Mentors - please use the format below to add your potential project to this list. This list will be linked to the PEP 2023 application page for applicants to review. For any questions, please email Onji at Onjale.ScottPrice@gmail.com

Example -

Mentor(s) and lab: Name, Lab name (if applicable), Lab website (if applicable)

Institution/Department: Institution, specific department (if applicable).

Research Interests: List all that apply

Potential 2023 project(s): A few sentences to a paragraph briefly describing the project. You may consider including if the project has significant lab or field components, if there is an opportunity to learn or enhance coding skills, etc. If there is more than one project, please clearly delineate between them.

Mentor(s) and lab: Chris Sherwood

Institution/Department: US Geological Survey, Woods Hole Coastal and Marine Science Center, WHOI Quissett Campus

Research Interests: Remote sensing of coastal change with aerial photography, fixed remote cameras, and satellites

Potential 2023 project(s): We use a variety of photogrammetry and machine learning techniques to observe and analyze coastal changes on beaches in Massachusetts and North Carolina. Students can select from some projects we have in mind (analyze video to measure velocities of overwash, model wave run-up, determine coastlines from camera imagery) or they can look over the data and design their own project. Student projects will offer opportunities to learn about image processing, and geographic data analysis using software and, if students are interested, coding in Python. Limited fieldwork opportunities may be available.

Mentors and lab: Dr. Jenny Watts, Kathleen Savage

Institution/Department: Woodwell Climate Research Center

Research Interests: Forest ecology, climate change, greenhouse gas fluxes

Potential 2023 project: Methane (CH_4) is second only to carbon dioxide (CO_2) in its contribution to human-induced climate change. Understanding the emission (source) and uptake (sink) of CH_4 from ecosystems is of critical importance if we are to implement global emission mitigation strategies, yet we understand very little about CH_4 flux in forests, the processes and feedbacks driving net flux, and how emission or uptake will change under future climate. As part of this work, the student will conduct controlled laboratory temperature and moisture incubations at the Woodwell laboratory, on microcosms of soils collected from the Howland Research Forest in Maine. This work aims to understand the drivers and responses of CH_4 source/sink CH_4 transitions under future climate change conditions predicted for the northeastern US.

Mentor(s) and lab: Hillary Sullivan

Institution/Department: Woodwell Climate Research Center

Research Interests: salt marsh restoration, biogeochemistry, nitrogen cycling

Potential 2023 project(s): We are implementing a new restoration strategy, called runnelling, in a marsh in Waquoit Bay. This technique involves digging a shallow channel to help drain standing water off the marsh, and to restore it to natural conditions. We know that marshes are often a nitrogen sink, using and removing nitrogen from nearby coastal waters. We do not know how the installation of runnels and alteration of hydrology will impact the marsh's nitrogen removal capability. In 2023, we will be taking pre- runnel installation measurements of nitrogen cycling processes. This will involve a 50/50 split of lab work and field work. Because this is a new project, a student would have the potential ability to ask a research question and design a research project.

Mentors and Lab: Dr. Yaamini R. Venkataraman and Dr. Carolyn Tepolt
Institution/Department: Woods Hole Oceanographic Institution, Biology Department
Research Interests: green crabs, ecophysiology, climate change, invasive species, adaptation

Potential 2023 project: The European green crab (Carcinus maenas) are one of the world's most successful marine invasive species, partly due to their ability to withstand broad temperature conditions. In order to better manage green crab spread, we need to understand why this species has a wide thermal tolerance. The PEP student will conduct a controlled laboratory experiment exposing green crabs to two different temperatures, then switching a subset of those crabs to a different temperature and measuring their performance. They will learn how to experimentally assess how organisms respond to a change in their environment using physiology techniques including respirometry and heart rate measurements. Based on the student's interest, there is the opportunity to expand the research question and assist with a larger laboratory experiment.

Mentors and Lab: Dr. Kristin Gribble
Department: Marine Biological Laboratory, Bay Paul Center for Comparative Molecular Biology and Evolution
Research Interests: Parental effects on offspring health, lifespan, and fitness; biology of aging; transgenerational inheritance; epigenetics; life history plasticity; phytoplankton and zooplankton

Potential 2023 Projects:
In many animals, offspring from older mothers have shorter lifespan, lower reproduction, and decreased health than do offspring from young mothers. Our lab uses rotifers (microscopic aquatic invertebrates) to study how a mother's age affects her offspring's phenotype. In either the following potential projects, students will learn to culture phytoplankton and zooplankton, measure hatching rate and lifespan, and will use methods including microscopy, molecular biology, respirometry, and/or simple biochemistry:

1. Investigate the effects of maternal age on offspring mitochondrial function, health, and reproductive success.
2. Compare levels of maternal investment in offspring from young and old mothers.

