NOAA Office of Education Science and Education Symposium Student Presentations

NOAA Office of Education
Ernest F. Hollings and Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Undergraduate Scholarship Programs
2023 and 2024 Scholar Classes
July 29 - August 1, 2024

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Welcome to the 2024 NOAA Office of Education Science and Education Symposium

Dear NOAA Scholars, Mentors, Family Members, and Friends:

Welcome to a week of exciting sessions and information sharing! We will begin the Science and Education Symposium with remarks by NOAA and Office of Education leadership, followed by presentations by the class of 2023 Ernest F. Hollings Undergraduate Scholars, and the classes of 2023 and 2024 Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Undergraduate Scholars. One hundred sixty (160) student scholars will present a summary of their 9- week summer internship which began in May 2024 for most scholars.

The undergraduate scholars selected scientific projects designed by NOAA scientists, natural resource managers, educators, and policy analysts and have spent the last 9 weeks conducting research in support of these projects. In this 10th week of the internship, scholars will share a summary of their research results in Silver Spring MD (and beyond) with the NOAA community, including Office of Education program staff, mentors, family members, and friends. NOAA subject matter experts will evaluate each oral and poster presentation and program staff will provide scholars with the evaluator's comments and feedback.
Scholar presentations are grouped in concurrent sessions according to NOAA's long-term mission goals and enterprise-wide capabilities. This information is summarized in the section entitled, "Student Presentations Agenda-at-a-Glance".

Thank you for your support and enjoy the 2024 NOAA Science and Education Symposium!
NOAA Office of Education
EPP/MSI and Hollings Scholarship Programs

NOAA Educational Partnership Program with Minority Serving Institutions - Brief History

The Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) is a Federal STEM education and training program that focuses on supporting the training and graduation of post-secondary students, particularly from underrepresented minority communities, in NOAA mission science fields. The EPP/ MSI program is committed to training a diverse pool of eligible candidates for the NOAA and NOAA mission related enterprise. The EPP/MSI program comprises four Cooperative Science Centers (CSCs), the Graduate Fellowship Program (GFP) and the Undergraduate Scholarship Program (USP).

The CSCs, each led by an MSI, consist of 24 academic institutions that train and graduate students in core NOAA-mission sciences. The CSC consortium includes: Center for Coastal and Marine Ecosystems (CCME - Florida A&M University), Center for Earth System Science and Remote Sensing Technologies (CESSRST - City College of the City University of New York), Living Marine Resources Cooperative Science Center (LMRCSC - University of Maryland Eastern Shore), and NOAA Center for Atmospheric Science and Meteorology (NCAS-M - Howard University). Since 2001, these institutions, collectively, have supported the awarding of more than 2,000 post-secondary degrees in core NOAA mission fields. Graduate students supported by CSCs are eligible to apply to the EPP/MSI GFP. This program supports a one year research residency at a NOAA facility under the mentorship of NOAA scientists and/or resource managers in collaboration with academic advisors at the Center institution.

The EPP/MSI USP provides two years of support for high performing rising junior and senior undergraduates attending MSIs and majoring in NOAA mission-related sciences. Undergraduate scholars are mentored by NOAA scientists and resource managers during 2 summer internships conducted at NOAA facilities. To further enhance their research experience, undergraduate scholars also conduct research under the direction of an academic mentor during their junior year at their academic institution. During the senior year, USP scholars are required to complete public service activities with the goal of contributing to and enriching their respective communities. Since 2001, nearly 200 undergraduate degrees have been awarded to USP scholars, the majority of whom advance to graduate study.

EPP/MSI Team
Jacqueline Rousseau, Director, EPP/MSI
Audrey Trotman, Ph.D., Lead Program Analyst
Natasha White, Ph.D., Management and Program Analyst
Erianna Hammond, Program Analyst
Amal Hussain, Program Specialist

Ernest F. Hollings Scholarship Program - Brief History

The Ernest F. Hollings (Hollings) scholarship program is designed to: (1) increase undergraduate training in oceanic and atmospheric science, research, technology, and education and foster multidisciplinary training opportunities; (2) increase public understanding and support for stewardship of the ocean and atmosphere and improve environmental literacy; (3) recruit and prepare students for public service careers with NOAA and other natural resource and science agencies at the Federal, state and local levels of government; and, (4) recruit and prepare students for careers as teachers and educators in oceanic and atmospheric science and to improve scientific and environmental education in the United States.

The Hollings Scholarship Program provides successful undergraduate applicants with awards that include academic assistance (up to a maximum of $9,500 per year) for two years of full-time study and a 10-week, full-time paid ($700/week) internship at a NOAA facility during the summer. The internship between the first and second years of the award provides the scholars with “hands-on”, practical experience in NOAA-related science, research, technology, policy, management, and education activities. Awards also include travel funds to attend a mandatory NOAA Scholarship Program orientation and the annual Science and Education Symposium, scientific conferences where students present their research, and a housing subsidy for scholars who do not reside at home during the summer internship. More than 85% of the Hollings alumni that continue on to graduate school pursue advanced degrees in NOAA-related STEM fields.

Hollings Undergraduate Scholarship Team
Victoria G. Dancy, Program Manager
Tiffany Upshaw, Program Specialist
Nia Robin, Administrative Specialist

NOAA Acronym Legend

EPP/MSI	Educational Partnership Program with Minority Serving Institutions
NESDIS	National Environmental Satellite, Data and Information Service
NMFS	National Marine Fisheries Service (NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research (NOAA Research)
OED	Office of Education
OMAO	Office of Marine Aviation and Operations
USP	Undergraduate Scholarship Program

NOAA Office of Education, EPP/MSI and Hollings Scholarship Programs

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Ernest F. Hollings Undergraduate Scholarship Program

Victoria Dancy	Program Manager
Nia Robin	Program Specialist
Tiffany Upshaw	Program Specialist

Educational Partnership Program with Minority Serving Institutions (EPP/MSI)

Erianna Hammond	Program Analyst
Amal Hussain	Program Specialist
Jacqueline Rousseau	EPP/MSI Program Director
Audrey Trotman, Ph.D.	Lead Program and Policy Analyst
Natasha White, Ph.D.	Program Manager

Acknowledgements — Mentors

NOAA Scholarship Programs rely upon the support of the NOAA community and its affiliates to ensure scholars receive well-rounded internship and professional development experiences. The success of the scholars would not be possible without the commitment and tireless efforts of the mentors, speakers, and volunteers listed below. We sincerely thank you for your invaluable contribution to the development and success of NOAA scholars and your support of the EPP/MSI and Hollings Undergraduate Scholarship Programs.

Summer 2024 Internship Mentors

Addison Alford, OAR
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Adrienne Sutton, OAR
Amanda Back, OAR
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Acknowledgements — Evaluators

Each year, NOAA Scholarship Programs rely on the NOAA community to serve as evaluators to provide feedback on student presentations during the Science and Education Symposium. We sincerely thank you for your selfless and invaluable contribution to the growth and development of NOAA scholars and your support of the EPP/MSI and Hollings Undergraduate Scholarship Programs.

2024 Student Presentation Evaluators

Aaron Ramus, NWS
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Student Presentations Agenda at a Glance

NOAA Office of Education
Silver Spring, Maryland
Science and Education Symposium
Hotel Silver Spring
8727 Colesville Road, Silver Spring, Maryland

Monday, 29 July 2024

PRESENTATION LOGISTICS

10:00 a.m. – 12:00 p.m. – Pinnacle Grand Ballroom

- Oral presentation check/preview (Pinnacle Grand Ballroom)
- Set-up Posters (Connections Room)

Tuesday, 30 July 2024

WELCOME and REMARKS

8:30 a.m.—9:00 a.m.– Pinnacle Grand Ballroom
Q & A (Session Logistics)

ORAL PRESENTATIONS

Concurrent Sessions:
9:00 a.m. – 12:00 p.m. 1A. Healthy Oceans—Pinnacle Grand Ballroom
9:00 a.m. – 12:00 p.m. 1B. Resilient Coastal Communities and Economies—Discovery Room
9:00 a.m. – 12:00 p.m. 1C. Climate Adaptation and Mitigation—Connection Room
9:00 a.m. – 12:00 p.m. 1D. Engagement Enterprise—Collaboration Room
12:00 p.m.—2:00 p.m. LUNCH ON YOUR OWN

- Informal Poster Viewing

2:00 p.m. – 5:00 p.m. 2A. ORAL PRESENTATIONS

- Healthy Oceans—Discovery Room

2:00 p.m. – 5:00 p.m. 2B. POSTER SESSION – Pinnacle Grand Ballroom

Wednesday, 31 July 2024

ORAL PRESENTATIONS

Concurrent Sessions:
9:00 a.m. – 12:00 p.m. 3A. Healthy Oceans — Pinnacle Grand Ballroom
9:00 a.m. – 12:00 p.m. 3B. Resilient Coastal Communities and Economies — Discovery Room
9:00 a.m. – 12:00 p.m. 3C. Weather-Ready Nation — Connection Room

Wednesday, 31 July 2024

ORAL PRESENTATIONS

Concurrent Sessions:
1:15 p.m. – 5:00 p.m. 4A. Healthy Oceans — Pinnacle Grand Ballroom
1:15 p.m. – 5:00 p.m. 4B. Science and Technology Enterprise — Discovery Room
1:15 p.m. – 5:00 p.m. 4C. Weather-Ready Nation — Connection Room

Thursday, 1 August 2024

ORAL PRESENTATIONS

9:00 a.m. – 10:45 a.m. 5A. Healthy Oceans — Pinnacle Grand Ballroom

SYMPOSIUM CLOSING & CONCLUDING REMARKS

10:45 a.m. – Pinnacle Grand Ballroom
11:00 a.m. – **11:20 a.m.** Ben Friedman, J.D., Deputy Under Secretary for Operations
11:20 a.m. – **11:30 a.m.** Christos Michalopoulos, Deputy Director, NOAA Education
11:30 a.m. Complete Post Program/Internship/Symposium Evaluation Turn in NOAA Badge

SYMPOSIUM ENDS

11:30 a.m.

Student Presentation Abstracts

Climate Adaptation and Mitigation

Top: Rebeca Buwalda, *Hollings '23*; Bottom: Elizabeth Oliver, *Hollings '23*

Taya Ambrose

DataViz: Visual Analytics of Multidimensional Datasets

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Derek Coffman and Patricia Quinn
Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

This report details the development and implementation of an application for the Atmospheric Chemistry Group at the Pacific Marine Environmental Laboratory designed to visualize multidimensional datasets from uncrewed aerial systems, ground systems, and shipboard data. The application provides a significant contribution to data accessibility for scientists and the general public, facilitating data analysis and visualization in 1D, 2D, and 3D plots. Unlike previous tools, this application offers more comprehensive visualization and access to NOAA data, enabling users to download datasets directly from their browsers for further research. The primary objective of this project is to create an intuitive platform that bridges the gap between complex data sets and end-users, fostering a more robust understanding of trends and patterns within the data. The methodology centers on integrating various visualization techniques to present the data comprehensively. Key innovations include user-friendly interfaces for data exploration and advanced plotting capabilities through Dash Plotly that support a wide range of analytical needs. Although the application has not yet been deployed in the field, it shows promising potential to enhance data accessibility and usability. The platform's ability to present complex data in an understandable manner is a critical advancement for both scientific research and public information dissemination. In conclusion, this application represents a substantial improvement in data visualization tools, providing essential support for scientific inquiry and public engagement with NOAA data. Future recommendations include expanding the dataset sources, enhancing the visualization features, and incorporating more analytical tools to accommodate evolving user needs.

About the Scholar

Taya Ambrose is a NOAA Ernest F. Hollings Class of 2023 scholar from San Luis Obispo, California. She is entering her fourth year at University of California, Santa Cruz studying Computer Science and is expected to graduate with her Bachelor’s degree in Spring 2025. Taya hopes to continue her education in environmental conservation through technology by earning her Master’s degree in Computer Science or Cyber Security, beginning in Fall 2025. She is completing an internship in Seattle, WA, building a data visualization system that makes NOAA research data accessible to the public and available for further research. As a budding data scientist, working for NOAA is Taya’s professional ambition. She is passionate about oceanic conservation and loves the natural world. Having a background in computer science and enjoying the problem-solving aspect of programming, she is excited to find a career that merges her skills with her love of the ocean.

Samantha Berlan

Informing Congress on NOAA's Climate Ready Nation

NOAA Mission Goal: Climate Adaptation and Mitigation
Mackenzie Soloman
Office of Legislative and Intergovernmental Affairs
National Oceanic and Atmospheric Administration (NOAA)

The "Informing Congress on NOAA's Climate Ready Nation" project serves to advance awareness of NOAA's climate information and services by helping organize, research and execute informational outreach and communication to members of Congress and their staff who represent districts that are awarded NOAA Urban Heat Island (UHI) mapping campaign projects in 2024. Throughout the duration of the project, the scholar has worked to facilitate consultation with program office staff and external partners from the National Integrated Heat Health Information System (NIHHIS) team to facilitate Congressional engagement with the NIHHIS program. Engagements are completed through Meet and Greet events with Congressional representatives and staff from UHI awarded cities, as well as cities awarded NIHHIS Centers of Excellence. The importance of reaching out to these members is that they represent constituents who would benefit from NOAA heat products and services. Through this project the scholar has expanded NOAA's reach to help communities better prepare for extreme heat events. From these, outcomes led to overall increased awareness of the NOAA Climate Ready Nation Initiative and heat-related programs. These are completed with senior NIHHIS staff and OLIA Congressional Affairs Specialists and tracked in collaboration with the Congressional Analysis and Research Division (CARD). In collaboration with their mentor, Mackenzie Soloman, the scholar performs legislative and informational research as well as briefs principals prior to any Hill engagements. In addition to the UHI outreach and educational work, the scholar began the project by assisting in coordinating a "NOAA Learning Series on Heat" which featured NOAA Deputy Administrator Jainey Bavishi and experts from NOAA, CDC, and local and academic partners.

About the Scholar

Samantha Berlan is a rising senior at Duke University, double majoring in Earth and Climate Sciences and Environmental Sciences and Policy. She is a 2023 Ernest F. Hollings Scholar and is expected to graduate with a Bachelor of Science in Spring 2025. Her interests include US environmental legislation and international climate policy. For her summer internship project she is working at the NOAA Office of Legislative and Intergovernmental Affairs to help advance awareness of NOAA's climate information and services by performing informational outreach to members of Congress and their staff who represent districts that are awarded NOAA Urban Heat Island (UHI) mapping campaign projects in 2024. She hopes to spend her first couple of post-graduate years in Washington, DC researching and drafting environmental policy and eventually plans to go to law school to become a lawyer.

Rebecca G. Buwalda

Determining the Carbon Sequestration Rates of New and Maturing Living Shorelines

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentor: Elaine Vaudreuil
National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

Living shorelines restore coastal habitat, function, and ecosystem services. The Connecticut National Estuarine Research Reserve (CTNERR) works with collaborators to oversee two living shoreline installations where Reef Balls™ have been deployed. The Reef Balls, installed up to 10 years ago, are part of a broader plan to restore fringing saltmarsh. While prior studies examined the success of living shorelines by quantifying increased biodiversity and sedimentation, few have focused on their parity with natural marshes in terms of climate mitigation by carbon sequestration. To determine carbon sequestration rates, sediment samples at installations at Stratford Point and Connecticut College were analyzed for organic carbon content via the loss on-ignition technique. Samples were compared to a naturally occurring fringe marsh and a negative control sample near one of the restoration sites. Carbon sequestration ($g/m^2/y$) rate was calculated as sediment organic carbon (%) multiplied by the sediment bulk density (g/m^3), then multiplied by a typical sedimentation rate for these areas measured as part of previous research (m/y). Preliminary results indicate that Connecticut College, a younger living shoreline, contains more organic carbon in its sediment than the older living shoreline, Stratford Point. However, there is a notable difference in sediment dynamics between the two locations that could explain the differences, as well as the tendency of new installations to accrete sediment more rapidly when first installed. While neither living shoreline site is achieving sequestration rates as high as natural fringing marshes, with continued maturation, living shorelines could become a beneficial piece of the climate mitigation puzzle.

About the Scholar

Rebecca Buwalda is originally from Atlanta, Georgia and is a rising senior at the University of Miami double majoring in Marine Science and Geological Science with a minor in Ecosystem Science and Policy. She is expected to graduate with her Bachelor's degree in Fall 2024. After,, she aspires to continue her education and obtain her PhD in biogeochemistry. She is passionate about the function of chemical and geological cycles in relation to ecosystem health. Rebecca is a NOAA Ernest F. Hollings Class of 2023 scholar. Her internship is examining the carbon sequestration rates of new and mature living shorelines in comparison to naturally occurring marshes. Becca's professional goal is to one day work for NOAA or USGS, because then she can blend her knowledge in geology and marine science. Overall, Becca wants to promote ocean health by understanding how biogeochemical cycles play a significant role in ocean and ecosystem function.

Cianna Cilenti

Assessing Heat Risk in Chicago: A Spatial Climate Analysis

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Gino Izzi and Kevin Donofrio
National Weather Service/Chicago, IL Weather Forecast Office
National Oceanic and Atmospheric Administration (NOAA)

Chicago, known for its densely populated urban areas, extensive paved surfaces, and high concentration of buildings and infrastructure, exhibits a significant Urban Heat Island (UHI) effect. This effect causes elevated daily and night urban temperatures, leading to more significant heat-related impacts than surrounding rural regions. Due to insufficient green space coverage, the city's strong UHI effect intensifies heat-related health risks, increasing the susceptibility among vulnerable populations with minimal relief from its effects. This project aims to compare seasonal temperature trends and create a heat risk visualization based on various heat-related indices for Chicago. Creation of seasonal linear regression and model analysis plots for stations Aurora (ARR) and Midway (MDW) airports aid in comparing low ambient and low feels-like temperatures. The plots emphasize that Midway, located within the city, experiences warmer low summer temperatures compared to Aurora, which is situated outside the city. This difference highlights the UHI effect, where urban areas retain more heat, resulting in minimal temperature recovery time for populations in the city. Utilizing ArcGIS, spatial datasets including Multispectral Landsat and Space Agency World Cover were obtained for land cover analysis to identify urban areas with the greatest need for additional green spaces. Additionally, various socioeconomic datasets from the American Community Survey (ACS) were used for risk assessment and vulnerability mapping throughout the city. Based on these findings, multiple indices covering socioeconomic, green space coverage, and temperature variations are combined to generate an overall Heat Risk Index (HRI). This index, visualized as a Heat Index map, aimed to enhance urban resilience for the City of Chicago. Future research may benefit from these findings, including the integration of climate projections in green space effectiveness and comparative analysis of various green infrastructures.

About the Scholar

Cianna Cilenti is from Tampa, Florida, and is a rising senior at Florida State University majoring in Meteorology. She is expected to graduate with her Bachelor’s degree in Spring 2025 and aspires to continue her education to obtain a Master’s in Geographic Information Systems while pursuing a career in the Air Force. Cianna is a NOAA Ernest F. Hollings Class of 2023 scholar, currently developing a severe weather climate database along with analyzing climate anomaly data. She is looking forward to furthering her studies in severe and tropical weather systems, utilizing programming and GIS applications. Cianna’s professional aspirations include becoming part of the 53rd Weather Reconnaissance Squadron and to work as a forecaster with the National Hurricane Center, Miami. She aims to combine her interests in severe and tropical weather systems to contribute to advancements in weather forecasting and climate science.

Sarah Herrera

Adapting to Changing Coastal South Carolina Freshwater Forested Wetlands

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Jessica Kinsella and Elaine Vaudreuil
South Carolina Department of Natural Resources
National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

Freshwater forested wetlands on remote islands of the low country of South Carolina serve a vital ecological role in the ACE Basin. However, these unique habitats are vulnerable to saltwater intrusion with rising sea levels and the introduction of invasive species, such as Chinese tallow (*Triadica sebifera*). We mapped approximately 50 acres of freshwater forested wetlands with a Trimble Geoexplorer 6000 GPS device to better understand the expanse of these remote wetlands and determine the depths of the Chinese tallow invasion. We also made Chinese tallow removal effort estimates, estimated sea level rise durability, and ranked the wetlands on public use. Recommendations for each wetland were formed into 2 priority categories: invasive control priority and exploration priority. Invasive control priority was given to wetlands that have greater public use, were more easily accessible by volunteers, and would be less affected by sea level rise. Exploratory priority was given to wetlands that are in the most danger from sea level rise and more inaccessible. Making these management distinctions will help prioritize staff resources to better support public use while also focusing efforts on better understanding these remote wetlands.

About the Scholar

Sarah Herrera is from Northern Virginia and is a rising senior at William and Mary majoring in Biology and minoring in Marine Science. She is expected to graduate in spring 2025 with her bachelor's degree in 2025 and is planning to attend graduate school to further her education in coastal science. Sarah is an Ernest F. Hollings Class of 2023 Scholar and interned this summer in the ACE Basin National Estuarine Research Reserve. During her internship, she mapped freshwater wetlands and invasive chinese tallow on remote islands to be able to make management recommendations for invasive work. Sarah's professional aspirations are to continue to work on invasive species and land management in coastal ecosystems.

Samantha Jerry

Evaluation of Meso-scale Eddies in MOM6-NEP Simulations using Satellite Data

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Wei Cheng, Heather Tabisola and Phyllis Stabeno
Oceanic and Atmospheric Research/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Eddies in the Gulf of Alaska are closed rotating currents that contribute to nutrients, heat, and salt transfer through the water column. We addressed a gap in understanding the Modular Ocean Model version 6 (MOM6) eddy representation in the Gulf of Alaska. This information is an important step in providing accurate data for a Climate Ready Nation and advancing the Climate Fisheries Ecosystem Initiative (CEFI). This project compared Gulf of Alaska eddies from MOM6-NEP hindcasts to AVISO satellite data to assess the ability of MOM6 to represent eddies. This evaluation involved using the "pyeddytracker" Python package to count cyclonic and anticyclonic eddies each day from 1993 to 2018. The counts were collected for eddies of all sizes and for eddies with radius > 50 km. Results were used to examine seasonal and interannual variability. The interannual variability of anticyclonic eddies was compared to the ENSO index, and the interannual variability of cyclonic eddies was compared to wind stress curl. Satellite and model data show similar seasonality in anticyclones and cyclones, although there were significantly more anticyclonic eddies observed in satellite data than the model hindcast. The anticyclonic interannual variability from satellite data showed weak correlation to the ENSO index, but the model showed significant correlation. The numbers of satellite cyclones are correlated with wind stress curl, but the modeled cyclones are uncorrelated. These results suggest promising capability of MOM6-NEP to represent mesoscale eddies in the Gulf of Alaska. Future work will address the relationship between eddy activities and primary production.

About the Scholar

Samantha Jerry is from Spanish Fort, Alabama and is a rising senior at the University of Alabama at Birmingham. She will graduate in the Spring of 2025 with a Bachelor's of Science in Biology with a concentration in Marine Science and minors in both Chemistry and Computer Science. She plans to continue her education through a marine science PhD program in the Fall of 2025. Samantha is a NOAA Ernest F. Hollings Scholar class of 2023. For her internship, she worked with EcoFOCI at the Pacific Marine Environmental Laboratory in Seattle, Washington. There, she used the MOM6 ocean model and AVISO satellite data to compare the identification and tracking of eddies and phytoplankton in the Gulf of Alaska. Professionally, she aims to be a research scientist studying how physical ocean processes and climate change alter marine productivity.

Meghan L. Kaschner

Exploring the impacts of warming timescales on top predator distributions in the California Current Ecosystem

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Elliott Hazen and Steven Bograd (Mentors)
National Marine Fisheries Service (NMFS)/Southwest Fisheries Science Center National Oceanic and Atmospheric Administration (NOAA)

Global long-term warming trends and internal climate variability will interact in novel ways in the future ocean. Warming signals include the long-term, basin-wide trend; natural, low-frequency variability, such as the Pacific Decadal Oscillation (PDO); and high-frequency variability such as marine heatwaves (MHW). When a warm PDO phase coincides with reduced upwelling on top of an increasing long-term warming trend, marine species can encounter anomalously warm temperatures. Conversely, cool PDO phases may mitigate, or even obscure, long-term warming trends. While previous studies have considered the responses of Northeastern Pacific top predators to long-term warming trends and MHWs independently, the impacts of interactions between different warming timescales remain unexplored. Here, we evaluate the responses of ecologically important top predators (*Dermochelys coriacea*, *Megaptera novaeangliae*, *Xiphias gladius*, and *Zalophus californianus*) to projected secular warming and variability using CMIP5 downscaled global climate model output from 1980 to 2100 in the California Current Ecosystem. Our findings indicate that long-term warming trends drive part of marine species' redistribution, with high- and low-frequency natural variability mitigating or amplifying the secular trend. While climate change has gradual long-term consequences, evaluating the impacts of extreme events—such as periods when internal variability amplifies the warming trend—offers insight into future top predator distributions and potential deviations from past MHWs. Further, analyzing how climate change is likely to affect marine environments is crucial for proactive and effective ecosystem-based management.

About the Scholar

Meghan Kaschner is a Santa Fe, New Mexico native entering her fourth year at University of California, San Diego. She expects to graduate with her marine biology bachelor's of Science degree in Spring 2025, after defending her Honors Thesis in March, 2025. She hopes to continue her education in a Biological Oceanography doctoral degree program, beginning Fall 2026. As a NOAA Ernest F. Hollings Class of 2023 scholar, Meghan used model output and data visualization to examine how future marine species' distributions may respond to climate warming variability. Her wide range of experiences—from anadromous fish husbandry and extremophile microbiology to abalone conservation and science communication—combined with her love of art, inclusivity, and technology, inspire her to find interdisciplinary solutions to pressing marine science issues. Professionally, Meghan aspires to conduct research with inquisitive marine scientists, advocate for ecosystem health, and forever learn about the world's ocean.

Jose Armando Keppis

Using VIIRS Land Surface Temperature and Emissivity to Compare and Contrast the Effects of Urban Heat Islands (UHI) on Socially Vulnerable Populations Living in Urban and Rural Settings

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Amy Leibrand and Julie Hoover
National Environmental Satellite Data and Information Service/Office of Low Earth Orbit Observations/Joint Polar Satellite System
National Oceanic and Atmospheric Administration (NOAA)

The Urban Heat Island (UHI) effect is characterized by higher temperatures in urban areas compared to their rural surroundings. This can result in temperature differences of over 8°F, which can cause environmental changes in weather patterns and water quality, as well as health impacts on heat-sensitive populations. UHI also has social effects that influence energy consumption, productivity, and vulnerability. This research project aims to use Geographic Information Systems (GIS) and Remote Sensing to study Land Surface Temperature and Emissivity (LST&E) data from the Joint Polar Satellite System's Visible Infrared Imaging Radiometer Suite (JPSS VIIRS) in conjunction with the Centers for Disease Control's Social Vulnerability Index (CDC SVI). This study will analyze UHI effects in Houston Texas by conducting spatial analysis and statistical modeling. This would provide insight into environmental justice because we hypothesize vulnerable urban areas could be urban heat islands.

About the Scholar

Jose Armando Keppis is an undergraduate in Earth Systems Science and Environmental Engineering at the City University of New York City College. His research interests include wastewater, solid waste, and air pollution. Jose is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar. Currently, he's interning with NOAA National Environmental Satellite, Data, and Information Service (NESDIS), using Geographic Information Systems (GIS) to interpret satellite data to find correlations between environmental stress and social vulnerability, particularly regarding the urban heat island effect. Jose aims to gain enough experience to pursue a path in academia, aspiring to attend graduate school for Environmental Engineering.

Karla Citlali Lemus Gordillo

Implications of Biomass Burning on Tropospheric Ozone Levels

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentor: Gary Morris
Oceanic and Atmospheric Research/Global Monitoring Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Tropospheric ozone and its negative effects account for one million premature deaths every year. Biomass burning has been an increasingly prevalent problem that has contributed to creating tropospheric ozone due to ongoing climate change. Climate change has exacerbated various aspects of wildfires such as their intensity, duration, and frequency. Wildfires release various pollutants including volatile organic compounds (VOCs) and nitrogen oxides (NOx) that create ozone through chemical reactions, including heat and sunlight. Thus, due to the increase in wildfires, the creation of ozone has been an ongoing concern specifically due to its negative effects on health and the environment. 2020 California and Colorado wildfires and 2023 Canadian wildfires dispersed smoke causing elevated ozone levels in various areas. The summer of 2020 saw numerous elevated ozone days for Colorado, particularly between the end of August and early September due to the Pine Gulch, Grizzly Creek, and Cameron Peak fires. California saw particularly high ozone during the same dates due to the August Complex, SCU Lighting Complex, LNU Lightning Complex, and North Complex fires. In 2023 Canadian wildfires impacted ozone levels across the US during early June in various places across Virginia due to the Donnie Creek Fire. Using surface ozone levels from monitoring sites and ozone data from ozonesonde launches, high tropospheric ozone concentrations were found to impact AQI. Furthermore, using HY-SPLIT back trajectories, tracking the location of elevated ozone levels were found to come from blazing wildfires. Preliminary findings have shown wildfire smoke plumes contributing to elevated tropospheric ozone levels.

About the Scholar

Karla Citlali Lemus Gordillo, a rising senior from Aurora, CO, studies at the University of Colorado – Boulder. She is double majoring in Chemistry and Political Science and is set to graduate in Spring 2025. Karla plans to pursue further education in environmental policy, either through a master's program or a JD program, starting in Fall 2025. As a 2023 NOAA Ernest F. Hollings scholar, she is researching the impact of wildfire smoke plumes on tropospheric ozone through the GML lab in Boulder, CO working alongside Gary Morris. As an interdisciplinary scientist, Karla aims to work alongside the government to create environmental policies that benefit marginalized communities affected by climate change. She is committed to advocating for these communities and implementing inclusive and beneficial policies.

Abigail McDonnell

Contrasting mechanisms for Winter and Summer Antarctic Sea Ice Predictability

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentor: Mitch Bushuk
Oceanic and Atmospheric Research/Geophysical Fluid Dynamics Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Antarctic sea ice extent (SIE) exhibits large year-to-year variations which influence fisheries management, wildlife conservation, scientific expeditions, and tourism. These internal sea ice variations also potentially mask multi-decadal signals associated with climate change. For these reasons, there is a growing interest in the seasonal-to-interannual prediction of Antarctic sea ice. Here, we examine seasonal-to-interannual Antarctic SIE predictability in the Coupled Model Intercomparison Project Phase 6 (CMIP6) models. We find that CMIP6 models exhibit a winter to winter reemergence of SIE anomalies, in which winter SIE is positively correlated with the SIE of following winters, despite a loss of correlation during the intervening summer months. This multi-year persistence of SIE anomalies is robust across CMIP6 models. We also show that CMIP6 models generally exhibit a "spring predictability barrier" for Antarctic summer SIE predictions, as there is a large decrease in skill for predictions initialized prior to December. A majority of models exhibit a sea ice volume (SIV)-based spring predictability barrier, which contrasts with earlier prediction studies that showed skillful predictions initialized prior to springtime months. For summer SIE predictions, we find that SIV provides additional predictability beyond SIE. Our results give insight into how seasonal-to-interannual prediction of Antarctic sea ice can be understood and improved in order to better predict Antarctic sea ice variability under climate change.

About the Scholar

Abigail McDonnell is a rising undergraduate senior at University of Illinois at Urbana-Champaign and is originally from Cary, Illinois. At UIUC, she is majoring in Atmospheric Sciences and minoring in Computer Science. She is set to graduate in May 2025 and aspires to continue her education and obtain her Master's degree in a climate science field. Abigail is honored to be a NOAA Ernest F. Hollings Class of 2023 scholar and is enjoying her internship opportunity at NOAA GFDL in Princeton, New Jersey. Her Hollings internship opportunity has allowed Abigail to learn more about climate modeling and data science. Abigail is excited to be working towards improving climate model projections in order to adapt to a changing climate. Abigail's research interests align fully with NOAA's mission of understanding and predicting changes in climate, and she is looking forward to doing more research working towards this goal in the future.

Vlad Munteanu

Atmospheric rivers of varying intensity in the Western United States: Variability in the present and future climate

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Dr. Mimi Hughes & Dr. Benjamin Moore
Oceanic and Atmospheric Research (OAR)
National Oceanic and Atmospheric Administration (NOAA)

Under a warming climate, the characteristics of landfalling atmospheric rivers (ARs) over the United States West Coast are expected to change. Recent work using a variable-intensity AR-identification method showed that the end-of-21st-century changes in West Coast AR landfall frequency depended on their intensity: extreme ARs (Integrated water Vapor Transport greater than the 98th percentile) increased in both frequency and intensity, whereas moderate ARs (IVT between 90th and 98th percentile) decreased in frequency by as much as 10%. Until now, this methodology has been applied only to a small set of regional climate models, however, in this work, we apply this methodology to a large set of global climate models (GCMs). We investigate the shifts of AR frequency as a function of AR intensity in the present and future climate over the United States in a subset of 11 models within the Coupled Model Intercomparison Project Phase 6 (CMIP6) and a set of 40 of 100 members from the CESM2 Large Ensemble Community Project (LENS2). We find that, similar to the previous work, weak to moderate ARs are reduced in frequency and moderate to extreme ARs increase in frequency, but find that the intensity at where this shift occurs varies by GCM. We also see variation in the shift-intensity across the members of the CESM-LE, but the across-member variation is relatively small. These shifts in AR frequency have direct implications for Western U.S. precipitation, with increased extreme precipitation from extreme ARs and decreased moderate precipitation amounts (impacting seasonal total precipitation).

About the Scholar

Vlad Munteanu is from Richland, Washington and is a rising senior at the University of Washington, Seattle. He is majoring in Atmospheric Sciences with a minor in Applied Mathematics and is expected to graduate with his Bachelor's degree in Spring 2025. He plans to continue his education by pursuing a graduate degree in atmospheric sciences beginning Fall 2025. Vlad is a NOAA Ernest F. Hollings Class of 2023 scholar and is working with Dr. Mimi Hughes at the David Skaggs Research Center in Boulder, CO. His project is to identify and analyze how western U.S. Atmospheric Rivers (ARs) are changing in both observational and model datasets in order to understand how precipitation may change with warming. In the future, Vlad aspires to channel his passion for understanding Earth's climate system to produce research that can directly inform and guide climate adaptation and mitigation efforts.

Elizabeth Oliver

How Does Temperature Affect Crab Migration in Great Bay NH?

NOAA Mission Goal: Climate Adaptation and Migration
Mentors: Chris Kinkade, Chris Peter, and Katie McGovern
Grand Bay National Estuarine Research Reserve and National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Ocean temperatures in the Gulf of Maine are among the most rapidly warming on earth, forcing estuarine and marsh animals to endure new stressors, adapt, migrate, or perish. Based on monitoring and observational work throughout the Great Bay in New Hampshire, there have been three new crustaceans: *Callinectes sapidus* (blue crab), *Carcinus maenas* (green crab), and *Minuca pugnax* (fiddler crab) found migrating into the Bay and its marshes. While at the same time, *Homarus americanus* (american lobster) is moving out of the Bay to deeper, cooler waters and becoming less prevalent in the Bay. Opposed to *Limulus polyphemus* (horseshoe crab), which appears to be increasing in population with warmer waters each spawning season. The goal is to identify how temperature is affecting these arthropods on a geographical and density scale, using various trapping techniques and point counts along a transect. Recognizing these trends can give insight on how the Bay and surrounding marshes in New Hampshire will change in the future and impact ecosystem interactions.

About the Scholar

Elizabeth Oliver is from Lakehurst New Jersey and is a rising senior at Eckerd College double majoring in marine science and Spanish with a minor in chemistry. She is expected to graduate with her Bachelor's degree in Spring 2025. Elizabeth is a NOAA Ernest F. Hollings Class of 2023 scholar and has been working on understanding the range expansion of various crab species within the Great Bay Reserve and how it might impact other native species populations in the future. She hopes to continue her education and obtain her Master's degree in marine science beginning Fall 2025. She is most interested in continuing the exploration of the relationship between climate change and marine life responses to these changes and provide information on prediction trends of changes in migration patterns, habitat, and symbiotic interactions as these fluctuations continue to occur. Elizabeth's career aspirations are to earn her Ph.D and eventually become a professor at a university to continue her love for research but also education. During this time she wishes to continue volunteering and advocating for the reduction of single-use plastics in our environment to promote cleaner waterways.

Corinne Renshaw

Shifts in Aragonite Saturation State and *P*co2 After Bleaching at Cheeca Rocks Reef, FL, USA

NOAA Mission Goal: Climate Mitigation and Adaptation
Mentors: Ana Palacio and Ian Enochs
Ocean Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

Scleractinian corals play a critical role in coastal marine ecosystems as a habitat for various fishes and invertebrates – a product of their aragonite skeleton precipitation. Declining aragonite saturation state (Ωarag), the mineral phase for coral calcification, is caused by increasing *p*CO2. In 2023, the Florida Reef Tract experienced a mass bleaching event associated with anomalously high sea surface temperatures (SST) and succeeded by high *p*CO2. Here we compare sea surface conditions in 2023 with the seven years prior, to understand how anomalies in *p*CO2 and SST might affect Ωarag at Cheeca Rocks Reef. Moored Autonomous *p*CO2 Buoy (MAPCO2) data for SST, sea surface salinity (SSS), and *p*CO2 were paired with total alkalinity (TA) from seawater samples to solve the carbonate system. Comparison between 2023 and 2016-2022 means show a 0.652°C SST increase in 2023, peaking in July (32.35 ± 0.94°C), but dropping in December (22.76 ± 1.7°C). Peak *p*CO2 (778 μatm) coincided with cooling SST in October, though the 2023 and 2016-2022 means were similar (418.4 ± 60.2 and 419.6 ± 32.2 μatm). Despite this, Ωarag in 2023 was consistently below the 2016-2022 average, and fall *p*CO2 peaks may have driven Ωarag for December (2.81 ± 0.31) nearly two standard deviations below the seven-year average (3.34 ± 0.18). Interannual trends at an inshore reef site highlight how fall *p*CO2 peaks are a temporal vulnerability stony corals face amidst increasing fossils fuel emissions. Future research aims to measure the response and resilience of benthic calcifying organisms to ocean acidification.

About the Scholar

Corinne Renshaw is from Chicago, Illinois and entering her senior year in Marine Biology and Environmental Science majors at Nova Southeastern University. She will be graduating in May of 2025 and plans to continue pursuing research through a Ph.D. program focused on Paleoceanography. As a NOAA Ernest F. Hollings Class of 2023 scholar, Corinne interned at the Atlantic Oceanographic and Meteorological Laboratory in Miami, FL, during the summer of 2024. Here she furthered her interest in marine carbonate chemistry, by evaluating the effects of ocean acidification on coral reef aragonite saturation state within her research project. Her developed affinity for Geology, alongside her love of Marine Biology, encourages her to further examine the effects of ocean acidification on various calcifying species through an analysis of paleo-isotope compositions in carbonate skeletons. In the future, she hopes to engage in this field as a NOAA Researcher, using paleoclimate records to predict the thresholds of modern species to ocean acidification.

Asha Spencer

Assessing Spatial Patterns and Trends in the Sea Level Annual Cycle

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentors: Jacob Steinberg, John Krasting
Oceanic and Atmospheric Research (OAR)/Geophysical Fluid Dynamics Laboratory (GFDL)
National Oceanic and Atmospheric Administration (NOAA)

Throughout much of the ocean, sea level variability is dominated by a seasonal cycle. Changes in this seasonal variability may be linked to long-term ocean warming, but reflect combined effects of circulation and heat content changes. The seasonal sea level cycle contains both an annual and semiannual component, with variations in these components influencing coastal flooding risks. The annual component of the seasonal cycle is dominant in most locations. Changes in sea level annual cycle have been explored in previous studies using tide gauge data, and more recently, satellite altimetry data; however, observations-based analyses are limited by data availability. Here, we use NOAA GFDL's CM4, a coupled ocean-atmosphere model run, to examine changes in the sea level annual cycle, especially in amplitude and phase over the historical period 1970-2014. We use harmonic analyses to find time-average and time-changing sea level annual cycles and look at changes in annual amplitudes and phases over this period. Results are compared to previous studies to search for potential similarities and differences between observations and the model. We find that mean and changing sea level annual cycles generally show agreement between observations and the model, such as in the Gulf Stream which shows large changes in amplitudes over the period. Continued research will explore patterns and drivers of amplitude and phase changes in CM4 and assess future projections for changes in the sea level annual cycle. Further research on teleconnections and other factors that may influence changes in the seasonal cycle is also recommended.

About the Scholar

Asha Spencer is from Pittsford, NY and is a rising senior at Pennsylvania State University majoring in Meteorology and Atmospheric Science. She is expected to graduate with her Bachelor’s degree in May 2025 and her Master’s in 2026. Asha is honored to be a NOAA Ernest F. Hollings Class of 2023 scholar. This summer, Asha worked at the Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey on research analyzing patterns of variability in the annual sea level cycle around the globe. Her research interests include atmospheric and climate dynamics and air-sea interactions, and this summer at GFDL was an exciting change of pace that built upon those interests. She is excited to pursue more research in the future that supports NOAA’s goals to better understand climate, oceans, and weather.

Grace Veenstra

Individuals to Integrals: Modeling the diversity of life history, through growth and development, in Snake River Chinook salmon

NOAA Mission Goal: Climate Adaptation and Mitigation
Mentor: Lisa Crozier
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

As climate change shifts temperatures, it is impacting the phenology of species with temperature-dependent growth. One such species is wild juvenile spring/summer Chinook salmon (*Oncorhynchus tshawytscha*) in the Snake River Basin of Idaho. Chinook salmon life history is complex; their growth and movement through the watershed is heavily influenced by temperature and food availability. In order to predict the impact of climate change on Chinook salmon life history, we developed a temperature-dependent integral projection model to evaluate potential salmon growth and development in freshwater. The model uses spawning and smolts counts and temperature data throughout the river to track Chinook salmon from spawning to outmigration as smolts. After eggs emerge, parr follow two alternative life history strategies, either overwintering in their natal tributary or downstream in the mainstem reaches, each with a distinct temperature regime. Both strategies culminate in spring outmigration to Lower Granite Dam downstream on the Snake River. The model predicts the size of juvenile Chinook salmon when they reach Lower Granite, allowing comparison with observed size distributions. Furthermore, the model illustrates variation in smolt size intra- and inter-annually, and the proportion of fish that followed a particular life history strategy. Initial results show the model is accurately predicting within the range of observed sizes at Lower Granite, even with the relatively simple set of parameters being used. While other growth and development models exist, the computational efficiency of an integral projection model is better suited for use in large-scale simulations, including predicting distributions under many different climate scenarios.

About the Scholar

Grace Veenstra is from Fairbanks, Alaska completing her fourth year as a Climate Scholar in the Honors College at the University of Alaska Fairbanks. She expects to graduate Spring 2025 with a Bachelor of Science double major in Biology and Science Communications, and a minor in Mathematics. As a Class of 2023 NOAA Hollings Scholar Grace has enjoyed her internship at Northwest Fisheries Science Center, combining her interests in ecology and mathematics by modeling salmon life history. Following graduation Grace aspires to continue exploring applied biomathematics, ideally working with NOAA scientists on climate issues impacting the arctic and subarctic. In addition, Grace will continue utilizing her skills in science communication, advocating for local and indigenous coproduction of knowledge and increasing science accessibility.

Engagement Enterprise

Top: Leah Henseler, *Hollings '23*. Bottom: Kelli Ong, *EPP/MSI '23*

Aurora Baker

Tackling the Last Mile - How NOAA's Data in the Classroom is Bridging the Gap Between Earth Science Open Data and the Needs of Educators

NOAA Mission Goal: Engagement Enterprise
Mentors: Rafael "Rafa" de Ameller and Amy Dean
National Environmental Satellite, Data, and Information Service (NESDIS)/Environmental Visualization Lab (VizLab)
National Oceanic and Atmospheric Administration (NOAA)

The advancement of earth science research and development has led to the onset of "big data," an obstacle for effectively tackling the "last mile" between open data and the needs of educators. Previous research studies have found that educator needs include resources aligned with learning goals and course curricula, functional tools, and curated datasets. The National Oceanic and Atmospheric Administration's (NOAA) Data in the Classroom (DITC) modules effectively address this criteria. Each module employs user-friendly historical and/or real-time NOAA data to promote problem-solving of real-world environmental issues. A broad range of supporting resources (including a Teacher Guide, worksheets and answer keys, and video tutorials) are provided for educators, as well as documentation of how each module supports. Next Generation Science Standards (NGSS). To further address educator needs and to develop resources that can be effectively integrated into existing curricula, the DITC modules are developed in tandem with educators. Data in the Classroom has undergone several iterations as learning materials have been adapted and updated in concurrence with advancing research and technology. The most recent iteration of DITC reflects an advancement of the software, with a transition from ESRI's Classic Story Maps to ArcGIS StoryMaps. Updating the tools and the format of the modules allows for continued ease of use by educators and a safeguard against deprecation as NOAA continues to bridge the "last mile" between open data and the classroom.

About the Scholar

Aurora Baker is from St. Louis, Missouri and is a rising senior at The University of Alabama, Tuscaloosa. She is an Environmental Science major with minors in Spanish and Geographic Information Systems (GIS). She is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to pursue a career that uses GIS to address environmental issues and increase public science literacy. She is a NOAA Ernest F. Hollings Class of 2023 scholar and is currently updating NOAA's Data in the Classroom (DITC) modules and developing maps for a module focused on urban heat islands (UHI). Striving to increase scientific knowledge and comprehension in the U.S., Aurora is excited to combine her interests in GIS with the development of data-driven resources for educators.

Jackson Boyle

Engaging Diverse Communities in Recovery of ESA-Listed Rockfish through Summer Camp and Translating a Kid's Book

NOAA Mission Goal: Engagement Enterprise
Mentors: Dayv Lowry and Grace Ferrara
National Marine Fisheries Service (NMFS)/Protected Resources Division, West Coast Region
National Oceanic and Atmospheric Administration (NOAA)

Yelloweye Rockfish and Bocaccio are two unique and critical species within the food web of Puget Sound. Since the 1970s, however, their populations have declined dramatically due to overfishing and environmental degradation. In 2010, the Puget Sound Distinct Population Segments of Yelloweye Rockfish and Bocaccio were listed as threatened and endangered, respectively. A major component of their recovery plan includes education and outreach so that conservation measures are supported throughout the decades-long process. Given the slow maturity and recovery of rockfish populations, particular emphasis has been placed on outreach to children so that future generations will continue to manage populations, and eventually fisheries, sustainably. One element of this outreach consisted of hosting students from NOAA Science Camp to teach them about the importance of rockfish, how population size and trend are determined, and how we can protect them. Another major aspect of this outreach campaign was a rockfish children's book, which was completed in 2020. To improve accessibility and engagement with diverse communities, we translated the book into Spanish. The translation was then workshopped with several native Spanish speakers within NOAA. The process developed here will set the stage for future translations into tribal, and other, languages spoken in the Puget Sound region. These efforts received lots of positive feedback from both collaborators and participants, suggesting that this focus on engaging diverse groups in conservation efforts is key to sustainable, long-term recovery.

