Summer Internship Opportunity: Work with NOAA Scientists and Learn to Integrate Mathematics and Fisheries Science

The Northwest Fisheries Science Center (NWFSC) and the University of Washington request applications for students in the Mathematical Sciences for a summer internship at the NWFSC. Interns will spend summer (~16 June – 15 September) working on a research project that integrates mathematics with the science that informs fishery managers. A stipend of $6,400 will be provided from the Usha and S. Rao Varanasi SAFS Faculty Endowment for Student Support, the Usha and S. Rao Varanasi Student Support Fund in Mathematics, the NWFSC, and the School of Aquatic and Fishery Sciences (SAFS). The successful applicants will also be provided with office space at the NWFSC or SAFS and a NWFSC mentor or mentors.

Although any projects related to sustainable management of west coast fish resources would be considered, the following projects are already available and mentors identified:

1. **Improving Estimates of Fishery Impacts on Marine Mammals by Incorporating Industry-Reported Interactions**
   Mentors: Kayleigh Somers, Eric Ward, and Kate Richerson
2. **Development of machine- and deep-learning models for processing remote-sensing data.**
   Mentor: Eli Holmes
3. **Developing machine learning models to more rapidly estimate fish age from Fourier Transform Near Infrared (FT-NIR) spectroscopy of fish otoliths**
   Mentors: Owen Hamel, Sabrina Beyer, and Melissa Monk
4. **"Right-sizing" trawl sample processing: Reviewing survey protocols to balance sampling efficiency and sufficient data collections**
   Mentors: Alicia Billings, Sabrina Beyer, Aaron Berger, Kiva Oken, Chantel Wetzel, Elizabeth Phillips
5. **Leveraging state-of-the art ocean modeling for climate adaptation breakthroughs**
   Mentors: Abigail Golden, Owen Liu, Megan Feddern, Brooke Hawkins, Darren Pilcher, Jameal Samhouri
6. **Modeling the occurrence of an alternative male mating life history strategy in Chinook salmon with long-term data**
   Mentors: Dr. Loren Stearman and Jesse Lamb

For more information on these projects contact the primary NWFSC mentors (Kayleigh Somers: kayleigh.somers@noaa.gov; Eli Holmes: eli.holmes@noaa.gov; Owen Hamel: owen.hamel@noaa.gov; Alicia Billings: alicia.billings@noaa.gov; Abigail Golden: abigail.golden@noaa.gov; Loren Stearman: loren.stearman@noaa.gov .

ELIGIBILITY
Must be a currently enrolled UW (Seattle or Tacoma campus) undergraduate student graduating in Spring 2026 or after

HOW TO APPLY
To apply for this internship, submit your application to this form https://forms.gle/FWpWAZdBKyRPMBPG9 by March 16, 2026.

- Application Materials (in one pdf). Save as "LastnameFirstname_MML2025.pdf" (where Lastname and Firstname are your name)
  - o Recent Resumé
  - o Unofficial UW Transcript
  - o Letter of Interest (maximum of four pages) – include the name of the project that most interests you and why; tell us about yourself and your research interests; explain how the internship will further your studies and career; include other information the selection committee should be aware of, such as what it means to you to have a commitment to diversity, equity, and inclusion.

DEADLINE FOR SUBMISSION
March 16, 2026

DECISIONS
Award notifications will be made by April 25, 2026

The University of Washington is an affirmative action and equal opportunity employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, gender expression, national origin, age, protected veteran or disabled status, or genetic information.

Project 1: Improving Estimates of Fishery Impacts on Marine Mammals by Incorporating Industry-Reported Interactions

Mentors: Kayleigh Somers, Eric Ward, and Kate Richerson

Background:

Fishing operations pose a potential threat to marine mammals and other bycatch species (including seabirds, sharks, and turtles) that, while rare, can significantly harm populations. In order to simultaneously support sustainable fisheries and conserve marine species, NOAA Fisheries must find innovative ways to evaluate and estimate these impacts. Currently, we use Bayesian time-series models that combine data from at-sea human observers and shoreside video reviewers of electronic monitoring (EM) data. We have yet to incorporate two additional data sources: industry self-reports in federal logbooks and to entanglement hotlines. These reports likely record additional, unmonitored interactions that would improve our ability to model fishery impacts on marine mammals. However, these reports are not currently available in a standard format and the completeness and reliability of the data have not been assessed.

