Learning from the Experts Webinar Series

# Oceanographic Research and Offshore Wind


**Travis Miles, Ph.D.**

Associate Professor,

Department of Marine and Coastal Sciences

Rutgers University, New Brunswick


**January 28, 2026**

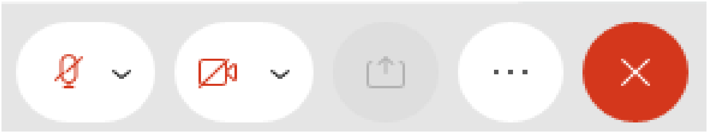
# Meeting Procedures

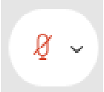
## Webinar recordings and presentations will be available at:

## www.nyserda.ny.gov/osw-webinar-series

## Participation for Members of the Public:

> Members of the public will be muted upon entry.



**You'll see**  **when your microphone is muted**

> Questions and comments may be submitted through the Slido Q&A feature at any time during the webinar.

> If technical problems arise, please contact Ayla.Morwin@nyserda.ny.gov

# Learning from the Experts

**This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.**



NEW YORK STATE | NYSERDA

# Oceanographic Research and Offshore Wind


Travis Miles, PhD, and many more!

rmi

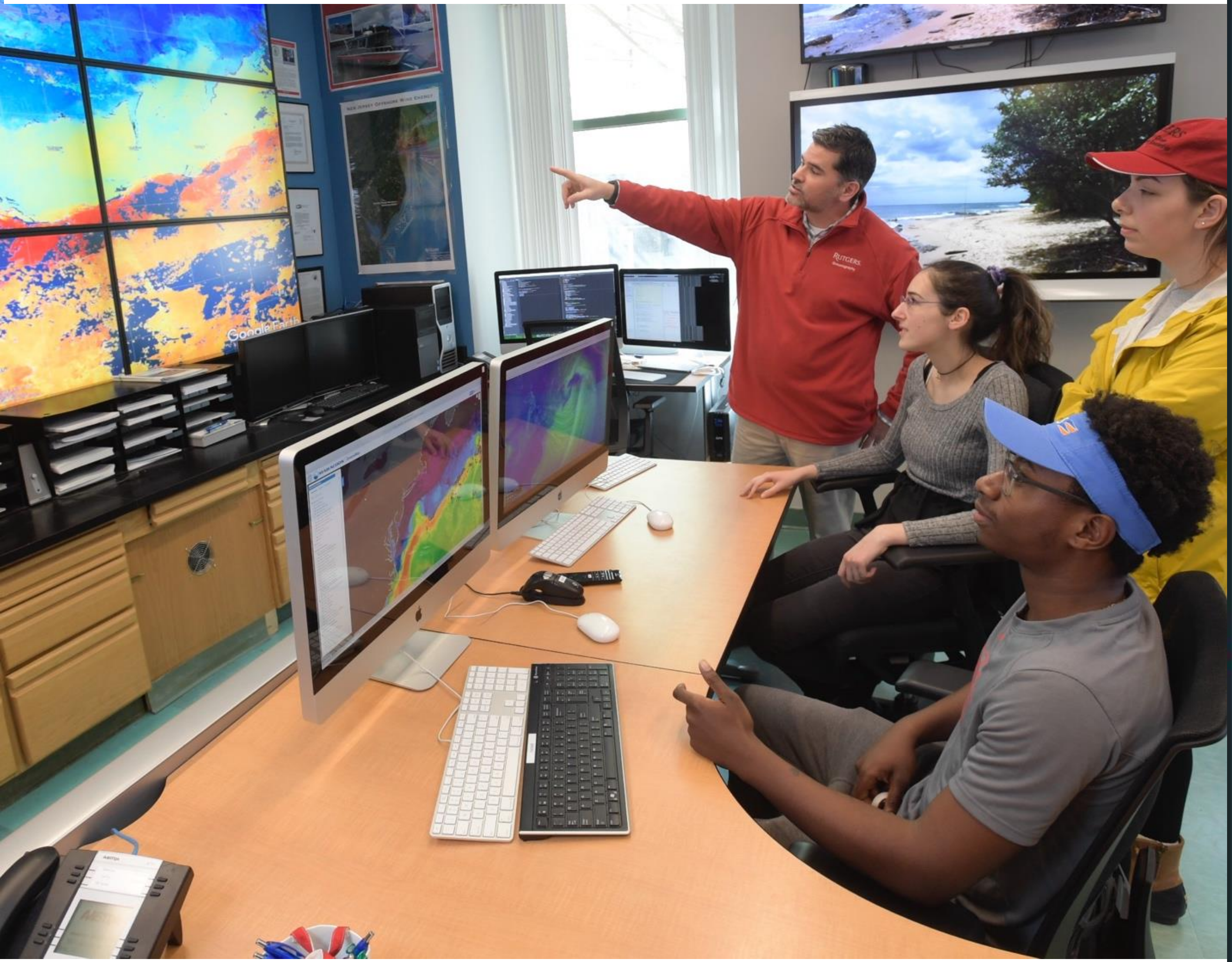
NEW YORK STATE OF OPPORTUNITY. | NYSERDA

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

New Jersey BPU Board of Public Utilities

RUTGERS–NEW BRUNSWICK
Center for Ocean Observing Leadership
School of Environmental and Biological Sciences

# The Rutgers University Center for Ocean Observing Leadership (RUCOOL)



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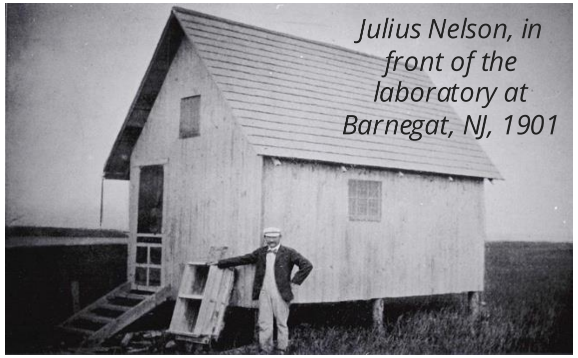
Marine and Coastal Sciences
School of Environmental and Biological Sciences

**The State Land Grant University of New Jersey - 1862**

**Mission:** [Provide]…**<u>immersive, hands-on research and experiential learning … to build a sustainable and just future</u>**.

**New Jersey Agricultural Experiment Station**


*Julius Nelson, in front of the laboratory at Barnegat, NJ, 1901*

Agents in all 21 counties
Full faculty and extension specialists

**Rutgers Coastal Campus – 2025 – combining 5 field stations**

- Rutgers University Marine Field Station
- Aquaculture Innovation Center
- Haskin Shellfish Laboratory
- Cape Shore Research Laboratory
- Jacques Cousteau Estuarine Research Reserve (JCNERR)

Integrated with **RUCOOL** on campus: Carrying out leading edge research with community applications and impacts

Haskin Shellfish Laboratory


Rutgers University Marine Field Station


Rutgers University Center for Ocean Observing Leadership


Global oceans

Protect safety and life at sea


Monitor and forecast coastal and global oceans


Innovate and develop new technologies


Study our changing climate


Utilize new technologies to understand our coastal resources and ecosystems

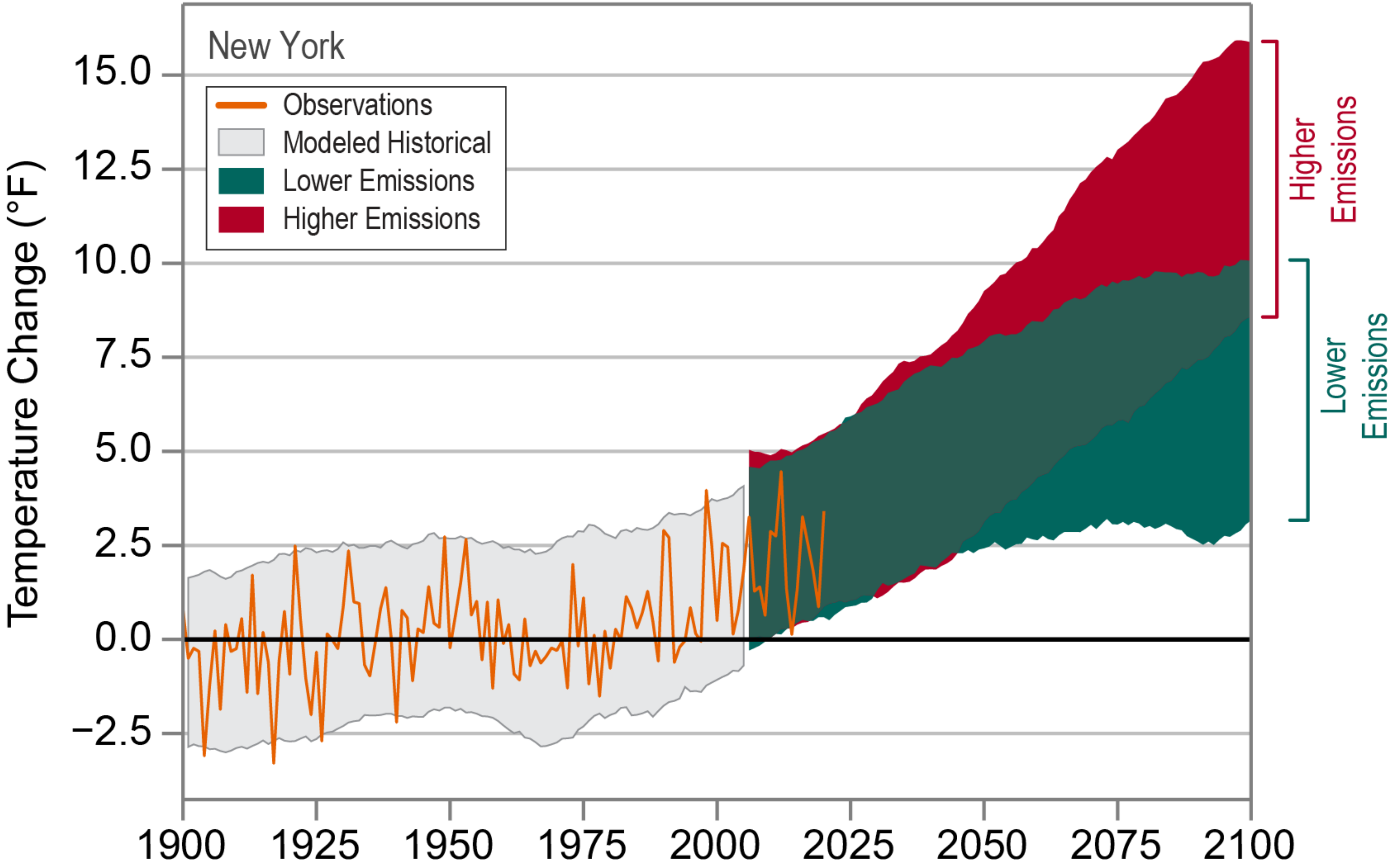

Train the next generation!

# Talk Outline

- Brief background on offshore wind
- The Physical Oceanography of the Mid Atlantic Bight (MAB)
- What and how RUCOOL measures and monitors the MAB
- Recent findings of dynamic ecosystems and interactions with offshore wind lease areas.

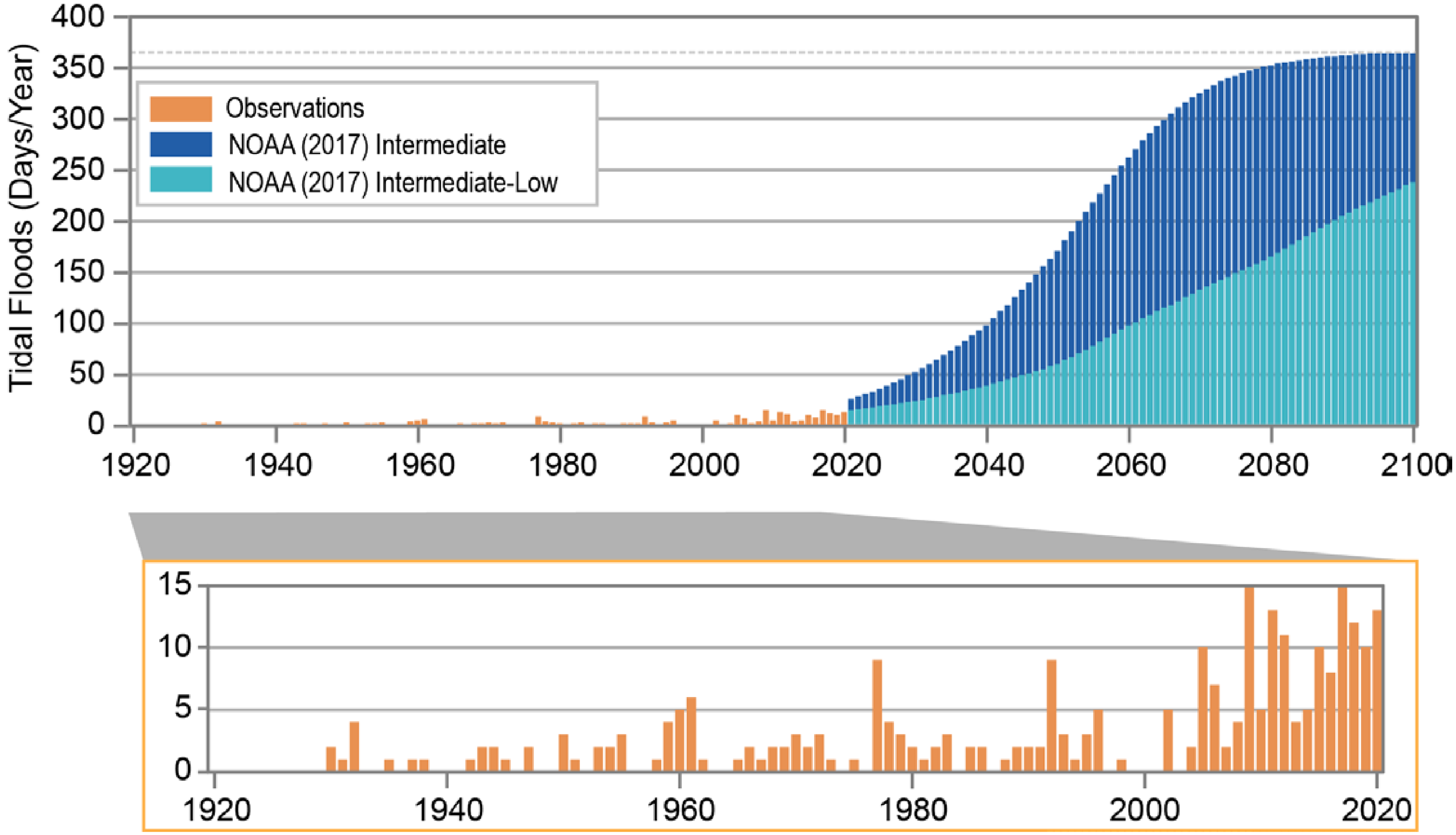
# NOAA State Climate Summaries – Third National Climate Assessment (2022)

New York average temperature change (compared to 1901 – 1960 average)

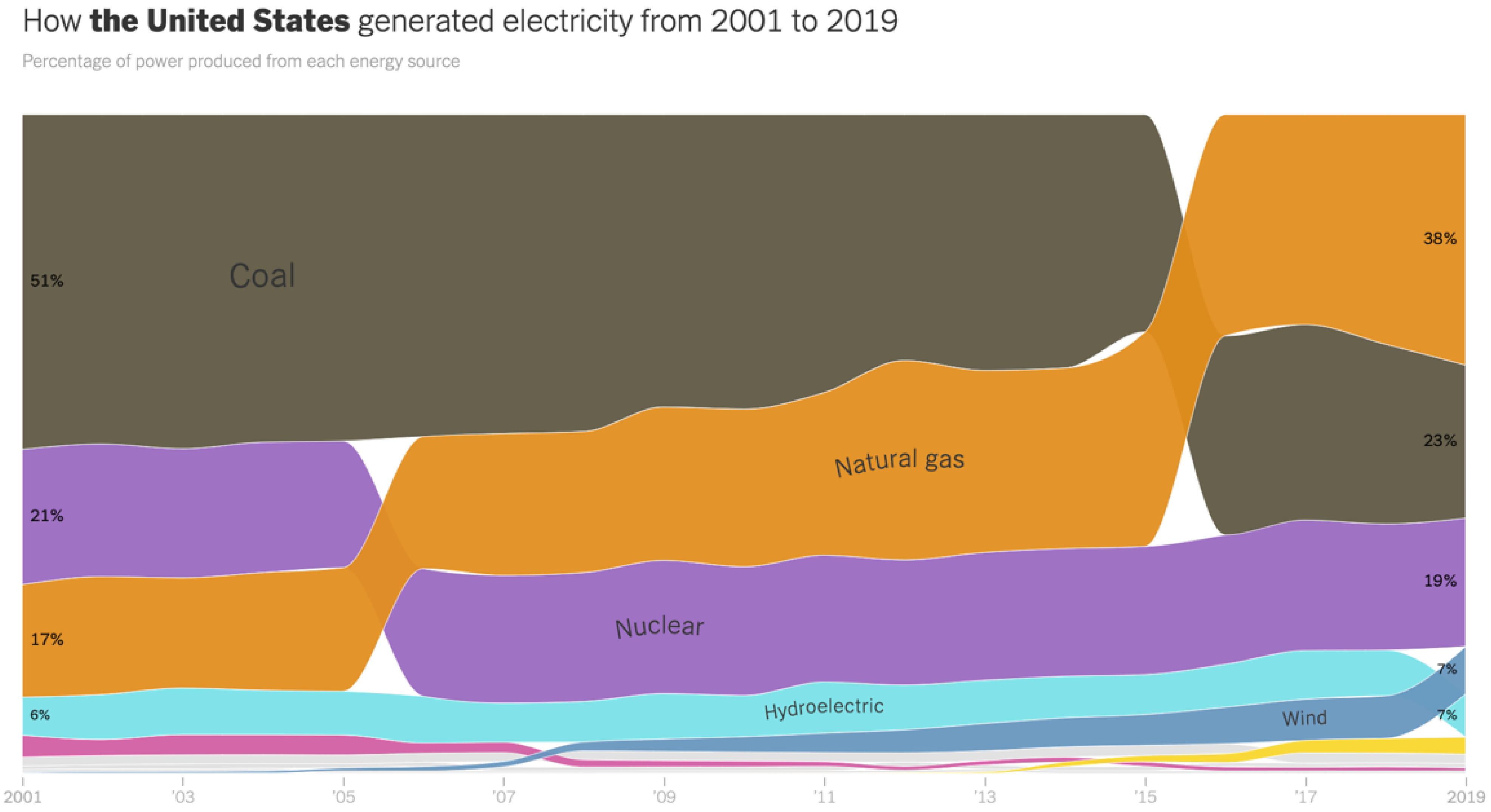


# NOAA State Climate Summaries – Third National Climate Assessment (2022)

Total floods (days per year) at The Battery, NY



# How Do We Get Our Electricity?




https://www.nytimes.com/interactive/2020/10/28/climate/how-electricity-generation-changed-in-your-state-election.html

