A Robot's View of our Ocean Planet

Promoting Partnerships for Research, Education, and Service to Society

Josh Kohut, Scott Glenn, Oscar Schofield,
Grace Saba, and Travis Miles.
Rutgers University

and MANY MANY MANY Others

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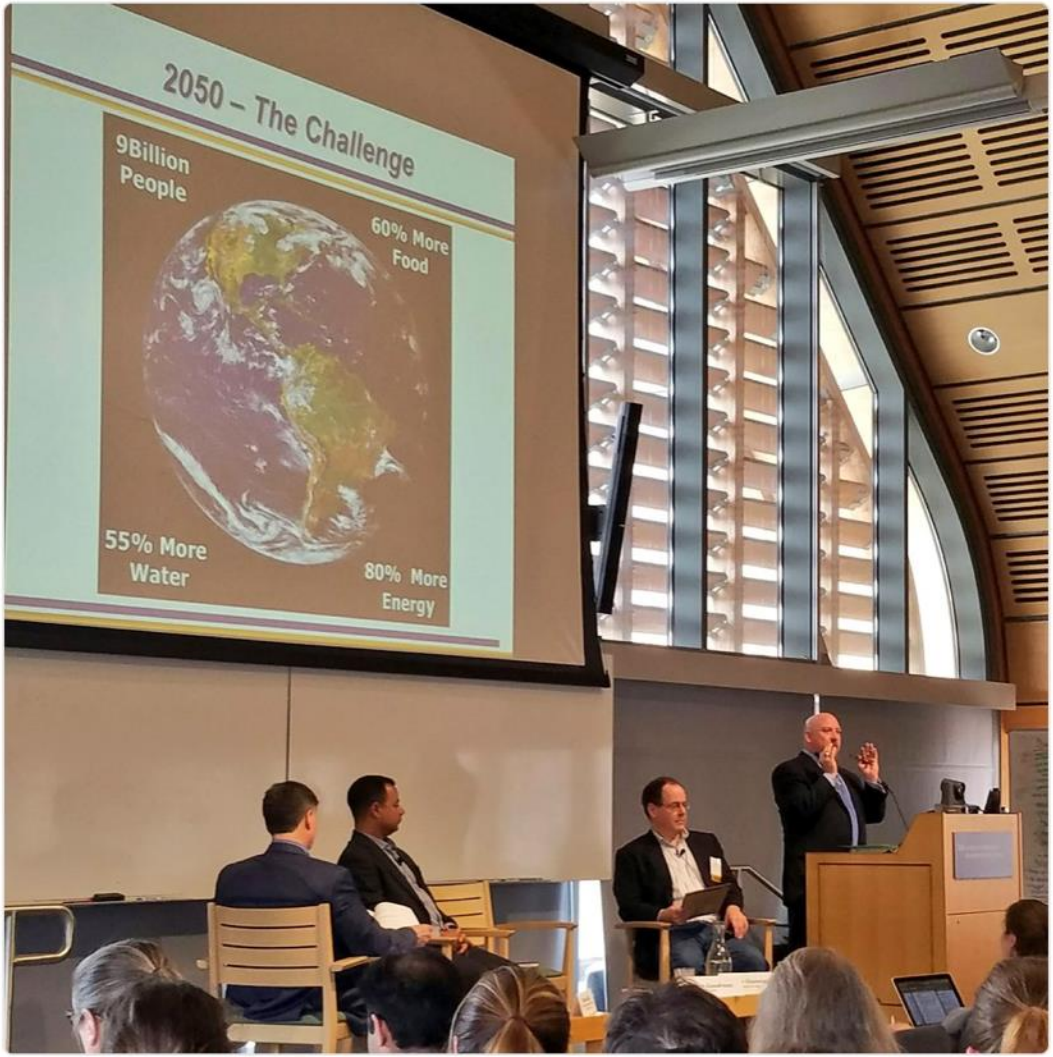

Conference at Yale Law School, 2017

60% more food, 55% more water, 80% more energy

Our Global Challenge

- Provide food, water, energy and economic security
- For a growing population
- That is increasingly coastal
- Growing faster in the less developed countries

Face this challenge while

- The climate is warming
- Sea level is rising
- Oceans are acidifying
- Increasing hypoxia
- Increasing extreme weather events –floods, droughts, hurricanes

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Sustainable blue economy requires information

Ocean Data, Predictions, and Analysis:

- Supports decision making
- Enables marine sector to
  - Operate efficiently
  - Maintain safety
  - Support the ecosystem
- Supported by many
- Usable by many more

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Realized through:

- Scientific understanding
- Emerging technologies
- Optimize sustained observations
- Improved forecasts

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27 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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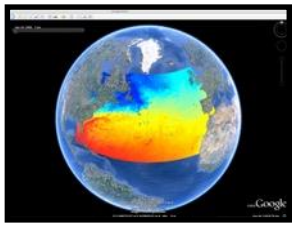
Rutgers University - Center for Ocean Observing Leadership
MARACOOS - Operations Center