Mentors and Lab: Dr. David McElroy, Giovanni Gianesin, and Lindsey Nelson
Institution: NOAA Northeast Fisheries Science Center, Cooperative Research Branch
Research Interests: Fisheries biology, marine ecology, habitat ecology
Potential 2023 Project:
The NEFSC Bottom Longline Survey conducts a biannual industry-based survey that is designed to collect increased data in structured habitats in the Gulf of Maine. These complex structured habitats can be challenging to sample with mobile fishing gears. At each randomly selected fishing location, a short video of the bottom habitat is collected to help verify the substrate and the presence of important benthic macrofauna. These data can then be paired with the other data at each station to improve our understanding of habitat and fish abundance. This work supports the NEFSC's mission to manage and understand the fishery resources and habitat in the Gulf of Maine. The student will help in the annotation of these videos and conduct some preliminary analyses. An interest in fisheries biology or marine ecology is recommended but not required.

Mentors and Lab: Dr. Adam Subhas

Institution/Department: Woods Hole Oceanographic Institution, Marine Chemistry and Geochemistry

Research Interests: The Subhas Lab is generally interested in organisms that grow calcium carbonate shells in the ocean, and their role in the global carbon cycle. We are interested in this cycle because it controls how much carbon the ocean can take up and sequester away from the atmosphere. We may be able to use this cycle to store anthropogenic carbon dioxide, helping to solve global warming and ocean acidification. This process is known as ocean alkalinity enhancement. There are many practical challenges and unknowns on the topic of ocean alkalinity enhancement, both from the engineering side and from the ocean impacts side. Some of the lab's work can be viewed here http://www.adamsubhas.com

Potential 2023 Project(s): There are several summer projects available in the lab involving ocean alkalinity enhancement in the Subhas Lab. The first is a set of experiments to measure calcification rates in seawater using a carbon isotope spike – this would be really useful to understand how fast organisms grow their shells in the first place – and further more it will help measure the impacts of ocean acidification – and alkalinization -- on these organisms. I also have a project looking at how fast some different types of silicate rocks (like serpentine) dissolve in seawater and produce alkalinity. These reaction rates are crucial to understanding how fast these rocks can neutralize carbon dioxide, and will help us understand if we can use these rocks to sequester anthropogenic carbon dioxide in the ocean.

Mentor(s) and lab: Dr. Heather Goldstone

Institution/Department: Woodwell Climate Research Center Communications Team

Research Interests: Science communication, data visualization, storytelling, multimedia design

Potential 2023 project(s): The Woodwell Communications team is offering a Multimedia Climate Science Communication Intensive project. The student will work collaboratively with multiple members of Woodwell's Communications Team to convey research findings and climate science through multimedia storytelling. They will create a series of photo essays or multimedia-heavy stories using new and archival content, and create multimedia materials to promote those stories via social media, email, and web. Mediums of focus can be shaped by the student's interest; there are opportunities in mapmaking and StoryMaps, infographic/graphic design, video editing and production, photo stories, and social media content generation.

Mentors and Lab: Dr. Andrew Gillis

Department: Marine Biological Laboratory, Bay Paul Center for Comparative Molecular Biology and Evolution

Research Interests: Development, growth and repair of the skeleton and sensory nervous system of cartilaginous fishes (sharks, skates and rays).

Potential 2023 Projects:

1. **Development, growth and repair of cartilage**: In mammals, cartilage is mainly an embryonic tissue, forming a model of the future bony skeleton. Cartilage persists permanently in relatively few places within the adult mammalian skeleton (e.g. in the joints, as articular cartilage), and has a very poor capacity for repair following injury. Sharks and skates, on the other hand, possess a skeleton that is composed entirely of cartilage, and that remains cartilaginous throughout life. We recently found that skates have the capacity to grow new cartilage throughout adulthood, and to spontaneously repair cartilage injury. Ongoing research in the lab aims to discover the cellular and molecular basis of adult cartilage growth and repair in the skate.

