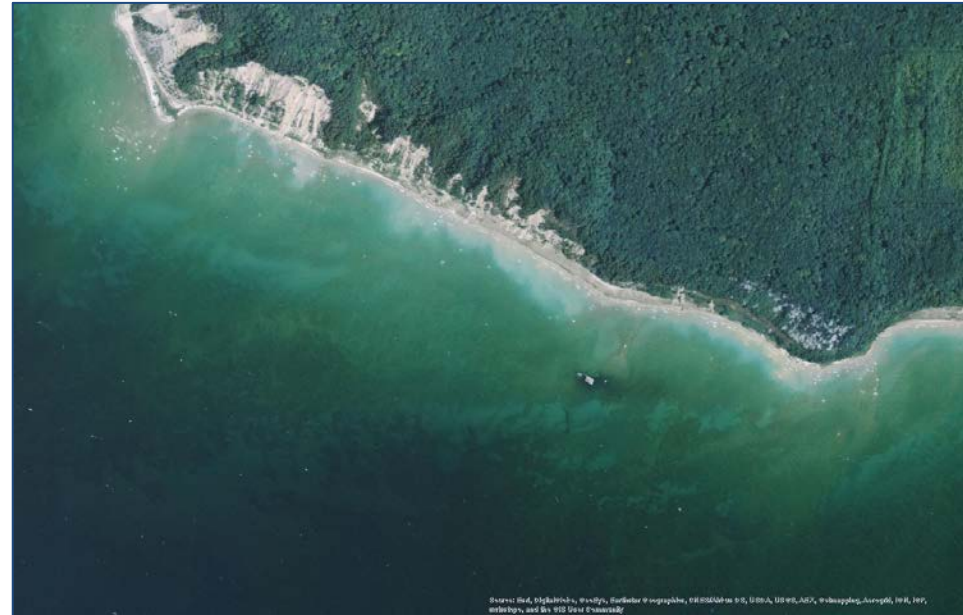
The Federal Geographic Data Committee (FGDC) has endorsed CMECS as a national standard. As an approved Federal Geographic Data Committee (FGDC) standard, CMECS would be required if federal funds are used for a project.



# Coastal and Marine Ecological Classification Standard (CMECS)

How can it be used?

- Ecosystem inventory and mapping
- Coastal and marine spatial planning
- Marine Protected Area selection, evaluation, and assessment
- Resource management and monitoring
- Conservation status assessment
- Habitat modeling
- Ecosystem services evaluation