L-Band & X-Band Satellite Receivers

46 Site CODAR Network

>500 Glider Deployments



Ocean & Atmos. Forecasts

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2016

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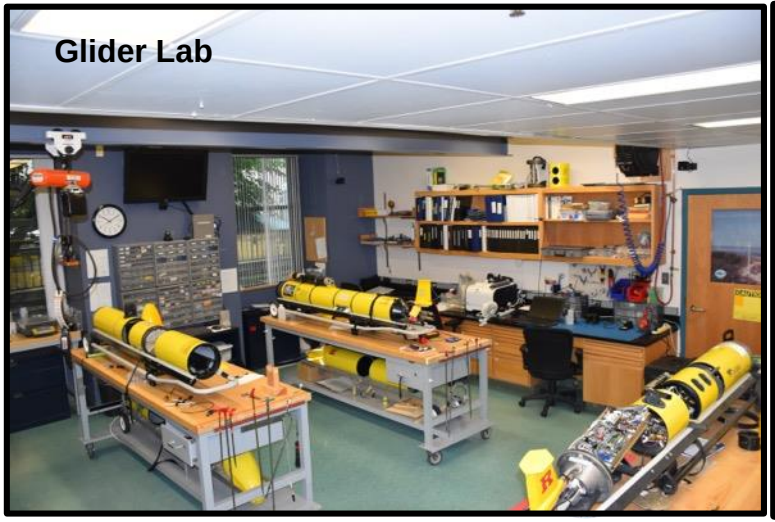
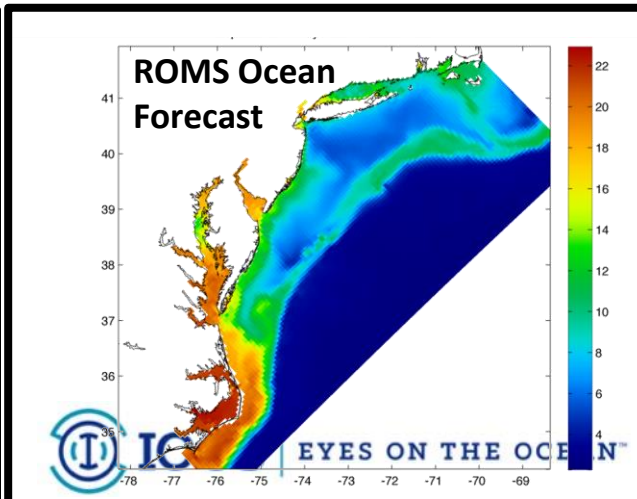
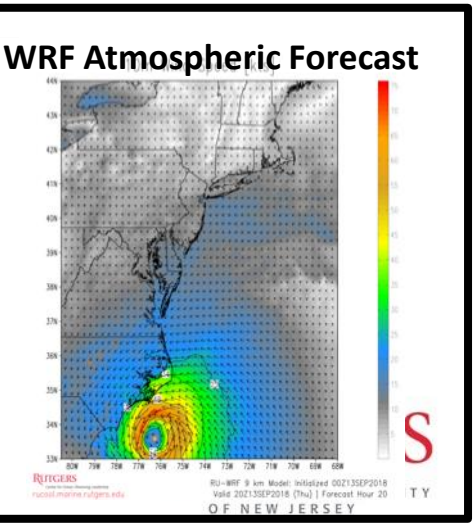
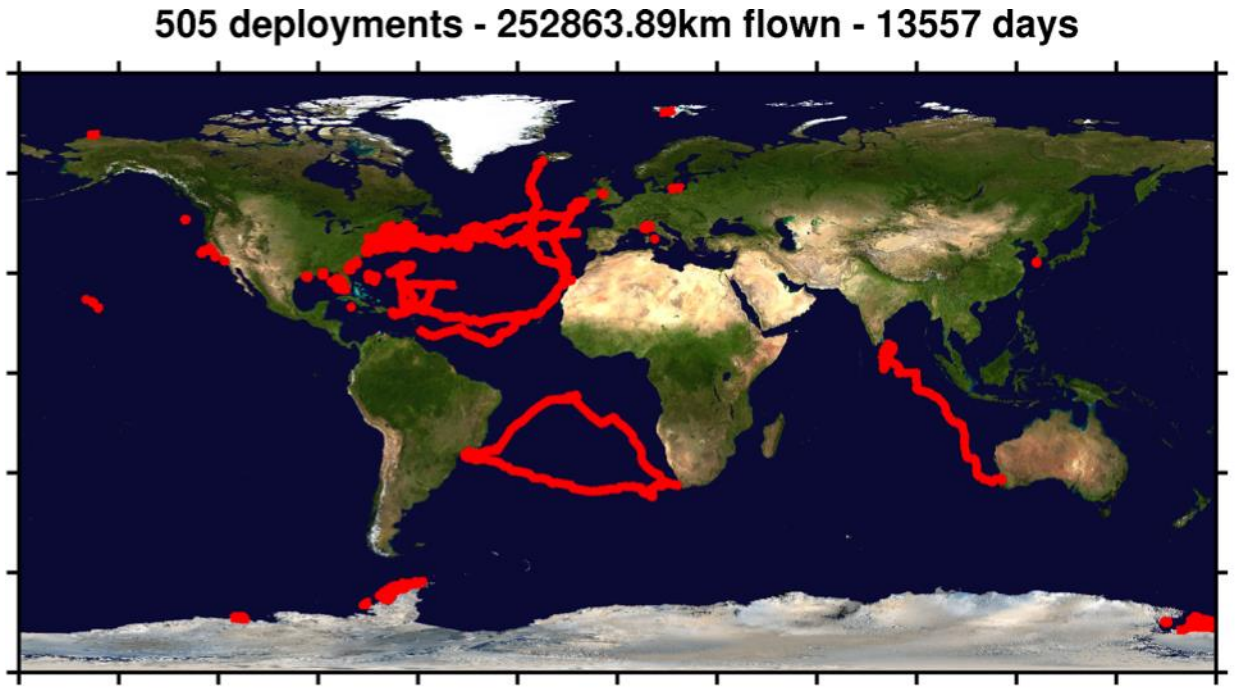