Project:

The intern will first create a dataset of self-reported marine mammal interaction data from two sources (existing databases that can be accessed via NOAA Fisheries). The intern will extract all records of interactions with humpback whales, sea lions, seals, dolphins, and other marine mammals from note and comment fields of federal logbooks. The intern will also reach out to entanglement experts to collate all cases where an industry member reported an interaction. The intern will then update an existing Bayesian model to incorporate these self-reported interactions with observer and EM datasets. As part of this, the intern will explore differences in detection rates across data sources, as well as by species, fishery, gear, and other variables.

What the intern will gain from this project?

In addition to getting to work closely with three particularly fun fisheries scientists and likely a bevy of other researchers, the intern will build R and collaborative coding skills (Github); practice the art of analyzing messy, real-world data; and explore the complexities of marine resource management. Advanced skills will include R package development, improving existing reproducible workflows, and Bayesian statistics (programming in Stan). The results of this project will be incorporated into future models for use in conservation and fishery management. If interested, the mentors would guide the intern on documenting this research in a manuscript for submission to a peer-reviewed research journal. Alternative project outcomes could include developing a Shiny app around the R package.

Desired Skills:

Experience coding in R and using git for collaboration would be helpful.

Project 2: Development of machine- and deep-learning models for processing remote-sensing data

Mentor: Eli Holmes

Background and Project:

In this project, you will work on a project using deep learning (e.g., convolutional neural networks) and machine learning (e.g. tree models) for processing remote-sensing data used for ocean ecosystem and fisheries research. There are a variety of different projects that we can mentor interns on if they have specific interests and goals. Our current main projects concern algorithms and applications for filling missing values in ocean satellite data and development of new data derived from the NASA PACE mission (the newest ocean sensing missing). Here are some of the summer projects you could work on but the intern is not limited to these projects and interns are encouraged to develop their own project based on their interests.

1. Develop a proof of concept for a foundational model for regional gap-filling and up-scaling tasks. Foundational models 'self-learn' a complex data set and then allow one to develop new gap-filling applications.

2. Continue the 2024 work on gap-filling ocean color data, finish the model validation and help write a paper for submission to a journal

3. Develop of a python package that uses trained deep-learning models to produce gap-filled or up-scaled ocean color data

4. Develop proof of concept approaches for chlorophyll-a estimates when remote-sensing data are fully absent (prior to 1997). This would extend a pilot project by the 2024 interns.

5.Assemble Cloud-ready and AI-Ready datasets for ocean and fisheries data from NASA PACE data.

Past intern projects are listed at this website: https://github.com/SAFS-Varanasi-Internship/

Why is this project important?

Derived from satellite observations, ocean color provides information about the concentration of chlorophyll-a, a proxy for phytoplankton abundance. Phytoplankton form the foundation of the marine food web, supporting zooplankton, which in turn feed many commercially important fish species. Ocean color data also allows us to detect and monitor harmful algal blooms, which pose produce dangerous toxins and can deplete oxygen levels, impacting fish health and habitats. Improving our chlorophyll products by developing better gap-filling algorithms and outputting new data products with these will directly benefit fisheries and ocean ecosystem work and research of carbon cycling. Learn about some of our work here https://fish-pace.github.io/

What the intern will gain from the project?

This project will give the intern experience working with ocean remote-sensing data and applying image classification and machine learning algorithms to create predictive models. The intern will take part in a research project on novel uses of these approaches in fisheries and have the opportunity to work with others during hackweeks. The intern will get experience with popular Python packages for machine learning (e.g. TensorFlow, PyTorch or Keras). As part of the project, you will also have the opportunity to participate in an earth data hackweek: OceanHackWeek, PACE HackWeek, or Fish-PACE (virtual). The Varanasi internship gives you an opportunity to develop research skills and past interns have had high success at acceptance to masters and PhD programs in computer science and data science.

Required background:

The intern will need programming experience in Python to be successful in this project. The intern should be able to read about an algorithm and write code to implement it. The intern should enjoy reading tutorials and then applying the ideas learned to a novel project on a different set of data. Prior experience with machine- and deep-learning (classes or self-study) will be helpful but not required as long as you enjoy coding and learning new skills.