# Coastal and Marine Ecological Classification Standard (CMECS)

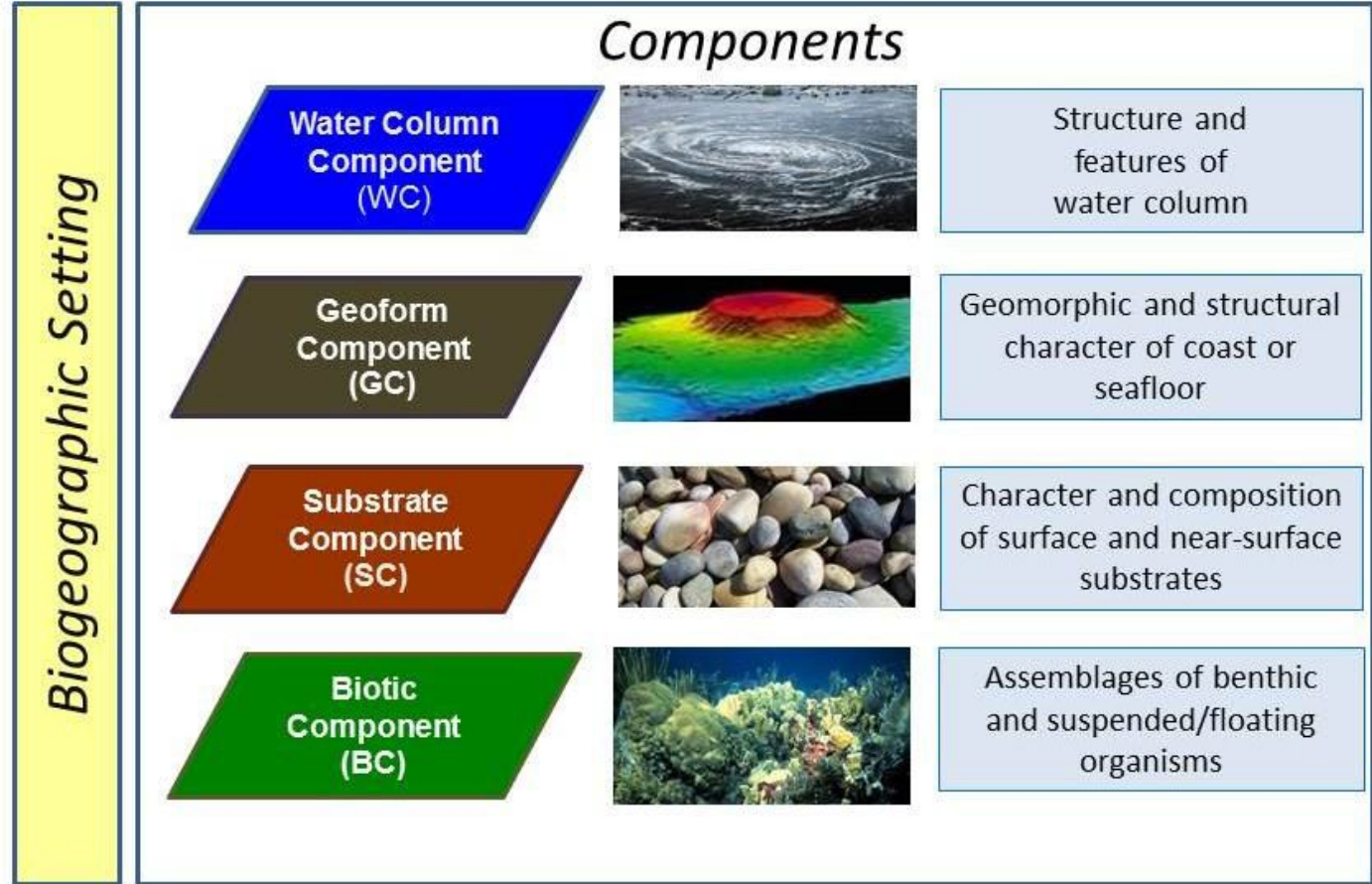
## CMECS Benefits

- Data collected by different sensors and methods can be integrated into a single database.
- All the physical, biological, and chemical-forcing functions that collectively determine a habitat type can be captured.
- The system has the flexibility to accommodate new units as additional information becomes available.
- CMECS incorporates water column habitats and associated landforms of the coastal and marine environment. This multi-component approach allows end-users to evaluate environmental drivers that influence species distributions and conditions independent of the observation process.