Rutgers Glider Network (1999 – Present)



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Recent Deployments

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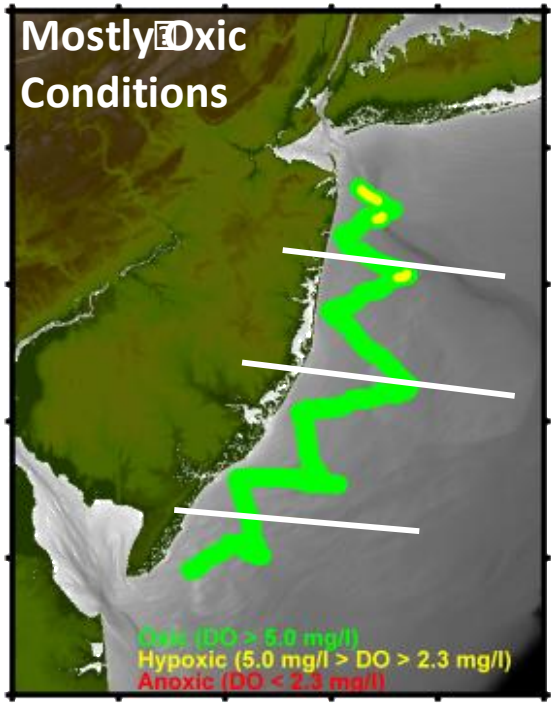
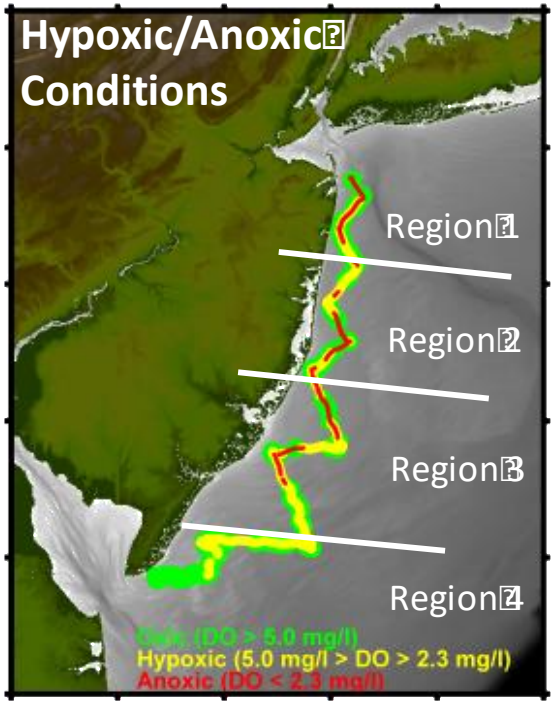
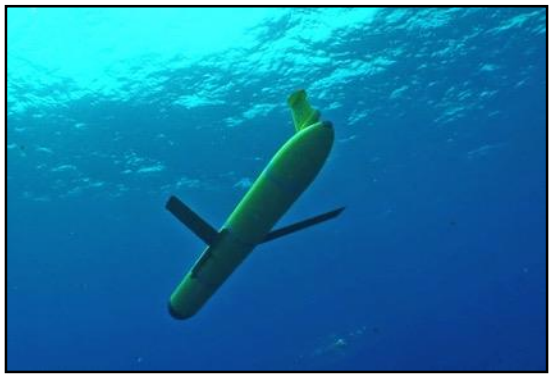
Monitoring Dissolved Oxygen Using Autonomous Gliders





