The Challenges of Making a Living in the Crowded and Ever Changing Ocean

Dr. Josh Kohut

Center for Ocean Observing Leadership
Department of Marine and Coastal Sciences
School of Environmental and Biological Sciences

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School of Environmental
and Biological Sciences

Over 30 Years of Ocean Observing at:

Rutgers University (RU)
Center for Ocean Observing Leadership (COOL)

Department of Marine and Coastal Sciences (DMCS)
71 Dudley Road, New Brunswick, New Jersey, USA
http://rucool.marine.rutgers.edu

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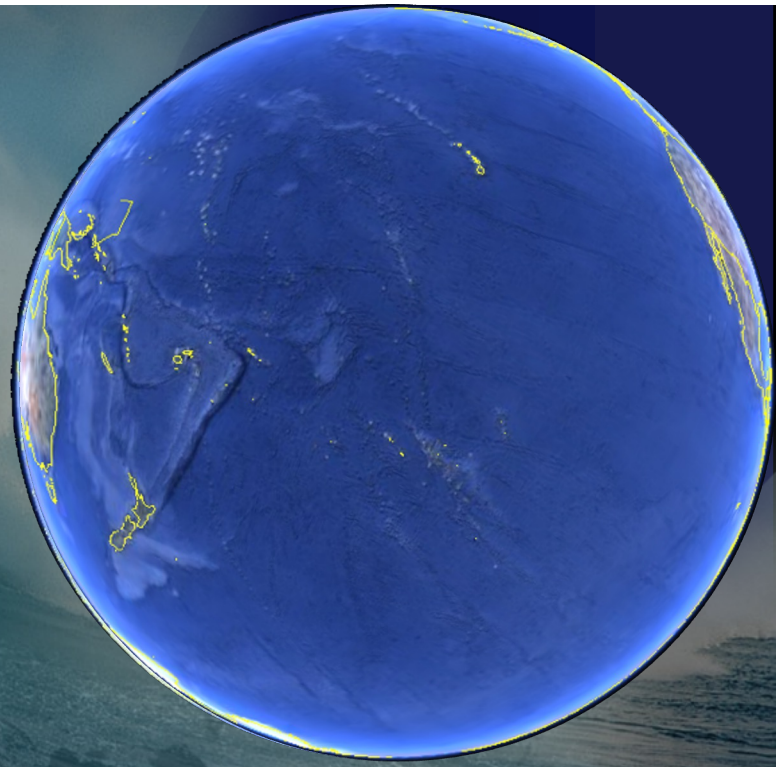
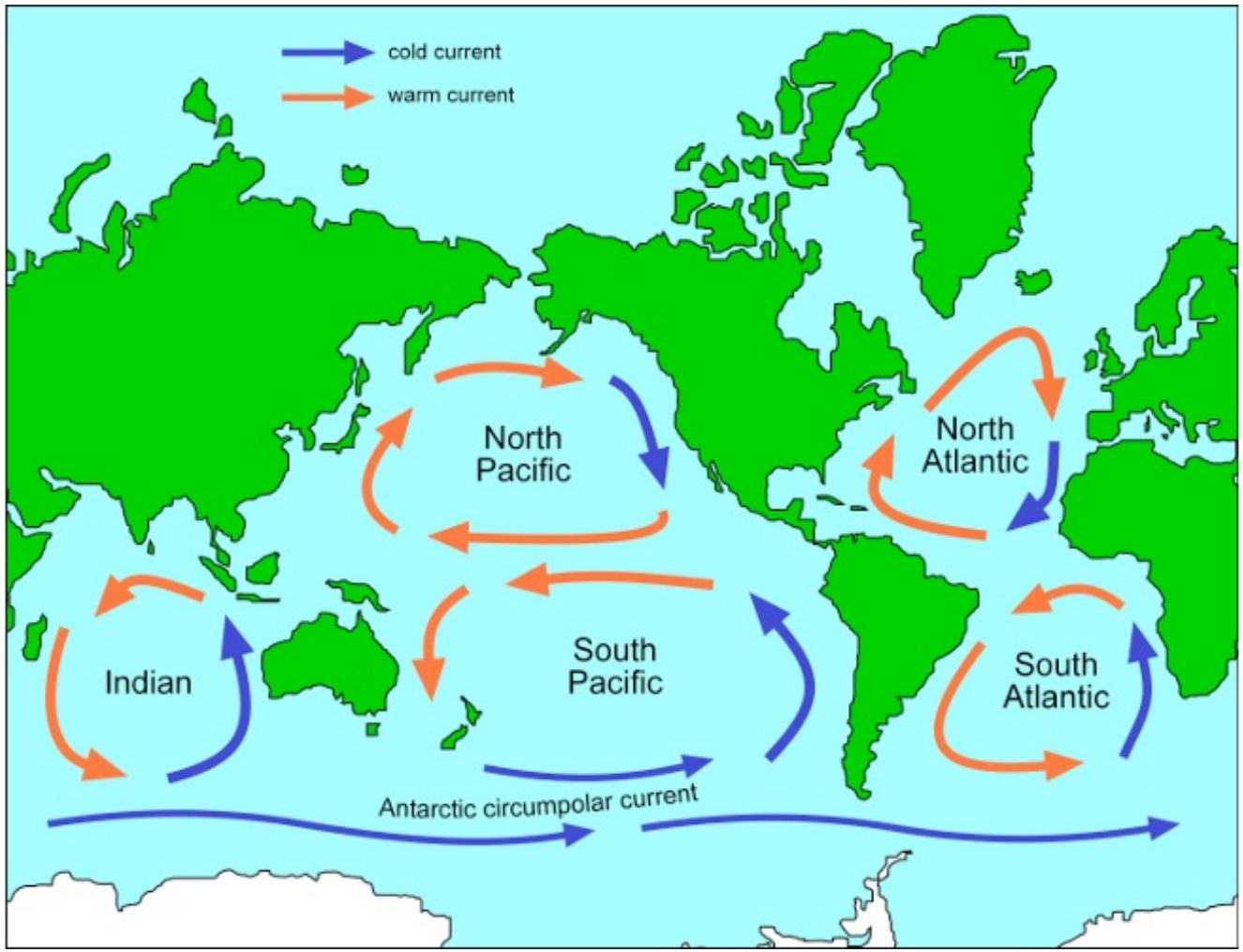
The Ocean



- **Covers 71%** of the Earth's surface
- **Contains 97%** of the Earth's water
- **Dominates** the Earth's Water Cycle
- 95% of the ocean remains **unexplored**
- **Supports** a great diversity of life and ecosystems
- Is a **major influence on** weather and climate, making earth habitable



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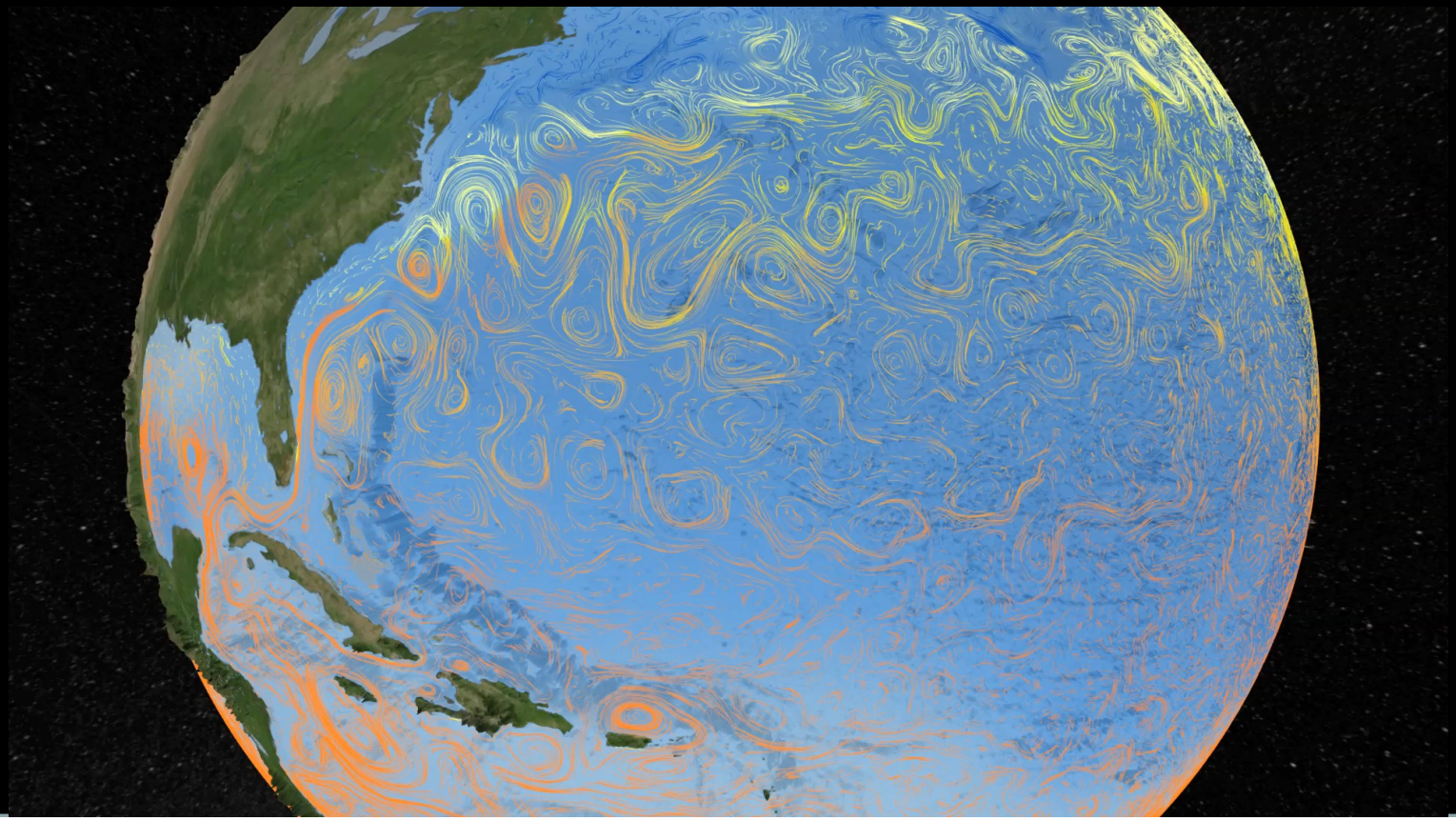
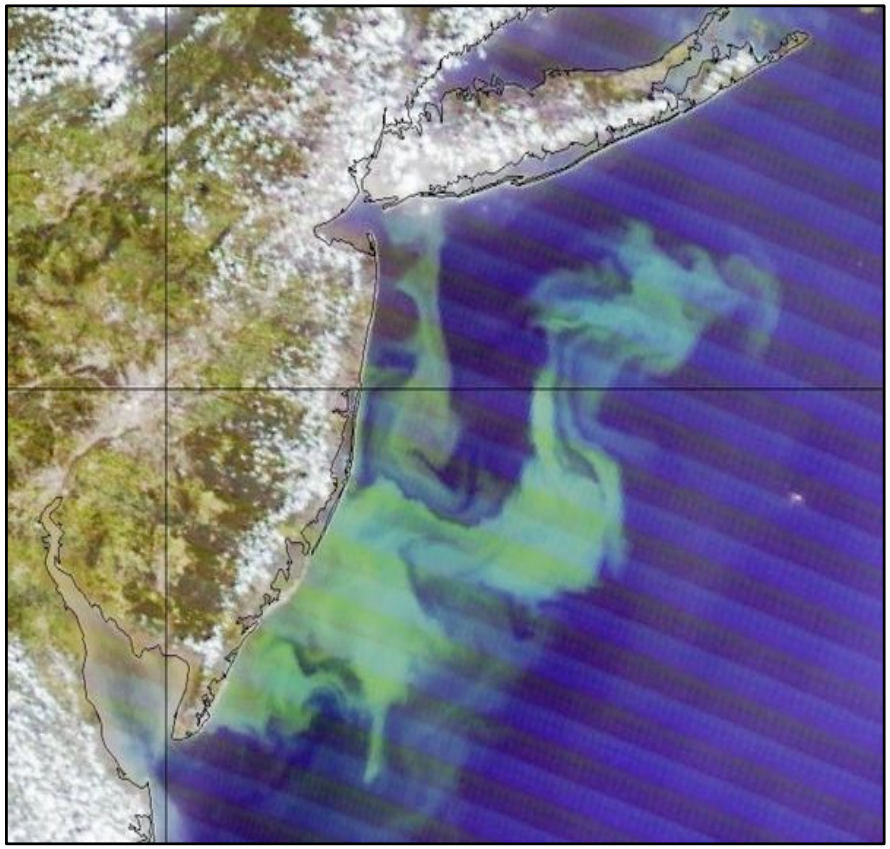
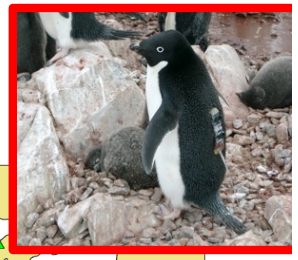
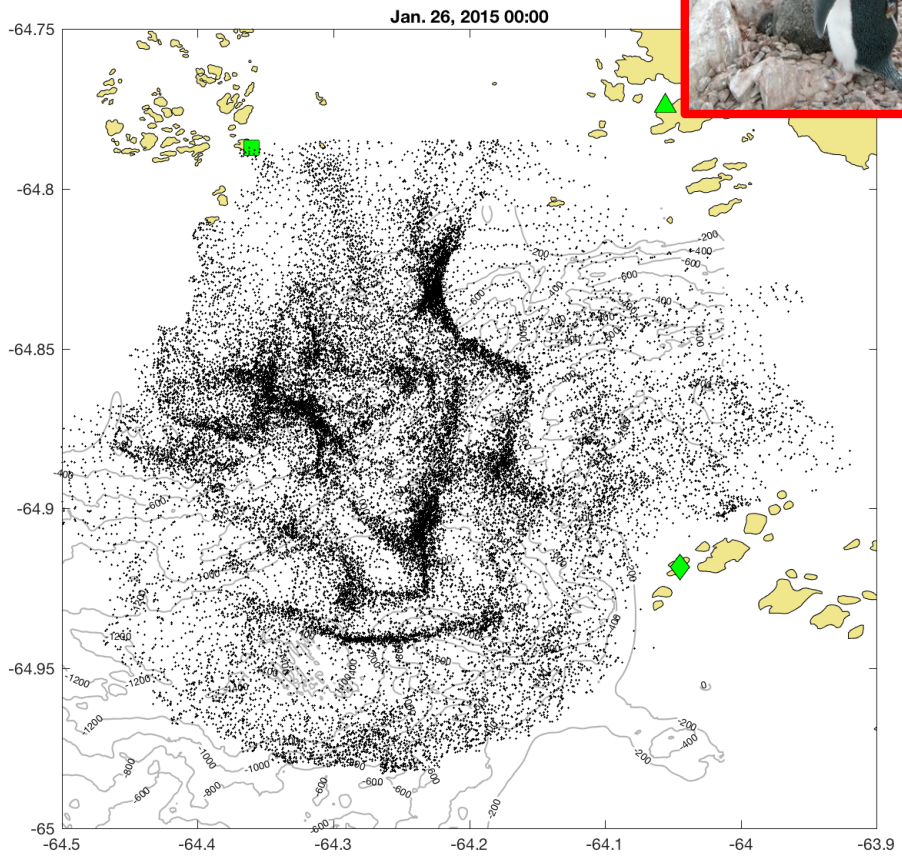
The Ocean