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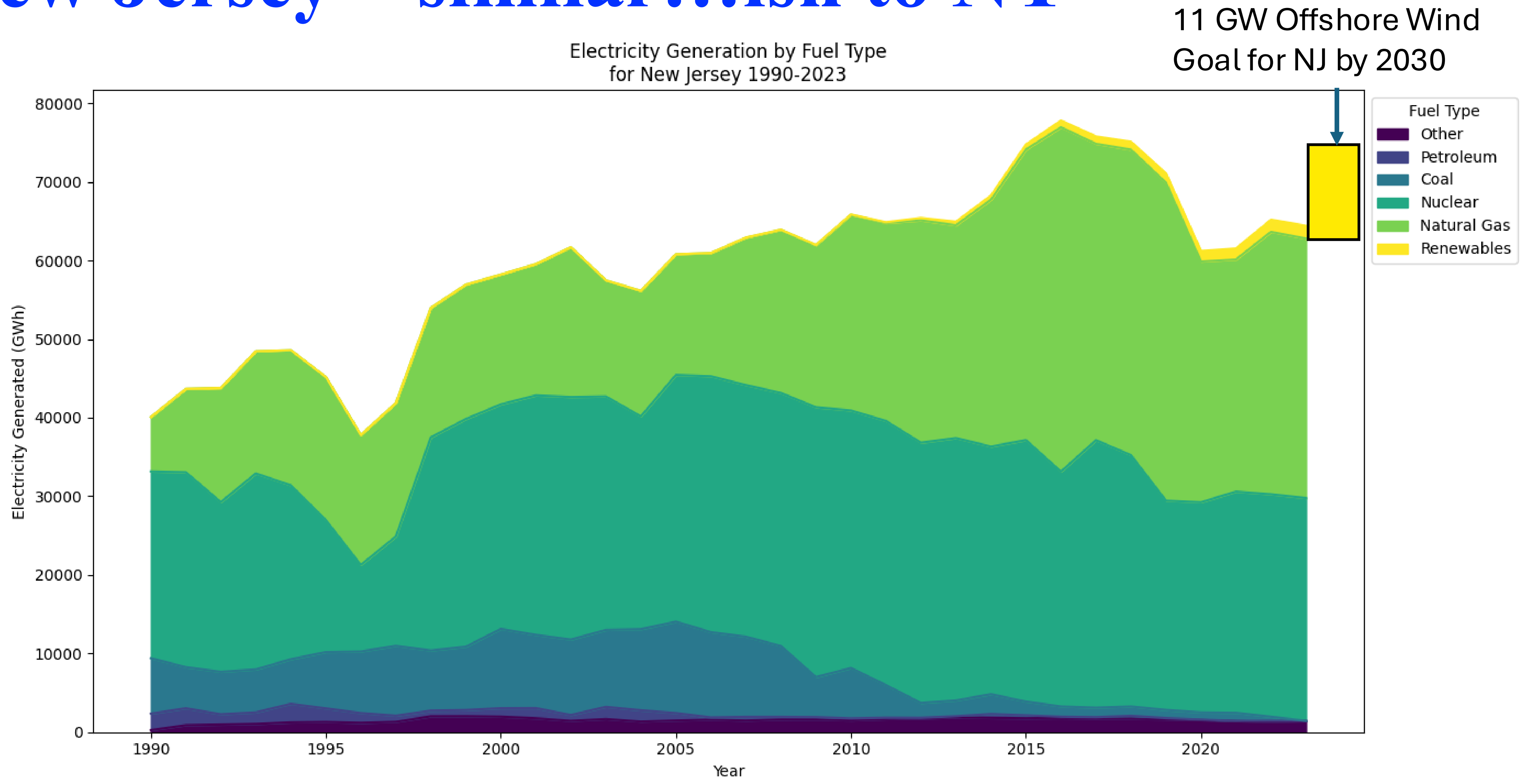
# New Jersey – similar…ish to NY




State of New Jersey
Energy Data Center

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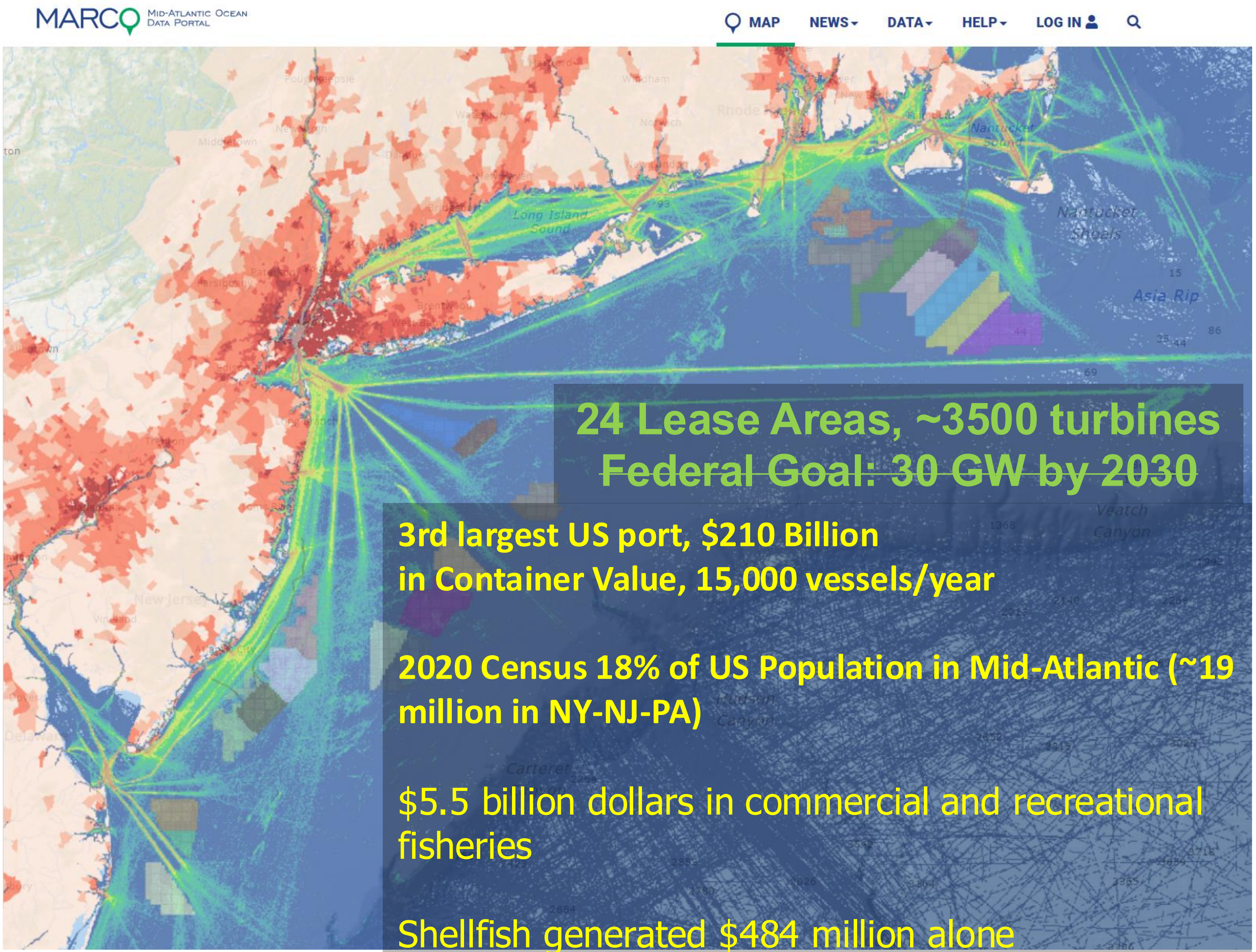
# Urbanized coasts & OSW
# (Out-of-date, but you get the idea)




24 Lease Areas, ~3500 turbines
~~Federal Goal: 30 GW by 2030~~

3rd largest US port, $210 Billion in Container Value, 15,000 vessels/year

2020 Census 18% of US Population in Mid-Atlantic (~19 million in NY-NJ-PA)

$5.5 billion dollars in commercial and recreational fisheries

Shellfish generated $484 million alone

| State | Goal (MW) | Target Date |
|---|---|---|
| Massachusetts | 5,600 | 2035 |
| Rhode Island | 430 | 2025 |
| Connecticut | 2,000 | 2030 |
| New York | 9,000 | 2035 |
| New Jersey | 7,500 | 2035 |
| Maryland | 1,568 | 2030 |
| Virginia | 5,200 | 2034 |
| North Carolina | 8,000 | 2040 |
| **Total** | **39,298** | |

# Offshore Wind – Opportunities and Challenges

- Wind turbines constructed in the ocean:
  - Do not occupy land resources
  - Can be built considerably larger than on land
  - Larger and more reliable wind resource offshore
  - More power per turbine > Lower cost per MW

- Offshore development faces many challenges beyond land-based wind
  - Dynamic physical, biological and ecological ocean characteristics and concerns
  - Multiple ocean uses – fisheries, recreation, shipping, national security, etc.
  - New regulatory pathways and supply chains
  - Currently an evolving legal, permitting, and policy landscape

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# Areas of uncertainty and research need:

SCEMFIS Science Center for Marine Fisheries

RUTGERS School of Environmental and Biological Sciences

**Could federal wind farms influence continental shelf oceanography and alter associated ecological processes? A literature review.**


Travis Miles, Assistant Professor, Rutgers University
Sarah Murphy, Graduate Student, Rutgers University
Josh Kohut, Professor, Rutgers University
Sarah Borsetti, Graduate Student, Rutgers University
Daphne Munroe, Associate Professor, Rutgers University


**Report Issued:** Dec. 1, 2020

PAPER

## Offshore Wind Energy and the Mid-Atlantic Cold Pool: A Review of Potential Interactions

AUTHORS


Travis Miles
Sarah Murphy
Josh Kohut
Sarah Borsetti
Daphne Munroe
Department of Marine and Coastal Sciences, Rutgers, The State University of New Jersey


RUTGERS School of Environmental and Biological Sciences

NATIONAL ACADEMIES Sciences Engineering Medicine

NATIONAL ACADEMIES PRESS Washington, DC

## Potential Hydrodynamic Impacts of Offshore Wind Energy on Nantucket Shoals Regional Ecology

**An Evaluation from Wind to Whales**

Consensus Study Report

## Oceanographic Effects of Offshore Wind Structures and Their Potential Impacts on the North Atlantic Right Whale and Their Prey

*A White Paper Prepared for the American Clean Power Association*

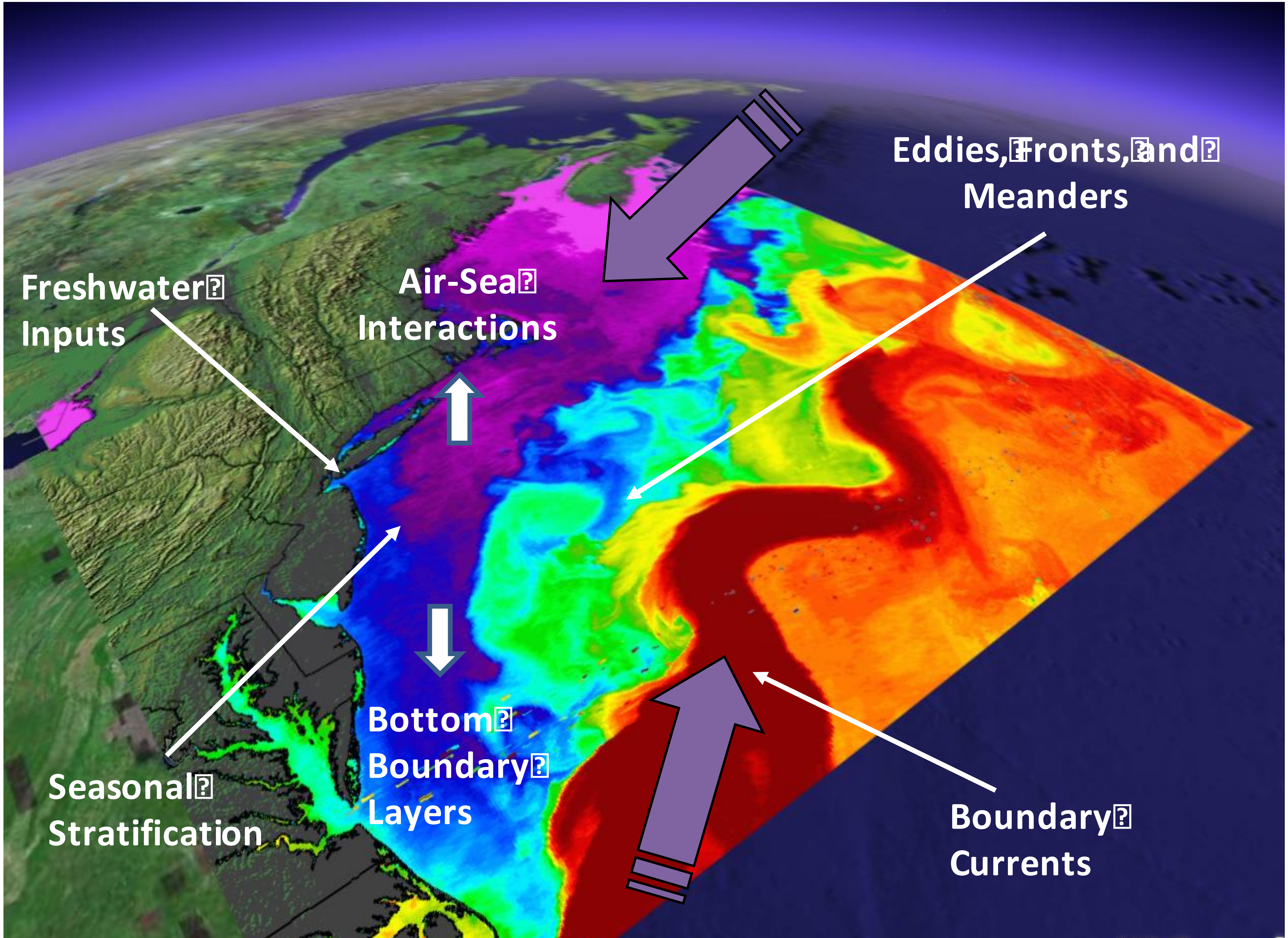
Prepared by:

AKRF

RUTGERS

Bigelow Laboratory for Ocean Sciences

October 2023


Eddies, Fronts, and Meanders
Air-Sea Interactions
Freshwater Inputs
Bottom Boundary Layers
Seasonal Stratification
Boundary Currents

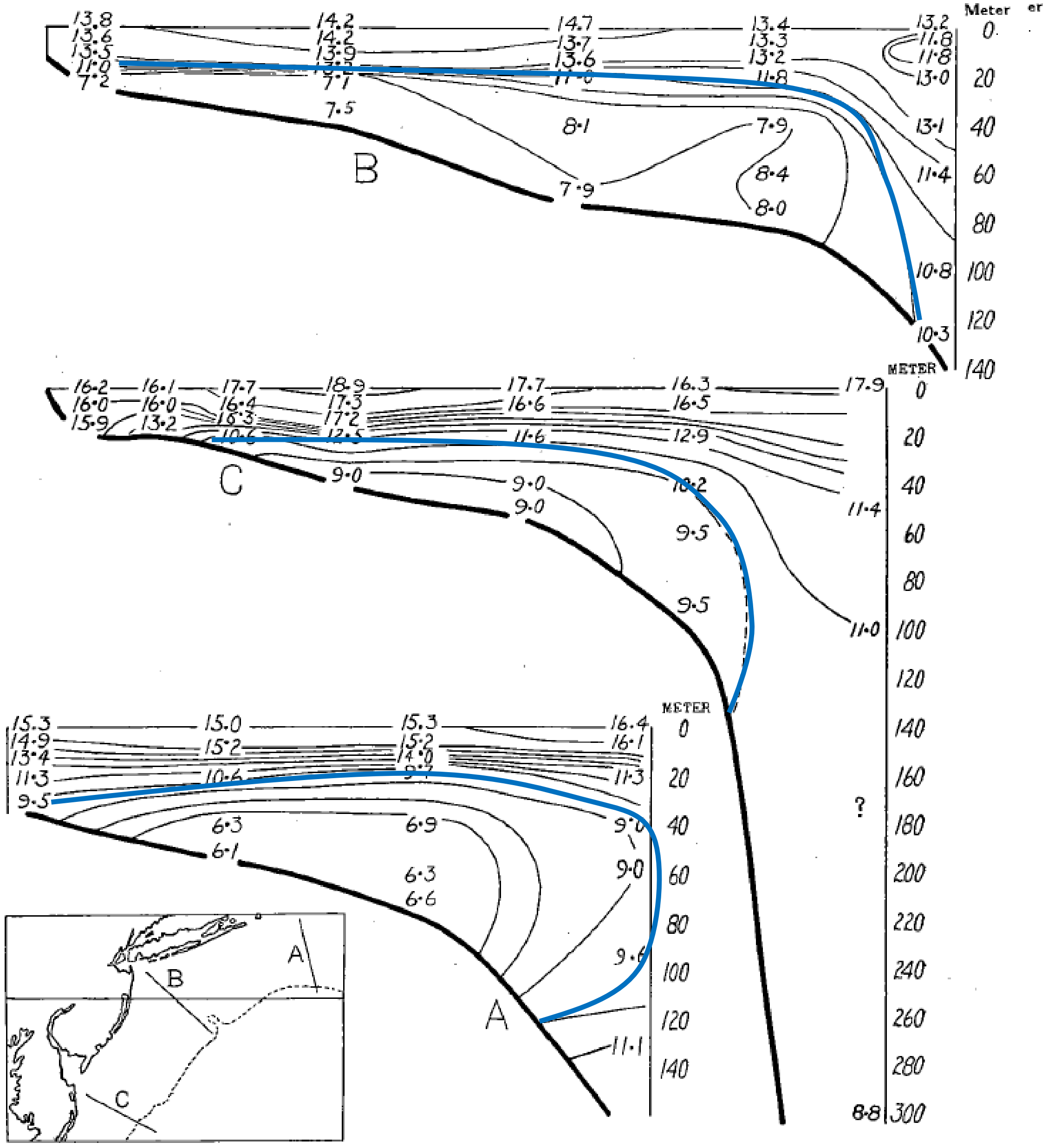



FIG. 31.—Temperature profiles crossing the continental shelf, June 8–14, 1930:—A, off Martha's Vineyard; B, off New York; C, off Cape May.