- Clean Water Act requires reporting of water quality impairments
- Existing D.O. monitoring program eliminated (1977-2005)
  - Labor intensive
  - Not representative
- Glider Patrols, initiates action if needed (2009 to present)



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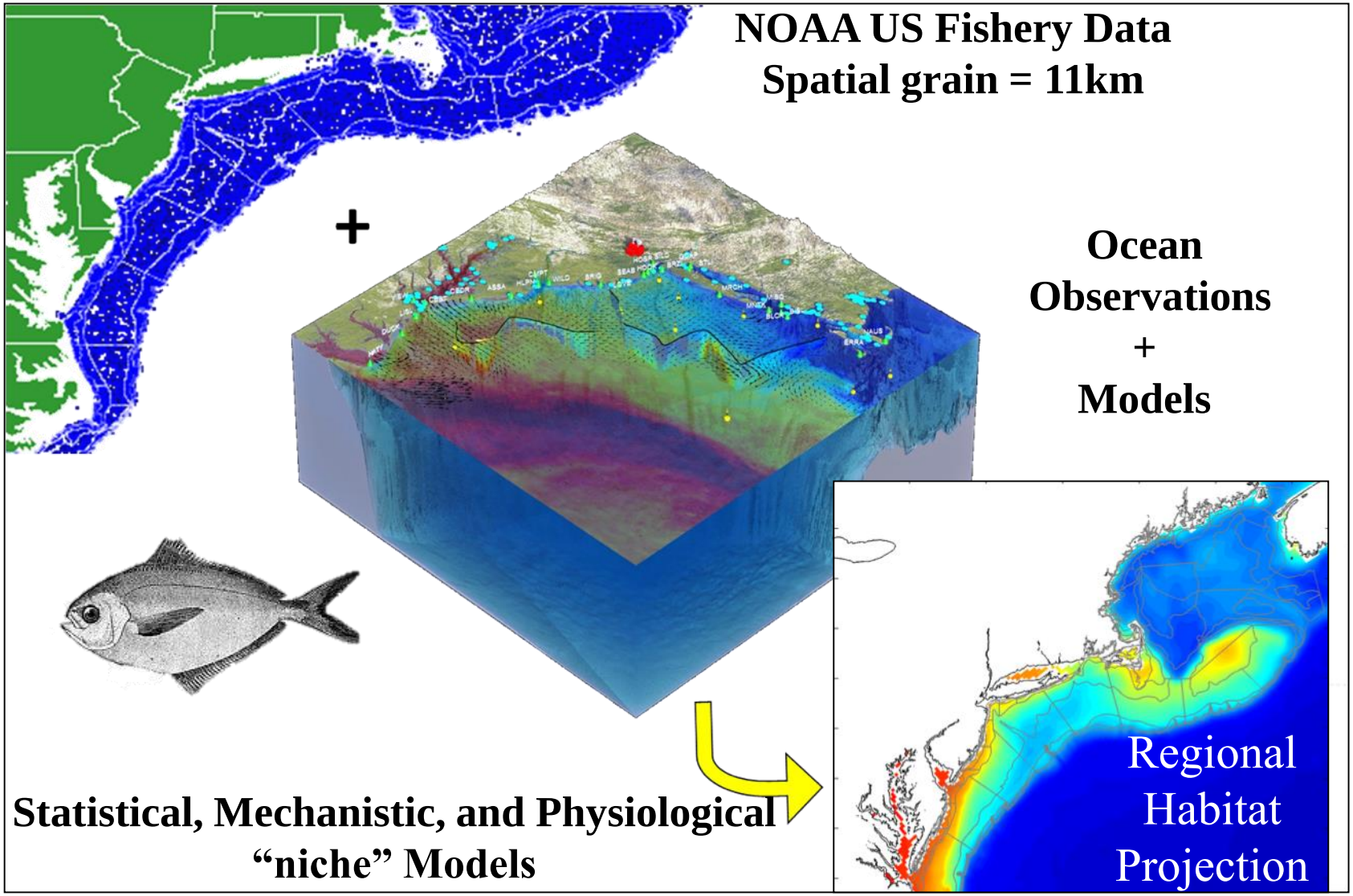
Approach: Regional Habitat Models



