CENTER FOR OCEAN OBSERVING LEADERSHIP
ANNUAL REPORT
2024

RUTGERS–NEW BRUNSWICK
Marine and Coastal Sciences
School of Environmental and Biological Sciences

Cover Photo: Becca Horwitz
RU38 Slocum glider deployed off of Mahahual, Mexico, to study heat transport into the Gulf of Mexico through the Straits of Yucatan.

TABLE OF CONTENTS

01 **Introduction**

02 **Career Pathways**

04 **Innovative Research**

Climate

04 New Jersey
04 Polar
04 Caribbean

Renewable Energy

05 RUCOOL Leading NJ/NY Environmental Monitoring
05 Whales
06 Commercially Important Fisheries Resources

06 **Storms and Extreme Events**

07 Living Resources
12 High Frequency (HF) Radar

10 **RUCOOL Efforts Around the World**

13 **Student Success**

13 Awards
14 MS in Operational Oceanography
14 Sentinel Glider
15 Completed Graduate Theses

16 **Community Service, Engagement, and Leadership**

16 Awards
17 International
18 National
18 Regional
18 Local
19 A 4-H youth development program changes perceptions, making students insiders in science, technology, engineering and mathematics

19 RUCOOL Staff Lead Multi-Institutional Workshop on Oceanographic Data Literacy

20 **Statistics**

The heart of RUCOOL's research, technology development, and teaching is the Mid-Atlantic Bight (MAB). The MAB is one of the oldest and most urbanized coastal oceans in the United States, with over 20 million people living in its watershed. Humans have long been drawn to the MAB due to its abundant food and resources, amazing biodiversity, and perfect natural ports.

THE UNIQUE FEATURES THAT UNDERLIE THE ABUNDANT FOOD AND NATURAL RESOURCES INCLUDES:

A. one of world's largest shallow continental shelfs buffeted offshore by the warm Gulf Stream

B. large seasonal cycles structuring migratory organisms (fish, birds, and marine mammals)

C. a location relatively sheltered from natural disasters

Human activity on the MAB is expected to increase in the coming decades with growing demands for harvested/farmed marine food, the extraction of energy, and global economic growth driven by maritime shipping. RUCOOL provides the MAB with one of the world's most advanced and integrated ocean observing networks, making the MAB one of the best sampled ocean regions on Earth. RUCOOL's goals are to understand the ocean environment and develop strategies to ensure the MAB continues to thrive and support future generations.

SCOTT GLENN
Board of Governors Professor

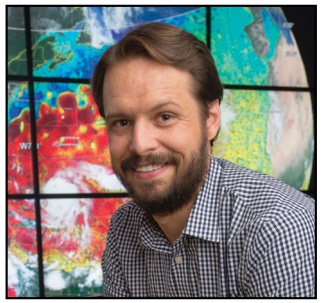
OSCAR SCHOFIELD
Distinguished Professor

THOMAS GROTHUES
Associate Research Professor

JOSH KOHUT
Professor

ALEX LOPEZ
Assistant Teaching Professor

JANICE MCDONNELL
Associate Professor



TRAVIS MILES
Assistant Professor

DAPHNE MUNROE
Associate Professor

GRACE SABA
Associate Professor

Career Pathways

RUCOOL thrives because of the talented people that keep it running, from the faculty to students and the research staff. RUCOOL is made up of 49 amazing staff who work hard year-round. Their passion is unmatched, but what is often under appreciated is the amazing skills they bring together as a team to help society. We want to thank the staff for their fantastic contributions and celebrate their selfless efforts to push innovations, operations, education, and overall excellence. The full team of the current RUCOOL staff is shown here. As a group, they illustrate the diverse skills needed to lead and excel. The team has Bachelor's, Master's, and PhD degrees in biology, education, physics, psychology, engineering, computer science, geography, management, human resources, meteorology, math, ecology, natural resource management, and all aspects of oceanography. There is no question that the diversity of backgrounds and personalities has played a major role in our success here at Rutgers and around the world.

People often ask what skills are needed to thrive in a research environment. Among the skill sets represented by RUCOOL are program management for large complex projects, budgeting and economic forecasting, advanced computing and management of big data, advanced data quality control/assurance, robotics, sensor technology, ecology, environmental science, shipboard operations, machine learning, satellite remote sensing, software development, acoustic sound processing, analytical chemistry, radar technology, signal processing, marketing, communication, K-Grey education, entrepreneurial skills and, of course, oceanography.

