

# ECOLOGICAL ASSESSMENT OF THE PROPOSED WISCONSIN-LAKE MICHIGAN NATIONAL MARINE SANCTUARY

*Coastal GeoTools, Myrtle Beach SC, February 12, 2019*

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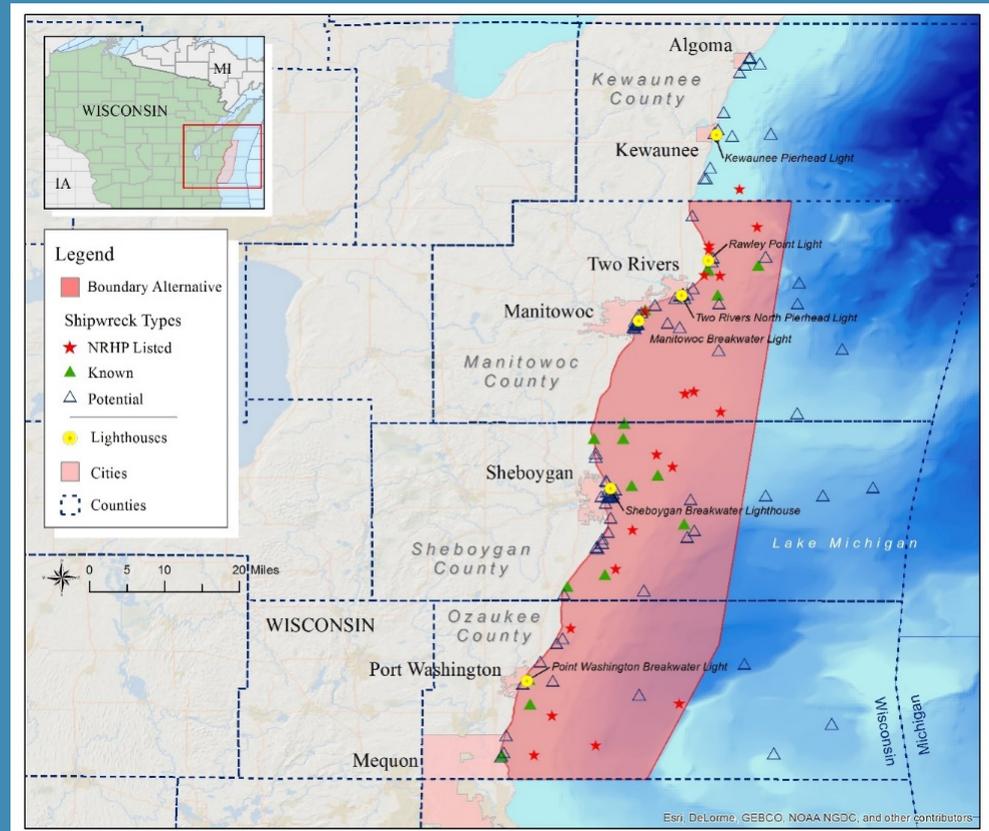
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National Ocean Service  
National Centers for Coastal Ocean Science



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# ECOLOGICAL ASSESSMENT OF PROPOSED WISCONSIN - LAKE MICHIGAN NMS

## ***Why a National Marine Sanctuary in Lake Michigan?***

To conserve maritime heritage, historic artifacts, and diverse lakebed habitats.

## ***Why an Ecological Assessment?***

Improve our understanding of the region's aquatic ecology and maritime heritage by creating maps of lakebed, and baseline ecological assessment .

## ***Where?***

An area offshore of four counties in Wisconsin.

## ***What is the Assessment?***

Benthic Habitat Maps from multibeam and sidescan sonar, 2017 and  
2018

Assessment Report – Lake Ice, Mussels, Water Quality, Algae, Habitat,  
Fish

Digital Atlas – online BIOMapper

Geospatial data synthesis



## The Study Area

Offshore of Ozaukee, Sheboygan, Manitowoc, Kewaunee\* Counties.