# STUDIES OF THE WATERS ON THE CONTINENTAL SHELF, CAPE COD TO CHESAPEAKE BAY

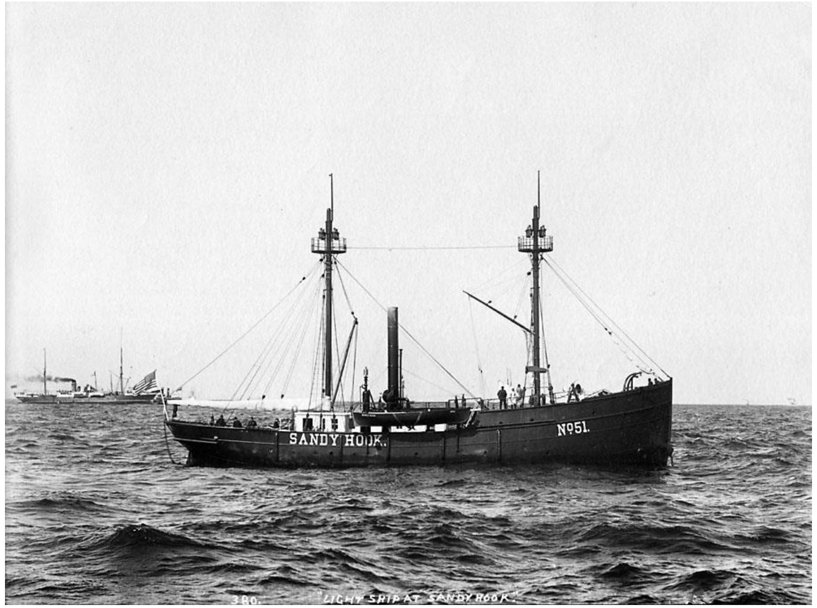
## I

## The Cycle of Temperature


BY
HENRY B. BIGELOW



CAMBRIDGE, MASSACHUSETTS
December, 1933

# The Middle Atlantic Bight Cold Pool: Evolution of the Temperature Structure During Summer 1979

ROBERT W. HOUGHTON

*Lamont-Doherty Geological Observatory of Columbia University, Palisades, NY 10964*

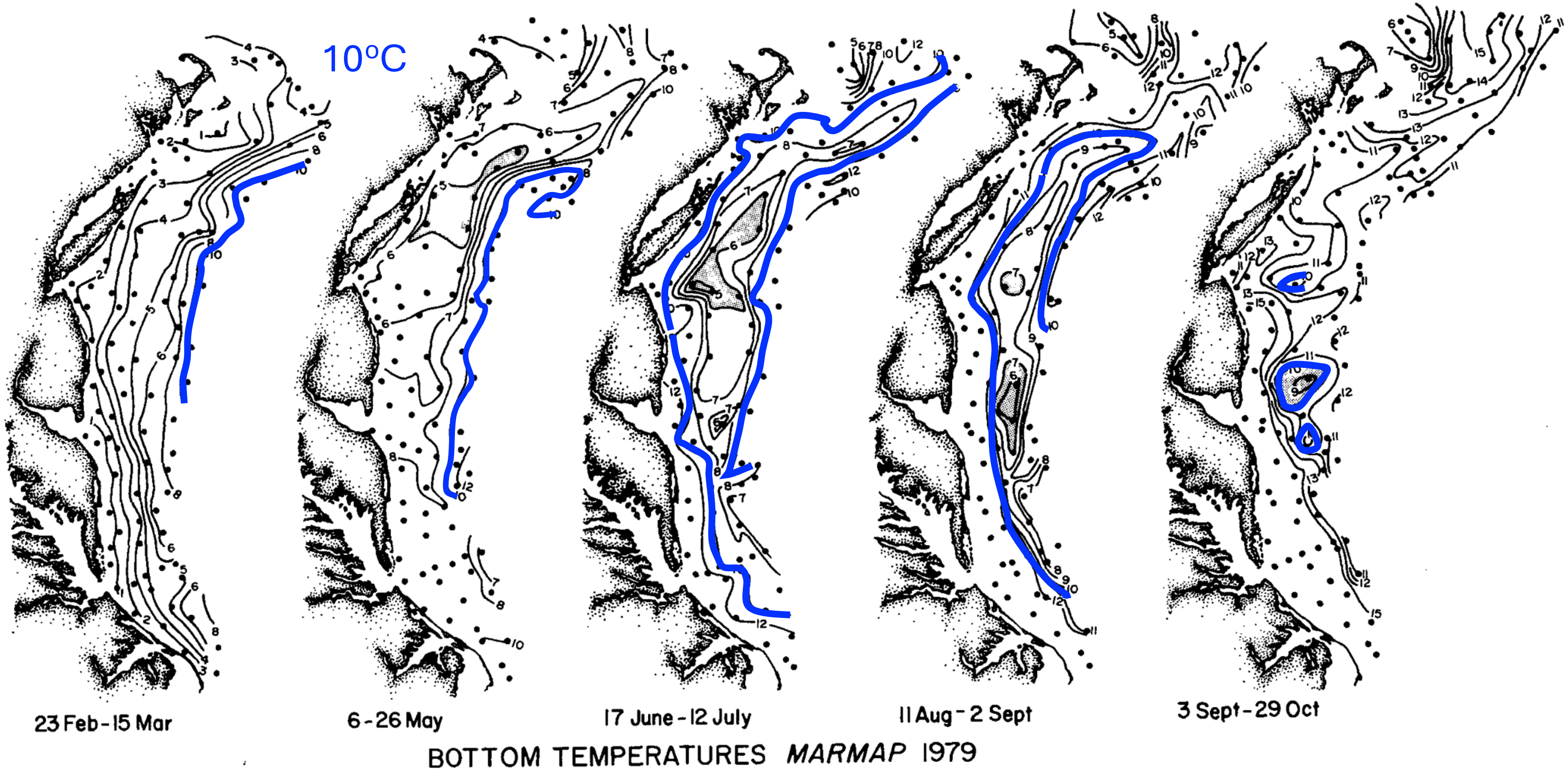
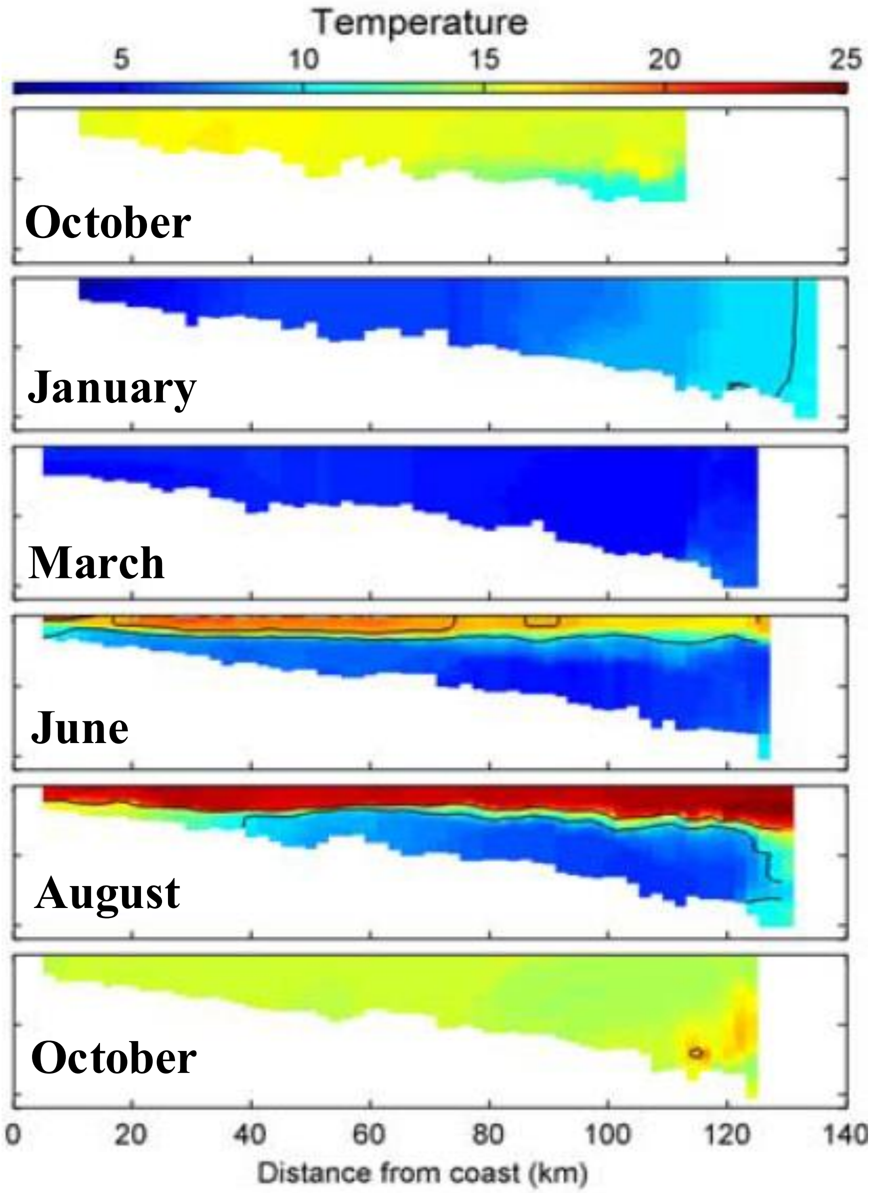



FIG. 5. MARMAP bottom temperatures out to the 200 m isobath. Contouring based on linear interpolation between stations is denoted by the dots.

More formally defined in *Manning, 1991* and *Mountain 2003*

Waters colder than 10°C and salinity less than 34 PSU

# The Mid Atlantic Ocean experiences some of the largest seasonal temperature changes in the world

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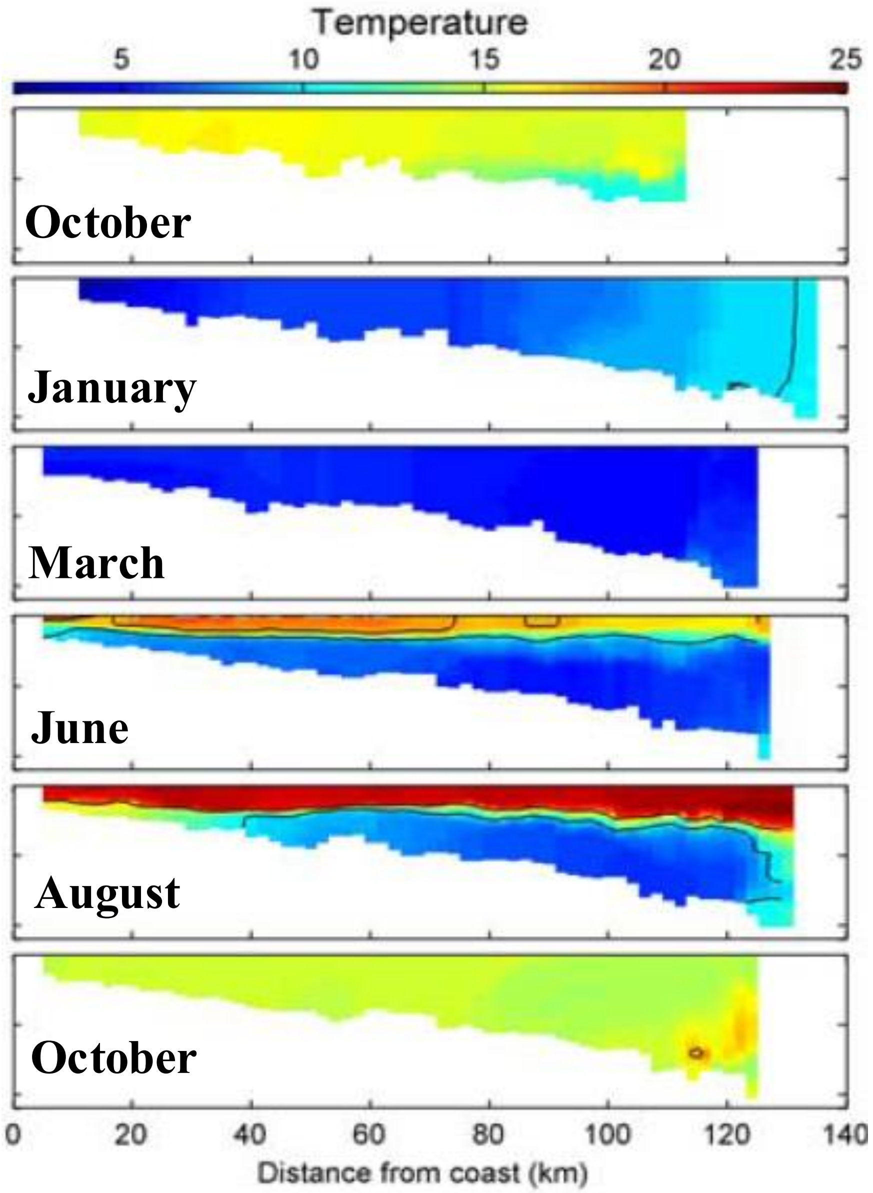
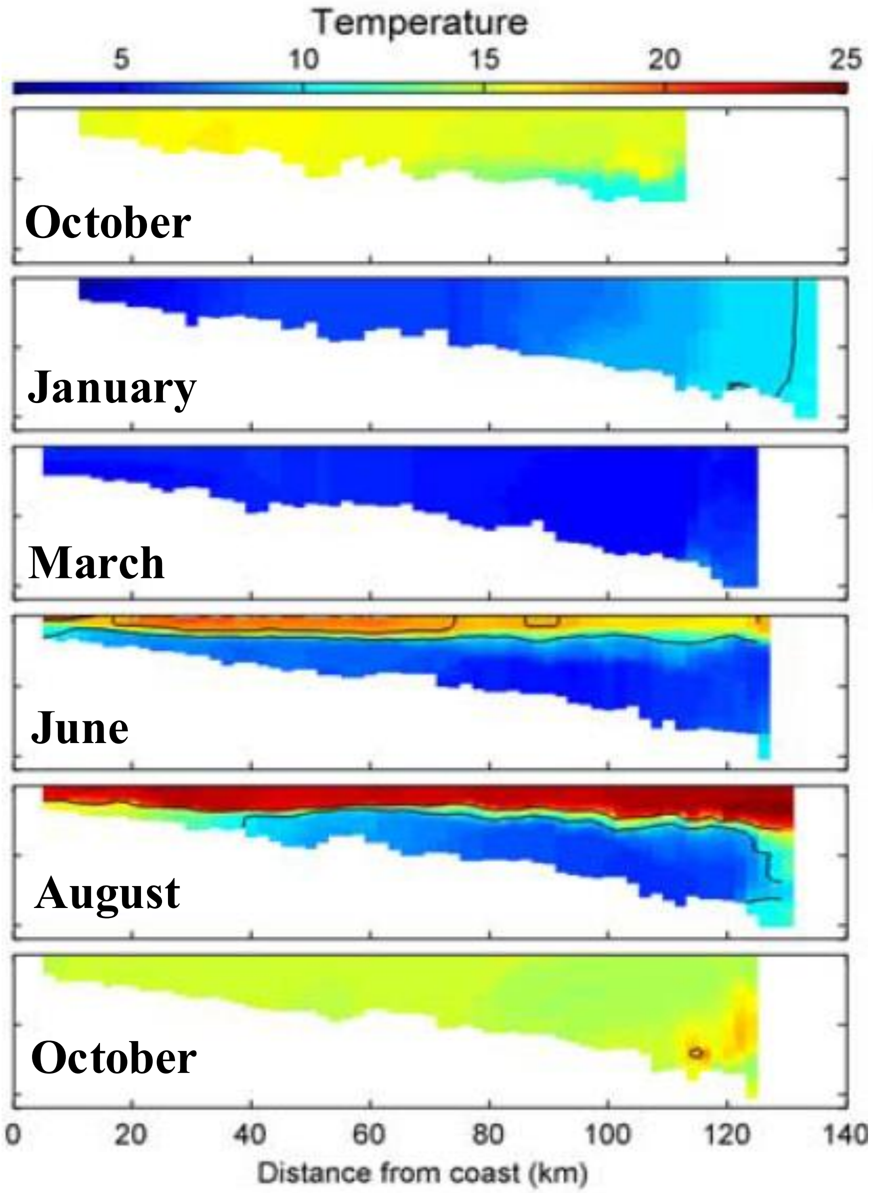
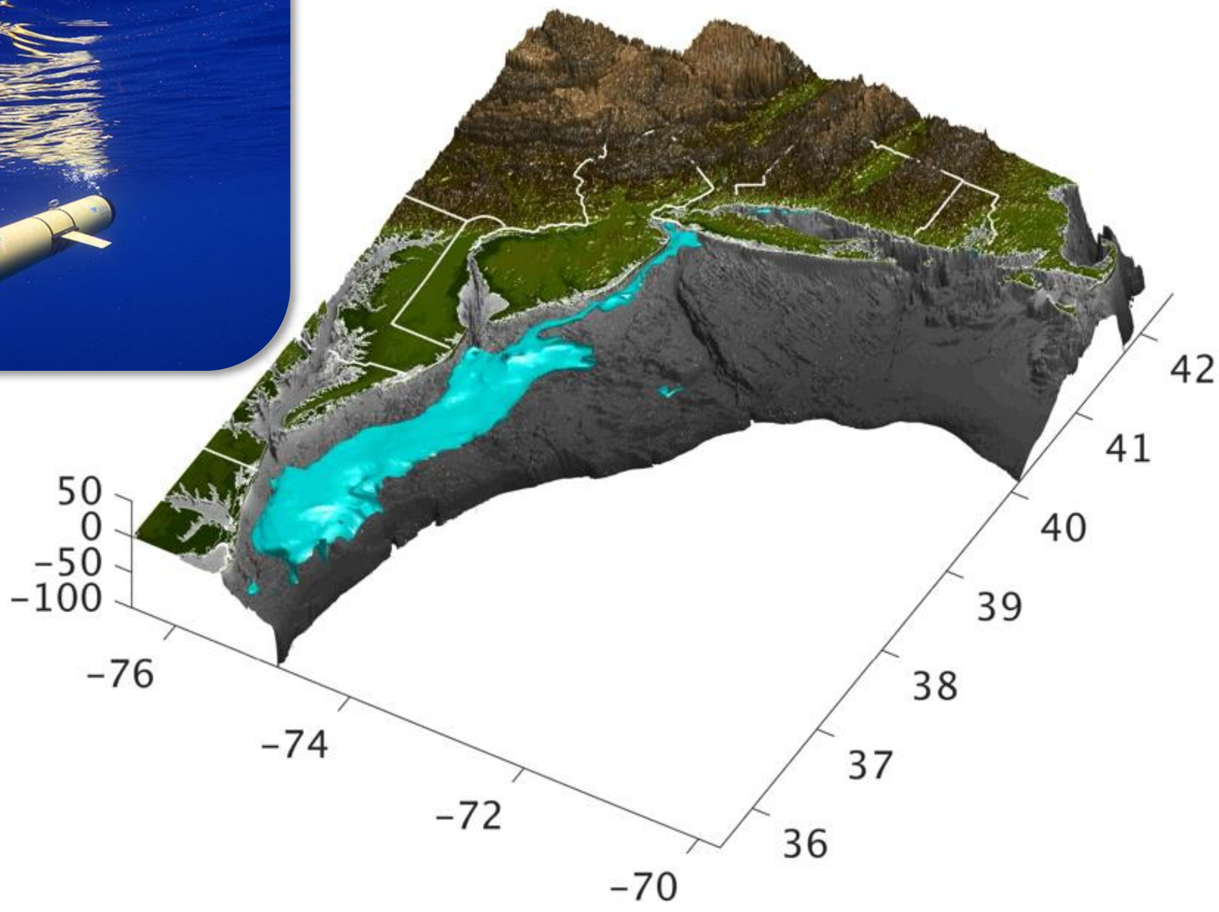