# CMECS

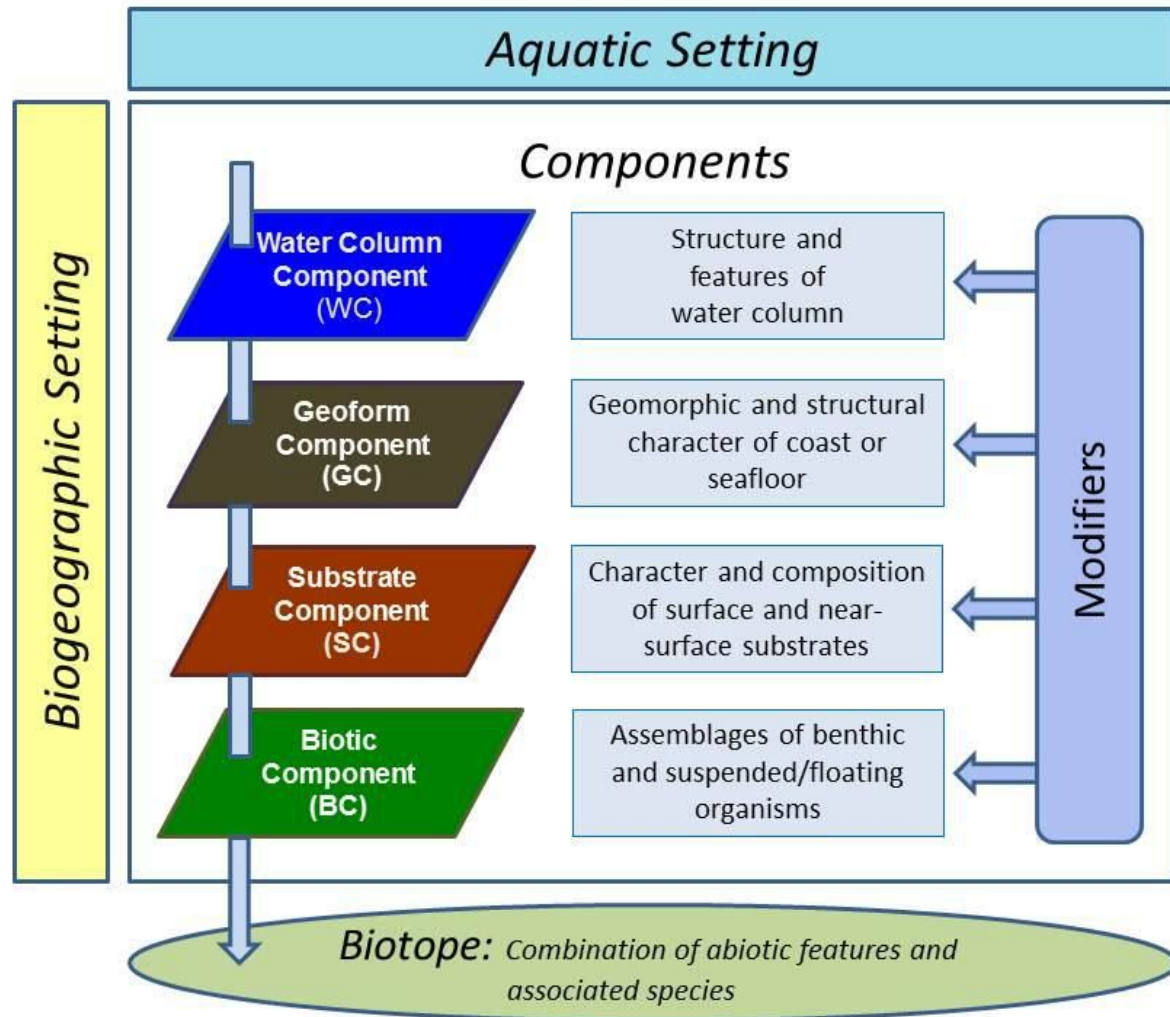
## Settings and Components



# CMECS

Settings and  
Components

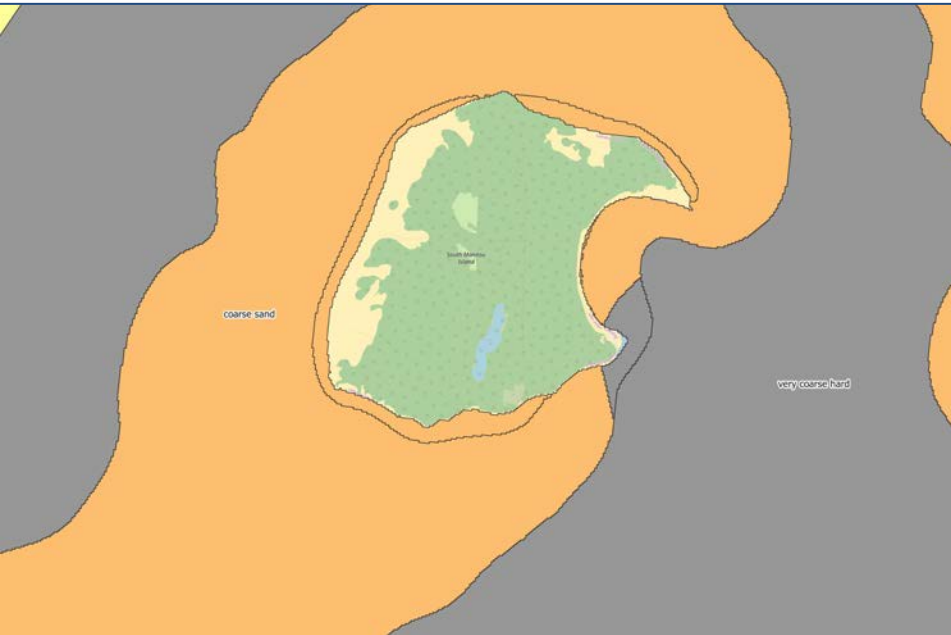
Resulting  
Biotope  
(*Habitat*)



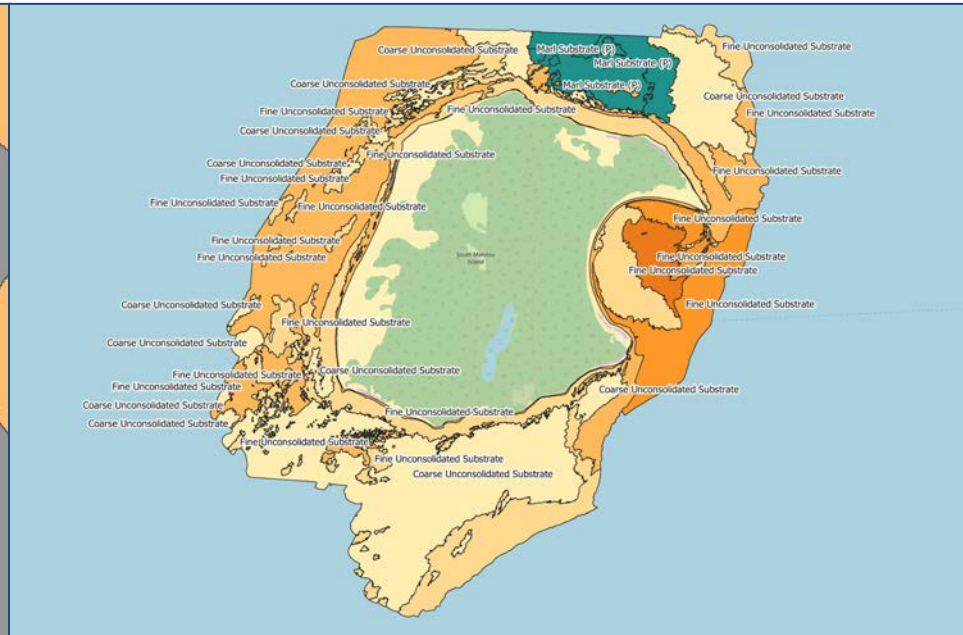
# Coastal and Marine Ecological Classification Standard (CMECS)

Biogeographic Setting (BS)	Aquatic Setting (AS)	Water Column Component (WC)	Geoform Component (GC)	Substrate Component (SC)	Biotic Component (BC)
<i>Realm</i> <i>Province</i> <i>Ecoregion</i>	<i>System</i> <i>Subsystem</i> <i>Tidal Zone</i>	<b>Layer Subcomponent</b>	<b>Tectonic Setting Subcomponent</b>	<i>Substrate Origin</i> <i>Substrate Class</i> <i>Substrate Subclass</i> <i>Substrate Group</i> <i>Substrate Subgroup</i>	<i>Biotic Setting</i> <i>Biotic Class</i> <i>Biotic Subclass</i> <i>Biotic Group</i> <i>Biotic Community</i>
		<b>Salinity Subcomponent</b>	<b>Physiographic Setting Subcomponent</b>		
		<b>Temperature Subcomponent</b>	<b>Level 1 Geoform Subcomponent</b> <i>Geoform Origin</i> <i>Level 1 Geoform</i> <i>Level 1 Geoform Type</i>		
		<b>Hydroform Subcomponent</b> <i>Hydroform Class</i> <i>Hydroform</i> <i>Hydroform Type</i>	<b>Level 2 Geoform Subcomponent</b> <i>Geoform Origin</i> <i>Level 2 Geoform</i> <i>Level 2 Geoform Type</i>		
		<b>Biogeochemical Feature Subcomponent</b>			