SAMANTHA ALAIMO
Graduate Student

ALEX AMBROSE
Graduate Student

DAVID ARAGON
Glider Operations Director

TEEMER BARRY
Graduate Student

BRIAN BUCKINGHAM
Glider Technician

LORI GARZIO
Research Analyst

SCOTT GLENN
Distinguished Professor

JOSEPH GRADONE
Postdoctoral Researcher
Graduate Student

THOMAS GROTHUES
Research Associate Professor

CHIP HALDEMAN
Boat Captain, Marine hardware

JESSICA LEONARD
Glider Technician

STEVE LEVENSON
Financial Manager

SAGE LICHTENWALNER
Education Web Design, Programmer

ALEX LOPEZ
Assistant Teaching Professor

GRACE SABA
Associate Professor

OSCAR SCHOFIELD
Distinguished Professor and Department Chair

JASON SEIPLE
Graduate Student

KAYCEE COLEMAN
Project Management and Analyst

LAUREN COOK
Graduate Student

MIKE CROWLEY
Technical Director: RUCOOL and MARACOOS

JOE DIDOMENICO
Graduate Student

QUINTIN DIOU-CASS
Graduate Student

JULIA ENGDAHL
Laboratory Researcher

BODHI FOX
Graduate Student

NICOLE FOX
Graduate Student

ETHAN HANDEL
HF-Radar Technician

LEAH HOPSON
Graduate Student

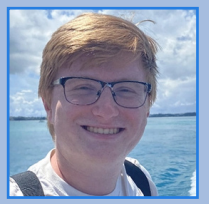
BECCA HORWITZ
Graduate Student

JOHN KERFOOT
Lead Software Developer

JAMES KIM
Research Project Assistant

JOSH KOHUT
Professor

JAKE KUENZLI
Graduate Student



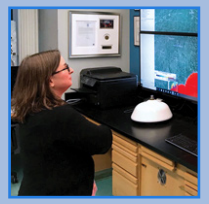
MATTHEW LEARN
Graduate Student

JANICE MCDONNELL
Outreach and Education Associate Professor

TRAVIS MILES
Assistant Professor

DELPHINE MOSSMAN
Research Program Coordinator

DAPHNE MUNROE
Associate Professor



LAURA NAZZARO
Research Analyst

FERNANDO PAREJA
Research Associate

SOPHIA PIPER
Graduate Student

HUGH ROARTY
Director of HF-Radar

MYA SHARPE
Graduate Student

AILEY SHEEHAN
Munroe Lab Manager

CLAYTON SMITH
Graduate Student

MICHAEL SMITH
Research Analyst

TIMOTHY STOLARZ
Marine Technician

HAILS TANAKA
Graduate Student

NICOLE WAITE
Glider Operations Assistant Director

CHASE WUNDER
Graduate Student

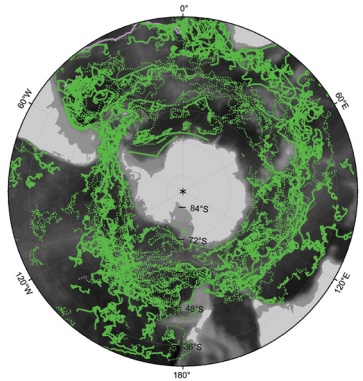
Innovative Research

Climate

NEW JERSEY

The RUCOOL team contributed significantly to James Shope's Climate Report. 2023 was the warmest year on record for sea surface temperatures globally, and ocean temperatures along the Mid-Atlantic reflected this. Winter, spring, and summer surface waters of the continental shelves off the coast of New Jersey were 1.8–3.6 °F (1–2 °C) above 15-year means for each season, with the warmest departures during the winter months prior to seasonal stratification (warm less dense water overlying colder, denser water) in the spring. RUCOOL contributes to this long-term record by deploying underwater gliders to monitor seasonal multi-stressor events.

POLAR



RUCOOL helps anchor global research in the Southern Ocean. The National Science Foundation recently continued funding RUCOOL research that uses a robotic float network to collect data autonomously. This image shows the current trajectory of an active array of robotic floats measuring the ocean's biological activity. These measurements are critical as the Southern Ocean accounted for over one third of the total global ocean heat increase since the 1970s, accelerating to over half during 2005-2017, and now accounts for up to half of the world's ocean carbon dioxide uptake. This makes this region central to understanding global climate change. The robotic profilers allow any human to study this ocean in real-time from their desktop.

RUCOOL continues to lead the acquisition of the world's oldest time series in the Antarctic Ocean, documenting how a melting Antarctic alters marine food webs. Changes in sea and glacial ice ripple through the planktonic ecosystem, shifting the magnitude of primary production and its community composition and altering the abundance of krill and other prey essential for marine mammals and seabirds. These climate-driven changes in the food web are exacerbated by human activity. The team conducted another successful field season over the last year with scientists deployed in the field for 6 months.

CARIBBEAN

The Caribbean Through-Flow (CTF) is an important component of Earth's climate system as it organizes and transports significant heat, salt, and freshwater fluxes from two major circulation systems – the North Atlantic Subtropical Gyre and the Atlantic Meridional Overturning Circulation. A major data gap existed in this region for vitally important subsurface observations, so over the last several years ocean gliders equipped with a unique suite of sensors have been deployed in island passages throughout the CTF. Results from these deployments have revealed an improved understanding of circulation dynamics as well as changes in the upper ocean water mass properties. These findings have implications for tropical cyclones, sea level rise,

R/V RUTGERS

41 Trips

300 People

marine ecosystems, and downstream water mass formation in the Atlantic Ocean.

Gradone, J.C., Wilson, W.D., Glenn, S.M., Miles, T.N., 2023. Upper Ocean Transport in the Anegada Passage from Multi-Year Glider Surveys. Journal of Geophysical Research: Oceans. *DOI: 10.1029/2022jc019608*

Renewable Energy

The United States has set an ambitious target to increase its offshore wind capacity to 30 gigawatts by 2030, of which the Northeastern U.S. and Mid-Atlantic (including NJ) will be a large contributor. Rutgers University is supporting this effort by adding to baseline measurements of the ocean environment to assess potential impacts.

RUCOOL LEADING NJ/NY ENVIRONMENTAL MONITORING

The New York State Energy Research & Development Authority (NYSERDA) funded RUCOOL and Stony Brook University to initiate an ocean monitoring program using autonomous underwater gliders that will establish necessary baseline oceanographic and ecological datasets to inform the responsible development of offshore wind within the lease areas in the New York Bight. This work monitors hydrographic conditions and performs passive acoustic monitoring of marine mammals, including the endangered North Atlantic Right Whale, between central Long Island and New Jersey.

RUCOOL has been monitoring water quality along the NJ shore using underwater gliders for 14 years, thanks to funding from the NJ Department of Environmental Protection. Mirroring the NYSERDA efforts above, the New Jersey Research and Monitoring Initiative funded RUCOOL to establish necessary baseline oceanographic and ecological datasets to inform offshore wind development in the NJ lease areas. These data support greater ecological understanding of living resources in a changing environment.

WHALES

With about 336 endangered North Atlantic right whales alive as of 2022, there is an urgent need for improved understanding of the distribution of North Atlantic right whales at high spatial and temporal resolutions and in proximity to the offshore wind energy areas. RUCOOL is aiding in this effort through monitoring whales using passive acoustic monitors on ocean gliders *robots4whales.whoi.edu* and by creating an AI-powered tool that visualizes an evolving spatio-temporal risk map of North Atlantic right whales encountered in proximity to designated offshore wind energy areas.

The RUCOOL and University of the Virgin Islands teams prepare to deploy glider RU29 on a mission to study heat transport in the Caribbean.

28
Peer Reviewed Publications

COMMERCIALLY IMPORTANT FISHERIES RESOURCES

With the development of offshore wind, RUCOOL has taken on several projects to understand potential impacts to commercially important fisheries resources. The team conducted a surfclam survey to assess the clam population distributions within a Bureau of Energy Management (BOEM) wind lease area off of Virginia (funded by Coastal Virginia Offshore Wind). RUCOOL found an unexpectedly high clam abundance in this lease area situated at the southern end of the range for surfclam habitat. These surfclams have distinct genetics, so RUCOOL is investigating whether the species is seeing a range expansion or adaptation to climate stress.