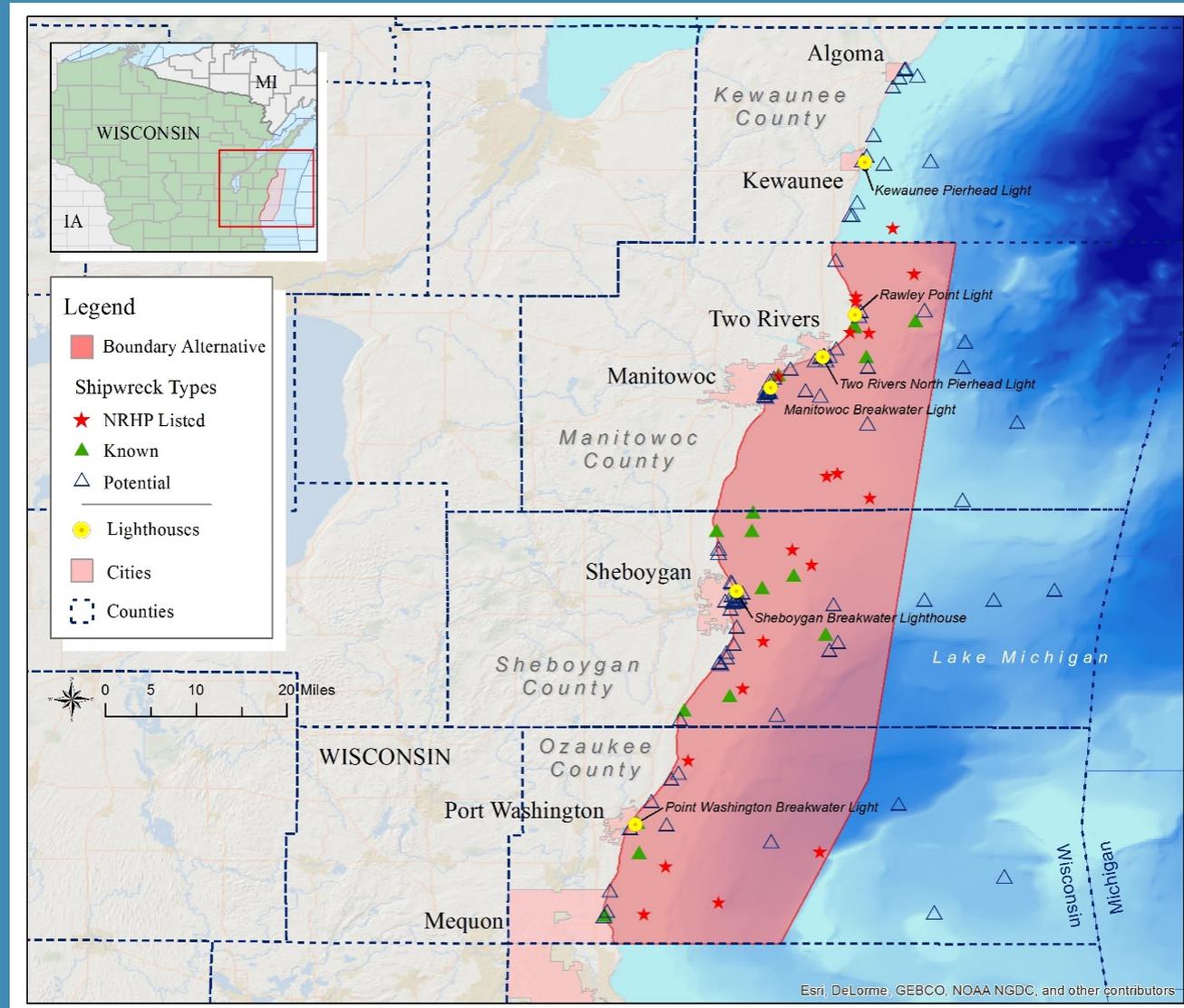
37 known shipwrecks

18 listed on NRHP\*

80 yet to be discovered?

\* Kewaunee County included in Alternative B.