About the Scholar

Jackson Boyle is from Bellingham, Washington and is a rising senior at Gettysburg College where he is majoring in Environmental Studies and Public Policy with a minor in Data Science. He is expected to graduate in spring 2025. As a 2023 NOAA Ernest F. Hollings Scholar, Jackson is interning within the Seattle Protected Resources Division on a project to increase public engagement with the recovery of ESA-listed rockfish in Puget Sound. Looking forward, he hopes to pursue a career that combines his interest in GIS, environmental management, and science communication to promote effective and sustainable policies.

Audrey Brandt

Relating Education and Outreach Initiatives to Resource Protection Issues at Monterey Bay National Marine Sanctuary

NOAA Mission Goal: Engagement Enterprise
Mentor: Lisa Uttal
National Ocean Service/Office of National Marine Sanctuaries/Monterey Bay National Marine Sanctuary
National Oceanic and Atmospheric Administration (NOAA)

Audience-appropriate education and outreach programs are integral to engaging the public in stewardship of our nation's National Marine Sanctuary System. The Office of National Marine Sanctuaries and Monterey Bay National Marine Sanctuary are committed to promoting support for the sanctuary system, ocean literacy, and conservation ethics through targeted outreach efforts. To fulfill this mission, I coordinated Monterey Bay National Marine Sanctuary's 2024 Pride Paddle, Recreational Fishing Charter, and Get in Your Sanctuary events. By reaching out to LGBTQ+ community members through the Pride Paddle and active-duty military families through the Recreational Fishing Charter, I promoted sanctuary priority goals to diversify engagement efforts by targeting historically underserved communities. These events encourage sustainable tourism by enhancing public awareness of the intrinsic, recreational, and economic benefits of healthy marine ecosystems. In coordinating these events, I created relevant educational messaging linking wildlife viewing and recreational fishing to organizational resource protection issues. I worked with partner organizations to plan and execute event details, create advertising materials and social media promotional content, and deliver advertising materials to target audiences. My work supports scientific findings and NOAA policy that reflect the importance of tailoring education and outreach efforts to a target audience to effectively promote key organizational ideas.

About the Scholar

Audrey Brandt is from Tampa, Florida and is a rising senior at the University of South Florida, St. Petersburg. They are pursuing a Bachelor of Science in Marine Biology and minoring in Anthropology with an expected graduation date of Spring 2025. Audrey is a NOAA Ernest F. Hollings Class of 2023 scholar. They are interested in studying the relationship between coastal communities and the ocean around them, particularly through education and outreach to encourage interest in environmental stewardship. Audrey's Hollings internship focused on planning education and outreach events at the Monterey Bay National Marine Sanctuary. They hope to continue to combine their interests in marine science, art, and anthropology to work on professional projects that encourage community collaboration, environmental stewardship, and climate resilience.

Jenna Callan

Citizen Science in Monterey Bay National Marine Sanctuary

NOAA Mission Goal: Engagement Enterprise
Mentor: Lisa Uttal
National Ocean Service/Office of National Marine Sanctuaries/Monterey Bay National Marine Sanctuary
National Oceanic and Atmospheric Administration (NOAA)

During Jenna Callan's summer internship, she coordinated Team OCEAN, a Monterey Bay National Marine Sanctuary (MBNMS) volunteer-based program. Team OCEAN is an on-the-water kayak-based program where MBNMS staff and volunteers kayak in two high-traffic sanctuary locations, Elkhorn Slough, Moss Landing, and Cannery Row, Monterey, California. While on the water, Team OCEAN members report and prevent wildlife disturbances while educating the public about the sanctuary and responsible animal viewing. Before her internship, Team OCEAN lacked a full-time program organizer and did not have enough volunteers for the shifts on the water. Jenna filled the role of program coordinator and ensured shifts were filled by kayaking several times a week. She increased the program's capacity and productivity by becoming a staff lead on the water, expanding public engagement, and designing a document to establish Team OCEAN as a citizen science program under NOAA's guidelines. Jenna contributed to the MBNMS goal to protect wildlife by educating the public about the sanctuary's history and its animals protected under NOAA's 1972 Marine Mammal Protection Act, including harbor seals, sea lions, and sea otters. She also increased outreach efforts by developing and pitching a web story for the Office of National Marine Sanctuaries to raise awareness about Team OCEAN, increase public engagement through volunteering, and inform the public of actions they can take to protect the sanctuary's wildlife. In the future, Jenna suggests that Team OCEAN should be expanded beyond its two current locations to increase wildlife protection and public engagement with MBNMS.

About the Scholar

Jenna Callan is from Ellensburg, Washington, and she is a rising senior at the University of Washington majoring in marine biology with a minor in quantitative science. She is expected to graduate in the spring of 2025 and is a NOAA Ernest F. Hollings Class of 2023 Scholar. After graduation, she plans to conduct field research and eventually attend graduate school. She is eager to apply her knowledge of marine biology within her Hollings project, which includes coordination of the citizen science program Team OCEAN in Monterey Bay National Marine Sanctuary. Jenna is also working on the water with Team OCEAN to protect wildlife and educate visitors about the sanctuary's organisms. Jenna is passionate about marine conservation and plans to combine her interests in quantitative science, marine biology, and community engagement in the future by conducting research and outreach within coastal communities.

MaKenna Collins

Conversations on the Current State of Heat Awareness in Jackson, Mississippi: Exploring Heat Vulnerability in the "City with Soul"

NOAA Mission Goal: Engagement Enterprise
Mentors: Susan Cobb and Eric Hackathorn
Oceanic and Atmospheric Research (OAR)/Global Systems Laboratory (GSL)
National Oceanic and Atmospheric Administration (NOAA)

Extreme heat is the leading cause of weather-related deaths in the United States, and conditions in Jackson Mississippi make residents more vulnerable to the impacts of extreme heat. Understanding the effects of extreme heat requires taking a look beyond meteorological data and toward the historical and socioeconomic data that shapes the "City with Soul" today. Jackson's roots are planted deeply in early America with Native American displacement and continued to grow during the Civil Rights Era and beyond. This study aims to analyze the interconnectivity of historical, social, and environmental factors in the case of extreme heat in Jackson, Mississippi. Through qualitative research methods, including interviews with Jacksonians aged 60 and above and respected city leaders, we identified key themes and insights that we hope will inform official heat mitigation and preparedness plans to protect residents' lives and property. Our results indicate the need for further education on extreme heat, equitable resource allocation, and increased city support during extreme heat events. Integrating these findings into official practices ensures that recommendations are accurately tailored for Jackson residents, ensuring a safer future.

About the Scholar

MaKenna Collins is a rising senior at Jackson State University, pursuing a B.S. in Earth System Science with a minor in Sociology. Passionate about research to operations, MaKenna has gained hands-on experience through roles such as an Undergraduate Research Student at her university and as a scholar in the NOAA Educational Partnership Program with Minority Serving Institutions Class of 2023. MaKenna is dedicated to applying her knowledge in Earth Systems Science and Sociology to make meaningful contributions to scientific and community goals. She is set to graduate in Spring 2025 and aspires to continue her education by earning a PhD.

Amy Deatherage

Improving Access to Sea Grant's STEM Educational Material

NOAA Mission Goal: Engagement Enterprise
Mentors: Amara Davis and Jessica Dupree
Oceanic and Atmospheric Research (OAR)/National Sea Grant Office
National Oceanic and Atmospheric Administration (NOAA)

Sea Grant aims to enhance marine education across America, which includes increasing educators' access to high-quality and credible marine education material. As part of this effort, Sea Grant is using the Teachers Pay Teachers (TPT) platform to increase access to educational materials created by Sea Grant programs. The focus of this project is to improve and examine educator engagement with Sea Grant's lesson plans, worksheets, and lab activities on TPT. Our approach involved interviewing educators across the country to understand their lesson planning process, the specific information they seek when searching for educational materials online, and whether they use TPT. We also reviewed high-performing TPT posts to identify strategies for maximizing visibility. Based on this research, we created ten TPT posts featuring educational materials from Sea Grant programs, including Delaware Sea Grant, MIT Sea Grant, and Ohio Sea Grant. Additionally, we developed a policy recommendation outlining best practices for TPT. Furthermore, we crafted social media posts to raise awareness of the Sea Grant TPT and its available resources. Through these initiatives, our goal is to ensure that educational materials developed by Sea Grant programs are easily accessible to educators now and in the future. Eventually, we hope to expand this approach beyond Sea Grant into the wider NOAA education sphere.

About the Scholar

Amy Deatherage is from Los Altos, California and is a rising junior at the University of Hawai'i at Manoa majoring in Global Environmental Science with a minor in Anthropology, under the Honors Program. She is expected to graduate in May 2026 with a Bachelor of Science and is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar. This summer, Amy interned at the National Sea Grant Office where her project focused on improving educator's access to K-12 educational material created by Sea Grant programs. Amy's career aspirations include joining ongoing efforts in conservation biology, particularly on the harmonious reintegration of humans and the natural world, which aligns with NOAA's mission of environmental stewardship. Looking ahead, Amy would like to work at NOAA or similar organizations that can provide unique opportunities and resources to meaningfully engage both locally and nationally towards this effort.

Allison Hartwell

Trash in Bird Nests…NERR or Far: Commonalities of Anthropogenic Material Found in Bird Nests at the Delaware National Estuarine Research Reserve (DNERR)

NOAA Mission Goal: Engagement Enterprise
Mentors: Christina Whiteman and Laurel Sullivan
Department of Natural Resources and Environmental Control (DNREC)
National Ocean Service (NOS)
National Oceanic and Atmospheric Administration (NOAA)

As more avian species adapt to their changing environments, the techniques used in nest construction can give insight to how they are using materials from their local environment, including anthropogenic debris. Studies have presented many different findings to the impact of anthropogenic debris in nests, and many are conflicting as to whether they have become beneficial or detrimental to the productivity and mortality of the nest. Through this project at the Delaware National Estuarine Research Reserve, we test the claim that the local environment can determine materials used in avian nest construction; therefore, avian nests located closer to the source of anthropogenic pollution will have a higher composition of unnatural debris. During the leaf-off period, 73 nests comprising of 10 different species were collected. This was followed by a thorough deconstruction of each nest for data collection of any "trash" found. 29 of the 73 nests (39.7%) collected contained anthropogenic material ranging from .5 cm to over 1m in length. 79.3% of all nests with debris were in residential cover or cropland habitats. For future research and management, this project demonstrates methods of analysis as it relates to habitat use and avian species.

About the Scholar

Allison Hartwell is from Indianapolis, Indiana and a rising senior at Colorado State University. She is majoring in fish, wildlife, and conservation biology with a minor in statistics, and is expected to graduate with her Bachelor's degree in Spring 2025. Allison plans to continue her education by obtaining a masters and/or doctorate in population ecology. She discovered her interest in coastal ecosystems during her undergraduate experience and has since pursued this field as a potential career. She is a NOAA Ernest F. Hollings Class of 2023 scholar and hopes to gain more experience and understanding of marine and coastal systems. As her studies continue with human impacts to coastal wildlife and their ecosystems, Allison hopes to perform research of populations under threat from climate change or other anthropogenic harms to aid in the understanding and better conservation of these species.

Leah Henseler

Scientist Academy: Exploring Maui's Ecosystems by Stepping into The Shoes of Researchers

NOAA Mission Goal: Engagement Enterprise
Mentor: Patty Miller
National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

This project focused on developing educational programming for the Hawaiian Humpback Whale National Marine Sanctuary in Maui, Hawaii, to engage students in science through hands-on activities called the *Scientist Academy*. The objective is to provide students with practical experience using the tools and techniques employed by real scientists every day. This project's final goal is to foster a deeper understanding and excitement for scientific inquiry and conservation. Key activities in the Scientist Academy include tagging turtles to learn about migration patterns, constructing and surveying dunes, and conducting water quality testing. These activities are designed to illustrate the interconnectedness of Maui's ecosystem and the critical importance of its conservation. A separate activity includes practicing whale disentanglement using grappling hooks and cutting tools to step into the role of a whale entanglement specialist. This educational program differs from traditional classroom learning by emphasizing experiential learning and active participation in field research. This approach aims to enhance students' comprehension of ecological relationships and environmental stewardship. Students who participated in the program demonstrated increased interest in environmental science and a greater appreciation for the complexity of marine ecosystems. In conclusion, this interactive education project not only informs students about marine biology and environmental science but also instills a sense of initiative and responsibility toward ecosystem preservation. Future recommendations include expanding the program to include additional scientific techniques and further integrating technological tools to enhance the connection between classroom learning and hands-on science.

About the Scholar

Leah Henseler is from Ithaca, NY. She is a rising senior at the University of Miami double majoring in Marine Affairs and Studio Art with a minor in Latin American Studies. She is expecting to graduate with her Bachelor's Degree in Fall 2024 and hopes to continue her education in marine science and design abroad in the coming years. Leah is a NOAA Ernest F. Hollings Class of 2023 scholar currently developing education activities that have students use real research techniques to understand the connected Maui ecosystem. She aspires to practice art that creates environmental change and use the environment to inspire artistic change. It is Leah's professional goal to combine her interests in design and marine science to create interdisciplinary and effective conservation efforts that protect our environment for years to come.

Mehana Leafchild

Scientific Storytelling

NOAA Mission Goal: Engagement Enterprise
Mentors: Stori Oates and Angela Doroff
National Marine Fisheries Service (NMFS)
National Oceanic and Atmospheric Administration (NOAA)

Over the summer, I had the opportunity to engage in and conduct science communication work, an essential yet often overlooked aspect of scientific research. My efforts spanned various media, including the creation of infographics and videos, demonstrating the diverse avenues available for communicating scientific knowledge. Engaging and informing the community is a fundamental pillar of NOAA's mission, reflecting its role as a federal agency dedicated to serving the public. Creating outreach education for some of the main projects Auke Bay Laboratories works on is not only important for tours of the lab but also for community events like STEAM(Science Technology, and Engineering) night. Educating young scientists in the community on how NOAA science impacts their community is critical in ensuring the future success of this lab and its mission. In my role, I undertook essential tasks such as sending emails, meeting with scientists, meeting with the community, giving tours of the lab facilities, and participating in research projects. These activities allowed me to gather comprehensive information on various research initiatives within southeast Alaska. Subsequently, I translated this information into various media formats, including videos, hands-on learning tools, and infographics, to effectively communicate complex scientific concepts to a broader audience.

About the Scholar

Mehana Leafchild is an accomplished Environmental Science undergraduate at Chaminade University of Honolulu, following her graduation from Punahou High School. With a profound dedication to the conservation of endangered marine species, Mehana aspires to pursue a Ph.D. in this field and ultimately lead as a head scientist in an endangered species laboratory. Over the summer, Mehana undertook a significant project focused on enhancing the communication of scientific information through storytelling at the Ted Stevens Marine Research Institute. Recognizing the complexities of Western science and its often limited accessibility to the general public, she explored innovative methods to bridge the gap between scientists and communities. Her work emphasized the integration of cultural ties and local knowledge to foster more meaningful and effective science communication.

Natalie Machado

Communicating fire weather research to policymakers and the public

NOAA Mission Goal: Engagement Enterprise
Mentors: Susan Cobb and Eric Hackathorn
Oceanic and Atmospheric Research/Global Systems Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Between 2020 and 2023, over 27.5 million acres of land was burned by wildfires across the United States and led to environmental, economic and social devastation. To assist in combating the impacts of wildfires, the National Oceanic and Atmospheric Administration (NOAA) has received and utilized $100 million in funding from the Bipartisan Infrastructure Law (BIL). Now, with multiple projects funded by the BIL seeing successes, NOAA Global Systems Laboratory has invested in a concentrated effort to communicate these successes to different audiences. The culmination of the effort, this communication project visualizes and communicates wildfire impacts, research accomplishments, and continued research gaps in multimedia format to the public and policymakers. The result of this project is the creation of both an ArcGIS Story Map and NOAA Explainer detailing the progress NOAA GSL and partners have made on decreasing wildfire impacts using BIL funding and where research could continue from its current state, using the 2024 Smokehouse Creek Fire as context. Overall, if we want people, whether or not they are holding a public office, to understand the need for NOAA fire weather research, we must effectively communicate the impacts of our research in a variety of formats.

About the Scholar

Natalie Machado is from Long Island, New York and is a rising senior at the University of Oklahoma. There, she is majoring in environmental sustainability (planning and management concentration) with minors in meteorology and professional writing. She expects to graduate in May 2025, but is currently undecided of her post-graduation plans. Natalie is a NOAA Ernest F. Hollings Class of 2023 scholar interning at the Global Systems Laboratory in Boulder, Colorado. Her project for the summer focuses on communicating fire weather and related research to policymakers and the public. Natalie's biggest passion is writing, and she hopes to one day use this passion to push the idea of what science communication looks like and better connect people to the many stories that can be found in the natural world.

Sofia Nuri

From Soundwaves to Sea-Ways: Interactive Exploration of Humpback Whale Migration and Song

NOAA Mission Goal: Engagement Enterprise
Mentor: Patty Miller
National Ocean Service (NOS)
National Oceanic and Atmospheric Association (NOAA)

This project is an educational activity. Effective science communication and outreach are crucial for raising awareness about environmental issues and inspiring the next generation of scientists. The complexities of humpback whale migration and song can pose significant challenges to public understanding. To address this, two educational tools were developed to simplify these concepts for a broader audience. The first tool is a board game that simulates the migration and development of humpback whales. Players begin as baby whales and navigate their journey to adulthood, encountering both triumphs, such as learning to breach, and challenges it may face, such as entanglement in fishing gear. This game accurately represents the migratory journey of humpback whales and incorporates periodic quizzes to enhance information retention. The second tool is a digital spot-the-difference game that immerses players in the role of marine acoustic scientists. Players analyze whale songs by identifying differences between two spectrograms, providing insight into the acoustic research conducted at the Humpback Whale Sanctuary. These tools will hopefully improve public understanding and appreciation of humpback whale behavior and conservation efforts.

About the Scholar

Sofia Nuri, from Washington, DC, is a rising senior at Brown University, majoring in Environmental Science, and a NOAA Ernest F. Hollings Class of 2023 scholar. She will graduate with her Bachelor's degree in Spring 2025 and aims to pursue a Ph.D. in marine sciences starting Fall 2026. Sofia has spent two summers at the Smithsonian National Museum of Natural History learning DNA sequencing and scanning electron microscopy, and another summer at the Carnegie Institute for Science working on protein purification and transforming bacteria. At Brown, Sofia is a member of the marine biology lab, assisting with organism identification and measuring fish biodiversity in the Galapagos. Currently, she is interning at the NOAA Hawai'i Humpback Whale Sanctuary in Maui, developing educational tools about humpback whale migration and songs. Sofia aspires to work for NOAA as a marine scientist, merging her interests in marine biology and forensic science to protect our oceans.

Benjamin Theunissen

Riding Giants: The Science Behind Big Wave Surfing

NOAA Mission Goal: Engagement Enterprise
Mentor: Leon Geschwind
Office of the Chief Administrative Officer
National Oceanic and Atmospheric Administration (NOAA)

This project aims to bridge the Pacific Integrated Ocean Observing System (PacIOOS) and NOAA's Science on a Sphere (SOS), enhancing the educational potential of both platforms. PacIOOS Voyager is an interactive online mapping platform for visualizing and downloading oceanographic and geospatial data related to the marine environment in the Pacific Islands. Science on a Sphere (SOS) is a 6-foot diameter global display with over 170 locations worldwide. PacIOOS offers unique datasets, notably wave data, not yet available on SOS. In this project I demonstrate how this data can be used to forecast big swell events for the North Shore of Oahu with relation to the Eddie Aikau, the pioneering big wave surfing contest. Using Python, I accessed data from PacIOOS and then created images compatible with the SOS system, employing data visualization libraries such as Matplotlib and Cartopy. I incorporate four different datasets—three from PacIOOS and one directly from the SOS library—to walk the audience through how forecasters decide whether the contest will run. As I learned to work with these two systems, I developed a Standard Operating Procedure (SOP) to instruct future developers, regardless of their experience with Python, on effectively creating visualizations on SOS using PacIOOS data. By the end of this internship I will add a playlist to the SOS database describing the science behind big wave surfing and add two real-time datasets to the SOS database: wave height and wave period, paving the way for other educators to contribute their ideas to this ever-growing platform.

About the Scholar

Benjamin Theunissen is a NOAA Ernest F. Hollings Class of 2023 scholar from Berkeley California. He will be entering his fourth year as an applied physics major at University California Santa Cruz. Expecting to graduate in June 2025 Benjamin hopes to continue and seek higher education in condensed matter physics. With the urgent issue of global warming Benjamin feels that the interface between research and the general public is key to catalyze the implementation of effective climate solutions. In his internship in Honolulu, HI Benjamin works to make data from PacIOOS, an interactive online mapping platform, more accessible by visualizing it on Science on a Sphere, a room-sized global display system and one of NOAA’s primary tools for outreach. Working for NOAA for Benjamin would mean to continue to excite young students about the environment and raise climate awareness throughout the country.

Ainsley Vanderhyde

Analysis of Meaningful Engagement Among Sea Grant's BIL/IRA Funded Marine Debris Projects

NOAA Mission Goal: Engagement Enterprise
Mentors: Amara Davis and Madison Willert
Oceanic and Atmospheric Research/National Sea Grant Office
National Oceanic and Atmospheric Administration (NOAA)

Marine debris is a significant and ongoing pollution issue. Sea Grant is addressing this challenge through two federally funded initiatives supported by the Bipartisan Infrastructure Law and Inflation Reduction Act. The Marine Debris Challenge (CHX) and Marine Debris Community Action Coalition (CAC) competitions are aimed at preventing and removing marine debris. The CAC places particular emphasis on meaningful engagement with underserved communities that have historically been exposed to pollution, specifically on Justice40 communities. The National Sea Grant Office is seeking to examine the concept of meaningful engagement within their fiscal year (FY) 22/23 funded projects and their future projects funded for FY 24/25. A preliminary policy analysis was conducted to statistically assess whether projects selected for funding demonstrated significantly higher meaningful community engagement, diversity, and outreach. A set of criteria for meaningful engagement was established based on common engagement practices within the funded projects for FY 22/23. A more detailed policy analysis was then carried out to assess meaningful community engagement within funded and unfunded CAC projects for FY 22/23, as well as funded CAC projects for FY 24/25. A second analysis was conducted to assess the extent of meaningful community engagement in FY 22/23 and FY 24/25 funded CHX projects. Preliminary analysis of FY 22/23 funded and unfunded CAC projects found that projects selected for Sea Grant funding scored significantly higher in community engagement and outreach. Results of the detailed analysis for CAC and CHX, as well as policy recommendations for future community engagement, are forthcoming.

About the Scholar

Ainsley Vanderhyde is from Flint, Michigan and is a driven rising junior at Barry University in Miami Shores, Florida. Pursuing a Bachelor's degree in Marine Biology with an anticipated graduation in Spring 2026, she aims to further her studies in Environmental Law. Ainsley is a member of the NOAA EPP/MSI Class of 2024 Undergraduate Scholars. Currently, she is immersed in a dynamic role at the National Sea Grant office, where she dedicates her summer to analyzing meaningful community engagement strategies among Sea Grant's Bipartisan Infrastructure Law and Inflation Reduction Act (BIL/IRA) funded marine debris projects. Ainsley's fusion of marine biology and policy bolsters her aspiration to contribute to NOAA's mission in the long run.

Allison Yamakawa

Waves of Innovation: Redesigning an Interactive Tsunami Simulator Exhibit

NOAA Mission Goal: Engagement Enterprise
Mentors: Leon Geschwind, Cindi Preller, and Nathan Becker
Office of the Chief Administrative Officer and National Weather Service/Pacific Tsunami Warning Center
National Oceanic and Atmospheric Administration (NOAA)

Tsunamis, despite claiming over 260,000 lives in the past century, are one of the most overlooked topics in natural disaster education. Although they can strike any coast at any time, the infrequent nature of tsunamis have left communities worldwide with a false sense of security, leaving people severely undereducated about their danger. Proper tsunami education is essential for saving lives, prompting the creation of more tsunami-related educational tools. The development of two new tsunami simulator exhibits, located in the Pacific Tsunami Museum in Hilo, Hawai‘i, and the Inouye Regional Center in O‘ahu, Hawai‘i, will provide critical tsunami education through a series of decision-based scenarios. The exhibit offers users the opportunity to step into the role of an everyday citizen, an emergency management specialist, or a tsunami scientist. This experience teaches users how to protect themselves during a tsunami, while fostering an understanding of the collaborative efforts that go into saving lives during a tsunami event. The exhibit additionally offers a unique interactive element where users can generate an earthquake with a location and magnitude of their choosing. This user-generated earthquake is then implemented into the various scenarios. Although it was developed as a permanent exhibit, the tsunami simulator can function independently on any computer regardless of internet connectivity. This portability allows it to be used in classrooms, on the go, and anywhere in the world. With this capability, life-saving tsunami information can reach as many people as possible.

About the Scholar

Allison Yamakawa is from Mililani, Hawai‘i, and is a rising senior at the University of Hawai‘i at Mānoa, majoring in Earth Science with a certificate in Geospatial Information Science. She is expected to graduate with her Bachelor’s degree in Spring 2025, and aspires to pursue a career in natural disaster prevention or environmental conservation shortly after graduation. As a NOAA Ernest F. Hollings Class of 2023 scholar, Allison completely redesigned a tsunami simulator located in the Pacific Tsunami Museum. With this project, she was able to use her knowledge of earth science to educate others about the dangers of tsunamis as well as build new skills, such as design, coding, and circuitry. Because of NOAA’s mission to invest in science, service, and stewardship, it is Allison‘s professional aspiration to work for NOAA in the future. She strives to contribute to the education of communities around the world and the protection of our environment.

Healthy Oceans

Top left: Sadie Gardiner, *Hollings '23*. Top right: Lalah Choice, *EPP/MSI '23* | Bottom: Kelley Strike , *Hollings '23*.

Esther Adelson

Validation of Marine Carbon Measurements

NOAA Mission Goal: Healthy Oceans
Mentors: Evan Howard and Adrienne J. Sutton
Catherine Redpath, Chris Ikeda (CICOES)
Anthony Canalungo (Ebb Carbon)
Oceanic and Atmospheric Research/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Total alkalinity is a parameter of the aquatic inorganic carbon system and, if known, along with one of the other three parameters, pH, dissolved inorganic carbon, and partial pressure of carbon dioxide, the other two can be determined. Measuring total alkalinity helps with measurement and mitigation of ocean acidification as total alkalinity values are crucial for tracking carbon dioxide sequestration within the ocean and assessing the efficacy of carbon dioxide removal systems. Traditionally, total alkalinity instruments are complex and require skilled operators making them difficult to implement. The system for total alkalinity which we tested was developed by Ebb Carbon to be less expensive, simpler to operate, and easier to deploy. It was compared to the validated system for total alkalinity measurement at Pacific Marine Environmental Laboratory (PMEL). The new system was qualitatively assessed for ease of set up, use, and quality of its procedures. Once it was set up and samples could be run it was evaluated for its bias and precision via comparison against the PMEL system. Preliminarily, the Ebb Carbon system has precision <10 μmol kg-1 and bias <5 μmol kg-1. It was found that the method for determining acid titrant concentration provides an incorrect value for acid concentration, introducing concerns about other system biases being introduced or overlooked. Presently the Ebb Carbon system is suitable for experimental analyses which are within the scope of the precision and bias, such as tracking large changes associated with marine carbon dioxide removal experiments.

About the Scholar

Esther Adelson is from Charleston, South Carolina and is a rising Senior at the University of South Carolina in Columbia with a double major in chemistry and mathematics. She is going to graduate with her bachelor's degree in Spring 2025 and will go on to pursue a PhD in chemistry following graduation. Esther is a NOAA Ernest F. Hollings Class of 2023 scholar and has spent her internship doing work examining the analytical chemistry and instrumentation behind ocean acidification measurement with the carbon group based at NOAA's Pacific Marine Environmental Laboratory in Seattle, Washington. For the higher degree she is mostly interested in research concerning inorganic or physical chemistry and increasing her knowledge and abilities as a research scientist. In the future she is interested in continuing to apply her chemistry and mathematical knowledge in interdisciplinary ways to increase scientific knowledge, help people, and protect the environment.

Ella Ashford

Developing Methodologies for Remotely Operated Vehicle Based Photogrammetry to Monitor Coral Reefs in National Marine Sanctuary of American Samoa

NOAA Mission Goals: Healthy Oceans
Mentors: Val Brown and Isabel Halatuituia
National Ocean Service/National Marine Sanctuary of American Samoa
National Oceanic and Atmospheric Administration (NOAA)

Mesophotic coral ecosystems are a significant component of the coral reef environments in the National Marine Sanctuary of American Samoa (NMSAS). Stretching from 30m to more than 100m deep, these ecosystems are poorly explored as divers must use highly specialized diving techniques to reach these depths. This study explored the viability of using a small Remotely Operated Vehicle (ROV) to create photogrammetry models with the goal of enabling NMSAS to more efficiently assess and monitor mesophotic coral reefs. In this study, shallow water photogrammetry models created from both ROV and diving methodologies were compared to evaluate the feasibility of ROV based photogrammetry. Additionally a NMSAS Standard Operating Procedure was developed inclusive of ROV operations, camera settings, and transect strategies. This exploratory field research indicates that ROV based photogrammetry could be a promising option for mesophotic coral reef monitoring in the sanctuary. Additionally, ROV technology can engage local communities in ocean stewardship through videos, 3D models, and hands-on education initiatives. In conclusion, a small ROV can be utilized as a lower-cost, more efficient, and safer method for both shallow and mesophotic coral reef monitoring in remote locations while also serving as an exciting science communication tool.

About the Scholar

Ella Ashford grew up in the Hawaiian islands but now calls Port Townsend, Washington home. She is a rising senior at Willamette University double majoring in Environmental Science and Archaeology with a focus on utilizing technology, such as Remotely Operated Vehicles (ROV), to aid scientific research. As a 2023 NOAA Ernest F. Hollings Scholar, Ella is interning at the National Marine Sanctuary of American Samoa, helping expand their ROV capabilities by developing ROV-based methodologies to categorize coral reefs and leading a ROV education workshop for teachers. Next, Ella plans to pursue her graduate degree in ocean science with career aspirations of working at a National Marine Sanctuary. Specifically, Ella is interested in understanding the ways that coastal regions and Pacific islands manage their marine and cultural resources while adapting to climate change with the goal of working towards a more sustainable, informed, and collaborative future in ocean stewardship.

Charles Azzarito

Freshwater Acidification Monitoring in Thunder Bay National Marine Sanctuary: Expanding and Implementing Environmental Stewardship on a Community Level

NOAA Mission Goal: Healthy Oceans
Mentors: Stephanie Gandulla and Reagan Errera
Oceanic and Atmospheric Research/Great Lakes Environmental Research
National Ocean Service/Office of National Marine Sanctuaries Laboratory
National Oceanic and Atmospheric Administration (NOAA)

NOAA's Ocean Acidification Program has studied the impacts of increased carbon gas emissions on the ocean's pH levels. OAP has explored how ocean acidification impacts coastal communities, fisheries, and weather patterns across the United States and its territories. However, little research has been done into the impacts of excess gas emissions on the Great Lakes system, the world's largest freshwater resource. Thunder Bay National Marine Sanctuary (TBNMS) oversees 448 square miles of Lake Huron, protecting one of the United States most preserved and nationally-significant collections of shipwrecks. In cooperation with the Great Lakes Environmental Research Laboratory (GLERL), TBNMS is in its third year of a pilot study establishing baseline data on the acidification of Lake Huron. TBNMS collects water samples off of its various shipwreck sites, which have fixed coordinates and can be regularly monitored due to TBNMS' Mooring Buoys. NOAA Divers collect samples at depth for the deeper shipwrecks. These samples are then transported to the GLERL and processed further for reporting. Understanding the extent of acidification in the Great Lakes system is critical to mitigating the impacts of Climate Change, building community resilience, and maintaining the health of the largest freshwater resources in the United States. TBNMS is working to expand this project through community involvement, public outreach, and by cooperating with the new National Marine Sanctuaries of the Great Lakes system.

About the Scholar

Charles "Charlie" Azzarito is from Ft. Lauderdale, Florida and is a rising senior at Florida State University. He is expected to graduate in May 2025 with a Bachelor's degree in Anthropology and Sociology, minoring in Religion and Law & Philosophy respectively. Charlie is a NOAA Ernest F. Hollings Scholar in the Class of 2024 and is working towards a career in underwater archaeology, studying Indigenous ecological knowledge and human adaptation to climate change. For his internship assignment, Charlie is monitoring the acidification of Lake Huron using shipwreck sites at the Thunder Bay National Marine Sanctuary. After graduating, Charlie will be pursuing both a Juris Doctor and a Masters degree in archaeology allowing him to combine his interests in archaeology and environmental policy. Professionally, Charlie aspires to work for a conservation agency, partnering with Indigenous tribes and advocacy groups in climate adaptation efforts.

Ellie Barkyoumb

Dissolved Gasses in Newly Discovered Mid-Atlantic Ridge Hydrothermal Vent Systems

NOAA Mission Goal: Healthy Oceans
Mentors: Tamara Baumberger and Anson Antriasian
Oceanic and Atmospheric Research/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

The Mid-Atlantic Ridge is a unique setting that hosts a diversity of hydrothermal systems. In 2023, three new hydrothermal vent fields were discovered along the Mid-Atlantic Ridge between 20 and 25 °N. Puy de Folles, which is characterized by high magmatic activity, as well as Falkor-EMARK and Hydra, which are both located off-axis in close proximity to an oceanic core complex (OCC). These vent fields were studied to improve the understanding of the biogeochemistry of hydrothermal vents located at OCCs. Hydrothermal plume samples were collected from a CTD/rosette package and sealed in copper tubes. They were subsequently processed in an onshore laboratory on a high-vacuum extraction line and analyzed on a 21-cm-radius, dual-collector, sector-type mass spectrometer to determine the helium isotope composition. Methane and hydrogen concentrations were determined at sea by gas chromatography. Puy de Folles has the highest concentrations of helium of the three sites visited, indicating that the system is basalt-hosted and influenced by magmatic outgassing. Hydra and Falkor-EMARK are similar to each other in that they have lower amounts of helium than the Puy de Folles vent system but large amounts of hydrogen that indicate ultramafic influences and water-rock interactions in exposed mantle. Hydrothermal vents play a key role in providing energy sources for chemosynthetic organisms that are the foundation of delicate ecosystems and contribute to a healthy ocean. Understanding hydrothermal activity at the Mid-Atlantic Ridge is essential to conserve these ecosystems as interest in deep-sea mining continues to increase and regulatory policies are developed.

About the Scholar

Ellie Barkyoumb was born and raised in Silver Spring, Maryland. They are currently a rising senior at the University of Miami double majoring in Marine Science and Geological Sciences, expected to graduate and receive their bachelor's degree in Spring 2025. After graduating, they plan on pursuing a PhD in marine geosciences beginning in Fall 2025. Ellie is a NOAA Ernest F. Hollings Class of 2023 Scholar. Their internship at NOAA's Pacific Marine Environmental Laboratory (PMEL) focused on understanding fluid chemistry at hydrothermal vent systems, with an emphasis on measuring and analyzing Helium isotopes. The NOAA Hollings program allowed Ellie to broaden and deepen their understanding and passion for earth science and they hope to use the connections and knowledge in this experience to pursue their interests in understanding how geologic processes, ocean chemistry, and human activity are interconnected.

Olivia Berman

Comparing Species Assemblage and Habitat Use of Oyster Aquaculture Gear and Eelgrass Meadows

NOAA Mission Goal: Healthy Oceans
Mentors: Ashley Hamilton and Jamie Vaudrey
Office: National Ocean Service/Connecticut National Estuarine Research Reserve
National Oceanic and Atmospheric Administration (NOAA)

Eelgrass (*Zostera marina*) and the Eastern Oyster (*Crassostrea virginica*) are both vital marine species and each provide a number of important ecosystem services. Both previously in decline, efforts are underway to increase their abundance. In certain locations, evidence indicates the oyster aquaculture industry has improved water quality and in turn improved conditions for eelgrass. Eelgrass and oyster aquaculture require similar environmental conditions, potentially creating a resource conflict due to eelgrass being federally protected as Essential Fish Habitat, (EFH). This prohibits aquaculture gear and farming near eelgrass meadows. As the oyster aquaculture industry continues to grow, management decisions to protect both resources are needed. This field-based research study, located in Beebe Cove, Noank, CT, aims to quantify fish species and assemblages in these overlapping habitats. To achieve this, GoPro HERO12 cameras were placed in four treatments: (1) Elevated oyster bottom cages within eelgrass; (2) Eelgrass (no cages); (3) Elevated oyster bottom cages on bare sediment; and (4) Bare sediment (no cages). Video was analyzed for species presence and biodiversity metrics were calculated. Preliminary results show that the structural features of the gear attracts eelgrass fish species and reef dwelling species, such as Black Sea Bass, thereby diversifying the habitat in which it is located. This study contributes to a growing body of research highlighting that aquaculture gear enhances the surrounding environment

About the Scholar

Olivia Berman is from Los Angeles, California and is a rising senior at University of California, Santa Cruz majoring in Environmental Studies and Biology with a minor in Black Studies. She is expected to graduate with her Bachelor's degree in Spring 2025, and is enthusiastic to continue her education and obtain a Master’s degree in restoration ecology beginning Fall 2027. Olivia is a NOAA Ernest F. Hollings Class of 2023 scholar. She is excited to continue her studies of the relationship between humans and the environment as she hopes to find ways to restore habitats while also cultivating human connection back to the environment. As a restoration ecologist, working for NOAA is a dream for Olivia. With the intention to protect natural ecosystems, she hopes to bring together her interests of science and intersectionality to advocate for sustainable living integrated with nature for all communities of people.

Myah Bowie

Estimating fish abundances and relationship with habitat using baited remote underwater video surveys in the Biscayne Bay

NOAA Mission Goal: Healthy Oceans
Mentor: Joe Serafy
National Marine Fisheries Service/Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Baited Remote Underwater Video (BRUV) systems are a way to non-invasively monitor fish populations and their habitats. This study deployed four BRUVs in northern Biscayne Bay to estimate relative fish abundance, better understand fish-habitat relationships, and explore population dynamics within Miami, Florida. Complementary water quality measurements, comprising of surface temperature, salinity, and dissolved oxygen, were taken to contextualize these findings. Preliminary analyses from BRUVs in neighboring habitats revealed that fish abundance was highest in areas with more complex benthic relief, while habitats near human settlements showed reduced diversity and abundance. Water quality parameters were found to impact fish populations, with poor water quality such as low salinity, correlating with lower fish abundance and diversity. This study underscores the importance of healthy oceans and water quality in supporting marine biodiversity and informs conservation strategies for these vital ecosystems.

About the Scholar

Myah was born and raised in Washington DC but currently lives in Maryland. She is entering her junior year of undergrad at University of Maryland Eastern Shore (UMES) this fall. This summer she is working on a project estimating fish abundances and relationship with habitat using BRUVs in Biscayne Bay, Miami. She used baited cameras to record fish in the bay at randomly selected sites with varying habitat, to then analyze and calculate fish abundance. She hopes to continue doing field work and learn more about fish and their relationship to the world around them, as she wishes to do conservation work in the near future. She loves the sea and has a special place in her heart for sharks. She is excited to further her experience in research and eventually
build a career within NOAA.

Daryl Bullock

Bubbling Beneath the Waves: Exploring Habitats and Communities of Methane Seeps Along the U.S. Atlantic Margin

NOAA Mission Goal: Healthy Oceans
Mentors: Heather Coleman and Savannah Goode
National Marine Fisheries Service/Office of Habitat Conservation
National Oceanic and Atmospheric Administration (NOAA)

Methane seeps are a type of 'cold seep' where methane escapes from cracks in the ocean floor. These habitats are known in all major oceans and primarily occur in deep waters below the photic zone. In the absence of sunlight, methane forms the base of the food chain for chemosynthetic microbes such as bacteria. Over time, these microbes form calcium carbonate, which provides a hard substrate for attachment by other animals like clams and mussels, tubeworms, crustaceans, and deep-sea corals and sponges. These communities are ecologically significant because they provide habitat and may serve as nursing/breeding grounds for many fish, shark, ray, and octopus species. It is therefore important that we better understand where methane seeps occur and the composition of their biological communities. In support of this need, the purpose of this project was to analyze seafloor images taken from several known seep sites along the U.S. Atlantic margin to characterize the visible habitat and invertebrate communities. Seafloor images were collected with a remotely operated vehicle (ROV) aboard NOAA Ship *Okeanos Explorer* in 2018 and 2019. The habitat visualized in each image was categorized according to its dominant substrate (e.g., muddy sand, muddy sand with carbonate, muddy sand with mussel shells) and invertebrate fauna were identified and annotated using the online image annotation platform BIIGLE 2.0. Habitat and community structure were compared between seep sites to investigate the degree to which they differ along the U.S. Atlantic margin.

About the Scholar

Daryl Bullock is from Upper Marlboro, Maryland and is a rising junior at the University of Maryland Eastern Shore majoring in Environmental Science with a concentration in Marine Science. He is expected to graduate with his bachelor's degree in Spring 2026. Daryl is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar. Under the mentorship of Heather Coleman and Savannah Goode of the Office of Habitat Conservation, Daryl is currently analyzing remotely operated vehicles photos for habitat and aquatic life comparison in deep sea cold seeps along the U.S. Atlantic margin. In the future, Daryl hopes to study cetacean life or sea turtles in relation to their migration patterns, consumption rates, and experienced effects as a result of climate change and human interactions. Other career goals he has are to acquire a scuba diving license and become certified to take underwater photos.

Life in Plastic is Not Fantastic: An Analysis of Microplastics in Sediments in the Massachusetts Mystic River Estuary

Eve Butterworth

NOAA Mission Goal: Healthy Oceans
Mentor: Ashok Deshpande
Dan Brabander, Wellesley College
National Marine Fisheries Service/ James J Howard Marine Laboratory/Habitat Ecology Branch
National Oceanic and Atmospheric Administration (NOAA)

Estuaries are essential ecosystems for wildlife and important infrastructure and economic resources. Urban estuaries, in particular, are accumulation points for sediments and pollutants due to waste runoff, transportation, manufacturing, and storm surges. A growing concern in estuaries is the increase in microplastics, plastics smaller than 5 mm, a result of plastic waste breakdown. This project identified and analyzed microplastics and sediments from the Mystic River Estuary in Massachusetts and the upstream, nontidal Mystic River separated by the Earhart Dam. Three location types were studied: riverbanks, phragmites reed patches, and mudflats. Through field observation, larger microplastics (>1 mm) were primarily found in phragmites reed roots and along high tide lines where detritus collected the plastics. Smaller microplastics (<0.5 mm) were observed in all samples, differing in type and sorting, depending on location. For analysis, microplastics were separated from sediments, photographed, and identified by chemical composition using pyrolysis-GC-MS. Polyethylene and polypropylene were found to be the most common plastic types. This study also analyzed estuary sediments as they are a major reservoir for contaminants, such as mercury. In freshwater, mercury adsorbs onto plastic, however, research on mercury adsorption in saltwater is minimal and merits further investigation because of bioaccumulation concerns. Sediments and microplastics were assessed using a DMA-80 Mercury Analyzer. Mercury was found in microplastics and sediments, justifying future research on estuary contaminants and adsorption. Microplastics and mercury threaten estuaries' health, as plastic waste, urban flooding, and runoff continue to increase contaminant input, emphasizing the urgency for responsible estuary waste management.

About the Scholar

Eve Butterworth was raised in Boulder, Colorado, and now lives in Massachusetts. She is a rising senior at Wellesley College in Massachusetts, where she is majoring in geoscience with a focus on environmental geochemistry and minoring in mathematics. Eve will graduate with a Bachelor of Arts in 2025 and plans to pursue a doctoral degree in environmental biogeochemistry and anthropogenic contamination. Eve is passionate about environmental justice and community engagement in science. Eve is honored to be a 2023 NOAA Ernest F. Hollings scholar researching microplastics at the Sandy Hook, New Jersey, line office. Her research aims to understand how microplastics vary within an estuary system and to analyze their individual composition. In the future, Eve intends to combine her passions for environmental justice and chemistry to continue researching pollutant vectors in estuaries, using her findings to advocate for a cleaner and more just environment for nature and humans alike.

Diet study of Pacific Halibut (*Hippoglossus stenolepis*) in Homer, Alaska

Ainsley Cain

NOAA Mission Goal: Healthy Oceans
Mentors: Chris Kinkade and Lauren Sutton
National Oceanic Service (NOS)
National Oceanic and Atmospheric Administration (NOAA)

Fishing of Pacific Halibut, *Hippoglossus stenolepis*, has long been a source of tourism and a sustainable food source within Kachemak Bay, Alaska. Many fishermen take the opportunity to open the stomachs of halibut caught to modify lures based on what is present in the stomach contents. This has created a need within the community for diet analysis that spans multiple fishing seasons. Halibut are generally known as opportunistic feeders, feeding on a variety of benthic prey. This study seeks to determine if halibut are solely opportunistic feeders or if they have a preferred prey species. Additionally, this study investigates if fish consumption by halibut varies seasonally or annually within Kachemak Bay. Halibut stomach contents were collected at Homer Harbor fish cleaning stations from personal use and charter fishermen over peak fishing season and identified to the lowest possible taxonomic level. Halibut stomachs processed from 2022 and 2023 consumed a diet dominated by bony fish, such as sand lance and capelin, along with a low diversity of crab species. In 2024, however, halibut diets were largely composed of diverse crab taxa and fewer bony fish compared to previous years. These results may indicate changes in environmental drivers creating favorable crab habitat where there weren't favorable conditions before, or shifting migratory patterns of halibut due to these conditions. Potential future research includes investigating the drivers of halibut population shifts and crab population dynamics in Kachemak Bay.

About the Scholar

Ainsley Cain is from Goshen, Indiana and is a rising senior at University of South Carolina studying Marine Science with a concentration in biological oceanography and a minor in Studio Art. She is expected to graduate with her Bachelor’s degree in Spring 2025, and aims to continue her education further. She plans to obtain her Master’s degree in marine sciences or population genetics to study coral reef disease and genetics. Ainsley is a NOAA Ernest F. Hollings Class of 2023 scholar. She has spent her internship working on stomach content analysis to better understand ecosystem interactions, and how this can be used to educate on sustainable fishing practices. As a marine scientist, Ainsley aspires to work for NOAA or a state agency to help achieve her goal of conducting research to inform policy change and promote conservation and sustainability.

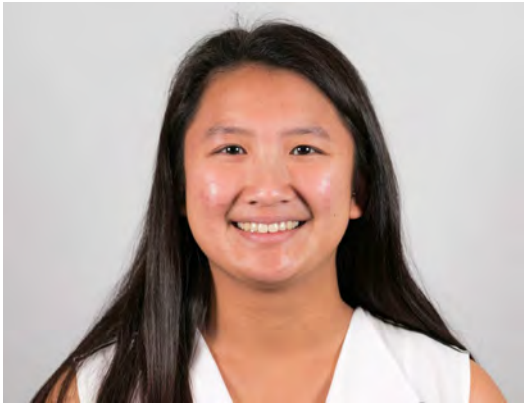
Christine Chan

Effects of Ocean Acidification and Increased Temperature on the Behavior and Physiology of the Sea Star *Evasterias troschelii*

NOAA Mission Goal: Healthy Oceans
Mentors: Chris Long and Emily Ryznar
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Rising levels of atmospheric CO_2 are lowering pH and increasing temperatures in oceans globally, causing concern with how marine species may be affected. The sea star *Evasterias troschelii* is a dominant consumer in sub- and intertidal ecosystems from California to Alaska. However, little is known about the combined effects of increased acidity and temperature on its physiology and behavior. To fill this gap, we conducted a full-factorial laboratory experiment where sea stars were kept in crossed pH (ambient and 7.5) and temperature (8^{o}C and 14^{o}C) treatments over a 37-day period. Feeding ration, growth, condition index, and respiration rate were measured. Foraging behavior was also observed. Preliminary results indicate both feeding ration and foraging behavior are affected by temperature, with sea stars in 14^{o}C treatments consuming more food and finding food faster than sea stars in the 8^{o}C treatments. However, lowered pH did not have a significant effect on feeding ration or foraging behavior, indicating that this species may be resilient in the face of ocean acidification to the pH that was used in this experiment. As an ectotherm, *E. troschelii* will need to consume more food to manage an increased metabolism under higher temperatures, which is supported by our results. Increased feeding with temperature from this predator species may have broader implications on predator-prey dynamics in its ecosystem as the oceans warm.