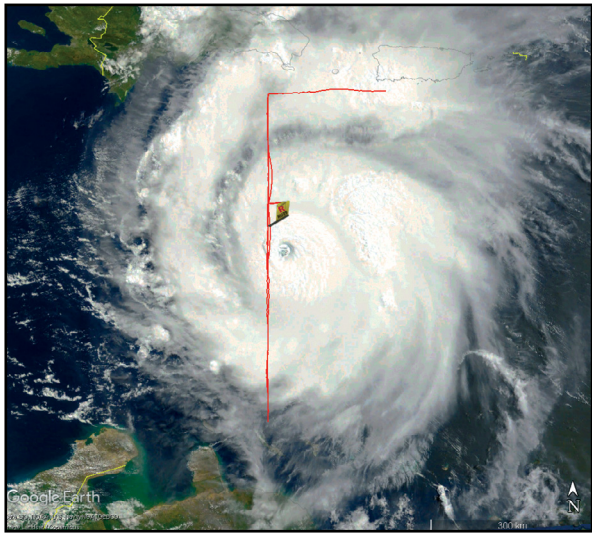
Atlantic cod stocks have declined dramatically in the region, with both U.S. cod stocks overfished and subject to more overfishing. During the spawning season, RUCOOL and Jasco Applied Sciences monitored the presence of Atlantic cod spawning aggregations within a BOEM lease area (funded by Revolution Wind, LLC). Atlantic cod make a grunting noise when they are in spawning aggregations. Using a passive acoustic monitor mounted on an ocean glider, listening for 86 days, RUCOOL detected three spawning events composed of 227 possible cod grunts. This information is helping inform NOAA on the health of the George's Bank stock that utilizes Cox Ledge and the surrounding areas in this region shared with offshore wind. In addition to detecting spawning cod, whale calls can be heard from North Atlantic right whales (751 upcalls were identified over 18 days), the acoustic signals of Humpback whales (30 days), Fin whales (27 days), Gray seals (17 days), and moans that could have been produced by either Sei or Blue whales.

Glider RU34 has a passive acoustic monitor mounted top to listen for underwater sounds.

Storms and Extreme Events

In 2023 and 2024, RUCOOL expanded its ocean observing capabilities in tropical cyclones and hurricanes, including 12 deployments, 417 days, and 41,142 profiles of upper ocean heat and salt in hurricane-prone regions. Additionally, RUCOOL published leading research on the impact of upper ocean salinity on storm intensification focused on Hurricane Ida (2021), which devastated the Gulf Coast and Northeastern United States. RUCOOL made history in the 2024 hurricane season by capturing data beneath the Category 5 Hurricane Beryl in the central Caribbean Sea. Beryl was the easternmost formation of an Atlantic hurricane in the month of June, underwent two periods of rapid intensification and devastated the windward islands. As Beryl moved into the central Caribbean, it rapidly intensified a third time and became the earliest Cat 5 storm on record. Glider RU29, on a mission supported by the G. Unger Vetlesen Foundation, was rapidly re-positioned, piloted by RUCOOL PhD students and coordinated with the NOAA Hurricane Field Program. The eye of Beryl passed within 17 nautical miles of RU29 with maximum sustained winds of 139 knots, and a radius of maximum winds of 10 nautical miles. This is the closest approach of a Cat 5 tropical cyclone to an autonomous platform and aided in guiding NOAA Hurricane Hunter surveys and air-deployed observing systems, as well as Saildrone surveys in Beryl.

RUCOOL continues its international leadership to develop new global weather forecasting systems. Insights provided from almost two decades of observing extreme events of the oceans is improving RUCOOL's ability to develop a framework to inform the World Meteorological Organization, the United States NOAA Science



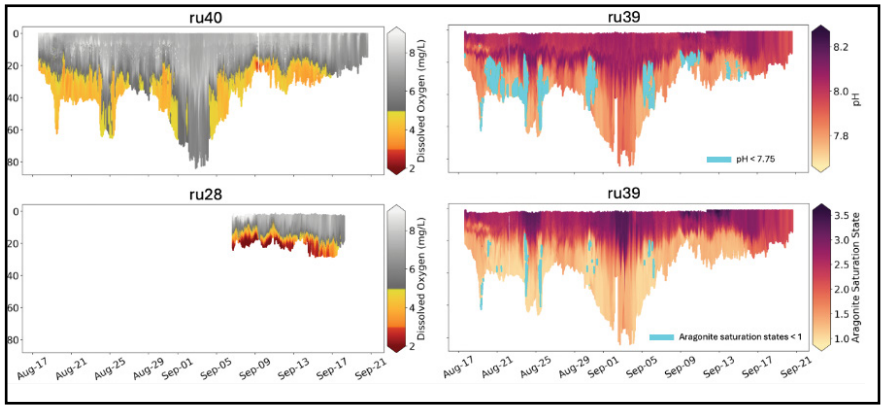
The glider track can be seen in red, flying through Category 5 Hurricane Beryl. The glider icon can be seen 17 miles from the eye, battling 139 knot winds.

Advisory Board, and the NOAA Environmental Information Services Working Group. These efforts are fueling the next generation of model and ocean observation efforts and are transforming the ability to predict the extreme weather events that will increase as the Earth continues to warm due to climate change.

To optimize the value of the NOAA/Navy/Academic Hurricane Glider fleet, RUCOOL Profs. Scott Glenn and Travis Miles co-lead the U.S. Integrated Ocean Observing System Hurricane Model-Data Comparison Project. This effort is targeted at improving the forecast models used by the National Hurricane Center and coordinates with hurricane glider operators, NOAA/academic scientists, and NOAA operational hurricane modelers. The broad collaboration is the most significant feedback the National Weather Service receives on their ocean forecasting systems, with Rutgers data products now regularly used to evaluate new modeling capabilities for transition to operations.

Living Resources

RUTGERS SCIENTISTS OBSERVE UNUSUAL OCEAN CONDITIONS POSSIBLY LINKED TO DEATH IN NJ MARINE LIFE. From late April to late September in 2023, Rutgers researchers used underwater robots to track ocean water quality (oxygen and pH) along the New Jersey coast. In August and September 2023, the robot gliders detected regions of low dissolved oxygen (concentrations < 3 mg/liter) that can kill marine organisms. In addition, low pH was detected, indicating regions of ocean acidification. This acidification can lead to reduced survival, calcification rates, growth, and reproduction in marine animals. During the time when low dissolved oxygen and pH were observed, numerous mortalities of fish, lobsters and crabs within the sampling area were reported. Mortalities were reported for American lobsters, Jonah crab, Atlantic rock crab, spider crabs, black sea bass, and tautog in pots where trapped organisms would not have been able to escape poor conditions. The cause of these events remains an open question.



Cross-sections of dissolved oxygen concentrations (left top and bottom), pH (right top), and aragonite saturation state (right bottom) during August and September 2023.