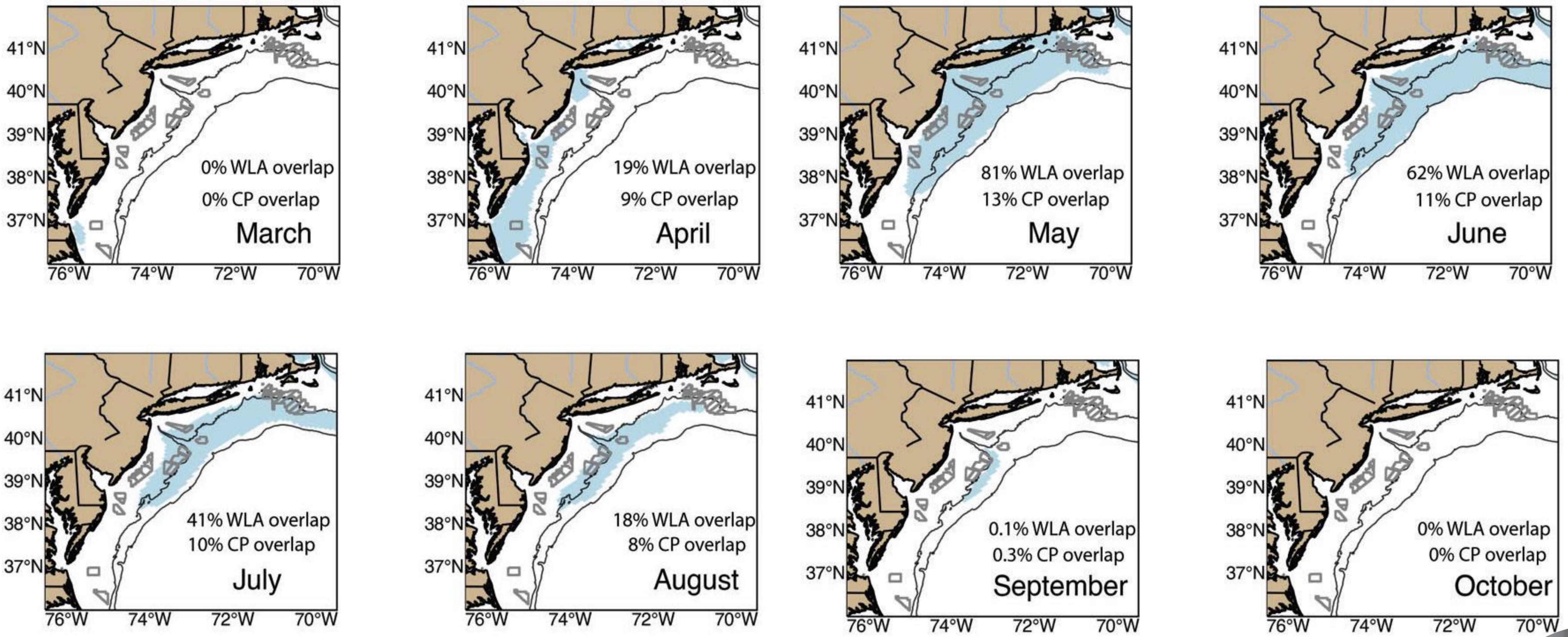

- Extends the southerly range of commercial and recreational fisheries
- Supports benthic habitat for shellfish
- Structures the life-history of migratory species and larval dispersal
- Can be upwelled to drive local primary productivity and alter coastal weather
- Acts as a buffer to intense hurricanes making landfall

# The Mid Atlantic Ocean experiences some of the largest seasonal temperature changes in the world



# The Mid Atlantic Cold Pool and Wind Lease Area Overlap (decadal means):





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**Original Article**

ICES CIEM International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer


## Overlap between the Mid-Atlantic Bight Cold Pool and offshore wind lease areas

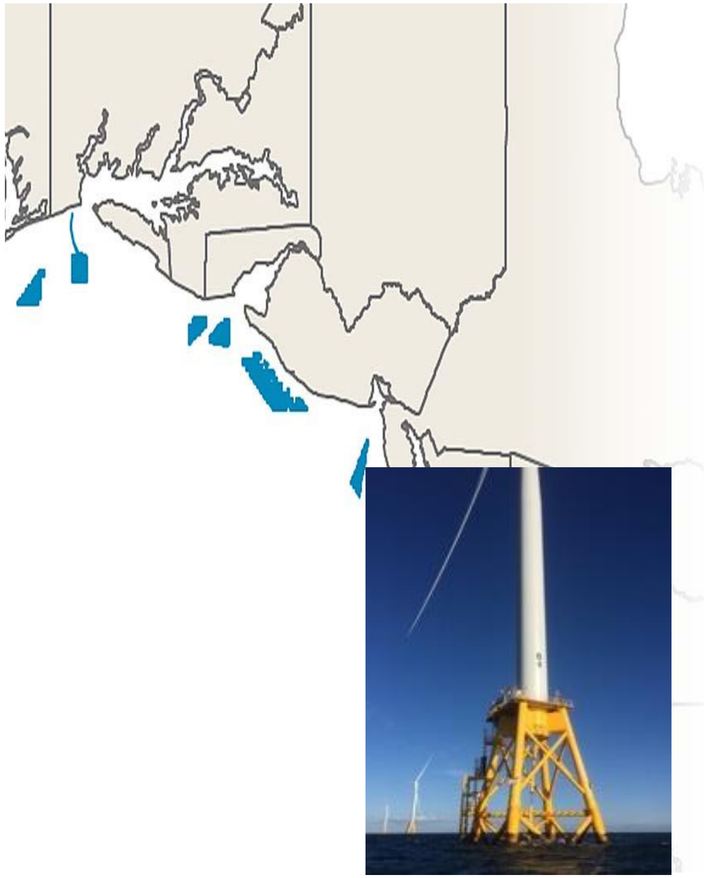

Rebecca Horwitz [1,*], Travis N. Miles [1], Daphne Munroe [1,2], Josh Kohut [1]


SCEMFIS Science Center for Marine Fisheries

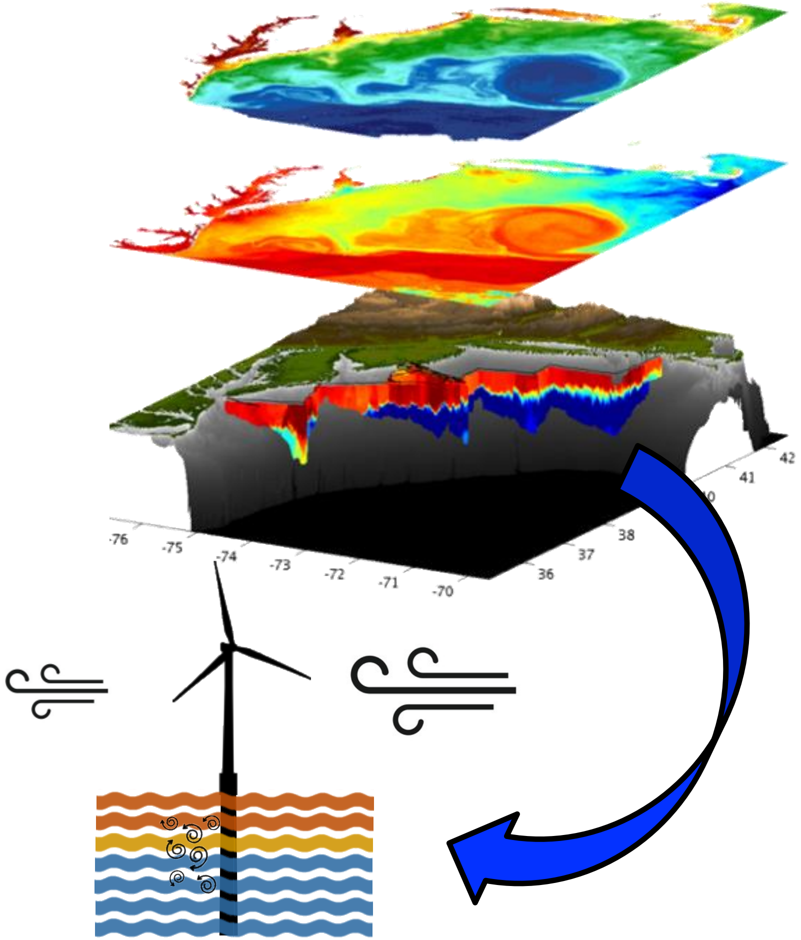
Becca Horwitz,
RU PhD Student

# Offshore Wind along the U.S. East Coast

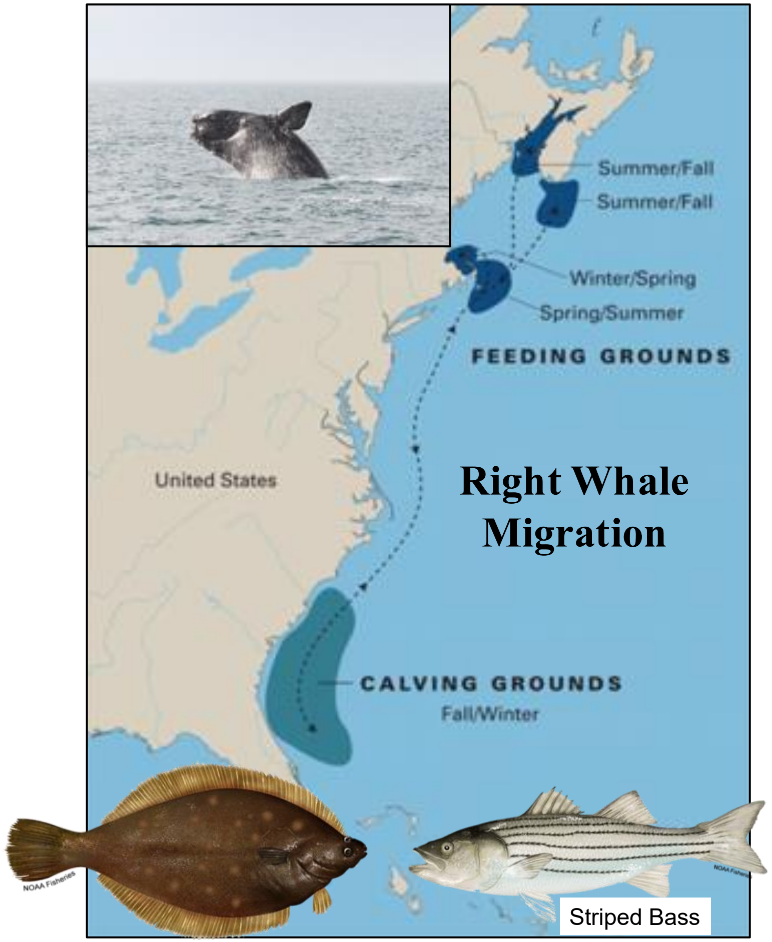
## The Evolving Plan



## The Dynamic Environment




## The Dynamic Ecology




Yellowtail Flounder

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# Offshore Wind along the U.S. East Coast: Research Needs

1. Need to establish a baseline from which to assess impacts from ongoing climate change and offshore wind development

# Offshore Wind along the U.S. East Coast: Research Needs

1. Need to establish a baseline from which to assess impacts from ongoing climate change and offshore wind development

2. Need data to perform simple modeling experiments to “gut-check” our more complex modeling systems

FEATURE

# THE SLOCUM MISSION

Narrative and Illustration
By Henry Stommel

IT IS DIFFICULT to realize that twenty-five years have passed since I first came to the Slocum Mission Control Center on Nonamesset Island, one of the Elizabeth Islands, in 1996. I was a post-doc in physical oceanography, and the Department of the Environment had just acquired the island from the descendants of a sea captain prominent in the China trade of the early nineteenth century. The government acquired Nonamesset to establish the World Ocean Observing System (WOOS), a facility capable of monitoring the global ocean, using a ... neutrally-buoyant floats called Slo... their power from the temperature stra... ocean. Nonamesset Island was chose... it is isolated from the mainland ... mostly because it is close to the Woo... graphic Institution, the Marine Bi... tory, and a thriving scientific com...

Nestling low in the hills is the ... Center itself, with its satellite an... beach, facing Buzzards Bay, the... for a small permanent staff. Mo... staff commute from their homes... area, reaching Nonamesset by a f... ...the one th... the Hole. ...

The payoff in increase of knowledge often is greatest the more unconventional the idea, especially when it conflicts with collective wisdom.

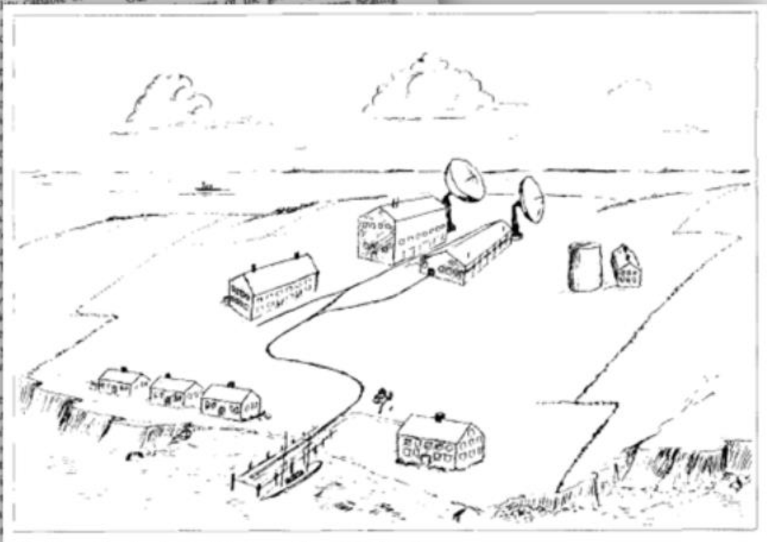
contact Mission Control via satellite. During brief moments at the surface, they transmit their accumulated data and receive instructions telling them how to steer through the ocean while submerged. Their speed is generally about half a knot. There are military applications for them, but our work in WOOS is unclassified. We have a fairly large fleet of Slocums, about 1,000. Half are devoted to a program of routine hydrographic observation, much like the meteorologists' upper air network. The rest make soundings of temperature, salinity, oxygen, nutrients, and those geochemically important tracers that the geochemists have been clever enough to find automatic measuring devices and sensors for. The other half of the Slocum fleet is devoted to purely scientific purposes: special research programs carried out under the instructions of academic scientists, by contract. Slocums were originally designed with a 5-year lifetime, but many have been in continuous service at sea for more than 10 years. They are widely dispersed throughout the world's ocean.

Our WOOS center and the Slocum Mission had ... of the growing concern with ...

...and they can be steered ... on wings at about a 35 degree angle. ...broach the surface six times a day to ...

Sound. On the grass ... is a flock of sheep grazing. I have the daily ... of those first deployments and experiments made in the early days of Mission Control before me on the ...

OCEANOGRAPHY·APRIL·1989



The Slocum Mission Control Center on Nonamesset Island.