About the Scholar



Christine Chan is from Holly Springs, North Carolina. She is entering her senior year at East Carolina University as a double major in Biology and Environmental Studies, with a minor in Coastal and Marine Studies. She is expected to graduate in Spring 2025 and plans to spend some time working in the field before seeking a PhD program in marine science. Christine is eager to combine her passions for research and education to connect her work with her local community, spread awareness of environmental issues, and inspire future scientists. As a NOAA Ernest F. Hollings Class of 2023 Scholar, Christine conducted her internship at the Kodiak Fisheries Research Center studying the effects of ocean acidification and ocean warming on sea star physiology and behavior. She aims to continue investigating invertebrates' responses to environmental stressors and its broader implications for species interactions.

Julianne Chan

Development of Silicone Band Passive Sampler Rate Constants for Per- and Polyfluoroalkyl Substances (PFAS) for Use in Coastal Ecosystems

NOAA Mission Goal: Healthy Oceans
Mentors: Emily Pisarski and Dr. Ed Wirth
National Ocean Service/National Centers for Coastal Ocean Science
National Oceanic and Atmospheric Administration (NOAA)

Per- and polyfluoroalkyl substances (PFAS) are a complex group of anthropogenic fluorinated organic compounds used worldwide for consumer and industrial applications. Environmental monitoring for PFAS is vital due to the reported adverse health impacts on humans and ecosystems at very low concentrations. However, measuring PFAS in estuarine and coastal ecosystems has been limited relative to other efforts focused on terrestrial or freshwater systems. This study assessed the use of silicone band passive sampler devices as an easy and inexpensive sampling tool for determining the time-weighted average water concentration of select PFAS. Laboratory-based exposures were conducted over 21 days with various salinities (2, 10, 20, and 30 ppt). Data plots were used to identify and determine required rate constants (i.e., water sampling rate (R_s) and sampler partitioning coefficients (K_{pw}) to estimate water concentrations for eight PFAS (perfluorohexane sulfonic acid (PFHxS), perfluorohexanoic acid (PFHxA), perfluorobutanoic acid (PFBA), perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluoroundecanoic acid (PFUnA), and two fluorotelomer sulfonic acids (6:2 FTS, 8:2 FTS)). Results indicated that analytes reached equilibrium before the end of the experiment (21 days). Preliminary observations found that increases in salinity did not have an effect on time to equilibrium. The K_{pw} values were calculated using this information and statistical analysis is ongoing. These laboratory-derived K_{pw} values will be used to determine PFAS water-based concentrations for silicone bands that are deployed at 20 sites around Charleston Harbor on a seasonal basis and aid in future studies where silicone bands are used.

About the Scholar

Julianne Chan is from Manahawkin, New Jersey, and a rising senior at Rutgers University—New Brunswick, majoring in Environmental Engineering with a concentration in remediation. After she graduates with her Bachelor of Science degree in Spring 2025, Julianne plans to continue her studies by pursuing a Ph.D. in environmental engineering with a research focus on environmental chemistry and toxicology. Julianne is a NOAA Ernest F. Hollings Class of 2023 Scholar and a Goldwater and Udall Scholar, completing her internship at the Hollings Marine Laboratory in Charleston, South Carolina. Her research aims to calculate the partitioning rate of per- and poly-fluoroalkyl substances (PFAS) onto passive sampler devices (PSDs) used for environmental monitoring. This project ties into her research interests, which include the fate and transport of emerging organic contaminants. In the future, she plans to become a professor to motivate future water quality scientists and engineers.

Kayla Cheney

Green Crab (*Carcinus maenas*) Interactions and Ecosystem Effects of Blue Crabs (*Callinectes sapidus*) in the Gulf of Maine

NOAA Mission Goal: Healthy Oceans
Mentors: Chris Kinkade, Jason Goldstein, and Laura Crane
Wells National Estuarine Research Reserve
National Oceanic and Atmospheric Administration (NOAA)

The invasive European green crab has had a significant presence in coastal New England for >200 years. By contrast, blue crabs are a recent range-expanding species into the Gulf of Maine, raising questions of how they will interact with green crabs and affect local ecosystems. This project aims to answer these questions by (1) investigating green crab-blue crab interactions in a laboratory setting; and (2) piloting a mesocosm experiment evaluating the effects of blue crab presence on salt marsh pool communities. Crabs were sourced from Wells, ME and maintained in laboratory holding tanks. Individual green and blue crabs were paired in trial tanks (n=17) and time-lapse recorded for ~72 hours to analyze a suite of predatory and aggressive behaviors. Treatments included varying green:blue crab size proportions (30-80%) and the availability of alternate prey (blue mussels). Preliminary laboratory results suggest that blue crabs may prey on green crabs <50% their size; blue crabs prefer green crabs to mussels; and as green:blue crab size proportion increases, time until green crab capture also increases. The mesocosm experiment quantified species in two marsh pools before and after introducing a blue crab to one pool for 9 days. Results from the mesocosm experiment will demonstrate real-world effects of blue crab expansion into Maine's saltmarsh pools and help to predict the overall impacts of range-expanding blue crabs on established green crab populations in Maine estuaries. Overall, both studies may indicate that the expansion of blue crabs could result in changes in some invasive green crab populations.

About the Scholar

Kayla Cheney is from Frisco, Texas and is a rising senior at California State University, Long Beach majoring in marine biology. She is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to continue her education and obtain her PhD in marine biology beginning Fall 2025. Kayla is a NOAA Ernest F. Hollings Class of 2023 scholar currently studying the interactions between blue and green crabs. She is looking forward to continuing her study of elasmobranchs, with a focus on the effects of human activities and the continued study of their diet and movement patterns. As a marine biologist, providing higher education to other aspiring biologists at a university level and continuing her research career are Kayla's professional aspirations. She aspires to combine her interests in biology and chemistry to promote elasmobranch protections and awareness while also furthering the knowledge of elasmobranchs in the scientific community.

Lalah Choice

Performance Comparison of Two Heart Rate Sensor Types in Tagged American Lobster

NOAA Mission Goal: Healthy Oceans
Mentor: Andrij Horodysky
National Marine Fisheries Service/Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration

Managing living marine resources in the Anthropocene requires additional mechanistic insights into the metabolic responses and energetic consequences of environmental variation in decapod crustaceans. This includes, but is not limited to the investigation of responses in unstudied species, the consideration of additional environmental variables, and the development/testing of novel sensors and tagging technologies for such studies. The NOAA JJ Howard Marine Sciences Laboratory is combining metabolic experiments and telemetry to investigate the multistressor effects of temperature and CO_2 exposure on the standard and maximum metabolic rates, aerobic scope, and costs of transport of adult American lobster (Homarus americanus) to triangulate the relationship between heart rate, activity, and metabolism. Here, we compare the performance of two cardiac sensor types in biologgers that record electrocardiograms (ECG), tri-axial acceleration, and temperature in user-defined intervals. Specifically, we compare the single channel leadless ECG sensor of commercially available Star-Oddi DST milli HRT-ACT tags versus a custom-designed dual wire lead sensor model. Each DST milli logger takes burst measurements of temperature (5-45 C +/- 0.2), tri-axial acceleration (+/- 2 mg), as well as ECG (80-800 Hz frequency) at the user-set time interval, and calculates the mean heart rate for each recording and grades each individual burst with a quality index. We discuss the implantation and tag attachment procedures required, and compare the quality indices of data archived with each sensor type. Thereafter, we frame the results in context of future multistressor lobster studies to balance user needs and the invasiveness of implantation/attachment vs. resulting data quality.

About the Scholar

Lalah Choice, a Florida A&M University senior majoring in Environmental Studies with a minor in Urban Studies and Economic Development, is supported by the NOAA CCME-II Award. Her focus on environmental advocacy aids in making NOAA's harmful algal blooms (HABs) data accessible and effective for all coastal communities. As an EPP/MSI scholar, Lalah has enhanced interagency communication regarding Ocean Acidification (OA) and Marine Carbon Dioxide Removal (mCDR). Currently, she is researching the performance comparison of two heart rate sensor types in tagged American Lobster to influence future OA and climate change research. Lalah's passion for science and community advocacy drives her to effectively communicate scientific information to diverse audiences, including policymakers, scientists, and the public. She aims to restore coastal ecosystems and influence environmental policy, bridging the gap between science, arts, and culture. With aspirations to become more than an Environmental Scientist but an activist for environmental justice, Lalah intends to concentrate on marine wildlife and the restoration of coastal ecosystems and surrounding communities, influencing environmental policy and fostering diversity in the STEM field.

Alanna Combs

Kemp's Ridley Sea Turtle Disease Research for the ESA 5-Year Review

NOAA Mission Goal: Healthy Oceans
Mentors: Angela Somma and Jennifer Schultz
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

The Endangered Species Act (ESA) requires NOAA Fisheries to conduct, at least once every 5 years, a status review of endangered or threatened species. These reviews determine if a species should have a status change or be removed from the ESA due to recovery. This project conducted research on the disease section for the Kemp's ridley sea turtle (*Lepidochelys kempii*) ESA 5-year review. Currently, the Kemp's ridley is listed under the ESA as endangered. The objective was to analyze recent studies on turtle diseases to determine which ones contribute to the endangerment of the Kemp's ridley. Fibropapillomatosis (FP) is a common debilitating neoplastic disease. Although it's not a major threat to Kemp's ridleys, FP should be monitored as cases have increased. Concluded from the analysis conducted, algae blooms and fungal infections are leading causes of disease in Kemp's ridleys. Red tides are brevetoxin producing blooms of harmful Karenia brevis algae. These heavily contribute to the strandings and deaths of Kemp's ridleys off the coast of Florida and South Texas. The fungal infections that Kemp's ridleys often experience are from order *Hypocreales*, resulting in fatal cases of pulmonary mycosis. Fungal infections are increasing due to emerging pathogens in new environments and global warming. The frequency and severity of K. brevis blooms are also expected to increase due to climate change and environmental pollution. Identifying that fungal infections and algae blooms have population-level impacts on the Kemp's ridley sea turtle is crucial for improving

About the Scholar

Alanna Combs is from Richmond, Texas and a rising senior at Prairie View A&M University, majoring in Biotechnology. She is expected to graduate with her Bachelor's degree in Spring 2025. She is aspiring to get her PhD in Biochemistry beginning Fall 2026. Alanna is a NOAA Ernest F. Hollings Class of 2023 scholar. She is thrilled to analyze diseases experienced by the kemp's ridley sea turtles, determine their threat levels to the species, and compile findings for the species' ESA 5 year review. Identifying which species should be labeled endangered is the first step in preventing extinction. As a biotechnologist desiring to protect the health of all species, working for NOAA is Alanna's professional goal. Alanna is ambitious to use her degree for biomedical research that increases the health and well-being of all living creatures.

Nishita Dashpute

Estimating Total Alkalinity of the Pacific Ocean using Random Forest Regression

NOAA Mission Goal: Healthy Oceans
Mentor: Candice Emmons
National Marine Fisheries Service/Northwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

A significant consequence of rapid carbon dioxide emissions is ocean acidification, which threatens marine ecosystems around the world. Total alkalinity acts to buffer the effects of ocean acidification and estimates can be used to determine which regions will be most affected by acidification. Current machine learning methods to predict total alkalinity are computationally expensive and are limited by interpolation ability, introducing the need for random forest regression (RFR), a faster technique for complex relationships. This project trains a random forest regression model using GLODAP data to estimate total alkalinity in the Pacific Ocean. A clustering algorithm (Gaussian Mixture Model) was used to define separate oceanic regions based on latitude, bottom depth, sea surface salinity, and sea surface temperature. A RFR model based on the parameters defined equation 1 of the Empirical Seawater Property Estimation Routines (salinity, potential temperature, apparent oxygen utilization, total dissolved nitrate, and total silicate) was applied to each of the regions to estimate total alkalinity. Spatial data such as longitude and depth are incorporated into the model as additional parameters. Root mean square error varied depending on the oceanic region, with the greatest error in coastal regions in the north Pacific. The estimates produced by the RFR model are comparable to the neural networks and local interpolations. This data product will be useful in estimating total alkalinity given available biogeochemical oceanographic data from measurement platforms like biogeochemical Argo floats.

About the Scholar

Nishita is a rising senior from Los Angeles, CA studying Forestry and Data Science at the University of California, Berkeley. After graduating, she hopes to pursue a graduate degree in climate science and modeling. Nishita spent this summer at the Pacific Marine Environmental Laboratory developing a machine learning model to predict total alkalinity, an important component of ocean acidification. As a 2023 Hollings Scholar, she is excited to continue learning about the intricate and dynamic relationships between the biological, chemical, and physical components of the ocean. In the future, Nishita hopes to design data-driven models to predict ecosystem responses and inform climate policy.

Karin Ebey

Small Mammal Survey at Rookery Bay NERR

NOAA Mission Goal: Healthy Oceans
Mentor: Elaine Vaudreuil
Jared Franklin Stewardship Coordinator Rookery Bay NERR/ National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

Invasive pythons (Python *morulus bivittatus*) have been linked to severe mammal population declines in the Greater Everglades ecosystem. Invasive pythons use a variety of habitats and small mammals are a key prey source. The goal of this project was to complete a baseline small mammal survey to determine what species are present in ten different habitat types in Rookery Bay NERR, both coastal (mangroves, beach dune, coastal strand, maritime hammock, shell mound) and upland (scrub, mesic flatwoods, salt marsh, hydric hammock, cypress dome). We surveyed small mammals using camera traps and Sherman live traps. We found four species of small mammals: the native marsh rice rat (*Oryzomys palustris*), cotton mouse (*Peromyscus gossypinus*), hispid cotton rat (*Sigmodon hispidus*), and the invasive black rat (*Rattus rattus*). The small mammal communities varied by habitat type with black rats generally dominating the community in coastal and wet habitats and hispid cotton rats dominating the community in drier upland habitats. These results can serve as a baseline for future monitoring to better understand the impact of invasive pythons on small mammals and for future research into invasive python ecology.

About the Scholar

Karin Ebey is from Los Alamos, New Mexico and is a rising senior at Eckerd College, majoring in Biology, Chemistry, and Mathematics, with an expected graduation date in Spring 2025. Karin is a NOAA Ernest F. Hollings Class of 2023 scholar, whose internship is completing a small mammal survey at Rookery Bay NERR. Interested in herpetology, Karin aspires to attend graduate school and pursue a career in research related to reptile conservation in the government sector.

Owen Fleischer

An Updated Analysis on the Diet of Lemon Sharks (*Negaprion brevirostris*)

NOAA Mission Goal: Healthy Oceans
Mentor: John Carlson
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Although many studies on the diet of juvenile lemon sharks (*Negaprion brevirostris*) have been published, publications on the diet of sub-adult and adult lemon sharks are lacking. An analysis of the diet of lemon sharks ranging from 179 to 270 cm in fork length (L_F) collected from 2011 - 2018 in the South Atlantic and Gulf of Mexico was conducted on 67 lemon sharks. Of the 67 stomachs, 53 (79.1%) had prey items present. To quantify the diet of lemon sharks, the Index of Relative Importance (IRI) (a common method) was chosen which quantifies diet numerically (N), gravimetrically (W), and considers the frequency of occurrence (O). The use of these three variables eliminates biases that less comprehensive indices may fail to account for. The Index of Relative Importance was further expressed as a percentage value to allow for comparison among studies. Based on %IRI, lemon sharks are mainly piscivorous (60.2%), primarily *Lutjanus campechanus* and *Caranx hippos* but also predate heavily on both molluscs (35.8%) and other elasmobranch species (4.21%). Other prominent prey items include octopodidae sp. (35.4%). These findings indicate a clear ontogenetic shift in lemon shark diet, as molluscs, specifically octopodidae sp., become more important in the diet of adults and sub-adults than in the diet of juveniles. Overall, the diet of adult and sub-adult lemon sharks is more evenly distributed across fish, molluscs and elasmobranchs whereas the diet of juveniles contains higher proportions of fish and crustaceans when compared with other prey, especially molluscs.

About the Scholar

Owen Fleischer is from Durham, New Hampshire and is a rising senior at the University of Rhode Island. Owen is pursuing a degree in Aquaculture & Fisheries Science and Marine Biology. As a member of the NOAA Ernest F. Hollings Class of 2023, Owen spent his summer in Panama City, Florida, interning with the Shark Population Assessment Group at the National Marine Fisheries Service Southeast Fisheries Science Center. Working under Dr. John Carlson, Owen performed an updated analysis on the diet of adult lemon sharks (*Negaprion brevirostris*) in the Gulf of Mexico. Upon graduating with a B.S in 2025, Owen plans to enroll in graduate school and pursue an M.S or PhD. Professionally, Owen hopes to work for NOAA as a research scientist. Owen's research interests center on marine predators, specifically sharks, skates and rays, and how they interact with and shape their respective environments.

Sadie Gardiner

Developing a Non-Invasive Juvenile White Abalone eDNA Detection Method

NOAA Mission Goal: Healthy Oceans
Mentors: David Witting & John Hyde
NOAA Southwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

White abalone (*Haliotis sorenseni*) are listed as endangered under the Endangered Species Act and critically endangered by the IUCN. NOAA currently leads a multi-partner initiative to recover wild populations through captive breeding efforts along the coast of California. This effort requires monitoring the outplanted cohorts to refine methods and monitor the species' status and trends. Obtaining an accurate census is challenging as juvenile abalone hide in crevices, undetectable unless the habitat is disturbed. Traditional methods of monitoring cryptic organisms involve physically moving objects to survey for presence – which may increase stress and potentially mortality rates due to increased predator access. This research aimed to test the feasibility of using eDNA in the field as a monitoring tool by sampling the water inside and underneath outplant modules recently stocked with juvenile *H. sorenseni.* Over the course of one month, 57 water samples were collected using 60ml syringes fitted with a 12in tube while conducting SCUBA surveys. Samples were filtered through 0.22µM syringe filters at the surface. The eDNA was extracted from the filters using DNEasy Power Water Kit, amplified by PCR using abalone specific primers and visualized with 2% agarose electrophoresis gels. Results indicate H. sorenseni are detectable using eDNA methods as 40.35% of all samples were positive for the species. The data suggests eDNA can be used as a monitoring technique, such as calculating *H. sorenseni* densities at a given site using SCUBA survey methods.

About the Scholar

Sadie Gardiner is from Los Angeles, California and a rising senior at the University of California, Santa Cruz majoring in Marine Biology. She is expected to graduate with her Bachelor's Degree in Spring of 2025, and plans to further her education in marine science and obtain her Ph.D. Sadie is a NOAA Ernest F. Hollings Class of 2023 Scholar conducting research to aid in the monitoring of outcropped juvenile white abalone offshores of San Diego using eDNA techniques. She is thrilled to work with NOAA as she aspires to conduct research and contribute to the conservation and restoration of endangered marine species and their habitat. It is her vision to combine her passion for marine science, biology/ecology, and SCUBA diving to help conserve and manage our marine resources and foster a healthy relationship between humans and the environment.

Saidee Geurts

Long-term characterization of European green crab, *Carcinus maenas*, monitoring in coastal Alaska

NOAA Mission Goal: Healthy Oceans
Mentors: Stacy Cummings and Ingrid Harrald
Jasmine Maurer (Invasive Species Research Contact)
National Oceanic Service
National Oceanic and Atmospheric Administration (NOAA)

Understanding how habitat preferences and abiotic factors influence native populations in coastal Alaska provides a way to improve early detection and mitigate harmful effects of marine invasives. The European green crab, *Carcinus maenas*, recently found in southeast Alaska, is highly invasive, causing damage to bivalve and eelgrass populations and outcompeting native crabs. In Kachemak Bay, Alaska, multiple long-term trapping sites for the early detection of green crab have been established, as well as community outreach and education events focused on early detection. Historical trapping data recorded from 2007 to 2023 in Homer and Seldovia were used with corresponding environmental data from the National Estuarine Research Reserve's (NERRs) System-wide Monitoring Program (SWMP). Native crabs such as *Telmessus cheiragonus* and *Metacarcinus magister* were found most often in the inner bay and fewer crabs overall were caught in the outer bay. While both locations showed varying catch by salinity levels, inner bay crabs were more often caught at specific temperatures whereas outer bay crabs were caught across the temperature gradient. Identifying these trends in Kachemak Bay serves to provide a baseline of ecological patterns to facilitate early detection and response to *C. maenas* locally, as well as inform a wider regional understanding of how green crabs affect the natural ecosystems of coastal Alaska.

About the Scholar

Keksi Geurts is a 2023 NOAA Ernest F. Hollings scholar from Littleton, Colorado. They are entering their senior year at the University of Hawai'i at Mānoa for a Bachelor's of Science in Marine Biology with a Marine Option Certificate in Fisheries with Marine Invasives. After graduating in Spring 2025, Keksi aims to become a NOAA Fisheries Observer for the southeast and Gulf of Mexico Fisheries. They are working with the Kachemak Bay National Estuarine Research Reserve to understand environmental factors and trends in the bay, to better understand how these qualities will change under pressure from invasive European green crabs. They are interested in applying their interests in ecology to fisheries to better support a sustainable ocean industry and a sustainable future.

Will Goddard

Similarities and differences in evolution of El Niño and La Niña ocean temperature anomalies from 1993 to 2023

NOAA Mission Goal: Healthy Oceans
Mentors: Gregory C. Johnson and John Lyman
Oceanic and Atmospheric Research (OAR)/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

El Niño-Southern Oscillation (ENSO) plays a large role in ocean heat storage and distribution, and is an important driver of global climate variability. Here, we use a gridded monthly 1993–2023 0–2000-m ocean temperature dataset constructed from Argo float and satellite data using machine learning. We first remove the local means, warming trends, and seasonal cycles. We then investigate the relationships between the Ocean Niño Index (ONI) and remaining temperature anomalies using lagged correlations. We also analyze the two-year evolution of temperature anomalies separately by compositing large (|Ocean Niño Index|>1) El Niño and La Niña events. Spatially-averaged anomalies in the Equatorial Pacific (5ºS-5ºN) are strongly correlated with the ONI. However, those in the tropical (20ºS-20ºN) Pacific are moderately anticorrelated, owing largely to the contribution of temperature fluctuations in the Western Pacific from 5ºS to 20ºN. The averaged composite monthly ONI values for large El Niño and La Niña events mirror each other closely about the temperature axis until the spring following the event peaks, when both composites tend towards La Niña conditions. This relationship is generally reflected by the temperature anomalies across the tropical Pacific, although the El Niño signal tends to be stronger in the far Western and Eastern Pacific for most of the two-year timespan analyzed, whereas the La Niña signal tends to be stronger in the Central Pacific. These results increase our understanding of the temporal and spatial structure of ocean heat content anomalies during strong ENSO events.

About the Scholar

Will Goddard is a NOAA class of 2023-2025 Hollings Scholar. He is from Sebago, Maine, and is a double major in physics and earth and oceanographic science at Bowdoin College, where he is expected to graduate in Spring 2025. Under the mentorship of Dr. Gregory Johnson, he is spending the summer analyzing ARGO float data in MATLAB to investigate the relationship between ocean heat content and El Nino/Southern Oscillation (ENSO), driven by an interest in the physics of energy exchange within and between the ocean and the atmosphere. Will is passionate about NOAA's mission of science in the name of stewardship of the planet. He especially enjoys experimental laboratory work, and plans to pursue a graduate degree in physics or materials science.

Reid Griffin

Otoliths and I: An Otolith Growth Analysis of Predatory Species in Weldon Headpond

NOAA Mission Goal: Healthy Oceans
Mentors: John Kocik and Joseph Zyndlewski
National Marine Fisheries Service/ Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

The Penobscot River supports the largest ESA listed population of Atlantic Salmon (*Salmo salar*) within the Gulf of Maine Distinct Population Segment - a NOAA Species in the Spotlight. The monitoring of predation related to impoundments is a critical management need. Recent telemetry data suggests that the Weldon Headpond is a site of high mortality for Atlantic salmon smolts. As such, this project serves as an investigation on whether Smallmouth Bass (*Micropterus dolomieu*) a non-native predator that inhabits the region, are responsible for the high mortality rates. My goal was to evaluate the otoliths of this predatory species in order to estimate age and growth trends of the species. Biologists gathered 49 Smallmouth bass from the Weldon headpond during 2022 and 2023. Fish were frozen until 2024, when I extracted the otoliths, cleaned, sectioned, and mounted them for microscopic analysis using imaging software. Annual growth was back calculated, and the yearly growth trends for Smallmouth Bass were modeled in a Von Bertalanffy function. Fish ages ranged from 2 to 13 and growth analyses are ongoing. By understanding the age structure and growth of these predators, my study will contribute to better quantifying interactions of salmon with these invasive predators.

About the Scholar

Reid Griffin is a senior at the University of Alaska Southeast. They are majoring in marine biology, with an expected graduation date of spring 2025. They are a 2023 NOAA Ernest F. Hollings Scholar. Their summer internship at the University Of Maine focused on analyzing the growth of local predatory species in the penobscot river, in order to investigate the high Atlantic Salmon smolt mortalities. Their interests involve invertebrate zoology, the conservation of deep sea ecosystems, and forming effective strategies at engaging communities in conservation efforts. They hope to pursue a higher degree in marine biology, eventually working in a profession that closely aligns with their interests.

Sophia Hemsi

Fine Dining with Southern Resident Killer Whales: Exploring Habitat Characteristics of Predation Locations

NOAA Mission Goal: Healthy Oceans
Mentors: Bradley Hanson and Candice Emmons
National Marine Fisheries Service/ /Northwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

A primary risk to recovery of the endangered population of Southern Resident killer whales (SRKW) is the limited availability and accessibility of preferred salmonid prey in a core part of their summer critical habitat. A key limitation to protecting foraging opportunities is a lack of understanding of how environmental features are associated with foraging. Our study aimed to identify aspects of the marine habitat that predict SRKW foraging. We used foraging data derived from (1) high-resolution sound and movement tags ('DTAGs') suction cup-attached to SRKW during September 2010, 2012 & 2014, and (2) concurrent focal follows of tagged whales, to identify locations of foraging events. Next, we computed environmental data including bathymetry, distance to shore, slope, and substrate, matched to whale location data on a dive-by-dive basis. We built generalized linear mixed models to identify environmental factors that predicted foraging and advance our understanding of the foraging habitat of SRKW, as well as their spatiotemporal distribution patterns. Additionally, these findings will improve our understanding of SRKW ecology and behavior, particularly in relation to habitat use and seasonal occurrence. Finally, identifying key habitat features associated with SRKW foraging areas can better inform conservation and management efforts to protect and recover this endangered marine mammal population by promoting foraging opportunities.

About the Scholar

Sophia Hemsi is from Boulder, Colorado and is a rising senior at Florida International University in Miami majoring in Marine Biology. She will graduate in Spring 2025, and aspires to obtain her Ph.D. in marine ecology beginning Fall 2025. At FIU Sophia is working on publishing two honors theses on Everglades estuarine shark sociality and Caribbean cetacean species composition. She is a NOAA Ernest F. Hollings Class of 2023 scholar working on assessing the habitat characteristics of predation locations of the endangered Southern Resident killer whales. Sophia aspires to pursue a research career as a marine ecologist, working to unravel the complex web connecting organisms and their environment within institutions like NOAA. She is excited to continually strive to learn more, discover more, and aid in the conservation of our incredible underwater world by generating scientific communication that inspires a passion for environmental literacy.

Emily Ignatoff

Thermal Impacts on Growth and Metabolism in Larval Tautog (*Tautoga onitis*)

NOAA Mission Goal: Healthy Oceans
Mentor: Christopher Chambers
NMFS, NEFSC, Sandy Hook, NJ
National Oceanic and Atmospheric Administration (NOAA)

As consumer demand for fish increases, it is critical that fisheries scientists consider how to efficiently rear fish with minimal detriments to health and survival. The tautog (*Tautoga onitis*) is a species of wrasse found in shelf and inshore habitats of the Western North Atlantic between Nova Scotia and South Carolina. It is highly popular among recreational fishers and as a market fish, but established methods for rearing tautog in an aquaculture setting have yet to be established. In order to develop tautog for the aquaculture industry, optimal husbandry conditions must be determined, leading to economically efficient culture of the tautog early life stages so that fish can be grown to market size. This study sought to utilize a laboratory population of tautog larvae to test how water temperature affects larval growth and metabolism. Data for this analysis were drawn from two sources. Results were analyzed from experiments conducted at the NOAA NMFS Sandy Hook Laboratory in 2023 that assessed the impact of a wide range of constant temperatures (16 to 24 °C) on larval size and metabolic rate at the end of the larval period. An experiment expanding the respirometry and imaging data at a weekly temporal frequency under a more modest temperature range (18 to 22 °C) is underway in 2024. Analyses of the 2023 data and the literature suggest greater respiration rates of larvae under temperature stress, but these measures of performance may come at a price of reduced metabolic efficiency, increased feeding costs, and elevated risks of starvation.

About the Scholar

Emily Ignatoff is from Tucson, Arizona and attends the University of California, San Diego where she is a rising senior. She intends to graduate with a Bachelor's degree in marine biology in the Spring of 2025. She also aims to continue her education in the marine sciences with a PhD program starting Fall 2025. Emily is a Class of 2023 NOAA Ernest F. Hollings scholar, interested in pursuing a career in research with a focus on -omics as they can be applied to understanding the evolution and ecology of marine fishes. This summer she expanded her experience to early life history as a lens to observe fish ecology. As an aspiring researcher, working with NOAA is an ideal opportunity for her to develop her skill set outside research in her home institution, and to broaden her horizons in seeking research career options.

C’Lannye James

Industrial Hitchhikers: Uptake Kinetics of Organic Contaminants onto Microplastics

NOAA Mission Goal: Healthy Oceans
Mentor: Ashok Deshpande
National Marine Fisheries Service | Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Microplastics—plastic fragments, beads, and fibers 5 nm or less in length—are emerging as pervasive contaminants in aquatic environments. Surveys by the Hudson River Trust have uncovered a significant presence of microplastics in the lower Hudson River. It is known that microplastics have interactions with persistent organic pollutants (POPs), but little is known about how microplastics interact with organic contaminants in the Hudson’s water column. Plastic may be a mode of transport for contaminants of industrial origin such as pesticides, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorines, and other chemicals. In this experiment, PET, HDPE, and nylon microplastics from consumer products were suspended in the Hudson River. 10 g of each plastic was collected from the water column every seven days. Organic contaminants were extracted from the plastics with hexane and analyzed by gas chromatography tandem mass spectrometry (GC-MS/MS) for the presence of POPs adsorbed over the course of five weeks. Adsorbed contaminants will be quantified using internal standards. POPs are expected to accumulate on the plastics over the course of five weeks. This work will contribute to our understanding of interactions between industrial contaminants and plastic contamination in the Hudson River and the combined threats they pose to connected marine ecosystems.

About the Scholar

C’Lannye James is from Boson, Massachusetts and is a rising senior at Union College in Schenectady, New York majoring in ACS Environmental Chemistry with a minor in Environmental Science. They are expected to graduate in the Spring of 2025. C’Lannye is a class of 2023 Ernest F. Hollings Scholar. C’Lannye plans to pursue a master’s degree in chemistry and/or environmental science and continuing research of environmental contaminants and the detection thereof. As a chemist, they aspire to meld their interests in equity and environmental chemistry to promote remediation of emerging and well known contaminants in urban spaces. The Hollings program has been instrumental in cementing their passion for this work and giving them the opportunity to conduct independent research which combines their interests in microplastics and organic contaminants.

Ruby Krasnow

Modeling spatial variation in Jonah crab (*Cancer borealis*) size at maturity

NOAA Mission Goal: Healthy Oceans
Mentor: Burton Shank
National Marine Fisheries Service/ Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Large variations in life history characteristics within fished stocks can create challenges for sustainably managing fisheries. The Jonah crab (*Cancer borealis*) fishery is managed primarily by effort controls and a minimum legal size, intended to protect females and immature males. However, there are many unresolved questions about the growth and molting of mature Jonah crabs, including spatial variation in size at maturity. For crab species that exhibit a change in external morphology at maturity, size at maturity may be estimated based on changing morphometric ratios, known as size at morphometric maturity (SMM). In this project, we first used simulation modeling to assess the performance of existing and novel statistical methods for estimating SMM. Based on the simulated testing, we developed an optimized workflow consisting of (1) classifying individual crabs as mature or immature using Gaussian mixture model-based clustering, followed by (2) spatial logistic regression using the R package sdmTMB, which employs the Template Model Builder (TMB) framework and Laplace approximation to efficiently solve complex likelihood problems. Our results represent a novel approach to spatially varying parametrization of SMM models that can be generalized to other crustacean fisheries. This methodology updates traditional SMM methods to utilize powerful statistical tools widely used in other areas of quantitative ecology. Mapping spatial variation in SMM model parameters also allowed us to visualize and quantify latitudinal and inshore-offshore variation in Jonah crab SMM, with direct implications for the sustainable management of this emerging fishery and the suitability of current fishery regulations.

About the Scholar

Ruby Krasnow is a rising senior at Clark University, majoring in Biology with a minor in Mathematics. She will graduate with her Bachelor's degree in December 2024 and plans to continue her education by entering a PhD program in Marine Biology at the University of Maine in January 2025. Ruby is passionate about using mathematical and statistical models to support sustainable fisheries management and advance the kelp aquaculture industry. As a Class of 2023 NOAA Ernest F. Hollings Scholar, Ruby is modeling the spatial variation in growth characteristics of Jonah crabs, a species of increasing commercial interest in New England. She is excited about the opportunity to support informed management of this developing fishery and to work closely with scientists at NOAA's Northeast Fisheries Science Center, where she hopes to work following the completion of her graduate studies.

Krithika Layagala

Transmissibility of Stony Coral Tissue Loss Disease (SCTLD) to Pacific Coral Species *Pavona clavus* and *Pocillopora damicornis*

NOAA Mission Goal: Healthy Oceans
Mentors: Ian Enochs and Michael Studivan
Atlantic Oceanographic and Meteorological Laboratory (AOML)/Coral Program
National Oceanographic and Atmospheric Organization (NOAA)

Stony coral tissue loss disease (SCTLD) is a devastating coral disease first observed in 2014 near Virginia Key in Miami. It has since spread to 30 Caribbean countries and U.S. territories. However, it has yet to be observed in the Pacific. Prior studies have demonstrated the transmissibility of SCTLD via simulated ship ballast water, and the Panama Canal represents a potential avenue by which the disease could spread into the Pacific. It is, therefore, imperative to determine whether Pacific coral species are susceptible to SCTLD, and if so, to develop disease diagnostics. We conducted an ex-situ waterborne disease challenge to test the susceptibility of the common eastern Pacific coral species, *Pavona clavus and Pocillopora damicornis*, to SCTLD. Additionally, *Orbicella faveolata* was used as a SCTLD-susceptible Caribbean control species (Atlantic) to compare disease signs in Pacific species. Treatments included disease-exposed water (waterborne transmission), disease adjacent (near-contact transmission), and healthy coral-exposed water. Transmission data collected suggested that *P. clavus* and *P. damicornis* are not immune to SCTLD, as some corals developed rapid tissue loss under near-contact and waterborne transmission. 25% of all disease exposed *P. clavus* developed lesions, and 35% of all disease exposed *P. damicornis* developed lesions. This information is critical for the management and prevention of SCTLD in coral reefs, providing further insight to the potential microbial origin of SCTLD, and developing SCTLD mitigation strategies across ocean basins.

About the Scholar

Krithika Layagala is a Biology major and Conservation minor at William & Mary, class of 2025. She is interested in marine microbial ecology and marine symbionts. Along with a passion for conservation, these interests blossomed a focus on coral reef disease causes, transmission, and prevention/treatments. As a NOAA F. Hollings Class of 2023 scholar, Krithika interned at the Atlantic Oceanographic & Meteorological Laboratory with the Coral Program this summer. She investigated the transmission of stony coral tissue loss disease (SCTLD) to the Pacific Coral Species *Porites Lobata*. She aspires to continue research on coral disease and begin a PhD in Fall of 2025. As an aspiring NOAA marine microbiologist, Krithika hopes to develop ways to understand, prevent, and address marine invertebrate disease to ensure a healthy marine ecosystem for generations to come.

Andie LeDoux

Characterizing changes in size, shape, development, and respiration in the early life stages of tautog, *Tautoga onitis*, a candidate species for aquaculture

NOAA Mission Goal: Healthy Oceans
Mentor: R. Christopher Chambers
National Marine Fisheries Service/Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

More species of fish are being considered as candidates for aquaculture as part of a solution to global food insecurity. One species, tautog (*Tautoga onitis*), is a wrasse (family Labridae) native to the Atlantic Ocean from Nova Scotia to South Carolina. Although a popular sport fish throughout its geographic range, little research on its feasibility for aquaculture has been conducted, especially in regards to its early life stages which are also fundamental to its successful recruitment in nature. This study provides fundamental information for understanding the early life history of tautog in wild and captive populations by focusing on key production variables during its larval period (e.g., size, development, and respiration). Using larvae from laboratory spawning that were reared under standard conditions for ~35 days after hatching, high temporal frequency samples of larvae were obtained for microscope imaging and microplate respirometry. These measurements are being used to generate high-resolution ontogenetic depictions of larval size, development, and respiration. Such data will lay the groundwork for further studies pertaining to tautog aquaculture and provide fundamental insights into tautog ontogeny that will benefit other researchers.

About the Scholar

Andie Le Doux is a senior at the University of Hawai‘i at Mānoa, studying Natural Resources and Environmental Management, with a specialization in soil and watershed conservation. She is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2023 Scholar, with a strong interest in NOAA fisheries, where she is spending her summer internship studying larval fish for aquaculture. After she graduates in the Spring of 2025, Andie hopes to pursue a PhD in fisheries to contribute to her broader interest in sustainable food production. She hopes to have a career in combining communities, culture, and food systems with resource management to contribute to both natural and social sciences.

Emily Lekas

Effects of Ocean Acidification on Feeding in Atlantic Surfclams

NOAA Mission Goal: Healthy Oceans
Mentors: Katyanne Shoemaker, Matt Poach, Genevieve Bernatchez, and Shannon Meseck
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

The Atlantic surfclam (*Spisula solidissima*) is a vital bivalve species in the Northeast, supporting a $41.7 million dollar shellfish industry. Surfclams are filter feeders that live in sandy sediments and obtain nutrients from plankton in the surrounding seawater. Ocean pH decreases as ocean acidification increases due to rising carbon dioxide levels in the atmosphere, negatively impacting marine life such as calcifying mollusks like surfclams. Coastal Atlantic surfclams experience natural pH shifts through tidal cycles and storm events, but these pulses will become more extreme as climate change continues to alter weather patterns. This study examined the effects of different pH levels on feeding in Atlantic surfclams to understand how this species reacts to pulse stress events. Twenty-seven juvenile surfclams were collected from Provincetown, Massachusetts and acclimated to ambient seawater in laboratory holding tanks before being exposed to pH levels of either 7.50 (low), 7.63 (moderate), or 7.87 (high). The biodeposition method was used to collect and filter water, feces, and pseudofeces and an equation was used to determine physiological factors such as clearance rate, organic ingestion rate, assimilation rate, and feeding efficiency. Results from this study will provide insight on how surfclams respond to short term stressors and what strategies they may use to endure environmental stress events.

About the Scholar

Emily Lekas was born and raised in Jacksonville, Florida and is a rising senior at the University of Richmond. She is a NOAA Ernest F. Hollings 2023 Scholar and will graduate with a Bachelor of Science degree in biology in May of 2025. Emily plans to attend graduate school in the fall of 2025 to earn a PhD in marine biology. Her research interests are in invertebrate chemical ecology and biology, stemming from her experience studying natural product discovery, octopus morphology and behavior, and surfclam physiology. This summer Emily worked with her mentors at the Northeast Fisheries Science Center in Milford, Connecticut to analyze the effects of ocean acidification on feeding in Atlantic surfclams. She aspires to work for NOAA after completing her graduate studies and research the roles of understudied marine invertebrate species in ecosystem health and human health.

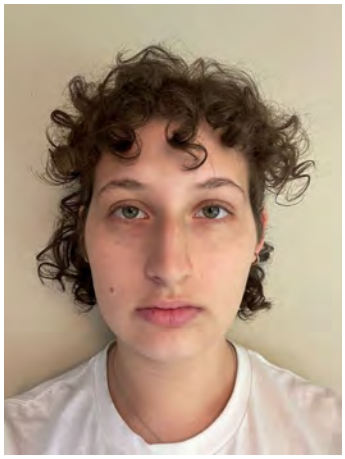
Jules Lieberman

Investigating water column fauna of the Mid and Southeast US

NOAA Mission Goal: Healthy Oceans
Mentors: Ashley Marranzino and Mashkoor Malik
Oceanic and Atmospheric Research/NOAA Ocean Exploration
National Oceanic and Atmospheric Administration (NOAA)

The mesopelagic zone (200-1000 m) is the largest biome on the planet by volume. However, due to the difficulty of accessing and exploring the water column, there still remains a significant knowledge gap about the biology and ecology of organisms in these ecosystems. NOAA Ocean Exploration's expeditions with the NOAA Ship *Okeanos Explorer* explore the faunal distributions of many water column taxa, including those found within the deep scattering layer (DSL), a zone of acoustically-reflective, aggregated midwater fauna. In 2019, NOAA Ocean Exploration conducted a series of three remotely operated vehicle (ROV) dives on and around the Blake Plateau, which is located off the coast of the Southeast United States. This region was investigated owing to the Blake Plateau's intellectual, scientific, and spiritual importance. Across these dives, ten total transects were taken at depths ranging from 300–1000 m. During these expeditions, ROVs collected video and environmental data (conductivity, temperature, depth, and oxygen concentration) while the ship collected active acoustic data (hull-mounted EK60 and EK80 sonars; 18, 38, and 70 kHz). This project aims to combine these data to describe the faunal composition of three dives in the Blake Plateau region. Furthermore, it seeks to identify whether faunal diversity and abundance are significantly different above, below, or within the DSL. These initial descriptions will help to inform management decisions for the region during future investigations into the mesopelagic zone on the ocean.

About the Scholar



Jules Lieberman is from Philadelphia, Pennsylvania, and they are entering their last semester at Oberlin College. They are expected to graduate with their Bachelor's degree in Fall 2024 with a major in Biology and a minor in Geosciences. Post-graduation, they plan to enter a Ph.D. program in Marine Biology or Biological Oceanography beginning Fall 2025. Jules is a NOAA Ernest F. Hollings Class of 2023 scholar. This summer, they are annotating mid-water ROV footage from *Okeanos* expedition EX1903L2 to determine the relationship between acoustic backscatter and pelagic fauna in the Blake Plateau region. Professionally, Jules aspires to study pelagic ecosystems as a research scientist and leverage their writing skills to communicate the importance of exploring the mesopelagic zone.

Tiffany Mar

Artificial Intelligence for Coral Segmentation in the Papahānaumokuākea Marine National Monument (PMNM)

NOAA Mission Goal: Healthy Oceans
Mentors: Randall Kosaki, John Burns, and Atsuko Fukunaga
National Ocean Service/Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration (NOAA)

The coral reefs within Papahānaumokuākea Marine National Monument (PMNM) are part of the largest protected marine areas in the United States. Research on coral habitat complexity and biodiversity typically demands manual annotation of coral imagery, which is labor-intensive and time-consuming. This project explores the application of AI-powered coral segmentation using TagLab, an open-source software developed by Visual Computing Studios. Specifically, this project developed personalized coral segmentation models for PMNM. The coral imagery data, collected using state-of-the-art underwater cameras, underwent preprocessing steps such as resizing, normalization, and data augmentation to enhance model training. Three models were created: a generalized PMNM model, a Porites Lichen model, and a Acropora Cytherea model. The models allow for an easier and more efficient coral annotation process, facilitating further coral research and conservation efforts in a vital marine national monument.

About the Scholar

Tiffany Mar, from Los Angeles, CA, is a rising senior at University of California, Berkeley, majoring in Environmental Studies and minoring in Data Science. After graduating in Spring 2025, she hopes to work for NOAA as a geospatial/data scientist and then obtain her PhD in Environmental Studies. Currently, she is interning at the MEGA Lab, located in the University of Hawaii, Hilo, implementing an AI-powered coral segmentation software to support the analysis of coral reefs in the Papahanaumokuakea Marine National Monument. She is excited to see how geospatial and data science tools can be used to advance the study of vital marine life.

Aileen McDonald

Evaluating Sustainability Metrics for Maine River Herring Populations in the Penobscot River

NOAA Mission Goal: Healthy Oceans
Mentor: John Kocik and Justin Stevens
National Marine Fisheries Service and Maine Sea Grant
National Oceanic and Atmospheric Administration (NOAA)

There are two species of river herring found throughout Maine watersheds, alewife (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*). River herring are born in the river and migrate to the ocean for about three years, returning in spring to spawn and then returning to the ocean. River herring play a vital role in the overall function of several ecosystems, providing nutrients in river and ocean systems, a food source for larger fish, mammals, and birds, and a fishery for humans. For centuries, dams blocked access to rivers and streams in Maine, drastically reducing fish passage which led to population declines. Currently, efforts are underway to remove dams and improve passage. We investigated biological data of river herrings to understand how restoration efforts have changed populations dynamic. We collected 50 river herring each week of the herring run from 2014 to 2024 at Milford Dam on the Penobscot River to collect biological data including, total length, weight, species, sex, age, and iteroparity rates. We prorated daily count data based on the biological samples taken. We found that there were more older river herring in recent years, with blueback herring up to age seven and alewife up to age eight. We observed a higher number of repeat spawners in later years. We observed that the timing of the run appears sooner in 2021-2023 than in earlier years. Our study is essential for understanding how river herring species and their ecosystems are affected by improved habitat and fish passage.

About the Scholar

Aileen McDonald is a rising senior from American University majoring in Environmental Science and minoring in Data Science, graduating in Spring 2025. Aileen intends to begin a PhD related to fisheries biology starting in Fall 2025. Through graduate school, she is excited to learn more and conduct research related to population dynamics, ecosystem-based management, climate change impacts, sustainability, data analysis, and more. Aileen is a NOAA Ernest F. Hollings Class of 2023 Scholar, and spent Summer 2024 interning with NOAA Fisheries Orono Field Office and Maine Sea Grant. Her project focused on Maine river herring sustainability and restoration measures, studying how the river herring population has changed over time. Aileen plans to pursue a career in fisheries biology, and she aspires to work for NOAA as a fisheries biologist in the future and make a difference in the management and well-being of our aquatic ecosystems through science.