The ocean is a dynamic environment







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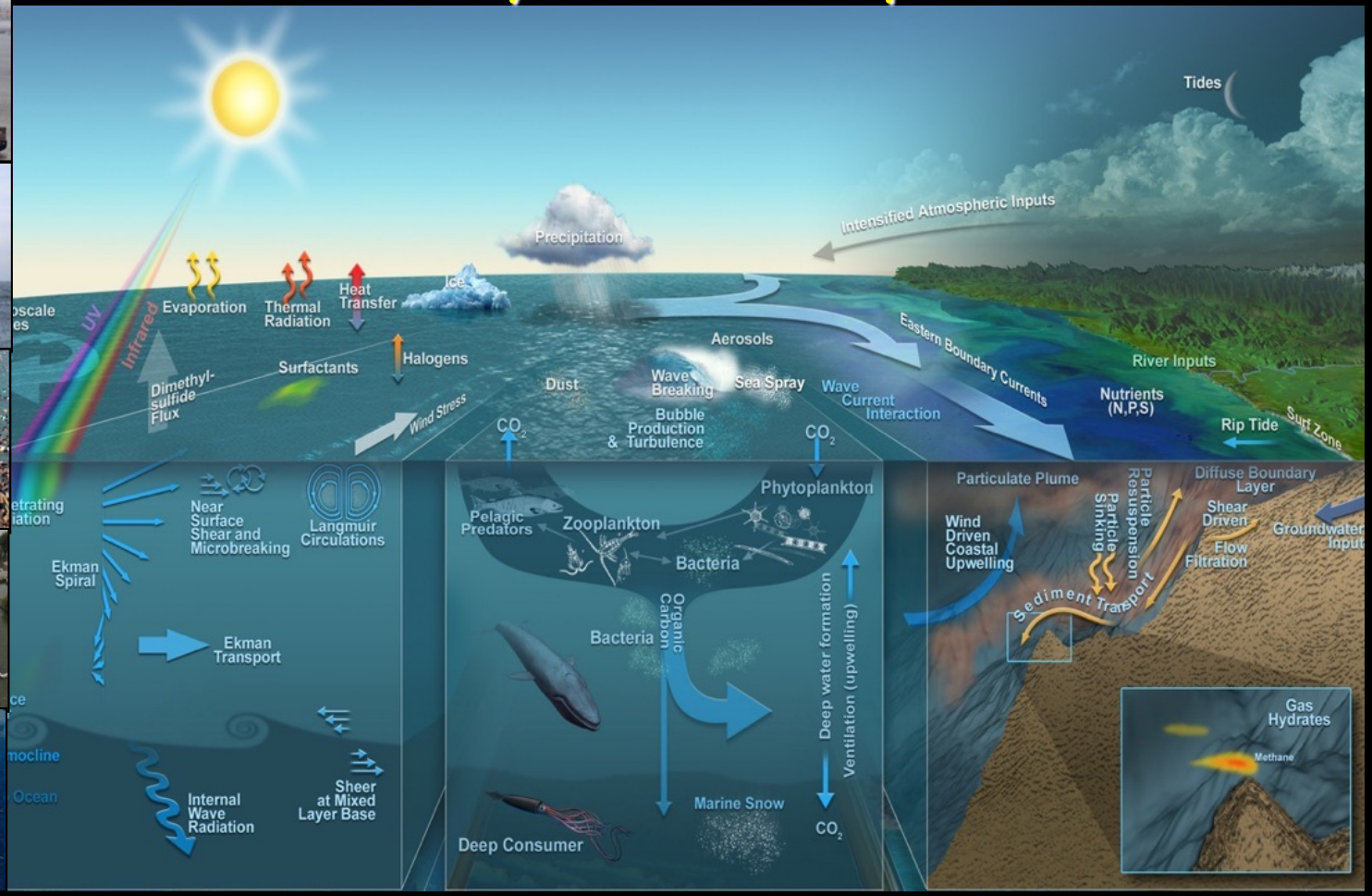
Marine systems are complex

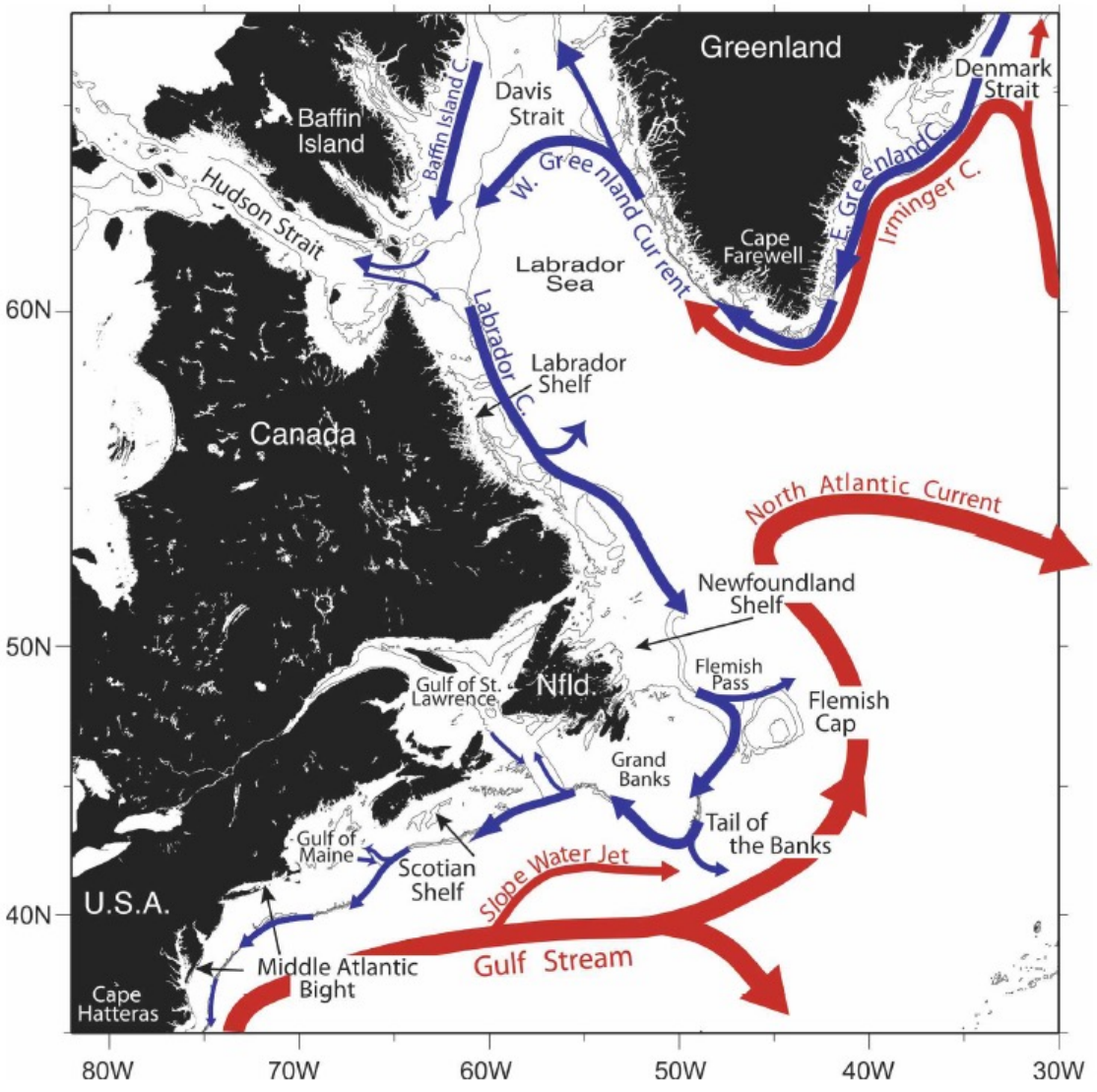


Thanks to the Neptune team

Northwest Atlantic: General Circulation

Warm Currents

Cold Currents



Fratantoni and Pickart. (2007)