OCEANOGRAPHY·APRIL·1989

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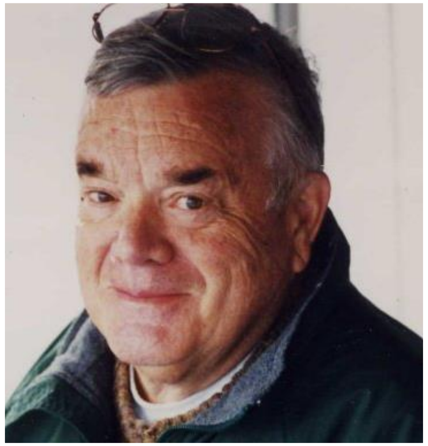
Henry Stommel



Doug Webb

## SLOCUM Glider

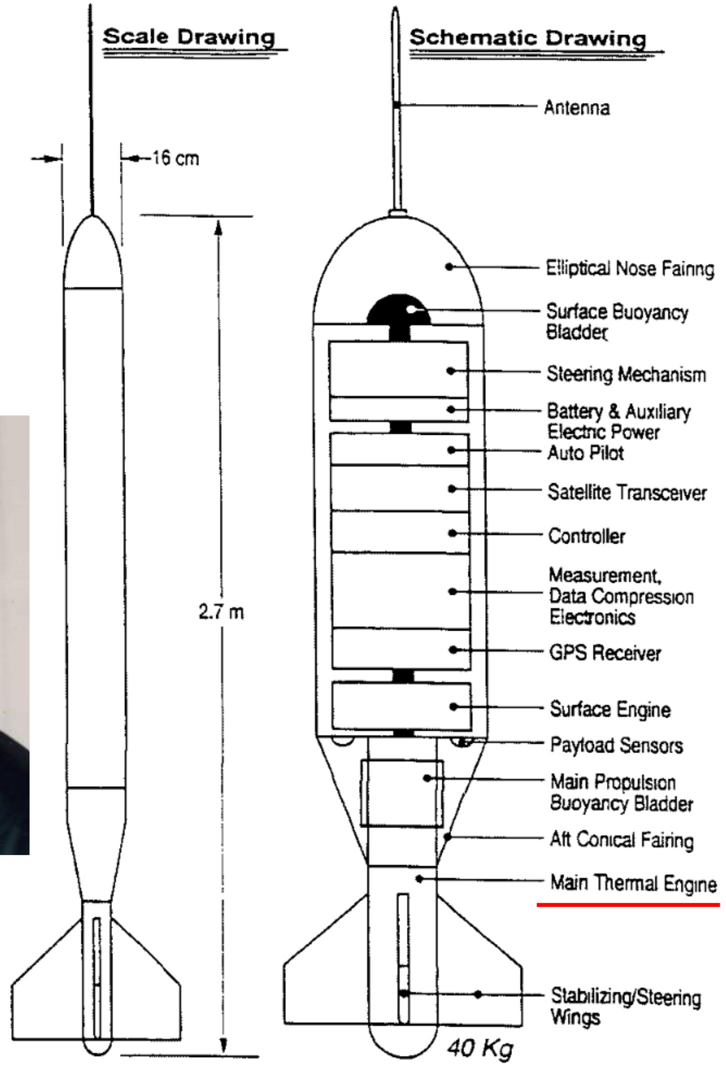
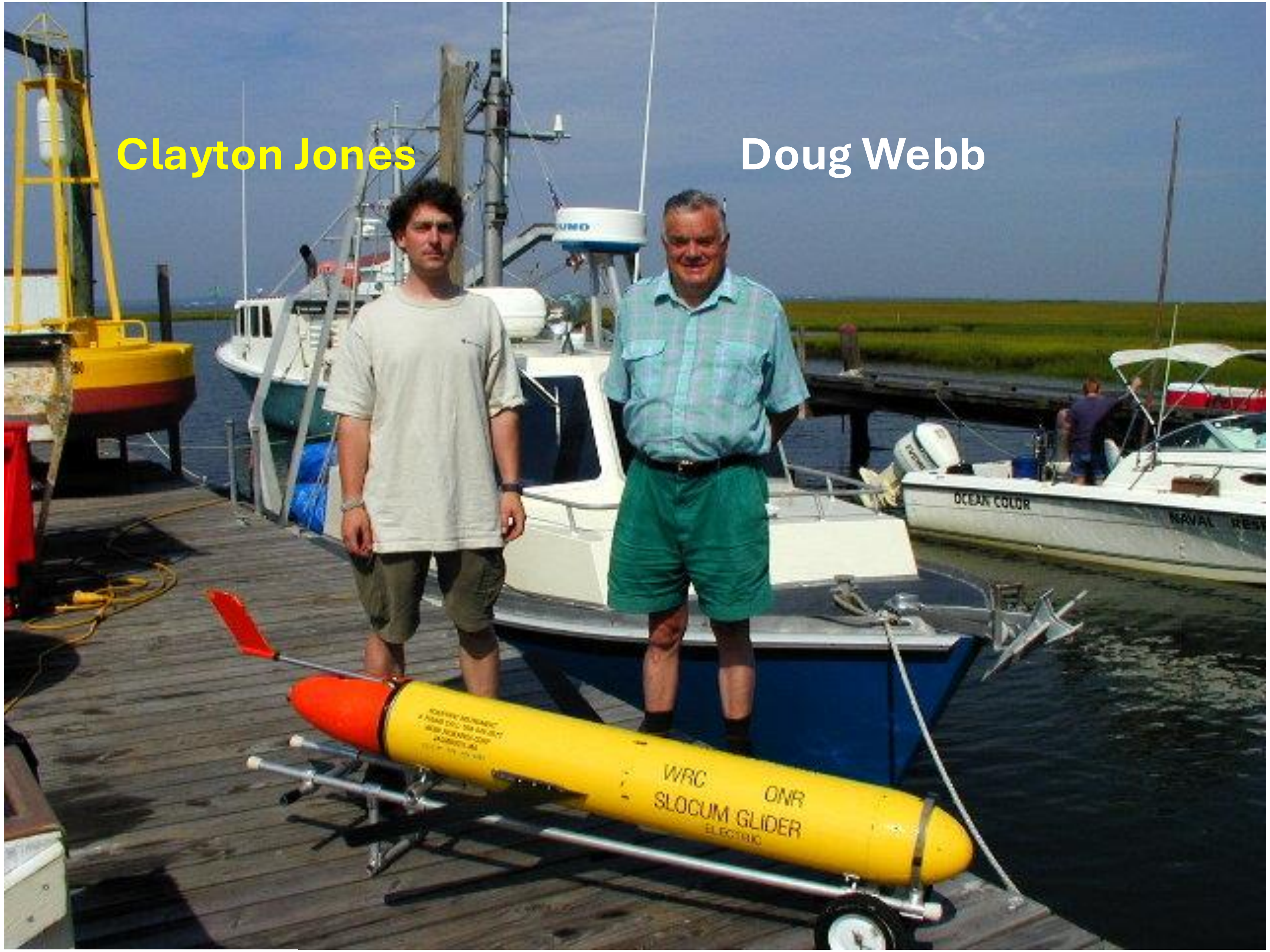



*Fig. 6: Schematic of Slocum, a small almost neutrally buoyant glider that moves vertically and horizontally through the water driven by small changes in buoyancy. Steering is by control surfaces or internal center of gravity adjustment.*




1999

First Slocum glider deployed at Sea

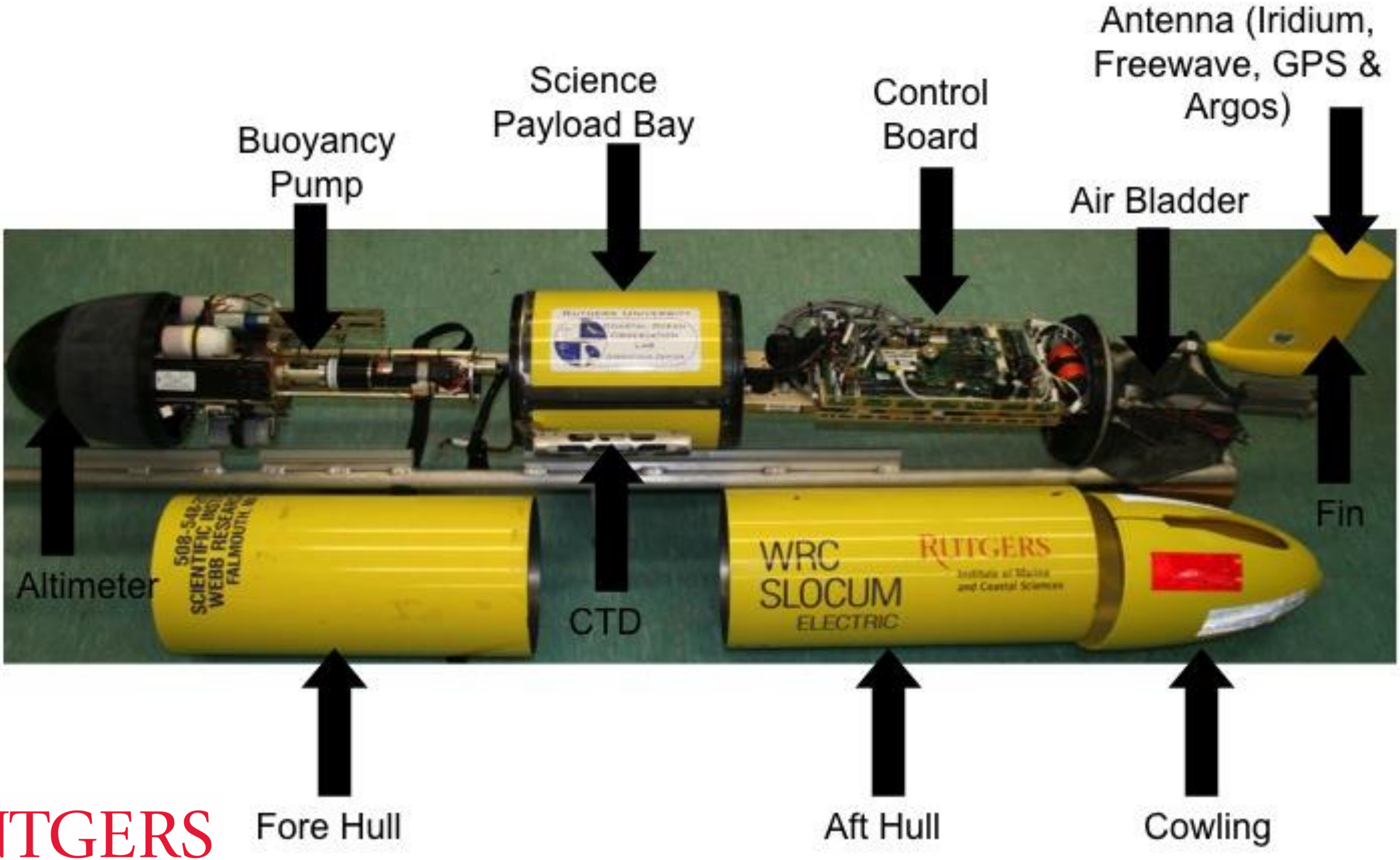
At the Rutgers University Tuckerton Marine Field Station

October 28 2003

First Slocum Glider Cross-shelf mission

RUTGERS

TELEDYNE WEBB RESEARCH
Everywhereyoulook™


Antenna (Iridium, Freewave, GPS & Argos)
Science Payload Bay
Control Board
Buoyancy Pump
Air Bladder
Fin
Altimeter
CTD
WRC
SLOCUM
ELECTRIC
RUTGERS
Fore Hull
Aft Hull
Cowling

# Glider-based Observations

Samples surface to bottom, Samples every 2s, 20k samples per day

# RUCOOL Glider Deployments

TELEDYNE WEBB RESEARCH
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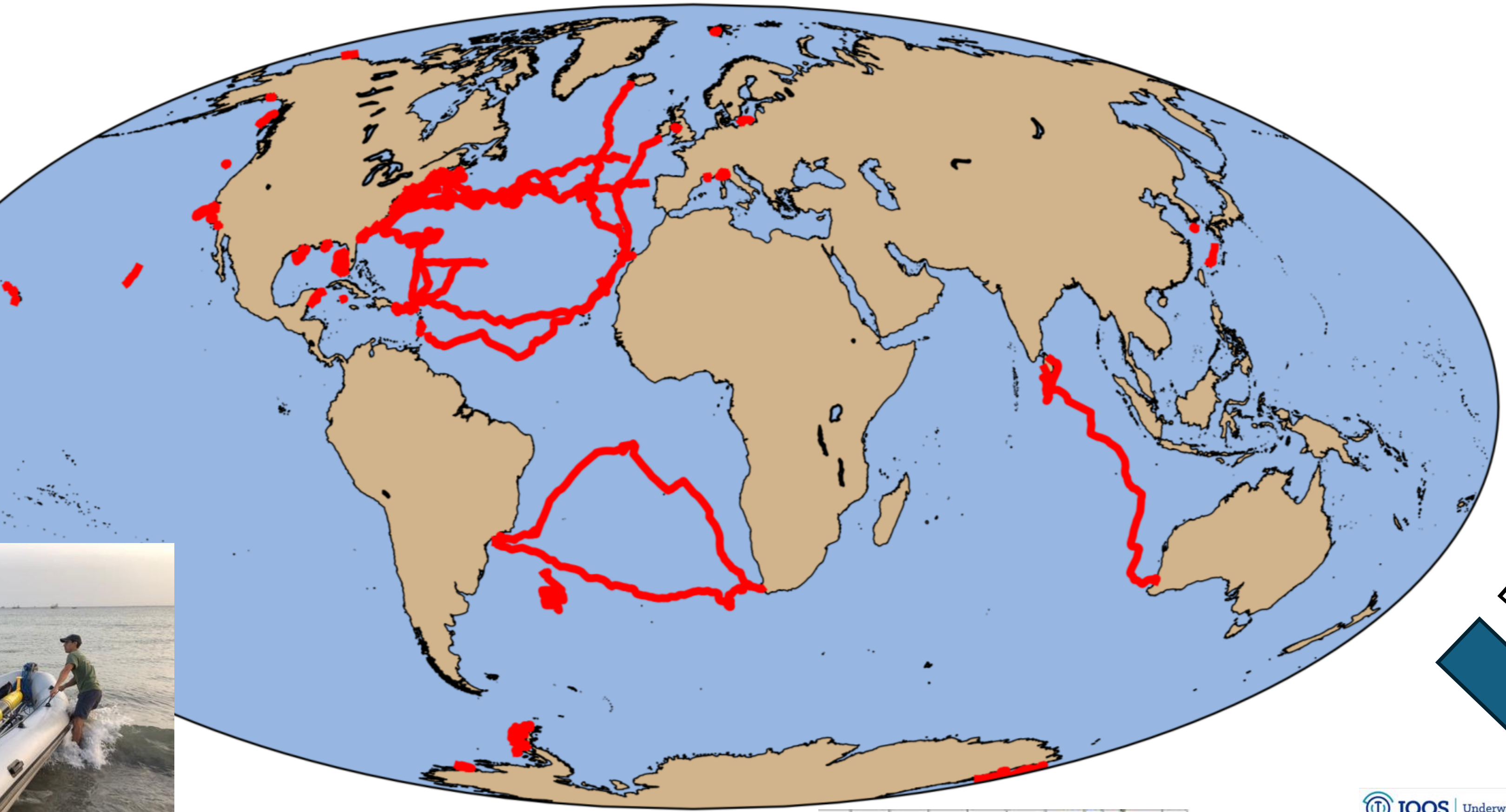
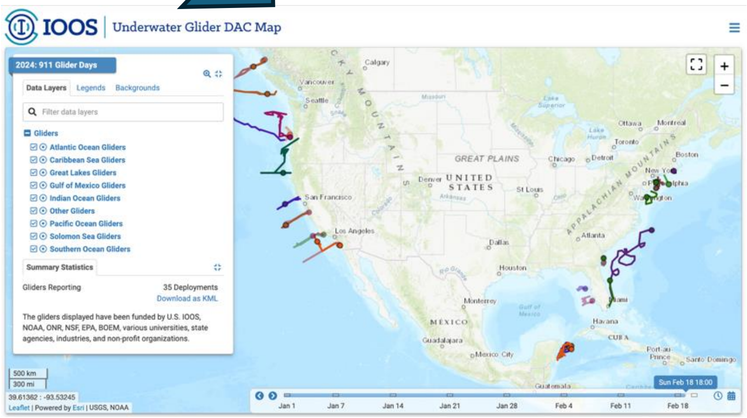
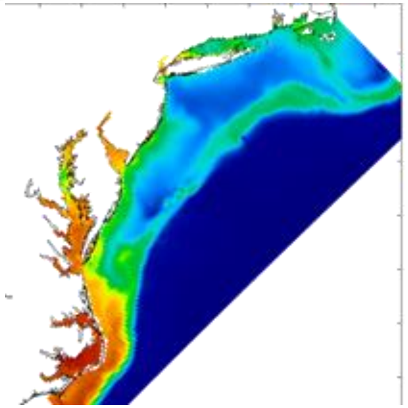


**Rutgers Glider Totals**
634 glider deployments
332,415 km (>8x Earth)
17,311 days (>47 years)

Data Flow

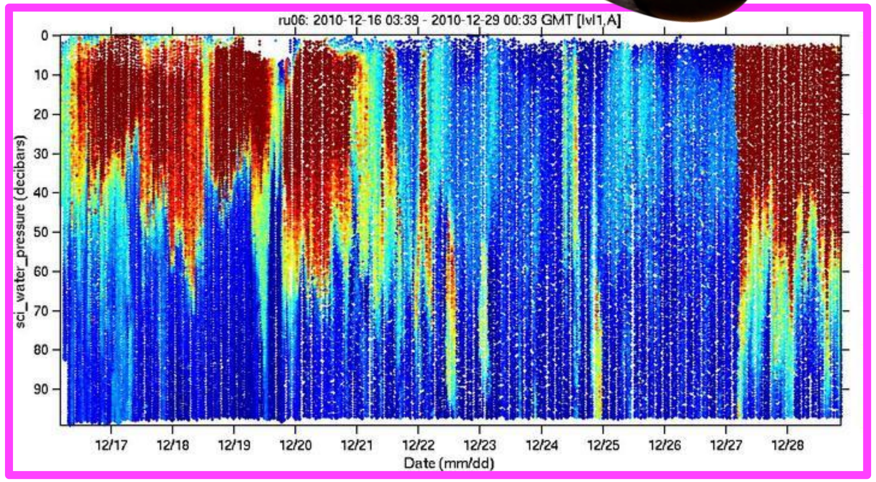


Supports:

- Real-time modeling and hurricane forecasts
- Scientific research papers
- Decision support products (water quality, marine mammals, commercial and recreational fishing)
- Ecosystem monitoring

# Advantages of Glider-based Monitoring


- High-resolution sampling
- Sustained ops, cost-effective
- Hazardous conditions
- Augment vessel-based surveys
- Navigate wind farms

<u>Sensors we integrate into ‘ecogliders’</u>:

Temperature & Salinity – Physics and ecosystems
Dissolved oxygen – Fisheries and water quality
pH, derived Omega – Carbonate System (shellfish)

Chlorophyll Fluorescence – primary productivity
Optical backscatter – sediment resuspension

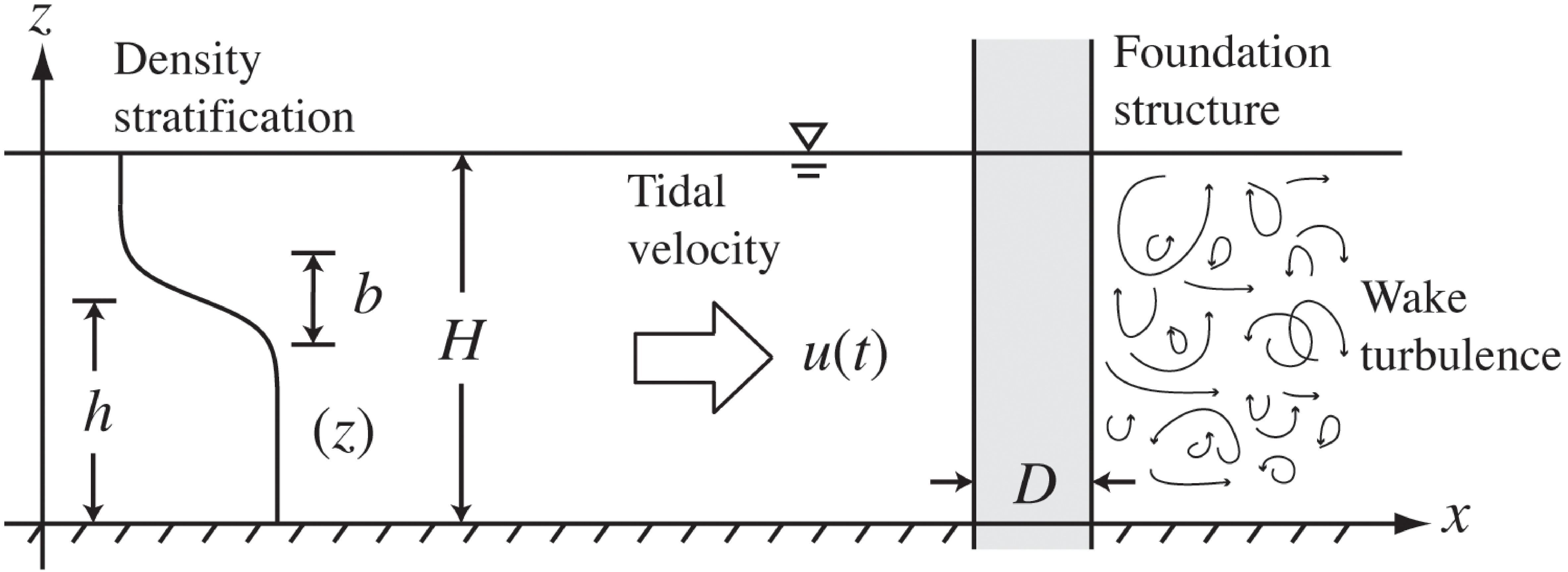
Active acoustics – pelagic fishes (38, 125, 200 kHz)
Active Acoustics – zooplankton (125, 200, 455, 769 kHz)
Passive Acoustics – marine mammal, cod detection
Fish telemetry – fish movement & migration

**NJ RMI Project Objective:** With our glider data and a simple model, can we estimate mixing (time scales) induced by offshore wind monopiles in the Mid Atlantic Bight?