Kennedy McGrath

Environmental impacts and risk on juvenile oyster growth and survival in Long Island Sound

NOAA Mission Goal: Healthy Oceans
Mentors: Meghana Parikh and Katherine McFarland
National Marine Fisheries Service/Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Eastern oysters *(Crassostrea virginica)* are ecologically and economically important throughout the Atlantic and Gulf of Mexico coasts. Oysters improve water quality by filter feeding and increase biodiversity by providing substrate and habitat for other species. Oyster aquaculture is a major industry that is worth over $14,000,000 in Connecticut alone. As a result, restoration projects and a push to bolster the aquaculture industry are prevalent in the Northeast, USA, however, climate change, disease, and sedimentation threaten restored and aquacultured populations. To discern environmental and biological effects, we measured growth and survival of juvenile oysters at two sites during summer 2024. Differential mortality between sites was attributed to heavy predation by oyster drills at one site but not the other. Oysters at the site with less predation also had a marginally higher growth rate. In anticipation of increased interest to establish new aquaculture leases, we incorporated these data into a risk assessment framework. Risk assessment and habitat suitability models have been successful in other parts of the world to identify optimal habitat for restoration, so we suggest future work centered around combining existing methods in a way that is relevant to the specific needs of Connecticut aquaculture. These recommendations are intended to serve as building blocks for scientists, industry, and local government to create a standardized framework for assessing the suitability of potential farm or restoration sites in Connecticut.

About the Scholar

Kennedy McGrath is from Kansas City, MO and a rising senior at the University of New Hampshire dual majoring in Marine, Estuarine and Freshwater Biology and Sustainability. She is expected to graduate with her Bachelor's degree in Spring 2025 and hopes to continue her education in New Zealand with a Master's in Marine Conservation. Kennedy is a NOAA Ernest F. Hollings Class of 2025 scholar. For her summer internship she is examining the growth of juvenile oysters in Long Island Sound as part of a larger project at the NEFSC Milford Lab, as well as developing a risk assessment for new aquaculture sites.With a particular interest in science communication and community involvement, Kennedy hopes to one day work at the intersection of science and policy to improve commercial aquaculture and mitigate the effects of marine plastic pollution.

Ryan McMullen

Using eDNA to Map the Distribution and Association of Deep-Sea Invertebrates with Cold-Water Coral Species in the Phoenix Islands Marine Preserve

NOAA Mission Goal: Healthy Oceans
Mentors: Meredith Everett and Timothy Shank
National Marine Fisheries Service/Northwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

The deep sea exists as one of the most extreme and remote biomes on Earth, yet communities and organisms thrive there due to remarkable adaptations and specialized characteristics. Of these unique adaptations, the ability of epifaunal invertebrates to locate, identify, and symbiotically partner with deep-sea corals is of particular interest, as these co-evolved partnerships can be observed across the full diversity of interspecies relationships (mutualistic, facultative, predatory, etc.) and often with high fidelity between the epifauna and its host. The biological mechanisms used to create and sustain such associations are currently unknown, but improving our understanding may offer new insights into larval dispersal, environmental sensing, small molecule signaling, and the evolution of diversity in the deep sea. While environmental DNA (eDNA) is considered a powerful and cost-effective tool to measure regional species diversity, it has never been used to detect the presence of coral-associated invertebrate species. In this project, samples and metadata from a 2017 cruise by the NOAA vessel Okeanos Explorer and a 2021 cruise by the R/V Falkor to the seamounts of the Phoenix Islands Protected Area (PIPA) were analyzed to construct a genetic barcode database of coral-associated invertebrate species, including newly discovered species. These barcodes were used to analyze eDNA aliquots to determine if associate DNA is detectable in the surrounding water column. The results of this ongoing study have the potential to inform new applications of eDNA in the deep sea, targeted at mapping the distribution patterns and association mechanisms of corals and their associate invertebrates.

About the Scholar

Ryan McMullen is originally from Cleveland, Ohio and is majoring in Marine Biology and Ecology at the University of Miami with minors in Ecosystem Science and Policy and Biology. He is set to graduate with his Bachelor's degree in Spring of 2025 and then plans to continue his education to receive his PhD. Ryan’s interests in marine science span multiple areas of focus including systems ecology, evolutionary biology, fisheries management, and ocean exploration. His goal is to conduct research that allows us to better understand the processes that shape life in our oceans, and he is passionate about using science communication to engage others and inform conservation efforts. Ryan is a member of the NOAA Hollings Scholarship class of 2025, and is spending his summer conducting DNA metabarcoding and eDNA analysis of deep-sea invertebrates in collaboration with the Shank Molecular Ecology and Evolution Lab at Woods Hole Oceanographic Institute.

Madison Medina

Understanding beaked whale distributions through passive acoustics

NOAA Mission Goal: Healthy Oceans
Mentor: Annamaria DeAngelis
Passive Acoustics Branch, Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Beaked whales are a cryptic family, limiting our understanding of their distribution and behavior. Given their deep-diving and prolonged time underwater, passive acoustics technologies have proven to be effective in detecting their species-specific calls. Passive acoustics allows for continuous monitoring even during adverse conditions, complementing traditional visual survey methods. Data collected from towed arrays can estimate locations of acoustically active species, providing range and bearing information. Our project focuses on understanding beaked whale distribution in the western North Atlantic. During a 2021 cetacean abundance survey (June through August) off the Northeast region of the United States, traditional visual and passive acoustic towed array methods were employed, including scientific echosounders. This was alternated on and off in a systematic manner, to test for differences in acoustic detections. Signals were detected, classified, and localized using PAMGuard software (v2.02.10), characterized by distinguishable species-specific frequency-modulated upsweep pulses. Individuals were annotated into two-dimensional tracks using towed hydrophone array data by grouping click trains with consistent changes in bearing. Using R (v4.3.2), their distribution was mapped and examined for differences in detection numbers between echosounder states. Preliminary results identified three of six North Atlantic beaked whale species: Goose-beaked (*Ziphius cavirostris*), Sowerby's (Mesoplodon bidens), and True's (*Mesoplodon mirus*) beaked whales. The National Marine Fisheries Service incorporates this into their federally mandated stock assessment reports, which support marine mammal management and conservation efforts. These annotations enhance future studies on beaked whale distribution, abundance, and ecology, important in understanding and conserving North Atlantic beaked whales.

About the Scholar

Madison Medina, a fourth-year Marine Biology student at the University of California, Santa Cruz, is from Rancho Cucamonga, California. She is expected to graduate with a Bachelor's degree of Science in Spring 2025, and aims to pursue a Master's in Marine Science. Madison is a NOAA Ernest F. Hollings Class of 2023 scholar and is committed to advancing her career by participating in this educational experience as part of her contribution to the science community. She's adept at gathering and analyzing data, particularly focusing on studying marine mammals such as cetaceans and pinnipeds to deepen understanding of their ecological relationships and enhance contributions to conservation strategies and management. To further her research goals, she plans to utilize her scientific diver certification possibly with NOAA or affiliated partners. This summer, she will contribute to NOAA's Passive Acoustic Cetacean Map through localizing beaked whales by species using passive acoustic data.

Dina Millerman

New Ocean Horizons: A Study of Which Ocean Conflicts are Driving Offshore Wind Siting in the U.S.

NOAA Mission Goal: Healthy Oceans
Mentors: James Morris, Isaac Keohane, Jennifer Wright, Joshua Chastain, and Bryce O'Brien
National Ocean Service/National Centers for Coastal Ocean Science (NCCOS)
National Oceanic and Atmospheric Administration (NOAA)

The Biden administration has set a goal of 30 GW of offshore wind capacity by 2030. This goal is not easy to reach when our oceans are full of conflicting uses such as fishing grounds, shipping lanes, military areas, and sensitive natural resources. The NCCOS marine spatial planning team uses spatial suitability modeling to identify areas of ocean space that have reduced conflict during offshore wind siting. These siting practices work to safeguard a healthy, cooperative ocean ecosystem, ensuring that all stakeholders, US citizens, and marine organisms benefit from our oceans. In this study, we worked to understand the impact that individual data layers and submodels have on final suitability models using a jackknife sensitivity analysis. Tests were run on previous offshore wind siting models created for the Gulf of Mexico, Gulf of Maine, Central Atlantic, and Oregon. The results revealed which variables are under or over-represented in the models and which data layers are most sensitive in each region. Running this analysis and determining which data are most influential in our models highlights which types of conflicts are being prioritized in decision-making for offshore wind siting. With this information, we can identify potential issues with the data that constitute the major ocean conflicts and suggest ways to improve upon both the available data and the marine spatial planning process in order to maximize the efficiency, accuracy, and effectiveness of our work and ensure sustainable siting and operation of offshore wind development.

About the Scholar

Dina Millerman is originally from New York and is a rising senior at Brandeis University, with majors in chemistry and environmental studies and a minor in Hispanic studies. She is a NOAA Ernest F. Hollings Class of 2023 scholar and is expected to graduate in Spring 2025. This summer, she is excited to work with the marine spatial planning team at NCCOS in order to learn more about the offshore wind planning process and the world of renewable energy. Post graduation, she plans to work in the renewable energy sector, continuing to contribute to our growing need for climate change mitigation.

Caroline Monaco

Assessment of Microplastic Distribution and Composition in a Contaminated Tributary of the Mohawk River

NOAA Mission Goal: Healthy Oceans
Dr. Ashok Deshpande (Mentor)
National Marine Fisheries Service/Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Since the beginning of mass production and consumption of plastics, the risk of their degradation has become a threat to human and ecosystem health. Microplastics pose a multitude of adverse physiological effects in the body. In waters, they can provide a vessel for other organic pollutants to accumulate on. While highly studied due to their abundance as marine debris in our oceans, it is equally important to focus on microplastics in freshwater streams. This study focuses on a freshwater stream in Upstate New York, the Hans Groot Kill (HGK), with known wastewater inputs due to failing sewage infrastructure. Microplastics in wastewater are of particular interest, as they have often made their way through the human body. To test how microplastic composition and distribution vary spatially in the HGK, sediment samples were taken in duplicate at eight different sites along the stream. Plastics found in sediment samples were sorted and counted before being subjected to chemical analysis. By using a novel pyrolysis method of Gas Chromatography-Mass Spectrometry (GC-MS), the chemical composition of plastics can be identified using a mass spectral library. Determining the most abundant types of plastics present in wastewater allows inferences to be drawn about which types of plastics are most prone to degradation, and which types of plastics are frequently ingested and excreted by humans.

About the Scholar

Caroline Monaco is a rising senior at Union College, double majoring in Environmental Science and French & Francophone Studies, with a minor in Chemistry. She is expected to obtain her Bachelor's of Science degree in June of 2025. Her research interests fall within environmental chemistry and the classification and removal of organic contaminants from bodies of water. Her undergraduate thesis focuses on removal of PFAS chemicals from freshwater bodies using leaf litter, and her Hollings Scholarship research project investigates the distribution and chemical composition of microplastics across a freshwater stream with known wastewater inputs. Caroline is a 2023 NOAA Hollings Scholar. After graduating from Union College, she hopes to pursue a fellowship to conduct research in a Francophone country before pursuing a graduate degree in Biogeochemistry. Although unsure of exact career aspirations, Caroline hopes to continue studying persistent, bioaccumulative, and toxic pollutants in our environment in hopes of developing remediation strategies.

Kalimah Muhammad

Oxygen Content Variability in the Deep North Atlantic Ocean

NOAA Mission Goal: Healthy Oceans
Mentors: Hernan Garcia, Courtney Bouchard and Zhankun Wang
National Environmental Satellite Data and Information Service/National Center for Environmental Information
National Oceanic and Atmospheric Administration (NOAA)

The North Atlantic Deep Water (NADW) mass can be conceptually thought as the origin of the global ocean density-driven circulation. Its distribution, rate of formation, biochemical and physical characteristics impact the earth-system climate dynamics on decadal and longer time scales. NADW is nominally distinguished from Southern Ocean water masses by its low temperature, high salinity, high O2 content, low nutrients, and high density relative to surrounding water masses in the North Atlantic. It is formed in the Greenland and Norwegian Seas and enters the Atlantic as it overflows over relatively shallow sills. As NADW sinks and circulates through the ocean depths, it delivers oxygen-rich content waters that were most recently in contact with the atmosphere and affected by air-sea exchange and gas solubility. Changes in NADW water type characteristics impacts the ocean overturning circulation and thus, the advection of O2-rich waters to the Southern Ocean, the Indian, and Pacific Basins. Because of the impact of ocean warming on ocean deoxygenation, it is anticipated that the NADW O2 content would be the most negatively affected in the past few decades. If real, this suggests a reduction in the NADW O2 inventory, and thus a reduction of its area and volume. Here I examine and map the long-term mean area and volume of the NADW in three different O2 bins (240-250, 251-260, 261+ umol/kg). The study is based on quality-controlled O2 observations collected over the 1965-2022 time period in NOAA's World Ocean Database and World Ocean Atlas climatologies. The data were analyzed using Python as a coding tool. This study provides a long-term baseline for calculating NADW O2 content anomalies and trends which otherwise would not provide a quantifiable metric of measuring change. This work was conducted in NOAA's NCEI Ocean Climate Laboratory.

About the Scholar

Kalimah Muhammad is a rising junior at Howard University majoring in Biology with a concentration in Ecology and Evolution. Inspired by her hometown of Miami, FL, Kalimah intends to complete her long-term academic goal of receiving her doctorate degree in Marine Biology upon the completion of her bachelor's degree in 2026. As a NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Class of 2024 Scholar, Kalimah worked with NOAA's National Centers for Environmental Information to study dimensional changes of the oxygen rich Deep Water Western Boundary Current in the Atlantic Ocean, which may be attributed to climate change. With this newfound insight, she plans to further explore the impacts of humans on marine ecosystems throughout her career. More specifically, Kalimah's interests include marine mammal behavior, habitat conservation, and environmental education. As a community advocate and an aspiring NOAA scientist, Kalimah strives to implement a sense of togetherness and positivity throughout every aspect of her career.

Cheyenne Murdaugh

Examination of the relationship between abundance and sizes of cladoceran prey items and larval Atlantic bluefin tuna (*Thunnus thynnus*) abundance in the Gulf of Mexico

NOAA Mission Goal: Healthy Oceans
Mentors: Glenn Zapfe and Frank Hernandez
National Marine Fisheries Service/Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Many marine zooplankton organisms are integral intermediary species linking primary productivity to higher trophic levels in the Gulf of Mexico (GoM) food web. At the population and community-level, shifts in average zooplankton body size can indicate changes in predator-prey size ratios and food quality available for early life stages of fishes. In the GoM, cladocerans are a main prey item for Scombroidei fishes (i.e., tuna, mackerel, and billfish species) and are selected over more readily available zooplankton taxa. Therefore, size of cladoceran prey can impact growth, mortality, and influence variability in abundance/distribution of early life history stages of tunas in the GoM, including Atlantic bluefin tuna (*Thunnus thynnus*) (ABT). To examine the relationship between abundance, distribution, and size range of cladocerans and larval ABT, plankton samples from several years of a fishery-independent survey were analyzed. Cladocerans and larval ABT were identified and body lengths of each taxa were measured using a microscope and digital imaging software. Abundance of each of the taxa were calculated using tow depth and volume filtered by the plankton net. Distribution maps for each of the taxa were generated to determine overlap and changes in abundance over the time series. Correlations between abundance and size ranges of cladocerans with larval ABT demonstrate the predator-prey relationship in the GoM. An established correlation will provide much needed information to help account for annual variability in larval Atlantic bluefin tuna abundance.

About the Scholar

Cheyenne Murdaugh is from Gainesville, Virginia and is a senior at University of Maryland Eastern Shore, Princess Anne majoring in Environmental Science with a concentration in Marine Science. Cheyenne is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to continue her education and obtain her Master's degree in Marine Science beginning in Fall 2025. Cheyenne is a member of the NOAA Living Marine Resources Cooperative Science Center (LMRCSC) program. She is excited to continue her education and pursue her goal of becoming a marine biologist. A professional aspiration of Cheyenne's is to work for NOAA. This is all to fulfill her desire to protect natural resources and promote sustainable fishing practices.

Kara Murphy

Mapping Saipan Lagoon: A Comparative Habitat Analysis

NOAA Mission Goal: Healthy Oceans
Mentors: Steven McKagan and Robbie Greene
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Located on the northeastern side of the island of Saipan in the Northern Mariana Island, Saipan Lagoon serves a major role in the economy and ecology of Saipan. The lagoon houses critical seagrass beds and coral reefs, and is used for a variety of recreational activities. A thorough understanding of the benthic habitat of the lagoon is necessary for proper management for recreational use, resource management, and public safety. Coastal benthic habitat mapping via Remote Sensing is a fairly new approach to creating accurate large-scale benthic habitat maps. In 2016, NOAA released a benthic habitat map of the lagoon using such techniques (Kendall and Costa 2016). Our study aims to create two major products to be compared to the 2016 maps, and used for later management decisions; an updated high resolution corrected satellite image, and an updated benthic habitat map. This was done using WorldView 3 imagery, analyzed in R and SNAP software, then classified in ArcGIS Pro. The comparison between the 2016 and 2024 imagery and maps serves as an important first step in analyzing the change in the bay, and the implications for management.

About the Scholar

Kara Murphy is entering her fourth year at the University of Hawai'i at Hilo, pursuing a dual degree in Marine Science and Environmental Science. She is an AAUS Scientific Diver and an Environmental Educator, and is passionate about connecting community to conservation. Her work primarily focuses on resource management and changing ecosystems. Kara hopes to continue to work towards finding solutions to small-scale marine resource problems to benefit coastal communities that rely the most on these ecosystems. She is excited to share some of the interesting changes being observed in a little-known pacific island.

Khrista Nicholas

Spatial Patterns in the Coral Reef Ecosystems of Papahānaumokuākea Marine National Monument

NOAA Mission Goal: Healthy Oceans
Mentors: Randall Kosaki and Chelsie Counsell
NOS - ONMS - Papahānaumokuākea Marine National Monument
National Oceanic and Atmospheric Administration (NOAA)

The Papahānaumokuākea Marine National Monument (PMNM) is a hub of cultural and ecological significance located in the Northwestern Hawaiian Islands. Largely undisturbed by local human urbanization, it holds high biodiversity and endemism isolated in the Pacific Ocean. To monitor the monument's coral reef, research expeditions have collected benthic and fish underwater SCUBA survey data since 2000. This research project used these data to conduct a spatial analysis of PMNM to identify biogeographic patterns. This helps characterize the marine resources of PMNM, and identify areas where further research and conservation efforts are needed. Our goal is important to the preservation of PMNM in the face of anthropogenic climate change, marine debris, invasive species, and other human impacts. We used the R coding platform to organize data, identify patterns, and create visualizations that represent the benthic and fish populations across the monument. Our results show that PMNM is an interconnected web of coral reef ecosystems, with each island having a unique profile of fish populations, benthic cover, and oceanographic setting. This suggests that each island in PMNM supports a unique marine ecosystem and may have a different standard of what healthy looks like. More data are needed as we continue to identify patterns through time at multiple atolls. This will help us recognize hotspots of ecological importance and monitor their condition. This is key to improving conservation efforts of PMNM ecosystems that provide resources for vulnerable marine life and local Hawaiian communities in the face of rapidly

About the Scholar

Khrista Nicholas is from South Florida with Trinidadian roots. She is a rising senior at the University of Miami double majoring in Marine Science and Biology with a minor in Math. She is expected to graduate with her Bachelor's degree in Spring 2025 and aspires to continue her education to obtain a PhD in Biological Oceanography. Khrista is a NOAA Ernest F. Hollings Class of 2023 scholar. During her internship, she conducted a spatial analysis of the Papahānaumokuākea Marine National Monument investigating decades of benthic and fish survey data. She is excited to study the impact of climate change on the relationship between dynamic oceanography, marine ecosystems, and the communities intertwined with them. Khrista is passionate about including the voices of local and underrepresented communities in research. She aspires to leverage her interdisciplinary background in her research to promote sustainability and strengthen policies protecting marine ecosystems.

Rose Nolan

Sperm Whale and Dolphin Presence in the Offshore Gulf of Maine

NOAA Mission Goal: Healthy Oceans
Mentor: Annabel Westell
Northeast Fisheries Science Center, National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Offshore wind energy development is planned for the Gulf of Maine (GOM), which is an important habitat for many marine species. Passive acoustic recorders (SoundTraps) sampling at 48 kHz were deployed in the offshore GOM, in Georges Basin, from 2022-2023. One of these sites, located west of the Northeast Channel, was analyzed for sperm whale and dolphin presence on an hourly basis using PAMGuard. For sperm whales, presence varied by season and time of day. Sperm whales were detected year round with distinct seasonality. From June 2023 to November 2023 sperm whales had a mean percent presence of 87%. In contrast, from December 2022 to May 2023 sperm whales had a mean percent presence of 8.6%. Dolphins were detected consistently year round and at all times of day. These results provide a baseline which will be used to assess ongoing sperm whale and dolphin presence. This study supports the idea that sperm whales, classed as Endangered in US waters, and dolphins should be considered in mitigation plans and permitting efforts for offshore wind energy.

About the Scholar

Rose Nolan is from Cambridge, Massachusetts and is a rising senior at Brandeis University majoring in both Computer Science and Environmental Studies. She is interested in the intersection of conservation and software, which she gets to explore through her summer internship with the NOAA Passive Acoustics Branch at Woods Hole. During her internship, Rose used the software PAMGuard to validate sperm whale click detections from sites in the Gulf of Maine, analyzing and visualizing the results using R. With a deeper understanding of how remote sensing blends computation and conservation, Rose hopes to continue working with remote sensing conservation projects after graduation.

Kelli Ong

Fit as a Fiddler: Evaluating the Predator/Prey Dynamics of Wilson's Plovers and Fiddler Crabs

NOAA Mission Goal: Healthy Oceans
Mentors: Chris Kinkade and Jay Black
National Ocean Service, Office for Coastal Management
National Oceanic and Atmospheric Administration (NOAA)
Rookery Bay National Estuary Research Reserve

Understanding the distribution and abundance of prey species is crucial for assessing the survival of their respective predators. Wilson's Plovers (Charadrius wilsonia) are Florida state-threatened shorebirds that primarily feed on fiddler crabs (Uca spp). Although adults are able to relocate to other sites to find prey, chicks must forage independently and remain in their natal hatching grounds until they have successfully fledged. It is hypothesized that less prey availability leads to higher chick mortality, though this theory has yet to be formally tested. To determine if a correlation exists between prey density and Wilson's Plover chick survival, we quantified fiddler crab abundance on three islands in Rookery Bay National Estuarine Research Reserve, FL and compared it to 2024 Wilson's plover nesting activity. We measured fiddler crab density in three intertidal zones with varying distances to shore and vegetation lines to identify if intertidal zone length is correlated with crab abundance. Additionally, we mapped thirteen years of historical nest sites from 2011 to 2024 to assess potential changes in Wilson's Plover nesting locations. We reviewed these datasets for trends in Wilson's plover nesting activity, fiddler crab density, and some abiotic habitat conditions. Such data will identify critical factors for chick survival and offer valuable insights into Wilson Plover feeding dynamics, an area that is significantly understudied.

About the Scholar

Kelli Ong is a rising senior from Los Angeles, California, and attends the University of California, Santa Cruz. She is majoring in marine biology and expects to graduate with her Bachelor's Degree in Spring 2025. As a Class of 2023 EPP/MSI scholar, she has worked in various disciplines across NOAA, from managing Arctic sea ice data to monitoring Florida wading birds. This summer, Kelli is interning at Rookery Bay National Estuarine Research Reserve in Naples, Florida, where her research determines how fiddler crabs affect the survival rates of Wilson's Plover chicks, a state-threatened shorebird. In addition to attending graduate school, Kelli hopes to combine her interests in conservation and project management to become a research director for NOAA.

Sasha Provost

Factors Affecting the Body Condition of Gray Whales During the Southbound Migration

NOAA Mission Goal: Healthy Oceans
Mentors: Tomo Eguchi and Trevor Joyce
NMFS/Cetacean Health and Life History Program
National Oceanic and Atmospheric Administration (NOAA)

As eastern North Pacific gray whales *(Eschrichtius robustus)* complete an annual Southbound migration from their Arctic feeding grounds to their wintering grounds in Mexico, collected body condition data offers insight into their fitness, foraging success, and overall population health. To determine potential environmental factors driving variability in Southbound body condition, a series of predictive models were created, exploring possible correlation across sixteen different Arctic environmental factors and gray whale width-to-length ratios during the Southbound migration. The body condition data was derived from a mixture of visual surveys and UAS footage collected off the coast of Central California from 1987 to 2024; similarly the collection timespan for the Arctic environmental data ranges from 1986 to 2023. The results indicated that from 1987 to 2013, variability in interannual Southbound body condition was correlated with an abundance of Crustacea and Bivalvia in Arctic feeding grounds, fluctuating sea ice cover in the Bering and Chukchi Seas, and changes in the Pacific Decadal Oscillation, which is indicative of trends in North Pacific Basin sea surface temperatures. In a mixed model, the annual averages of the aforementioned correlated factors from April to October accounted for 25.47% of the body condition variance during subsequent Southbound migrations, with two highly significant parametric coefficients and two significant smooth terms. These results demonstrate the importance of looking to trends in Arctic environmental conditions as possible indicators of future gray whale population health and as potential explanations for any anomalous trends observed during the Southbound migration.

About the Scholar

Sasha Provost is a rising senior at Duke University where she is expected to graduate in the Spring of 2025 with a double major in Marine Science & Conservation and Public Policy and a minor in History. She is a member of Duke University's Rachel Carson Scholars Program and a Class of 2023 NOAA Ernest F. Hollings Scholar. Through the Hollings Scholarship Program, she is currently completing a summer internship with the Cetacean Health & Life History Program at NOAA's Southwest Fisheries Science Center in San Diego, CA. During her internship, she is assisting with UAS-based photogrammetry efforts and completing a research project focused on the potential environmental drivers of gray whale body condition during their southbound migration. She is interested in the behavior and population dynamics of cetacean species, the use of UAS in scientific research, and marine-oriented conservation policy.

Diet analysis of fish species in the snapper/grouper complex from the northern Gulf of Mexico

Sarah Rawlinson

NOAA Mission Goal: Healthy Oceans
Mentors: Frank Hernanadez and Glenn Zapfe
National Marine Fisheries Service, Southeast Fisheries Science Center, Pascagoula Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Holistic approaches to marine fisheries management, such as Ecosystem-Based Fisheries Management (EBFM), are widely advocated in favor of single-species stock assessment approaches. Often EBFM is informed by ecosystem models that include trophic relationships, because fishing pressure, habitat alterations, and other factors that impact food web connectivity in marine systems ultimately impact predator and prey populations. A limiting factor in the development of many trophic models is the availability of quantitative diet data, particularly for non-commercial species. Clearly, a critical need for continued development of food web models (and their successful application to fisheries management) is more detailed trophic data. The primary objective of this project is to gather much needed data on the trophic ecology of several fish species across the northern Gulf of Mexico (nGOM). This would be in collaboration with an existing fisheries independent survey (Southeast Area Monitoring and Assessment Program, or SEAMAP) with an emphasis on fishes in the snapper/grouper complex. Samples were collected during the 2024 Summer SEAMAP Groundfish survey in the western nGOM. Fish were weighed; measured; full stomach removed and weighed; all prey items removed from the stomach; and empty stomach weighed to get total weight of prey items. Traditional visual identification of gut content was used to inspect the diets of rock sea bass (*Centropristis philadelphica*) and red snapper (*Lutjanus campechanus*) to calculate the proportion by number and frequency of occurrence for the prey items found. The trophodynamic data from this project can help inform EBFM models and stock assessments in the nGOM.

About the Scholar

Sarah Rawlinson is from Pittsburg, California, and is a rising sophomore at the University of Maryland Eastern Shore. Sarah is expected to graduate with her Bachelor's degree in Spring 2027, and she aspires to continue her education and obtain her Master's degree in Marine Science in Fall 2027. Sarah is a NOAA Living Marine Resources Cooperative Science Center (LMRCSC) Scholar. She is excited to delve deeper into the complexities of marine ecosystems, explore the impacts of climate change on aquatic life, and contribute to the development of sustainable fisheries management practices. Sarah's professional goal is to work for NOAA as a marine scientist. Sarah is currently engaged in research pertaining to the diet of ground fish found in the Gulf Coast. She seeks to protect natural resources by merging her scientific expertise with advocacy efforts, ultimately becoming a champion for ocean conservation and sustainability.

Bridget Reheard

Mixture effects of PFOS and PFHxS on larval sheepshead minnows (*Cyprinodon variegatus*)

NOAA Mission Goal: Healthy Oceans
Mentors: Philip Tanabe and Peter Key
National Ocean Service/NCCOS Ecotoxicology Branch
National Oceanic and Atmospheric Administration (NOAA)

Per- and polyfluoroalkyl substances (PFAS) are a ubiquitous class of pollutants commonly found in aquatic ecosystems. Perfluorooctane sulfonate (PFOS) is a particularly toxic and persistent PFAS that has been shown to be toxic to fish. While PFOS toxicity has been well documented, its mechanisms of toxicity, as well as mixture effects with other PFAS are largely unknown, especially in estuarine organisms. This study aims to characterize the acute and sublethal mixture toxicity of PFOS with perfluorohexane sulfonate (PFHxS) on larval sheepshead minnows (*Cyprinodon variegatus*). Larvae were exposed for 96 h at the no observed adverse effects concentrations of PFHxS (12.5 mg/L) and PFOS (1 mg/L), as well as a mixture of the two (12.5 mg/L PFHxS + 1 mg/L PFOS). Significantly higher mortality was observed in the mixture (35.0±2.9%) relative to the control (1.7±1.1%), 1 mg/L PFOS alone (1.7±1.7%), and 12.5 mg/L PFHxS alone (1.7±1.7%). Gene expression of two antioxidant enzymes, superoxide dismutase (*sod*) and catalase (*cat*) were quantified following exposure. Significant upregulation of *sod* was observed in the mixture relative to the control (50.1±26.0%), while expression of *cat* was not significantly different. Concentrations of reduced glutathione (GSH) and malondialdehyde (MDA) were measured to assess antioxidant depletion and lipid peroxidation, respectively. While no significant differences were observed in MDA concentrations, significant reductions in GSH were observed in the mixture (25.0±5.8%) relative to the control. These findings suggest PFHxS increases the toxicity of PFOS in sheepshead minnows through oxidative stress, helping to improve future risk assessments of PFAS mixtures in aquatic environments.

About the Scholar

Bridget Reheard is from Lancaster, Pennsylvania and is a rising senior at Penn State double majoring in Geosciences as well as Wildlife and Fisheries Science. She is expected to graduate with her Bachelor's degrees in August 2025 following a field geology experience in the summer and intends to pursue a Ph.D. in Ecology and Evolutionary Biology. She is interested in understanding how anthropogenic stressors as well as natural physiochemical conditions of aquatic environments drive the survivorship and resilience of fish species. Bridget is a NOAA Ernest F. Hollings Class of 2023 scholar as well as a 2024 Barry Goldwater scholar. She has been working at the Hollings Marine Laboratory in James Island, South Carolina to assess the mixture toxicity of per- and polyfluoroalkyl (PFAS) compounds with a sulfonate group (PFOS, PFHxS, and PFBS) on the survivorship and expression of oxidative stress biomarkers in larval sheepshead minnows. In the future, she is excited to be able to combine her unique background of contaminant geochemistry, environmental toxicology, and genetics to monitor the adaptive capacity of aquatic organisms in a rapidly changing world.

Madeline Rich

Identifying Anthropogenic Sounds in an Offshore Wind Energy Site Prior to Construction

NOAA Mission Goal: Healthy Oceans
Mentor: Rochelle Gordon
Passive Acoustics Branch - Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Sound is one of the most valuable properties studied in the ocean, leading to the increased use of passive acoustic monitoring to understand the impacts of biological, anthropogenic, and ambient noise in the marine environment. Marine species rely on sound for essential life functions, such as foraging and communication, emphasizing the importance of understanding how human noise can disrupt these ecosystems. Offshore wind energy development is also increasing, which has the capacity to alter soundscapes through anthropogenic noise from activities such as high vessel presence, pile driving, and site surveys. The preconstruction phase of offshore wind energy development is lacking sufficient baseline data, which leaves the potential to be underestimating the effects of anthropogenic sound prior to turbine installation. The significance of this study is to create an accessible catalog of anthropogenic sounds for future comparisons to facilitate the protection of marine life and mitigation efforts in wind energy areas. In this study, acoustic data were collected from a bottom mounted acoustic recorder deployed from November 2022 to April 2023 in the Southern New England, US offshore wind energy area. The data from the recorder was reviewed using Raven Pro software, sampling every fifth day for anthropogenic sound sources. Further assessment of anthropogenic acoustic signals by comparison to mariner's reports and AIS data aids in identification of the sound sources and possible patterns related to offshore wind energy development. Potential sounds have been compared to geophysical survey devices, such as sub bottom profilers and sparkers, along with other oceanographic instrumentation.

About the Scholar

Madeline Rich is a rising senior at the University of South Carolina with an expected graduation of May 2025. She is originally from Richmond, Virginia and is majoring in Marine Science. Additionally, Madeline has a minor in Business Administration and concentration in Coastal Resource Management and Marine Policy. After obtaining her Bachelor's degree, Madeline plans on beginning a career with NOAA or other similar agency and is interested in returning to graduate school after gaining experience in the workforce. Madeline is a NOAA Ernest F. Hollings Class of 2023 scholar. She completed her internship in Woods Hole, MA at the Northeast Fisheries Science Center with the Passive Acoustics Branch. Her internship focused on analyzing passive acoustic data to study anthropogenic impacts in relation to wind energy areas, specifically in the pre-construction phase. Her chosen area of study reflects her committed interests in environmental policy, coastal management, and sustainable ecosystems.

Anjali Shah

Using glider data to explore spring ice melt and productivity regimes in the Bering Sea

NOAA Mission Goal: Healthy Oceans
Mentors: Heather Tabisola and Shaun Bell
Ecosystems and Fisheries Oceanography Coordinated Investigations, Pacific Marine Environmental Laboratory/ Oceanic and Atmospheric Research (OAR)
National Oceanic and Atmospheric Administration (NOAA)

The Bering Sea is one of the most productive fisheries in the United States, but the area has faced warming and sea ice decline over the past decade, shifting phytoplankton bloom types with potential bottom-up effects. Cold year, ice-associated blooms provide seasonal carbon fluxes to benthic communities while warm year, open water blooms feed smaller surface dwelling organisms, indicating a possible shift in trophic energy flow with earlier ice retreat. Quantifying the spatial extent and changing phenology of bloom types with traditional methods such as stationary moorings, temporally limited Conductivity, Temperature, Depth (CTD) casts, and surface satellite data has proven difficult. However, the Oculus glider autonomously collects depth-integrated ocean profiles at a high frequency, filling the gaps in mooring, CTD, and satellite data, thus creating a uniquely high spatial and temporal resolution dataset. Oculus was deployed in the Southern Bering Sea in May 2023; the data was processed and visualized along with moorings and CTD casts in order to quantify the spatial and temporal extent of ice associated and open water blooms. Oculus recorded 3 productivity regimes in the southern Bering Sea, including ice-associated and open water blooms. All 3 regimes are quantitatively validated through a K-means clustering algorithm. Furthermore, the Oculus glider's high resolution illustrates the spatial extent and discrete boundary between productivity regimes that cannot be identified through more conventional monitoring methods. This analysis supports future Oculus deployment to map and predict the extent of ice influence and ice-associated blooms in a warming Bering Sea.

About the Scholar

Anjali Shah is a rising senior at Brown University in Providence, RI, studying EEPS (Earth, Environmental, and Planetary Science) and Applied Mathematics. She is passionate about the intersections of quantitative and biological oceanography with fisheries policy, which has culminated well in her work at NOAA's Ecosystem-Fisheries Oceanography Coordinated Investigations in Seattle, WA. Anjali is expected to graduate with two bachelor's degrees in May 2025. She aims to attend a graduate program that combines physical and biological oceanography, where she can engage in interdisciplinary research to advance sustainable ecosystem-based management.

Cameron Stacey

Variability in dissolved organic carbon within southeastern forested wetlands

NOAA Mission Goal: Healthy Oceans
Mentor: Erik Smith
National Ocean Service
National Oceanic and Atmospheric Administration

Forested wetlands represent the headwaters of the organic rich “blackwater” rivers and streams that are characteristic of the southeastern coastal plain. The sources of organic matter within forested wetlands that contribute to the highly colored nature of blackwaters remain poorly resolved. A field research study was conducted to quantify dissolved organic carbon (DOC) concentration and optical characteristics (absorbance) within four sites typical of the southeastern coastal plain. These included two forested upland sites, one dominated by coniferous long-leaf pine (*Pinus palustris*) and the other by deciduous laurel oak (*Quercus laurifolia*), and two forested wetland sites, one dominated by coniferous swamp cypress (*Taxodium distichum*) and the other dominated by deciduous swamp tupelo (*Nyssa biflora*). Ground and surface waters from the wetland sites and precipitation throughfall and soil leachates from all sites were measured for DOC and absorbance. Results indicate high variability in DOC and color (absorbance) among sites and sample types. In general, wetland surface and ground waters are highly enriched in colored DOC, compared to typical values observed in blackwater rivers and streams that are the receiving waters for wetland discharge. Interestingly, DOC absorbance values for throughfall and soil leachates were significantly lower than those of surface or groundwater samples in wetland sites, suggesting subsequent biogeochemical processing is transforming the optical properties of these sources over time. While further studies should investigate the processes altering internal DOC dynamics, results of this study demonstrate the importance of forested wetlands in contributing highly colored DOC to downstream blackwater systems.

About the Scholar

Cameron is obtaining her Bachelors in oceanography with a chemistry minor at Texas A&M University at College Station, expecting to graduate in May 2025. She aspires to get her PhD in chemical oceanography starting in Fall 2025. She is currently working as a NOAA Hollings Scholar in conjunction with NERRS to better understand the dissolved carbon budget surrounding Southeastern United States wetlands. In the future, she hopes to expand her research endeavors into quantitative and qualitative contaminant and remediation research. As such, Cameron’s career aspirations include working for the USGS as a chemical analyst for marine systems. She hopes to employ environmental chemical understanding to inform policy and advocate for affected communities.

Peyton Steffek

Spatiotemporal Distribution of Dolphins Around the Gulf of Maine Wind Energy Area

NOAA Mission Goal: Healthy Oceans
Mentor: Amanda Holdman
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Dolphin presence in the Gulf of Maine (GOM) has been previously classified as constant, with little specification beyond this general term. As construction of wind energy areas in the GOM is slated to begin in the near future, gaining a deeper understanding of the spatiotemporal distribution of dolphins is imperative. From 2020 to 2023, acoustic recorders (AMARs, Soundtraps, and F-PODs) were deployed in 30 sites throughout the GOM. Data were analyzed for dolphin whistles on an hourly time scale using the PAMGuard whistle and moan detector module and a custom, python-based detection-viewing software, Soundscope, for validation. Dolphins were detected at all recording locations with varying presence based on region and time of year. Dolphins were present year-round in offshore GOM, while seasonally present in inshore GOM. For the inshore GOM, presence varied seasonally by location. In the Southern coastal shelf, dolphin presence peaked in spring and fall, while in the northern coastal shelf , dolphin presence peaked in fall only. At one site, MDR, in the northern shelf, dolphin presence extended into the winter. These results expand on current knowledge of dolphin habitat use and can be used to guide wind energy plans for lowest impact. Outputs of this study can be furthered with the development of an acoustic delphinid classifier to gain a better understanding of species-specific distributions throughout the Gulf of Maine.

About the Scholar

Peyton Steffek, a senior at the University of California, San Diego, navigates her studies in Marine Biology where her roots dig deep into the coastal city of San Diego. Graduating in Spring 2025, she sets her sights on a Master's program the following Fall. Peyton stands adorned as a NOAA Hollings Scholar, joining the Class of 2023, and has delved into the depths of research with the Northeast Fisheries Science Center. There, her focus on delphinid presence in the Gulf of Maine unfolds. Peyton's interests in marine ecology/behavior coupled with conservation and restoration align seamlessly with NOAA's dedication to marine sustainability. With an unwavering passion for marine life, Peyton readies herself to chart a course from academia to the vibrant waters of the marine science workforce, where her journey promises to make waves.

Savannah Stephenson

OneArgoPy: Creating a Python Library for Accessing, Analyzing, and Plotting Argo Float Data

NOAA Mission Goal: Healthy Oceans
Mentor: Hartmut Frenzel
Ocean and Atmospheric Research/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Argo is an international program that measures water properties across the world's oceans using a fleet of robotic instruments that drift with the ocean currents and move up and down between the surface and a mid-water level. These data help scientists understand how the physical state of the ocean is changing over time, however, to utilize Argo data scientists must have tools that are accessible, understandable, and fit within their workflow. Argo data are stored at Global Data Assembly Centers (GDACs) in NetCDF files which offer access to the complete Argo data collection including float metadata and profile data. To navigate to a specific float's NetCDF files the user must have information about the float including its full ID, the data assimilation center it uses, and whether or not it is a biogeochemical float and be able to navigate the structure of the NetCDF file. The process is tedious and would require intimate knowledge of both the GDAC file system structure and the NetCDF file structure. Streamlining this process is the goal of our library. By translating an existing MATLAB toolbox into Python, which is becoming increasingly popular among scientists, we are simplifying the use of Argo data. The library can be used to select Argo float profiles based on geographic and time limits, with flexibility for more selection criteria to be added at a later date. The trajectories of selected floats can be plotted, and the scientific data from the NetCDF files can be loaded into a pandas dataframe.

About the Scholar

Savannah Stephenson is from Corpus Chisti, Texas and is a rising senior at Texas A&M University Corpus Christi (TAMUCC) majoring in Computer Science with a double minor in Creative Writing and Math. Savannah is expected to graduate with her Bachelor's degree in Fall 2025, and aspires to continue her education and obtain a doctoral degree in computer science. Savannah is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2023 Scholar. Savannah has always admired the work of meteorologists, oceanographers, and other physical scientists; she aims to combine her passion for computer science and problem-solving to enhance these scientists' effort and make data easier to interpret, more accessible, and more reliable. This summer Savannah worked with the Pacific Marine Environment Laboratory (PMEL), coding the basis for a python library that will allow users to access, analyze, and graph data from the Argo project. Argo is an international program that collects information from inside the ocean using a fleet of robotic instruments that drift with the ocean currents and move up and down between the surface and a mid-water level.

Kelley Strike

Toxicity of PFOS and PFOA to Three Benthic Estuarine Organisms

NOAA Mission Goal: Healthy Oceans
Mentor: Pete Key
Katy Chung
National Ocean Service (NOS)
National Oceanic and Atmospheric Administration (NOAA)

Per- and polyfluoroalkyl substances (PFAS) are a group of fabricated chemicals that includes such compounds as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). PFOS is no longer manufactured in the U.S., but it is still produced internationally and can be imported into the U.S. in consumer goods. PFOA is used worldwide as an industrial surfactant in a variety of applications. Toxicity information about PFOS and PFOA in regards to estuarine organisms is limited - especially in sediment-dwelling estuarine organisms. Any effects on these benthic organisms can have repercussions on their ecosystem as a whole. The objective of this research experiment was to characterize the effects of PFOS and PFOA in juvenile polychaetes (*Neanthes arenaceodentata*), juvenile hard clams (*Mercenaria mercenaria*), and juvenile amphipods (*Leptocheirus plumulosus*) in aqueous-only acute tests and in acute tests in the presence of sediment. *N. arenaceodentata* are deposit feeders that live in the tropical waters of the Pacific and Atlantic Oceans. *L. plumulosus* are surficial modifiers widely distributed along the East coast of the U.S. *M. mercenaria* are filter-feeding bivalves native from Canada to Mexico. PFOA was more toxic to the three organisms than PFOS. In the presence of sediment, PFOA toxicity decreased for amphipods and polychaetes while remained similar for the clams. PFOS toxicity in polychaetes and clams showed only about 15% mortality in the highest exposures for both aqueous-only and sediment. PFOS toxicity in amphipods requires further testing. Comparisons of toxicity results of previous exposures with PFOS and PFOA on other estuarine organisms will be presented. The research with these PFAS compounds will add essential data to assess how these contaminants pose a risk to estuarine organismal health.

About the Scholar

Kelley Strike is from Vienna, Virginia and is a rising senior at the University of South Carolina. She is currently studying to receive her Bachelor’s degree in Marine Science and plans to graduate Spring 2025. After obtaining her Bachelor's degree, Kelley wishes to work towards earning her Master’s degree beginning in Fall 2025. Kelley is a NOAA Ernest F. Hollings Class of 2023 scholar. During the Summer of 2024, she conducted research with NOAA’s toxicology lab in Charleston, South Carolina. Using PFOA and PFOS, she ran LC50 tests - both aqueous and with sediment - on polychaetes, amphipods, and juvenile clams. Regarding her future career, Kelley aspires to work for NOAA and conduct research involving anthropogenic impacts on marine life and climate change - primarily ocean acidification. This research will assist in advocating for protection and conservation of the environment as well as spreading awareness of the impact humanity has on it.

Sophie Strock

Analyzing the Soundscape of Murat Marine Park to Improve Monitoring Efforts

NOAA Mission Goal: Healthy Oceans
Mentor: Jessica McCordic
Passive Acoustics Branch, Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

A soundscape consists of anthropogenic, biological, and geological sounds within an environment and may serve as a tool to assess the condition of an ecosystem. Soundscapes should be monitored and managed to reduce the negative impacts of human activities. In this study, we examined the soundscape of Murat Marine Park, located in the Great Australian Bight. Classified as a National Park Zone, this marine park is considered a no-take marine protected area (MPA), so human activity is still permitted, but fishing and collecting are not allowed. Monitoring soundscapes in MPAs is particularly important due to the dependence of many marine species on sound for biological functions. In this location, underwater recorders were deployed from February to May 2020, and we used this data to determine the hourly presence of anthropogenic and biological sounds up to 5 kHz. During this monitoring period, vessel presence was limited and showed no influence on long-term patterns of sound levels. Biological sources included dolphins, snapping shrimp, fish pulses and choruses, and baleen whales. These baseline measurements will be useful to continue to manage and monitor the biological state of Murat Marine Park.

About the Scholar

Sophie Strock is a rising senior at Eckerd College, St. Petersburg, Florida, from Centerville, Massachusetts. She is majoring in Marine biology and is expected to graduate with a Bachelor of Science in May 2025. Sophie is a NOAA Ernest F. Hollings Class of 2023 scholar and is excited to continue her study of using soundscape ecology to improve monitoring in remote marine parks. Sophie’s professional ambition as a marine biologist is to work for NOAA and continue research in conservation biology. She aspires to use her research findings to help create policies that protect natural resources and those who benefit from them.