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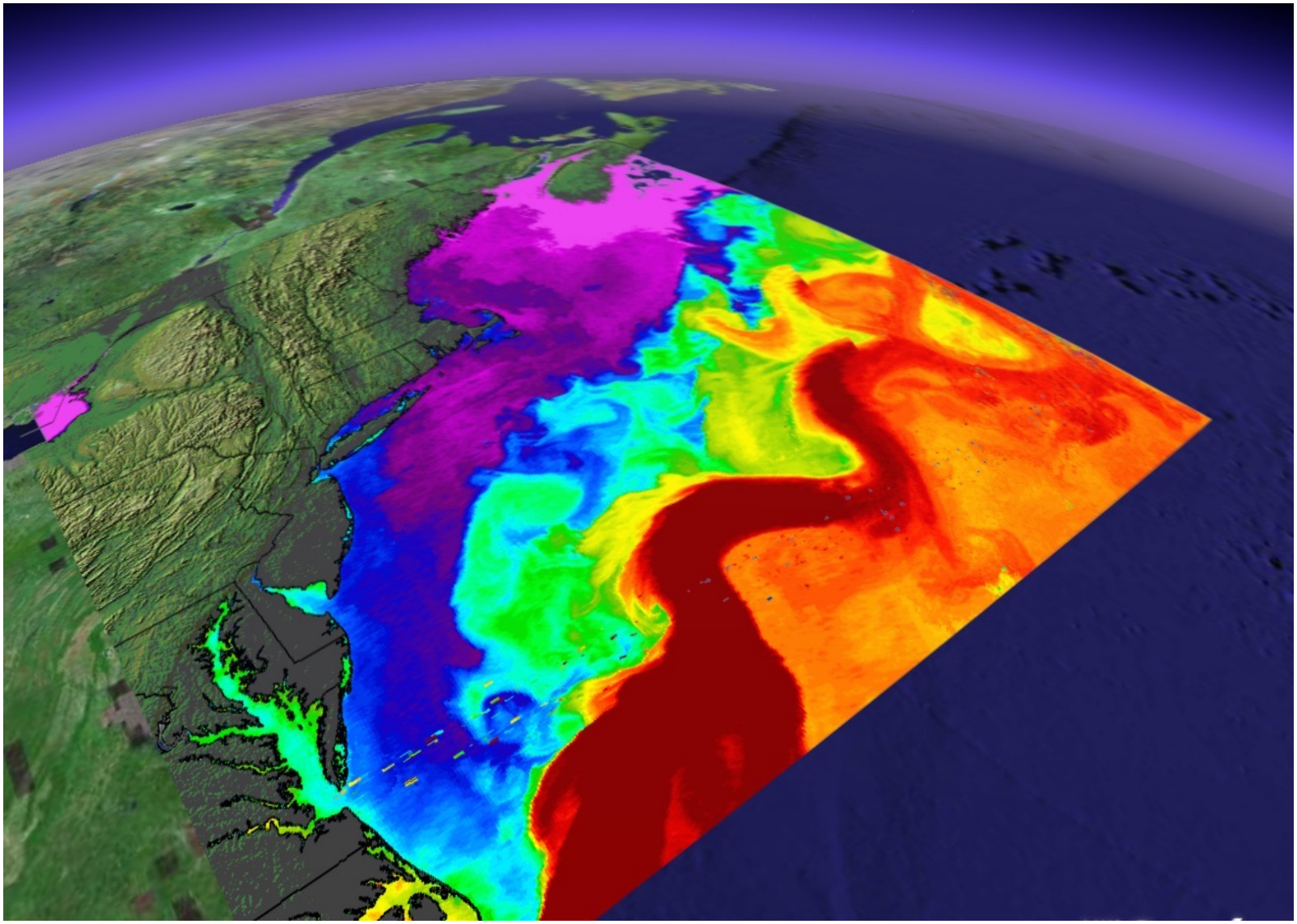

MID ATLANTIC BIGHT

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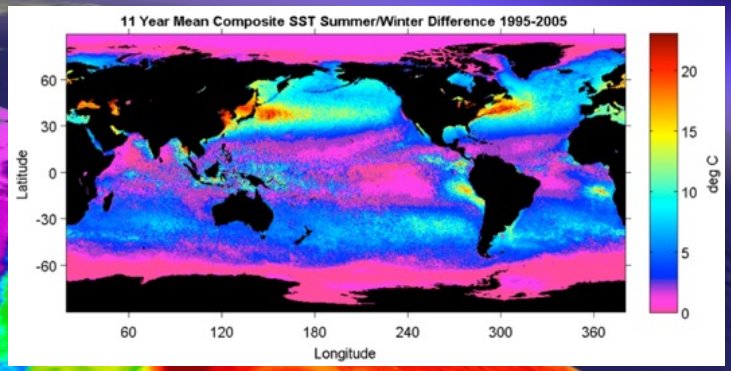
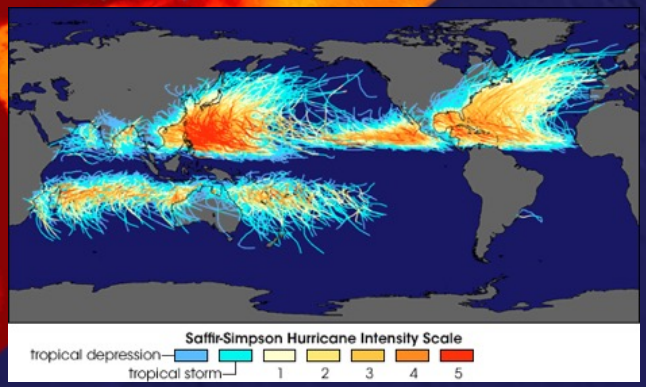
Physical Oceanography of the Mid Atlantic Bight



Ocean Seasonality



Tropical Cyclones

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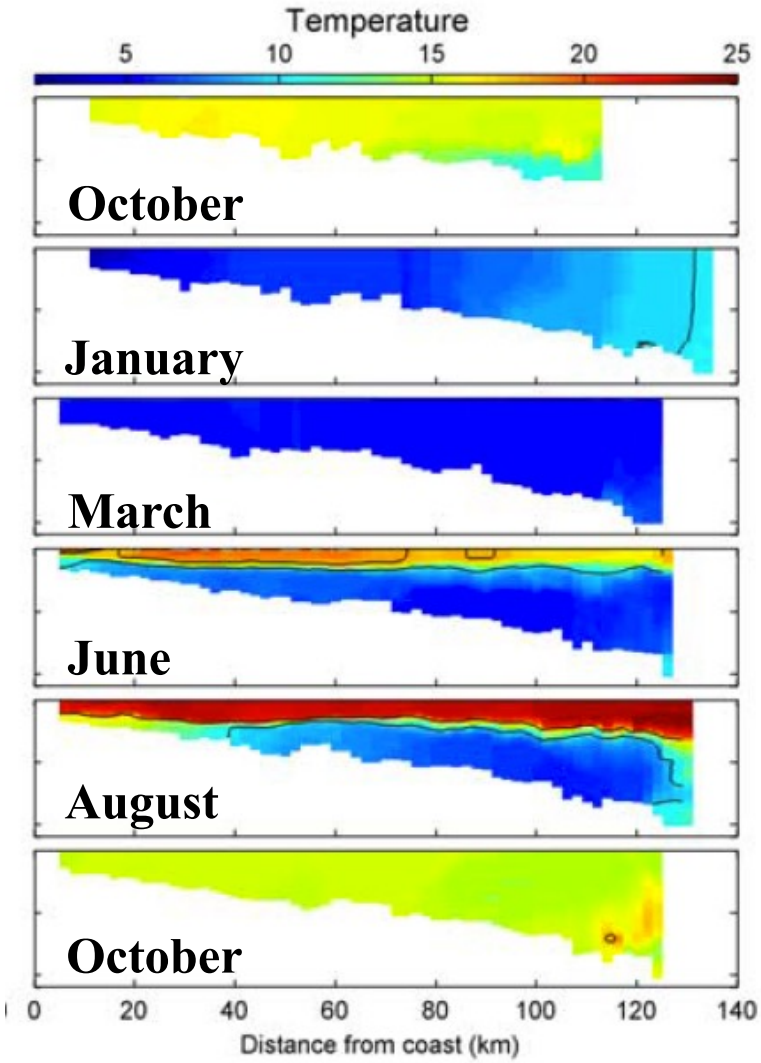
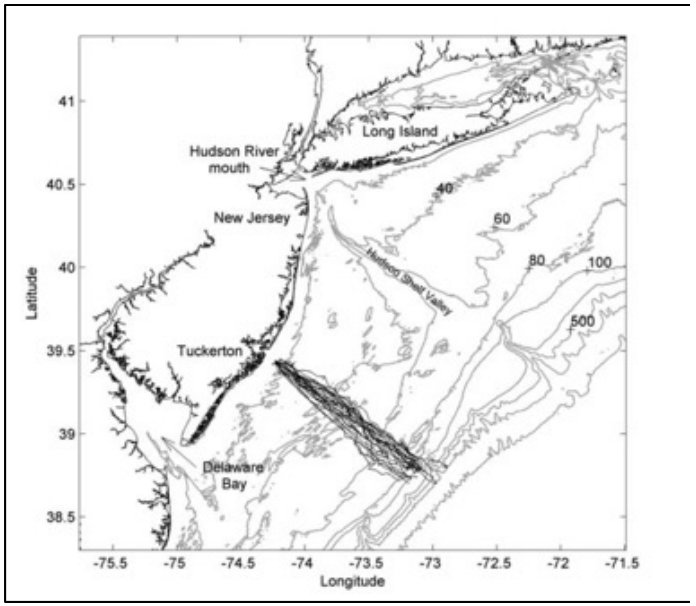
Seasonality





Castelao et al. 2008

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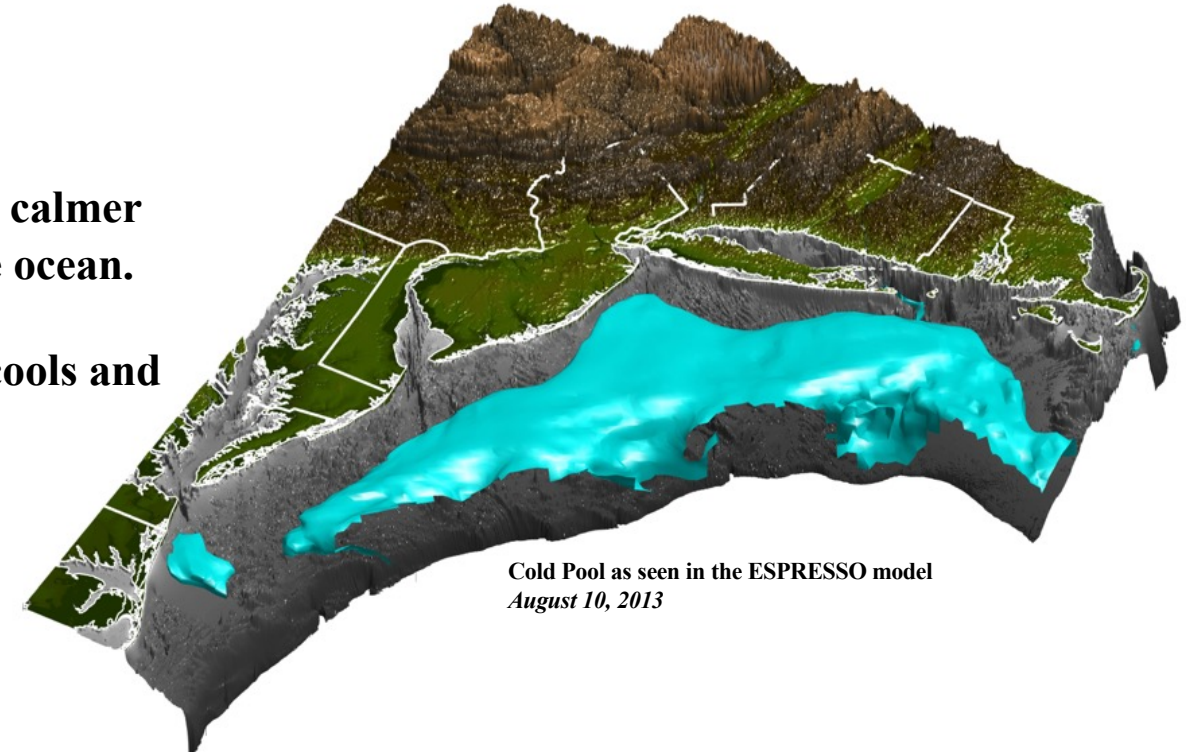
Bottom Temperature: The Cold Pool