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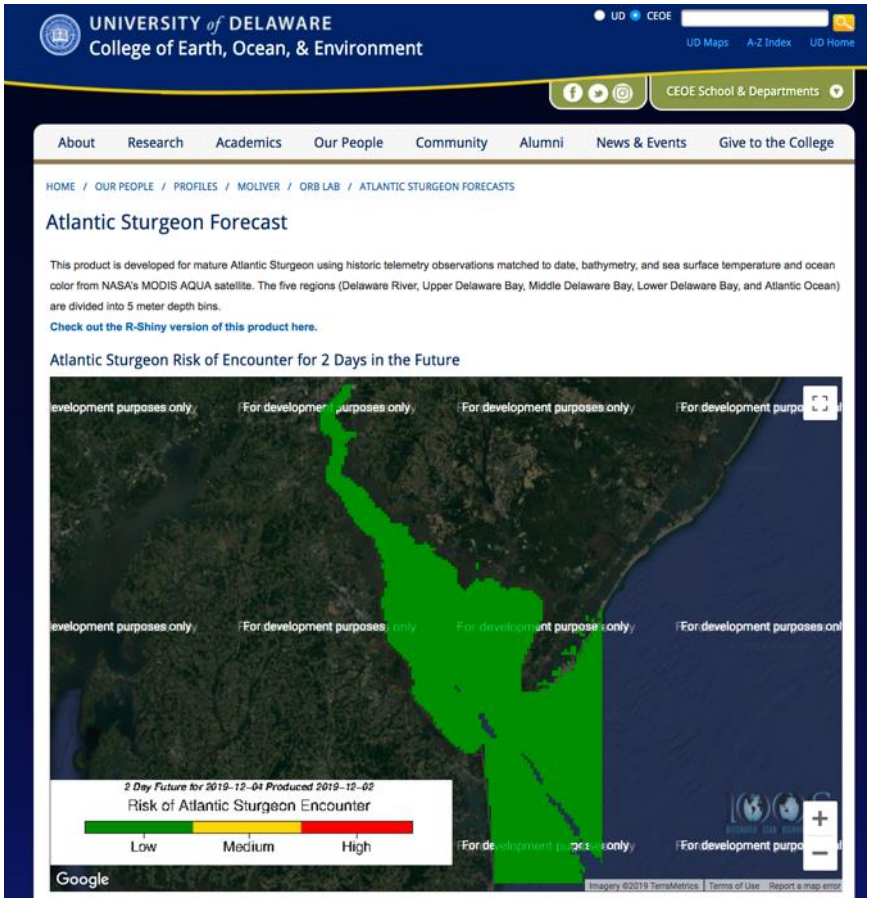
Sturgeon Mission

(2013)

- 79 Days at sea
  - 10 April – 28 June
- 1,420 km
- 71,000 Profiles
  - Salinity
  - CHL
  - CDOM
  - Temperature
  - Oxygen
- 62 Sturgeon
- 187 Detection Hours



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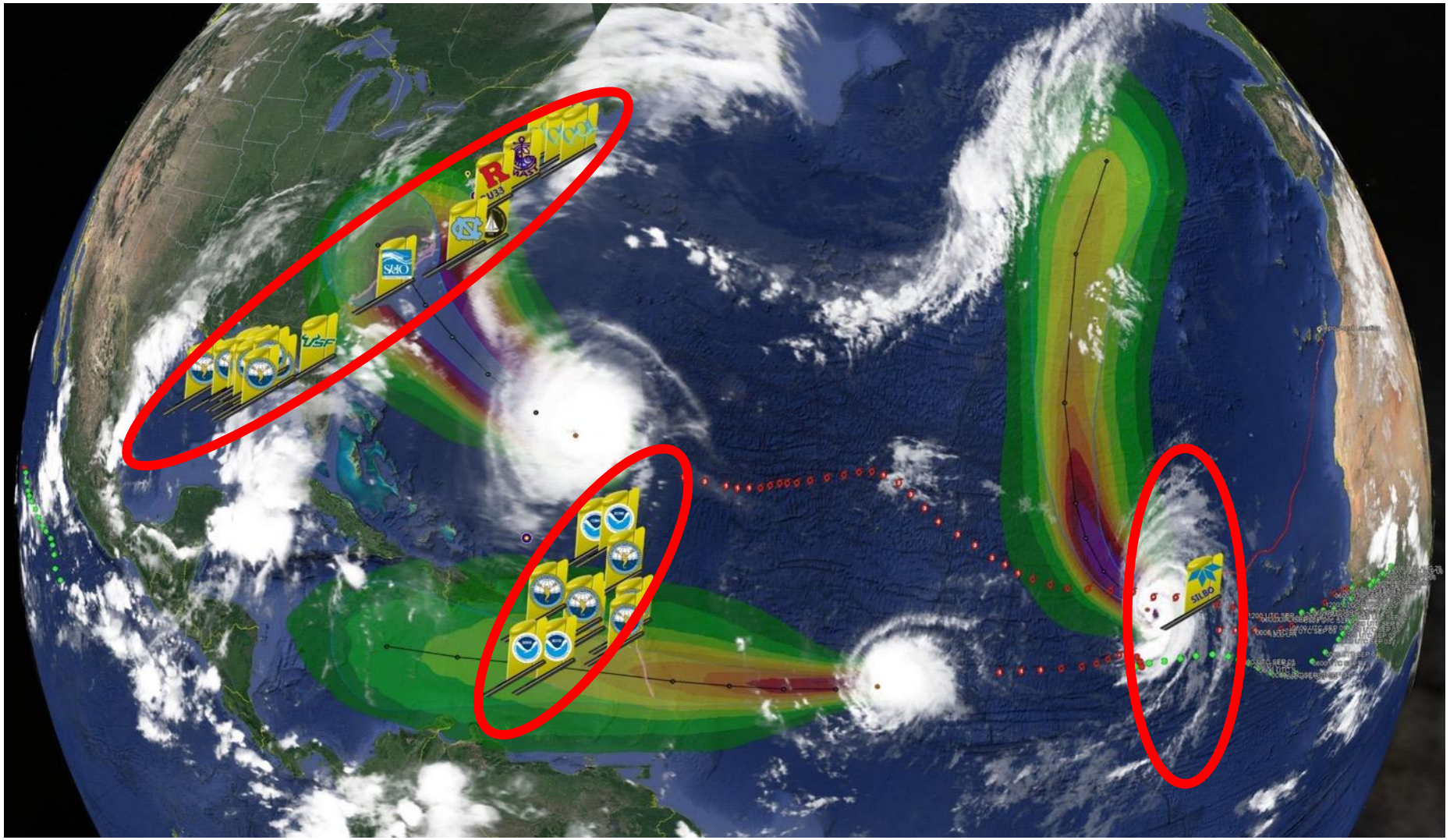
UNIVERSITY OF DELAWARE