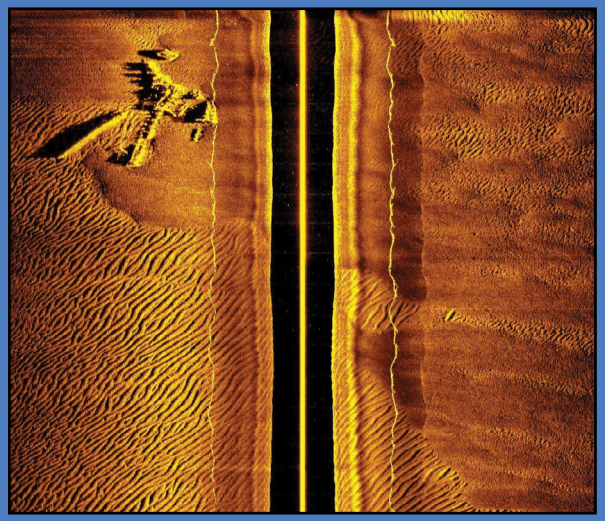
RUCOOL contributed to the NOAA Fisheries State of the Ecosystem 2024: Mid-Atlantic report. The purpose of this report is to synthesize ecosystem information to allow the Mid-Atlantic Fishery Management Council to better meet fishery management and risk assessment objectives
repository.library.noaa.gov/view/noaa/61273

RUCOOL, through joint efforts with the Jacques Cousteau National Estuarine Research Reserve, continues to contribute to the tagging and tracking of fishes and horseshoe crabs throughout the region. A focus on summer flounder, the bread and butter for the recreational fishing industry and an important ecological connection between estuaries and the continental shelf, responds to stakeholder concerns that migrations and accessibility to this bottom-dwelling species could be altered by the electromagnetic field of buried power export cables from planned wind farms. Baseline information on the movements of these fish comes from a receiver observatory covering all of New Jersey's inlets and cooperation with other arrays along the east coast. A similar array focuses on the use of a shoreface sand ridge that is being considered for mining as a source of sand for beach nourishment. Small sharks and skates, which are both electrosensitive and use sand habitat, are also being tracked. The listening arrays mutually contribute to many other programs coastwide as other tagged fishes, visit these study sites and vice versa, increasing sample size and habitat use diversity metrics.

Both internal transmitters and external marker tags are fitted to summer flounder and other fish. The transmitter can be detected if it passes with several hundred meters of listening stations and can be searched for by gliders and surface vessels. Marker tags let fishers report captured fish and contribute data on long-term patterns of movement.

Autonomous vehicles, both underwater (AUV) and on the surface (ASV), map fish habitat and contribute to understanding of human habitat alteration and enhancement. The ASV has been mapping shallow artificial oyster reef enhancements along the shoreline of New York City's Hudson River Park, New Jersey's Great Bay estuary, and Waquoit Bay, MA. Processing of bathymetry and side scan sonar imagery is being further developed by students of the MS in Operational Oceanography as an engaging teaching tool with benefit to understanding erosion and sediment deposition in areas sensitive to sea level rise. The submersible (AUV) similarly maps offshore sand ridge habitat and fishes as well as local hydrography and eddies that schooling fish use; these are further contextualized by regional scale measurements from gliders and HF-Radar.

The ASV Calypso maps a shallow water habitat enhancement area of Gansevoort, NY



A section of side scan sonar map near Sandy Hook, New Jersey shows a habitat change from rippled sand to flat bottom as well as remains of an old shipwreck.

Shellfish farms not only rely on healthy and clean waterways for habitat, they also contribute directly to cleaning and improving productivity of those habitats. Through filter feeding, shellfish help to clean water, improve water clarity, and support habitat for other ecologically important species such as seagrasses. By providing structure, shellfish farms can serve as important habitat for mobile fish and crustaceans. The structures used to farm shellfish, including bottom cages and floating bags, can help to stabilize shorelines and protect from erosion caused by waves and sea level rise. All of these processes, services, and interactions are important to understand and quantify, particularly as shellfish farming grows in the US and globally. Recent and ongoing projects have been addressing these various ways that shellfish farms support ecosystem services or interact with important wildlife species. These studies aim to quantify farm-scale filtration and nitrogen removal, habitat provisioning and wave dampening by oyster farm gear, and endangered species interactions at coastal farms. The results of these studies are further framed in a way that supports coastal management and decision-making into the future.

We have produced the first hybrids between southern surfclams and Atlantic surfclams. These animals will help us understand the unexpected patterns we are seeing in offshore wind clam surveys. They may also be critical to development of climate-adapted aquaculture shellstock (clammy word for livestock).

GARDEN STATE FILM FESTIVAL
www.gsff.org

Check out this short film!

Life on the Edge – Exploring New Jersey's Coastal Ecosystems

youtube.com/watch?v=046j_Cwy9qg

The film about the Munroe Lab's aquaculture research won the Home Grown Student Short Documentary Award at Garden State Film Festival *gsff.org/winners*

344 **UNDERGRADUATES**
Taught per year

Scarlet Knight, Challenger, Potential Sentinel Lines

UNDERGRADUATE PROJECTS

SCIENCE MISSION

TECHNOLOGY DEVELOPMENT

RUCOOL Efforts Around the World

GREENLAND (DENMARK)

ICELAND

UNITED STATES ALASKA

CANADA

Ocean Acidification Coastal Circulation

Tidal Dynamics

IRELAND

PORTUGAL

SPA

UNITED STATES

SWOT Validation

Hurricane Forecasting
Marine Ecology

Harmful Algae Blooms
Deep Water Horizon
Loop Current Physics
Ocean Heat Climate Change
Hurricane Forecasting