- **Forms in the spring as longer days and calmer winds preferentially warms the surface ocean.**
- **Breaks down in the fall as the surface cools and more frequent storms mix the ocean.**
- **Important bottom feature throughout the summer.**



Cold Pool as seen in the ESPRESSO model
August 10, 2013

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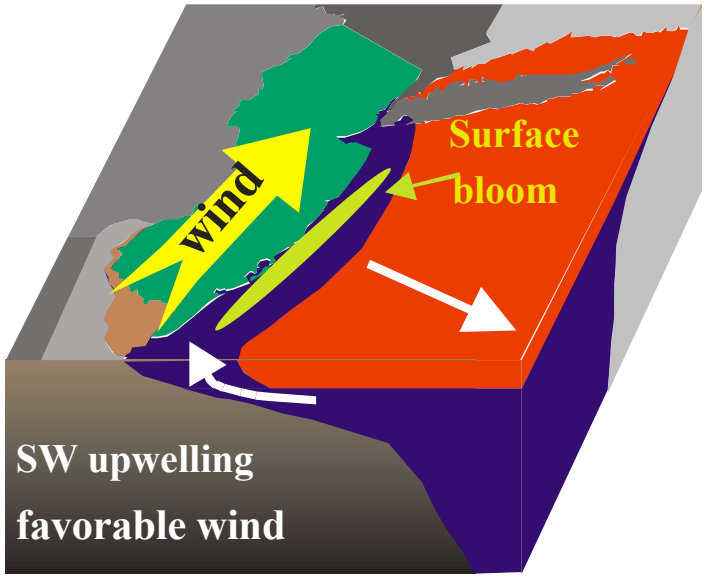
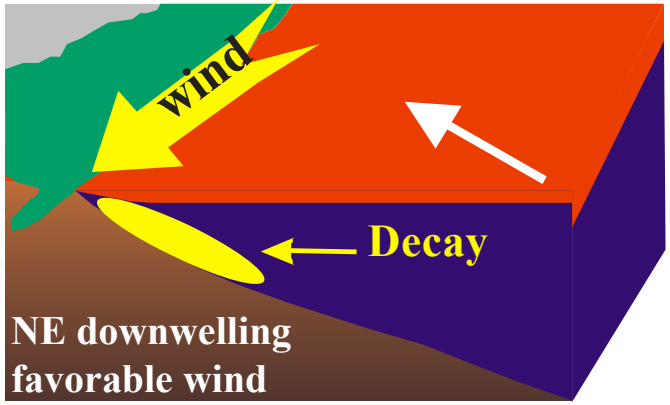
Coastal Upwelling / Downwelling



Physical Process -
Wind Driven
Coastal Upwelling
and Downwelling



Coupled Biological Response -
Bacterial Decay of a
Phytoplankton Bloom

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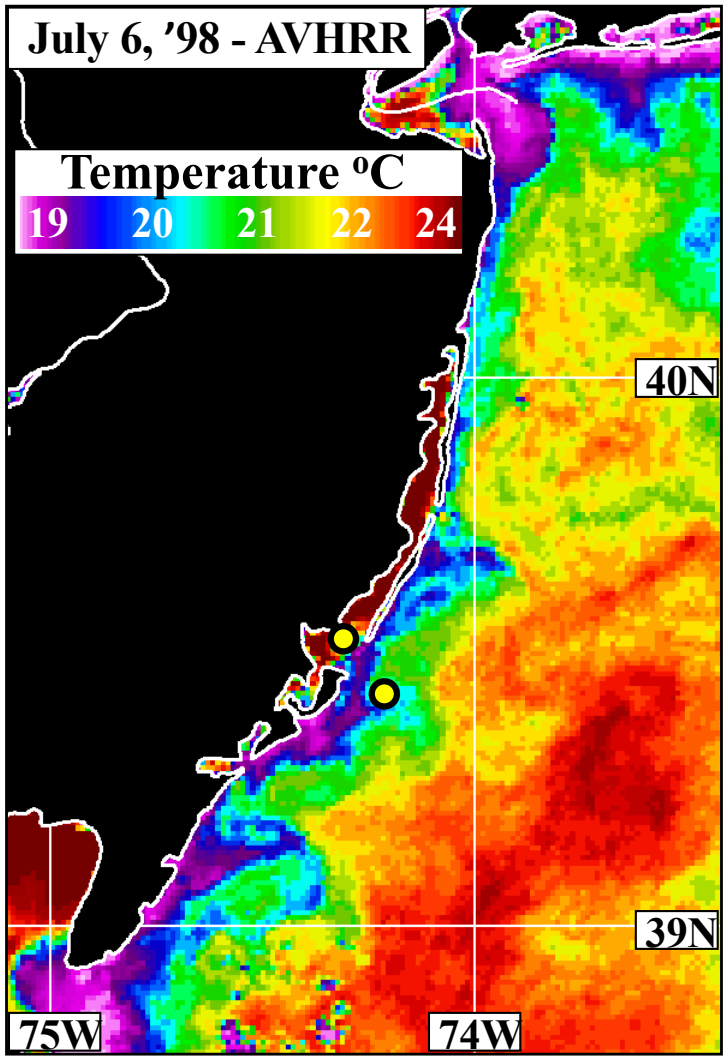

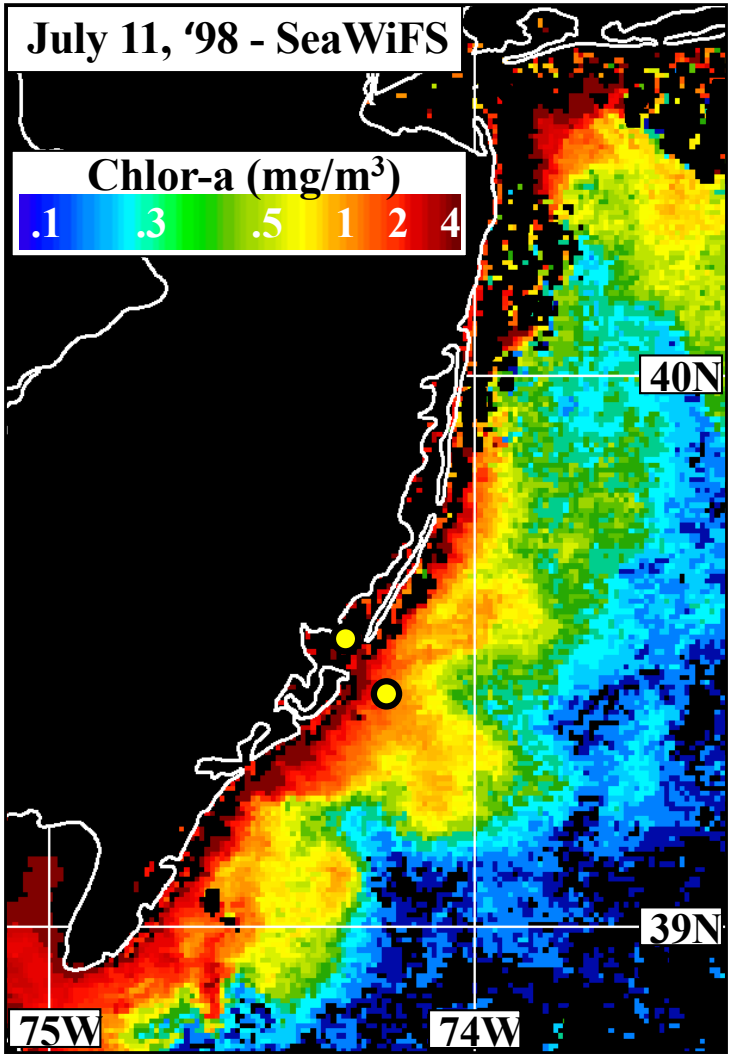

New Jersey Coastal Upwelling

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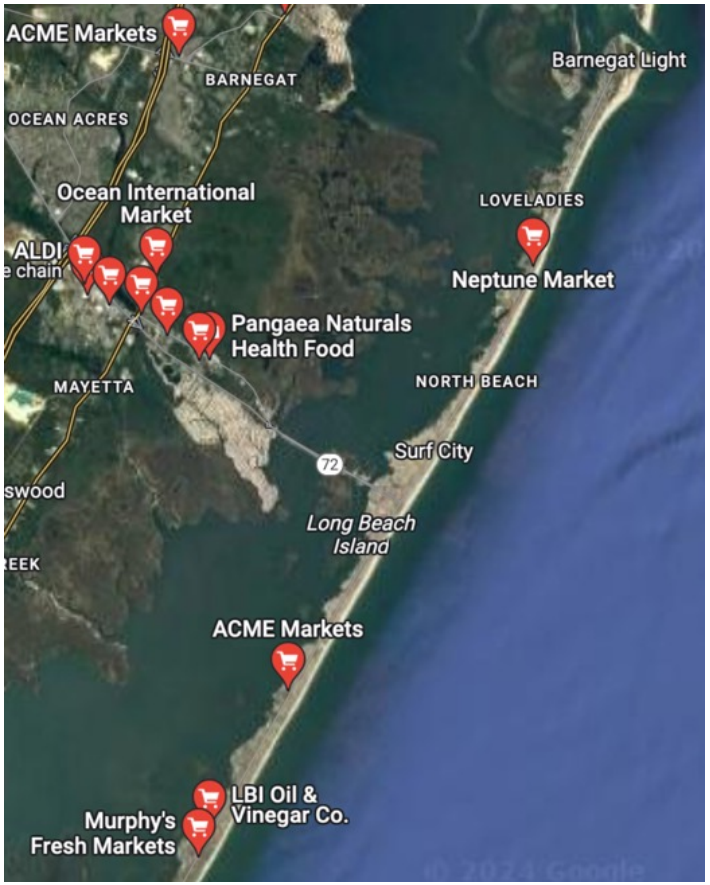
Landscapes are NOT Seascapes!!



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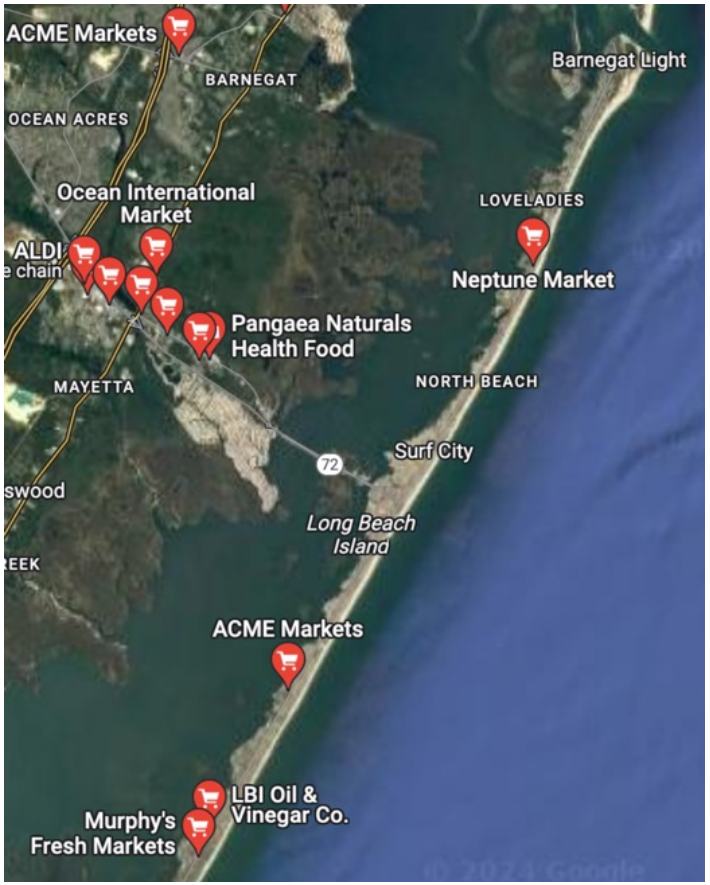

In the ocean….