Travis Miles

Fernando Pareja-Roman

Julia Engdahl



**NJ RMI Project Objective:** With our glider data and a simple model, can we estimate mixing (time scales) induced by offshore wind monopiles in the Mid Atlantic Bight?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Fernando Pareja-Roman


Julia Engdahl

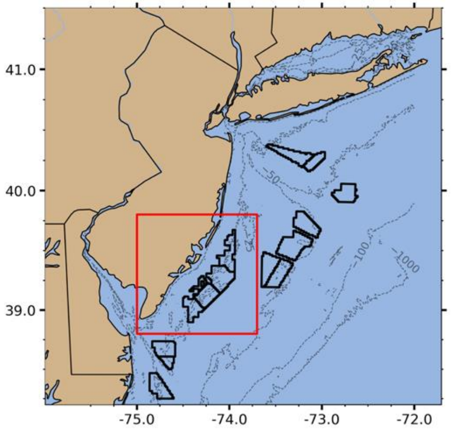
**Power removed** by monopile array due to drag = **Power delivered** to water column for mixing

$$\textbf{Power delivered} = \frac{1}{2}(\text{density})\,(\text{drag coefficient})\,(\text{frontal area})\,\frac{(\text{speed})^3}{(\text{monopile spacing})^2}$$

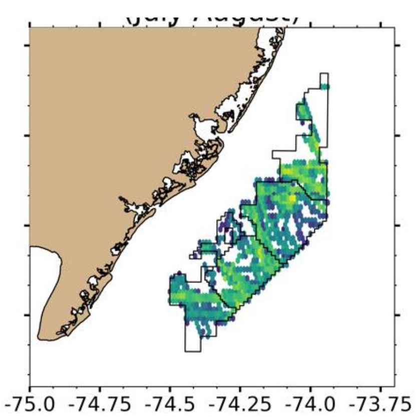
Cubed! Small changes in ocean current speed can have big impacts.

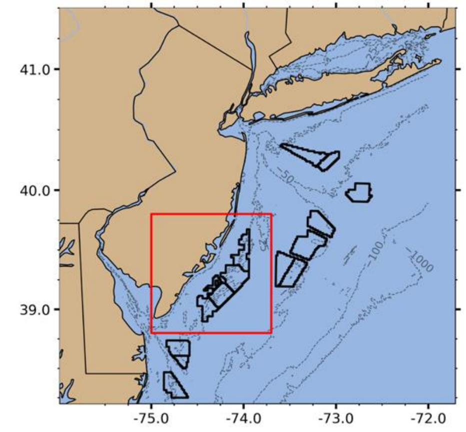
$$\textbf{Mixing Time Scale} = \frac{(\text{max stratification})\,(\text{depth})}{(\text{Richardson number})(\text{pycnocline thickness})\,(\text{power delivered})}$$

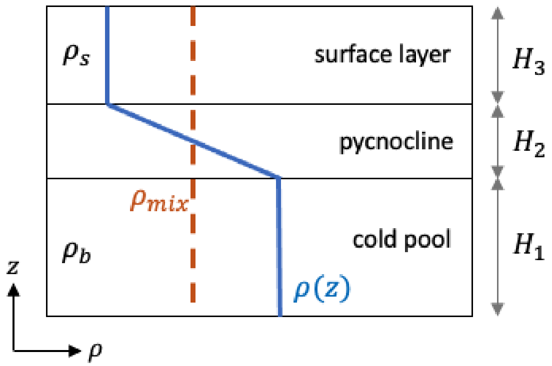
Stratification is the oceans resistance to mixing




Aggregate data in a wind lease area

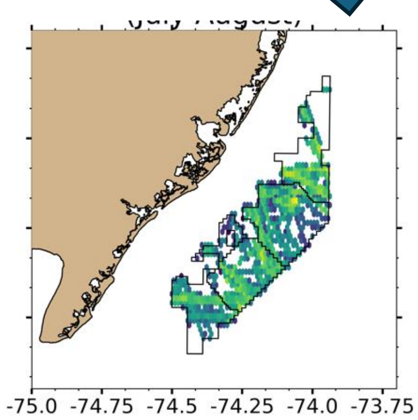


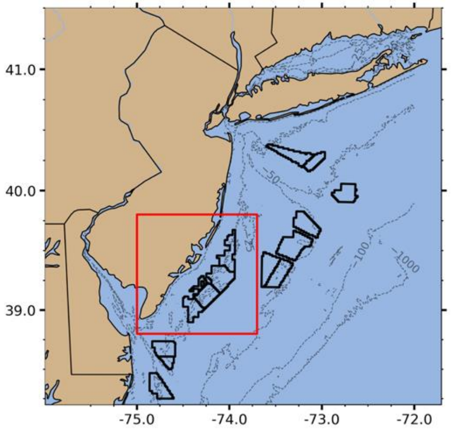


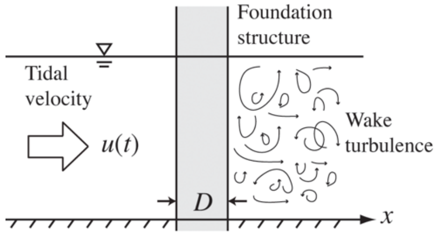

Aggregate data in a wind lease area

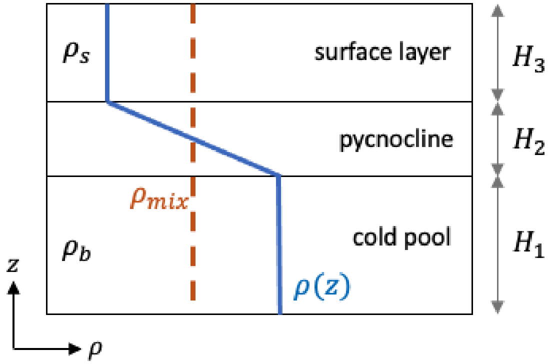
Create an average profile





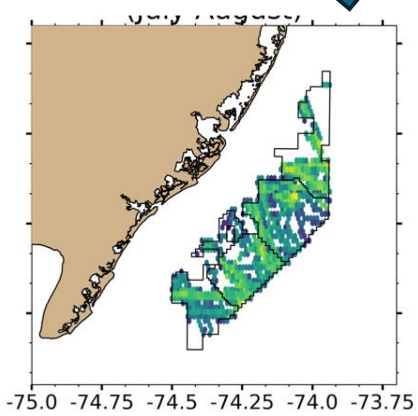

Run our Simple model

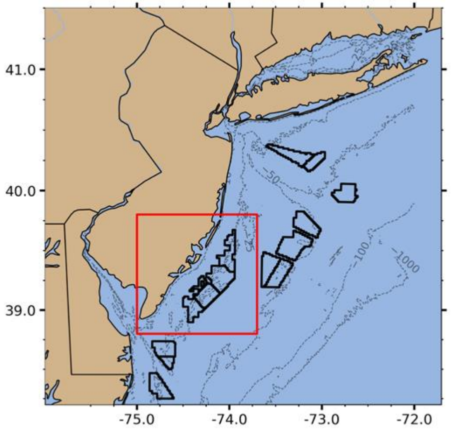


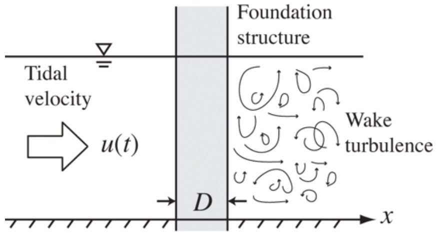

Aggregate data in a wind lease area

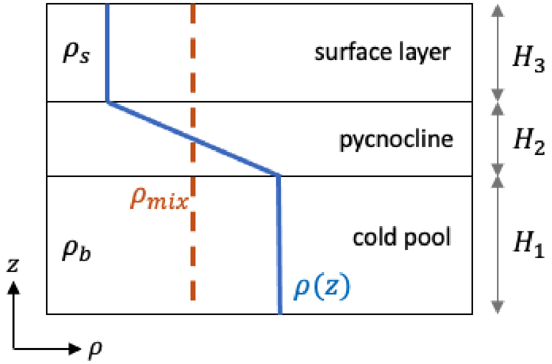
Create an average profile





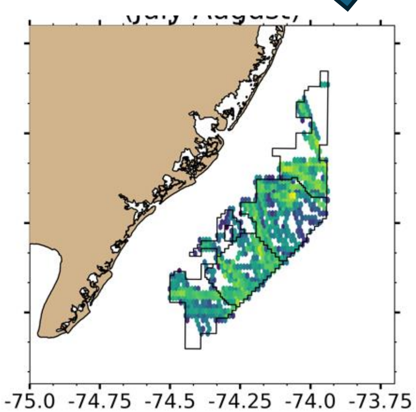

Run our Simple model



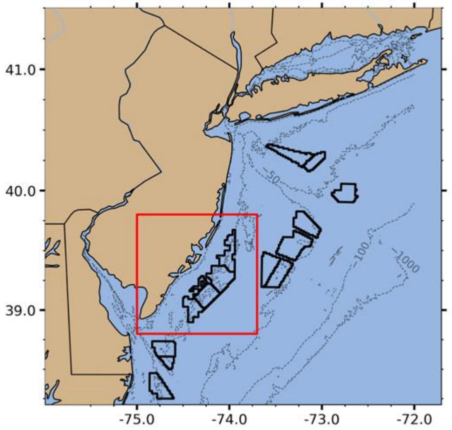




Compare with occurrence of velocities in the region

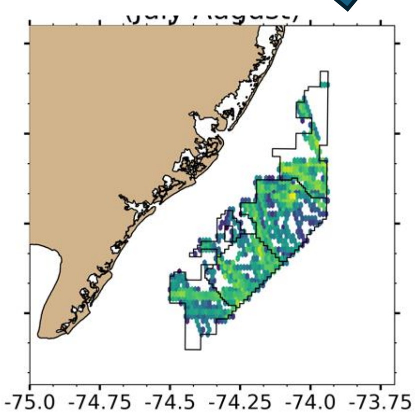
Aggregate data in a wind lease area



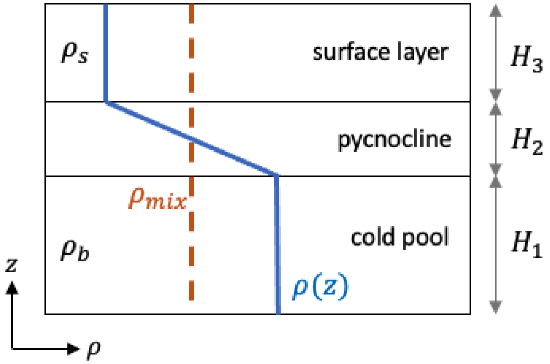

Create an average profile



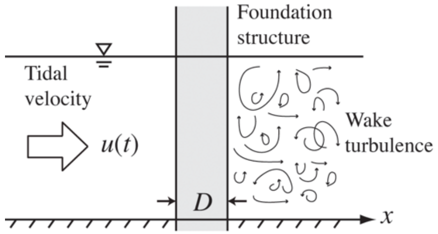

Aggregate data in a wind lease area




Create an average profile




Run our Simple model




Compare with occurrence of velocities in the region

~300 Years

~30 Years

~3 Years

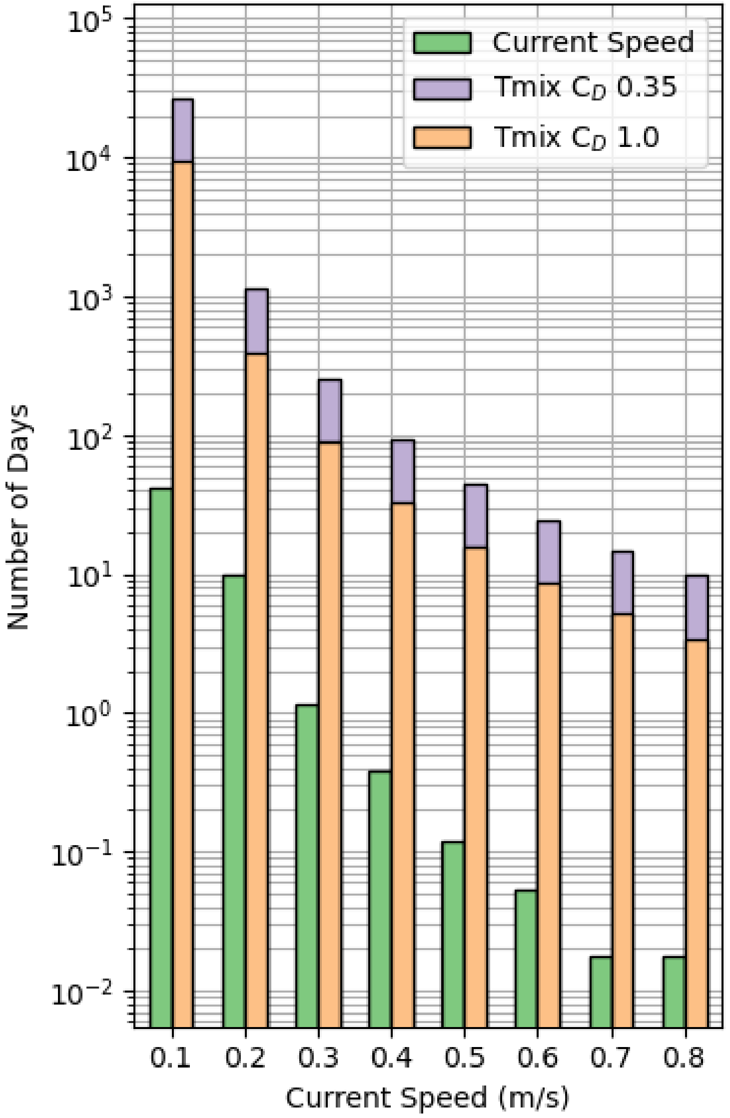
~3 Months

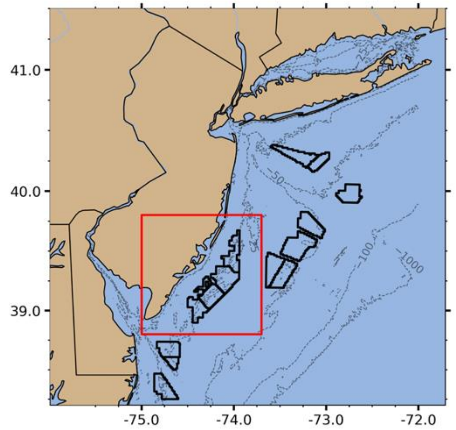
10 Days

1 Days

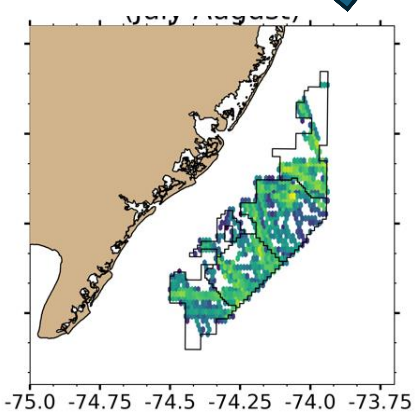
~0.1 Days

~0.01 Days

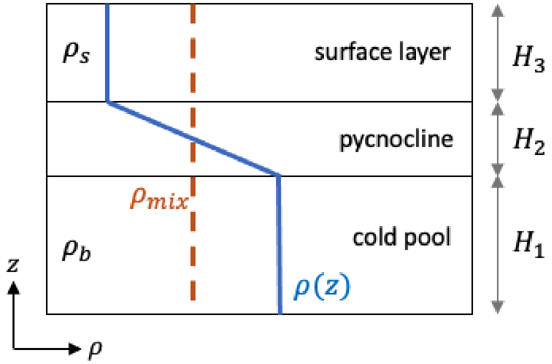




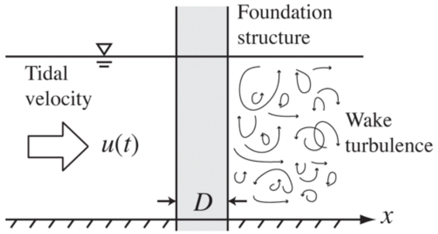

Aggregate data in a wind lease area




Create an average profile




Run our Simple model




Compare with occurrence of velocities in the region

**High Level Summary:**

- **Simple model estimate:** for turbines to mix the Cold Pool it would take ~30 years at the typical ~10 cm/s tidal velocities we experience in the MAB.
- **Caveat:** Smaller amounts of mixing may affect nutrients, phytoplankton, zooplankton aggregation and higher trophic levels (but not likely to totally mix the water column).