2018 Demonstration: Hurricane Sentinel Glider Picket Lines

Atlantic Basin



Multi-institutional 30+ glider fleet

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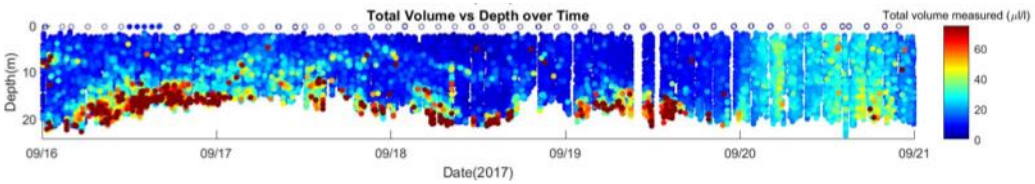
Development & Testing of New Glider Sensors

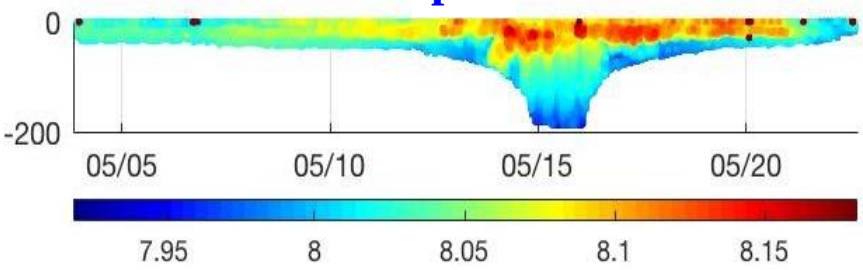
SEQUOIA

Office of Naval Research ONR Science & Technology

Suspended Sediment



pH



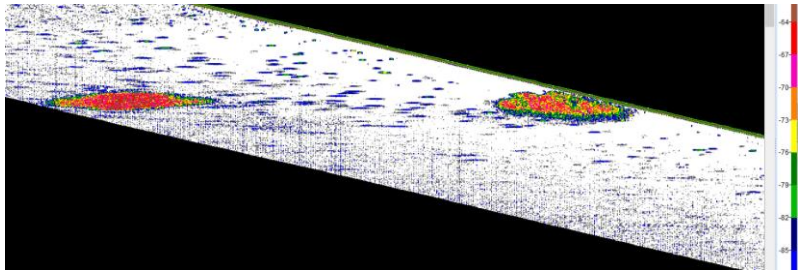
NSF

SEA-BIRD SCIENTIFIC

Acoustic Zooplankton and Fish

ASL Environmental Sciences

NSF



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The Opportunity

Our Classrooms

Our Students

In 2050, they all will be in their 50's to 60's.