\*National Register of Historic Places



# BENTHIC MAPPING PRIORITIZATION TOOL

The screenshot displays the 'Wisconsin-Lake Michigan Lakebed Mapping Prioritization' tool. The interface includes a search bar at the top left with 'Esri World Geocoder' and a search icon. Below the search bar is a toolbar with various map navigation icons. A 'Spatial Prioritization' panel is open on the left, showing the following settings:

- Coins assigned: 93
- Coins available: 7
- Cells selected: 0
- Assign Coins (per cell): 10
- Primary Justification: General knowledge gap
- Secondary Justification (optional): None
- Tertiary Justification (optional): None
- Primary Map Product: General lakebed mapping
- Secondary Map Product (optional): None
- Tertiary Map Product (optional): None

The map shows a grid of cells along the western shore of Lake Michigan, with colors corresponding to the legend. The legend on the right is titled 'WILM\_Grid\_test - Prioritization' and lists the following categories:

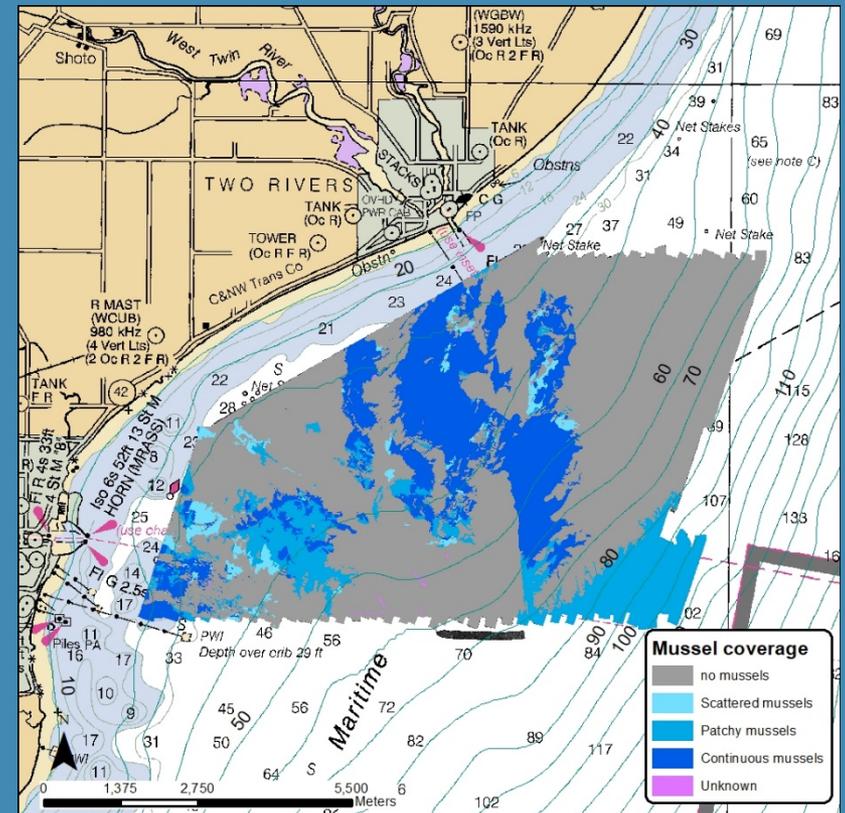
- General knowledge gap (teal)
- Commercial fishing (orange)
- Cultural/historical resources (blue)
- Diving (purple)
- Important biota/natural area (light green)
- Infrastructure (pink)
- Managed area (green)
- Monitoring (brown)
- Recreational boating (yellow-orange)
- Safety and navigation (red)
- Scientific research (dark purple)
- Sediment movement and management (yellow)
- Sport fishing (light purple)

Below the legend is a section for 'Lake Michigan Data' with 'Administrative Areas' and 'Proposed Sanctuary Boundaries' (Alternative A (preferred) and Alternative B).

The map shows the coastline of Lake Michigan with labels for 'Green Bay' and 'Milwaukee'. The bottom of the map includes the text 'Esri, HERE, Garmin, NGA, USGS, NPS | NOAA/'.

# JUNE 2017 MAPPING MISSION

Offshore of Manitowoc County  
Accuracy assessment completed  
New benthic habitat classification



