



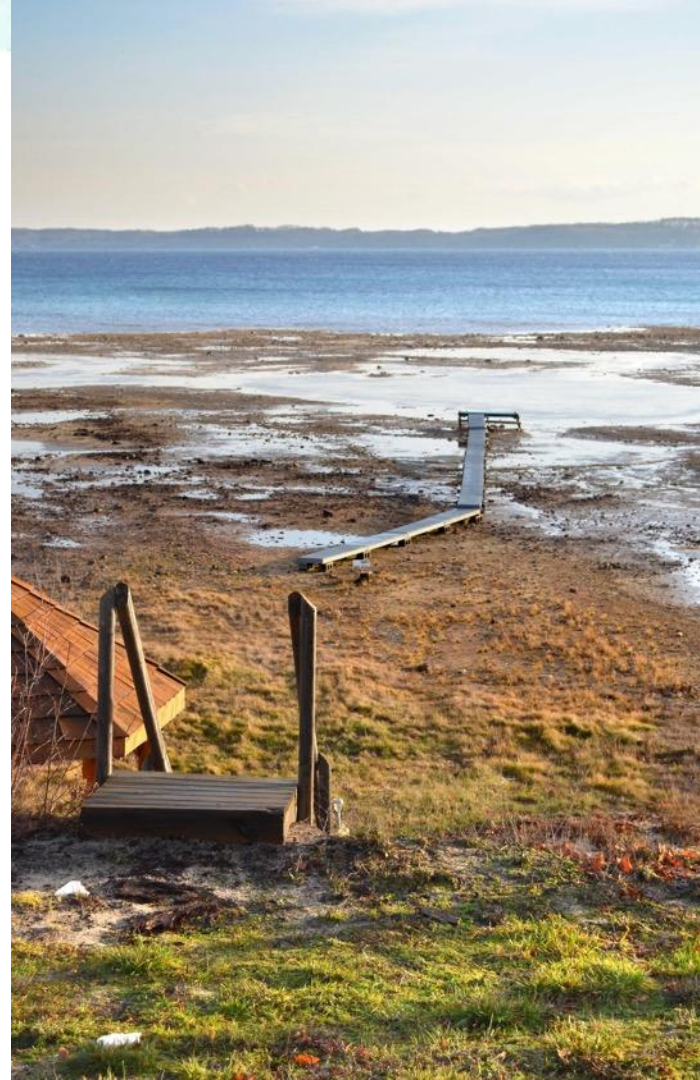
**If you seek a  
pleasant  
peninsula, look  
about you**