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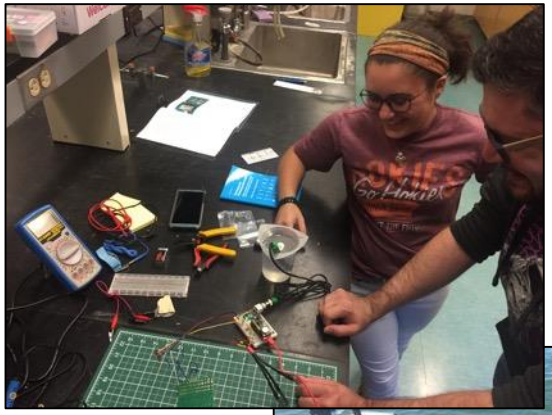
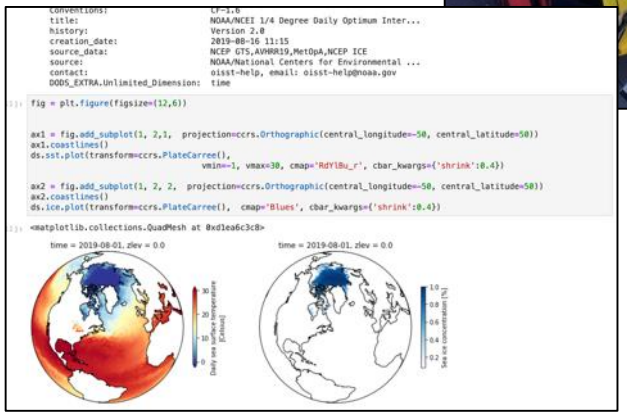
Rutgers Masters in Integrated Ocean Observing

Gain experience working with cutting edge ocean technologies



Work on real world problems connecting ocean, society, and the economy

Develop strong data analysis and communication skills



rucool.marine.rutgers.edu/academics/masters-of-operational-oceanography/

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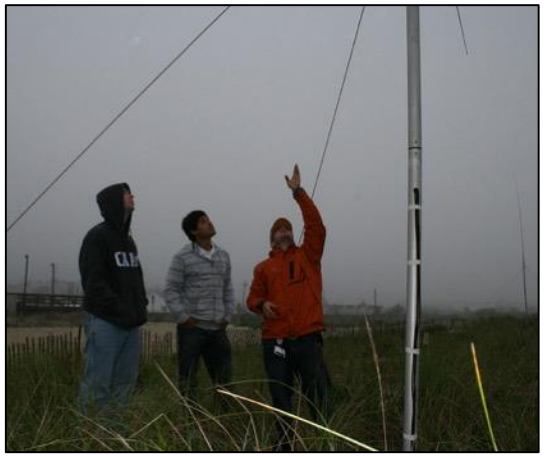

Training a workforce:

- Residency in an operational ocean observatory – build community through grand challenges
- Work together as a team to operate new observing technologies in frontier areas
- Curate the data flow from collection to use in forecasts that inform decisions makers
- Senior students mentor junior students (near-peer model)

Key concept:
Hands-on experience through total immersion in a working ocean observatory

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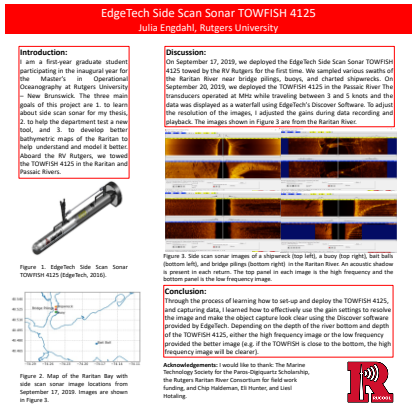
Key concept: Hands-on experience through total immersion in a working ocean observatory.

Students will:

Develop skills to use cutting-edge technology

Present their work at marine technology meetings



EdgeTech Side Scan Sonar TOWFISH 4125

Julia Engdahl, Rutgers University

Introduction:
I am a first-year graduate student participating in the inaugural year for the Master's in Operational Oceanography at Rutgers University – New Brunswick. The three main goals of this project are 1. to learn about side scan sonar for my thesis, 2. to help the department test a new tool, and 3. to develop better bathymetric maps of the Raritan to help understand and model it better. Aboard the RV Rutgers, we towed the TOWFISH 4125 in the Raritan and Passaic Rivers.

Figure 1. EdgeTech Side Scan Sonar TOWFISH 4125 (EdgeTech, 2016).

Figure 2. Map of the Raritan Bay with side scan sonar image locations from September 17, 2019. Images are shown in Figure 3.

Discussion:
On September 17, 2019, we deployed the EdgeTech Side Scan Sonar TOWFISH 4125 towed by the RV Rutgers for the first time. We sampled various swaths of the Raritan River near bridge pilings, buoys, and charted shipwrecks. On September 20, 2019, we deployed the TOWFISH 4125 in the Passaic River. The transducers operated at MHz while traveling between 3 and 5 knots and the data was displayed as a waterfall using EdgeTech's Discover Software. To adjust the resolution of the images, I adjusted the gains during data recording and playback. The images shown in Figure 3 are from the Raritan River.

Figure 3. Side scan sonar images of a shipwreck (top left), a buoy (top right), bait balls (bottom left), and bridge pilings (bottom right) in the Raritan River. An acoustic shadow is present in each return. The top panel in each image is the high frequency and the bottom panel is the low frequency image.