Rohan Vaswani

Variability of Pelagic Fauna in the Mid Atlantic Ridge and Azores Plateau

NOAA Mission Goal: Healthy Oceans
Mentors: Adrienne Copeland and Mike Ford
Oceanic and Atmospheric Research/Office of Ocean Exploration and Research
National Oceanic and Atmospheric Administration (NOAA)

Occupying the region between the ocean surface and seafloor, the pelagic ecosystem contains the largest portion of the ocean's biomass. The lack of observations in this region has resulted in limited understanding of ecosystem variability and dynamics. In July 2022, NOAA Ocean Exploration utilized the remotely operated vehicles (ROVs) Deep Discoverer and Seirios to conduct two midwater dives over the Mid-Atlantic Ridge North of the Azores (MARNA) marine protected area and the Azores Plateau (AP), the first water column explorations for the region. During these dives, horizontal transects were conducted at relatively consistent depths throughout the water column (~300-1800m) and ROV video was annotated . Utilizing the annotations of the visible pelagic fauna to the lowest taxonomy level at first appearance for each transect, Shannon-Wiener biodiversity indices, species abundance, and species evenness were derived providing critical insight on pelagic fauna inventory and behavior. As hypothesized, there was minimal variability between equivalent transect depths of the dive sites since they are in close proximity to each other; however vertical pelagic fauna variability was observed. These values allow for inferences about the variability of pelagic fauna in the vertical dimension from the mesopelagic to bathypelagic zone along with variability between the dive sites.

About the Scholar

Rohan Vaswani is a rising third year at the University of California, Irvine majoring in Earth System Science with a specialization in Oceanography and minoring in Literary Journalism. He is expected to graduate with his Bachelor's of Science in Spring 2026. Rohan is a 2024 NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Undergraduate Scholar and is excited to explore a new aspect of the NOAA mission as he interns with NOAA Ocean Exploration. His project involves annotating Remotely Operated Vehicle (ROV) water column transects along with analyzing hydroacoustic and conductivity temperature depth (CTD) data to examine pelagic fauna in the deep scattering layer. Additionally, he has diverse interests in ocean exploration, physical oceanography, science communication, marine technology, and marine operations. Rohan aspires to commit to a career of service and is interested in the NOAA Corps and the Office of Marine and Aviation Operations.

Alyssa Walter

Risk Analysis of Elasmobranch Species as Biovectors Using Satellite Telemetry

NOAA Mission Goal: Healthy Oceans
Mentors: Ryan Freedman and Elizabeth Duncan
Channel Islands National Marine Sanctuary
National Oceanic and Atmospheric Administration (NOAA)

Bioaccumulation of Persistent Organic Pollutants (POPs) in seafood is a topic of concern in Southern California and the recent discovery of a Deep Water Dumpsite off Catalina Island with Dichlorodiphenyltrichloroethane (DDT) has heightened public concern. The high trophic position of elasmobranchs mean they can bioaccumulatePOPs, presenting an unknown risk to humans if consumed. This study utilized satellite telemetry to compare the movements of Bat Rays (*Myliobatis californica*), Leopard Sharks (*Triakis semifasciata*), and Angel Sharks (*Squatina californica*), predator species commonly caught by sustenance fishers off of local piers that could be potential biovectors of POPs. Thirteen Pop-Up Archival Satellite Transmitting tags were deployed, providing depth, temperature, and estimated location data. Angel Sharks and Leopard Sharks used a limited shallower depth range, while Bat Rays made a number of deep dives (over 300 feet). Using Minimum Convex Polygons we found that Bat Rays had large home ranges (avg = 7231.285 +/- 6084.04 km^2) that encompass five of the Channel Islands. The high movement capacity observed in Bat Rays shows their ability to forage in distant locations with unknown contaminant levels before time of capture. Testing of contaminant levels in tissue samples for these three species is recommended, as well as further tagging and tracking of Angel and Leopard Shark movement.

About the Scholar

Alyssa Walter is from Davis, California and is a rising senior at California State University, Monterey Bay majoring in Marine Science with a minor in Statistics. She will graduate with her Bachelor's degree in May 2025, and is planning to pursue a PhD studying marine ecology beginning Fall 2025. Alyssa is a NOAA Ernest F. Hollings Class of 2023 scholar working with the Channel Islands National Marine Sanctuary Research team. She is excited to continue her study of ocean predators and learn to work with satellite and acoustic telemetry data to analyze animal movement and behavior. Alyssa's professional aspirations include working for NOAA or teaching at a University. She plans to integrate community science and education into her research to actively engage and benefit local communities.

Sophie Welch

Quantifying variability in the north Pacific oxygen minimum zone

NOAA Mission Goal: Healthy Oceans
Mentors: Hernan Garcia, Courtney Bouchard, and Zhankun Wang
National Environmental Satellite Data and Information Service/National Centers for Environmental Information
National Oceanic and Atmospheric Administration (NOAA)

The global ocean includes Oxygen Minimum Zones (OMZs) generally located near intense upwelling regions such as in the Eastern Pacific. OMZs are regions and depth layers that have relatively low oxygen content (e.g., < 60 μmol/kg) when compared to relatively more oxygenated open ocean waters(> 200 μmol/kg). OMZs result from a balance difference between O2 sources (e.g., circulation, marine production) and sinks (e.g., respiration of export sinking organic matter). Regions like these are effectively dead zones for higher trophic level animals near the surface, which not only affects biodiversity, but also has impacts on the fishing and aquaculture industry. Because of global deoxygenation caused by ocean warming, the net area and volume of OMZ might be increasing overtime. The long-term baseline mean (1965-2022) global area and volume of OMZ in the Pacific (> 20S) for 3 different O2 bins (0-30, 31-60, and 61-90 μmol/kg) were calculated. The analysis is based on quality-controlled O2 observations in NOAA's World Ocean Database and World Ocean Atlas 2023 as well as development of python code to quantify the results. The relevance of this study is that it documents an internally consistent baseline data analysis for the estimation of O2 anomalies to study OMZ variability and trends. This study analyzes observations from Argo floats with O2 sensors which have increased the 4-D coverage of the instrumental record. The analysis of this new data allows for enhanced understanding of the complex interactions between physical, chemical, and biological processes in the deep ocean's circulation conveyor belt. This work was conducted in NOAA's NCEI Ocean Climate Laboratory.

About the Scholar

Sophie Welch is from Chattanooga, TN, and is a rising junior at Nova Southeastern University double majoring in Marine Biology and Environmental Science with minors in Chemistry, honors Transdisciplinary Studies, and Scientific Diving. Sophie is expected to graduate with her Bachelor's degrees in May of 2026 and she is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar. This summer, she worked with Dr. Hernan Garcia and the National Centers for Environmental Information to quantify the temporal variations of the North Pacific oxygen minimum zone. Her professional aspiration is to work for NOAA's National Centers for Coastal Ocean Science as an environmental scientist for the ecotoxicology branch. She intends to combine her interest in chemistry and marine sciences to protect the health of our aquatic resources.

Alyssa Wentzel

Investigating Microplastic Distribution and Abundance in Two Inlets of South Carolina

NOAA Mission Goal: Healthy Oceans
Mentos: Elaine Vaudreuil, Jennifer Plunket-NERR, Stefanie, and Whitmire- Clemson University
National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

Estuaries are the intersection of upland, rivers, and the sea and have the potential to accumulate plastic pollution before it enters the ocean. Two estuarine inlets along the coast in Georgetown County, South Carolina, Murrells Inlet and North Inlet, with similarities in structure and large differences in urbanization. Murrells Inlet is characterized as an urbanized town with limited plastic policies, high rates of tourism, and high plastic consumption. North Inlet has little urbanization impacts and receives little tourism. A field experiment study was performed to collect water samples at 5 different sites at each inlet (n=10) to analyze microplastic distributions, abundance, and composition across these two inlets to see 1) how microplastics are distributed across these two inlets 2) plastic composition differences across these two inlets 3) the impact urbanization plays on microplastic abundance between these two inlets. Across all locations in Murrells Inlet, the number of microplastics averaged to about 230.8 ± 64.77 MP/m3 while North Inlet showed an average of about 195± 78.21 MP/m3. Across both inlets, a major source of microplastic that emerges is rubber. Although there was no statistical difference in abundance (p=0.227), Murrells Inlet experienced higher amounts of polytetrafluoroethylene (PTFE) (p=0.015) and polyethylene terephthalate (PET) (p= 0.054).

About the Scholar

Alyssa Wentzel is from Reading, Pennsylvania and is a rising senior at the University of Delaware. They are double majoring in Marine Science and Public Policy with a minor in Geography and is expected to graduate in spring of 2025. Alyssa is a NOAA Ernest F. Hollings Class of 2023 scholar and their research interests focus on evaluating contaminants and the impacts they have on coastal communities. They are currently interning at the National Estuarine Research Reserve in Georgetown, SC investigating microplastic distribution and abundance across two South Carolina Inlets. Alyssa hopes to become a professor at a public university in order to teach and empower a new generation of marine scientists.

Asher Wescott

Interstitial Shelter Temperature Refuge for Gulf of Maine Atlantic Salmon

NOAA Mission Goal: Healthy Oceans
Mentors: John Kocik and Graham Goulette
National Marine Fisheries Service/Northeast Fisheries Science Center/Maine Field Station
National Oceanic and Atmospheric Administration (NOAA)

National Oceanic and Atmospheric Administration (NOAA) Gulf of Maine Atlantic Salmon (*Salmo salar*) are listed under the Endangered Species Act and are a NOAA Species in the Spotlight. Numerous factors have caused this population decline and climate change impacts, including increasing river temperatures, are of interest to managers. Our project goal was to determine if interstitial zones act as a temperature refuge. We completed two different studies to answer this question. First, we planted 28 temperature loggers in the Narraguagus River in an experiment and control design. We placed one control logger set in undisturbed river bed substrate and another experimental logger set in an artificial redd at each sample point. Each sample point had two loggers: one at the river bed surface and one buried 10 in into the interstitial zone. For the second study, we measured the number of interstitial shelters and temperatures at shelters. To do this, we counted the number of shelters at 20 sites, and recorded the temperature inside the shelter and in the adjacent water column to compare the differences. Our preliminary results indicate that the shelters averaged 1.1 ℃ cooler than the water column. This indicates that the interstitial shelters provide some amount of temperature refuge for Atlantic Salmon. While we have not yet retrieved our temperature loggers, we predict similar results will be found through a longer time period. This research can inform future conservation efforts, such as artificially creating more shelters for the Atlantic Salmon to seek temperature refuge.

About the Scholar

Asher Wescott is a rising senior at the University of California-Santa Cruz, majoring in Ecology and Evolutionary Biology. He is looking forward to learning more about Ecology, and is especially interested in Behavioral Ecology. After he graduates, Asher plans on taking on seasonal research positions, then getting a Masters degree a few years later. He aspires to be able to understand the interconnectedness of the natural world, in order to help protect and maintain it. Asher is a class of 2025 Hollings scholar and is studying Atlantic Salmon, and how they may be able to rely on interstitial shelter as a temperature refuge. He is thankful for the opportunity to gain more knowledge and hands-on experience with designing studies, analyzing data, and learning how to approach research while thinking about how to combat climate change.

Kathryn Whitmer

A Sparrow's Toolkit: Assessment and Monitoring of *Ammospiza caudacuta* at the Narragansett Bay NERR

NOAA Mission Goal: Healthy Oceans
Mentors: Kenneth Raposa, Jon Mitchell, Elaine Vaudreuil
Narragansett Bay National Estuarine Research Reserve
National Ocean Service
National Oceanic and Atmospheric Administration (NOAA)

Salt marshes serve as vitally important ecosystems for many organisms, but sea level rise is leading to their decline, as marshes are not gaining elevation fast enough. This is putting marsh-reliant species at risk, such as the declining saltmarsh sparrow (*Ammospiza caudacuta*), which rely on healthy marsh habitat for nesting. As such, monitoring the populations of saltmarsh sparrows while developing minimally invasive monitoring methods is important for conservation efforts. Given this, the present study centers on the following goals: understanding saltmarsh sparrow distribution and relative abundance on Prudence Island, Rhode Island, using SHARP (Saltmarsh Habitat and Avian Research Program) surveys, discerning what additional information passive monitoring methods could provide about saltmarsh sparrows, and exploring potential consequences of camera traps on sparrow nest predation. All work was done on Prudence Island, using study points generated according to the SHARP protocol. It was found that saltmarsh sparrow abundance correlated with increased high marsh grass (Spartina patens), and community composition of marsh birds differed when saltmarsh sparrows were present. Passive sampling methods, such as camera traps and acoustic monitoring, yielded no additional information on saltmarsh sparrows when compared to SHARP, but showed potential for general marsh bird monitoring. It was also found that camera trap presence did not make a significant difference on nest predation. This study highlights the importance of high marsh habitat restoration for saltmarsh sparrow conservation, and reinforces that cameras used for nest monitoring have minimal impact. Further research into more passive study methods is recommended for long-term monitoring efforts.

About the Scholar

Kathryn Whitmer is from Spokane, Washington, and currently attends the University of Washington in Seattle, pursuing a degree in marine biology with a minor in data science. She is expected to graduate with a bachelor's degree in June of 2025, and aims for a PhD focused on marine biology. Kathryn is a NOAA Ernest F. Holling's scholar recipient, currently doing a summer internship at the Narragansett Bay National Estuarine Reserve in Rhode Island. There, she has been studying salt marsh birds, including saltmarsh sparrow nest predation. She has also worked to set up acoustic monitoring devices in salt marshes to record bird use. Ultimately, Kathryn aspires for a career in coastal marine ecology, with a potential focus on birds. Through this, she aims to combine her interests for marine ecology with community based conservation in an effort to protect the marine environment.

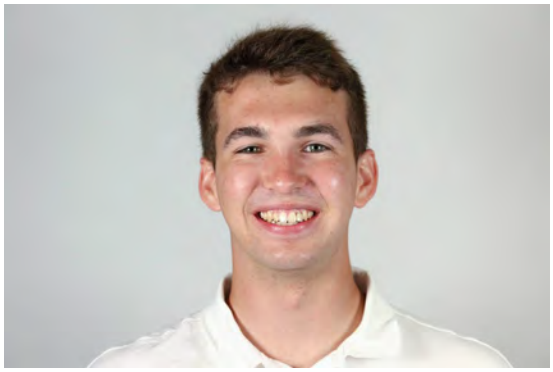
Roger M. Wilder

Creatures of Habitat: Analysis of fish recruitment in nearshore areas of Alaska's Inside Passage

NOAA Mission Goal: Healthy Oceans
Mentors: Jordan Hollarsmith and Becca Cates
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Researchers use a variety of methods to analyze fish population recruitment in nearshore habitats around the globe, each with their own benefits and weaknesses. Originally developed by Amman (2004), the Standard Monitoring Unit for the Recruitment of Fishes (SMURF) is a device that allows scientists to sample fish recruits in nearshore habitats in a way that is more comprehensive, cost-effective and passive compared to visual underwater surveys. Considering the recent progression of Alaska's aquaculture industry, we deployed SMURF devices on mooring lines and used nets for SMURF collection at kelp aquaculture sites, setting the groundwork for a longer study to understand how kelp farms influence fish species diversity and abundance throughout the harvest cycle. We deployed SMURFs near the surface and at depth in a kelp farm site and similar control site. After three days, we retrieved the SMURFs and identified and measured the fish species inside, while also conducting underwater visual surveys of fish and invertebrate species to collect data on biotic communities in the area before kelp is planted. SMURF deployment and visual surveys will be repeated while kelp is growing and again after it has been harvested as part of a larger study to elucidate the habitat provisioning impacts of kelp aquaculture, especially on species of commercial and regulatory importance, in Alaska's Inside Passage.

About the Scholar



Roger Wilder is originally from Sandia Park, New Mexico. As a rising senior at Bowdoin College, Roger plans to graduate with a Bachelor of Arts in Biology with a concentration in Ecology, Evolution, and Marine Biology and a minor in History. After graduation, Roger intends to pursue a Ph.D. in Coral Biology and Coral Reef Ecology, working towards a career with NOAA where he can combine his interests in research and science communication to raise awareness of and appreciation for tropical marine systems. As a 2023 NOAA Ernest F. Hollings Scholar, Roger is researching the impacts of habitat provisioning of marine aquaculture sites on nearshore faunal communities in Juneau, Alaska. He hopes to incorporate the knowledge and experience he gains from this opportunity into his scientific trajectory next year and after graduation.

Zoe Willis

The Water Quality Factor: Why is Water Quality Important for Stony Coral Tissue Loss Disease Interventions in Puerto Rico?

Healthy Oceans
Mentors: Helena Antoun and Maria Vega-Rodriguez
National Marine Fisheries Service/National Oceanic and Atmospheric Administration (NOAA)
Puerto Rico Department of Natural Resources

Stony Coral Tissue Loss Disease (SCTLD) is a highly infectious coral disease that emerged in the Florida Keys in 2014 and rapidly spread throughout the Caribbean. This disease was first documented in Puerto Rico in November of 2019, and since then has spread to reefs across the entire island, causing an estimated loss of 50% coral cover on diseased reefs. In response to this massive loss, a State of Emergency was declared in Puerto Rico's coral reefs, and funds were mobilized to aid intervention strategies. Since then, the Puerto Rico DNER has used an amoxicillin paste applied along SCTLD disease lesions to control SCTLD advancement at specific locations around Puerto Rico. This treatment has been shown to stop lesions in SCTLD-infected colonies, but application of the treatment in Puerto Rico has had variable effectiveness. It is not known what causes this variability, but water quality parameters may play a role. In order to create a baseline of comparison against treatment efficacy, a full depth profile of water quality parameters at these sites were determined using a Eureka Manta multiparameter sonde. Highlighting parameters such as temperature, salinity, pH, dissolved oxygen, colored dissolved organic matter, and chlorophyll-a concentration, sites were compared. This project highlights the importance of long-term water quality monitoring at reef sites and the need for a greater understanding of the interactions between water quality and coral disease.

About the Scholar

Zoe Willis is from Anderson, South Carolina, and attends the College of Charleston majoring in Marine Biology and Chemistry. She is expected to graduate with both degrees in Spring 2025, and then continue her education with a PhD in marine biology beginning Fall 2025. Zoe is a NOAA Ernest F. Hollings Class of 2023 scholar working in Puerto Rico to determine factors that impact stony coral tissue loss disease antibiotic treatment success. After graduate school, she hopes to continue a career as a coral researcher with a university, government agency, or nonprofit organization. Through her research, Zoe will explore how coral disease, eutrophication, warming, and other human impacts interplay with restoration efforts. Her goal is to utilize her research to develop restoration strategies that benefit the coastal communities most vulnerable to coral decline.

Morgan Youngblood

Fidelity and Flux: Comparative Analysis of Marine Predator Residency

NOAA Mission Goal: Healthy Oceans
Mentors: Ryan Freedman and Elizabeth Duncan
National Ocean Service/Channel Islands National Marine Sanctuary
National Oceanic and Atmospheric Administration (NOAA)

This study assessed movement and habitat fidelity metrics of seven tagged marine predator species opportunistically detected within the Channel Islands National Marine Sanctuary (CINMS) from 2013 to 2024. Some of these tagged species are threatened or endangered and others are vulnerable to anthropogenic disturbance. Researchers track these species' movements to identify behavioral patterns and locate aggregation sites. Data from 13 acoustic receivers stationed around four Northern Channel Islands revealed both broad-scale spatial patterns and species-specific behaviors. Of 277 transmitters detected, 224 individuals were identified through a collaborative telemetry network of West Coast universities and research institutions. Leopard (*Triakis semifasciata*), Sevengill (*Notorynchus cepedianus*) Sharks and Giant Sea Bass (*Stereolepis gigas*) exhibited high site fidelity; while Soupfin Sharks (*Galeorhinus galeus*) and Yellowtail Amberjacks (*Seriola lalandi*) displayed high connectivity and low site fidelity within the sanctuary. Bat Rays (*Myliobatis californica*) and White Sharks (*Carcharodon carcharias*) exhibited seasonal site fidelity in Fall and Summer, respectively. Notably, juvenile White Sharks exhibited the greatest maximum daily displacement, the farthest distance between detection locations in a single day, at 45.5 km. These findings highlight the value of CINMS as a multi-purpose habitat for both resident and migratory species in the Northeast Pacific, underscoring the need for expanded long-term, inter-regional, acoustic monitoring networks to inform future conservation strategies.

About the Scholar

Morgan Youngblood is from Colorado Springs, Colorado, and is an upcoming senior at the University of Hawaii, Hilo, majoring in marine science with a minor in chemistry. He is set to graduate with his bachelor’s degree in Spring 2025 and plans to continue his education by pursuing a PhD in marine ecology starting in Fall 2025. Morgan is a current NOAA Ernest F. Hollings Class of 2023 scholar. He is excited to continue his studies in sustainable infrastructure, natural resource management, indigenous stewardship practices, and the impact of human activities on geochemical interactions in coastal communities. As a marine scientist, Morgan aspires to work for NOAA and teach. In his efforts to promote a more equitable relationship with our environment, he aims to inspire future researchers and leverage quantitative ecological research to enhance community engagement in environmental stewardship.

Kira Zautcke

Using Trace Metals to Characterize Three Newly Discovered Hydrothermal Vents Along the Mid-Atlantic Ridge

NOAA Mission Goal: Healthy Oceans
Mentors: Pam Barrett and Joe Resing
Office of Oceanic and Atmospheric Research/Pacific Marine Environmental Laboratory/National Oceanic and Atmospheric Administration (NOAA)

Hydrothermal vents play a critical role in regulating oceanic geochemical cycles. Different types of vents vary in their impacts on oceanic geochemistry and ecology. Hydrothermal systems driven by serpentinization reactions (Type 3) — characterized by alkaline fluids with high concentrations of methane and hydrogen and low concentrations of trace metal and carbon dioxide — are the least studied, due in part to their rarity. An expedition on the R/V Falkor (too) in 2023 set out to search for active serpentinization on oceanic core complexes at slow spreading centers along the Mid-Atlantic Ridge, where seawater reacts with exposed mantle rocks. It discovered new active vent fields at three locations (Puy des Folles, Grappe Deux, and Kane Fracture Zone (KFZ)), and collected water samples from tow-yo's, vertical casts, and ROV explorations. Samples were analyzed for total and dissolved Fe (tFe, dFe) and Mn (tMn, dMn) concentrations using flow injection analysis coupled with fluorescence detection. Preliminary results show notably high hydrogen concentrations at Grappe Deux, indicating the largest influence of serpentinization-driven venting; however, it is clearly a mixed system (Type 2) because of trace metal content and black smoke. Two vents were sampled at Puy des Folles, both with high tFe and tMn and low hydrogen concentrations, characteristic of black smoker (Type 1) systems, but variable methane. KFZ had similar tFe compared to the Type 1 vents, but lower tMn; this, combined with higher metal/gas ratios than Grappe Deux, suggest KFZ as an intermediate between the two (Type 2).

About the Scholar

Kira Zautcke is a rising senior at the University of Florida with majors in chemistry and marine science. She is a NOAA Ernest F. Hollings Class of 2023 scholar. Her summer project centers around using flow injection analysis to quantify Mn and Fe concentrations in hydrothermal vent water samples. She plans to graduate with her bachelor's degree in Spring 2025, and intends to pursue a PhD in chemical oceanography beginning Fall 2025. She hopes to continue on with biogeochemistry research by exploring topics such as carbon sequestration, trace metal cycling, and chemical biomarkers. Kira aspires to become a professor one day, combining her passions for teaching and research.

Top: Kay Poonawala, *Hollings '23.* Bottom: Mia Gomez, *Hollings '23*

Kiran Bajaj

Triploids or diploids? A decision support tool for Puget Sound oyster farmers in the face of climate change

NOAA Mission Goal: Resilient Coastal Communities and Economies
NOAA Mentors: Paul McElhany and Shallin Busch
Craig Norrie (Mentor, University of Washington)
National Marine Fisheries Service, Northwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Oyster aquaculture in Puget Sound is a highly valued industry of both economic and cultural importance. To increase yields, some oyster farmers choose to plant triploid oysters (individuals with three sets of chromosomes), for their faster growth rate, sterility, and marketability during the summer months when diploids are reproductive. However, farmers must balance these advantages with observed mortality in triploids that is likely to be influenced by one or more stressors including high temperature, hypoxia, desiccation, and food availability. We conducted a meta-analysis of diploid-triploid experiments to evaluate the risk of triploid mortality as reported in the literature so far under various stressors. We compared environmental data from long-term monitoring buoys and cruises around Puget Sound to loggers placed directly on farms to estimate an offset in conditions. This analysis is an important step towards mapping risk of triploid mortality. To synthesize the best available data into a user-friendly format and decision support tool, we developed an interactive R Shiny app. The app will help farmers understand existing triploid mortality data and receive information relevant to their farm given its environmental conditions. Because the direct link between triploid mortality and the environment is currently not well parameterized, the tool will be improved to provide increasingly confident recommendations as more experimental data is reported.

About the Scholar

Kiran Bajaj is a rising senior at Northeastern University with a major in Marine Biology and a minor in Data Science. Kiran is a NOAA Hollings Class of 2023 scholar and will be graduating in spring of 2025. For her internship project, Kiran is working on a decision support tool for oyster growers in Puget Sound, with a goal to help farmers choose between planting diploid or triploid Pacific oysters. At Northeastern, Kiran studies local adaptation and population genetics of Eastern oysters using molecular and ecological techniques. After graduation, Kiran plans to take one gap year and apply for lab technician jobs and possibly a Fulbright grant. Kiran hopes to pursue a PhD in marine population genetics or conservation genomics in fall 2026, and aims to use molecular tools to inform successful conservation and aquaculture.

Abby Charlton

Recreation Suitability Analysis for Virginia's York River

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentor: Sarah Gonyo
National Ocean Service/National Centers for Coastal Ocean Science
National Oceanic and Atmospheric Administration (NOAA)

Recreation terrain suitability mapping is an analytical process that identifies areas that are optimal for recreation activities. This study focuses on the York River and coastal Virginia, where fluctuations in population density and land use necessitate a better understanding of the relationship between cultural recreation use and landscape features. Using ArcGIS software, this project analyzed Land-Use/Land-Cover data, proximity to natural and human infrastructure features, and severity of slope to highlight locations with high, moderate, and low potential for various types of recreation. The resulting maps provide estimations of where visitors will recreate and what type of recreation they might engage in. Furthermore, this study integrates human mobility data–a type of aggregated GPS data from smartphones, apps, and mobile devices–to identify discrepancies between recreation potential and observed turnout. This research ultimately enables local land managers to better understand the relationship between the visiting populations and the York River and to make informed decisions for local recreation.

About the Scholar

Abby Charlton is a 2023 Ernst F. Hollings Scholar interning for the NCCOS Social Science team this summer. Growing up in Granville, OH, she goes to school at Ohio Wesleyan University, where she double majors in environmental studies and geography and minors in French. After graduating with her Bachelor's degree, she will pursue graduate studies in regional planning with a concentration in environmental planning. As she studies the interaction of humanity and the natural environment through space and place, she aspires to better the relationship between the two and to reduce the impact that one has on the other. This summer, she is working on a recreation suitability index for the York River of coastal Virginia.

Logan Evans

Stories of Biocultural Restoration in He‘eia: A Fish Eye View

NOAA Mission Goal: Resilient Coastal Communities and Economies
NOAA Mentors: Fred Reppun and Stacy Cummings
Shimi Rii - Hawai‘i Institute of Marine Biology, He‘eia National Estuarine Research Reserve
Kim Falinski, The Nature Conservancy Hawai‘i
Anthony Olegario, State of Hawai‘i Division of Aquatic Resources
National Ocean Service/National Oceanic and Atmospheric Administration (NOAA)

The goal of this project is to characterize the diversity and abundance of fish species in the He‘eia estuary, and provide preliminary analysis of any changes that have occurred over recent years in response to biocultural restoration activities occurring throughout the He‘eia ahupua‘a (social-ecological land division roughly following watershed boundaries) led by community-based non-profit organizations Paepae o He‘eia and Kāko‘o ‘Ōiwi. Fish monitoring has taken place intermittently in the estuary over several decades, and in 2019, a collaborative research effort of He‘eia NERR, State Division of Aquatic Resources (DAR), and The Nature Conservancy (TNC) started a comprehensive fish monitoring project in He‘eia using castnet, visual, and eDNA surveys. This project focuses on analyzing data from the ten castnet surveys, conducted from December 2019 to June 2024. Major habitat changes have occurred since the initiation of the first castnet survey, including extensive removal of invasive mangrove trees and ongoing restoration of native wetlands and waterways. Forty-five unique species have been documented in the five years of castnet surveys, and exploratory analysis of the castnet data shows a shift in species composition over time. Particular focus was given to comparative analysis of relative abundance of the native Hawaiian mullet species (*Mugil cephalus*), a culturally important food species, and the non-native Marquesan mullet (*Moolgardia engeli*). Through this project with castnet survey data, we have created a streamlined process for integration of future monitoring data, and a pathway to incorporate eDNA data, visual surveys, water quality, and environmental data into the wider fish monitoring project.

About the Scholar

Logan Evans is from Los Angeles, California and is a rising senior at Duke University double majoring in environmental science & policy and earth & climate science with a focus in ecology. She will be graduating with her Bachelor’s degree in Spring 2025 with plans to pursue a PhD following graduation. Logan is a NOAA Ernest F. Hollings Class of 2023 scholar. Her summer project is working with the He‘eia National Estuarine Research Reserve in Kāne‘ohe Bay, O‘ahu, Hawai‘i. In addition to working with community partners on Indigenous led biocultural restoration activities, she is analyzing data from the NERR’s fish monitoring program to characterize changes in the diversity and abundance of fish species in the He‘eia estuary that have occurred over recent years following major habitat changes from restoration activities. Her professional aspirations are to pursue research, teaching, and community-led solutions in applied marine community ecology focused on coastal restoration and conservation projects.

Talofa Fe’a

Ia Uluulu Matāfolau: Exploring the Risk of Ciguatera Poisoning in American Samoa

NOAA Mission Goal: Resilient Coastal Communities & Economies
Mentors: Val Brown and Eileen Nalley (Hawai‘i Sea Grant)
National Ocean Service/National Marine Sanctary of American Samoa
National Oceanic and Atmospheric Administration (NOAA)

Ciguatera poisoning (CP) is a food-borne illness caused by the consumption of seafood that has bioaccumulated ciguatoxin, a type of toxin produced by dinoflagellates (*Gambierdiscus* spp). This type of seafood poisoning significantly impacts the health, socio-economic stability, and cultural practices of Oceania, where communities heavily depend on ocean resources. While there is well-documented knowledge of ciguatera in parts of the Pacific (e.g., French Polynesia), CP remains understudied in other Pacific Island Countries and Territories. In American Samoa, CP was last studied in 1997, leaving uncertainty about its current extent and impacts on fishing communities. This research aims to address data gaps on the prevalence and impacts of CP in American Samoa. The study recognizes the value of traditional knowledge and community experiences in understanding local CP risks and uses anonymous surveys and targeted interviews. Using an exploratory sequential research design, suspected fishing sites from responses were directly sampled for the presence of the responsible dinoflagellate. Survey results indicated a general lack of awareness, with interests (>80% of respondents) in using a reliable, affordable test kit to test seafood for CP if made available. Interview data revealed common themes among knowledgeable individuals, including a desire for increased education and awareness. This research offers essential insights for managers to ascertain the impacts and mitigate the risk of CP in American Samoa. Findings can be used to inform policy, outreach materials, future studies, and management actions in American Samoa and throughout the region.

About the Scholar

Talofa J. Fe’a is from American Samoa. She was born and raised on the island of Tutuila, in the villages of Faleniu and Iliili. Fe’a is a Natural Resources and Environmental Management major at the University of Hawai‘i at Mānoa, and an EPP/MSI Undergraduate Scholar at NOAA. This summer, she had the opportunity to work with National Marine Sanctuary of American Samoa (NMSAS) and the University of Hawai‘i Sea Grant’s Pacific Ciguatera Network on a study aimed at increasing understanding of ciguatera poisoning impacts in American Samoa. Expected to graduate with her Bachelor’s degree in Fall 2024, Fe’a is excited to continue her studies in resource management and conservation. As a Samoan scientist and STEM scholar, she aspires to conduct research informed by the environmental challenges and cultural heritage of Pacific Island communities. Fe’a intends to use her interests in science to amplify the voices of her people and advance the needs of Oceania.

Mia Gomez

Evaluating the Effects of Coral Bleaching at Mission: Iconic Reefs Coral Restoration Sites in the Florida Keys National Marine Sanctuary

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: T. Shay Viehman(Mentor) and Sophie Cook
National Ocean Service, National Centers for Coastal Ocean Science
National Oceanic and Atmospheric Administration (NOAA)

Coral reefs worldwide have been significantly stressed by high ocean temperatures in the past year during the fourth global coral bleaching event. From June to September 2023, the Florida reef tract experienced severe coral bleaching. To quantify the impacts of this bleaching event on a high coral cover site, I annotated coral colonies in Taglab software using orthophoto mosaic imagery of a 10m by 10m restoration monitoring plot at Cheeca Rocks reef in the Florida Keys National Marine Sanctuary. Results from a comparison of imagery collected in June 2022 and May 2024 show a decrease in coral cover, an increase in mortality on coral colonies, and an increase in macroalgae. Coral cover decreased from approximately 35% to 27% and turf macroalgae increased from 12% to 25%. Overall, the corals in the genus *Orbicella sp.* and *Siderastrea sp*. had the highest percent cover pre- to post-bleaching event. Coral colony mortality was prevalent on the tops of coral colonies, which are likely to have experienced higher irradiance. Results demonstrate the importance of continued coral reef monitoring to quantify climate-based disturbances, such as bleaching, and ecological resilience and will inform restoration design and implementation.

About the Scholar

Mia Gomez is from Miami, Florida and is a rising senior at Florida Atlantic University Wilkes Honors College in Jupiter. She is expected to graduate in Spring 2025 with her Bachelor's degree in Marine Biology and minor in Law & Society. Mia plans to conduct research in Australia through the U.S. Fulbright Student Program and pursue a Master's degree in marine ecology and conservation. Mia is a NOAA Ernest F. Hollings Class of 2023 Scholar and interned this summer with the National Center for Coastal Ocean Science in Beaufort, NC. During her internship, she annotated large-scale imagery of coral reef restoration sites in the Florida Keys National Marine Sanctuary under Mission: Iconic Reefs to evaluate coral reef condition post-fourth global coral bleaching event. Mia aspires to pursue research in marine ecology, focusing on endangered species and impacts of climate change on marine organisms, to inform marine policy and management.

Alexis Hadinger

Balancing Marine Mammal Protection and Fisheries Sustainability: Social Indicators in California's Dungeness Crab Fishery

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Elliott Hazen and Steven Bograd
National Marine Fisheries Service/Southwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

In recent years, a series of marine heatwave events in the North Pacific Ocean have impacted the California coastal ecosystem, posing social and economic challenges for fishing communities and decision-makers. A significant consequence has been increased whale entanglements within the California Commercial Dungeness Crab (*Metacarcinus magister*) Fishery, partly due to shifting whale populations. Balancing marine mammal protection with maintaining a financially viable fishery presents a critical challenge. This research explores whether social indicators can capture the socio-economic impacts of disturbances on the fishery. While indicators of coastal community vulnerability exist for the US West Coast, we hypothesize that fishery-specific indicators, developed in partnership with its participants, will provide deeper insight into how environmental and regulatory changes affect the fishery and its stakeholders. We identified potential local indicators through semi-structured interviews with fishery participants to examine how regulatory actions impact stakeholders. By identifying social indicators from these interviews, we aim to monitor the fishery's socio-economic resilience to regulatory changes. These indicators offer insights into the fishery's adaptability to various disturbances, including changes to mitigate whale entanglements and environmental stressors. While ecological indicators have traditionally guided fishery management, this project aims to integrate social data into coastal fisheries decision-making processes. Our objective is to identify variables serving as effective indicators of fishery health, facilitating more adaptive management strategies amid dynamic environmental and regulatory conditions. We expect fishery-specific social indicator development to provide richer information than solely relying on state-level fishery data for assessing the Dungeness crab fishery's wellbeing.

About the Scholar

Alexis Hadinger is from Santa Cruz, California, and is a rising senior at Oregon State University pursuing a degree in Oceanography with minors in Chemistry and Marine Conservation/Management graduating in June 2025. She plans to attend a Marine Policy Master’s program in Fall 2025. Alexis is a 2023 NOAA Ernest F. Hollings Scholar and worked in interdisciplinary fisheries research during her internship. Her research interests are focused on fisheries policy and management, aiming to integrate her scientific background with conservation efforts to protect marine ecosystems. Alexis is deeply committed to public education about human-ocean impacts and advocating for sustainable practices. She intends to use her education and experiences growing up on the coast to create positive change in ocean conservation, whether through NOAA, a role with the state, or non-profit organization. Her ultimate career goal is to merge scientific knowledge with policy-making to foster ocean protection and environmental sustainability.

Jacqueline Kiszka

Investigating the Impact of Climate Variability and Change on the California Current System

Resilient Coastal Communities and Economies
Natalie Freeman and Dillon Amaya
Ocean and Atmospheric Research (OAR)
National Oceanic and Atmospheric Administration (NOAA)

Ocean-atmosphere teleconnections driven by the El Niño-Southern Oscillation (ENSO) can have significant impacts on the physical and biogeochemical ocean properties of the California Current Large Marine Ecosystem (CCLME), one of the world's major upwelling regions that supports important marine resources. This study aims to deepen our understanding of the impacts of ENSO on the ocean processes that influence marine ecosystems in the CCLME. This is accomplished using a Tropical Pacific Pacemaker Ensemble from the Community Earth System Model 2 (CESM2), a climate model in which 10 members have sea surface temperature (SST) anomalies in the eastern tropical Pacific that are nudged to observations from 1880 to 2020, thus capturing the observed ENSO signal and allowing the rest of the fully-coupled global system to freely evolve. These 10 simulations demonstrate 10 different realizations of natural or internal variability in the climate system, including the possible influence of ENSO on the CCLME. This study investigates the statistical relationships and uncertainties between the Niño-3.4 index and multiple physical and biogeochemical properties in the CCLME. We show that the maximum correlation between the monthly Niño-3.4 index and CCLME SST anomalies has an ensemble mean lag time of 6 months, with a possible range of 5 to 8 months. The winter Niño-3.4 index and subsequent spring CCLME SST anomalies exhibit higher correlations than the monthly correlation with no lag time, highlighting the expected lagged response associated with the poleward propagation of coastally trapped Kelvin waves along the US west coast.

About the Scholar

Jacqueline Kiszka is a rising senior from York, Pennsylvania studying Meteorology and Atmospheric Science with a minor in Marine Sciences at Pennsylvania State University. Her research interests include air-sea interactions and biogeochemistry, and she hopes to expand her knowledge in these areas through a PhD program in atmospheric and oceanic science beginning in Fall 2025. She is a class of 2023 Ernest F. Hollings Scholar and her internship with the NOAA Physical Sciences Laboratory in Boulder, CO is investigating the impact of large-scale climate variability, specifically the El Niño Southern Oscillation (ENSO), on the physical and biogeochemical ocean processes that drive marine ecosystems in the California Current System. Her goal is to pursue a career in atmospheric and oceanic research, exploring the complex interactions between the two systems and their impacts on the natural environment.

Alexandra Kreis

Evaluating the Equitable Distribution of Coastal Resilience Spending at NOAA

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentor: Amber Fandel
Office of Legislative and Intergovernmental Affairs
National Oceanic and Atmospheric Administration (NOAA)

Executive Order 12898 calls for the prioritization of environmental justice across the Federal government. In other words, this order requires the just treatment and meaningful involvement of all people in Federal processes so that everyone may be protected from disproportionate and adverse health and environmental risks. At the National Oceanic and Atmospheric Administration (NOAA), under its vision of fostering resilient coastal communities and economies, environmental justice must be central to considering its investments in the nation's coastal communities. This policy report explores how three of NOAA's coastal resilience programs under the Infrastructure Investment and Jobs Act, or the Bipartisan Infrastructure Law, are distributed across coastal and Great Lake states. In order to assess equitability, the report highlights Congressional representation, and the risk of flooding and socioeconomic demographics using the Environmental Protection Agencies' EJScreen. The states in the Gulf of Mexico were identified as being most vulnerable to flooding, having a high proportion of the population within the floodplain, and higher socioeconomic vulnerability than the national average. However, these states, all of which are represented in Congress by Republicans, consistently received a disproportionately low rate of coastal resilience investments compared to Democratically represented states. As NOAA is one of the federal agencies that stands on the frontlines of protecting the nation from the increasing risks of climate change, it must ensure that future coastal resilience awards proportionately invest in the communities, ecosystems, and economies of regions facing the highest levels of risk by supporting regional capacities for competitive applications.

About the Scholar

Alexandra "Sasha" Kreis is a rising senior at the University of Maryland, College Park majoring in Environmental Science & Policy with a concentration in Politics & Policy. Her professional interests center around Environmental Justice as it interconnects with international climate diplomacy, domestic renewable energy expansion, and green infrastructure. As an intern at NOAA's Office of Legislative and Intergovernmental Affairs, she is exploring these interests by researching how Bipartisan Infrastructure Law funding can be dispersed more equitably, especially as it relates to localized demographics, politics, and regional capacity to adapt to climate change. Following the completion of her Bachelor's degree in Spring 2025, she plans to continue her education and obtain her J.D. with a focus on environmental & energy law beginning in Fall 2028. Ultimately, she aspires to use her background in law to promulgate and defend crucial climate reform policies across the global stage.

Emma McGuire

Identifying and Communicating the Threat of Ciguatera (CP) Poisoning in the Pacific Islands

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Keith Kamikawa and Eileen Nalley
National Marine Fisheries Service/Pacific Island Regional Office and Hawai‘i Sea Grant
National Oceanic and Atmospheric Administration (NOAA)

Ciguatera Poisoning (CP) is caused by ingesting ciguatoxins produced by epiphytic dinoflagellates, most commonly *Gambierdiscus toxicus*. These algae produce ciguatoxins that can be transmitted through reef fish; herbivorous reef fish inadvertently ingest ciguatoxins as they feed on algae, and through biomagnification or bioaccumulation, the toxin concentration increases. While rarely fatal, neurological and gastrointestinal issues are common and can persist from days to years, and there is currently no cure. It is estimated that over 500,000 Pacific Islanders have suffered from ciguatera, and this number is expected to rise. CP is also underreported, which makes management challenging. To address the significant underreporting of ciguatera, educational and outreach materials were developed in collaboration with the Hawai’i Department of Health. Posters, infographics, decals, and an educational module were created for the fishing and healthcare communities to encourage disease reporting and awareness. Furthermore, field monitoring methods were tested for feasibility and implementation. Sieves were constructed with 20 and 200 micron mesh filters attached to a three-inch PVC pipe. Eleven algae samples were collected at three locations along reefs on the south shore of O‘ahu, and epiphytic dinoflagellates were removed using established methods. These epiphytes were examined under a light microscope to identify *Gambierdiscus* spp.. Developing educational content and creating sampling method pipelines will serve as a framework for future monitoring efforts and increase CP awareness and reporting within Pacific Island communities.

About the Scholar

Emma McGuire is from Dallas, Texas but was born and raised in Atlanta, Georgia. She is a rising senior at the University of New Hampshire double majoring in Biomedical Sciences: Medical Microbiology and English as well as double minoring in Marine Biology and Women’s Studies. Emma expects to graduate with her Bachelors of Science in Spring 2025 and plans to continue her education by attending graduate school where she hopes to research marine extremophiles to achieve a deeper understanding on the origin of life and planetary habitability. As a 2025 NOAA Ernest F. Hollings scholar, she is conducting her internship this summer in Hawai’i within the Pacific Island Regional Office and Hawai’i Sea Grant. Her work explores the risk of ciguatera fish poisoning in Pacific Island fishery communities. Emma highly values the interdisciplinary aspect of STEM within her internship, which demonstrates the necessity for science communication and project development.

Kay Poonawala

Tidal Dynamics of the Lower Columbia: Effects of Seasonal Differences in River Outflow

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Lorraine Heilman, Katie Kirk, and Adrienne Copeland
National Ocean Service/Center for Operational Oceanographic Products and Services
Oceanic and Atmospheric Research/Ocean Exploration
National Oceanic and Atmospheric Administration (NOAA)

The Lower Columbia River Estuary (LCRE) is a dynamic environment influenced by seasonal variations in river outflow and hydropower operations, making it an interesting area to study tidal dynamics. This study examined the impact of seasonal river flow variations, particularly influenced by the Bonneville Dam, on tidal characteristics of the water levels and currents along the LCRE for the two years of the Columbia River Current Survey conducted by NOAA's National Current Observation Program (NCOP) from March 2022 to October 2023. Hourly water level data from six NOAA National Water Level Observation Network (NWLON) stations and corresponding current velocities measured at nearby NCOP stations using Acoustic Doppler Current Profilers (ADCPs) were analyzed for different time periods during the survey. Harmonic analysis, implemented with the Utide package in Python, decomposed the time series data into tidal constituents, providing insights into the amplitude and phase of dominant tidal cycles. Different analysis techniques were employed to account for the variability introduced by fluctuating river flows. The changes in river flow regimes correlate with changes in the amplitudes of semi-diurnal and higher frequency tidal constituents in both water levels and currents. The results highlight the complex interaction between tidal and fluvial processes in estuarine environments, essential for improving tidal predictions for navigation and coastal management.

About the Scholar

Kay Poonawala is from Phoenix, Arizona and is a rising senior at the University of Arizona majoring in Geoscience, with minors in Math, Physics, and Marine Science. She is a NOAA Ernest F. Hollings Scholar, Class of 2023 and is expected to graduate with her Bachelor's degree in Spring 2025. This summer, she is working with NOAA CO-OPS to research the estuarine dynamics of the Lower Columbia River and help deploy acoustic doppler current profilers in the field. In Arizona, she uses climate model data to research the mass balance of the Greenland Ice Sheet in past and future climates and works as a hiking and backpacking guide for UA Outdoor Recreation. She aspires to combine her interests in earth science and math in graduate school, while continuing to be an advocate for more diversity in the outdoors and in the field.

Avalon Provance

Benefits of Community Education and Outreach: Thunder Bay National Marine Sanctuary

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentor: Giselle Samonte
National Ocean Service/Office of National Marine Sanctuaries National Oceanic and Atmospheric Administration (NOAA)

Thunder Bay National Marine Sanctuary is located in Lake Huron, northeast of Michigan, and is part of the National Marine Sanctuary System consisting of sixteen national marine sanctuaries. The sanctuary is culturally and nationally significant with about 100 shipwrecks which describe the history of the Great Lakes region as well as the country. This presentation focuses on the communities located near the sanctuary which consist of the following counties: Alcona, Alpena, Iosco, Montmorency, and Presque Isle. The main goal of this project is to determine if these communities benefit from the sanctuary's educational and outreach programs. Ecosystem services, defined as the benefits people receive from nature and cultural resources include education as a vital component. Education ecosystem services refer to the capacity to acquire and provide intellectual enrichment. Data was collected from federal databases such as the U.S. Census, National Center for Educational Statistics, and NOAA's Office of Education database. By using these datasets, 17 indicators were analyzed, for example: number of educators, number of P-12 students, and number of people reached through public/outreach activities. Additionally, the population and annual income of the counties were examined to gauge socioeconomic benefits. The trends in the number of P-12 students and the number of educators varied annually. Similarly, the number of people reached through public/outreach activities also showed yearly fluctuations. The findings reveal that educational outreach programs at the Thunder Bay National Marine Sanctuary promote cultural appreciation and enhanced socioeconomic benefits.