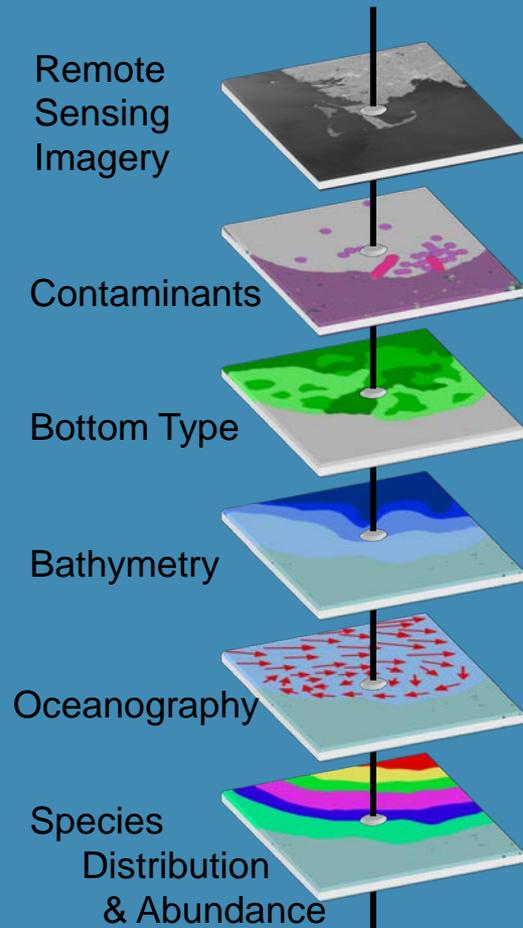
# ECOLOGICAL ASSESSMENT

- **Invasive Mussels**
- **Fish**
- **Water Quality**
- **Habitats**



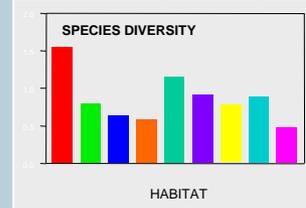
# Biogeographic Assessment Framework (Caldow, et. al.)