Robotics and Plastic Waste

MOROCCO

WESTERN SAHARA

MAURITANIA

Robotic Smart Networks

MEXICO

ATLANTIC OCEAN

UNITED STATES HAWAII

DOMINICAN REPUBLIC

HAITI

GUATEMALA

EL SALVADOR

NICARAGUA

COSTA RICA

PANAMA

PACIFIC OCEAN

VENEZUELA

GUYANA

SURINAME

FRENCH GUYANA

COLOMBIA

ECUADOR

PERU

BRAZIL

ASCENSION ISLAND

BOLIVIA

PARAGUAY

URUGUAY

CHILE

ARGENTINA

SOUTHERN OCEAN

Upwelling and Ocean Ecology

Climate Change and Ocean Ecology

Glacial Melt and the Ocean

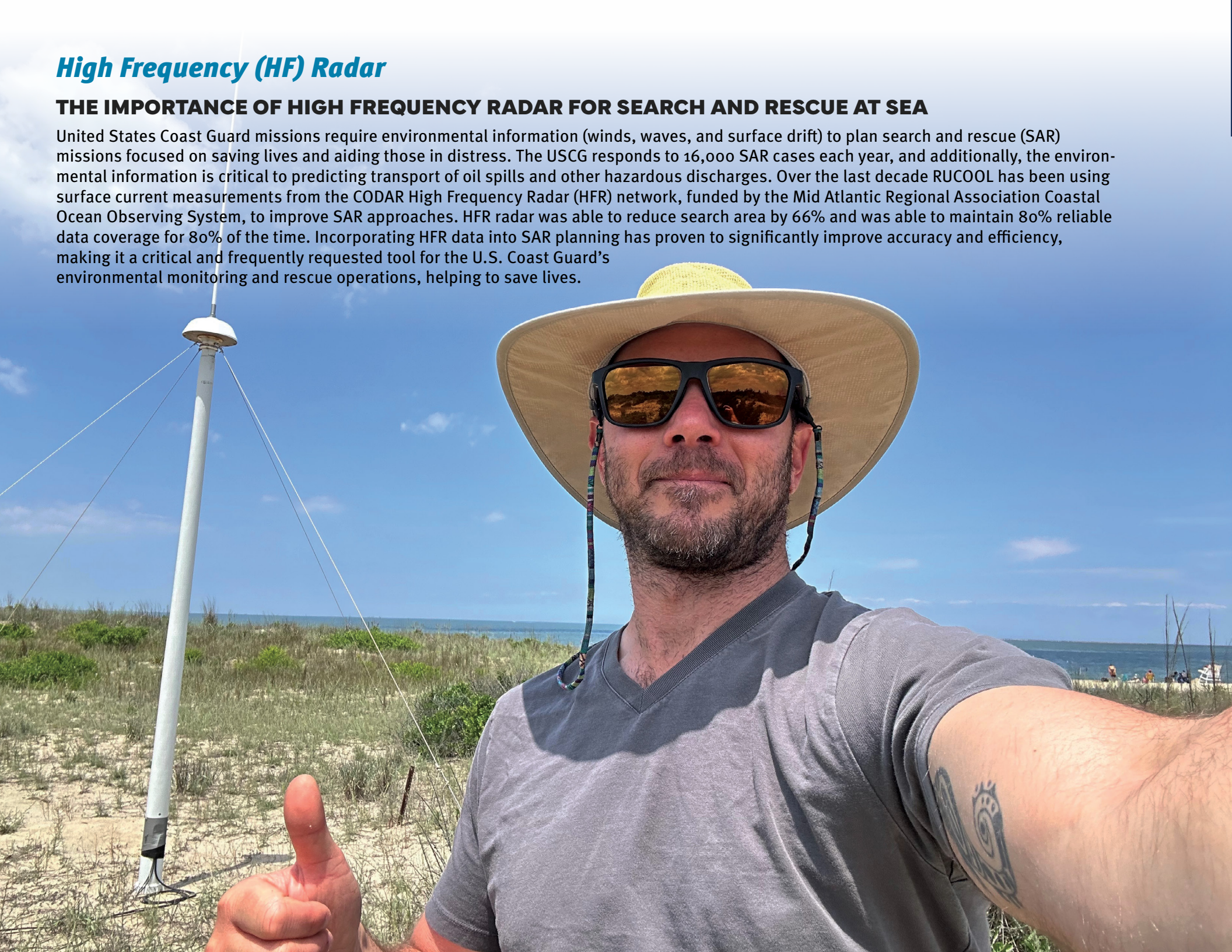
Eddy Su


ARCTIC OCEAN
Fjord Physics
SWEDEN
FINLAND
NORWAY
AUV TESTS
ESTONIA
LATVIA
LITHUANIA
RUSSIA
NETHERLANDS
GERMANY
POLAND
BELARUS
UKRAINE
KAZAKHSTAN
MONGOLIA
FRANCE
ITALY
AUSTRIA
HUNGARY
ROMANIA
MOLDOVA
SERBIA
BULGARIA
N MACEDONIA
ALBANIA
Bio-Optics
TURKEY
UZBEKISTAN
TURKMENISTAN
KYRGYZSTAN
TAJIKISTAN
CHINA
Typhoon Physics
NORTH KOREA
SOUTH KOREA
JAPAN
CYPRUS
LEBANON
ISRAEL
SYRIA
IRAQ
IRAN
AFGHANISTAN
PAKISTAN
TUNISIA
ALGERIA
LIBYA
EGYPT
SAUDI ARABIA
KUWAIT
QATAR
UNITED ARAB EMIRATES
OMAN
YEMEN
INDIA
NEPAL
BHUTAN
BANGLADESH
MYANMAR
LAOS
THAILAND
CAMBODIA
VIETNAM
PHILIPPINES
Island Nation Food Security
NIGER
CHAD
SUDAN
ERITREA
DJIBOUTI
SOMALIA
ETHIOPIA
NIGERIA
SOUTH SUDAN
CENTRAL AFRICAN REPUBLIC
CAMEROON
EQUATORIAL GUINEA
GABON
REPUBLIC OF THE CONGO
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
RWANDA
BURUNDI
TANZANIA
SRI LANKA
Giant Squid Ecology
MALAYSIA
INDONESIA
EAST TIMOR
NEW GUINEA
PACIFIC OCEAN
ANGOLA
ZAMBIA
MALAWI
ZIMBABWE
MOZAMBIQUE
MADAGASCAR
NAMIBIA
BOTSWANA
SOUTH AFRICA
LESOTHO
SWAZILAND
INDIAN OCEAN
AUSTRALIA
Eddy Dynamics
bduction
SOUTHERN OCEAN
NEW ZEALAND
ANTARCTICA

High Frequency (HF) Radar

THE IMPORTANCE OF HIGH FREQUENCY RADAR FOR SEARCH AND RESCUE AT SEA

United States Coast Guard missions require environmental information (winds, waves, and surface drift) to plan search and rescue (SAR) missions focused on saving lives and aiding those in distress. The USCG responds to 16,000 SAR cases each year, and additionally, the environmental information is critical to predicting transport of oil spills and other hazardous discharges. Over the last decade RUCOOL has been using surface current measurements from the CODAR High Frequency Radar (HFR) network, funded by the Mid Atlantic Regional Association Coastal Ocean Observing System, to improve SAR approaches. HFR radar was able to reduce search area by 66% and was able to maintain 80% reliable data coverage for 80% of the time. Incorporating HFR data into SAR planning has proven to significantly improve accuracy and efficiency, making it a critical and frequently requested tool for the U.S. Coast Guard's environmental monitoring and rescue operations, helping to save lives.



Student Success

AWARDS

Congratulations to PhD student Leah Hopson for an Honorable Mention to the National Science Foundation's Graduate Research Fellowship Program and the National Center for Atmospheric Research's Bridge to Graduate Visitor Program. Leah was also selected to be a 2024-2025 Fellow in the Rutgers Pre-Doctoral Leadership Development Academy.

Congratulations to PhD. students Hails Tanaka and Sam Alaimo who have both been awarded NSF Internships to work with fishing companies and managers to conduct cooperative research on climate driven dynamics in commercial shellfish and finfish fisheries.

Congratulations to PhD candidate Joe Gradone, who was awarded the "Best Oceanography Talk" of the National Defense Science and Engineering Graduate Fellowship 5th annual conference in New Orleans. Joe's work spans cutting edge ocean robotic technology, balancing ocean heat budgets, and improving storm forecasting. From a letter on behalf of Mary Munk, the President of the Walter Munk Foundation for the Oceans, and Justin Manley, President of the Marine Technology Society: "This award seeks to underscore the great importance of ocean science and technology; to recognize achievements to date and to encourage [the recipient] to continue Walter Munk's legacy of daring exploration and discovery throughout your career."