About the Scholar

Avalon Provance is a dedicated scholar from Riverside, California and is set to embark on her senior year at California State University, Monterey Bay. Currently pursuing a major in Environmental Studies and a minor in Statistics, she is on track to graduate with her Bachelor's degree in Spring of 2025. A recipient of the NOAA Ernest F. Hollings scholarship, Avalon's research project focuses on socioeconomic indicators of selected counties neighboring the Thunder Bay National Marine Sanctuary. Her research aims to determine whether the counties' schools and students benefit from the sanctuary's education and outreach programs. Avalon's passion lies in exploring the connection between communities and the natural environment, seeking to understand and promote sustainable relationships between them. In the future, Avalon has her sights set on pursuing a master's degree in either environmental science or public administration, with plans to commence her graduate studies in Fall of 2025.

Jaida Rhea

Freshwater Wetlands and Science Communication in Coastal South Carolina

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Kaitlyn Dirr, Julie Binz, and Danielle Boudreau
ACE Basin National Estuarine Research Reserve (NERR)
South Carolina Department of Natural Resources (SCDNR)
National Oceanic and Atmospheric Administration (NOAA)

The recent Supreme Court decision in Sackett v. EPA has led to weaker federal protections for freshwater wetlands. Under this decision, wetlands must be indistinguishable from Waters of the United States (WOTUS), which requires that 1) a relatively permanent body of water be connected to WOTUS, and 2) the wetland has a continuous surface connection with WOTUS. This could strip federal protections away from approximately 63% of wetlands in the U.S., many of which are ephemeral. Ephemeral wetlands transition through wet and dry cycles and are not obviously connected to other wetland habitats or waterways, but still provide important habitat for wetland species, help maintain water quality, and recharge groundwater. The purpose of this project was to use trail cameras and stream gauges to capture imagery of water level, vegetation, and wildlife in two ephemeral wetlands sites in coastal South Carolina. The selected sites were in Botany Bay Wildlife Management Area (site 1) and South Fenwick Island (site 2) within the ACE Basin NERR. The images collected were analyzed and compiled into an informative timelapse using ArcGIS StoryMaps to communicate the importance of these environments to coastal decision-makers. The analysis revealed that water level fluctuated between 0 and 4 inches over the 7-week period at site 1 and remained at 0 inches over the same period at site 2. A process agenda for an ephemeral wetland identification field training was also created and will be carried out by the ACE Basin NERR Coastal Training Program in the coming year.

About the Scholar

Jaida Rhea is from Southern Maryland and is a rising senior at Goucher College. She is double majoring in environmental studies and professional writing and will be graduating with her bachelor's degree in Spring 2025. Jaida plans to pursue either a PhD or a graduate degree in Norway through the U.S. Fulbright Student Program starting in Fall 2025. Jaida is a NOAA Ernest F. Hollings Class of 2023 Scholar and interned this summer with the ACE Basin National Estuarine Research Reserve. In this position, she collected observational and numerical data related to water level, soil characteristics, and surrounding vegetation at two ephemeral wetland sites in Coastal South Carolina and maintained trail cameras and gauges to capture imagery of surface water cover over time. Jaida's professional aspiration is to pursue research on marine ecosystems and habitats with a focus on developing science communication techniques to inform important policy decisions in the field.

Elizabeth Roros

Evaluating tumble culture as a method to improve Pacific oyster growth and labor efficiency on Southeast Alaska shellfish farms

NOAA Mission Goal: Resilient coastal communities and economies
Mentors: Jordan Hollarsmith, Henry Fleener, and Kyle Neuman
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

High water turbulence, tidal flux, and biofouling at Alaska's high latitude create various challenges for growing marketable Pacific oysters (*Crassostrea gigas*). As oyster mariculture expands in this region, there is continued interest in developing efficient oyster grow-out that minimizes farmer labor. SEAPA brand oyster cages are configured to move with tide and wave action and be exposed during low tide, thus naturally tumbling oysters, deterring growth of fouling organisms, and reducing farm maintenance. To understand the efficiency of these tumble cages in creating marketable oysters while reducing labor, we stocked SEAPA cages with 500 oysters per cage, equipped them with HOBO temperature loggers and accelerometers, and deployed in both the subtidal and intertidal at an oyster farm in Juneau, Alaska in early June 2024. Subsets of 20 oysters were collected in late June and July 2024, where we measured shell morphology (height, length, depth), group weights (N=20 oysters), biofouling on cages, and water flux to determine differences between tidal region (subtidal or intertidal) and gear configuration. Initial results indicate minimal differences in oyster morphology between tidal sites and high survival across all treatments. This research is part of a larger study including two other farms in Ketchikan and Hoonah where subtidal arrays will be tested and compared to the Juneau farm subtidal and intertidal data. Overall, these results can inform Southeast Alaska farmers about the best tumble gear configurations for sustainable, productive growth of oysters, providing opportunities for mariculture operations to expand in the region.

About the Scholar

Elizabeth Roros is originally from Annapolis, Maryland and currently lives by the beaches of southern Delaware. She is a rising senior at the University of Delaware majoring in marine science with a concentration in marine biology. As a 2023 NOAA Hollings scholar, Elizabeth had the pleasure of collaborating with mentors at the Alaska Fisheries Science Center and local oyster farmers, researching new methods of shellfish aquaculture in Alaska’s high latitude climate. She aspires to continue her studies in graduate school, aiming to expand her knowledge in fisheries science. She is particularly interested in researching how climate change factors affect fish migration patterns and using that data to inform stock assessments for commercial fisheries. Her ultimate goal is to work for NOAA’s National Marine Fisheries Service, conducting research that helps develop sustainable commercial fisheries and fosters stewardship between scientists and fishermen.

Paola Marie Santini Dosal

Mapping Coastal Futures: Using CORA Data to Visualize Flood Risks and Educate Communities

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Analise Keeney and Audra Luscher
National Ocean Service/Center for Operational Products and Services (CO-OPS)
National Oceanic and Atmospheric Administration (NOAA)

NOAA's Center for Operational Products and Services (CO-OPS) leverages stakeholder engagement to develop vital data and services, primarily based on the National Water Level Observation Network (NWLON). Collaborations with partners like the University of Hawaii's Sea Level Center enhance CO-OPS' inundation products, aiding coastal communities in addressing climate change and sea level rise. The Coastal Ocean Reanalysis (CORA) project is a critical initiative aimed at improving the resolution and accuracy of historical coastal water level data, providing observations between NWLON stations. This project focuses on using CORA data to highlight flood risk areas by visualizing maximum water levels during extreme weather events. CORA's high-resolution data offers essential insights into sea level rise and extreme weather impacts, benefiting researchers, policymakers, and coastal communities. The Miami case study, following Hurricane Irma, showcases CORA's ability to simulate and validate coastal flooding accurately. Despite Irma making landfall 180 km south, the significant storm surge at Virginia Key demonstrates CORA's precision. Researchers use CORA to assess historical sea level changes, flooding impacts, and support long-term coastal planning. Stakeholder interviews with University of Hawai'i researchers Linta Rose and Matthew Widlansky, and mapping maximum water level elevations along the southern Atlantic seaboard, underscore the importance of stakeholder input in developing effective inundation products. The project also integrates flood images from citizen scientists and web cameras into NOAA's Coastal Inundation Dashboard, enhancing flood visualization tools. By creating ESRI StoryMaps and interactive educational products, CORA data becomes accessible to diverse stakeholders, fostering informed decision-making in coastal management.

About the Scholar

Paola Santini-Dosal is from Puerto Rico and is currently a rising junior at the University of Central Florida, majoring in Marine Biology with a minor in Political Science. She aims to graduate with her Bachelor's degree in Spring 2026 and pursue a Ph.D. degree in marine biology. Paola is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar and her research interests are centered on conservation, animal behavior, and acoustics, particularly interested in understanding how the impacts of human activity on marine life affect their ecosystems. This summer, Paola is working on the Coastal Ocean ReAnalysis (CORA) project, integrating water level observations with hydrodynamic modeling to provide coastal data and creating GIS-based visualizations to improve the resilience of coastal communities. As a marine science student , Paola aspires to work for NOAA, combining her interests in science and advocacy to become an ambassador for conservation and marine policy.

Hazelanne Stuart

A Taste of Sustainability: A Culinary Journey of US Seafood

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Amara Davis and Hallee Meltzer
Oceanic and Atmospheric Research/NOAA Sea Grant Office
National Oceanic and Atmospheric Administration (NOAA)

Throughout human history, humans have settled on coasts all around the world, because of the importance of water for food security and economic growth. With increasing concerns over human-induced environmental degradation, overfishing, and rising sea levels, seafood sustainability is vital for maintaining healthy marine ecosystems and ensuring future food security. To bridge the gap between science and food and to enhance public understanding and appreciation of sustainable seafood, this project addresses the need for greater public awareness and understanding of sustainable seafood practices through the production of a video series. This was accomplished through comprehensive research on sustainable fisheries practices, connecting with Sea Grant professionals, collecting and demonstrating recipes, and filming, editing, and producing educational content. After production, these videos will be shared via Sea Grant's social media, monthly newsletter, and website. Audience engagement and interaction will be analyzed to measure the effectiveness and impact of the content. A final report will be developed to provide recommendations to Sea Grant on further sustainable seafood outreach opportunities and discuss the importance of effectively conveying scientific and environmental information to a broad audience.

About the Scholar

Hazelanne Stuart is a rising junior majoring in Sustainability Studies at Alaska Pacific University and a 2024 Educational Partnership Program with Minority Serving Institutions (EPP/MSI) scholar. With a strong passion for environmental justice, Hazelanne is committed to making climate science accessible and understandable for all audiences, aiming to uplift diverse voices. Currently, she serves as a Seafood Communications Intern with the National Sea Grant Office, producing cooking videos that showcase the cultural importance of various seafood across the United States. She actively engages with viewers on social media, sharing these videos and monitoring their impact. Hazelanne's long-term aspirations include continuing to bridge the gap between climate science and underrepresented communities, working collaboratively to ensure environmental actions are inclusive and impactful.

Max Taylor

Using autonomously collected eDNA to assess phytoplankton community composition and the presence of harmful algal species

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Nicolaus Adams and Stephanie Moore
Northwest Fisheries Science Center, National Oceanic and Atmospheric Administration

The Olympic Coast National Marine Sanctuary on the U.S. West Coast is home to a number of economically and culturally important species that are sometimes affected by harmful blooms of diatoms in the genus *Pseudo-nitzschia*. Some species of *Pseudo-nitzschia*, most notably *P. australis*, produce the neurotoxin domoic acid which can accumulate in filter-feeding fish and shellfish, shutting down fisheries and causing illness or even death in humans and marine birds and mammals. This study uses environmental DNA (eDNA) collected by an advanced autonomous sampler called the Environmental Sample Processor to assess phytoplankton community composition, including the presence of *Pseudo-nitzschia*. DNA metabarcoding analysis using the 18S rRNA V9 region was performed on 37 samples collected and archived by the ESP during two deployments in summer/fall 2021 and spring 2022. The eDNA reads were classified using the PR2 reference database to identify phytoplankton community composition at the genus level. The phytoplankton community composition differed significantly between the two deployments, with higher relative abundances of *Pseudo-nitzschia* in the summer/fall, consistent with higher levels of domoic acid. Five *Pseudo-nitzschia* species were observed: australis (71% confidence), seriata (90%), delicatissima (78%), heimii (96%), and fraudulenta (72%). The ciliate genera Mesodinium and Eutintinnus, the dinoflagellate family Thoracosphaeraceae and the diatom genera Corethron and Thalassiosira were the most closely correlated with *Pseudo-nitzschia*, occupying a similar ecological niche. Further monitoring of *Pseudo-nitzschia*, domoic acid and phytoplankton communities will help us determine what allows *Pseudo-nitzschia* to outcompete these genera and form harmful algal blooms.

About the Scholar

Max Taylor starts her senior year at the University of Florida, graduating with a BS in Microbiology and Cell Science in Spring 2025. She is a NOAA Ernest F. Hollings Scholar, class of 2023. This summer, Max's research with NOAA surveys phytoplankton communities in the coastal waters off of Washington state using eDNA, identifying potentially harmful species. At UF, Max is analyzing the impact of nemertean egg predators on blue crab fertility. She has also studied the environmental impacts of a microsporidian parasite in invasive crayfish and is helping develop a mouse model for Malaria Associated Acute Respiratory Distress Syndrome (MA-ARDS). Max will pursue a Ph.D. in infectious diseases in Fall 2026. She hopes to use her microbial and marine science background to identify gaps in global disease surveillance, particularly in emerging zoonotic pathogens.

Evelyn Weaver

Pervasive Evasive Invasives: How NMFS Handles the European Green Crab and Other Unwelcome Aquatic Species

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Shivonne Nesbit and Monica Keim
National Marine Fisheries Service/West Coast Region/Protected Resources Division
National Oceanic and Atmospheric Administration (NOAA)

I aimed to understand how the Endangered Species Act (ESA) addresses the negative impacts of aquatic invasive species on ESA-listed species and their critical habitat. Using the spread of the European green crab (*Carcinus maenas*) in Washington state as a case study, I researched the regulatory mechanism under the ESA that addresses invasive species removal. European green crab (EGC) are detrimental to eelgrass habitat, a critical habitat for juvenile pacific salmon (*Oncorhynchus spp*). EGC also prey on juvenile salmon and a variety of other prey, altering the food web. In 2022, Washington's State Governor issued an emergency proclamation addressing the exponential increase in EGC populations and directed WDFW to implement emergency measures to prevent EGC establishment and expansion. However, these emergency measures can cause the 'take' of ESA-listed species, triggering a need for ESA consultation. Through my research, I learned that limiting the spread of EGC, though very important, requires NOAA Fisheries to issue a Section 10(a)(1)(A) enhancement permit to WDFW for their EGC trapping efforts. I also learned that issuing a Section 10(a)(1)A) permit triggers Section 7 of the ESA because NOAA Fisheries is required to analyze the effects of the action–the action being issuing a permit authorizing take. When aquatic invasive species removal programs cause take, NOAA Fisheries reviews the programs' effects to ensure that they are conducive to enhancing listed species survival and conserving critical habitat.

About the Scholar

Evelyn Weaver (she/her) is a Batten Honors College student at Virginia Wesleyan University. A rising senior, she is triple majoring in Environmental Studies, Philosophy, and Studio Art. Means of communication and expression are different in each of her majors. The overlapping of the three is conducive to an interdisciplinary approach to her areas of interest, including conservation, environmental law, and environmental justice. Evelyn is a 2023 NOAA Hollings scholar, and, after earning her bachelor's degree, she is considering pursuing a master's degree in Environmental Justice at the University of Michigan. Her embracing of an interdisciplinary approach to her life and interests is evident through her experiences thus far, some of which are her salt marsh restoration research, live oak scenic easement internship, earth and environmental sciences work-study position, and summer landscaping job at the Pennsylvania Renaissance Fair.

Sydney Wray

Changes to Benthic Habitats in Saipan Lagoon; Implications for Coastal Flood Hazards

NOAA Mission Goal: Resilient Coastal Communities and Economies
Mentors: Steven Mckagan and Robbie Greene
National Marine Fisheries Service
National Oceanic and Atmospheric Administration (NOAA)

Benthic habitat structures play a crucial role in coastal dynamics. In this study we take a three-step approach to assessing the benthic habitat distributions in Saipan Lagoon. We began by analyzing a WorldVeiw-3 satellite image of our study area, correcting for atmospheric and water column distortions. From this we extracted spectral bands pairs used as environmental predictors. These predictors along with geographic and topographic predictors were used in Booster Regression Trees models to map predicted environmental conditions throughout the lagoon. We performed benthic surveys (n=112) as Ground Validation points to provide us with data on percent-cover of nine substrate and cover types. Using this data, we were able to create a map modeling the percent-cover of coral throughout the study area. Combining this map with those created to model environmental predictor values, we created one composite map with seven benthic habitat types. Using percent coral cover we were able to produce estimated values for the incident wave friction coefficient (fw) and the current and infragravity wave friction coefficient (cf). We repeated this process using data from the previous benthic map made for the area in 2016 to compare the ability of this coastal habitat to dissipate wave energy and diminish coastal flood hazards. We found that the estimated percent cover of coral throughout the study had decreased, decreasing the average fw and cf values and indicating an increase in coastal flood hazards. In the future, these updated fw and cf values can be used as inputs for coastal flood models.

About the Scholar

Sydney Wray is from Jacksonville, Florida and is a rising Senior at the University of Miami majoring in Marine Biology and Ecology with a minor in Computer Science. She is an AAUS Scientific Diver and serves as the Vice President of the UM SCUBA Club. As a NOAA Hollings Class of 2023 Scholar, Sydney is working at the CNMI NOAA Fisheries Field Office on Saipan. Sydney is using a mixture of UAV imagery derived data and field surveying to create an updated benthic habitat map of Saipan Lagoon, which she will use to assess changes to coastal flood hazards. Sydney is passionate about combining her love of field work and conservation to advance marine science and hopes to promote environmental stewardship through her ongoing personal and professional endeavors.

Top left: Olivia Kilmer, Hollings ‘23. Top right: Javier Mata, EPP/MSI ‘23. Bottom: Christian Boudreaux, Hollings ‘23

Yair Jordi Banuelos

AWIPS: DBGeo Plug-in Enhancements for Aviation Weather Center Aircraft Observation

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Maurice McHugh, Joe Zajic, Lee Byerle, Jaina Morgan, Ry McClure, Matthew Comerford
National Environmental Satellite Data and Information Service/GOES-R Program Office
National Weather Service/Office of Observations
National Oceanic and Atmospheric Administration (NOAA)

In response to the evolving demands of meteorological data processing within the Advanced Weather Interactive Processing System (AWIPS), this project outlines significant enhancements to the DBGeo plugin. DBGeo is a plugin within AWIPS that is responsible for applying trivia to a given geometry. The current DBGeo plugin lacks flexibility in handling new data types, requiring extensive manipulation or custom coding for each new data source, which poses challenges in implementation. The primary objective is to refactor DBGeo to integrate diverse data types efficiently through a unified architecture configurable via XML files. This approach aims to streamline data integration within AWIPS, reducing dependency on custom coding and enhancing capabilities to visualize temporal data associated with meteorological parameters such as temperature and pressure associated with a geometry. Specifically, the updated plugin will support the display of turbulence recorded by aircraft, significantly augmenting AWIPS's functionality for meteorological forecasting and analysis at the Aviation Weather Center. The study focuses on software development within a research context, emphasizing departures from traditional plugin architectures. Methods include software refactoring and XML configuration implementation. Results include improved data handling capabilities and enhanced visualization tools within AWIPS. The significance of these enhancements lies in their potential to optimize meteorological data processing, supporting more accurate weather forecasts and better decision-making for aviation weather center operations. Future directions include expanding plugin functionalities to accommodate evolving data sources and refining integration processes to ensure scalability and usability across AWIPS.

About the Scholar

Yair Jordi Banuelos is from Ventura, California, and is a rising junior at Northeastern Illinois University, majoring in Computer Science with a minor in Network Security and Applied Mathematics. He is expected to graduate with a bachelor's degree in the spring of 2026 and aspires to continue his education to obtain a master's degree in Artificial Intelligence. Yair is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar and is excited to study the application of artificial intelligence to meteorology, particularly in the areas of weather prediction and climate impact assessment. He aims to understand how advanced AI algorithms can be used to build software that helps meteorologists and forecasters make more accurate predictions about the weather, ultimately protecting life and property. As an aspiring scientist, working for NOAA is Yair's professional aspiration. In an effort to protect natural resources and vulnerable communities, Yair aims to combine his interests in science and technology to become a machine learning engineer.

Christian Boudreaux

An Eggciting Breakthrough: Extracting Maternal DNA From Leatherback Sea Turtle Egg Shells

NOAA Mission Goal: Healthy Oceans
Mentors: Peter Dutton and Amy Frey
National Marine Fisheries Service//Southwest Fisheries Science Center
National Oceanic and Atmospheric Administration (NOAA)

Leatherback sea turtles (*Dermochelys coriacea*) spend the majority of their life cycle in the open ocean. Nesting females represent the easiest way to assess adult leatherbacks, but traditional sampling requires lengthy nocturnal surveys along extensive stretches of beach. Genetic information of females is important for understanding population and reproduction dynamics of this vulnerable, declining species.Direct capture is not the only way to obtain this data, however, as yolkless eggshells in the nest contain a membrane layer that contains maternal DNA. This study refined and validated methodology for the extraction, replication, and sequencing of mitochondrial and nuclear DNA obtained from yolkless leatherback eggshells. This novel methodology will allow researchers to obtain maternal genetic information in a non-invasive way that does not require the presence of the mother. This information will be crucial in tracking nesting mothers, assessing population health, and informing conservation and management strategies to protect this at-risk species.

About the Scholar

Christian Boudreaux is a rising senior and attends the University of Mississippi and studies Biology, with minors in Chemistry and Spanish. Christian plans to pursue his PhD upon graduation with a focus on the genetic reasons underlying organismal stress response. He hopes to use this information to inform conservation efforts and policy to safeguard organisms and ecosystems in the advent of the climate crisis. Christian is a member of the NOAA Ernest F. Hollings Class of 2023 and, as a result, is completing an internship at the NOAA Southwest Fisheries Science Center in San Diego. He is refining methods for the extraction and sequencing of leatherback sea turtle maternal DNA using the membrane found on the inside of their eggshells. The information generated from this project will contribute to the monitoring and conservation of this endangered species.

Sophia Brice

What's My Age Again? A Comparison of Bottlenose Dolphin Aging Techniques

Science and Technology Enterprise
Mentors: Wayne McFee and Jamie Torres
National Centers for Coastal Ocean Science (NCCOS)/National Ocean Service (NOS)
National Oceanic and Atmospheric Administration (NOAA)

Knowledge of population demographic data, such as age, can be highly beneficial for understanding potential underlying causes and patterns of marine mammal strandings. However, accurately estimating ages of marine mammal species has proven to be consistently challenging due to minimal external signs of aging and asymptotic total length reached in adulthood. Several methods currently exist for calculating age estimates of dolphins. Sectioning and counting growth layer groups (GLGs) in mandibular teeth has been used traditionally for dolphin aging, but analyzing chronological bone ossification developments through pectoral flipper radiography (PFR) has emerged in recent years as a potentially more accurate method for older aged animals that is both less invasive and easily applicable for live animals. This research study aimed to assess the comparability of age estimates from both methods, while also discussing the benefits and limitations of each method when using samples from deceased animals. Age estimates of 14 Tamanend's bottlenose dolphins (*Tursiops erebennus*) stranded on the South Carolina coast were obtained using both GLG and PFR techniques in order to compare these methodologies. Results showed that the age estimates from GLGs were more consistent with morphological data than PFR estimates, which may be due to issues obtaining high quality images from flippers that are radiographed while frozen. These results suggest that GLGs may remain the preferred method for obtaining bottlenose dolphin age estimates of deceased animals, and that PFR may be preferred for use during health assessments of live animals.

About the Scholar

Sophia Brice is a rising senior at Florida Southern College double majoring in Marine Biology and Environmental Studies. She will be graduating with her Bachelor's degree in May 2025, and plans to continue her education by pursuing a Master's degree in marine science in Fall 2025. Sophia is a NOAA Ernest F. Hollings Class of 2023 scholar and completed her internship at the Hollings Marine Laboratory in Charleston, South Carolina, where she compared bottlenose dolphin aging methods on stranded animals. Her project aims to improve understanding of dolphin population demographics to aid in interpreting underlying stranding causes. Sophia is interested in utilizing topics such as genetics, predator-prey interactions, and life history studies to improve understanding of marine organisms and inform conservation efforts. Her professional aspiration is to combine her passion for marine mammals and genomics to enter a research-oriented career focused on marine conservation through an organization such as NOAA.

Normandy Carter

Immersive Miami: Exploring the Effects of Sea Level Rise

NOAA Mission Goal: Science and Technology Enterprise
Mentor: Andrew Peck
Oceanic and Atmospheric Research/Office of Research Transition and Application
National Oceanic and Atmospheric Administration

Immersive Miami: Exploring the Effects of Sea Level Rise investigates the impacts of sea level rise on Miami, Florida, focusing on historical trends and future projections. Miami is particularly vulnerable due to its low-lying topography and coastal location, which exacerbate flooding risks. This study examines past sea level changes using historical data and geological records, alongside future projections based on climate models and current trends. The analysis highlights significant threats to Miami's community, infrastructure, and economy, such as increased frequency and severity of flooding, which jeopardizes freshwater supplies and local ecosystem health. The project also explores adaptation strategies, including urban planning, greenhouse gas emission reduction, and community-based initiatives to enhance resilience. By integrating geographical information systems mapping, environmental data, and a virtual reality experience, "Immersive Miami " provides a comprehensive overview of sea level rise impacts and underscores the urgent need for proactive measures. Ultimately, this interdisciplinary approach aims to inform policymakers and the public about sustainable solutions to safeguard Miami's future in the face of climate change.

About the Scholar

Normandy Carter is from Fredericksburg, Virginia, and is a rising junior at North Carolina A&T State University, where she is pursuing a bachelor's degree in IT. She is also considering a master's degree in machine learning and AI. Her research interests focus on the impact of electronic waste on the environment and innovative recycling methods to benefit communities. Normandy's work aligns with NOAA's mission of science, service, and stewardship. She is currently interning with the Office of Oceanic and Atmospheric Research (OAR), working under Andrew Peck. Her project involves integrating geographical information systems into a Virtual Reality experience to enhance NOAA's outreach efforts and engage communities in environmental and STEM fields. Normandy aspires to contribute to sustainable environmental solutions through technological innovation.

Jose Cisneros

Advancing Steller Sea Lion Artificial Intelligence Methods Towards an Automated Workflow

NOAA Mission Goal: Science and Technology Enterprise
Mentor: Katie Sweeny
National Marine Fisheries Service - Alaska Fisheries Science Center, Marine Mammal Lab
National Oceanic and Atmospheric Administration (NOAA)

The Alaska Fisheries Science Center's Marine Mammal Laboratory conducts annual aerial surveys of Steller sea lion (*Eumetopias jubatus*) habitats throughout the Aleutian Islands to track the endangered western distinct population segment (WDPS). Monitoring this population is critical given its significant decline over the last 40 years. Steller sea lions are a valuable natural resource with deep cultural significance for Alaska Natives. They also function as bioindicators, providing insights for fishery management. The accuracy and timeliness of data used to estimate marine mammal abundance, stock structure, behavior, and health are critical.

Traditional methods of manually counting sea lions using aerial imagery are time-consuming and labor-intensive. To enhance efficiency, the lab utilized artificial intelligence (AI) to automate image processing, significantly reducing processing time and potentially accelerating results delivery to stakeholders. This study describes the development and implementation of AI techniques in the workflow, emphasizing the advantages over previous manual methods. The AI-based approach provides a more efficient and accurate method of monitoring Steller sea lion populations, resulting in timely data for conservation and management efforts. Our findings show that AI can effectively process aerial survey imagery, resulting in an adaptable approach for marine mammal monitoring. This advancement not only supports the conservation of Steller sea lions but also sets a precedent for incorporating AI in ecological monitoring.

About the Scholar

Jose Cisneros is from Brownsville, Texas and is a junior at The University of Texas at Rio Grande Valley, majoring in Marine Biology with a minor in Environmental Science. He is on track to graduate with his Bachelor’s degree in Fall 2025 and intends to further his education by obtaining a Master’s degree. Jose’s undergraduate experience encompasses population studies, sea mapping, artificial intelligence, and restoration work. He is deeply committed to marine biology and conservation, with a focus on leveraging technology to address environmental challenges.

Eleanor (Ella) Crotty

Using eDNA and hypoxia data from Olympic Coast National Marine Sanctuary to identify species-specific responses to hypoxic events

NOAA Mission Goal: Science & Technology Enterprise
Mentors: Zachary Gold[1] & Shannon Brown[1,2]
Sean M. McAllister[1,2], Jeannette Waddell[3], Kathryn R Hough[3], Simone R. Alin[1], Matthew P. Galaska[1]
Ocean and Atmospheric Research/National Oceanic and Atmospheric Administration (NOAA)
[1]Pacific Marine Environmental Lab, Oceanic and Atmospheric Research, National Oceanographic and Atmospheric Administration, Seattle, WA
[2]Cooperative Institute for Climate, Ocean, & Ecosystem Studies, University of Washington, Seattle, WA
[3]Olympic Coast National Marine Sanctuary, National Ocean Service, National Oceanographic and Atmospheric Administration, Port Angeles, WA

In the Olympic Coast National Marine Sanctuary (OCNMS), off the coast of northwest Washington State, hypoxic events caused by upwelling are increasing in severity and duration. Hypoxia is generally defined as dissolved oxygen below 2 mg/L, which can cause fisheries collapse, but hypoxia tolerance varies by species and less severe events can still have sublethal effects on marine organisms. The marine habitats in OCNMS support recreation, fisheries, and four sovereign tribal communities: the Hoh Tribe, Makah Tribe, Quileute Tribe, and the Quinault Indian Nation. In order to understand the effects of hypoxic events on these habitats, it is important to determine which species are most severely affected. This study aims to determine how the presence or absence of certain priority species in OCNMS are affected by dissolved oxygen levels. Environmental DNA (eDNA) samples were collected by McLane phytoplankton and particle samplers, deployed for three, month-long intervals between May 2021 and August 2022. These samplers collected, filtered, and preserved 1 L water samples every 36 hours. Data from the Teawhit Head mooring in OCNMS was combined with species detection data from the eDNA samples to compare species presence with oxygen levels. Of the 37 species prioritized by OCNMS, we detected 22, 4 of which had over 10 detections. The presence of these four species was not significantly correlated with oxygen levels. This methodology allows researchers to determine the in situ effects of hypoxia on species presence within an area using autonomous sampling, reducing the time and resources required.

About the Scholar

Eleanor Crotty (Ella) is an interdisciplinary major in Environmental Studies and Biology at Reed College. She is from San Diego, California, and enjoys exploring kelp forests and seagrass beds. She plans to graduate from Reed in 2025 and study oceanography in graduate school. She has a variety of research interests, including conservation genetics, conservation of highly migratory species, and strange deep-sea organisms. She is currently a Hollings Scholar at the Pacific Marine Environmental Laboratory's Ocean Molecular Ecology group in Seattle, Washington. Her project is investigating the effects of low oxygen on species presence and absence in the Olympic Coast National Marine Sanctuary using eDNA. In the future, she hopes to conduct research that improves conservation policy.

Faith DaSilva

Data Analysis of a 20-Year Citizen Science Program in Monterey Bay National Marine Sanctuary

NOAA Mission Goal: Science and Technology Enterprise
Mentor: Lisa Uttal
National Ocean Service/Office of National Marine Sanctuaries/Monterey Bay National Marine Sanctuary
National Oceanic and Atmospheric Administration (NOAA)

Team OCEAN began in 2000 as a community-based science program that trains volunteer naturalists to kayak in recreational areas throughout Monterey Bay National Marine Sanctuary (MBNMS). Staff and volunteers prevent and report wildlife disturbances by educating the public about responsible wildlife viewing. For 23 years, staff and volunteers have recorded observational data in the field; data collected includes: on-water shift hours, recreational watercraft type/abundance, observed wildlife disturbances, prevented wildlife disturbances, and other interaction data. However, a lack of data analysis has prevented a proper evaluation of Team OCEAN's contribution to upholding NOAA's MBNMS standard of resource protection, as specified under the 1972 Marine Mammal Protection Act. Quality assurance and quality control (QA/QC) checks were executed on the dataset of surveys conducted in 2 different locations within MBNMS (Elkhorn Slough and Cannery Row), covering a total of 1,706 on-water shifts, 2,470 prevented disturbances, and 1,699 observed disturbances from 2001 to 2023. Data analysis was conducted using RStudio to visualize long-term and short-term trends with scatter plots, line charts, and bar graphs. It is proven that Team OCEAN prevents more wildlife disturbances than they observe and their time on the water is positively correlated with prevented wildlife disturbances. Recommendations include expanding the scope of data that Team OCEAN collects to include watercraft density (among other metrics) to better understand the scale on which wildlife disturbances in MBNMS occur. These conclusions emphasize the importance of using community science data to inform future resource management and protection.

About the Scholar

Faith DaSilva is from Seekonk, Massachusetts and is a rising senior at Endicott College majoring in Environmental Science with minors in Biology and Theater. She is expected to graduate with her Bachelor's degree in May 2025. Faith is a NOAA Ernest F. Hollings Class of 2023 scholar interested in studying the relationships between humans, climate change, and marine organisms. For her Hollings internship project, Faith performed data analysis of a 20-year community science project in Monterey Bay National Marine Sanctuary to analyze the efficacy of citizen science. In the future, Faith aims to take part in research that informs the conservation and restoration of vulnerable marine ecosystems.

Kion James

Taxonomic identification of otoliths collected from sediment samples from Gulf of Mexico: Abstract

NOAA Mission Goal: Science and Technology Enterprise
Mentor: Beverly Barnett
NOAA Fisheries, Southeast Fisheries Science Center, Panama City Laboratory
National Oceanic and Atmospheric Administration (NOAA)

This research project focuses on the taxonomic identification of otoliths extracted from sediment cores collected in the Gulf of Mexico. Approximately fifty sediment cores were analyzed for the presence of otoliths from various species. The recovered otoliths exhibited a range of sizes and shapes. Following the initial survey, a subset of otoliths was selected for detailed taxonomic identification. Resources utilized for this identification included the NOAA archive, Ivy E. Baremore and Dana M. Bethea "A Guide to Otoliths from Fishes of the Gulf of Mexico", and Steven E. Campana "Photographic Atlas of Fish Otoliths of the Northwest Atlantic Ocean". The primary objective of this study is to accurately identify each otolith, with further plans to age them and potentially assess the pH levels of their environmental origin in the future. Identifying otoliths contributes to scientific knowledge by enhancing our understanding of fish biodiversity, biogeography, and environmental changes over time, which can inform conservation efforts and ecological studies.

About the Scholar

Kion James is from Miami Gardens, Florida and is a rising senior at Florida Agricultural & Mechanical University majoring in Environmental Science. Kion is expected to graduate with his Bachelor’s degree in Summer 2025 and intends to continue his education and obtain his Master’s degree in Environmental Science following graduation. Kion is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) CCME Cohort #2 Scholar. He is currently interning at NOAA Fisheries, SEFSC, Panama City Laboratory working on a research project that focuses on the taxonomic identifications of otoliths found in sediment cores samples from the Gulf of Mexico. Kion is very eager to further develop his expertise in the diverse branches of environmental science. His professional ambition is to work for NOAA and concentrate on coastal conservation and sustainability.

Olivia Kilmer

Evaluation and Improvements to Low-Cost River Level Sensors

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Crane Johnson and Bob Busey
National Weather Service/Alaska Pacific Regional Forecast Center
National Oceanic and Atmospheric Administration (NOAA)

Stage sensors along rivers in Alaska are integral to flood forecasting for protecting communities across the state. Current, low-cost technology (iGage) has been found to be temperature sensitive due to the nature of ultrasonic systems. This project aims to research, evaluate, and implement different sensing technologies and correction techniques to improve iGage accuracy for future products. The sources of error are from both variations in the temperature profile between the sensor and water surface and error associated with the air temperature measurement on these low cost acoustic sensors. Temperature profiles were measured at bridges in the field to understand the error due to temperature profile variations. The error associated with using a single temperature measurement was compared against using the full temperature profile The iGage was then evaluated during changing weather conditions next to a reference weather station measuring a fixed distance. Results show that the ultrasonic sensors incur upwards a 2.56% distance error. Temperature spikes of 20+ °F, compared to a reference measurement over one hour were discovered to affect measurements. Implementing a moving average and temperature change cap was tested out to mitigate spikes; these methods reduced error, but didn't completely eliminate the temperature inaccuracy. While the low cost acoustic sensors provide acceptable river stage readings, other innovative sensing technologies were evaluated. An inexpensive LiDAR gauge was developed as a proof of concept that uses the same hardware as the iGage, confirming that it could be a drop-in replacement for current gauges.

About the Scholar

Olivia Kilmer moved around the eastern board, but calls South Berwick, Maine her home. She is a rising senior at Columbia University, majoring in Mechanical Engineering. She expects to graduate with her Bachelor's degree in Spring 2025, and aspires to continue pursuing her passion with water sensing technology, either in the workforce or through continuing higher education. She is a NOAA 2023 Ernest F. Hollings Scholar and aided the NWS Alaska Pacific River Forecast Center in developing improvements to river gauges along Alaska's waterways. As an engineer, she is always looking for ways to improve techniques for observation since she strives to provide the most efficient and effective data collection methods for the protection of rivers, oceans, and regions surrounding them. NOAA piqued her research interests through providing an avenue to increase accuracy in essential, time-sensitive forecasts for flood-prone communities.

Peyton Lockett

The Evaluation and Evolution of the Office of Marine and Aviation Operations Flight Hour Database Management

NOAA Mission Goal: Science and Technology Enterprises
Mentors: Lieutenant Commander Kevin Doremus
Yessica Ruiz, Reginald Clyburn, Nikki Hathaway, Justin Blancher
Office of Marine and Aviation Operations (OMAO)
National Oceanic and Atmospheric Administration (NOAA)

Effective management of flight hour data is crucial for ensuring aviation safety, operational efficiency, and regulatory compliance. This project explores the fundamental principles, challenges, and best practices associated with managing flight hour data within NOAA aviation operations. The core challenges lie in collecting, storing, and utilizing vast volumes of flight hour data from diverse sources including aircraft systems, crew logs, and operational records. Ensuring this data's accuracy, completeness, and timeliness is critical for supporting decision-making processes, such as maintenance scheduling, resource allocation, and safety analysis. Data management teams have collaborated to construct a dashboard called the "NOAA Aircraft Management Information System," or NAMIS, to guarantee this degree of efficiency. This solution has effectively facilitated the management of flight hour data for OMAO officials and data analysts. Although this system effectively gathers real-time and historical information about aircraft operations, OMAO officials believe there is a faster alternative to handle tasks. This updated dashboard, created through the software named Tableau, offers a more visually appealing display of the recorded flight data, including geographical coordinates, and is working to determine the number of executed and allotted flight hours. The pace at which data must be gathered for quarterly reports—which include flying hours throughout the fleet in fiscal or calendar years, the quantity of support hours, and more aircraft information—is accelerated by the presence of this dashboard.

About the Scholar

Peyton Lockett is from Red Banks, Mississippi and is a rising junior at Jackson State University majoring in biology with a concentration in Marine Science and a minor in Spanish. He is a current NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2024 Scholar. After graduating with his Bachelor's Degree in the Spring of 2026, he will strive to achieve his Doctorate Degree in Environmental Policy. Peyton's aspirations in pursuing a career studying marine environmental life began at a young age and strengthened after he realized how communities are negatively impacted by the outcomes of industrialization and unregulated capitalism, such as pollution and habitat destruction. This summer, under the supervision of Kevin Doremus, an OMAO NOAA corps officer, Peyton is creating a dashboard to manage flight hour data quickly and efficiently. Peyton plans to use the knowledge and skills he gained from his experiences at NOAA to enhance the lives of humans and the natural world around them.

Javier Mata

Born in a Barrel: Using Remote Site Incubators as a Salmon Recovery Tool

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Shivonne Nesbit and Joel Casagrande
National Marine Fisheries Service, West Coast Region, Protected Resources Division
National Oceanic and Atmospheric Administration (NOAA)

The Endangered Species Act (ESA) is a federal law that helps identify, list, and recover threatened and endangered species in the U.S. On the West Coast, 28 salmon (*Oncorhynchus* spp.) stocks have been listed. The listings of these stocks have inspired the development of new approaches to research, evaluate, and monitor salmon. Remote site incubators (RSIs) are a relatively new technology designed to aid in salmon recovery. RSIs are simple structures that are used to rear eggs in their natal rivers and allow the fish to retain their natural instincts. The objective of this project was to explore the regulatory framework of the ESA and identify how RSIs are considered for approval under the ESA. Although RSIs can be a beneficial tool, NOAA Fisheries must first evaluate the effects of RSI units on species and their habitat prior to authorization. I found that ESA Sections 4, 7, and 10 provide the regulatory process for RSIs. This project further aimed to evaluate the feasibility of installing RSIs for the long-term recovery of salmon populations. I found that, despite some logistical challenges, RSIs are a reasonable and effective tool to aid in salmon population decline due to their economic viability and the fish's high short-term survival rate. Finally, I chose this project to better understand how science informs policy and how science must operate under regulations set forth by policy.

About the Scholar

Javier Mata is from Whittier, California and is entering his last semester at California State University, Long Beach as a marine biology major. He will be graduating in December 2024 and is planning to continue on to pursue graduate work studying elasmobranch biology and behavior. Javier is a class of 2023 Educational Partnership Program through Minority Serving Institutions (EPP/MSI) scholar. During his first internship, he worked under the National Geodetic Survey in developing GEOID2022, a model that uses mean sea level as a basis for heights for North America. This summer he worked under the National Marine Fisheries Service to assess, interpret, and apply the Endangered Species Act to Pacific salmon population recovery strategies. Long term, Javier plans to work for NOAA as a biologist and be a member of their dive team. Javier further aspires to use his background to make marine science accessible to underserved communities.

Sydney Paull

Responses of Water Quality Properties to Hurricane Isaias in the Chesapeake Bay

NOAA Mission Goal: Science and Technology Enterprise
Mentor: SeungHyun Son
National Environmental Satellite, Data, and Information Service (NESDIS)
National Oceanic and Atmospheric Administration (NOAA)

The Atlantic U.S. coast faces increased intensity and frequency of hurricanes, indicating a pressing need to understand the coastal dynamics of water quality parameters following these events. This study investigates the response of water quality parameters in the Chesapeake Bay to Hurricane Isaias in order to identify the impacts on the coastal system. Hurricane Isaias made landfall as a Category 1 hurricane and weakened into a tropical storm before hitting the Chesapeake Bay region on August 4, 2020. In situ data was obtained from the Chesapeake Bay Interpretive Buoy System and the Chesapeake Bay Program's (CBP) Water Quality Database for physical and nutrient measurements to assess the system's response. In addition, ocean color properties and sea surface temperature were derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite and NOAA's Coral Reef Watch (CRW) Program, alongside higher spatial resolution (3m) imagery from the commercial sensor, PlanetScope. The data demonstrates a clear signal in temperature, salinity, chlorophyll-*a*, and turbidity from storm-induced physical mixing that returned to normal values after a few days. However, compared to the seasonal data for 2020, the water quality variables maintained typical levels as seen throughout 2020, suggesting that Hurricane Isaias did not severely impact water quality or increase the flow of nonpoint source nutrients. In preparation for continued storm impacts along the East Coast, monitoring these coastal dynamics is critical in determining how our coastal communities will be impacted and how long those effects will last.

About the Scholar

Sydney Paull is a NOAA Ernest F. Hollings Class of 2025 scholar from San Diego, California, and will be a senior at Eckerd College in St. Petersburg, Florida this fall. She looks forward to graduating with her Bachelor's degree in Marine Science, with a focus in geology, and a minor in Coastal Management in Spring 2025. While graduate school is something she intends to pursue, she aspires to seek employment after college to broaden her knowledge of the field and our rapidly changing world. Sydney anticipates the prospect of building upon her education and having resources to impact the communities threatened along our coastlines. Her internship with NOAA this past summer allowed her to meet these goals by examining the influence of hurricanes on nonpoint nutrient pollution. Going forward, Sydney intends to continue exploring the applications of satellite oceanography to analyze the role of climatic changes on natural systems.

Steven Roche

AI-Driven Magnetic Navigation: Predicting Position from Anomalies

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Manoj Nair and Richard Saltus
National Environmental Satellite, Data, and Information Service
National Oceanic and Atmospheric Administration (NOAA)

GPS is widely used in navigation settings because it can provide exact global coordinates for vehicles. However, GPS is vulnerable to various attacks such as jamming, and viable alternative methods are necessary in the event GPS fails. MagNav is an alternative navigation framework that can be used in all weather conditions, over oceans, and in day or night. The US DoD, with NOAA assisting, is spearheading work on this promising alternative navigation system. In this worksupport of this effort, we investigate the potential of using machine learning methods to predict an aircraft's position using only a magnetometer and a pre-existing magnetic map for navigation. Moreover, we assume the aircraft does not know its initial position (the so-called "cold start" problem). Our project discovered that 1-D CNNs have high potential to succeed on this cold-start problem, achieving mean average errors that are approaching the EMAG2 sampling resolution (~4 km) on multiple regions. We also explore methods to make the CNN models robust to errors and uncertainty in instrument measurements and/or map values as well as the effect of varying flight profile lengths. Future work should consider complicating the problem statement by allowing for changes in altitude, velocity, and profile complexity. Overall, this work suggests that machine learning may be a viable tool in the MagNav framework.

About the Scholar

Steven Roche is from Hanover, Massachusetts and is a rising senior at Boston College, Massachusetts double majoring in Computer Science and Mathematics. After graduation, he plans on obtaining his PhD in Computer Science. Steven is a NOAA Ernest F. Hollings Class of 2023 scholar, and his interests include flood prediction and magnetic navigation (MAGNAV). As an intern at NOAA he is researching how magnetic anomaly measurements could aid navigation in the absence of GPS. He anticipates alternative navigation systems becoming more mainstream and refined in the future for both subaquatic and airborne vehicles. Professionally he hopes to research at an organization such as NOAA or NASA. He hopes his research will not only lead to new scientific discoveries but will also inform policy within the government and associated agencies.

Devin Shaw

A machine learning prediction of magnetic anomaly maps to aid Alternative Positioning and Navigation (Alt PN)

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Manoj Nair and Richard Saltus
National Environmental Satellite, Data and Information Service/National Centers for Environmental Information
National Oceanic and Atmospheric Administration (NOAA)

Alternative magnetic navigation (MagNav) uses pattern matching of previously mapped magnetic anomalies to provide a position estimate – particularly relevant to navigation in the absence of GPS. Unfortunately, the global mapping of magnetic anomalies, particularly over Oceans is incomplete. The purpose of my project is to evaluate the use of machine learning to make reasonable predictions of magnetic anomalies in these unmapped areas. Following a previous study (Graw, Wood, & Phrampus, 2023) that used the random forest technique to predict global heat flow from various predictor grids, I am adapting that work to magnetic anomaly mapping. I employ Python and relevant data science libraries, such as NumPy, pandas and scikit-learn, within the Google Colab environment. Initial benchmarking showed promising results with a higher R^2 score than achieved by Graw, Wood, & Phrampus (2023), even when using only a subset of our available features. My initial results show promise for machine learning approaches for magnetic anomaly prediction.

About the Scholar

Devin Shaw is a community college transfer from Indio, California, and a rising senior computer science major at University of California Riverside. Devin will graduate with a Bachelor's degree in the Spring of 2025. He is a NOAA Educational Partnership Program with Minority-Serving Institutions Class of 2023 Scholar. Devin has a background of experience in data and AI, which is his personal focus outside of the classroom. His aspirations also go outside of technology. Devin has also worked in K -12 outreach for four years and he continues this work on two outreach committees at his university. Devin's main research interest is to use machine learning methods to leverage remote sensing data. He worked (summer research explained here) and plans to take his skills to NESDIS upon graduation. After a period of time working in the remote sensing field, Devin then plans to pursue a specialized master's degree.