# CMECS Example: South Manitou Island



South Manitou Island GLAHF Substrate (2015)



South Manitou Island CMECS Substrate (2016)



# CMECS Projects in the Great Lakes



Google Earth  
Image © 2019 Google  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image Landsat / Copernicus



# Completed Projects

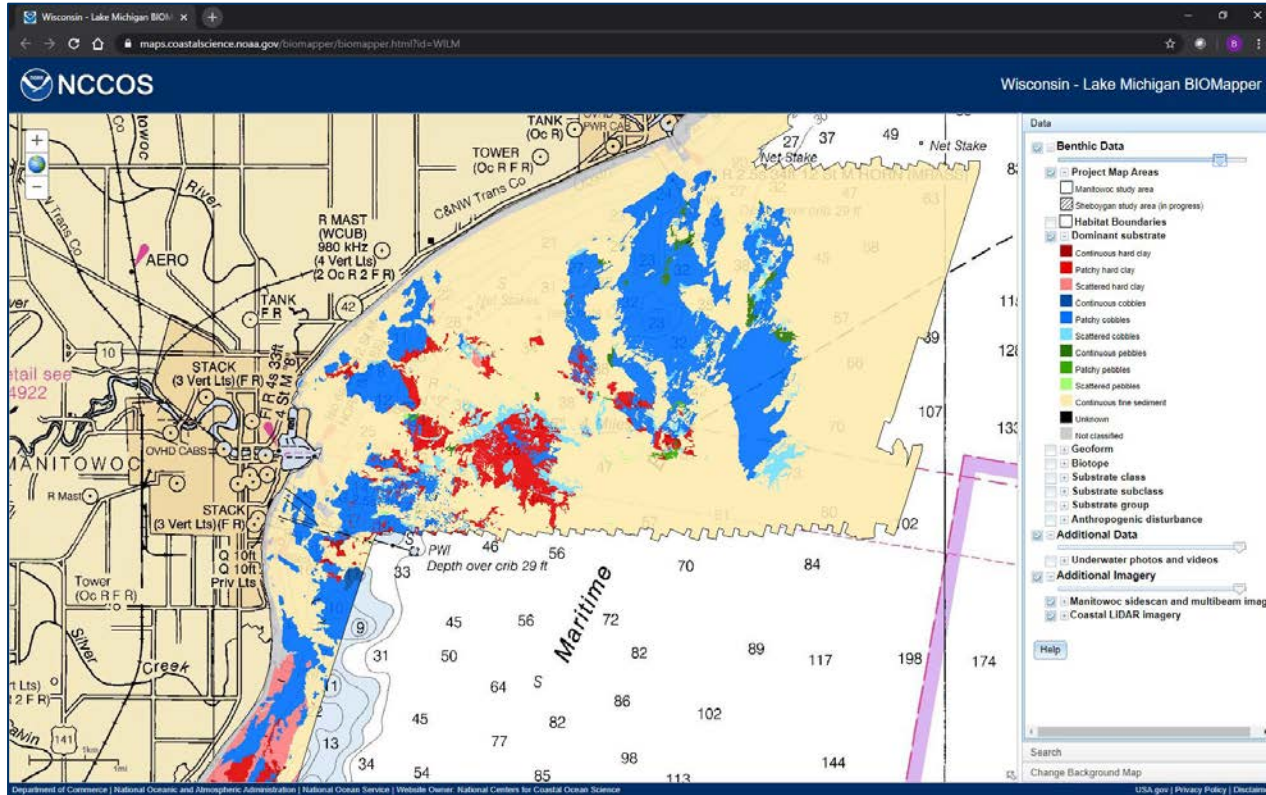
South Manitou Island Benthic Cover Geodatabase (2016)