- The streets move (Often!)
- The primary producers live days to weeks
- Fish are cold blooded

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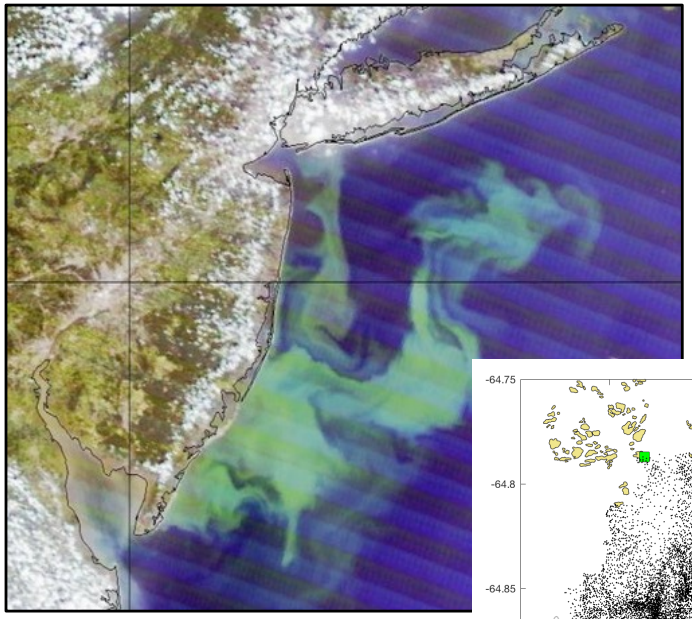

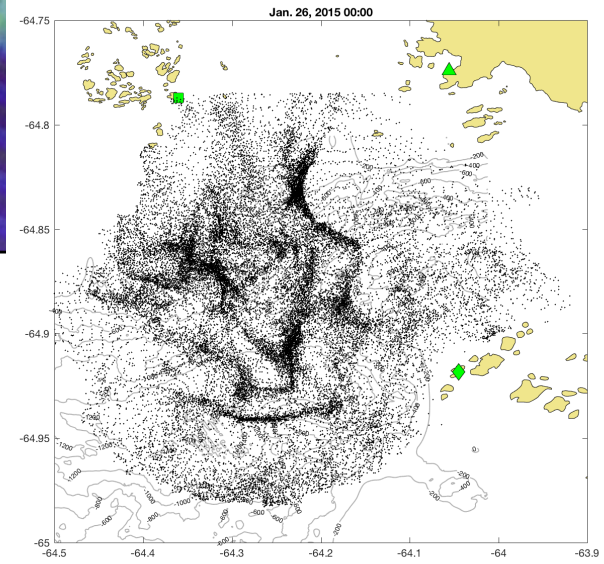

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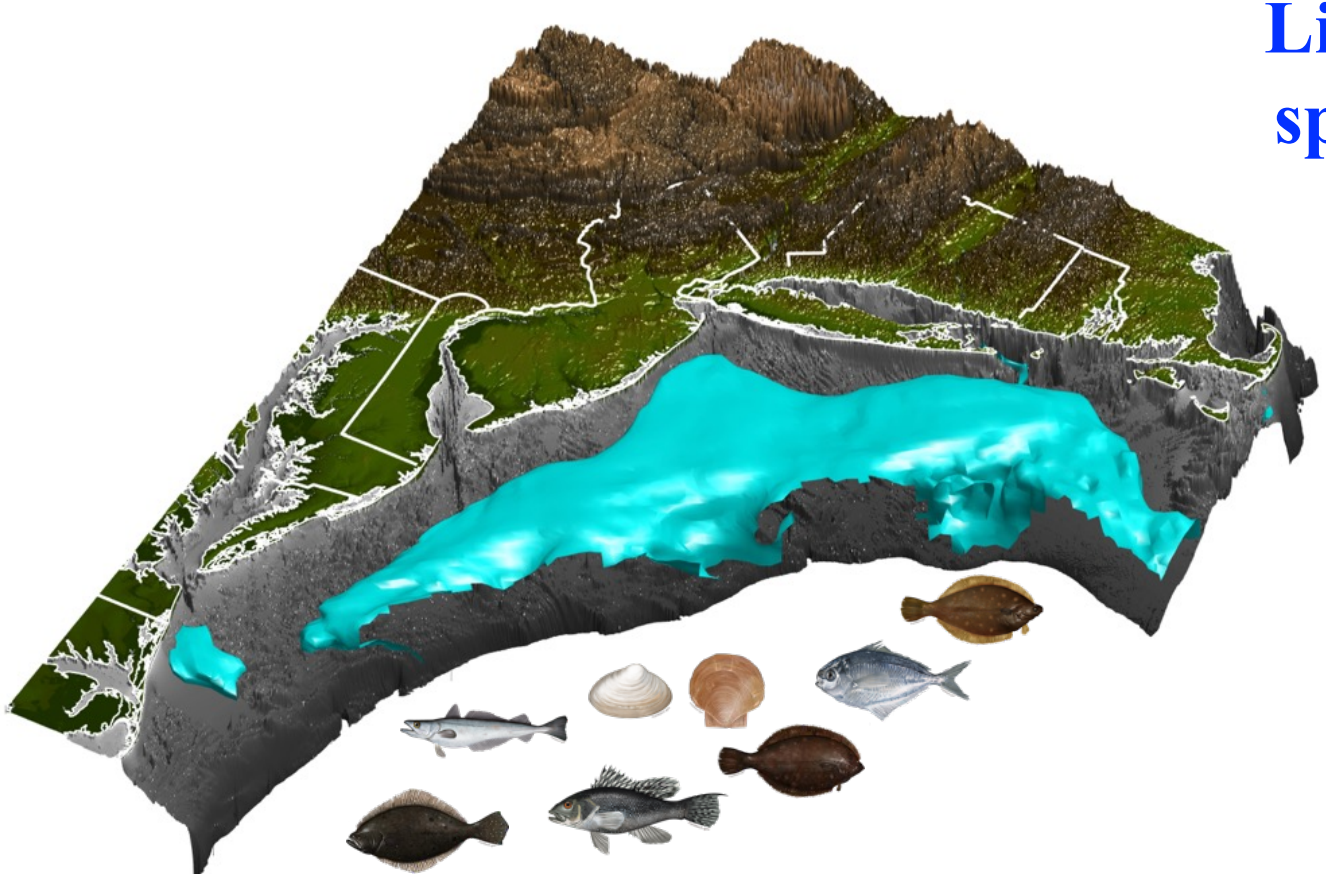

Life histories of many species are attuned to changes in ocean temperature

Migration
Spawning
Recruitment
Abundance

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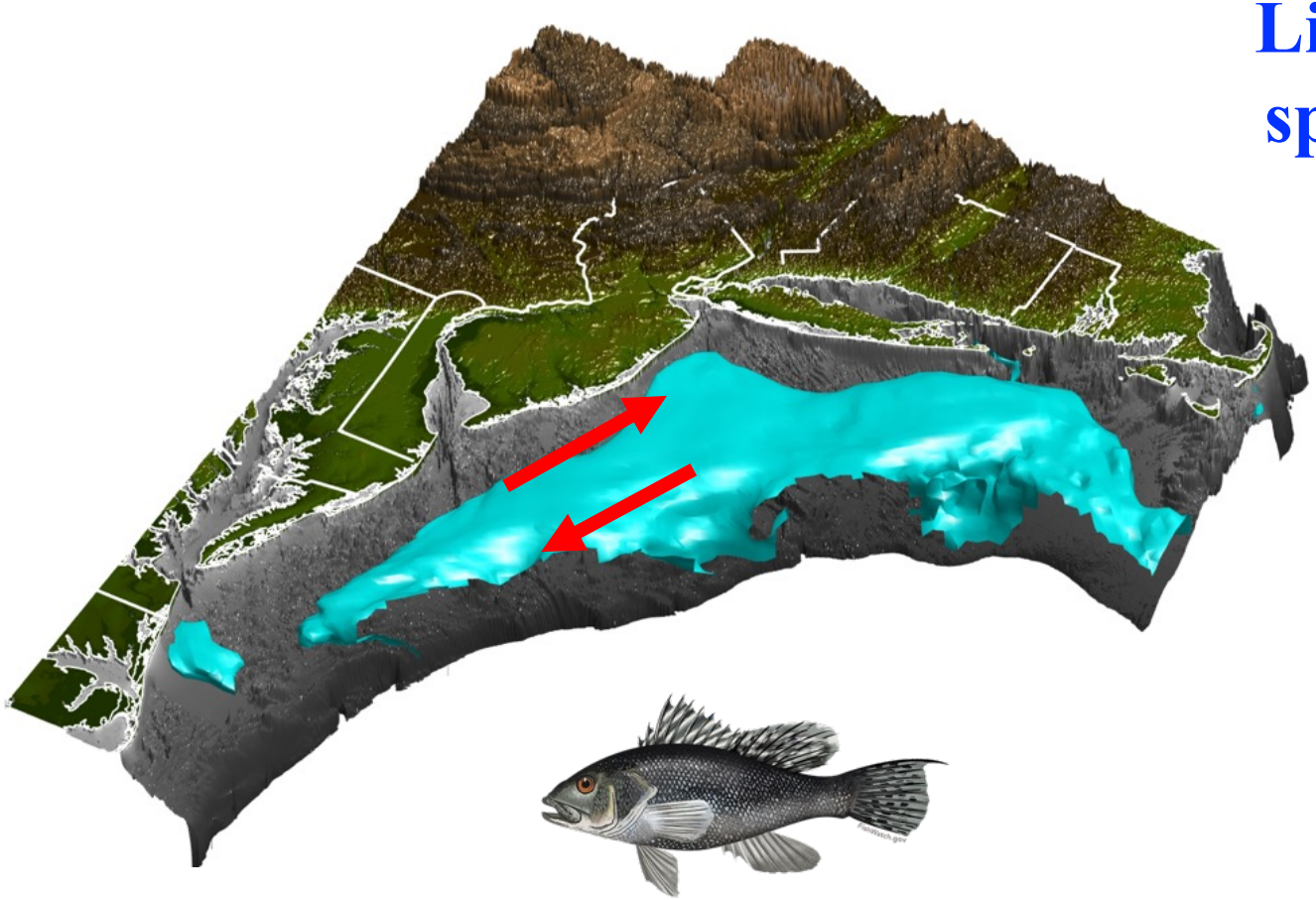
Life histories of many species are attuned to changes in ocean temperature