Project 3: Developing machine learning models to more rapidly estimate fish age from Fourier Transform Near Infrared (FT-NIR) spectroscopy of fish otoliths

Mentors: Owen Hamel, Sabrina Beyer, and Melissa Monk (Southwest Fisheries Science Center)

Background:

Fish age information is critical to model the growth and dynamics of U.S. West Coast fish populations to inform sustainable fisheries management. However, traditional methods to estimate age currently require a visual assessment of annual growth patterns (similar to tree rings) in fish otoliths (ear bones). Visual assessment methods can be difficult, tedious, and are subjective to reader experience. Advancements in technology and science have led to experiments in using Fourier Transform Near Infrared (FT-NIR) spectroscopy to rapidly scan otoliths. FT-NIR spectroscopy is a non-destructive method that measures the absorbance of different light frequencies related to the chemical bonds in the otoliths. This technique shows promise for estimating age from the spectral profiles produced by the scans. Thousands of otoliths from multiple, economically-important fish species have been traditionally aged and scanned at the Northwest and Southwest Fisheries Science Centers (NWFSC and SWFSC) to develop machine learning models to estimate age from the FT-NIR spectra. Similar models have been developed at the Alaska Fisheries Science Center (AFSC). We are looking to operationalize these methods by refining and comparing machine learning models to fully implement the FT-NIRS method at the NWFSC and SWFSC.

Project:

The intern will evaluate and compare two candidate convolution neural network (CNN) models, which use FT-NIR spectra and ancillary biological information to estimate age for Pacific hake (Merluccius productus), sablefish (Anoplopoma fimbria), and Chilipepper rockfish (Sebastes goodei). The student will assist with running, evaluating and comparing models to operationalize for the three species. This includes developing quantitative and visual comparison methods and writing and implementing code.

What the intern will gain from this project:

The intern will work closely with the NWFSC and SWFSC mentors to learn about the FT-NIRS CNN models and to develop methods for model comparison. Modification or extension of the CNN code in the course of evaluation is a possibility, though not a requirement. The intern will gain real-world experience in advancing biological methods to improve data collection and analysis pipelines for stock assessment and fishery management.

Desired Skills:

Experience with R and/or Python, machine learning models, data visualization, and science reproducibility (e.g., Github).

Project 4: "Right-sizing" trawl sample processing: Reviewing survey protocols to balance sampling efficiency and sufficient data collections

Mentors: Alicia Billings, Sabrina Beyer, Aaron Berger, Kiva Oken, Chantel Wetzel, Elizabeth Phillips

Background:

The acoustic-trawl survey team at NOAA Fisheries Northwest Fisheries Science Center conducts biennial surveys for Pacific hake off the U.S. west coast to provide information to understand population size and to support sustainable fisheries management. A key component of this survey involves using a trawl net to catch acoustically-detected aggregations of fish to validate that the aggregation is Pacific hake and to obtain representative samples of the length, sex, and age of the aggregation. The sampling protocol for biologists working on the survey vessel includes measuring 400 randomly sampled Pacific hake for length and sex from each trawl sample. Of those, 50 fish are randomly selected for additional "enhanced" sampling of individual weight, maturity status, and to extract otoliths (ear bones) to estimate age. These measurements are used to apportion acoustic backscatter to appropriate length and ages of Pacific hake, which are an important component of accurately estimating Pacific hake biomass. The measurements are also used in the population model of Pacific hake that helps to inform sustainable catch limits, where age data help quantify relative availability of different ages to the survey and inform estimates of numbers and biomass by age. Depending on the size of the overall catch, processing a single trawl can take 2-4 hours with the current sampling protocol. Because multiple tows occur throughout a sampling day, biologists spend many hours working in the wet lab processing fish, which can have negative consequences to staff health due to repetitive motion injuries. Optimizing the value of information collected from trawls (e.g., 'right-sized' sampling) is crucial for understanding the acoustic backscatter that is used in the population model to estimate sustainable catch limits, while at the same time ensuring efficient use of available resources.

Project:

We are looking for a motivated student to develop computer simulation models that replicate the current trawl sampling protocol, and model variations in the protocols that quantify how changes in the number of fish measured may influence estimates of age-specific Pacific hake biomass. The goal is to establish a quantitative basis for the sampling protocol that balances the need for sufficient sample sizes to estimate the length and age range of Pacific hake sampled in an aggregation while balancing efficient, cost-effective sampling while working at-sea.

What the intern will gain from this project: The intern will work closely with an established team of survey scientists and population ecologists. We will have weekly lab meetings / check-ins for the 10-week period, and will be available to provide additional guidance as needed – this may include additional meetings to discuss technical aspects, or review of code and outputs.

Desired Skills:

Experience working with R and with reproducible tools (R-markdown/Quarto, Github).