Congratulations to Rutgers undergraduate student Brenden Henley for winning the best student paper award at the 13th Currents Waves and Turbulence Measures workshop.

GLIDER

30 Deployments

20,629
kilometers flown
(Half circumference of earth)

977 Days at sea

Leah Hopson

Hails Tanaka

Sam Alaimo

Joe Gradone

Brendan Henley

MS IN OPERATIONAL OCEANOGRAPHY

The Master's in Operational Oceanography program at Rutgers offers a unique blend of science, technology, and real-world experience. This year, students completed two successful missions with glider RU23, now a dedicated teaching glider for the degree program (the first climate ocean observing line run by students in history). This required the students to deploy and pilot the glider on a three-week mission off the coast of New Jersey navigating around storms, ship traffic, and ocean currents to detect the Mid-Atlantic cold pool. Students in the program work closely with the RUCOOL glider team, gaining hands-on expertise in mission planning, piloting, recovery, and data analysis. This year, two RUCOOL students have secured careers with Teledyne Webb Research, the manufacturer of the robotic gliders, upon completion of their degree program.

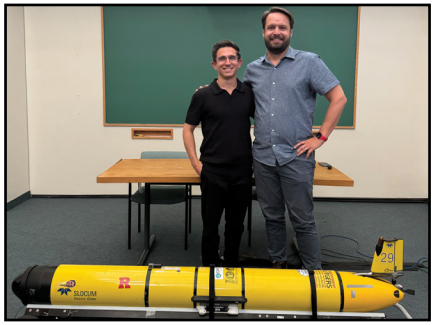
SENTINEL GLIDER

Rutgers University and Teledyne Webb Research unveiled The Sentinel Mission in a remarkable display of academic and technological collaboration. This unprecedented initiative marks the beginning of an ambitious historic robotic journey as Teledyne's Slocum Sentinel Glider, "Redwing," (Research & Education Doug Webb Inter-National Glider) prepares for a historic round-the-world flight. The mission is further strengthened by the involvement of NOAA, the Marine Technology Society, and the UN Ocean Decade. A celebration at Rutgers showcased the intricate planning and resilient partnership behind The Sentinel Mission. The Redwing glider, embodying the intersection of research and education, pays homage to Doug Webb, a pioneer of autonomous underwater technology. The glider stands not only as an innovative piece of machinery but also as a symbol of global research unity and exploration. Rutgers President Jonathan Holloway delivered remarks celebrating the partnerships needed to do this endeavor.

Master's of Operational Oceanography students recover a Slocum glider off the New Jersey coast.

Rutgers undergraduate students meet with President Holloway to discuss the Sentinel global glider mission.

COMPLETED GRADUATE THESES



Joe Gradone, PhD
ON THE DYNAMICS OF CARIBBEAN THROUGH-FLOW WATER MASS TRANSPORT.

Micheal Chen, MS
SPATIAL AND SEASONAL CONTROLS ON EDDY SUBDUCTION IN THE SOUTHERN OCEAN.

Jackie Veatch, PhD
PHYSICAL DRIVERS OF FOOD WEB FOCUSING IN MARINE ECOSYSTEMS.

Leslie Birch, MS
DODGING SHIPS: IS NEW JERSEY VESSEL TRAFFIC A THREAT TO UNDERWATER GLIDERS?

Emily Busch, MS
A DIP IN THE POOL: ANALYZING THE STABILITY OF THE MID-ATLANTIC COLD POOL.

Bre DiRenzi, MS
BIOLOGICAL RESPONSE OF SPISULA SOLIDISSIMA (ATLANTIC SURFCLAMS) TO VARYING CARBONATE CHEMISTRY IN THE MID-ATLANTIC BIGHT.

Rhyan Grech, MS
IMPACTS OF OCEANIC CONDITIONS ON NORTH ATLANTIC RIGHT WHALE DISTRIBUTION ON THE NANTUCKET SHOALS.

Yachen Li, MS
ESTUARINE PARTICLES SIMULATIONS: THE CONNECTION BETWEEN DELAWARE BAY AND OFFSHORE WIND LEASE AREAS.

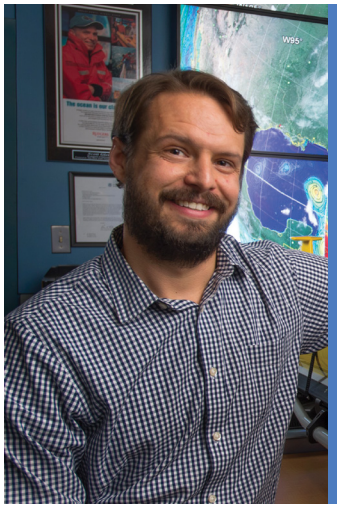
Jake Zappala, MS
DOES PROMINENT COASTAL UPWELLING ALONG NEW JERSEY LEAD TO INCREASES IN OFFSHORE WIND TURBINE POWER PRODUCTION?

19 **GRADUATE STUDENTS**
Annually

Community Service, Engagement, and Leadership

AWARDS

RUCOOL faculty, students, and staff continue to lead research and education in the oceanographic community. This year, the group received several prestigious awards from the Oceanographic Society and the Marine Technology Society for their continued service in advancing research in the field and teaching the future generation of marine researchers. Additionally, RUCOOL celebrates its successes within the university with Dr. Miles' promotion to Associate Professor.



Congratulations to Travis Miles for being promoted to Associate Professor and earning tenure. Travis's research is focused on processes that are associated with physical ocean boundaries, including ocean interactions with the atmosphere above, the seafloor below, the land and the sea, and between the different water layers within the ocean interior itself. External scientists pronounced his work as the wave of the future.

The Oceanography Society (TOS) congratulated RUCOOL on its selection as the recipient of the TOS Ocean Observing Team Award. This award recognizes innovation and excellence in sustained ocean observing for scientific and practical applications. The award recognizes RUCOOL for transforming oceanography by sharing their pioneering sampling platforms, sensing methods, and their integration into models and education.

rucool.marine.rutgers.edu/2024-tos-ocean-observing-team-award

Oscar Schofield and Scott Glenn gave the renowned Walter Munk Commemorative Lecture at the Ocean Sciences meeting this February. The talk was titled "The view from the COOLroom". It chronicled the 30+ year history of ocean observing leadership at Rutgers.

Congratulations to Oscar Schofield for being awarded the Marine Technology Society (MTS) Fellow Award. Designation as a Marine Technology Society Fellow is one of the highest accolades a member can achieve. With a foundation in biology and ocean optics, Oscar's career at Rutgers led to the creation of RUCOOL. His innovative use of underwater glider technology has opened new frontiers in marine research.