Lindsay Weingart

Aleutianamine: The Search And Synthesis of Potential Cancer Treatments From Deep-Sea Sponges

NOAA Mission Goal: Science and Technology Enterprise
Mentors: Christina Conrath, Mark Hamann, George Hanna, Menny Benjamin, and Cody Dickinson
National Marine Fisheries Service and Medical University of South Carolina
National Oceanic and Atmospheric Administration

Aleutianamine is a secondary metabolite found within members of the Lantrunculiidae family that has shown promising anti-cancer activity specifically against pancreatic and colon cancer. Our research worked to identify both Aleutianamine and Dischorbin B—a precursor to Aleutianamine—from *Lantruncula austini* (*L. austini*) and *Lantruncula opernae* (*L.opernae*) tissue samples as well as cultures taken from both species. 62 sponges were collected in the field via a collaboration with the National Marine Fisheries Aleutian Island Survey and were analyzed at the Hollings Marine Lab (HML) and the Hollings Cancer Lab (HCL) in collaboration with the Medical University of South Carolina (MUSC). Both Dischorbin B and Aleutianamine (as well as other Dischorbin derivatives) were found within the *Lantruncula austini* tissue samples but not within the culture dishes. Neither Aleutianamine or Dischorbin B were detected in the unknown bacteria cultured from the *L. austini* samples. Due to the remote nature of the Aleutian Island Survey, the *L. opernae* samples will be analyzed later this summer after the completion of the survey. Moving forward this project works to increase the efficiency in Aleutianamine production, either by isolating and cultivating a bacteria strain shown to produce the compound, or by identifying precursors (such as Dischorbin B) used to increase the efficiency in the laboratory synthesis of Aleutianamine. With this increase in synthesis efficiency, we hope to eventually develop a more effective method of treating solid tumor cell lines such as pancreatic and colon cancer.

About the Scholar

Lindsay Weingart, from San Antonio, Texas, is a rising senior at the University of Miami double majoring in marine science and biochemistry with a minor in creative writing. She is expected to complete her Bachelor's degree in May 2025. After graduation, Lindsay plans on pursuing a PhD in either marine biomedicine or regenerative medicine. Her research interest focuses on the regenerative capabilities of marine invertebrates, and how those capabilities might apply to human medicine. Lindsay is a NOAA Ernest F. Hollings Class of 2025 scholar. For her internship project, Lindsay is working in conjunction with Dr. Mark Hamann and the Hollings Cancer Center at the Medical University of South Carolina and the National Marine Fisheries Service to help develop alternative treatments for pancreatic cancer through compounds produced by Aleutian sponges. Lindsay hopes to use the knowledge gained from this experience to help further her goal of finding less invasive, alternative treatments to human diseases.

Weather Ready Nation

Left: Thyme Brown, *EPP/MSI '23. Right:* Erik Heden - Warning Coordination Meteorologist, NC Weather Forecast Office.

Emily Allen

Assessing Public Information Needs Leading Up to Severe Weather Events

NOAA Mission Goal: Weather Ready Nation
Mentor: Kenzie Krocak
Joe Riperger (The University of Oklahoma Institute for Public Policy Research and Analysis) Oceanic and Atmospheric Research/National Severe Storms Laboratory
National Oceanic and Atmospheric Administration (NOAA)

While there is an abundance of guidance and tools available for meteorologists to incorporate into their forecasts, there is often limited time and space to explain the details of severe weather forecasts. Previous work has identified what information people need to make protective action decisions, including information about the chance, location, severity, timing, impacts, and protective actions related to the hazard. This project aims to analyze the main subject of questions left on NWS Facebook and X (formerly Twitter) accounts. Posts were collected from 10 days prior until one day after 35 tornado events that occurred between 2019 and 2021. Using context from the original posts and mutually exclusive categories, we aim to evaluate public information needs and provide recommendations for tailoring severe weather messaging on social media. Initial results show that many individuals need location and chance information prior to these events, which may indicate the need for risk personalization in the decision making process. This presentation will discuss these results and strategies for prioritizing location information and other forecast attributes with limited space and time.

About the Scholar

Emily Allen is from Alabaster, Alabama and is a class of 2023 NOAA Ernest F. Hollings Scholar. She is a rising senior at the University of Louisiana Monroe, and is majoring in Atmospheric Science with minors in Mathematics and Psychology. She is expected to graduate with her Bachelor's degree in Spring 2025 and hopes to continue her education by obtaining her master's degree in Meteorology beginning in the Fall of 2025. Through her summer internship, she was able to combine her love of meteorology with social science and she is excited to continue this research in order to improve weather and forecast communication to help protect life and property.

Sor Bello Melendez

Evaluating Power Outages and Socioeconomic Disparities through Satellite Data

NOAA Mission Goal: Weather Ready Nation
Mentors: Julia Hoover and Amy Leibrand
National Environmental Satellite Data and Information Service/ Office of Low Earth Orbit Observations/Joint Polar Satellite System
National Oceanic and Atmospheric Administration (NOAA)

After extreme weather events such as hurricanes, cities often suffer major damage, including significant structural damage, flooding, fatalities, and power outages. Power outages present new challenges to communities that depend on electricity, particularly those who rely on it for daily routines and medical needs, impacting essential machines like ventricular assist devices and respiratory machines. This research aims to evaluate the impact of Hurricane Ian on power outages in Lee County, Florida, and analyze the socioeconomic disparities in power restoration efforts. Using Joint Polar Satellite System (JPSS) Visible Infrared Imaging Radiometer Suite (VIIRS) nighttime light data from the Black Marble product, we examined approximate power restoration times across different zip codes. The study considered how socioeconomic diversity affects electricity companies' decision-making and disparities between race and income in zip code areas after a power outage post-Hurricane Ian. Our analysis revealed significant disparities in power restoration times, with lower-income and minority communities experiencing longer outages. These findings highlight the potential need for more equitable power restoration strategies to ensure all communities are prioritized equally during emergency responses. Understanding these disparities can help address and improve equitable treatment during power restoration efforts, ultimately contributing to more resilient communities.

About the Scholar

Sor Bello Melendez is originally from the Dominican Republic and moved to New York in 2016 to continue her studies. She is a rising junior at City College of New York, majoring in Earth Science & Environmental Engineering, and is expected to graduate with her Bachelor’s degree in the Spring of 2027. As a NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI) class of 2024 scholar, Sor is currently working at NESDIS for her first summer internship. Her last research project was phytoremediation of water pollution which inspired her to continue her education by pursuing a Master’s degree in exploring more advanced techniques related to freshwater quality, such as remote sensing for water quality monitoring, advanced water treatment methods, and the use of bioreactors for contaminant removal. Her aspirations are to work for NOAA in their line office of water prediction or at the National Environmental Satellite, Data, and Information Service (NESDIS) as an environmental engineer or a climate change analyst.

Cameron Bennett

Investigating Weak vs. Significant Tornadic Environments Within the Tennessee Valley

NOAA Mission Goal: Weather-Ready Nation
Mentors: Katie Magee and Christina Amiot
National Weather Service/Huntsville Weather Forecast Office
National Oceanic and Atmospheric Administration (NOAA)

When it comes to public perception of severe weather in the Tennessee Valley, tornadoes are seen as the most significant threat when the National Weather Service (NWS) personnel interact with the public directly. Another important aspect is that NWS personnel interact with their Core Partners, which includes Emergency Managers and the Broadcast Media to serve as message amplifiers when severe weather is a threat. To anticipate when tornadoes may occur, NWS forecasters use environmental information from weather models. Weak vs. significant tornadoes can have very different impacts to the public and may require different preparation actions by Core Partners ahead of an event. Therefore, forecasters need to be able to anticipate when significant vs. weak tornadoes are possible. This study used the Storm Events Database to identify local tornadoes and the Storm Prediction Center's Mesoanalysis Archive to catalog key environmental information for tornadic environments for 192 events. Unavoidable data availability issues led to this study only including 35 tornadoes in the final analysis. The four environmental components analyzed were surface-based instability, 0-1 km wind shear, 0-6 km wind shear, and 0-1 km storm-relative helicity. Of the four parameters, the only notable differentiation between weak and significant tornadoes is the 0-1 km storm-relative helicity magnitude. Additional research will be required to draw additional conclusions. This presentation will define and discuss the key environmental components for tornadoes to form, walk through an example analysis case, and discuss analyzed differences between weak and significant tornadoes for the Huntsville, AL area.

About the Scholar

Cameron Bennett is from Atlanta, Georgia, and is a rising senior at Jackson State University, majoring in Meteorology. Cameron is expected to graduate with his bachelor's degree in Spring 2025 and aspires to continue his passion for meteorology in graduate school. Cameron is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2023 Scholar. He is excited to continue his study of weather forecasting by pursuing a career in broadcast meteorology. Cameron plans to further his research by looking into serving people worldwide by educating them on how to prepare for weather occurrences to prevent loss of life.

Thyme Brown

Identifying and Defining Vulnerable Communities in Eastern North Carolina

NOAA Mission Goal: Weather-Ready Nation
Mentors: Ryan Ellis and Erik Heden
National Weather Service/Weather Forecast Office Newport/Morehead City, NC
National Oceanic and Atmospheric Administration (NOAA)

Integrating social science into forecast operations is essential for the National Weather Service (NWS) to enhance community resilience and support its mission of protecting life, property, and the economy. The Newport/Morehead City, NC, Weather Forecast Office (WFO) is addressing this by leading an initiative to identify and define local weather-related and socioeconomic vulnerabilities. Now in its third year, the project aims to create a county-by-county atlas and maintain a database of vulnerable communities in eastern North Carolina to improve impact-based decision-making. Key elements in completing this atlas include community outreach through emergency preparedness events and forums, conducting interviews with Emergency Managers, and collaborating with Warning Coordination Meteorologists. By optimizing outreach and improving access to timely and actionable meteorological data in vulnerable communities, this project aligns with the NWS' mission of creating a Weather-Ready Nation.

About the Scholar

Thyme Brown, an undergraduate NOAA scholar in the EPP/MSI program, Class of 2023, is a senior at Alaska Pacific University pursuing a Bachelor's degree in Liberal Studies with a minor in Marine and Environmental Science, along with an Associate's degree in Business Administration. Her interdisciplinary studies integrate her interests in arts, social science, science communication, marine and environmental science, ecology, and policy. Thyme's research focuses on education and science communication to promote sustainable practices and informed policies, reflecting her passion for environmental advocacy. During her first summer with NOAA, she developed an educational coloring book featuring the National Marine Sanctuaries for the National Ocean Service. Currently, she is interning with the National Weather Service in Eastern North Carolina, creating an atlas to identify and map vulnerable communities to improve outreach efforts. After graduation, Thyme aims to continue her work with NOAA, contributing to policy, ocean sciences, environmental ecology, and social sciences research.

Skyler Carlson

Examination of Atmospheric Gas-Particle Partitioning of Ammonium Nitrate

NOAA Mission Goal: Weather Ready Nation
Mentor: Ann Middlebrook
Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

Fine particulate matter (PM2.5) are harmful air pollutants consisting of particles less than 2.5 microns in diameter. U.S. emissions of PM2.5 particles and their precursor emissions have decreased by 36% in the past two decades, but PM2.5 sulfate has had a larger decrease relative to its precursor than PM2.5 nitrate (Hand et al., 2024). This discrepancy is not currently well understood, and therefore it is important to better understand how particulate nitrate forms in the atmosphere. Partitioning of gas phase ammonia (NH3) and nitric acid (HNO3) into particulate phase ammonium nitrate (NH4NO3) is strongly affected by gas phase concentrations, ambient temperature, and relative humidity. This study examines measurements from six flights during NOAA's 2023 AEROMMA field campaign for evidence of this partitioning. For vertical profiles where the particulate nitrate fraction was increasing with altitude at colder temperatures, mixing ratios of particle phase species were plotted against gas phase species. A -1 correlation indicates stoichiometric partitioning of NH3 and/or HNO3 into NH4NO3. Results were generally consistent across locations and flights with most of the profiles showing one or both species partitioned between phases. The remaining profiles indicated either a poorly mixed atmosphere or possibly partitioning into other aerosol species.

About the Scholar

Skyler Carlson is from Rochester, New York and is a rising senior at Columbia University, majoring in Environmental Science. She is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to continue her education to obtain her Environmental Law degree in Fall 2025. Skyler is a NOAA Ernest F. Hollings Class of 2023 scholar. Her goal is to participate in NOAA General Counsel's Attorney Honors Program where she can gain experience providing legal advice on a wide variety of environmental issues, including climate change remediation and marine preservation, in an effort to advance NOAA's mission. Skyler's long term goal is to work in public service as an attorney who is committed to environmental advocacy and protection.

Mario A. Escobar

Defining and Mapping Aridity and Semi-Aridity in the Continental United States

NOAA Mission Goal: Weather Ready Nation
Mentor: Margaret Hurwitz
National Weather Service/Analyze Forecast and Support Office
National Oceanic and Atmospheric Administration (NOAA)

The National Weather Service provides uniform drought products and services across the continental United States, an approach that may not serve arid regions that are permanently dry. This study investigates the classification and distribution of arid and semi-arid regions in the continental United States using mean annual precipitation to define aridity. Arid regions are defined as areas receiving 10 inches or less of annual precipitation, while semi-arid regions receive between 10 and 20 inches. Using XMACIS, the mean annual precipitation for two stations in each state for the periods 1991-2020 and 2014-2023 was used to map arid regions and examine recent changes in precipitation. Further analysis of stations in states with arid or semi-arid characteristics helped to build a map of arid and semi-arid regions of the Western continental United States. County-level projected precipitation from climate models was used to identify areas that may become arid or semi-arid in the coming decades. This study will inform more equitable hydroclimate services, ensuring that hydroclimate products are tailored to regional needs and effectively address the unique challenges posed by a changing climate.

About the Scholar

Mario Escobar originates from Eagle Pass, Texas, and is a rising junior at the University of the Incarnate Word in San Antonio, Texas. Majoring in Meteorology with a minor in Mathematics, he is on track to graduate with his bachelor's degree in Spring 2026. He plans to further his education by attending graduate school for Atmospheric Science. As a NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Class of 2024 Scholar, Mario is eager to deepen his understanding of weather and climate , such as analyzing areas of aridity and semi-aridity through his internship with Margaret Hurwitz of the National Weather Service—Climate Services Branch. His research specifically focuses on climate analysis and drought applications in the continental United States. Aspiring to become a meteorologist , Mario considers acquiring a job at NOAA a top career goal. He aims to leverage his passion for climate studies to combat climate change and protect our future.

Kyle Eskew

Analyzing the Correlation Between Wildfire Extent and the Evaporative Demand Drought Index in the Western U.S. and Providing Tools to Use Fire Weather Information in Operations

NOAA Mission Goal: Weather-Ready Nation
Mentors: Tom Dang and Kiera Malarkey
National Weather Service
National Oceanic and Atmospheric Administration (NOAA)

Fire weather is a major operational consideration for the National Weather Service in its Western Region. Increased evaporative demand, a quantification of the evapotranspiration that would occur under given atmospheric conditions when unconstrained by surface moisture, is connected to drier fuels and thus increased wildland fire danger. This research uses the aggregated daily anomaly in evaporative demand, known as the Evaporative Demand Drought Index (EDDI), to investigate the timescales under which enhanced moisture stress is most likely to signal extensive wildfires. Using the National Interagency Fire Occurrence dataset and NOAA's EDDI data archive, we analyzed the likelihood of any given fire in the Western U.S., broadly defined as all states Colorado and westward, reaching various threshold sizes based on the drought demand conditions in which it originated. We found that, across the study domain, EDDI values calculated over longer timescales, which indicate if drought has emerged, are more useful for signaling critical fire weather conditions than those calculated over shorter timescales, which indicate flash drought instances or the potential for drought emergence or intensification. Furthermore, to integrate key fire weather indicators into weather forecast operations and for situational awareness purposes, we developed a dashboard with a focus on EDDI metrics, current fuel and weather observations, and forecast conditions for use in Weather Forecast Offices.

About the Scholar

Kyle Eskew is from Beavercreek Township, Ohio and is a rising senior at the University of Oklahoma's School of Meteorology with a minor in mathematics. He expects to graduate in May 2025 and intends to pursue a master's degree in meteorology or atmospheric science before becoming an operational meteorologist for the National Weather Service. As a NOAA Ernest F. Hollings Class of 2023 scholar, Kyle is tasked with investigating how to best use the Evaporative Demand Drought Index as a tool to predict wildland fire intensity and operationalizing the tool by creating a fire weather dashboard at the NWS Weather Forecast Office in Tucson, Arizona.

Ashley Fanning

Assessing Extreme Precipitation Forecasts through In-Situ Soil Measurements: Verification and Validation of the RRFS Ensemble Model

NOAA Mission Goal: Weather-Ready Nation
Mentors: Amanda Back, Liaofan Lin, Shawn Murdzek
Oceanic and Atmospheric Research/Global Systems Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Accurate soil moisture forecasting is vital for predicting near-surface temperature and humidity, the uptake of moisture into developing storm systems, cloud formation, and assessing drought and fire risks. A persistent warm daytime bias during the warm season has been identified as an ongoing issue for many climate and weather models, often attributed to soil moisture bias. Incorporating soil moisture as a control state in Numerical Weather Prediction systems has shown to reduce temperature and humidity forecast errors. This research project evaluates the performance of the experimental Rapid Refresh Forecast System (RRFS) ensemble model developed as part of NOAA's Unified Forecast System, or UFS. Through comprehensive statistical model verification, this study aims to provide insights into the reliability and precision of the RRFS ensemble, specifically for extreme precipitation events. Three time periods are evaluated: Summer 2023, Winter 2024, and Spring 2024. The analysis includes an ensemble of the model with five members and a control, as well the currently-operational High Resolution Rapid Refresh as a member. Variables assessed include soil moisture and soil temperature at 5 cm, 10 cm, and 50 cm depths, as well as 2-m air temperature and 1-hour precipitation accumulations. In-situ data from the International Soil Moisture Network (ISMN), including 5 different data networks, is used to compare to model values to evaluate the skill of individual ensemble members and overall model biases. This project emphasizes the importance of soil moisture data assimilation to improve land surface condition predictions in order to create and maintain a weather-ready nation.

About the Scholar

Ashley Fanning is from West Chester, Pennsylvania and is a rising senior at the University of Miami majoring in Meteorology and minoring in Math, Spanish, and Climate Science and Policy. She is expected to graduate with her Bachelor's degree in Spring 2025, and plans to pursue a Ph.D. in Atmospheric Science following graduation. Ashley is a NOAA Ernest F. Hollings Class of 2023 scholar. Her interests include understanding the scientific background of severe storms and enhancing their prediction through advanced weather modeling. As part of her summer internship at the Global Systems Laboratory, Ashley has been working on weather model verification using in-situ soil moisture measurements to better predict extreme precipitation. As an atmospheric scientist, she hopes to make a difference in severe weather forecasting and public preparedness, and she is eager to achieve that through NOAA.

Gavin Fry

NWS and Social Science: Can We Read a Map?

NOAA Mission Goal: Weather Ready Nation
Mentors: Kevin Laws and Kim Klockow-McClain
National Weather Service/Birmingham, AL Weather Forecast Office
National Oceanic and Atmospheric Administration (NOAA)

Although weather forecasts have improved with evolving technology, there are still many unknowns regarding how effectively the forecast system communicates severe weather risks to the public. In particular, social media is often used by the National Weather Service (NWS) and broadcast meteorologists to convey timely weather information. However, there is still a gap in knowledge around how people interpret, understand, and act on social media messaging. In this study, social media comments were analyzed from NWS offices in Paducah, Kentucky; St. Louis, Missouri; Omaha, Nebraska; and Duluth, Minnesota. Comments from severe weather graphics on Facebook posts and live events were reviewed with a focus on location questions. To complement this, Comments were reviewed in a similar manner from broadcast meteorologist James Spann's severe weather posts on Facebook. To better understand location concerns and interpretation challenges, a set of commenters were interviewed about their social media experience. Results from these interviews can draw out the nuance behind interpretation of social media weather graphics and help inform the larger weather enterprise on potential improvements to our social media weather communication strategies.

About the Scholar

Gavin Fry is originally from Northeast Arkansas and Southeast Missouri where he grew up in farmland USA. Now, he is a rising senior at Dartmouth College where he is pursuing a custom major in Climate System Science. He expects to graduate with his bachelor degree in June 2025, and plans to work either with the National Weather Service (NWS) or in emergency management after graduation. Gavin is a 2024 Truman Scholar with a commitment to a career in public service as well as a Class of 2023 NOAA Ernest F Hollings Scholar. He is excited to investigate the social vulnerabilities to severe weather in the Southeast U.S during his internship with the NWS-Birmingham office in Alabama. He has a passion for weather, helping the common man, and bridging the gap between the social and physical sciences through meteorology and climate science.

Roy Galang

Quantifying the Risk of Hurricane Threats to Vulnerable Populations

NOAA Mission Goal: Weather-Ready Nation
Mentors: Joshua Alland, Stephanie Stevenson, Matt Onderlinde
National Weather Service
National Oceanic and Atmospheric Administration (NOAA)

Impact-based decision support services (IDSS) has been a focus of the National Weather Service to help build a Weather-Ready Nation. The new Probabilistic IDSS roadmap highlights the need to understand how impacts overlap with vulnerable populations, who are more negatively affected by extreme weather. The hurricane community needs to better understand what aspects of a storm produce high impacts, and how such hurricanes impact vulnerable populations. A more holistic understanding of impacts will help reduce damages and fatalities from hurricanes. To better understand what aspects of hurricanes cause high impacts, a logistic regression of storms from 2008-2021 determined three thresholds of the most impactful storms: a future intensity of at least 70 mph (a high-end tropical storm), a forecast storm surge of at least 6 feet, and a maximum RI probability of at least 30%. To better understand how impactful storms overlay with vulnerable populations, we created maps intersecting hurricane and social vulnerability data, allowing us to determine where vulnerable populations overlap with impactful hurricane hazards. Our findings also suggest flooding risks should be considered when connecting vulnerability and hurricane impacts, especially since it led to two misses after reviewing the storms used in the logistic regression.

About the Scholar

Roy Galang is a rising senior at the University of Oklahoma originally from Houston, Texas. He is expected to graduate in May 2025 with a bachelor's degree in meteorology and a minor in communication. Afterwards, he plans to go into the workforce to gain experience before potentially continuing his education towards a master's degree. Roy is a NOAA Ernest F. Hollings Class of 2023 scholar. His internship at the National Hurricane Center is about utilizing vulnerability data to find where vulnerable populations are when a hurricane has immediate threats to areas in the contiguous United States. With his interest in tropical meteorology, Roy hopes to contribute to NOAA's mission by better understanding and communicating knowledge about tropical cyclones, whether it be through research or forecasts. With these experiences, he hopes to share the information with the public to ensure vigilance in weather readiness.

Ashley Garcia

Enhancing the San Juan Forecast Office's Hazardous Weather Risk Assessment Tool Using Machine Learning

NOAA Mission Goal: Weather-Ready Nation
Mentors: Ernesto Rodriguez and Odalys Martinez
National Weather Service/Weather Forecast Office San Juan, PR
National Oceanic and Atmospheric Administration (NOAA)

This study explores the innovative integration of Machine Learning (ML) techniques with traditional meteorological practices to transform risk assessment tools at the San Juan Weather Forecast Office (SJU WFO). Focusing on critical weather events such as flash floods, thunderstorms, waterspouts, tornadoes, and hail, the research begins with in-depth training on NOAA and National Weather Service (NWS) structures and procedures, including the deployment of weather balloons and upper air sounding systems for data collection. Leveraging extensive meteorological datasets and local storm reports specific to the San Juan region, ML techniques were applied to enhance predictive capabilities and improve the accuracy and efficiency of severe weather risk assessment tools. The study meticulously addresses specific challenges in atmospheric data interpretation, establishes clear objectives, and implements robust methodologies to ensure the intellectual merit of the work. By analyzing historical-sounding data and applying various training models, the study identifies critical variables influencing weather risks. Feature importance analysis highlights several key predictors, including atmospheric thickness, Precipitable Water, K Index, Average Wind Direction, and Relative Humidity at 75 mb above the surface. These predictors play pivotal roles in determining atmospheric stability, moisture content, and wind patterns, which are essential for anticipating adverse weather conditions. The research underscores the significance of integrating machine learning with meteorological practices to enhance community resilience and preparedness against severe weather events.

About the Scholar

Ashley Garcia is from the Chicagoland area and is a rising senior at Northeastern Illinois University, majoring in Computer Science with a specialization in Data Science and a minor in Economics. She is expected to graduate with her Bachelor’s degree in May 2025. Ashley is a NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) Class of 2023 Scholar. She currently works as a Machine Learning Engineer at NOAA National Weather Service in San Juan, where her role involves enhancing risk assessment tools for natural disasters through machine learning models. Ashley’s previous experience includes developing data visualizations for the National Ocean Service. Proficient in Java, Python, SQL, and various technologies, Ashley envisions herself working as a data scientist to make impactful contributions by utilizing data-driven insights to solve real-world problems and improve community resilience.

Shania Green

Using Probabilistic Rainfall Totals to Improve Flash Flood Messaging

NOAA Mission Goal: Weather-Ready Nation
Mentors: Katie Magee and Todd Barron
National Weather Service (NWS)
National Oceanic and Atmospheric Administration (NOAA)

Flash flooding is the second-deadliest weather-related cause in the United States, responsible for an average of 88 deaths each year. Because the power of water is often underestimated, many individuals are typically caught off guard by the rapid onset and intensity of flash floods. To help save lives and ensure that safety precautions are taken, it is essential that National Weather Service (NWS) meteorologists deliver proper Impact-Based Decision Support Services (IDSS) messaging to NWS Core Partners and elevate the threat levels of flooding rain events when severe weather grants it necessary. Because this need is constant and ever-evolving, enhancements to messaging are highly sought-after. This study assesses whether probabilistic rainfall totals from the High-Resolution Ensemble Forecast (HREF) can improve external messaging and identify higher-end rainfall totals that would deviate from the widespread rainfall total forecast typically communicated by a Weather Forecasting Office (WFO). It utilizes a comparative analysis approach between the HREF forecasts and Multi-Radar Multi-Sensor (MRMS) rainfall totals observed during intense rainfall events. Specifically, the study focuses on Flash Flood Warnings labeled as “considerable” or “catastrophic” that occurred between January 2021 and May 2024 across several southeastern County Warning Areas (CWAs) including Huntsville, AL, Birmingham, AL, Memphis, TN, and Jackson, MS. The study concludes that the HREF max 24-hour rainfall forecasts, followed by the localized probability-matched mean (LPMM), are the most representative of higher-end rainfall totals. Moving forward, future research will incorporate spatial differences in heavy rainfall and events influenced by complex terrain.

About the Scholar

Shania Green is from Atlanta, Georgia and a rising senior at the University of Georgia. She is double-majoring in Atmospheric Sciences and Geography, while also pursuing a certificate in Geographic Information Science. She is expected to graduate with her Bachelor’s degree in Spring 2024, and plans to continue following her passion for meteorology by either entering the workforce or pursuing graduate school. As a NOAA Ernest F. Hollings Class of 2023 scholar, Shania conducted her internship at the National Weather Service Weather Forecasting Office in Huntsville, Alabama, where she performed operational tasks and completed a research project investigating probabilistic rainfall. Her research intends to improve forecaster confidence in rainfall estimates and enhance external messaging for possible considerable and catastrophic flash flooding events. Shania believes in the importance of a weather-ready nation and aspires to protect life and property, educate others about weather, and advance meteorology and human health research in her professional career.

Haniston Holloway

Tornado on a Leash: A Case Study of a Violent Tornado Track in Iowa on March 5, 2022

NOAA Mission Goal: Weather-Ready Nation
Mentor: Matthew Flournoy
National Weather Service / Storm Prediction Center
National Oceanic and Atmospheric Administration (NOAA)

In a collaborative project that involves scientists and forecasters at the Storm Prediction Center and National Severe Storms Laboratory, this project aims to analyze a growing database of observed supercells and tornadoes to address the gaps in knowledge of various aspects (i.e., tornado-warning performance and background environment) of these storms. The overarching goal is to better understand supercell thunderstorm environments, evolution, tornado production, and warning characteristics. We used coding techniques (e.g., Python) to further analyze specific tornadic (and nontornadic) supercell cases to highlight the difference in environments, evolutionary paths, etc. Using radar data retrieval and analysis to help construct a supercell and tornado database, a specific supercell event was chosen to analyze for a case study: the violent, EF-4 tornado that impacted Winterset and other areas in central Iowa on March 5, 2022. Deriving azimuthal shear (AzShear) of the MRMS Rotational Track product and plotting rotational velocity (Vrot) from the SPC Vrot Tool at the lower (~ 1.5 km) and mid-levels (~ 4.5 km), this case study will discuss relationships between these variables for mesocyclonic and tornadic strength during the long-lived supercell. AzShear and Vrot time series throughout the storm track are assessed, as well as the variability of these products with radar distance and elevation. This presentation will discuss the opportunity to compare Vrot and AzShear in order to encourage a more weather-ready nation, via a transition of increased knowledge of storm-scale processes to improved real-time predictability.

About the Scholar

Haniston Holloway is from Mesquite, Texas and is a rising senior at the University of Louisiana at Monroe. She is pursuing a Bachelor's degree in Atmospheric Science and wants to further her studies in this field by obtaining a Master's degree in Fall 2025. Haniston is a NOAA Ernest F. Hollings Class of 2023 scholar who is thrilled to pursue her research on supercell thunderstorm environments, evolution, tornado production, and warning characteristics to better understand severe weather preparedness and impacts. She has professional aspirations of becoming an educator with goals of enhancing atmospheric science education and encouraging the public, especially vulnerable communities, in their knowledge of weather to promote and support a weather-ready nation.

Lucas Jones

The Impact of Including a Wave Model in the Seasonal Forecast System

NOAA Mission Goal: Weather Ready Nation
Mentors: Jessica Meixner and Neil Barton
National Weather Service/Environmental Modeling Center
National Oceanic and Atmospheric Administration (NOAA)

The Environmental Modeling Center's (EMC's) ongoing work to develop the Seasonal Forecast System (SFS) weather model has the potential to greatly improve long range environmental forecasting globally. The SFS is currently at an early stage of development with multiple areas of continuing research. One question facing EMC is whether a wave model (WAVEWATCH III) should be included within the SFS. The SFS will replace the Climate Forecast System version 2 (CFSv2), which does not utilize a wave model, providing little background on the value of coupling WAVEWATCH III in the SFS. This work compares forecasts from a developmental version of the SFS with and without the wave model. Starting from several historical initial condition dates selected for being winters with a strong El Niño, the SFS is run 90 days into the future. Sea surface temperatures (SSTs), ocean mixed layer depth, 850 hPa geopotential height, and precipitation are compared with and without waves to assess the value of coupling WAVEWATCH III.

About the Scholar

Lucas Jones, a meteorology senior at the University of Oklahoma, has had a passion for weather since his childhood. The wild beauty, fragility, and sometimes dangerous unpredictability of weather continues to fascinate him today. His experiences growing up in Albuquerque, NM have cultivated research interests in long term climate variability and seasonal modeling. Lucas has continued this pursuit through the Ernest F. Hollings Undergraduate scholarship program with a summer internship at the National Weather Service's Environmental Modeling Center (EMC). During his time at the EMC, he has researched the benefits of including a wave model in the new coupled subseasonal to seasonal model of the upcoming Unified Forecast System. Lucas will also expand on his education this fall, starting an accelerated Master's in Data Science and Analytics while finishing his undergraduate meteorology degree.

ReneDiego Martinez

Developing a Jupyter Notebook-based tutorial of the GDAS Proxy Application for Enhanced Data Assimilation in Earth System Prediction

NOAA Mission Goal: Weather Ready Nation
Mentors:Krishna Kumar, Cameron Book, Keven Blackman, and Maoyi Huang
Oceanic and Atmospheric Research/Weather Program Office/Earth Prediction Innovation Center National Oceanic and Atmospheric Administration (NOAA)

The Earth Prediction Innovation Center (EPIC) is developing a Data Assimilation (DA) Proxy App, a generic community version based on the structure of the Global Data Assimilation System (GDAS) Application (GDAS App) and global-workflow from the National Centers for Environmental Prediction global model utilizing the Joint Center for Satellite Data Assimilation's (JCSDA) Joint Effort for Data assimilation Integration (JEDI) framework for data assimilation.

This project involves a comprehensive review and understanding of the GDAS App and global-workflow software, testing and verifying the GDAS Proxy App on NOAA's on-prem Research & Development High Performance Computing system (RDHPCS) and producing a Jupyter Notebook based tutorial on assembling and testing the GDAS App on NOAA RDHPCS environments. The Jupyter Notebook platform documents the steps of setting up and executing the GDAS Proxy App for the UFS scientific and academic community. The tutorial provides accessibility and a student perspective to the academic and scientific community who are looking to further develop and advance DA research. Partnering with the EPIC team, the presentation will discuss the process for building and running various UFS Applications on NOAA RDHPCS, along with generating a Jupyter Notebook based tutorial for a building and testing a cycling run of the GDAS Application.

About the Scholar

ReneDiego "Diego" Martinez is from San Antonio, Texas and is a rising junior at Texas A&M University - Corpus Christi, majoring in Atmospheric Science and minoring in Applied Mathematics. Diego is currently completing his Bachelor's degree and will graduate in Spring 2026. He plans to continue his education by obtaining his Master's degree in Atmospheric Science and his PhD in Atmospheric science with a focus on severe mesoscale meteorology. Diego is a NOAA Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Class of 2024 Scholar. He is extremely passionate about meteorology, the processes involved in tornadogenesis in supercells, and hopes to be able to further predict and model the development of tornadoes. This past summer, Diego had the opportunity to intern at the Office of Oceanic and Atmospheric Research (OAR) in the Earth Prediction Innovation Center (EPIC); and support the Global Data Assimilation System (GDAS) Proxy Application utilized in the Unified Forecast System (UFS).

Cullen McNinch

Technologies and Mission Concepts to Advance Spaceborne Wind Measurements

NOAA Mission Goal: Weather Ready Nation
Mentors: Otto Bruegman and Valerie Mikles
National Environmental Satellite, Data, and Information Service (NESDIS) National Oceanic and Atmospheric Association (NOAA)

We consolidate instrument and satellite studies to create a concept mission for a satellite constellation that measures ocean surface wind vectors, with a focus on lowering cost and reducing development timelines. Previous missions that collected similar data, such as WindSAT and AMSR2, were expensive and had to be developed over a long period of time. We provide a concept mission that proposes an alternative to traditional satellites utilizing the demonstration instrument Compact Ocean Wind Vector Radiometer (COWVR). Developed by the Jet Propulsion Laboratory, COWVR utilizes commercial components and unique design innovations to reduce the mass and mechanical complexity, consume less power, and cost less than larger microwave radiometer instruments. The concept mission uses COWVR on a constellation of 5 satellites, 2 in sun-synchronous orbits 4 hours apart, and 3 with a 30º inclination angle. This allows for both global coverage and an additional focus on the tropics. Additionally, we propose multiple low-cost spacecraft buses and launch vehicle options classified for SmallSats (less than 500kg). The data collected by this concept mission would provide key information on the ocean surface winds in a consistent manner, which would be useful for NOAA operations, such as the U.S. National Hurricane Center, the Numerical Weather Prediction, and commercial shipping lines. Overall, this concept mission conveys the potential of using commercial components in future LEO missions and the power of a multi-element constellation over a single, larger satellite.

About the Scholar

Cullen McNinch is from Kitty Hawk, North Carolina and is a rising senior at the University of North Carolina at Charlotte. He is majoring in electrical engineering technology and plans to graduate with a Bachelor's degree in Spring 2025. Cullen is currently in an early entry program to obtain a Master's degree in applied energy and electromechanical engineering. Cullen is a NOAA Ernest F. Hollings Class of 2023 Scholar and was able to intern with the LEO program at Goddard Space Flight Center. He was able to apply his engineering experience in order to develop a concept mission for a satellite constellation that measured ocean wind vectors, which could improve the accuracy of weather forecasts. He hopes to use the experience gained from this internship and his education to work on the forefront of renewable energy, and to one day be able to develop new technologies for renewable energy.

Josiah J. Melke

High-Resolution Mobile Mesonet Observations of the 24 March 2023 Rolling Fork, Mississippi, Tornadic Supercell during PERiLS 2023 IOP 3

NOAA Mission Goal: Weather Ready Nation
Mentors: Anthony W. Lyza, and Sean M. Waugh
Oceanic and Atmospheric Research/National Severe Storms Laboratory
National Oceanic and Atmospheric Administration (NOAA)

On 24 March 2023, a supercell produced a high-end EF4 tornado that impacted Rolling Fork, Mississippi. The third intensive observing period (IOP 3) of the 2023 season of the Propagation, Evolution, and Rotation in Linear Storms (PERiLS) field campaign was ongoing in the Mississippi Delta and observed the near-storm environment and supercell evolution before and during the Rolling Fork tornado. The NOAA/OAR National Severe Storms Laboratory (NSSL) Mobile Mesonets (MMs) collected high-resolution surface data in the forward-flank and rear-flank regions of the supercell. In this presentation, we perform a storm-relative analysis of the NSSL MM dataset from the Rolling Fork supercell. Various features within the supercell – such as the left-flank convergence boundary (LFCB) and forward-flank convergence boundary (FFCB) – are identified and characterized by locally strong, baroclinically generated, streamwise vorticity normal to the MM motion and by gradients in virtual potential temperature following the MM motion. These MM observations are also analyzed with the C-band on Wheels (COW) radar data from the University of Illinois Urbana-Champaign to help identify radar signatures that correspond to the identified supercell features.

About the Scholar

Josiah Melke is from Nekoosa, Wisconsin, and is a rising senior at St. Cloud State University. He is expected to graduate in Spring 2025 with a Bachelor's degree in Meteorology and minors in Applied Mathematics and Hydrology. Josiah plans to continue his education by pursuing a Master's degree in Atmospheric Sciences in Fall 2025 where he hopes to continue his study of severe weather. Josiah's professional aspiration is to work at NOAA's National Severe Storms Laboratory, which is where Josiah spent his summer as a Class of 2023 Hollings scholar. As a research meteorologist, Josiah hopes to further our understanding of severe weather hazards–such as tornadoes, hail, and lightning–and apply these findings to forecast operations where they will improve severe weather forecasts.

Benjamin Moose

Dual-Polarization Radar-based Analysis of Supercell Evolution: Comparing Phased-Array and WSR-88D Observations

NOAA Mission Goal: Weather-Ready Nation
Mentors: Addison Alford and Charles Kuster
Office of Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

As the National Weather Service considers the options for replacing current Weather Surveillance Radars-1988 Doppler (WSR-88Ds), phased array radar (PAR) is one replacement option under consideration. Thus, identifying use cases to examine how PAR data may offer improvements over WSR-88D observations becomes crucial. One potential target use case type involves the identification of dual-polarization features in severe convection, which provide insights into various storm-scale processes and structures relevant to operations. With significantly faster full volume scans and potentially higher data quality than existing WSR-88Ds, PARs can resolve the evolution of dual-polarization signatures more clearly and at a higher temporal frequency. This project investigates potential benefits of PAR via comparison of dual-polarization radar signatures collected by the Advanced Technology Demonstrator (ATD) PAR at NOAA's National Severe Storms Laboratory with observations from the co-located KOUN and nearby KTLX WSR-88D radars. Depictions of multiple supercell dual-polarization signatures, including Z_{DR} arcs, Z_{DR} - K_{DP} separation vectors, and Z_{DR} columns, are qualitatively analyzed for a selection of case studies containing supercell storms. Further, quantitative output from a modified version of the Supercell Polarimetric Observation Research Kit (SPORK), an algorithm designed for dual-polarization signature identification, is collected for each case. Meteorological implications of differences between WSR-88D and ATD returns are explored, with a particular focus on the operational advantages gained by analyzing rapid-update ATD data. Qualitative analysis assists in identifying benefits that PAR may provide to warning decision-makers, while SPORK output is used to complement qualitative findings and explore the utility of PAR data in radar-based algorithms.

About the Scholar

Benjamin Moose is a rising senior at Cornell University studying atmospheric science. As a 2023-25 NOAA Ernest F. Hollings scholar, Benjamin is particularly interested in research-to-operations work at the intersection of meteorology, mathematics, and computer science, and he plans to pursue graduate studies in the atmospheric sciences. This summer, he is working with the National Severe Storms Laboratory (NSSL) to investigate the extent to which faster volume scans from phased-array radar (specifically, NSSL's Advanced Technology Demonstrator) can better depict the evolution of dual-polarization radar signatures. In the longer term, he aims to pursue a career with opportunities to meaningfully improve the operational forecast or warning process, whether through work at the National Weather Service itself or NOAA's research labs such as NSSL. He plans to work toward these goals via research that makes use of numerical modeling and simulation, meteorological observations such as weather radar, or machine learning techniques.

Keller Morrison

Validating Saildrone Ocean Wave Measurements via Spectral Comparisons with Moored Buoys

NOAA Mission Goal: Weather Ready Nation
Mentors: Edward Cokelet, Dongxiao Zhang, Chidong Zhang
Oceanic and Atmospheric Research/Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Ocean surface waves generated by hurricanes can pose a major threat to coastal life, property, marine ecosystems, and the shipping industry. High waves and storm surges also damage uncrewed observing platforms sent to measure hurricane conditions at the air-sea interface. Since the 2021 hurricane season, NOAA/AOML and PMEL have partnered with Saildrone Inc. to deploy 5-12 Uncrewed Surface Vehicle (USV) saildrones every year to measure the air-sea interaction processes under hurricanes to improve hurricane forecasts. To evaluate the capability of the USV saildrones in measuring waves, this project compares wave directional spectra observed by saildrones within 10 km of moored NOAA/NDBC and Coastal Data Information Program (CDIP) weather/wave buoys during the 2021–2023 Atlantic hurricane seasons. Raw 20-Hz GPS and inertial measurements from saildrones were used to calculate wave and vessel information such as dominant energy spectra, wave direction, wave height, and wave period. Statistical comparisons between these calculations and buoy measurements were then used to determine the reliability of saildrone wave measurements. It was demonstrated that bulk wave parameters can be accurately derived from the data collected by saildrones using directional wave spectra methods. This research contributes to wind-wave and air-sea interaction research through the development of the capability of USV saildrones to measure ocean surface waves.

About the Scholar

Keller Morrison is from Bellingham, Washington and is a rising senior at Brown University studying mechanical engineering with a focus on fluid mechanics. He is expected to graduate with his Bachelor's degree in Spring 2025, and is planning to pursue a graduate degree in either mechanical or ocean engineering in Fall 2025. Keller is a NOAA Ernest F. Hollings Class of 2023 scholar working at PMEL with Dr. Dongxiao Zhang, Dr. Chidong Zhang, and Dr. Edward Cokelet. His project compares wave directional-spectra calculations between historical Saildrone and NDBC buoy measurements to further understand wind-water interactions in order to improve hurricane forecasting. Keller aspires to connect his passions for the ocean and fluid mechanics to better understand extreme weather events, design sustainably, and develop renewable energy systems that can power the future.

Camden Opfer

Towards Improved Verification and Metrics: A Case Study Over the Sevier River Basin at the CBRFC

NOAA Mission Goal: Weather-Ready Nation
Mentors: Paul Miller and Michelle Stokes
National Weather Service/Colorado Basin River Forecast Center
National Oceanic and Atmospheric Administration (NOAA)

The Sevier River basin in Southwestern Utah is an isolated system which supplies water to around 60,000 residents and, more notably, the large agricultural sector in the Sevier Valley. The Colorado Basin River Forecast Center (CBRFC) provides predictions of near-future flow and total seasonal water resources for the Colorado River, Great, and Sevier River Basins, which are used by water managers to inform use, including the amount of water diverted for irrigation in the Sevier Valley. To ensure a high standard of accuracy in these models, a comparison was carried out to determine whether regulated or unregulated forecasts perform better in the Sevier River basin. To this aim, both existing and newly devised verification methods were applied to model output produced by the CBRFC, evaluating model performance against observational data from USGS gages. It was found that unregulated forecasts were more skillful, with one strong indicator being that unregulated forecasts issued between January and May yielded 56.29% of the mean absolute relative error associated with regulated forecasts. This supports the conclusion that the CBRFC should switch its official forecasts for the Sevier River basin to be unregulated in order to provide the best possible information to water managers and users.

About the Scholar

Camden Opfer— a student at the University of Colorado, Boulder from Fort Collins, Colorado— is going into his fourth year of undergraduate work double majoring in Atmospheric & Oceanic Sciences and Mathematics with a minor in Leadership Studies. He plans to graduate in Spring of 2025, after which graduate school for atmospheric science and a career in scientific research are his main goals. Camden is an Ernest F. Hollings Scholar in the 2023 cohort, and completed his associated internship with the Colorado Basin River Forecasting Center (CBRFC) in Salt Lake City. He has appreciated the opportunity to hone various data science skills, and aims to apply similar coding, statistical analysis, and data-based approaches in the future. The public and policymaker facing aspects of this work have also sparked interest, and combining thought-provoking science with meaningful, real world outcomes is also something Camden hopes to find in a future career.

Stephanie M. Ortiz Rosario

Understanding the direct effect of CO2 on tropical precipitation extremes using theory and high-resolution simulations

NOAA Mission Goal: Weather-Ready Nation
Mentors: Veeshan Narinesingh, Andrew I. L. Williams and Timothy M. Merlis
Oceanic and Atmospheric Research/Geophysical Fluid Dynamics Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Communities worldwide are exposed to heavy rainfall events, with extreme tropical precipitation being particularly impactful. Climate change is expected to affect precipitation extremes, but climate models disagree on the response of tropical precipitation extremes to warming. To make progress on this, previous work has mostly focused on the response of rainfall extremes to sea surface temperature (SST) warming, but with fixed CO2 concentrations. As a result, this study examines how high percentiles of precipitation change with increasing CO2, over fixed SSTs, and decomposes their response between thermodynamic and dynamic contributions. CO2 concentrations are quadrupled using a cloud-resolving model, specifically the System for Atmospheric Modeling (SAM). These idealized, radiative-convective equilibrium simulations are contained in a 100 km^2spatial domain over a tropical ocean and have a 1 km horizontal resolution, which resolves deep convection. Domain-averaged precipitation time series and high quantile calculations show that precipitation extremes (i.e., 99.99 percentile) decrease by almost 4% in response to a quadrupling of CO2, compared to a 5-6% increase per degree of SST warming, as found in previous work. By comparing fractional and absolute changes in the thermodynamic (i.e., temperature) and dynamic variables (i.e., vertical velocity), it is found that the dynamics play a greater role in influencing the weakening of precipitation extremes over the tropics. Future work seeks to further quantify the contribution of the vertical velocity to changes in tropical precipitation extremes by using a condensation rate equation.

About the Scholar

Stephanie Ortiz Rosario is a rising senior at the University of Puerto Rico at Mayagüez, majoring in Theoretical Physics. Throughout her undergraduate studies, she has taken courses in atmospheric science, which have strengthened her interest in the field, especially in tropical and mesoscale meteorology. She has been an NCAS-M II Fellow with the NOAA Educational Partnership Program with Minority-Serving Institutions (EPP/MSI) since spring 2023. As an EPP/MSI intern at the NOAA Geophysical Fluid Dynamics Laboratory (GFDL), she has been studying the impact of CO_2 on tropical precipitation extremes. After graduation, Stephanie is interested in pursuing a PhD in Atmospheric Sciences. Among her goals as a future atmospheric scientist, she aspires to communicate her field knowledge with the public and support new generations of Latinx/Hispanic students.