Conclusion:
Through the process of learning how to set-up and deploy the TOWFISH 4125, and capturing data, I learned how to effectively use the gain settings to resolve the image and make the object capture look clear using the Discover software provided by EdgeTech. Depending on the depth of the river bottom and depth of the TOWFISH 4125, either the high frequency image or the low frequency provided the better image (e.g. if the TOWFISH is close to the bottom, the high frequency image will be clearer).

Acknowledgements: I would like to thank: The Marine Technology Society for the Parres-Dgiquartz Scholarship, the Rutgers Raritan River Consortium for field work funding, and Chip Haldeman, Eli Hunter, and Liesl Hotaling.

Be immersed in ocean observatory operations every day

Application Deadline: 1 January, 2020!!!

No GRE Exam requirement

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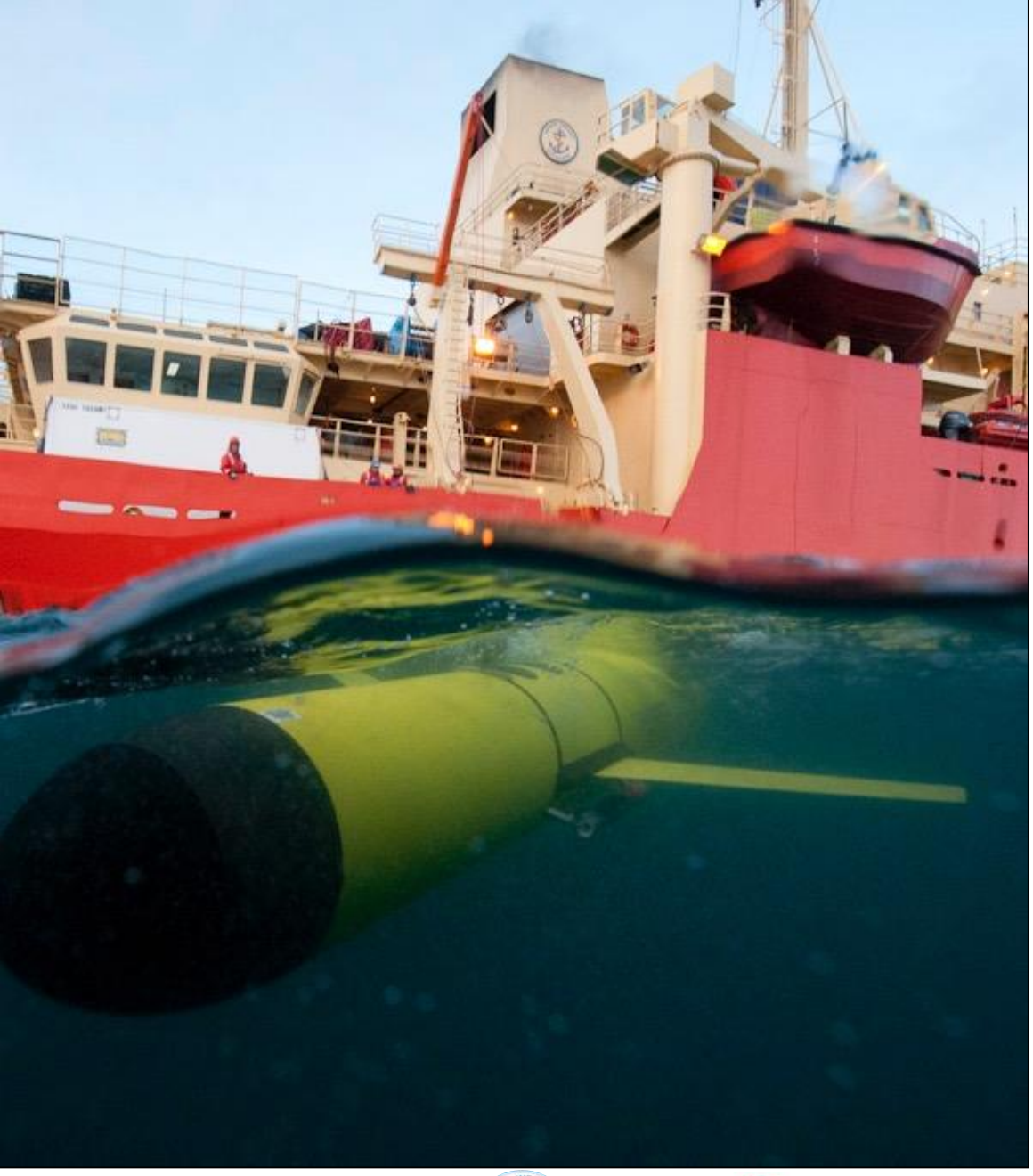

Summary

- **Integrated Approach**
- **Enabled by New Technologies**
- **Requires Partnerships**
- **Supports scientific and societal goals**
- **We aim to train an experienced and inspired workforce**