**NOAA Hydrographic Services Review Panel | September 26, 2024**

Mark Breederland, Michigan Sea Grant Extension

# Challenges facing the Great Lakes and coastal communities

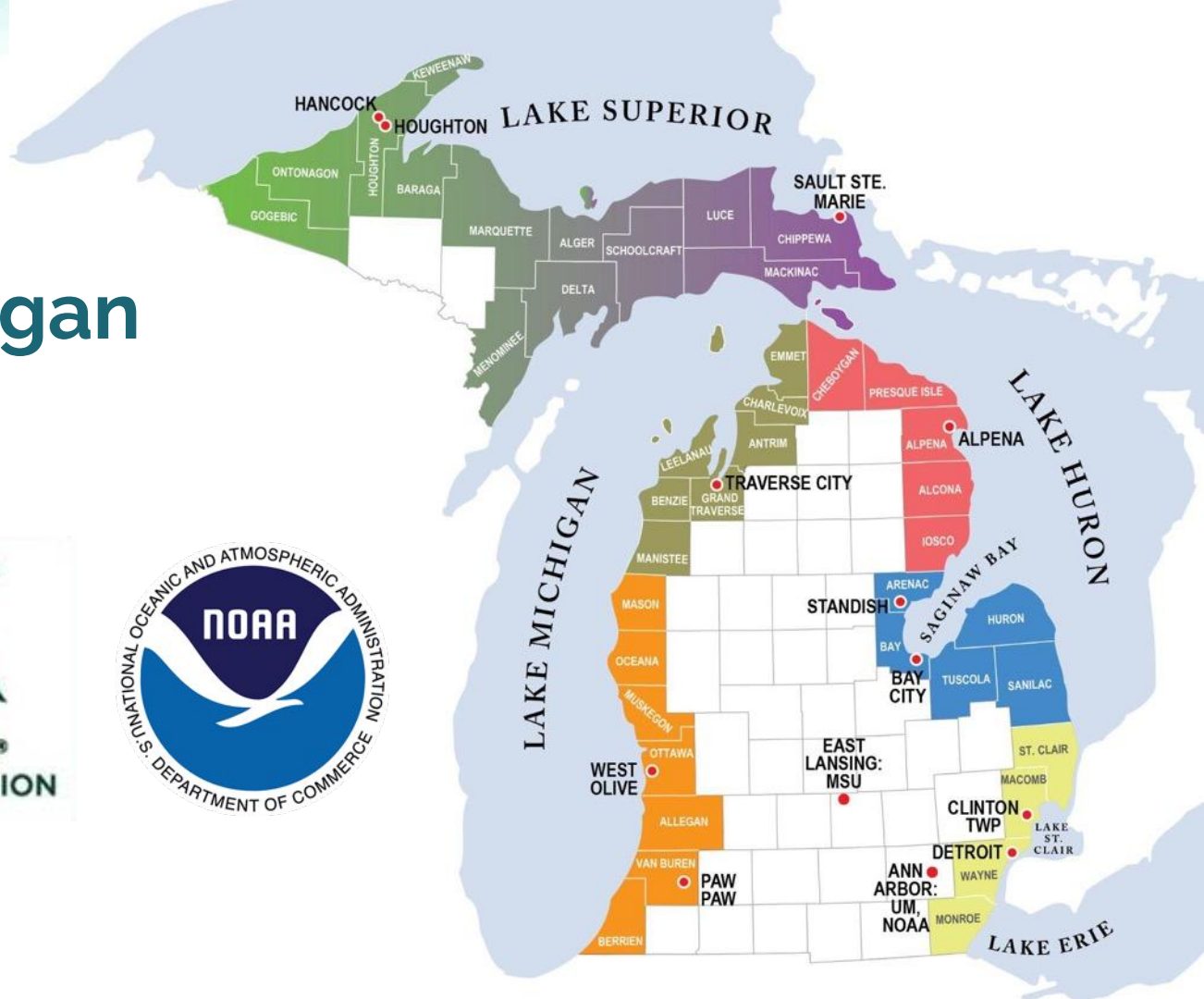
- Harmful algal blooms
- Invasive species
- Coastal resiliency / changing water levels
- Changing fisheries
- Declining workforce







# What is Michigan Sea Grant?



# What is Michigan Sea Grant?

Michigan Sea Grant facilitates research, education, and outreach through partnerships with people, communities, and organizations to foster healthy Great Lakes coastal ecosystems, communities, and economies.



**HEALTHY COASTAL  
ECOSYSTEMS**



**SUSTAINABLE  
FISHERIES &  
AQUACULTURE**



**RESILIENT  
COMMUNITIES  
& ECONOMIES**



**ENVIRONMENTAL  
LITERACY &  
WORKFORCE  
DEVELOPMENT**

# MAKING A DIFFERENCE

Here are a few ways MISG is making a difference in the Great Lakes



## MICHIGAN FRESH FISH

Produced the Mi Fresh Fish Project to educate consumers about the value and availability of fish harvested, farmed, and processed in Michigan and connected aquaculture farmers and commercial fish producers/processors directly to consumers.



## CENTER FOR GREAT LAKES LITERACY

Created interactive online courses that teach educators about specific Great Lakes topics and make it easy for them to share information and knowledge with their students on everything from aquatic species to marine debris.



## INTERNS AND FELLOWS

Coordinated and funded undergraduate and graduate students working on environmental research projects, preparing the next generation of scientists, resource managers, and others who want to protect the Great Lakes.



## NONINDIGENOUS SPECIES

Continued to grow the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS), which provides information about aquatic invasive species to managers and the public.



## MICHIGAN CLEAN MARINAS

Helped administer a state grant program that allows public and private marinas to reduce pollution from boats by providing funds for new or upgraded pumpout stations and waste reception facilities.



## REGIONAL FISHERY WORKSHOPS

Hosted annual fishery workshops to provide recreational anglers and commercial fisheries with regionally tailored information and community science opportunities.



# How does Michigan Sea Grant address HABs?



Get the scoop on harmful algal blooms (HABs) in an upcoming “HABs 101” webinar, hosted by Michigan Sea Grant and partners around the state.