Black Sea Bass
Alongshore
Migration

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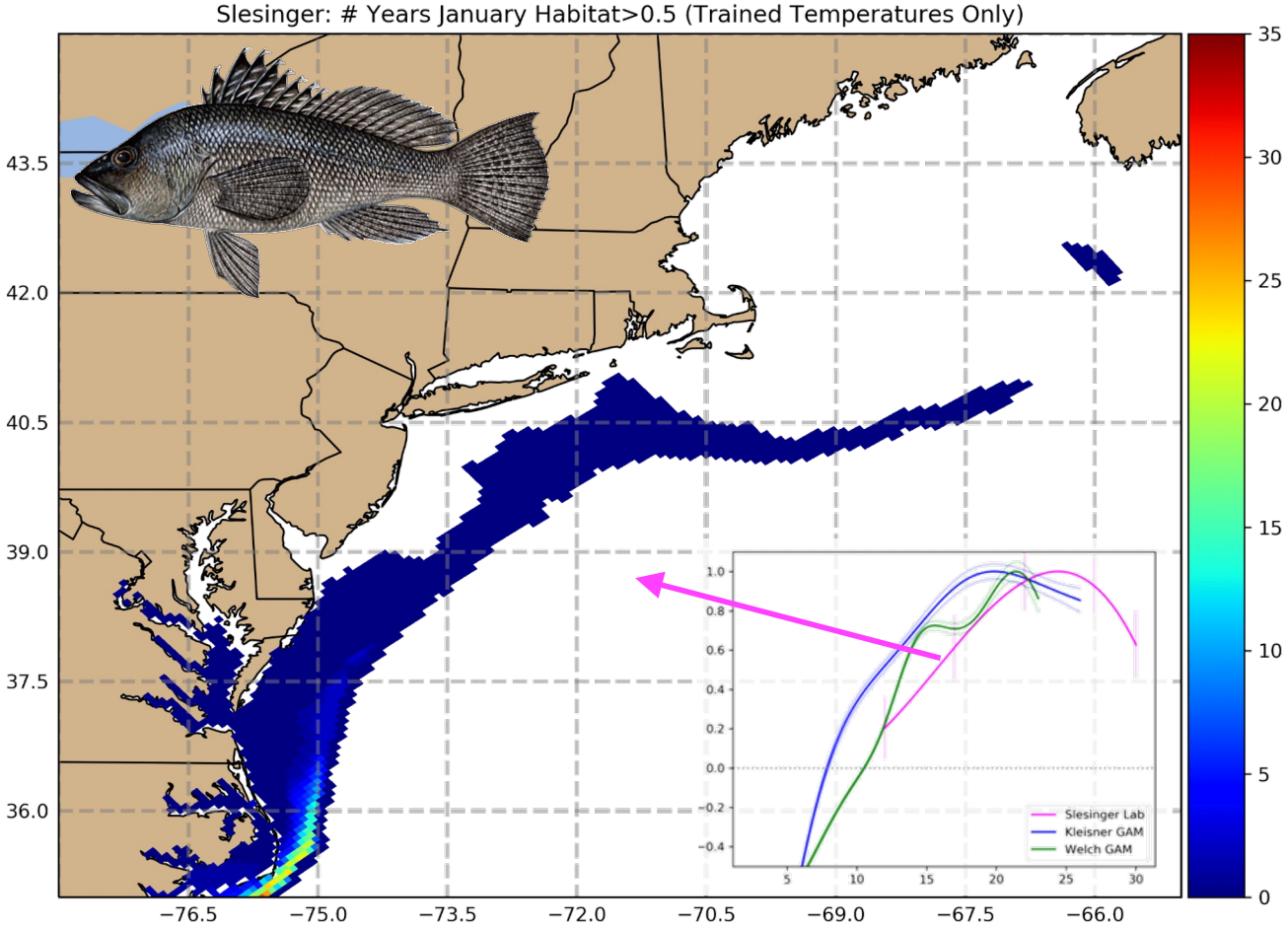
Black Sea Bass Habitat (Lab based physiology)



Data provided by E. Slesinger and G. Saba

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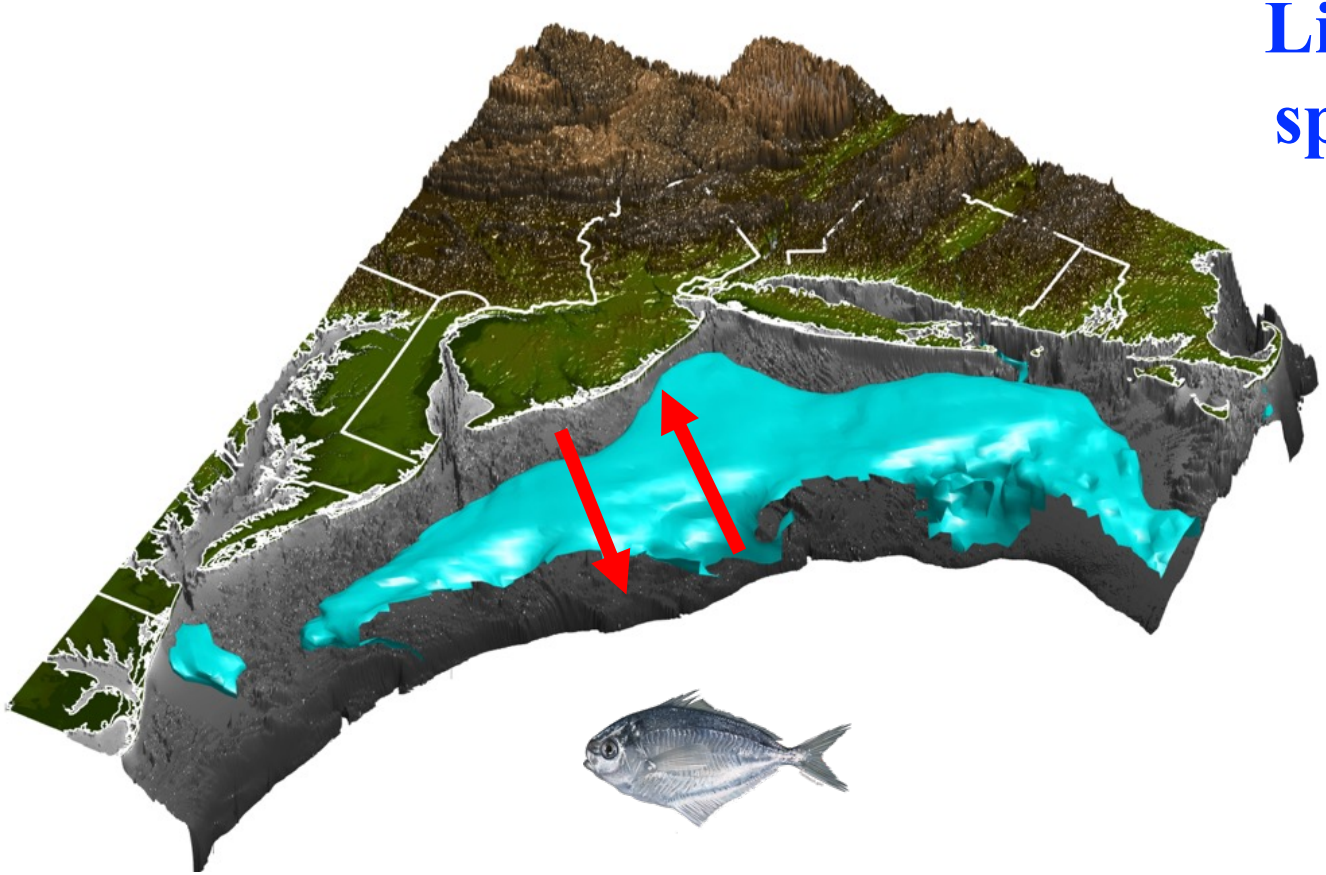

Life histories of many species are attuned to changes in ocean temperature

Atlantic Butterfish
Cross Shore
Migration

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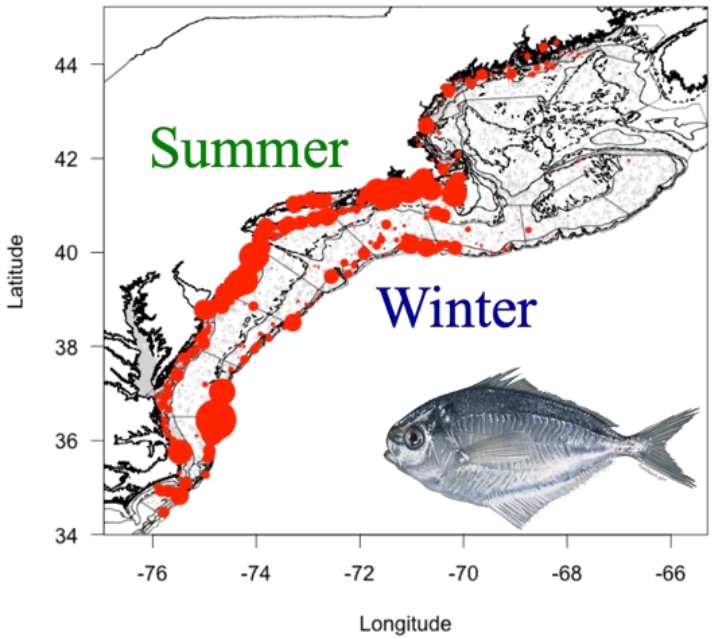
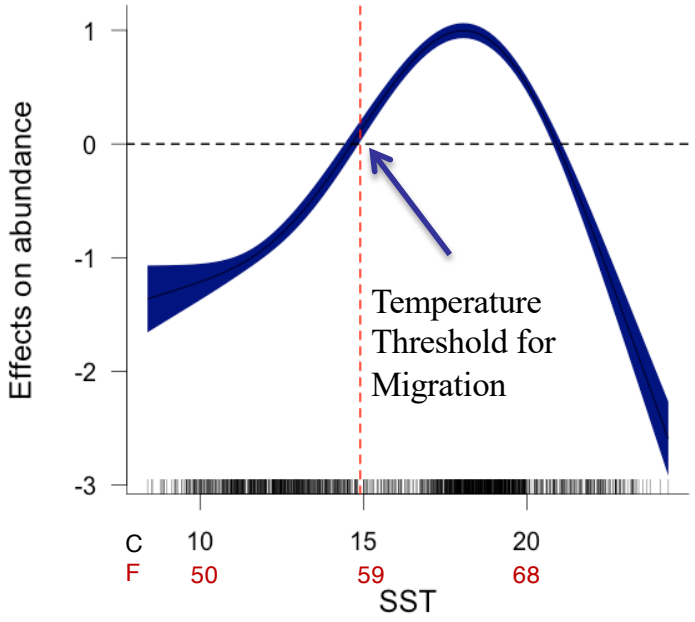
Life histories of many species are attuned to changes in ocean temperature



- Thermal optimum = 18.1C (65F)
- Fall offshore migration trigger: first time <15C (59F)



Atlantic Butterfish
Cross Shore
Migration

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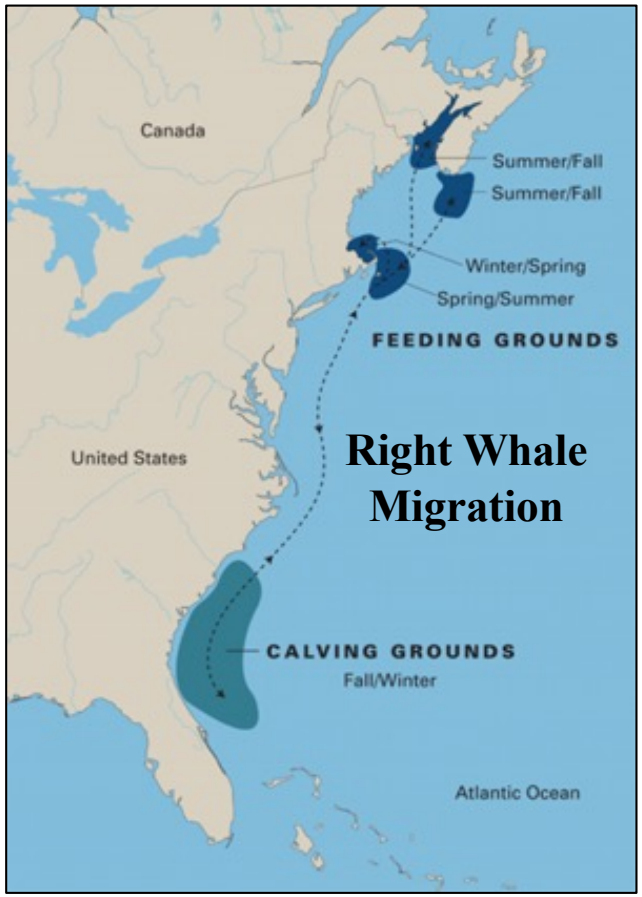
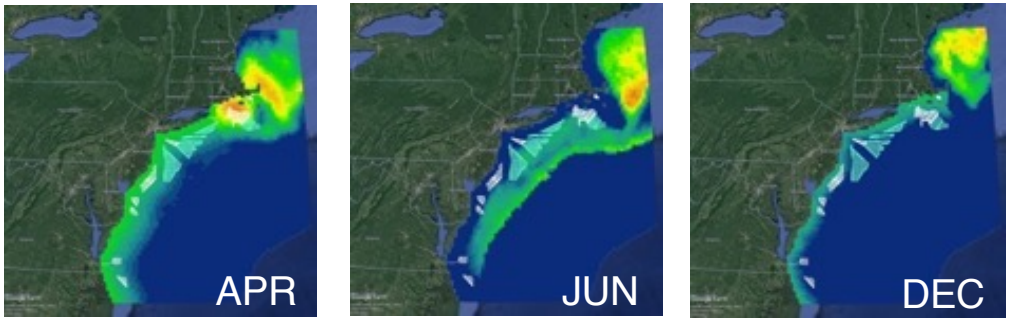
Marine Mammals