2. **Neuroendocrine cell type diversity**: Neuroendocrine cells are a diffuse class of cells that release hormonal signals in response to environmental stress, and thus play a pivotal role at the interface of an organism's physiology and behavior. Vertebrates animals possess ~40 different neuroendocrine cell types that are dispersed across several organ systems, and in humans, many of these neuroendocrine cell types may give rise to aggressive cancers. We are taking a comparative approach to resolve the embryonic tissue origin of and molecular signature of neuroendocrine cell types in a range of vertebrate and invertebrate model systems. This will allow us to reconstruct whether/how neuroendocrine cell type diversification relates to major transitions in animal evolution, and may also generate new biomarkers of neuroendocrine cancers in humans.

Projects in both of these areas will involve training in a range of widely applicable laboratory skills, including dissection and histology, gene expression analysis by mRNA *in situ* hybridization and immunofluorescence, microscopy, molecular biology and embryology.

Mentor(s) and lab: Jesús Pineda

Institution/Department: Woods Hole Oceanographic Institution, Benthic Ecology and Nearshore Oceanography Lab

Research Interests: List all that apply

Potential 2023 project(s): Research in the Benthic Ecology and Nearshore Oceanography lab addresses the factors that determine the distribution and abundance of bottom dwelling organisms. We conduct our research in temperate and tropical environments, and our research interests include investigating the consequences of environmental heterogeneity, particularly hydrodynamic phenomena, on larval behavior, larval transport, larval dispersal, settlement, recruitment, and population dynamics. Our lab is also interested in using fundamental knowledge to address societally relevant problems such as the processes most relevant to biofouling in aquaculture.

This summer, students in the lab will have the opportunity to research fundamental questions in larval behavior and ocean ecology and relate their findings and understanding to problems faced by oyster farms in New England. Depending on the student's interests, specific research questions may focus on topics such as latitudinal differences in larval settlement and biofouling, native versus invasive barnacles as biofoulers, and the relationships between biofouling intensity and local environmental conditions. Depending on the question, the student may participate in weekly and monthly visits to field sites, and analysis of metadata, including survey data of oyster farmers in New England.

Mentor(s) and lab: Loretta Roberson

Institution/Department: Marine Biological Laboratory

Research Interests: Coral and seaweed physiology and biology, impacts of climate change

Potential 2023 project(s): A list of potential projects students could work on include the impact of contaminants like microplastics or oxybenzone on coral behavior and growth; the use of seaweed extracts or antioxidants to improve coral growth and repair; real-time imaging of calcification in corals; and co-cultivation of seaweeds and shellfish to mitigate ocean acidification and enhance growth rates.

Mentor(s) and lab: Dr. Sara Gonzalez and Scott Lindell

Institution/Department: Woods Hole Oceanographic Institution, Applied Ocean Physics & Engineering Department and Biology Department

Research Interests: Ecology, aquaculture, physiology, seaweed, kelp life cycles, speciation

Potential 2023 project(s): A newly discovered seaweed off the east coast of the U.S. called skinny kelp has exciting potential for aquaculture — it is more palatable and can be grown more densely in ocean farms compared to the commonly farmed species, sugar kelp. But it is unclear whether skinny kelp and sugar kelp are different species or merely alternative forms of the same species. This project seeks to uncover important aspects of the early life history of skinny kelp, compare it to sugar kelp, and understand how it can be farmed for optimal production. The PEP student will quantify key metrics of kelp reproductive success and farm yield including spore production in wild-harvested kelp, development and growth rate of early life stages, and optimal seeding density on string used for ocean farming. The student will gain experience in essential laboratory skills including microscopy, cell counting, and image analysis, as well as specialized skills such as preparation of kelp tissue for spore release, identifying different life stages of kelp, and working in a kelp hatchery.

Mentor(s) and lab: Dr. Stace Beaulieu (https://www2.whoi.edu/staff/sbeaulieu/)

Institution/Department: Woods Hole Oceanographic Institution, Biology Department

Research Interests: Data science, ocean biogeochemistry, autonomous underwater vehicles, Northeast U.S. Shelf Long-Term Ecological Research (NES-LTER), Ocean Observatories Initiative (OOI)

Potential 2023 project(s): We seek a student to join our multi-institution NES-LTER team to explore what we can learn from data collected by mobile assets including autonomous underwater vehicles (AUVs) deployed at the OOI Coastal Pioneer NES Array. We will co-develop a data science project to explore patterns in ocean biogeochemistry important for understanding the productivity of the Northeast U.S. Shelf ecosystem. This will be an opportunity to enhance coding skills.