Kylie Overton

Development and Test of Noaa’s Next Generation Sea Level and Waves Measurement Systems

NOAA Mission Goal: Weather Ready Nation
Mentors: Robert Heitsenrether and Laura Fiorentino
National Ocean Service/Center for Operational Oceanographic Products and Services
National Oceanic and Atmospheric Administration (NOAA)

The National Oceanic and Atmospheric Administration's (NOAA) Center for Operational Oceanographic Products and Services (CO-OPS) manages the National Water Level Observation Network (NWLON), a system of 210 long-term stations that provide critical water level data for marine navigation, coastal hazards monitoring, and habitat preservation across the nation. One of CO-OPs' long-term goals is to address spatial gaps in NWLON to provide coastal communities with the most local, real-time data possible. This project supports this goal by evaluating two low-cost, quick-deployable water level and wave sensors (Vegapuls C22 and RBR Duet 3), which could potentially serve as tools to efficiently increase observation coverage. The Vegapuls is a radar sensor, which measures range from above the water's surface and has applications in real-time water level and wave monitoring. The RBR is an internal logging, pressure sensor, which has applications in post-event coastal hazard analysis. The first test site focuses on quantitatively comparing both test sensors' water level observations to a NOAA tide gauge. The second test site focuses on quantitatively comparing the Vegapuls's wave observations to a NOAA reference wave sensor at an open ocean site. The RBR was also tested at a third location with limited vertical referencing and water level measuring infrastructure to simulate a realistic coastal hazard application. Results from this third site focused on utilizing a webcam for impact graphics and Global Navigation Satellite System to vertically reference water level data. Sensor performance from the three field sites will be presented, along with recommendations for future NOAA applications.

About the Scholar

Kylie Overton is a rising senior at the University of Alabama, majoring in mechanical engineering. During her college career, she has explored a variety of research areas that combine her engineering skills with her passion for improving the environment. She has conducted material science research on incorporating nanomaterials into polymeric membranes to improve water quality and filtration efficiency. She also has done research on paleo streamflow reconstructions that create robust datasets that help decision makers ensure water security. During her internship with the Center for Operational Oceanographic Products and Services (CO-OPS) this summer, she will explore coastal hazards monitoring by conducting design analysis, field testing, and performance evaluations of two new low cost and quick deployable water level sensors. This experience will support her career goals of using her engineering expertise to support projects that aim to improve both communities and the environment.

Cheryl Reuben

Validation of Sea Surface Latent and Sensible Heat Fluxes in Three Global Reanalysis Products Against Saildrone Observations During 2023 Atlantic Hurricane Season

NOAA Mission Goal: Weather Ready Nation
Mentor: Chidong Zhang
Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

Many devastating hurricanes, such as Katrina, Harvey, and Maria, have seen a 30+ kt increase in the maximum sustained wind speed in a 24 hour period. This is known as rapid intensification and is challenging for models to predict. One key factor in rapid intensification is the energy transfer from the ocean to the atmosphere. While observations from systems such as saildrones, buoys, and aircrafts can be used to observe the air-sea energy exchange, they are irregular in space and/or time. Reanalysis procedures assimilate all available observations and synthesize them into products that are uniform in both space and time. However, model errors can impact these products. Before reanalysis products are used as proxies for in situ observations, they should be validated, especially during extreme conditions such as hurricanes. This study aims to validate sea surface latent and sensible heat fluxes from three commonly used global reanalysis products (NASA MERRA2, ECMWF ERA5, NOAA CFSR2) against saildrone observations taken during the 2023 Atlantic hurricane season. Hourly averaged saildrone data were paired with reanalysis data from each product. Discrepancies between saildrone observations and reanalysis outputs were mostly within one standard deviation with sporadic large spikes. CFSR2 demonstrated a systemic negative bias for latent heat fluxes and large negative and positive errors for sensible heat fluxes. These results suggest heat fluxes from MERRA2 and ERA5 are a reliable representation of air-sea interactions in the Atlantic Ocean and are consistent with a similar study conducted for the Pacific sub-Arctic Ocean.

About the Scholar

Cheryl Reuben is from Cedar Rapids, Iowa and is a rising senior at the University of Iowa, majoring in Chemical Engineering with a minor in Chemistry. She is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to continue her education in chemical engineering. Cheryl is a NOAA Ernest F. Hollings Class of 2023 scholar and is using saildrone observations to validate reanalysis products during Atlantic hurricane season. During the summer of 2023 Cheryl conducted a study on catalyst coated membranes for pressurized water electrolysis at the National Renewable Energy Lab. At her home institution, Cheryl uses machine learning methods to create predictive models for soil and air qualities to be used in farming and agricultural applications. In the future, Cheryl plans to continue exploring her diverse research interests.

Juliette Rocha

Correlation Analysis for Strongly Coupled Atmosphere-Ocean Data Assimilation for Future Versions of the GFS

NOAA Mission Goal: Weather-Ready Nation
Mentors: Cory Martin and Cathy Thomas
National Weather Service/National Centers for Environmental Prediction/
Environmental Modeling Center/National Oceanic and Atmospheric Administration (NOAA)

Coupled models use various components (atmosphere, ocean, sea-ice, waves) together to produce a seamless prediction of the Earth system as a whole. The upcoming version of the National Oceanic and Atmospheric Administration's (NOAA) Global Forecast System (GFS) is planned to be coupled with initializations performed individually for each model component. This is known as weak coupling; whereas with strong coupling, the model components data assimilation (DA) are initialized together. The Joint Effort for Data assimilation Integration (JEDI) framework aims to unify data assimilation (DA) programs across modeling systems. It allows for the use of weak or strong coupling with various models. Using the JEDI framework, this project aimed to determine the importance of atmosphere-ocean coupling strength for implementation in future versions of the GFS. This involved an analysis of the DA coupling between the Finite-Volume Cubed-Sphere dynamical core atmospheric model (FV3) and the Modular Ocean Model 6 (MOM6). To evaluate this coupling, high resolution sea surface temperature (SST) from the MOM6 and 2 meter air temperature (T2m) from the FV3 were compared via difference and correlation analysis with daily data from eleven days in the summer and winter. Correlations are seen to change temporally and spatially. T2m–SST correlations over time showed the strongest relationships in the summer hemisphere and in certain specific locations, such as the El Nino Southern Oscillation (ENSO) region. Correlations were weakest towards the poles with increasing sea ice. Difference plots (SST-T2m) also demonstrated spatial differences between the two components and showed significant flow dependence.

About the Scholar

Juliette Rocha is from McKinney, Texas and is a rising senior at Texas A&M University, majoring in Meteorology with a minor in Oceanography and Mathematics. She is expected to graduate with her Bachelor's degree in Spring 2025, and aspires to continue her education and obtain her doctorate degree in atmospheric sciences beginning Fall 2025. Juliette is a NOAA Ernest F. Hollings scholar, Class of 2023. Juliette explored her interests in numerical weather prediction with her internship at the Environmental Modeling Center in College Park, Maryland. Her project involved conducting a correlation analysis of temperature fields from the Global Forecast System's atmospheric and oceanic models, aiming to identify and understand discrepancies between the two models.

Caitlyn Scott

Evaluating QLCS Mesovortices Using Dual-Polarization Radar Data

NOAA Mission Goal: Weather Ready Nation
Mentors: Ben Herzog and Charles Kuster
National Weather Service
National Oceanic and Atmospheric Administration (NOAA)

Issuing convective warnings on quasi-linear convective systems (QLCSs) is a challenge for National Weather Service operations, as they develop quickly and are small scale phenomena. To guide forecasters, the three ingredients method and QLCS mesovortex warning system were developed. However, this system doesn't yet incorporate dual-polarization radar data. Therefore, this study compares radar signatures already within the mesovortex warning system to the evolution of specific differential phase (K_{DP}) to determine if K_{DP} offers any predictive ability (lead time) to mesovortex development and damage potential. To accomplish this study, we compared low-level K_{DP} core, midlevel K_{DP} core, and K_{DP} drop evolution relative to mesovortex formation. We chose two QLCS events, May 19, 2022 in Saint Louis and February 20, 2017 in San Antonio, and examined the signatures mentioned above for damaging vs non-damaging mesovortices and tornadic vs non-tornadic mesovortices. In general, K_{DP} drops frequently precede mesovortex development and are slightly more frequent for mesovortices that produce damage. Furthermore, low-level and midlevel K_{DP} cores have a higher magnitude for tornadic mesovortices than non-tornadic mesovortices and for damaging mesovortices than non-damaging mesovortices. These findings could be used by forecasters to build confidence in whether a given mesovortex might produce damage or not.

About the Scholar

Caitlyn Scott is from Hastings, Nebraska, and is a rising senior at the University of Nebraska - Lincoln majoring in Meteorology/Climatology with minors in Mathematics and Communication Studies. She will be graduating with her Bachelor's degree in May 2025, and plans to continue her education by pursuing a Master's degree in atmospheric science. Caitlyn is a NOAA Ernest F. Hollings Class of 2023 scholar and completed her internship at the National Weather Service St. Louis Weather Forecast Office, where she completed both operational tasks and a research project analyzing dual polarization radar variables in quasi-linear convective systems. Her project aims to improve forecaster confidence and warning lead time for issuing severe thunderstorm and tornado warnings for QLCS events. Her professional aspiration is to become a forecaster with the National Weather Service, where she can combine her passion for weather and service to aid in the protection of life and property.

Michael Self

Comparing Tornado Production from Merging and Isolated Supercells Across Several Convective Events

NOAA Mission Goal: Weather Ready Nation
Mentor: Matthew Flournoy
Oceanic and Atmospheric Research/National Severe Storms Laboratory
National Oceanic and Atmospheric Administration (NOAA)

This project aims to analyze tornado production across merging supercells using an extensive database of 'right-moving' supercell tracks in the contiguous United States. The two main objectives are: (1) contributing to a robust database consisting of thousands of supercell tracks, and (2) analyzing this database to address key questions about the behavior and characteristics of merging supercells and their associated tornadoes. The database is developed by tracking all observed supercells using archived radar imagery (GR2Analyst) and pairing these tracks with tornado paths, severe thunderstorm warnings, and environmental parameters such as storm-relative helicity (SRH), convective available potential energy (CAPE), and the supercell composite parameter (SCP). The focus of this project is on supercells that have other supercell(s) merge into them during their lifespan. Some research questions to be addressed include: the frequency of tornadic and non-tornadic merging supercells, differences in the evolution of merging and isolated supercells within similar environmental conditions, and the tendency of azimuthal shear before and after a supercell merger. The results of this project will be updated as additional contributions are made to the comprehensive supercell database. Current findings are based on more than a dozen convective days from early 2022 through mid-2023. Based on this analysis, more than half of the dominant merging supercells produced at least one tornado. Additional preliminary findings show that both the mid-level and low-level maximum azimuthal shear tends to slightly increase, on average, after a dominant supercell experiences a merger with another supercell.

About the Scholar

My name is Michael Self, and I am a fourth-year Meteorology and Geography double major at the University of Florida from Orlando, Florida. At UF, I am actively involved in the growing meteorology community, serving as the founding president of the AMS Gator Chapter, where I lead weather balloon launches and visits to National Weather Service offices. I also serve on the national AMS Board on Student Affairs Student Outreach and Engagement Committee and am the treasurer of the Gator Amateur Radio Club, tracking weather balloons with my own hand-built antennas. As a UF Department of Geography ambassador, I educate students about the program and the new Meteorology major. My research focuses on severe weather, particularly supercells and tornadoes, and I have developed a machine learning model to predict lightning. Currently, I am working on a supercell database with the National Severe Storms Laboratory. I plan to attend graduate school to further my research and improve forecast models.

Amanda Sparks

NOAA Hurricane Hunter Airborne Instrumentation Operator's Guide

NOAA Mission Goal: Weather-Ready Nation
Mentors LCDR Kevin Doremus and LCDR Jamie Park
Office of Marine and Aviation Operations/Aircraft Operations Center
National Oceanic and Atmospheric Administration (NOAA)

The NOAA Hurricane Hunter Airborne Instrumentation Operator's Guide was created for the purposes of putting together convenient and accessible information on NOAA's Lockheed WP-3D Orion Aircraft and the four main radar instrumentation systems onboard used in hurricane reconnaissance operations. The nose radar, lower fuselage radar or multi-mode radar (MMR), stepped frequency microwave radiometer (SFMR), and tail doppler radar (TDR) all have different uses and collect different types of data that are important for making forecasts and predictions of a tropical system. Knowing about these instruments and their standard operating procedures as well as their specific flight profiles are integral parts of having a well-rounded knowledge of the WP-3D's airborne capabilities.The nose radar is used for navigational purposes as well as other flight level measurements. The MMR is used to obtain a full 360° scan of a tropical system. The SFMR is used to obtain surface wind speeds during hurricanes.The TDR is used to obtain a 3D view of the structure of a tropical system as well as real time changes in structure and size of hurricanes. This operator's guide is educational in nature to give pilots, flight directors, and any other relevant party the ability to quickly gain the main information on flight profiles for each instrument, why each instrument is important, and other necessary information for hurricane flight operations. Historically, NOAA's Aircraft Operations Center (AOC) has utilized a multitude of various documents with specific types of information regarding the instruments onboard the WP-3D. This Airborne Instrumentation Operator's Guide collates everything into one easy to digest document that can be shared among each branch at AOC for training and/or informational purposes.

About the Scholar

Amanda Sparks, originally from Los Lunas, New Mexico, is graduating with her Bachelor's of Science degree in Geoscience with an emphasis in Physical Geography and Conservation and minors in Environmental Science, Geology, and History from Adams State University in Alamosa, Colorado. After graduation in December of this year, Amanda plans to continue on in her education and pursue a Master's Degree in Natural Hazards and Catastrophe beginning in the Fall of 2025. As a NOAA Ernest F. Hollings Class of 2023 scholar, Amanda has had the opportunity to work with NOAA's Hurricane Hunters in the Office of Marine and Aviation Operations to develop an in-flight WP-3D Orion Hurricane Instrumentation Operator's Guide for pilot and flight director use during hurricane operations. Amanda's interests in aviation, hurricane research, prediction, and mitigation has led her to pursue a professional goal in becoming one of the NOAA Corps' aviators, specifically flying the WP-3D Orions through hurricanes in the coming years.

Kate Stapleton

A Comparison of the Radar and Lightning Characteristics Between Tropical Cyclone Tornadoes and Waterspouts and Their Associated Warnings

NOAA Mission Goal: Weather Ready Nation
Mentors: Ben Schenkel and Thea Sandmæl
Office of Oceanographic and Atmospheric Research/National Severe Storms Laboratory
National Oceanic and Atmospheric Administration (NOAA)

Recent research has demonstrated that tropical cyclone (TC) tornado warning skill is reduced compared to non-TC tornadoes. Most of these TC tornadoes occur near the coast, where conducive conditions exist over both land and water. Upon moving onshore, the rotation of these supercells often strengthens, likely due to increased friction over land. The TC tornadoes that occur over land are warned with tornado warnings, while tornadoes over the ocean are classified as waterspouts and warned using special marine warnings. However, there have been no prior studies comparing TC tornadoes and waterspouts. As a first step, this study will examine radar and lightning data from 2013 to 2023, associated with tornado and waterspout reports from landfalling TCs. Initial results indicate that TC tornadoes over land have more lightning. Additionally, land TC Tornadoes appear to have stronger rotation and greater convergence than TC waterspouts. These differences may be attributed to increased friction on land. This analysis aims to improve our understanding of supercell properties for onshore and offshore TC tornadoes.

About the Scholar

Kate Stapleton is a 2023 Ernest F. Hollings Scholar from Austin, Texas. She is a rising senior at Texas A&M University double majoring in Meteorology and Oceanography with a minor in Mathematics. She is expected to graduate with a Bachelors of Science in Spring 2025. She plans to continue her education in pursuit of a Masters and PhD in Meteorology starting Fall 2025. Through the Hollings internship, she was able to combine her interests in mesoscale and tropical meteorology to study tropical cyclone tornadoes. She hopes to improve our understanding of tropical cyclone tornadoes and their forecasting ability, so we can best inform those at risk. Kate aspires to become a research scientist with NOAA or a cooperative institute. As a meteorologist, she hopes to further our knowledge of weather phenomena and improve scientific communication in order to protect the life and property of others.

Josh Timm

Remote Sensing Mission Concept with Radio Occultation

NOAA Mission Goals: Weather Ready Nation
Mentors: Otto Bruegman and Valerie Mikles
National Environmental Satellite, Data, and Information Service
National Oceanic and Atmospheric Administration (NOAA)

We analyze NOAA and commercial sources of Radio Occultation technology and propose a reference architecture for a NOAA-owned backbone. Currently, NOAA receives most of the baseline RO profiles from the COSMIC-2 constellation, which flies in inclined orbits. Other sources of RO data are commercial and partner sources, like EUMETSAT. The COSMIC-2 mission ends in 2026, and NOAA presently has no plans to replace that data with another government source. Radio Occultation is a high-priority measurement for Numerical Weather Prediction Models. By leveraging recent, space-proven technological advancements and commercial parts, we propose a constellation of four small satellites in a low-inclination orbit that would provide necessary observations at a low mission cost. The mission would have a relatively short development timeline, given that several possible instruments have flight heritage. By owning a backbone constellation that provides at least 8,000 occultations per day, NOAA would be able to ensure long-term reliability of its RO sources at a reasonable price.

About the Scholar

Josh Timm is a 2023 NOAA Ernest F. Hollings Scholar from Grand Rapids, Minnesota. As a rising senior at North Dakota State University, he is studying mechanical engineering and is expected to graduate in Spring 2025. This summer, he worked with his mentors at the Office of Low Earth Observation to develop a concept for a mission to place radio occultation instruments on satellites, which would observe how Global Positioning System satellite signals interact with the atmosphere. These observations would contribute to weather and climate models. Josh aspires to combine his interests in climate science and engineering to improve NOAA's capabilities for earth observation.

Annabel Wade

Exploring Multi-Model Ensembling Methods to Improve on Deep Learning Based Smoke Detection

NOAA Mission Goal: Weather-Ready Nation
Mentors: Rey Koki, Christina Kumler, Jebb Stewart
Office of Oceanic and Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)

With increasing occurrences of wildfires in recent years, effective and fast-delivering wildfire and smoke detection tools are needed to support hazard management and reduce risks to human health and environmental resources. The NOAA Geostationary Operational Environmental Satellites (GOES) provide high spatial and temporal resolution imagery of North America that can be used to detect the presence and density of smoke plumes. Recent advancements in computer vision have shown the capabilities of deep learning models to automate the classification of detailed images on a pixel-by-pixel basis by training encoder-decoder networks on large labeled datasets. Additionally, ensemble methods can improve model generalization and prediction accuracy by combining the results of multiple models. We present an ensemble of deep learning models that produces representative predictions of if and where wildfire smoke plumes exist in GOES imagery. Our results demonstrate that ensemble techniques can improve performance compared to using a single model. This multi-model data-driven ensemble is expected to support fire and hazard management by being able to automate the monitoring of smoke in real-time from satellite imagery.

About the Scholar

Annabel Wade is an undergraduate senior at the University of Washington, majoring in Applied Mathematics: Data Science, with a minor in Oceanography. Her research interests include machine learning and modeling for earth science applications. For the NOAA Hollings internship, she is applying deep learning and ensemble techniques for wildfire smoke detection from satellite imagery at the Global Systems Laboratory in Boulder, Colorado, with mentors Christina Kumler, Rey Koki, and Jebb Stewart. In the future, she aspires to continue technical research, supporting the use of artificial intelligence as a tool to accelerate weather and ocean science.

Suzanne Marie West

Inequality in Heat Vulnerability: Why Where You Are Matters

NOAA Mission Goal: Weather Ready Nation
Mentor: Jared Rennie
National Environmental Satellite, Data, and Information Service/National Center for Environmental Information
National Oceanic and Atmospheric Administration (NOAA)

The United Nations recognizes the right to a healthy environment as a universal human right. Projections are that fifteen years from now, the coolest typical year will be among the warmest on record in Texas. As a result, the risk of heat-related illness is increasing. Outside of heat-related exposure, the main factors affecting heat health are age, social isolation, air conditioning access, pre-existing health conditions and the pharmaceutical medications that accompany them. Heat-related illnesses can be alleviated and avoided as temperatures continue to rise when vulnerable communities are accurately identified, and infrastructure and policy improvements are properly implemented. Currently, many heat vulnerability risk assessment indices identify classified risk areas. However, key explanatory factors linked to heat vulnerability vary from one location to another. Many indices lack geographic and community-level specificities that render the information extrapolated locally irrelevant and unapplicable. These indices often include aggregated and interpolated data, increasing false positive and false negative identification of intra-urban heat islands, leading to unreliable results. Misclassification increases as aggregation increases, emphasizing the need for heat vulnerability indices to be tailored to the highest spatial resolution possible to be beneficial and effective in public health, policy, and infrastructure planning. This work highlights how locale-specific conditions, including city districting, meteorological phenomena, and environmental toxicity, affect heat vulnerability, and provides recommendations for heat-resilient policy and infrastructure improvements in Austin, Texas.

About the Scholar

Suzanne West is a recent graduate of Austin Community College with an Associate of Science in General Studies in Science and Environmental Science and Technology. She is currently attending St. Edward's University where she is majoring in Environmental Science and Policy and minoring in Legal Studies. She is a NOAA Educational Partnership Program with Minority Serving Institutions Scholar, and has also earned awards and scholarships from ACC, St. Edward’s University, the National Science Foundation, Phi Theta Kappa and Phi Beta Kappa. She aspires to attend graduate or law school following completion of her degree from St. Edward's University and is interested in a career in environmental law. As a part of the EPP/MSI program, Suzanne interned with the National Ocean Mapping, Exploration and Characterization Council analyzing ocean policy and with the National Center for Environmental Information mapping political and socio-economic factors that affect heat vulnerability and resilience.

Mallory Wickline

Visualization and Analysis of Coronal Holes and Associated High-Speed Solar Wind Streams

NOAA Mission Goal: Weather-Ready Nation
Mentors: Nicholas Zaremba and Irfan Azeem
National Environmental Satellite, Data and Information Service/Office of Space Weather Observations/National Oceanic and Atmospheric Administration (NOAA)

Coronal holes are solar features characterized by reduced temperature and density in comparison to neighboring locations of the corona. Often associated with open magnetic field lines, coronal holes serve as a source of outward-moving high-speed solar wind streams. The goal of this project is to develop Python tools to visualize and analyze the coronal hole features in solar wind and SUVI data in order to ultimately better understand the impact of space weather on Earth's ionosphere/thermosphere. We start by visualizing multi-wavelength ultraviolet images from the Solar Ultraviolet Imager (SUVI) onboard the NOAA GOES-R Series satellites to identify periods when coronal holes were present. We then pre-process Solar Wind Electron, Proton, and Alpha Monitor (SWEPAM) data from NASA's Advanced Composition Explorer (ACE), so that we can visualize and spectrally analyze solar wind data using Python and identify high-speed solar wind streams. We visualize the bulk solar wind plasma parameters before performing a wavelet analysis on the resulting signals across the selected periods. The results of the wavelet analysis reveal variations in the solar wind speed associated with coronal holes. 'Space weather readiness' is an important concept to connect to NOAA's goal of building a weather-ready nation. Analysis of the effects of high-speed streams on earth's ionosphere will aid in a better understanding of the sun-heliospheric-planetary system as a whole and further contribute to this goal.

About the Scholar

Mallory Wickline is a rising senior at Pennsylvania State University, originally hailing from Clinton, New York. She is pursuing a double major with honors in Meteorology & Atmospheric Science and Planetary Science & Astronomy. She is on track to complete her bachelor's degree in May of 2025, after which she plans on attending graduate school and obtaining her PhD. Mallory is a Class of 2023 NOAA Ernest F. Hollings Scholarship recipient and is grateful for the opportunity to intern with the joint NOAA-NASA Office of Space Weather Observations (SWO) during the summer of 2024. Her scholarly interests include heliophysics, planetary atmospheres, and the impact of space weather on the near-Earth environment. Mallory is excited about NOAA's commitment to furthering operational space weather projects. She seeks to unite her dual passions in atmospheric science and space through her career and produce high-quality research contributions to the wider scientific community.

Kyla Wolski

Quantifying Regime-Dependent Snow-to-Liquid Ratios in the Upper Great Lakes

NOAA Mission Goal: Weather-Ready Nation
Mentors: Mark Kulie and Claire Petterson
National Environmental Satellite, Data, and Information Service
National Oceanic and Atmospheric Administration (NOAA)

The snow-to-liquid ratio (SLR), whereby the liquid equivalent amount of snowfall is converted to geometric depth, is a crucial winter weather forecasting parameter. In this research project, a 2015-2023 dataset of snowfall measurements from the Precipitation Image Packaging (PIP) and
Micro Rain Radar (MRR) instruments located at the Marquette, Michigan National Weather Service was analyzed to quantify SLR variability on 6-hourly, monthly, and interannual time scales. Additionally, SLR variability associated with different snowfall regimes (e.g., lake-effect, lake-orographic, lake-enhanced, and synoptic) was also studied. The SLR results created from 1-minute PIP observations offer important refinements to previous SLR studies that have used manual 6-hour and 24-hour snowfall measurements and confirm considerable SLR variability between northern Great Lakes snowfall regimes. For example, while the PIP analysis shows that synoptic events possess mean SLR values near the conventionally applied 10:1 value, lake-effect (~15:1) and lake-orographic (~15:1) snow events have systematically higher mean SLR and display considerably more variability. Further variability within each regime is documented on different time scales. This study illustrates that SLR values derived from PIP and MRR observations not only provide a robust way to quantify regime-dependent SLR, but also demonstrate how SLR derived from high temporal sampling observations can benefit short-term forecasting applications.

About the Scholar

Kyla Wolski is a rising undergraduate senior at University of Illinois at Urbana-Champaign majoring in Atmospheric Sciences and Geography and GIS, with a concentration in GIS. She is set to graduate in May 2025 and will be pursuing a Master's degree in Atmospheric Sciences beginning in Fall 2025. Kyla is originally from Deerfield, Illinois and is honored to be a NOAA Ernest F. Hollings Class of 2023 scholar. Her Hollings internship opportunity at NESDIS in Madison, Wisconsin has allowed Kyla to deep-dive into research on one of her favorite types of weather: snow. She is driven by her goal of furthering research that helps improve important weather and climate-based decision making. Kyla believes in the importance of NOAA's mission for a weather-ready nation, and hopes she can fully be a part of that mission throughout her prospective professional career.

EPP/MSI Undergraduate Scholarship Program
Academic Year Research Project Summaries

EPP/MSI undergraduate scholars conduct NOAA mission-aligned research under the guidance of mentors at their academic institutions during their junior year. The following executive summaries represent the research completed by the EPP/MSI undergraduate scholar Class of 2023.

EPP/MSI Undergraduate Scholarship Program Class of 2023.

Thyme Brown

From the Sun to the Sky: Teaching Kids about Space Weather and the Auroras

Mentor: Meredith Marchioni
Alaska Pacific University

Introduction

This innovative project explored the mesmerizing phenomena of the Northern and Southern Lights (Aurora Borealis and Aurora Australis), delving into the intricate interactions between the Sun, Earth's magnetic field, and the upper atmosphere that gives rise to these spectacles. It covers key scientific concepts such as space weather, geomagnetic storms, coronal mass ejections (CMEs), solar flares, and Earth's magnetic field.

Purpose

To make these complex scientific concepts accessible, an interactive coloring book for children ages 5 to 10 was developed. The coloring book demystifies the relationship between the Sun and Earth, demonstrating how solar energy interacts with our atmosphere to produce auroras. It supports NOAA's outreach efforts and enhances public understanding of space weather. By simplifying complex concepts, it aims to inspire a lifelong passion for discovery among young learners while maintaining scientific accuracy.

Methods

The development of the interactive coloring book began with a literature review to identify key scientific concepts related to space weather and auroras suitable for young learners. A storyboard was crafted to outline the narrative and illustrations, ensuring each concept was presented in an engaging manner. Using Procreate, illustrations were developed to accompany simple, accurate explanations of complex phenomena. The final step involved formatting the book as a printable to ensure it is financially accessible, making it a valuable educational resource for schools and communities.

Conclusion

The interactive coloring book effectively guides young readers on an imaginative journey from the Sun to Earth's sky, making complex scientific concepts about space, weather, and auroras relatable and understandable. Through interactive illustrations and clear explanations, it enhances visual appeal and educational accuracy while reflecting the cultural significance of auroras through historical myths and modern interpretations. To expand its impact, the project aims to reach schools and communities through printable books and create supplementary educational materials that align with NOAA's missions. By engaging educators and continuously updating content based on feedback, the project seeks to foster an early interest in STEM among young learners, preparing them to become informed and engaged citizens of a scientifically literate society and inspiring lifelong curiosity and appreciation for science.

Lalah Imani Marie Choice

Assessing Public Perceptions of Harmful Algal Blooms and NOAA's Forecasting Product in Southwest and Central West Florida

Mentors: Ashley Lacey and Charles Jagoe
Florida Agricultural & Mechanical University

Introduction

Public perception of harmful algal blooms (HABs) and their associated risks is crucial in shaping policy responses and resource allocation. This study explores the complex interplay between scientific understanding, public awareness, and policy responses to mitigate the impacts of HABs on human health and the environment. HABs, commonly known as red tides due to water discoloration, significantly impact the marine ecosystem and public health by releasing toxins by algae such as Karenia brevis. The National Centers for Coastal Ocean Science (NCCOS) provides critical forecasts regarding respiratory impacts and HABs at individual beaches along the Florida Gulf Coast, aiding in informing and mitigating these impacts. Using the Cohen Framework, the analysis examines the values, politics, technology, science, management, and economics of addressing HAB challenges. Effective change must incorporate both stakeholder and administrative support alongside data and technology. This study not only seeks to elucidate public awareness but also aims to inform evidence-based strategies for mitigation and adaptation, thereby improving NOAA's communication with coastal communities and enhancing the effectiveness of forecasting products.

Methodology

The research utilized a comprehensive mixed-methods approach, combining quantitative surveys with qualitative interviews and focus groups. Surveys were distributed online and at community events, targeting users and non-users of NCCOS’s forecasting products. Community outreach efforts included webinars and participation in local events to increase engagement and gather diverse insights.

Results and Discussion

The survey results indicate a varied level of awareness and understanding of HABs among residents and visitors. While many participants recognized the term "red tide" and were aware of its health risks, detailed knowledge about Karenia brevis and its specific effects was less common. Users of NOAA’s forecasting product reported feeling more informed and prepared during red tide events, while non-users often lacked awareness or understanding of the product. This highlights a critical gap in public outreach and education efforts, suggesting that increasing visibility and improving the usability of NOAA's forecasting tools could enhance public engagement and preparedness. Legislative policies such as the Clean Water Act and various Harmful Algal Bloom Task Forces are critical in addressing the environmental and public health implications of HABs. Effective management of HABs requires integrating scientific knowledge, technological innovations, and stakeholder engagement into policy-making processes.

Conclusion

By addressing the gaps identified in this study, such as improving the visibility and usability of NOAA’s forecasting product and enhancing community engagement efforts, stakeholders can better prepare coastal communities for the challenges posed by HABs. Future research should focus on developing and evaluating targeted communication strategies to improve public understanding and engagement with HAB forecasts. A well-informed public is essential for effective risk management and the protection of both human health and marine ecosystems.

MaKenna Collins

Beginning to Address Socioeconomic Vulnerability and Extreme Heat in Jackson, Mississippi

Mentor: Latrice Maxie
Department of Meteorology, Jackson State University

Introduction

Accelerated population growth has exacerbated the release of carbon dioxide through various industrial activities that drive climate change. Consequently, the increase in greenhouse gases has led to a rise in global temperatures. These extreme temperatures pose significant risks to urban areas like Jackson, Mississippi.

Methods

The research combines both qualitative and quantitative components to develop an understanding and effectively tailor mitigation strategies for at-risk communities. For the qualitative approach, this study uses content analyzing techniques to research an array of sources like news articles, Jackson community blogs, the National Weather Service, social media posts, and other articles. This method provides a descriptive understanding of community perceptions, their experiences, and opinions on the impacts of extreme heat in their city. For the quantitative approach, data from the United States Census and CAPA Strategies' urban heat island mapping 2020 were analyzed to identify correlations between vulnerable communities and the expedited effects of extreme heat.

Results

Analyses of the CAPA Strategies' urban heat island mapping data show significant temperature variations across the different communities in Jackson, Mississippi. Data from the U.S. Census indicates that neighborhoods with higher temperatures have a higher percentage of residents living below the national poverty line and with lower access to healthcare services. The thematic content analysis of the news articles, community blogs, and social media posts reveals real-time attitudes toward extreme heat and climate initiatives. Attitudes underscore the challenge of incorporating community engagement and trust in climate mitigation actions that also address community concerns.

Discussion

Both the quantitative and qualitative methods revealed insights into how specific extreme heat mitigation strategies can be tailored to the Jackson, Mississippi community. The findings of this study highlight the need for tailored policy interventions to mitigate extreme heat impacts. While this study aims to fully detail the socioeconomic influences in extreme heat resilience, there are some limitations. Future research should include a more diverse sample of resources to further validate these findings. To tackle the effects of extreme heat, policymakers must use localized actions that address community and environmental needs.

Talofa Fe’a

Understanding the Prevalence and Impacts of Ciguatera Poisoning in the Pacific Islands: A Review for Fishing Communities and the Pacific Ciguatera Network

Mentor: Dr. Eileen Nalley
University of Hawai‘i Sea Grant, University of Hawai‘i at Mānoa

Introduction

Ciguatera poisoning (CP) is an illness caused by consuming seafood containing ciguatoxins produced by dinoflagellates, specifically *Gambierdiscus spp*. It is the most common non-infectious seafood-borne illness globally, causing severe symptoms and sometimes life-threatening complications (Chinain et al., 2021; Dickey & Plakas, 2010). The Pacific Islands have some of the highest reported rates of CP, though many cases go unreported, making it difficult for managers and the general public to ascertain the true impacts of the illness.

Purpose of Review

This review aims to highlight CP's impact on Pacific Island fishing communities, stressing the importance of understanding and mitigating its effects. As of 2023, the Pacific Ciguatera Network, led by Dr. Eileen Nalley at the University of Hawai‘i Sea Grant College Program, was established to connect partners throughout the Pacific Islands to discuss, better understand, and address needs related to CP. This review supports the network by examining ciguatera in the context of the Pacific region, thus informing local and regional research and management actions.

Methods

The review is based on scientific literature, including reviews, reports, and journal articles, organized into four primary sections: (1) epidemiology, (2) contributory factors, (3) health impacts, and (4) socio-economic consequences.

Key Takeaways

1. Increased Incidence: Ciguatera incidence in the Pacific has risen since the 1970s.
2. Contributory Factors: Habitat degradation and global warming are potential contributors. CP risk in the Pacific is expected to increase in parallel with climate change.
3. Diagnostic Challenges: Lack of diagnostic standards and clear symptom distinction leads to misclassification and underreporting.
4. Negative Impacts: CP significantly affects Pacific Island populations, causing medical issues, financial loss, social burdens, and dietary changes.
5. Need for Action: Both local and regional efforts are required for better management, monitoring, and reporting of ciguatera.

Ashley Garcia

Communication Patterns in Underserved Communities During Adverse Weather Conditions

Mentor: Greg Anderson
School: Northeastern Illinois University

Introduction

The project's focus was on analyzing meteorological patterns using extensive weather data from the Meteorological Database at Argonne National Laboratory. This data provided a unique opportunity to explore temperature trends, precipitation patterns, wind speed, and atmospheric pressure variations within the context of urban climate dynamics in Chicago.

Method

The analysis involved graphing temperature levels and using data visualization techniques to represent temperature fluctuations and trends effectively. Machine learning techniques, specifically Random Forest algorithms, were applied to identify patterns and anomalies in the weather data. Additionally, various data imputation techniques were implemented to handle incomplete weather data, ensuring the integrity and accuracy of the dataset. The data cleaning and validation processes were crucial in maintaining the quality of the analysis. A significant challenge was dealing with incomplete data, which required data imputation techniques such as mean imputation and k-nearest neighbors imputation to fill in missing values. A thorough validation process was conducted to ensure that the imputed data maintained the dataset's integrity and accuracy.

Outcome

The analysis confirmed several expected trends, such as higher temperatures in urban areas compared to the suburbs, consistent with the urban heat island effect known in Chicago. This phase of the project provided valuable opportunities to enhance programming skills, particularly in using Python for data analysis and visualization. The application of data analysis techniques, including machine learning algorithms, allowed for a deeper understanding of complex datasets.

Future Work

The project provided practical experience in data handling, visualization, and machine learning, preparing for future research endeavors in the upcoming summer internship project for improving the weather risk assessment tool in San Juan Puerto Rico. The combination of enhanced technical skills and a deeper understanding of urban climate dynamics positions the researcher well for continued contributions to climate science and community resilience efforts.

Andie C. LeDoux

Protecting Moananuiākea Meals: Understanding the effects of weather inflicted *Oryctes rhinoceros* on Pacific Island food security

Mentor: Dexter K. Kishida
Department of Agriculture, University of Hawai‘i at Mānoa, Hawai‘i

Introduction

The Coconut Rhinoceros Beetle (*Oryctes rhinoceros*), native to Asia, became an invasive species in the South Pacific after its introduction in 1909, with nearly all control efforts unsuccessful. Despite its strong association with coconut palms, the beetle also attacks many crops and food sources significant to the Pacific Islands. In O‘ahu and Guam, CRB poses a significant threat to agriculture and biodiversity, with gaps in understanding its distribution, impact, and effective control strategies. This study aimed to fill these gaps by examining CRB distribution and its correlation with weather patterns, proposing solutions to mitigate its spread and protect agricultural lands in these regions.

Methods

This study included historical and archival research to identify past agricultural sites on O‘ahu and Guam, assessing current high food production areas through agricultural data analysis, satellite imagery, and collaboration with local experts, GIS mapping of the overlap between CRB activity and agricultural zones, and meteorological data analysis to explore correlations between weather patterns and CRB spread.

Results

In Guam, discussions with entomologists indicated that Coconut Rhinoceros Beetles (CRB) typically do not fly far on their own, but can spread through human activity and are potentially aided by high winds from typhoons. Typhoon Dolphin in 2015 and subsequent events likely facilitated CRB spread due to increased green waste and rotting vegetation, ideal breeding grounds for CRB grubs, leading to heightened coconut palm mortality post-typhoon. On O‘ahu, despite no severe weather events since CRB detection in 2013, studies suggest that prevailing wind patterns from east to west may contribute to CRB distribution. CRB detections on O‘ahu show a concentration in central and leeward regions, which tightly coincide with historical and present-day agricultural areas.

Discussion

The concentrations of CRB in central and leeward O‘ahu suggest CRB is posing risks to local food supply. Based on the findings, both O‘ahu and Guam should prioritize decentralizing green waste facilities to mitigate CRB spread after high-wind events. Enhanced community education via webinars, social media, and workshops is crucial for raising awareness about CRB management among farmers and landowners.

Javier Mata

Prey Abundance and Prey Species Diversity of Juvenile White Sharks (*Carcharodon carcharias*) in Southern California Midterm Report.

Elizabeth Jahn and Dr. Chris Lowe
Department of Biological Sciences, California State University Long Beach

Introduction

Climate change is affecting distributions around the globe, with one of those being the distribution and abundance of organisms in the oceans. As a result, one research priority is to understand and predict where animals will be distributed. One of the changes in animal distribution has been the formation of juvenile white shark (*Carcharodon carcharias*) (JWS) aggregations in recent years at southern California beaches. To ensure the safety of both JWS and beaches, there have been ongoing studies and efforts to understand why the sharks are there and how long the sharks are residing. This project focused on the prey availability hypothesis to determine if the presence of prey is a contributing factor to aggregations of JWS.

Methods

This project was done using baited remote underwater video surveys (BRUVS). Each unit was made of rebar structure with a one-meter PVC pole extending out from the center of the structure and a bait canister at the end of the pole, with a GoPro facing the canister. The BRUVS were deployed at an aggregation site and a non-aggregation site. MacOS software was used to retrieve the footage to count and identify species that were recorded. All analysis was done in R.

Outcome

Padaro, an aggregation site, had a count of 83 observations of 11 different prey species. Belmont, a non-aggregation site, had a count of 199 observations of 7 different prey species. With more prey species diversity in Padaro, there were fewer observations across all species present. Belmont saw less species richness combined with a greater number of prey observations. Belmont had a greater proportion of invertebrates, while Padaro had a greater proportion of elasmobranchs. This difference suggests JWS are having an effect on the prey community, specifically a top-down predator effect in Padaro.

Further work

Additional studies that cover a wider range of sites over a longer period of time are needed to assess whether abundance or richness contributes more to the formation of aggregations. We must continue to monitor JWS behavior to ensure a healthy ecosystem. Continuing to study factors such as prey availability, allows us to understand where JWS may be residing, informing decisions on how to keep beaches safer, while promoting healthy shark populations.

Kelli Ong

For Good Measure: Evaluating Non-Invasive Methods for Obtaining Morphometrics of Large Marine Mammals

Mentors: Millie Rivera and Dr. Roxanne Beltran
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Introduction

Measuring wild, large animals poses a considerable challenge. Their substantial body sizes often require physical restraint or chemical immobilization, posing safety risks for both field scientists and subjects. To address a need for non-invasive techniques, we test two, remote measurement tools: 1) drone photogrammetry and 2) LiDAR (Light Detection and Ranging) scans using wild Northern elephant seals (*Mirounga angustirostris*) as subjects. With further refinement, the methods evaluated in this study can be broadly applicable to other species, guiding data collection methods for large subjects that are difficult to handle, sedate, or physically access.

Methods

- *Traditional measurements*: A series of four length measurements were taken by-hand on a Northern elephant seal subject using tape measures.
- *Drone photogrammetry*: Aerial images using a DJI Mavic 2 Pro drone were taken. All photos were compiled into a 3D model using DroneDeploy, a web-based app.
- *LiDAR*: We used an iPad Pro and "Zooniverse" app to scan the seal, capturing photo-points around its perimeter, which were then rendered into a 3D model.
- *3D Model Assembly*: All 3D models were uploaded to Blender, a modeling software, where the lengths, surface area, and volume of each seal model were measured.

Preliminary Results

LiDAR has shown promising results, producing measurements that are closely aligned with traditional tape measure numbers. Drone photogrammetry performs well with larger individuals, but slightly overestimates the size of the animal when measuring smaller seals.

Future Steps

This study will extend into 2025 as part of my senior thesis project, during which we will measure at least 17 additional seals. Our current results are based on juvenile seals, but more adult seals will be measured in our future work. Additionally, seals sampled thus far were measured after a one-month fast during molt season, a period when they are typically leaner. In the next season, our measurements will reflect seals that have returned from foraging at sea for over three months, thus testing our methods on girthier, fatter seals.

Devin R. Shaw

Longitudinal Controls of Connected Automated Vehicles

Mentors: Manoj Nair and Richard Saltus
University of California Riverside
Cooperative Institute for Research in Environmental Sciences (CIRES)

Introduction

The EcoCar Electric Vehicle (EV) Challenge aims to reduce vehicle emissions through intelligent transportation systems utilizing intervehicle communication. The EcoCar EV challenge's Connected Automated Vehicles (CAV) team aims to develop fuel-efficient driving algorithms in electric vehicles. In its second year, the project focuses on prototyping longitudinal controls for future implementation.A key focus of this project is the development of longitudinal control algorithms that use Cooperative Adaptive Cruise Control (CACC). Traditional Adaptive Cruise Control (ACC) employs lidar to maintain safe distances from lead vehicles. In contrast, CACC leverages vehicle-to-vehicle (V2V) communication to enhance safety and fuel efficiency. Our task involves creating CACC-based algorithms to optimize fuel efficiency while ensuring safety and performance standards. The development process uses the MathWorks suite of tools, emphasizing simulation and model-based design.

Research Design

We built upon an existing CACC algorithm from MathWorks, using an iterative model-based approach involving simulations and adjustments to optimize fuel efficiency.
Control Algorithms

- Activation Controls: Designed to allow driver intervention with states for standby, activated, and inactive modes.
- Speed Control: Implemented using PID control to manage vehicle speeds when out of range of other vehicles, tuned via Matlab/Simulink.

Development Tools

- Simulation and Prototyping: Used Matlab/Simulink and Roadrunner software.
- On-Vehicle Implementation: Utilized RTMaps and Autera AutoBox for real-time testing.

Results and Roadblocks

We faced server-side issues with MathWorks toolboxes, leading us to focus on activation controls and traditional PID controls. We successfully implemented these aspects in RTMaps for real-vehicle testing. Documentation of our workflow and algorithms was created to guide future work.

Future Planning

Year 3 will focus on enhancing team knowledge of Matlab tools and implementing a more complex CACC algorithm involving V2V communication. We plan to have two teams: one for research and simulation and another for implementation and testing. The primary goal is to maximize fuel-use improvements.

Savannah Stephenson

Semaphore Summarized: Streamlining the Research to Operations Pipeline for Coastal Prediction AI Models

Mentor: Dr. Philippe Tissot
Texas A&M University Corpus Christi

Introduction

The Conrad Blucher Institute (CBI) at Texas A&M University Corpus Christi (TAMU-CC) has a plethora of graduate and undergraduate students working on coastal prediction AI models. These predictive weather models have the potential to aid meteorologists and oceanographers in their forecasts and save time, money, and the lives of those living on the coast. Some of the models currently being developed include a cold stunning model, an inundation model, a water level model, and a fog prediction model. The challenge, however, becomes how to take these models from products of research to something operational that can be utilized by the public. Semaphore is a student-built and maintained Python application that semi-automates the process of operationalizing AI models. Semaphore downloads data, runs models, post-process outputs, and saves outputs. Unlike a custom operations approach, semaphore is made to be as general and flexible as possible so that researchers can put their modes into production as quickly as possible.

Methods

Semaphore is being developed on Github. The code is primarily made up of python, but there was some SQL code written before moving over to SQLAlchemy, and the team employs the use of docker files, json files, and some shell scripts to automate and streamline Semaphore's deployment pipeline. The Semaphore Team uses weekly meetings through Teams and a Discord chat to maintain constant communication between Team members and advisors.

Discussion

At both its first and current iteration Semaphore operationalizes AI modes by asking for two things from the researcher: an H5 file and DSPEC file for the model. The architecture of Semaphore can be roughly divided into five parts: Series Storage, Data Ingestion. Series Provider, Model Execution, and API. Semaphore uses the 'series' as a way to uniquely define data by location, data source, series name, ect. The 'series is used in order to ensure flexibility so that Semaphore could eventually be scaled to two dimensional or even three dimensional predictions. Semaphore also employs the use of interfaces, implementing a degree of code exclusion that keeps the code maintainable, flexible, and testable while still providing a guideline for what must be included in certain classes. Some significant milestones achieved over the course of the 2023-2024 academic year include dockerizing Semaphore, operationalizing Semaphore on development and production servers, designing and implementing database migration protocols, and beginning on data visualization for operationalized models.

Results

Semaphore currently has 60 individual models running on the its development server producing predictions that are stored in the Semaphore database.Semaphore has gone from only running locally with a single test model, to running on a production and development server with automated deployment, version control, and database migration protocols is an achievement worth recognizing.

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