Data: Duke University Marine Geospatial Ecology Lab

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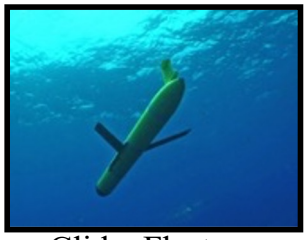
The COOLRoom

CODAR Network

L-Band & X-Band Satellite Receivers



Glider Fleet

3-D Nowcasts & Forecasts

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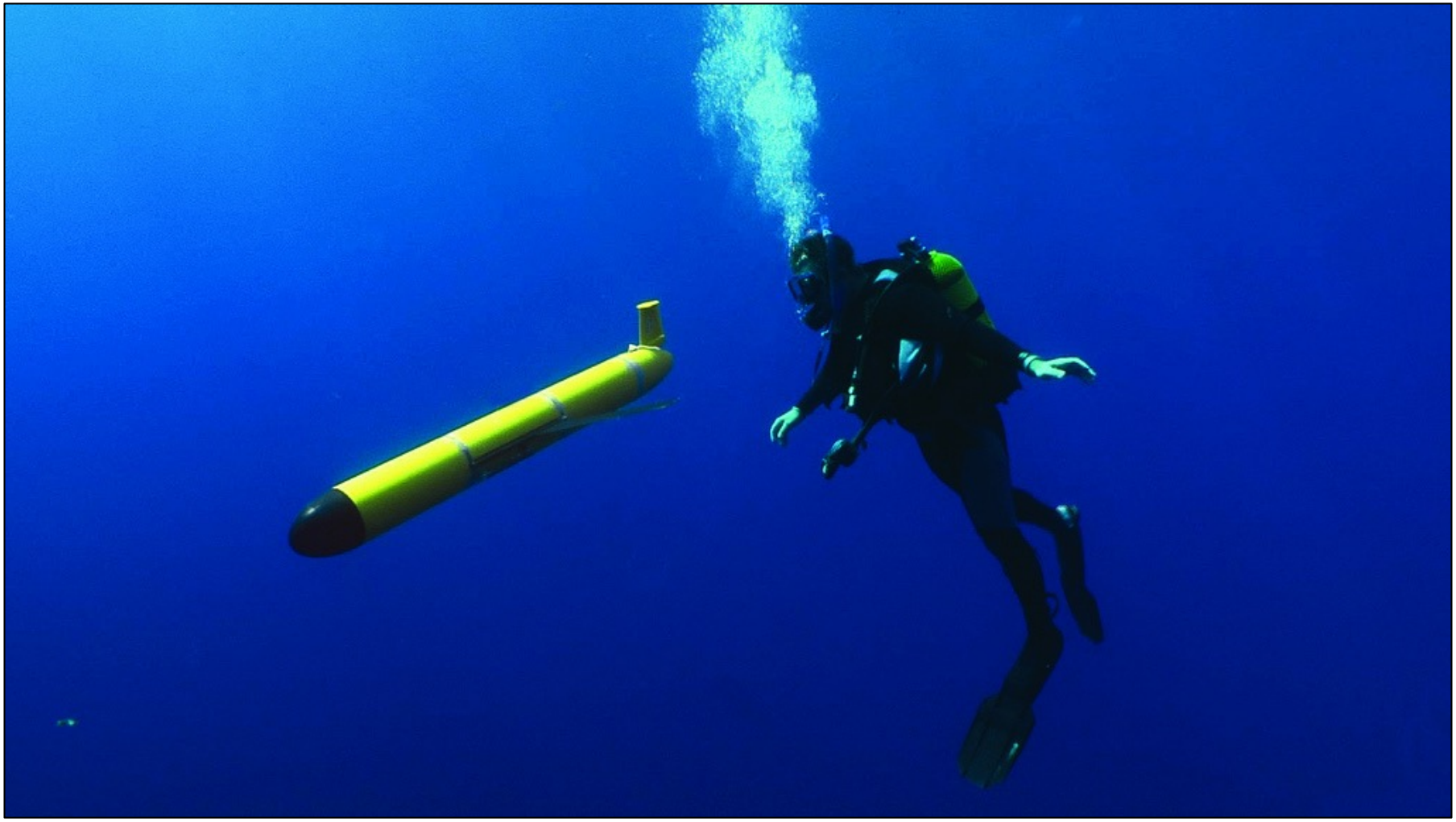
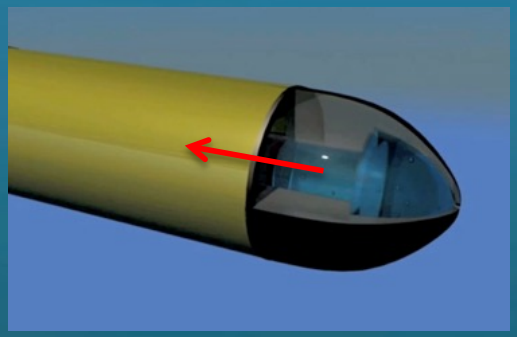
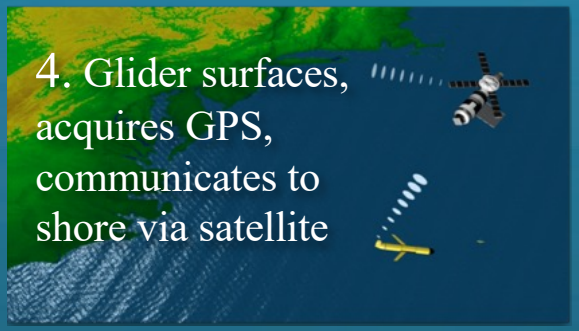
Robotics Revolution: Slocum Underwater Gliders



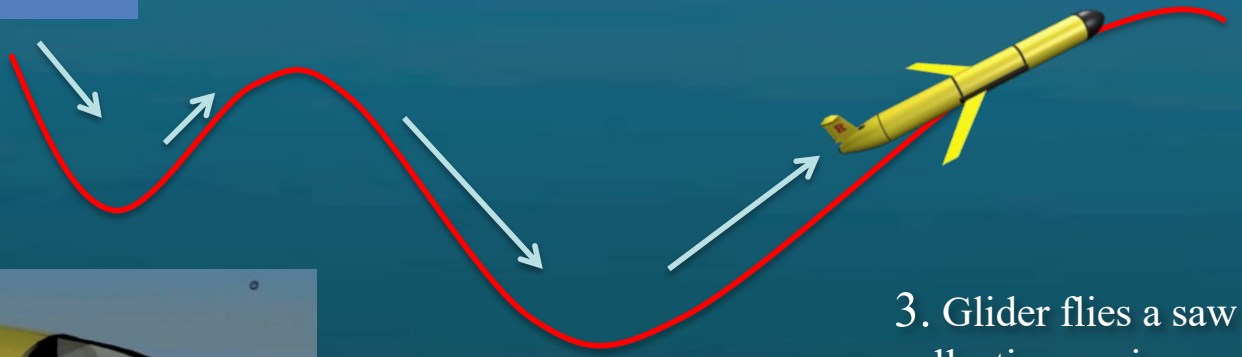
How an underwater Glider works…

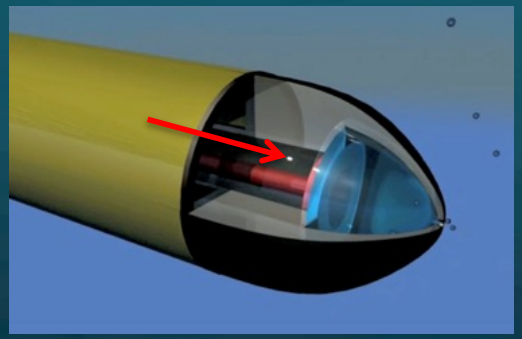


1. At surface, pump/diaphragm decreases volume, Glider descends



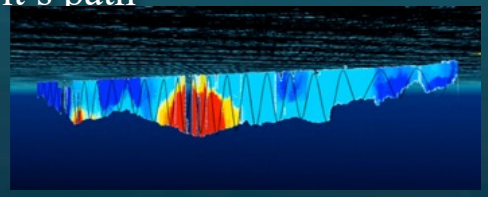
4. Glider surfaces, acquires GPS, communicates to shore via satellite