## Biogeographic Data Layers

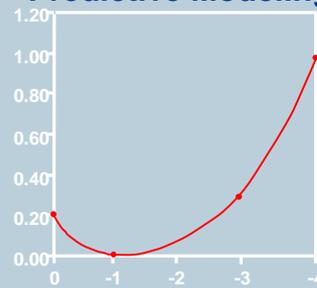


## Analyses

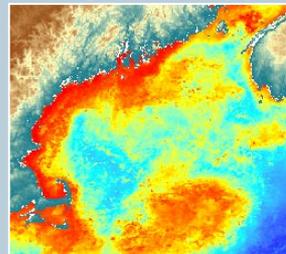
### Community Analyses



### Predictive Modeling



### Geo-spatial Mapping

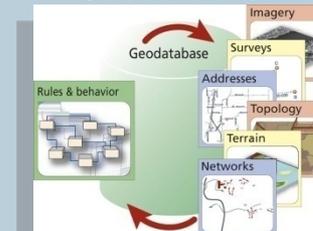


## Products

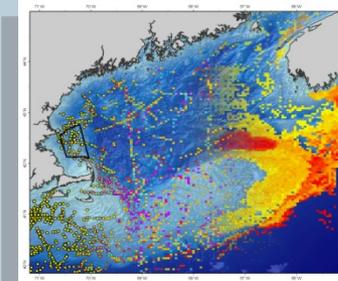
### Report



### Geodatabase



### Geo-spatial Analyses

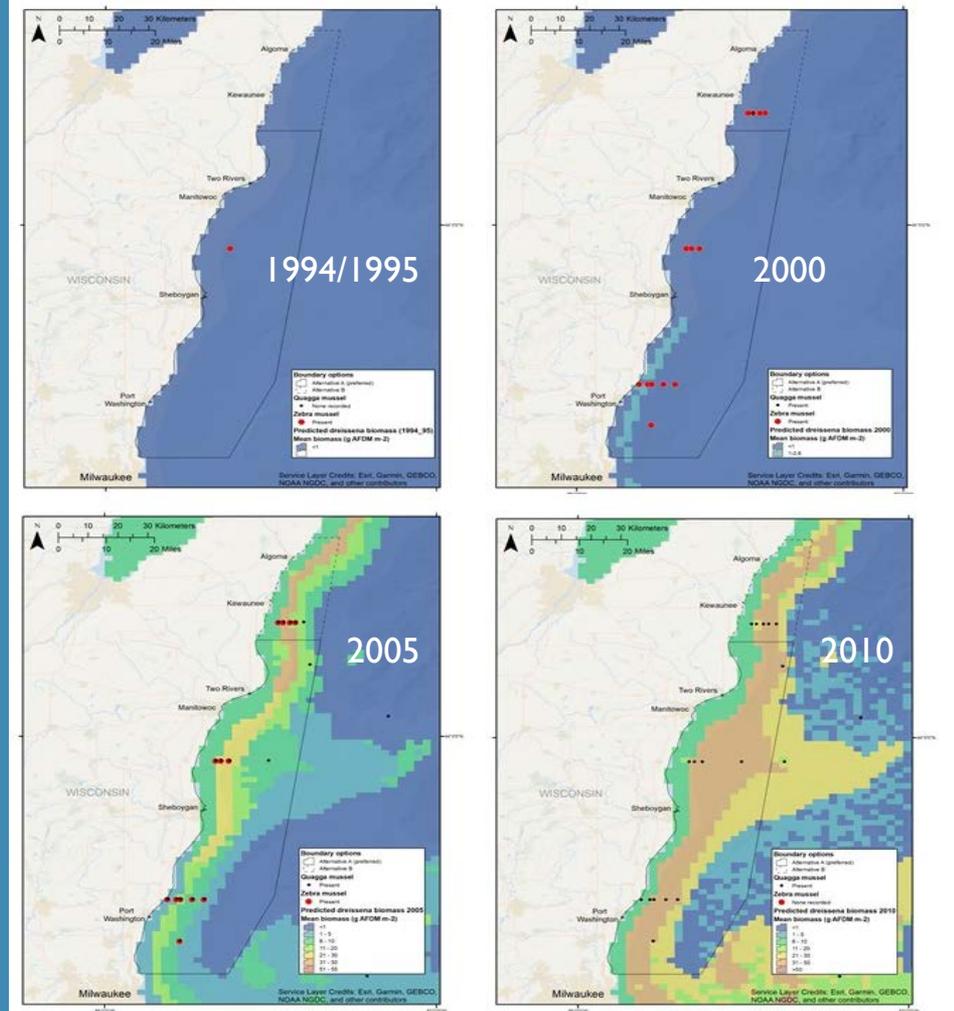


# MUSSELS

Abrupt increase in 2005

Invasion began in shallow water, with increasing trend and extension into deeper water