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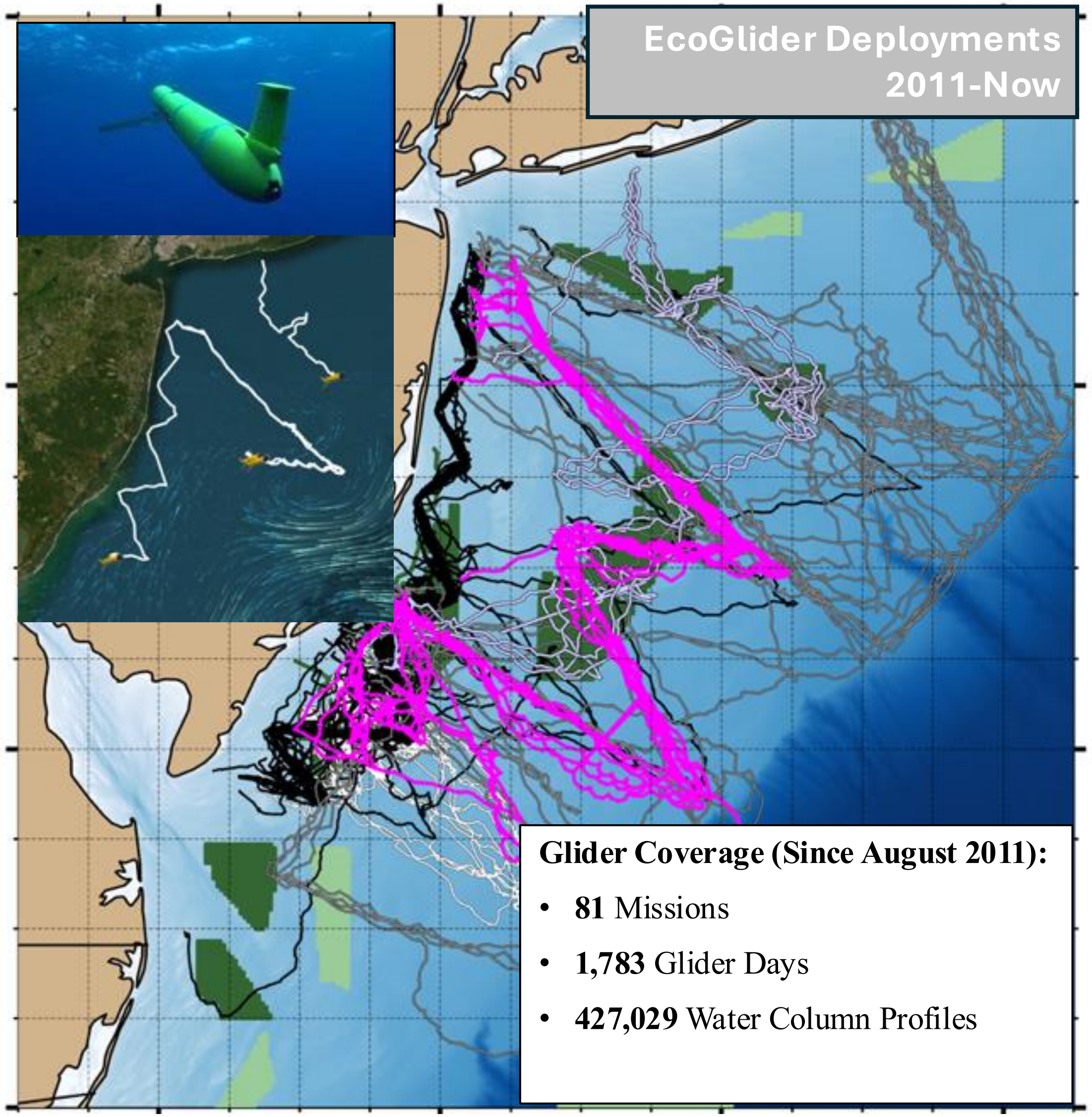
1) **GLIDE: Glider based ecological and oceanographic surveys of the New York Bight – NYSERDA (Kohut, Miles, Thorne)**

2) **NJ RMI Eco-Glider: Oceanographic and Ecological Sampling – NJDEP (Saba and Kohut)**

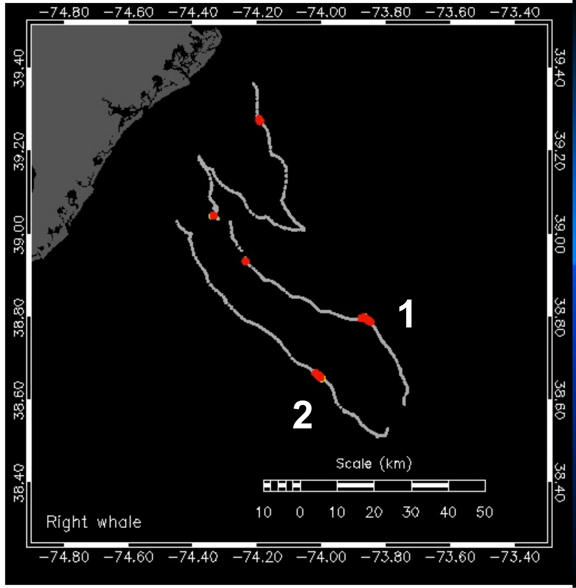
Primary Goal:

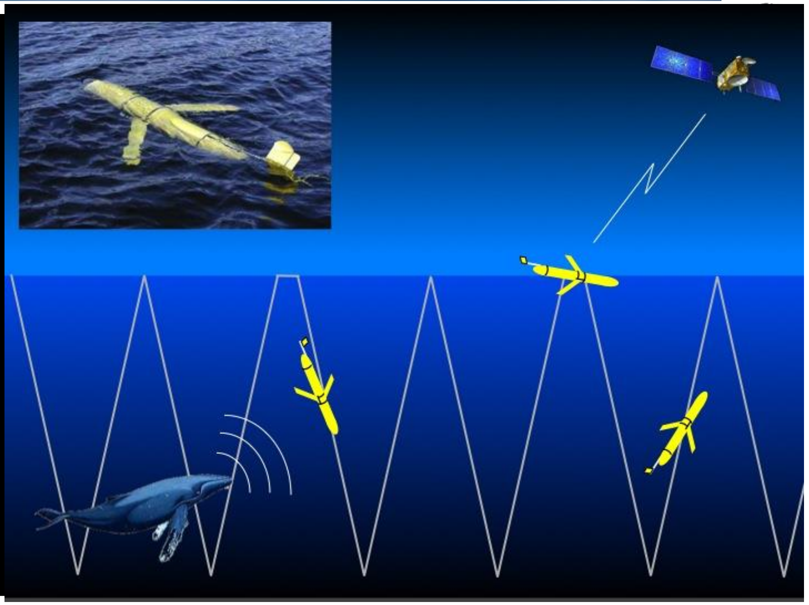
Collect baseline hydrographic to ecosystem data in and adjacent to regions of offshore wind development to support studies of the Cold Pool and Ecosystems (phytoplankton -> marine mammals)

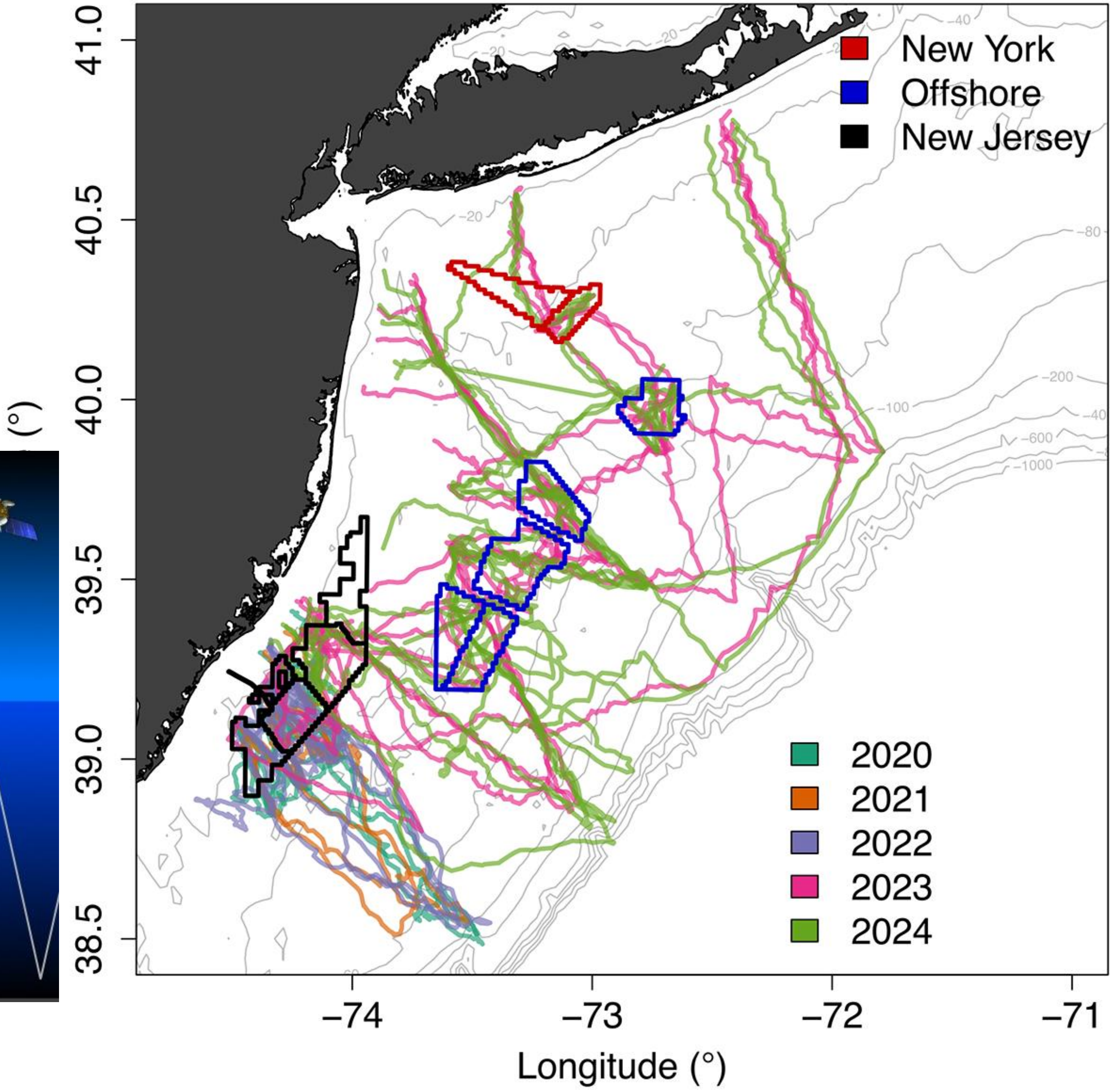



MARACOOS Ocean Information for a Changing World
Stony Brook University
WOODS HOLE OCEANOGRAPHIC INSTITUTION

# GLIDE: Marine Mammal Survey Findings (pre-construction)



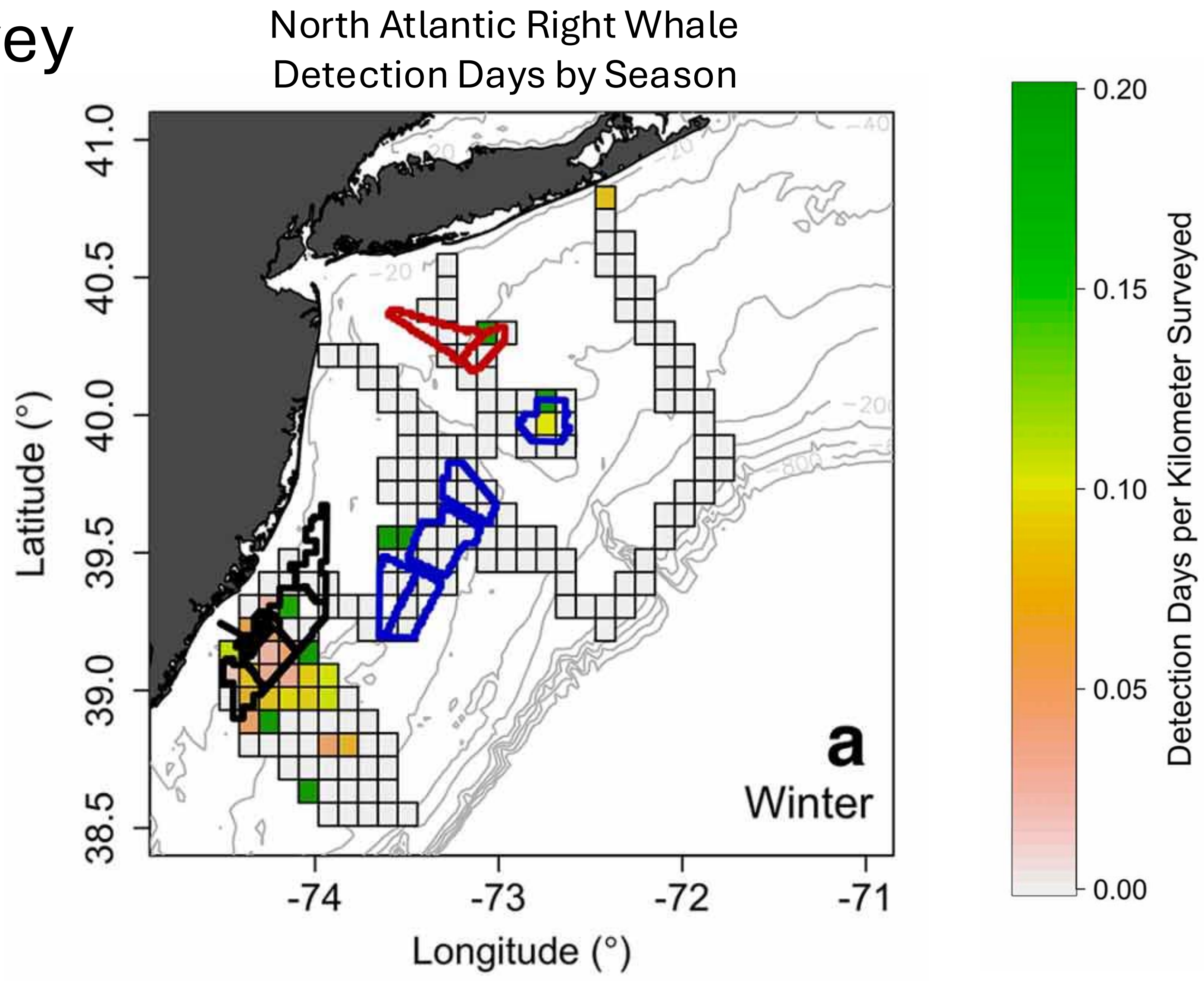






https://robots4whales.whoi.edu/

# GLIDE: Marine Mammal Survey Findings (pre- construction)

- Winter (most detections) focused more nearshore (NJ and NY WEAs)

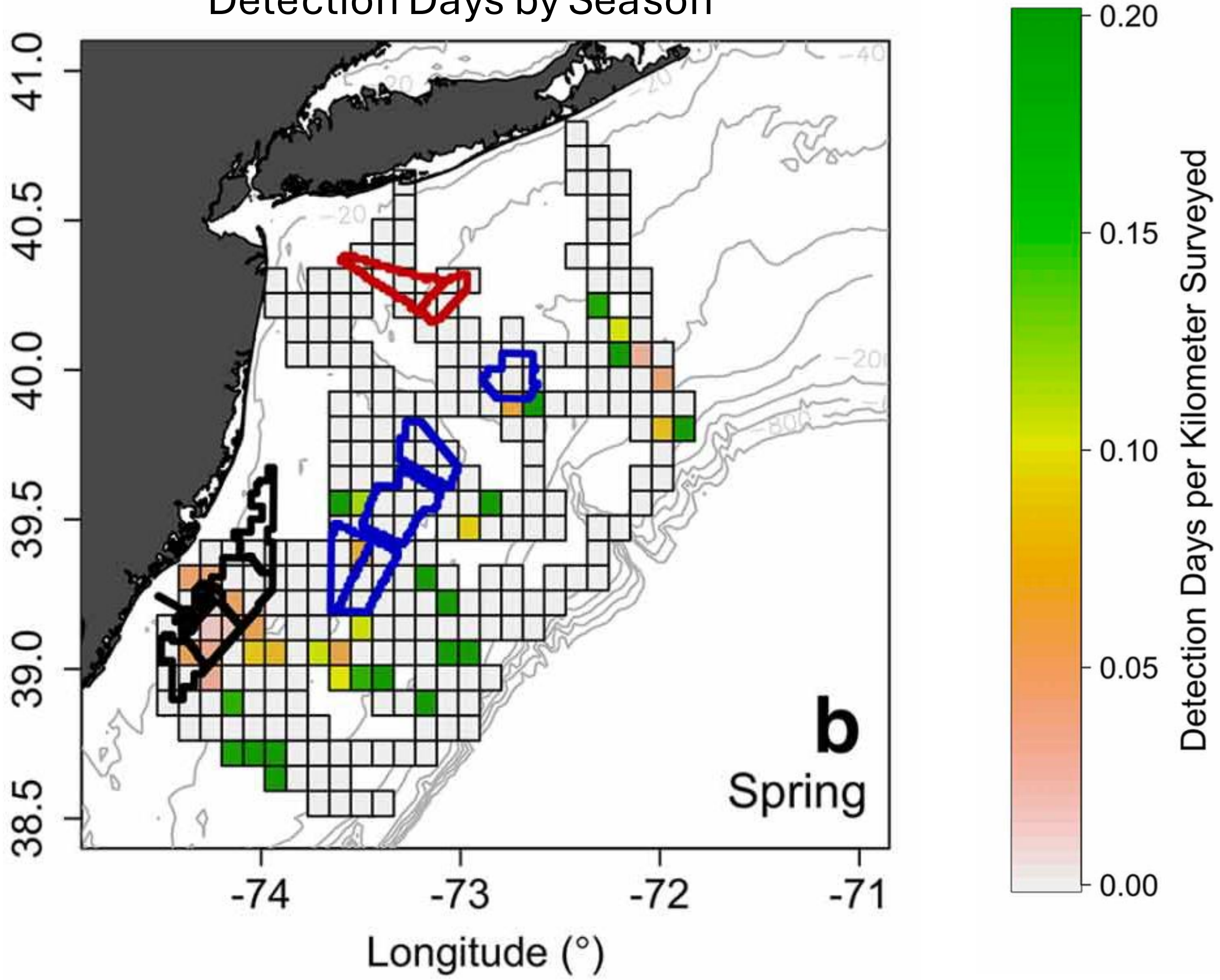



Gallagher et al., (2025)