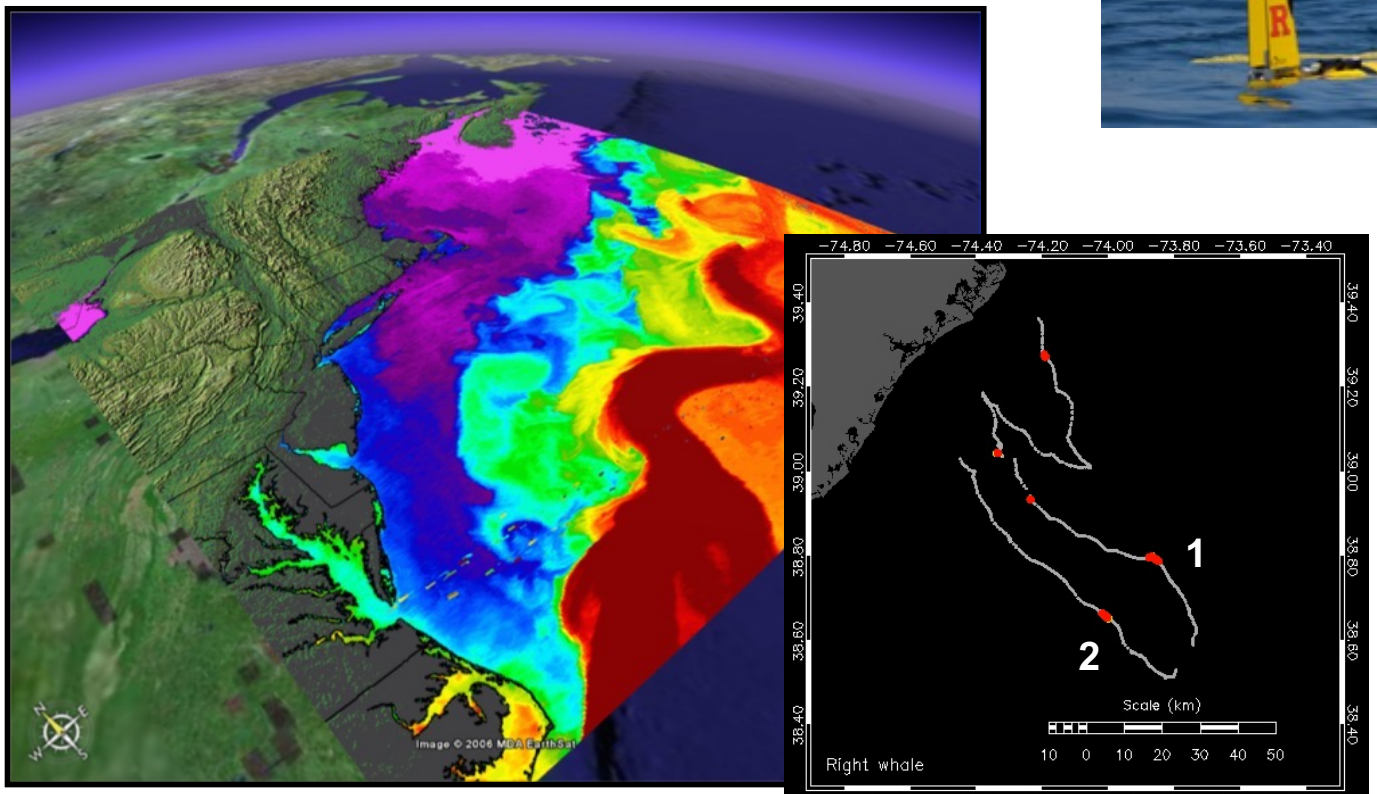


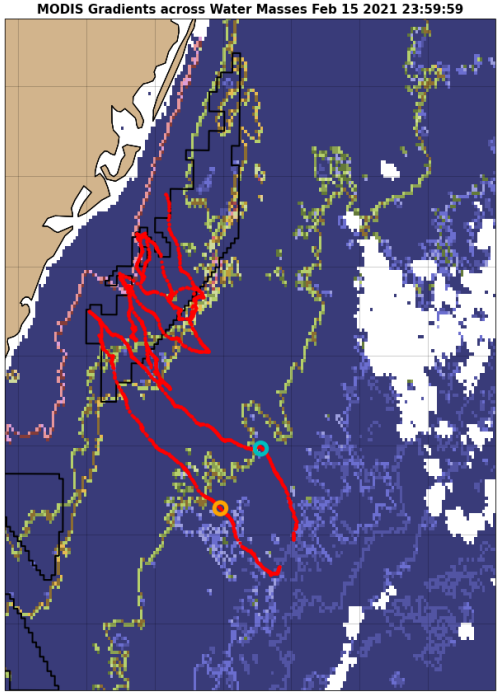
2. At depth pump/diaphragm increases volume, Glider ascends

3. Glider flies a saw tooth pattern, collecting environmental data along it's path



High Resolution Ocean and Marine Mammal Mapping





Ørsted | Ocean Wind

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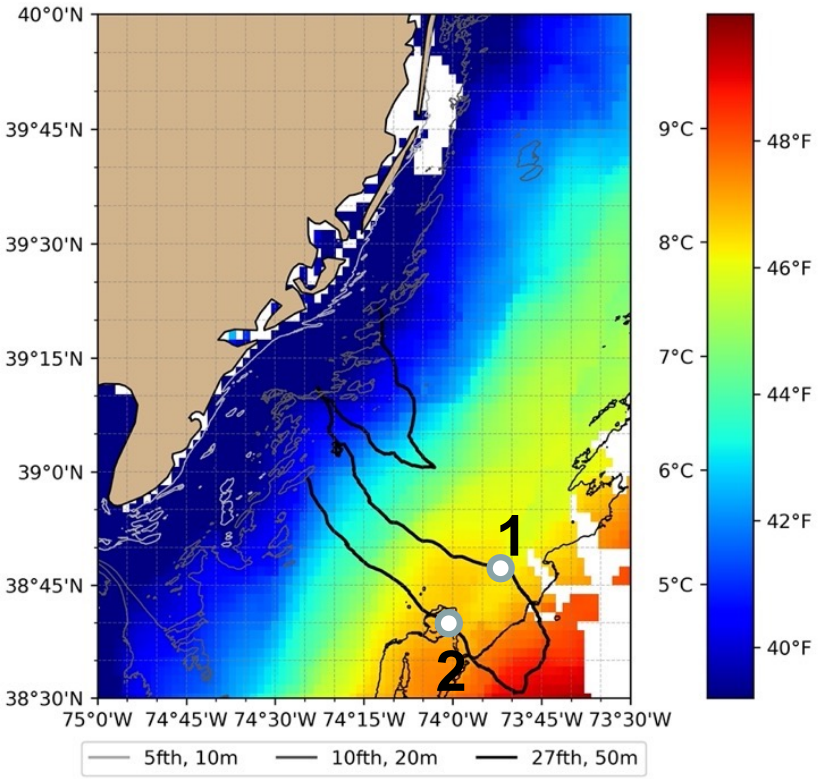
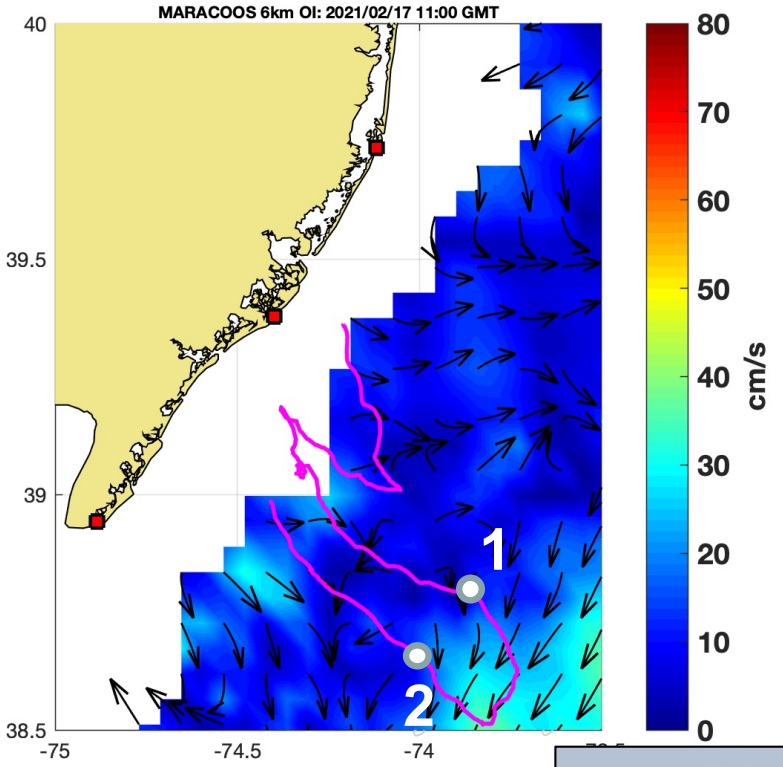
THE UNIVERSITY OF RHODE ISLAND

High Resolution Ocean and Marine Mammal Mapping





Ørsted | Ocean Wind

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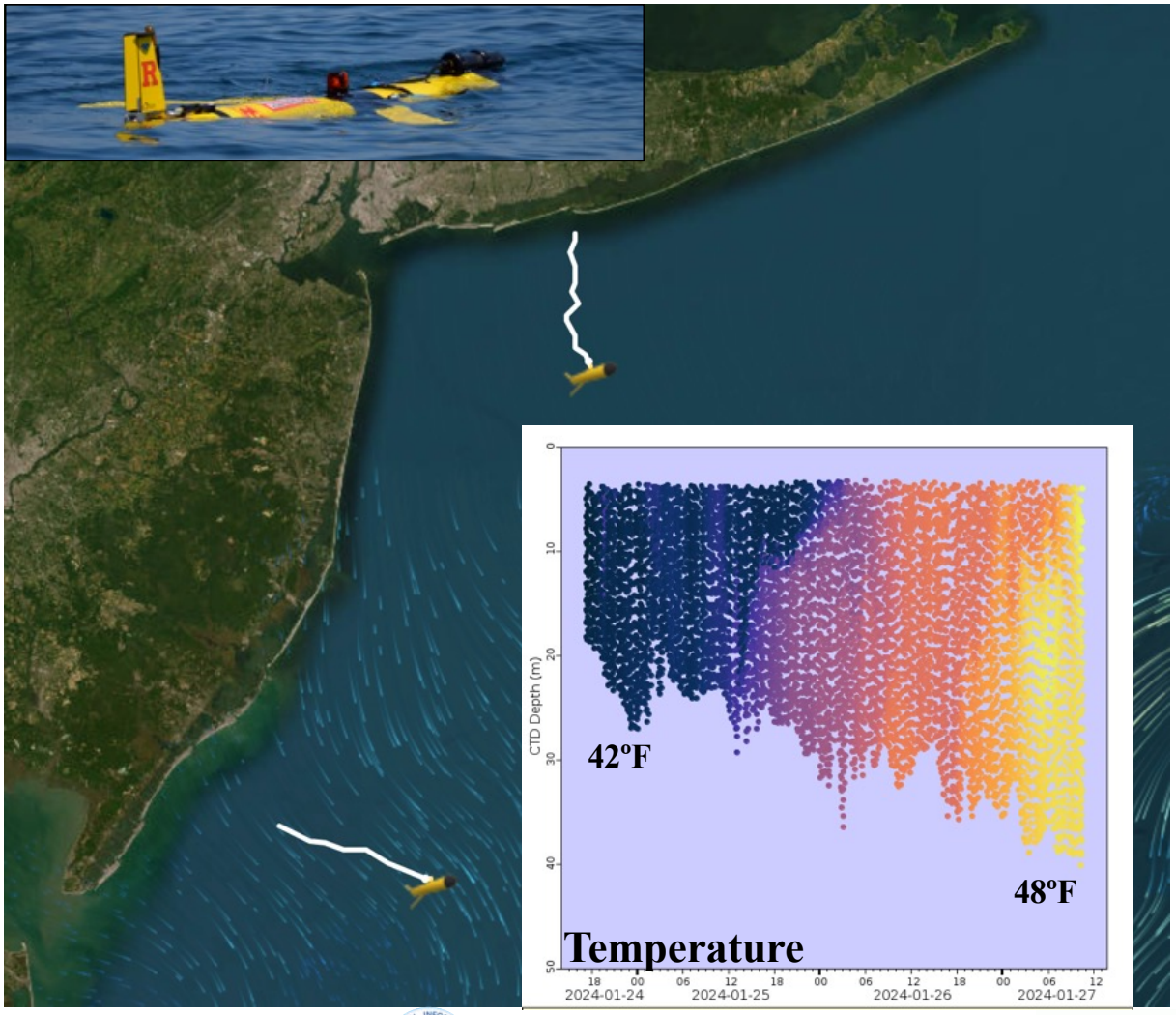

EcoGliders:

January 24-Today

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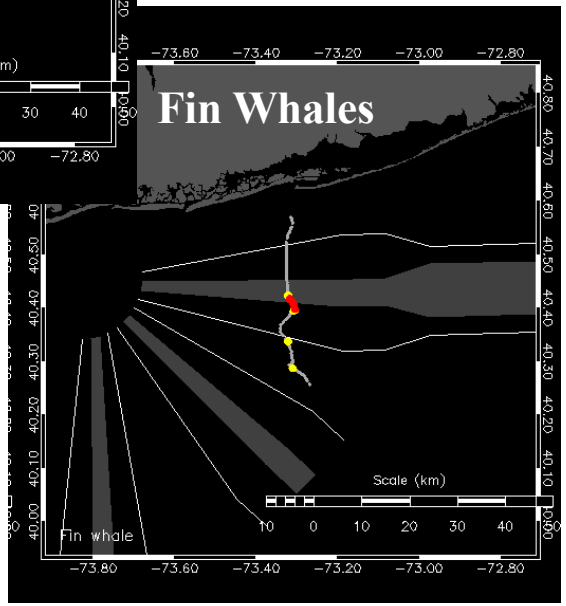
EcoGliders:

January 24-Today



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University of Delaware

Stony Brook University

Woods Hole Oceanographic Institution

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In Summary

- **The ocean is an incredibly dynamic environment** with significant variability from days and weeks to years and decades.

- **Seascapes are not landscapes:** Marine ecology is constantly adjusting to the dynamic ocean within which they live.

- Researchers at **Rutgers are working through collaborative research** projects to advance our understanding of this fascinating ecosystem.

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Thank you!

For more information:
Josh Kohut
kohut@marine.rutgers.edu
https://rucool.marine.rutgers.edu

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