Highest biomass in 30-60 m water

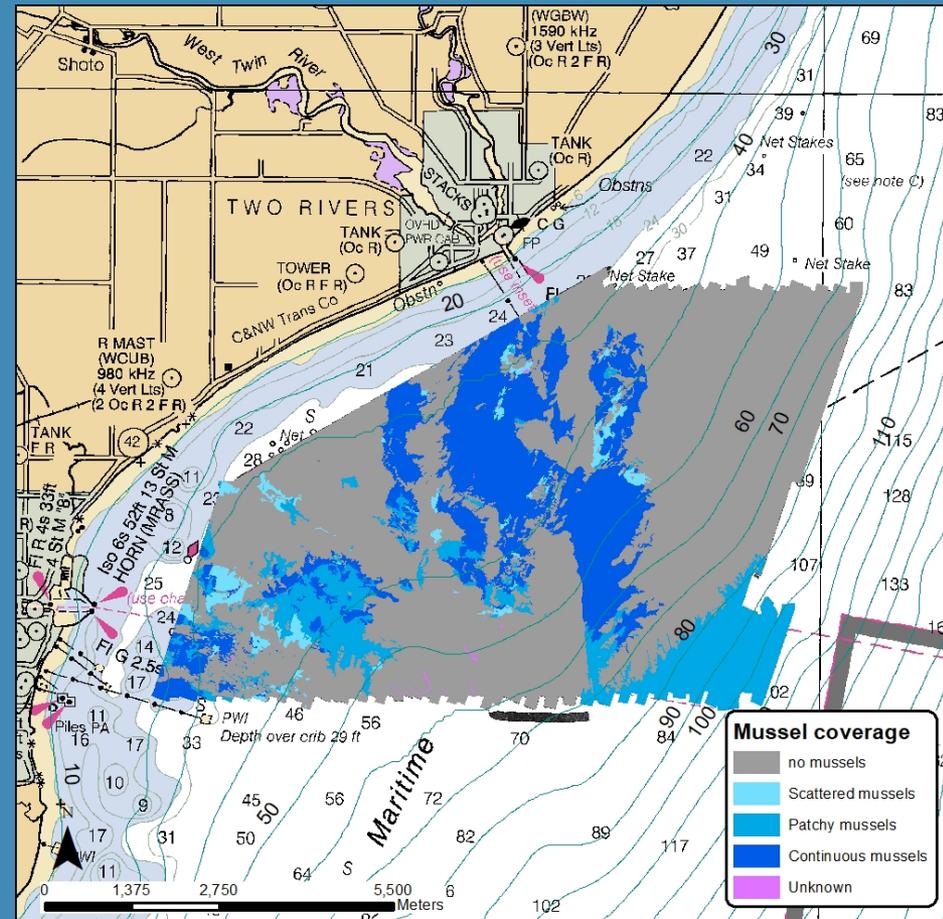


# MUSSEL HABITAT

Mussels on 50% of lakebed

Highest coverage in continuous swaths between 20 and 60 feet

Strong association with cobblely habitat, except >80 ft



# FISH AND FISHERIES

Fish fauna includes both native and non-native species

Historic spawning areas for lake trout, lake herring, yellow perch.

Anadromous species (e.g. steelhead) run in tributary streams.

Major forage fish include bloater chub, sculpins, alewife, round goby, smelt.

Inshore “cool water” species include yellow perch, smallmouth bass.

Recreational fisheries for chinook and coho salmon, lake trout, steelhead trout, and inshore species.

Commercial fishery now primarily for lake whitefish.

Proposed Sanctuary is *not* involved in fisheries management.



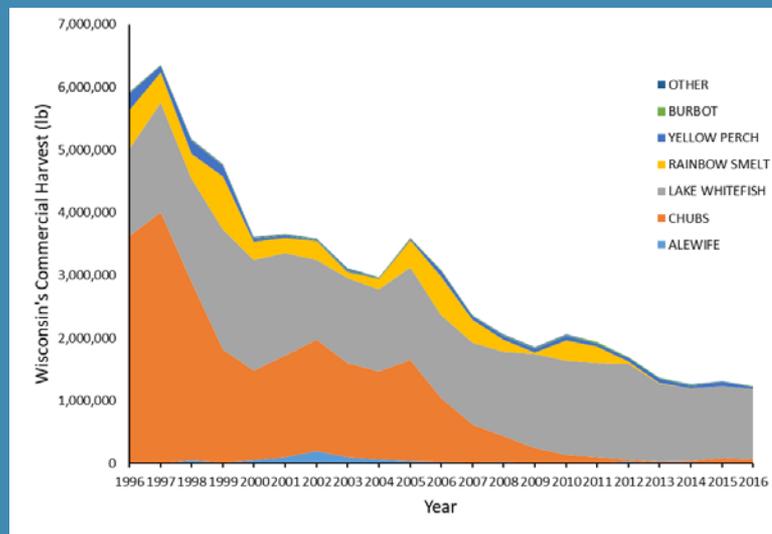
# COMMERCIAL FISHERIES IN WISCONSIN – LAKE MICHIGAN

Many species historically caught.

Many forage fish population levels are near historic lows.

Only lake whitefish persists in commercial landings.

Gear includes trap and gill nets.



# WATER QUALITY

## Long Term Water Quality Monitoring

23 long term monitoring stations only one (MI31B) in the proposed sanctuary (1995-2015), parameters;

- Physical
  - Temperature °C, Upwelling
  - Turbidity (Beam Attenuation m-1)
  - Conductivity  $\mu\text{S}/\text{cm}$
- Chemical
  - Dissolved Oxygen mg/l
  - Phosphorus  $\mu\text{g}/\text{l}$
  - Inorganic nitrogen Nitrite-Nitrate mg/l
- Biological
  - Chlorophyll a  $\mu\text{g}/\text{l}$