Mentor(s) and lab: Dr. Sean A. Hayes

Institution/Department: NOAA Northeast Fisheries Science Center- Protected Species Branch

Research Interests: I like to build research programs that address the ecological challenges of our marine resources in order to remove the ambiguity around stakeholder concerns around everything from fishing gear entanglement to offshore energy development, thus enabling managers and stakeholders to make scientifically informed decisions to ensure sustainability of our marine resources. I'm increasingly interested in the social power of certain marine species to influence marine policy and affect marine spatial planning where it is otherwise lacking.

Potential 2023 project(s): As part of the protected species branch teams- students will be exposed to a range of survey efforts that go into documenting marine mammal, turtle and fish (marine and anadromous) populations, distributions and habitat uses, as well as the tools and technologies we develop to minimize conflicts between these species and critical activities like commercial fishing, hydropower and offshore wind development. Students could develop a range of potential projects from working with animal telemetry data sets, evaluating performance of ropeless fishing technologies, to developing conceptual essays on the role of charismatic taxa (protected by laws like the Endangered Species Act and Marine Mammal Protection act) play in setting the course for marine resource conservation and preventing the tragedy of the ocean commons.

Mentor(s) and lab: Dr. Samuel Laney (AVAST Director)

Institution/Department: Woods Hole Oceanographic Institution, AVAST

Research Interests: Ocean instrumentation, ocean technology, advanced fabrication

Potential 2023 project(s): AVAST is a new facility at Woods Hole Oceanographic that focuses on new ocean technologies and instrumentation, often related to autonomous vehicles and sensing technologies ('AVAST'). AVAST hosts summer students interested in ocean technologies and related fields of engineering, physics, coding, and fabrication. Summer projects are done in conjunction with one of the several active research projects present in AVAST at the time. Students with technical interests are encouraged to apply but opportunities are available for interested students with minimal prior background in technology, as long as they are willing to learn new skills. Projects in 2022 included design and fabrication of a sediment test tank, and programming and electronics for an autonomous surface vehicle.

Mentor(s) and lab: Dr. Sean Lucey

Institution/Department: Northeast Fisheries Science Center, Ecosystem Dynamics and Assessment Branch

Research Interests: Ecosystem-based fisheries management, offshore wind development, integrated ecosystem assessments, ecosystem modeling, indicator development, R, Open Science

Potential 2023 project(s): I am developing an integrated ecosystem assessment of the interactions between offshore wind development, fisheries, and the environment. During the summer of 2023 we will be developing a conceptual model of the interactions through participatory modeling with relevant stakeholders. Our goal is to make sure that the fishermen feel heard and that we adequately capture what they think is important in the system as well as what scientists think. This includes combing through public comments received during the offshore wind area development process. Over the course of the summer, the student scholar will be engaged with various members of the integrated ecosystem assessment team and the Ecosystem Dynamics and Assessment Branch. The student will develop R coding skills, conceptual mapping, and communicating scientific concepts to a broad audience.

Mentors and lab: Dr. Scott Chimileski and Dr. Jessica Mark Welch

Institution/Department: Marine Biological Laboratory, Bay Paul Center for Comparative Molecular Biology and Evolution

Research Interests: Human microbiomes; confocal microscopy; marine microbiomes; spatial organization of bacterial communities; genomics and metagenomics of bacteria.

Potential 2023 projects:

Animals, including humans, use mucus to interact with bacteria. Mucus can be a sticky net that captures bacteria and pushes them away to keep mucosal surfaces clean, or mucus can be a rich food source to encourage growth of desirable bacteria. We use microscopy to study bacterial growth and organization, particularly the spatial organization of bacterial communities in mucus. Student projects will investigate how mucins and inert polymers change how bacteria grow, spatially organize, and interact with each other. Students will learn how to cultivate bacteria, image them using state-of-the-art microscopes, and process and analyze the image data. Most of the bacteria we study are from the human mouth or gut, but projects could also involve marine microbes.