A big congratulations to Grace Saba for winning the Marine Technology Society (MTS) John P. Craven Mentorship award. The John P. Craven Mentor Award is presented to any established MTS Mentor invoking the long and impactful career of John Pina Craven, this award is conferred upon an MTS member who has demonstrated outstanding and sustained service to the field of marine technology through mentorship.

International

The United Nation's Global Ocean Observing System (GOOS) Co-design Program has identified six Exemplars to demonstrate the value of ocean observations for the UN Decade of Ocean Science for Sustainable Development (2021-2030) and accelerate the international build-out of GOOS. Scott Glenn serves as the international Co-Chair of the program's Tropical Cyclone (TC) Exemplar. With an international steering team that includes RUCOOL's Travis Miles, the TC Exemplar has identified five pilot study regions globally that are vulnerable to cyclone impacts and have unique and challenging forecast environments, including: the Tropical Americas and Caribbean that experiences the most damaging TCs (hurricanes); the North Pacific Ocean and Marginal Seas that experiences the strongest TCs (typhoons); the Bay of Bengal that experiences the most deadly TCs; the southeast coast of Africa where marine heat waves and TCs combine to threaten subsistence fisheries; and the South Pacific Islands where vast distances challenge weather forecasting services for small island developing states.

The Tropical Cyclone Exemplar has become a centerpiece for collaboration between the World Meteorological Organization (WMO) and its oceangraphic counterpart, the UN's Intergovernmental Oceanographic Commission (IOC). Over the last year, Scott has participated in WMO and IOC meetings in France, Panama, Spain, Sweden, Korea, Australia, Indonesia, South Africa, and Austria. One highlight was Scott's participation as the Ocean Observing Expert with the Director of the U.S. National Hurricane Center on the 1st Ocean Panel at the 46th Session of the WMO Region IV Hurricane Committee. Recognizing the important role of ocean observing to coupled atmosphere-ocean hurricane forecasting, the WMO Hurricane Committee voted to make the Ocean Panel an annual event.

50+

ACTIVE AWARDS

(grants, donations, cooperative agreements)

580

PEOPLE VISITED RUCOOL OVER 22 COUNTRIES

National

The connection between a warming ocean and changes in extreme weather and rainfall events is increasingly recognized by the National Weather Service (NWS) and the World Meteorological Organization (WMO). Quoting the recently retired head of NOAA Oceanic and Atmospheric Research and distinguished Rutgers alumni Craig McLean, “If you like your 7-day weather forecast, thank an oceanographer.” In response, RUCOOL is increasingly called on to fill leadership roles promoting and enabling the use of ocean observations to improve the accuracy and lead time of weather forecasts both nationally and globally.

In the U.S., Scott Glenn is the oceanographic co-chair of the NOAA Science Advisory Board’s Environmental Information Services Working Group (EISWG), the only Working Group authorized by the U.S. Congress and charged with providing advice for prioritizing NOAA weather research initiatives, and for adopting emerging technologies and techniques found in private industry or the research community that can improve National Weather Service forecast skill. The Congressional Weather Act requires Scott’s EISWG team of twenty leading experts and innovators from all relevant fields of science and engineering to develop an Annual Report to Congress on NOAA progress in adopting EISWG recommendations. Recommendations range from improvements to hurricane, tornado and tsunami event forecasting, to long term seasonal forecasts and space weather forecasts.

HFR SURFACE CURRENT COVERAGE

213,000 KM²

AVERAGE

292,000 KM²

MAXIMUM

50 MIL VECTORS

Regional

RUCOOL graduate students Sam Alaimo and Lauren Cook led the way, engaging with stakeholders in our region. They hosted a table at the Northeast Cooperative Research Summit where they engaged with the commercial fishing industry on marine research. In addition, they held a forage species workshop at the NYSERDA State of the Science on Offshore Wind meeting. The workshop was so well attended, people were vying for any available space to participate in the discussion.

Local

RUTGERS MARINE SCIENTISTS PARTNER WITH NEW BRUNSWICK SCHOOL DISTRICT FOR “SCIENCE FAMILY NIGHT”

McKinley Community School in New Brunswick welcomed 11 undergraduate students, graduate students, staff and faculty from Rutgers University in a night of STEM learning. This program was designed to inspire and engage the next generation of science-informed students and to break down barriers to science learning and engagement through a fun family event. The team engaged with more than 180 students and their families in hands-on activities focused on climate change. Activities included the Carbon Cycle game, where kids made a carbon “bracelet or keychain” to build their understanding of the Earth’s carbon cycle, and the Fish Migration game, which is a human board game designed to help kids understand the impact of warming waters in the north Atlantic. Additionally, they interactively learned about impacts of climate change when families conducted simple demonstrations to understand glacier melt and sea level rise and the impacts of climate change here in

New Jersey. Dr. Janene Rodriquez, Principal of McKinley Community School, notes that “the partnership with Rutgers for this Joint Family Science Day event on climate change was significant. We not only nurture scientific curiosity, but also foster a sense of collective responsibility towards our planet. More importantly, we empower our families to become stewards of environmental sustainability, ensuring a brighter future for generations to come.”

A 4-H YOUTH DEVELOPMENT PROGRAM CHANGES PERCEPTIONS, MAKING STUDENTS INSIDERS IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS

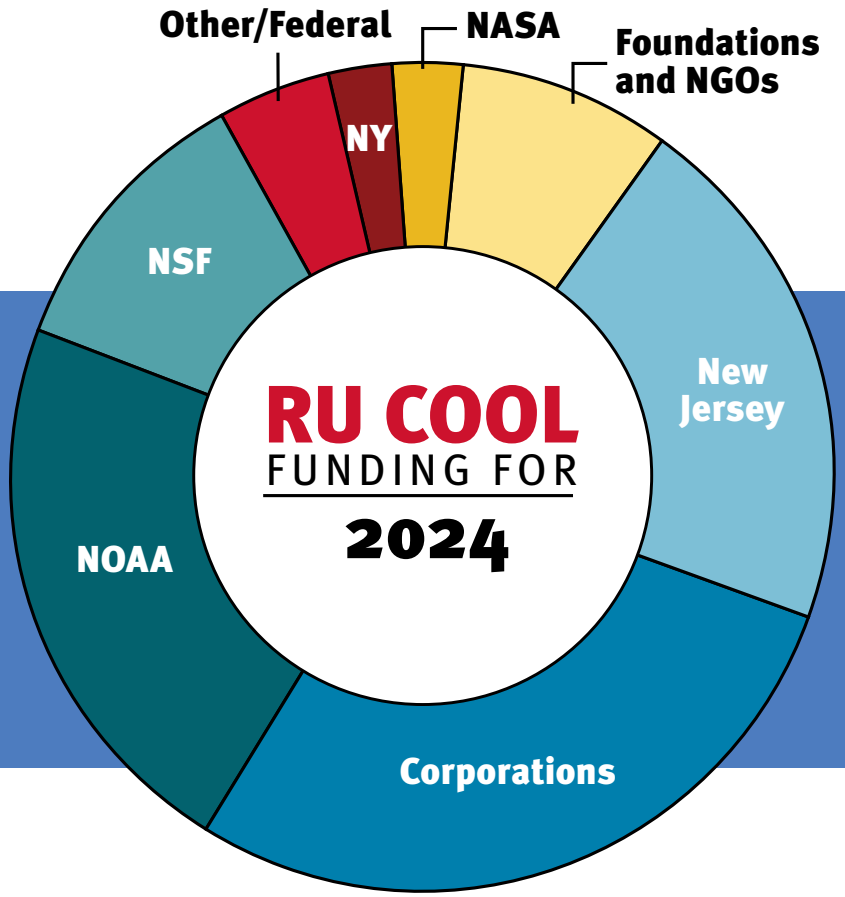
A big part of what Janice McDonnell is doing with a program known as Rutgers 4-H STEM Ambassadors, is to connect with working scientists without a STEM role model in their families or communities. Most young people don’t have a broad or informed perspective on science and mathematics or career pathways in STEM fields. This is not unexpected, as many participants don’t have local role models in STEM and come from under-resourced communities that don’t have access to STEM opportunities. Research shows that under-served students perceive themselves as STEM outsiders. The 4-H program creates STEM “insiders” by changing perceptions. Scientists and engineers talk with STEM ambassadors about what it is like to be a STEM professional and normalize challenges. Fortunately, the STEM Ambassador program has many success stories. Many ambassadors end up attending college at Rutgers University. In a recent study of our first 10 cohorts, 34% have attended Rutgers.

RUCOOL STAFF LEAD MULTI-INSTITUTIONAL WORKSHOP ON OCEANOGRAPHIC DATA LITERACY

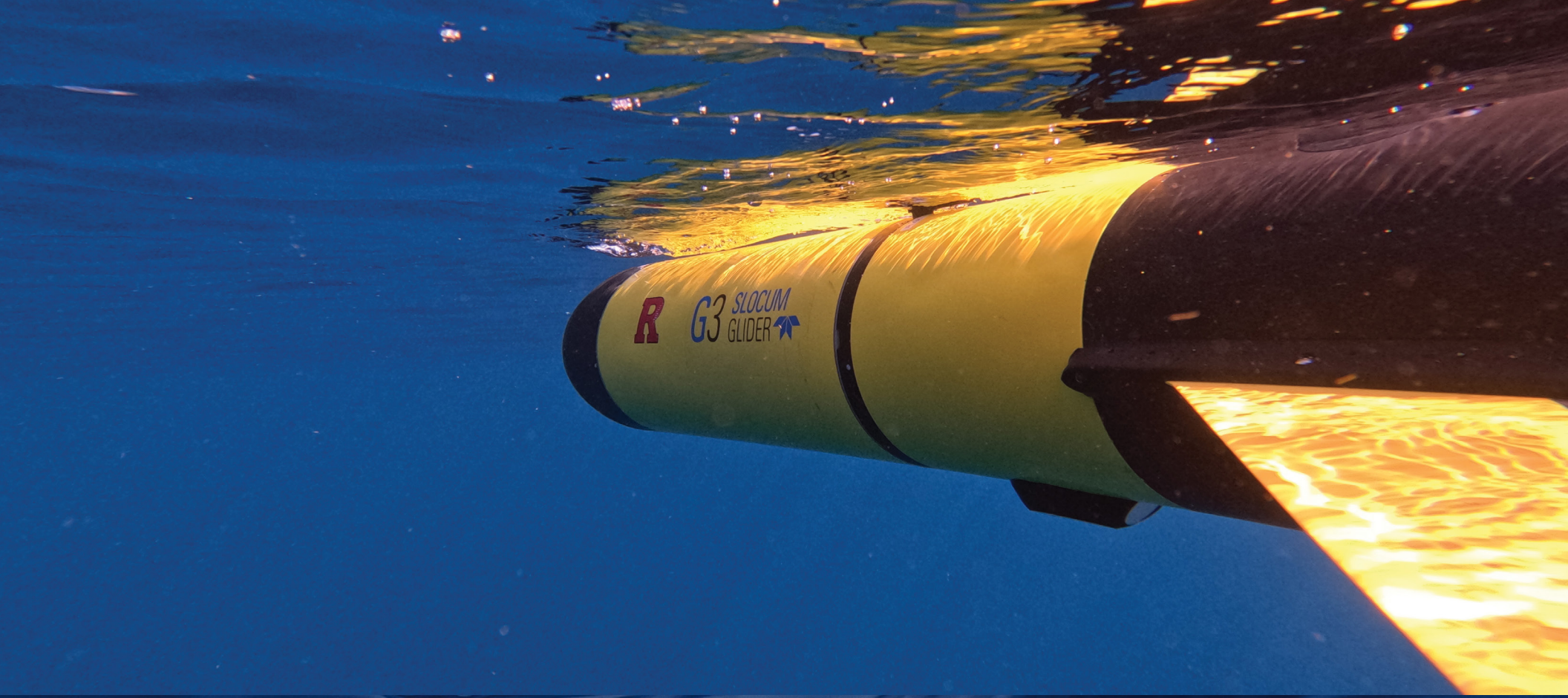
For over a decade, RUCOOL has collaborated with various Rutgers departments and outside institutions to create new, lasting ways to easily visualize and play with big datasets. RUCOOL hosted a data literacy workshop in Wilmington, North Carolina, which included nearly 50 professors from across the country, learning about each other’s experiences teaching at various institutions, from community colleges to universities with doctoral programs. This diverse mix led to innovative ideas on engaging students with messy, raw data. The professors gained practice using the data visualization tools available to chunk the National Science Foundations' Ocean Observatories Initiatives’ raw data into workable teaching data sets. They also collaborated to create teaching plans that they can implement in their own classrooms.

Statistics

$10.4
MILLION
In funding per year



- **$2.18M** State of New Jersey
- **$2.8M** Corporations
- **NOAA $2.31M** National Oceanic and Atmospheric Administration
- **NSF $1.17M** National Science Foundation
- **$460K** Other/Federal
- **$250K** State of New York
- **NASA $299K** National Aeronautics and Space Administration
- **$859K** Foundations & NGOs



RUTGERS–NEW BRUNSWICK
Marine and Coastal Sciences
School of Environmental and Biological Sciences

marine.rutgers.edu

Department of Marine and Coastal Sciences
71 DUDLEY ROAD | NEW BRUNSWICK | N.J. | 08901-8520