# GLIDE: Marine Mammal Survey Findings (pre- construction)

- Winter (most detections) focused more nearshore (NJ and NY WEAs)
- Offshore WEA detections mostly in Spring

North Atlantic Right Whale Detection Days by Season

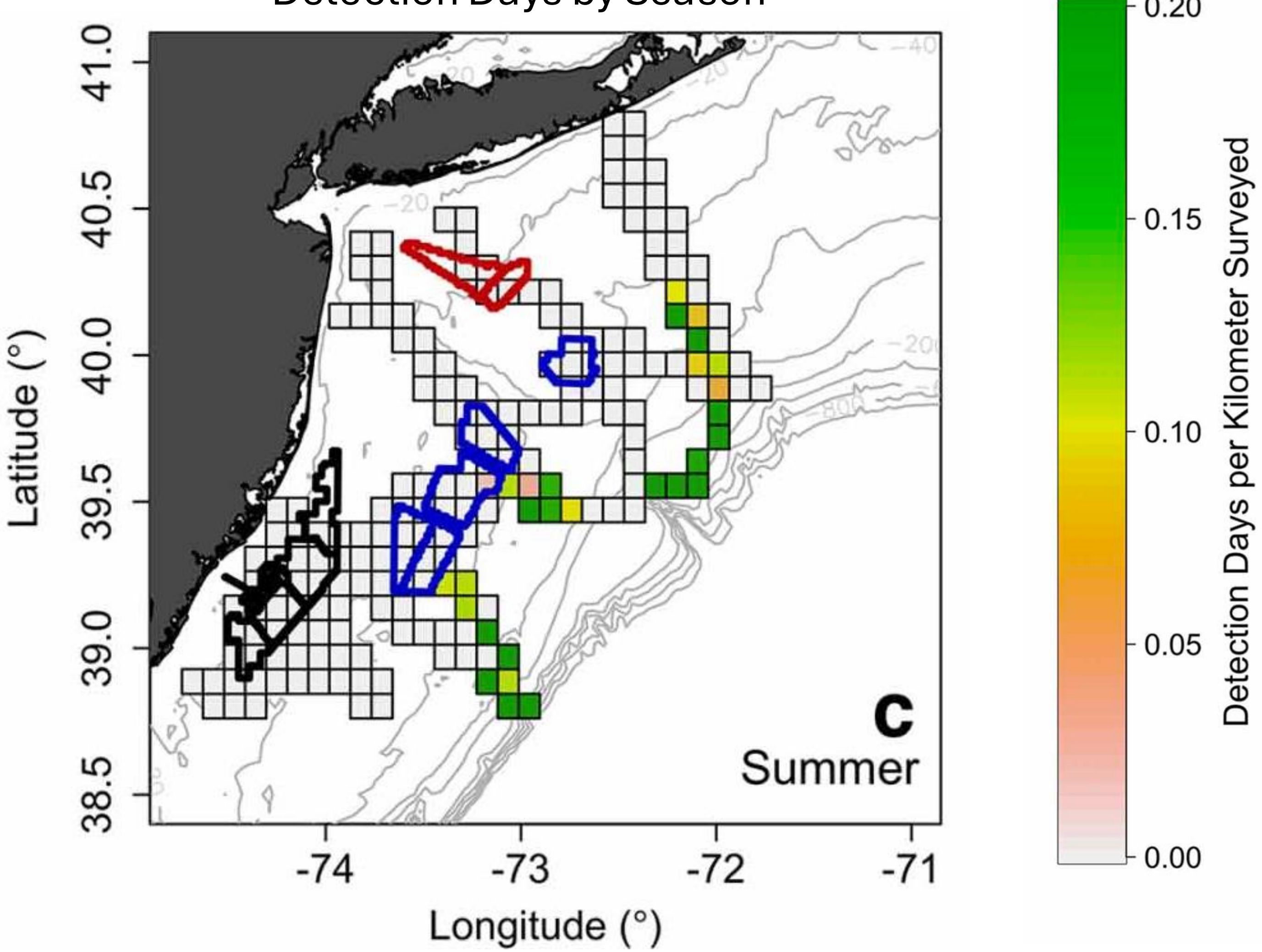



Gallagher et al., (2025)

# GLIDE: Marine Mammal Survey Findings (pre- construction)

- Winter (most detections) focused more nearshore (NJ and NY WEAs)
- Offshore WEA detections mostly in Spring
- Summer had the least detections in any WEA
- Independent of offshore wind, what are they responding to?

North Atlantic Right Whale Detection Days by Season

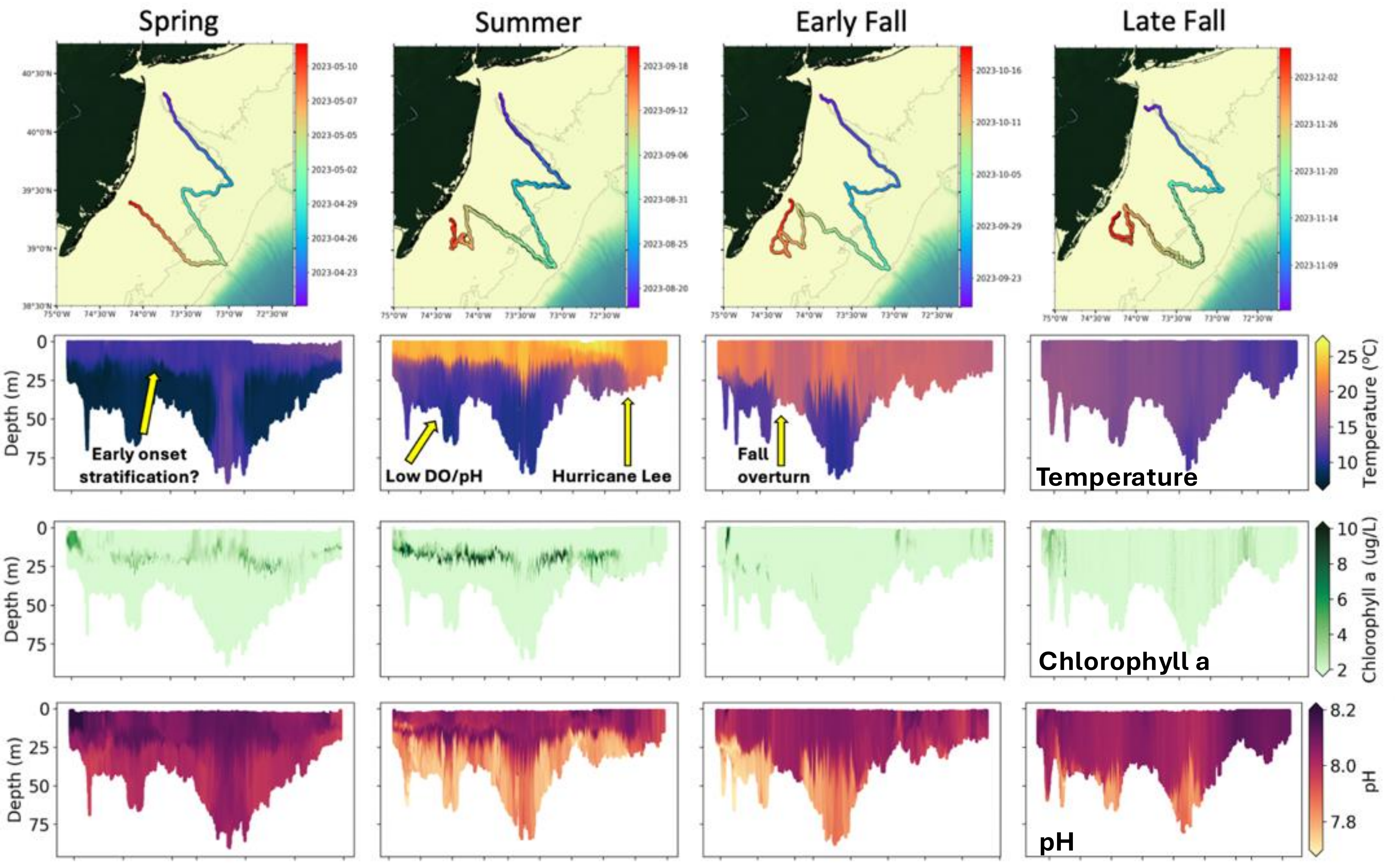



Gallagher et al., (2025)

# Baseline Monitoring: Seasonal Evolution of Oceanographic Properties

Monitoring strategy increases our ability to:

- Characterize the true variability of the system
- Relate the physical, chemical, biological variables

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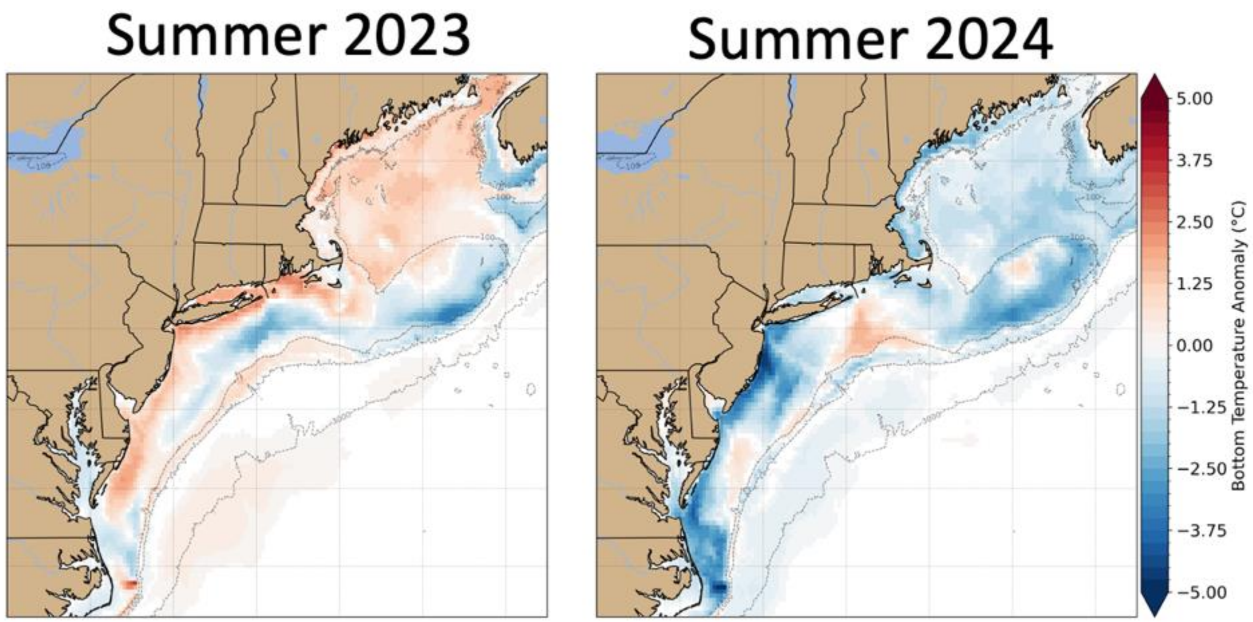
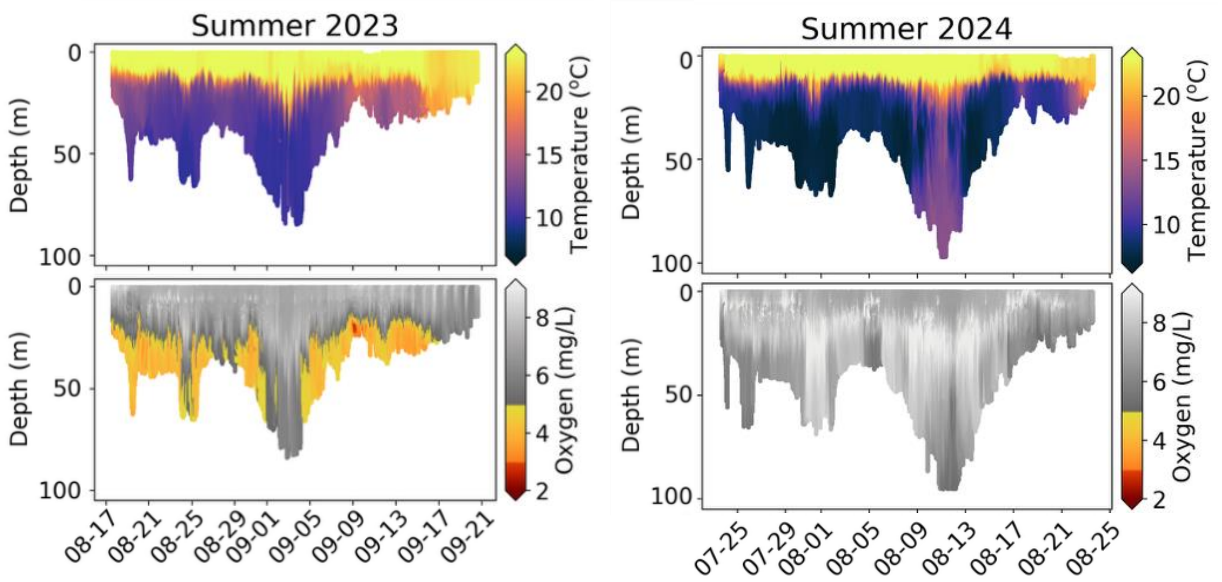
# Baseline Monitoring: Extremely High Interannual Variability

- Warm to anomalously cold bottom temps from 2022-2024
- Earlier stratification in 2023
- Significantly lower dissolved oxygen in bottom water in 2023
- Reported fish, lobster, & crab mortalities from fishers
- Independent of Offshore Wind, large interannual variability

Data Assimilative Ocean Modeled Bottom Temperature Anomaly




# Summary and Wrap-Up

1. We’re all unsure about the short- and long- term future of offshore wind on the US East Coast. Some wind farms have already been built, so research and monitoring is needed

2. The Cold Pool is our signature regional oceanographic feature

3. We don’t expect turbine monopiles to mix/destroy the Cold Pool significantly

4. We need to and are to monitor ecosystem parameters (phytoplankton to whales) to understand baseline variability and potential impacts

5. We have the technology to do this and have already been doing it for years (but it’s hard work, and we need more data)

6. Thank you!

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rmi

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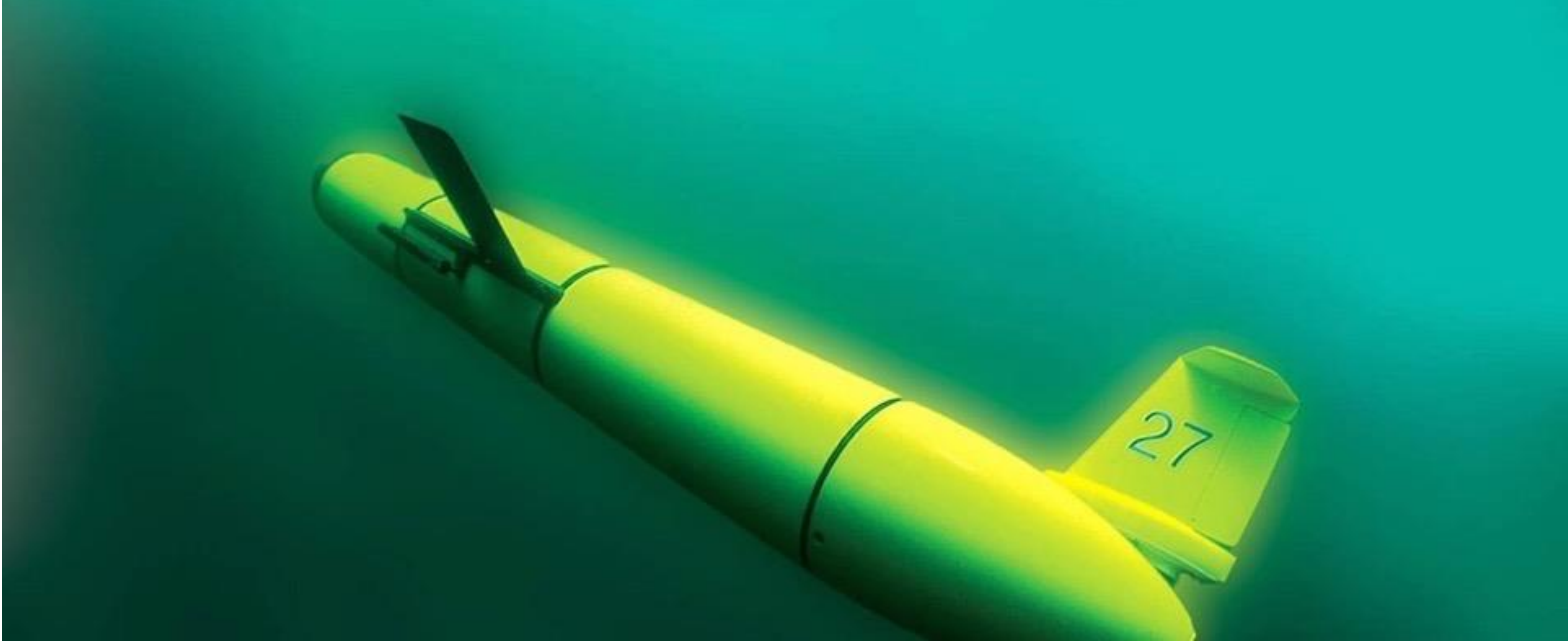
# Thank you!

**Contact Information:**
Travis Miles
tnmiles@marine.rutges.edu



## Next Webinar

### March 25, 11:00 a.m. ET

## Logistics of Offshore Construction

### Anna Ritzen and Stefan Hartman

Visit wind.ny.gov to register

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