## Mapping genetic variation in *Microcystis* to improve Great Lakes harmful algal bloom models



**CORE QUESTION:**

How do genetic differences influence *Microcystis*' ability to survive predators in harmful algal blooms?





# Resilient Coastal Communities: Sustainable Small Harbors



# **An Integrated Physical-Social-Community (PSC) Approach for Sustainable Shore Protection, Beach Integrity and Bluff/Dune Stabilization along Lake Michigan**

**in response to:**

## **Special Joint Sea Grant Request: Michigan, Illinois-Indiana and Wisconsin**

Michigan – Guy Meadows, Pengfei Xue, Longhuan Zhu, Ryan Williams, Mark Breederland, & Chenfu Huang

Illinois-Indiana – Cary Troy, Aaron Thompson, Hazem Abdelhady, Hannah Tomkins, Ben Nelson-Mercer, Stuart Carleton & Sean Vitousek

Wisconsin - Chin Wu, Robert Enright, Adam Bechle, Miles Tryon-Petith, Luke Lu, Josh Anderson, Lai Wong

2019-2022



# Project Goal

To achieve resilient coastal communities in Lake Michigan through sustainable coastal infrastructure based upon an integrated Physical-Social-Community (PSC) approach



# South Haven – Experimental Plan

## Field Study Goals:

- Assessment of sediment storage in fillets
- Assessment of sediment lost to offshore
- Sediment budget for harbor region
- Impacts updrift and downdrift

Directional Wave,  
Winds and Temps



FVCOM Computational Grid

Jet ski bathymetric mapping



AWAC – ADCP with  
ADV near bottom  
velocities



Web Cam #1



Web Cam #2



IVER bottom survey  
of sand deposits



Jet ski bathymetric mapping



~3 km Offshore

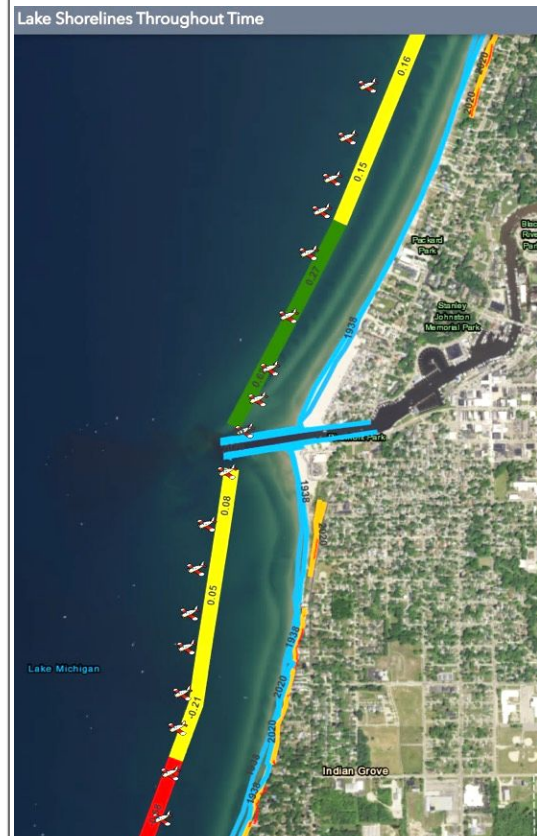
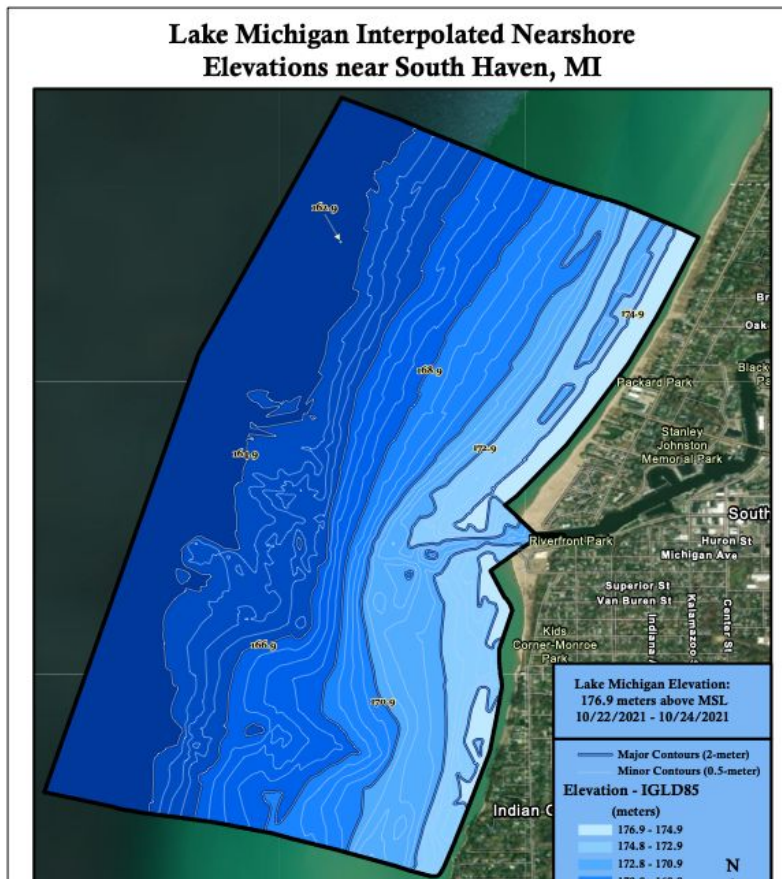
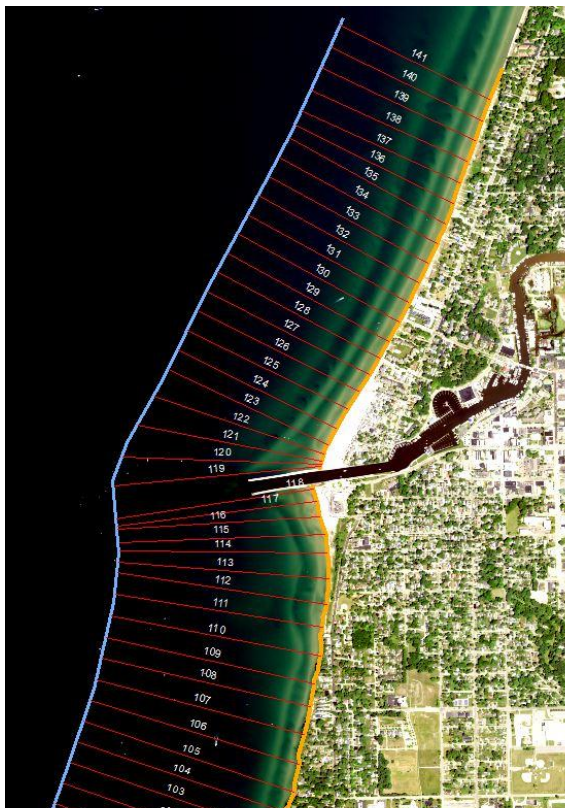
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# Cumulative Impacts of Perpendicular Structures on Bathymetry