Lakebed Mapping and Assessing Ecological Resources off Wisconsin's Lake Michigan Coast (2019)



Mussel hash and Cladophora, South Manitou Island 2016

# NOAA NCCOS BioMapper



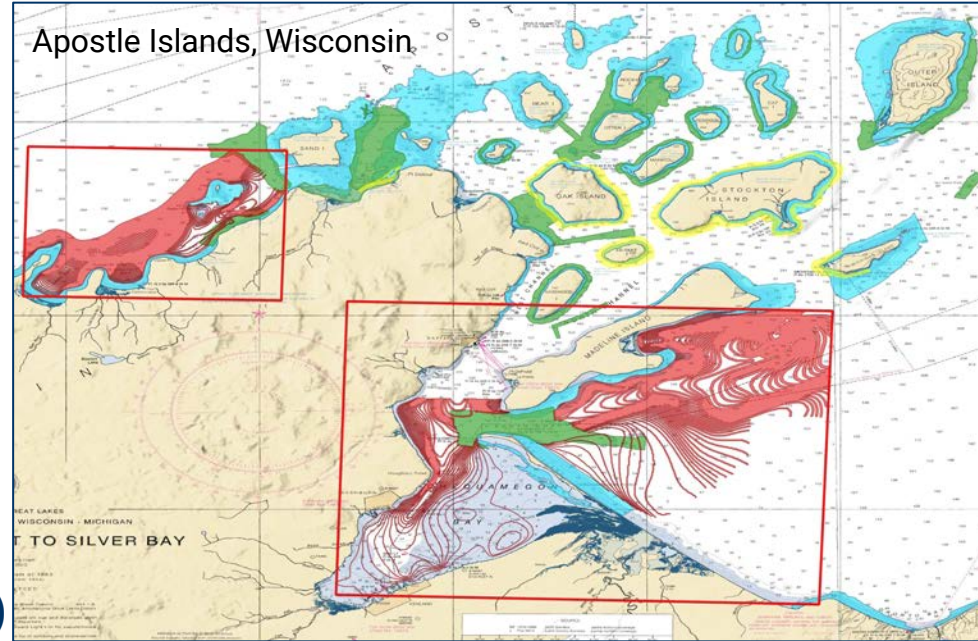
# In Progress Projects

Thunder Bay NMS  
(NOAA)

Illinois Beach State Park  
(USACE, NOAA)

Apostle Islands National Lakeshore  
(NOAA, NPS)

TBD in the Great Lakes  
(NOAA, CSO, Limnotech, Respec, DEA)



# Great Lakes Bottom Mapping





# Resources

NOAA Office for Coastal Management Digital Coast

*[coast.noaa.gov/digitalcoast](https://coast.noaa.gov/digitalcoast)*

Coastal and Marine Ecological Classification Standard

*[iocm.noaa.gov/cmecs/](https://iocm.noaa.gov/cmecs/)*

NOAA NCCOS BioMapper for Lake Michigan

*[maps.coastalscience.noaa.gov/biomapper/biomapper.html?id=WILM](https://maps.coastalscience.noaa.gov/biomapper/biomapper.html?id=WILM)*

NOAA NCEI Bathymetric Data Viewer

*[maps.ngdc.noaa.gov/viewers/bathymetry/](https://maps.ngdc.noaa.gov/viewers/bathymetry/)*