Data Source; EPA, USGS, GLAHF and NASA



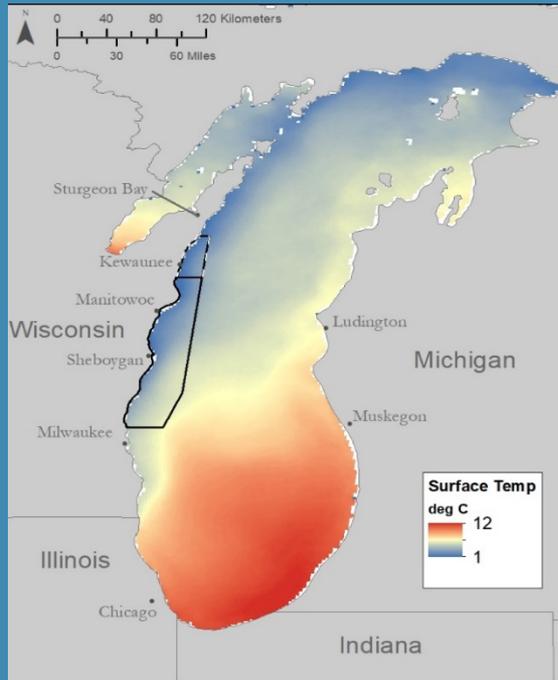
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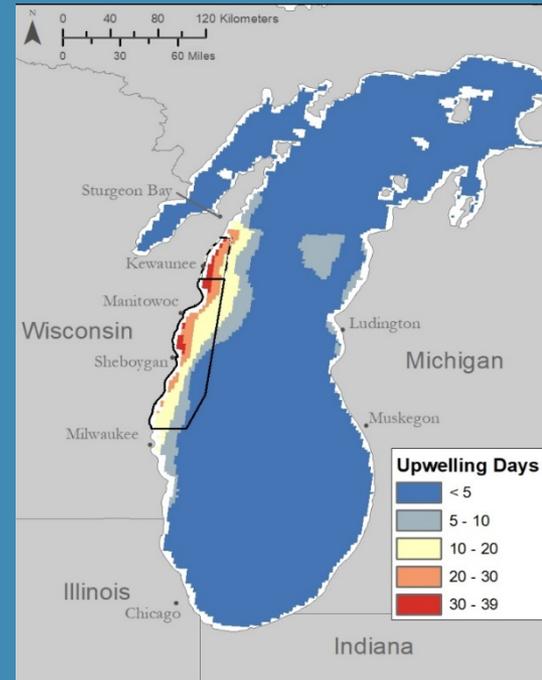
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# UPWELLING

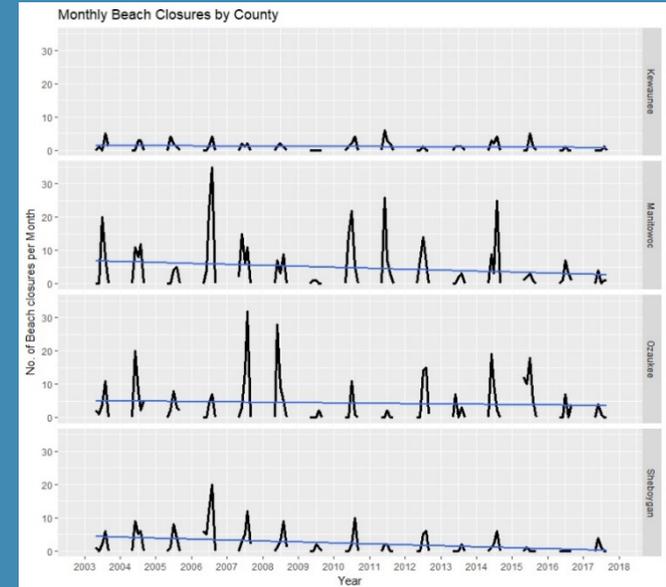
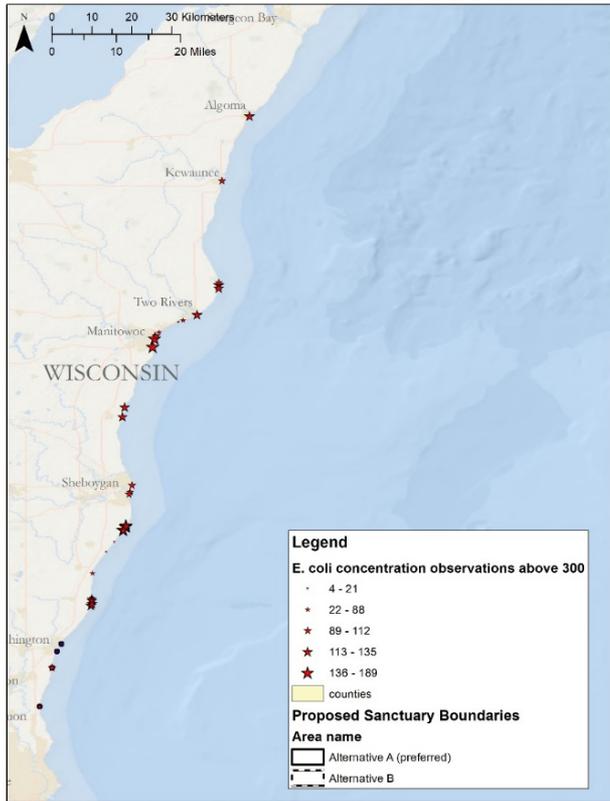
## Surface Temperature