## Medium Size Harbor Jetties – South Haven, MI

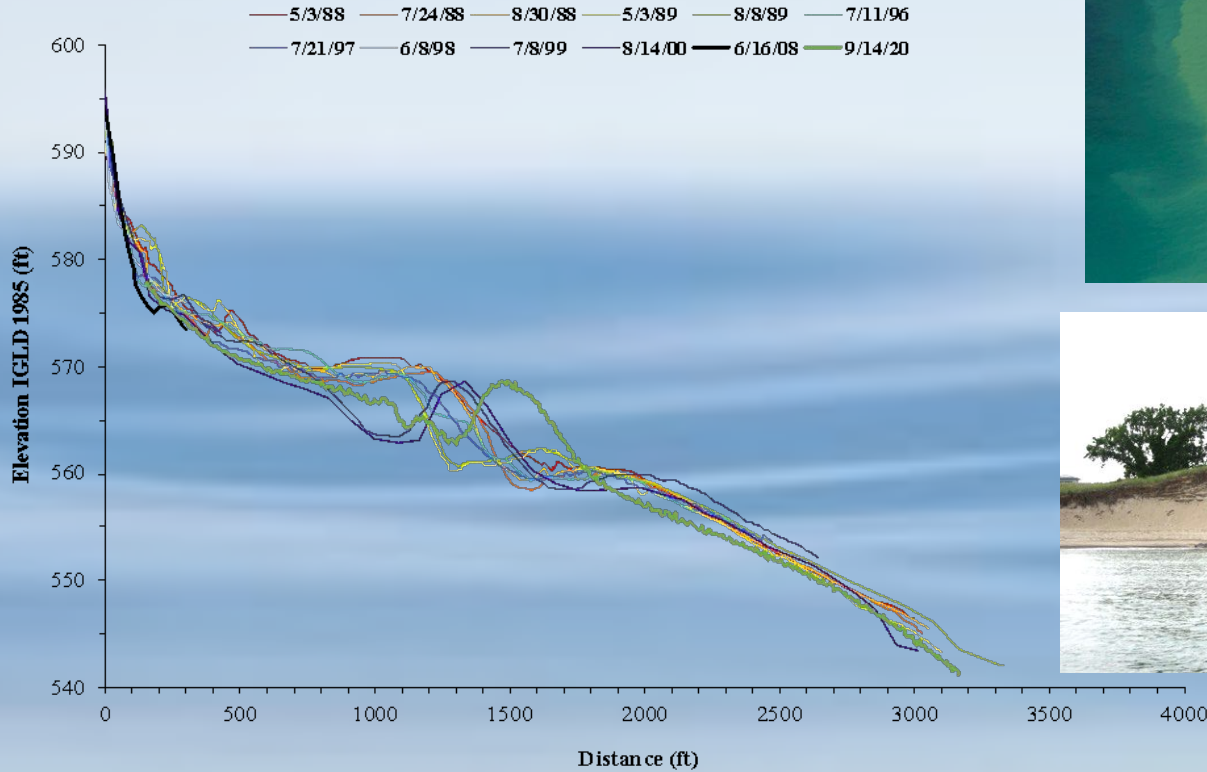
### 2021 Surveys





# Cumulative Impacts of Parallel Structures on Offshore Profiles

## NEW BUFF3



# What Have We Learned Thus Far?

- A warming Great Lakes climate has produced:
  - Extreme, record, water levels, both high and low within a 7 year period (2012 – 2020)
  - Greater future extremes are expected
  - The resulting wave climate of Lake Michigan is also changing
    - Increasing with increasing water levels
    - Increasing with loss of winter ice cover
  - Nearshore sediment transport is driven by the wave climate
  - Valuable nearshore sediment is being lost to offshore
- Shoreline mapping is critical to our further understanding
- Coastal population is continuing to increase – problems will only increase

# Research questions that need to be answered

## – Knowledge Gaps

- Where does the sand go and in what quantities?
  - Around harbor structures?
  - In response to shoreline armoring?
  - Other offshore losses?
- How does the beach recover as water level falls? Does it recover?
  - How do we continue work through falling water levels and falling interest?
- How do we move toward Resilient Coastal Communities?
  - In response to increasing population density
  - Which nature based solutions work on the exposed coasts?
  - What is the role of offshore structures, sediment bypassing and beach nourishment?
- Will long-term monitoring at our three reference sites answer some of these research questions?
- Who could be additional partners in this effort?



# International Joint Commission Science Strategy for the Great Lakes



## 4. Human capital: workforce development

Fostering a vigorous Great Lakes research community and developing a professional workforce is an essential component of a decadal scale Science Strategy and presents job opportunities and economic returns. The region has a distinct advantage in terms of the training of the next generation of practitioners through one of the world's finest assemblages of institutions of higher education.

Encouraging a young, diverse pool of new talent will follow from an investment in research, but should be augmented by programs funding graduate students, post-doctoral fellows and collaborative research coordination networks across these institutions and federal, state, provincial and local management agencies.

# MISG Graduate Fellowship Program

Graduate students plan and implement Great Lakes research projects in our four key areas.

Have funded 11 projects and awarded >\$700K since 2018!



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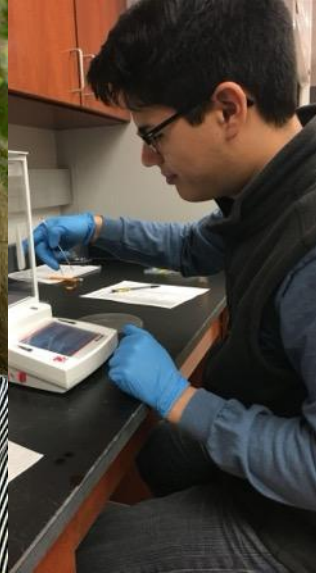
# MISG Undergraduate Internship Program

Undergraduate students plan and implement Great Lakes environmental research and stewardship projects with:

- Local government
- State and federal agencies
- Environmental non-profit organizations
- Private businesses
- University faculty\*

Has grown since 2019 into largest Sea Grant internship program.











[michiganseagrants.org](https://michiganseagrants.org)