Helpful background reading:

Hulson, P.F., Williams, B.C., Bryan, M.D., Conner, J., Siskey, M.R.. 2024. Reductions in sampling effort for fishery-independent age and length composition: balancing sampling efficiency, data uncertainty, and workforce health. Canadian Journal of Fisheries and Aquatic Sciences. 81(1): 63-78. https://doi.org/10.1139/cjfas-2023-0164

Project 5: Leveraging state-of-the art ocean modeling for climate adaptation breakthroughs

Mentors: Abigail Golden, Owen Liu, Megan Feddern, Brooke Hawkins, Darren Pilcher, Jameal Samhouri

Background:

The regional Modular Ocean Model (MOM6) is a new, state-of-the-art ocean modeling system for the Northeast Pacific Ocean (NEP). This new model system provides high resolution output of physical and biogeochemical variables across both historical (i.e. hindcast) and future (e.g. seasonal to multi-decadal) timeframes. Leveraging these outputs can help us refine our understanding of environmental drivers of fish stock status and incorporate them into stock assessments; improve our ability to understand and predict the spatial dynamics of migrating fish populations; and explore how fishermen on the West Coast might respond to environmentally driven boom-and-bust cycles of population abundance in valuable species. The NEP hindcast has been validated across the broader model domain, and it is now time to adopt it in specific use cases within the California Current, and ensure that MOM6 can meet these needs without introducing unanticipated biases.

Project:

We are seeking a motivated student scientist to join the Northwest Center's Changing Ecosystem and Fisheries Initiative (CEFI) in developing a project to evaluate MOM6 model outputs for use in fisheries management-relevant analyses. The specific focus of the student project will be co-developed by the student and the CEFI team based primarily on the interest of the student. The student will develop environmental indices, species distribution models, fishing fleet footprints, and/or other products using ocean model output and other sources of environmental and fishery dependent data. Deliverables will depend on the chosen project, but will likely include data summaries and visualizations, reproducible code pipelines, and/or a short report(s).

What the intern will gain from this project:

The intern will gain experience and technical expertise working with ocean model output and other forms of complex spatial data. In addition, the Changing Ecosystem and Fisheries Initiative team works on a wide range of decision support applications relevant to fisheries management on the West Coast. By working with this interdisciplinary team of scientists, they will gain exposure to a variety of fisheries policy on-ramps for quantitative analysis and collaborate with experts in a range of quantitative disciplines, including stock assessment, spatial ecology, oceanography, data science, and econometrics.

Desired skills:

The intern will need prior experience creating processing and visualizing datasets in the R programming language. Prior experience working with spatial data is desirable.

Project 6: Modeling the occurrence of an alternative male mating life history strategy in Chinook salmon with long-term data

Mentors: Dr. Loren Stearman and Jesse Lamb

Background: Life history portfolio diversity is critical for fostering robust salmon populations and fisheries. While most Chinook salmon spend 1-3 years at sea maturing, some males remain in or near natal streams and mature in freshwater as precocious parr. Laboratory studies have established rate of growth as a primary driver of precocious development; however, we still understand little towards which environmental factors drive precocious development in the wild. This project aims to explore a 3-decade dataset of juvenile Chinook salmon population demographics collected over 16 sites in the upper Salmon River, Idaho, to examine potential drivers of precocious male development. Tributaries of the Salmon River are among the most remote and unperturbed Chinook Salmon spawning and rearing habitats in the contiguous United States. These streams offer an unparalleled opportunity to study the conditions in the wild which foster alternative life history strategies. The results of this project will help inform conservation and management strategies which promote resilient salmon through multiple life history strategies.

Project: We are seeking an intern to analyze how numerous environmental variables, such as thermal and hydrologic regimes, wildfire histories, returning adult demographics, spatial effects, and rearing community composition, among others, drive rates of precocious development in Chinook Salmon parr. Modeling techniques are open for exploration but may include generalized linear models, time series models, zero-inflated models, etc. The intern may also collect additional explanatory variables from publicly accessible data.

What the intern will gain from this project: The intern will have the opportunity first and foremost to hone data acquisition and organization, coding, analysis, and data visualization production skills. We anticipate the intern will be able to produce both 1) a set of analyses of the data, and 2) visualization products such as graphs, which may be used for presentations in undergraduate symposia or development of manuscripts if the intern chooses. Further, the intern will build strong collaborative bridges with several fellow researchers across multiple partner agencies involved in data collection and related efforts. Opportunities to assist in one week of field data collection may also be available.

Required Background: The intern will need programming experience, preferably in the R Language for Statistical Computing. Prior experience with statistical modeling techniques is preferred but not necessary.