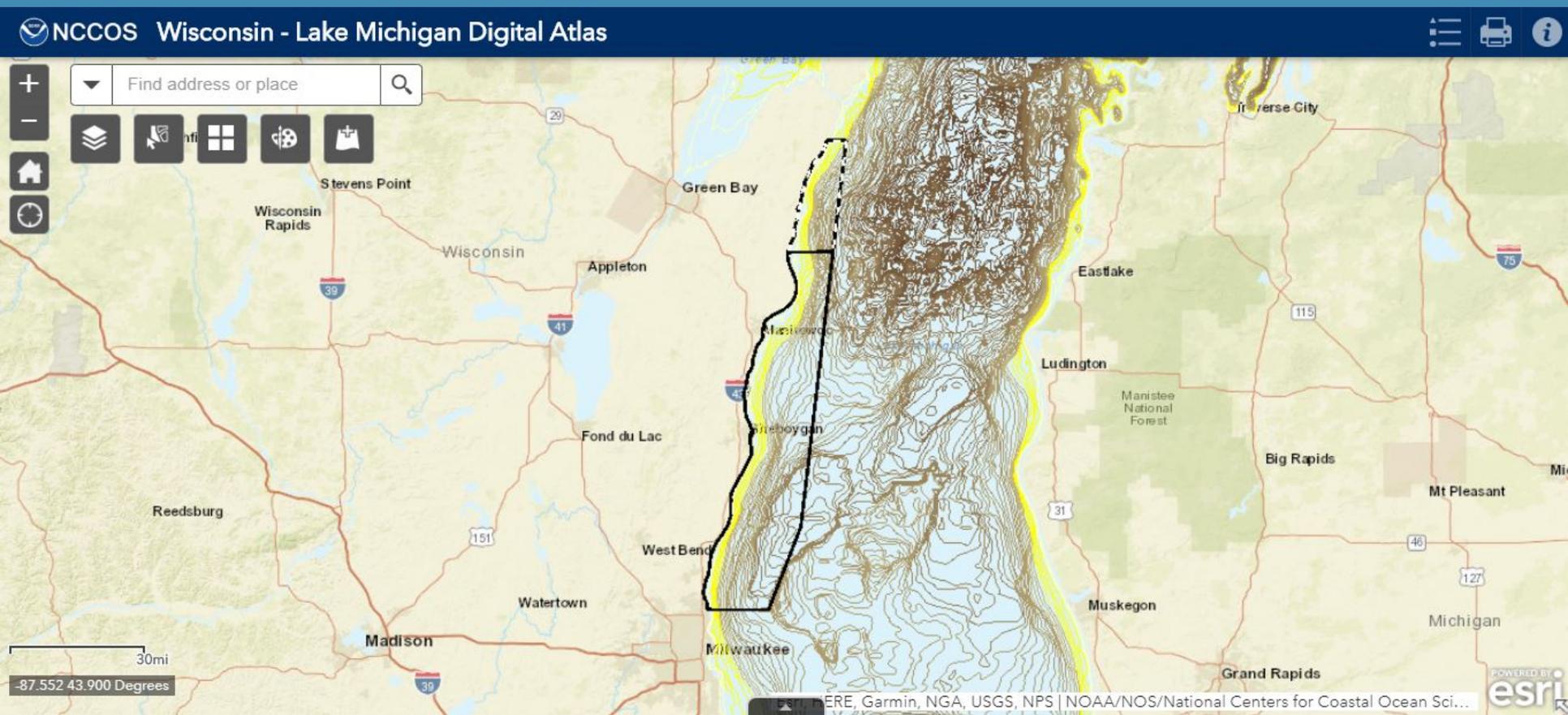
## Upwelling



# BEACH CLOSURES



# ON-LINE GEOSPATIAL DATA



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# WHAT IS NEXT?

Publication and release of digital benthic habitat maps

Publication of assessment report

Launch of public BIOMapper