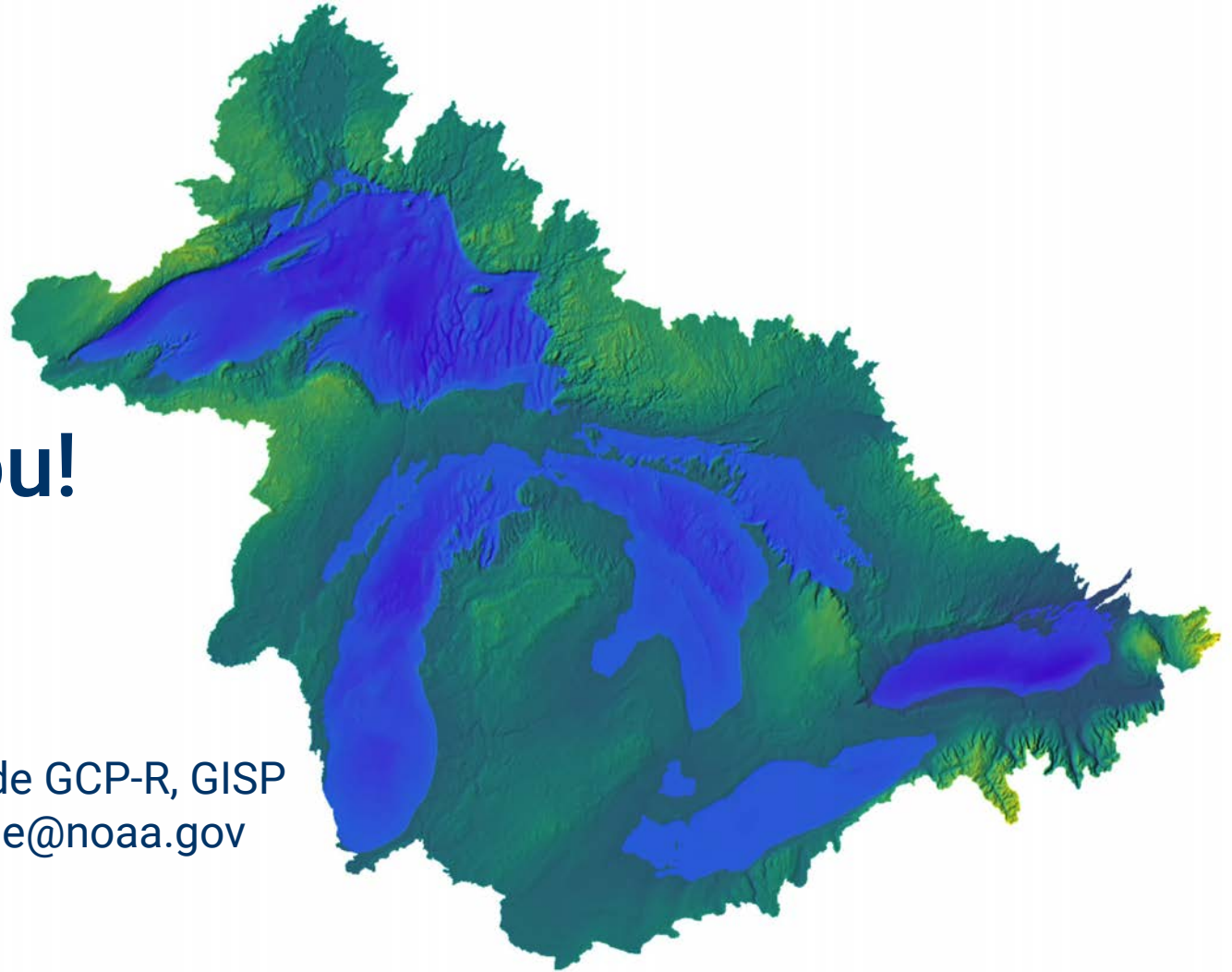
US Interagency Elevation Inventory

*[coast.noaa.gov/inventory/](https://coast.noaa.gov/inventory/)*



# Thank You!

Brandon Krumwiede GCP-R, GISP  
brandon.krumwiede@noaa.gov  
(320) 290-1381  
@bkgeospatial



# Need for Coastal Bathymetry

