2021 STATE OF THE COAST

OCTOBER 28 & 29, 2021

BOOK OF STUDENT RESEARCH ABSTRACTS & ART

2021 State of the Coast Student Presenters

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Researcher Name: Risa Askerooth

Co-Authors: Rebecca Mostow, Hieu Ly, Rose Antaki, Sally Hacker
Institution: Oregon State University
Degree: Integrative Biology Expected Graduation: 2023

Title: **Discovery that a novel invasive beachgrass hybrid (*Ammophila arenaria* x *A. breviligulata*) is widespread across Oregon and Washington coastal dunes**

Keywords: Plant invasion, Invasive, Climate change, Coastal protection, Sea level rise, flooding, Native species, Coastal dunes, Beachgrass, Species distribution

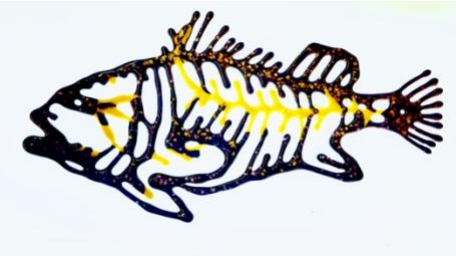
Abstract:
Coastal dunes in the Pacific Northwest coast have undergone a dramatic transformation beginning in the 20th century through the introduction of two invasive beachgrasses, *Ammophila arenaria* (European beachgrass) and *A. breviligulata* (American beachgrass). These ecosystem engineers stabilize sand and form dunes that serve as the "first line of defense" for coastal communities against storms and sea level rise, although they also have detrimental effects for native dune species. Recently, we have discovered a hybrid (*Ammophila arenaria* x *A. breviligulata*) of the two non-native beachgrass congeners in northern Oregon and southern Washington, a region where these species overlap in their range. This summer, dune surveys that investigated the distribution and abundance of the hybrid across the region found it to be much greater than previously known. Currently, researchers and community scientists have discovered 111 hybrid patches at numerous sites across a 155-mile stretch from Pacific City, Oregon to Ocean Grove, Washington. Other research efforts are underway to understand hybrid traits that are important for dune-building, including its morphology, growth form, and sand trapping potential. The large range and abundance of the hybrid, coupled with preliminary research that suggests it may exceed its parents in some dune building functional traits, may mean that the hybrid will play a substantial role in influencing dune shape, coastal protection, and species diversity across the Pacific Northwest coastline.

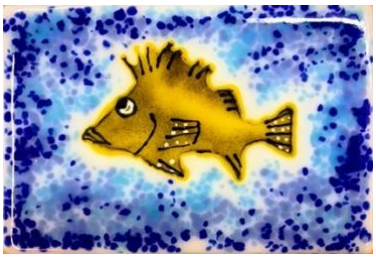
Artist Name: Alexandra Avila

Institution: Oregon State University
Degree: PhD Fisheries, Expected Graduation: 2022

Description (linked to art): I think this is the best place to share the fusing of art and science, and believe that all the people that I want to reach (marine scientist, fishers, resource managers) will see it. (https://beav.es/Umf)

Artist Statement: My career focuses on the unique creatures of the salty deep and my goal is to help protect them using the best available science that promotes proper management of marine resources. I specifically focus on sustainable fisheries and these pieces were inspired by my research on the China rockfish and what I have learn about them in grad school. In the early 2000s, rockfish were overfished which caused the fishery to close. However, thanks to putting into practice the best available science and through proper management, the rockfish have made the most amazing comeback. I hope my research contributed to the best available science used in sustainable fishery management practices, but it is also my wish to use my art to better communicate my science to everyone (fishers, resource managers, coastal communities that depend on these resources, and policy makers), including why sustainable fisheries management is so important. Just like these glass sculptures, our marine resources are delicate, and if not properly managed, they too can shatter. The recovery of the Rockfish fishery in the Pacific Northwest (PNW) is proof that if we all work together (fishers, scientists, managers, etc.), we can ensure that these delicate and precious marine resources will be there for many generations to come. This work is dedicated to two mentors, Marsha Rathja and Charles Robinson, who both sadly passed away in 2020. They consistently encouraged me to pursue both of my passions, pushing my creative boundaries to merge art and science. I always loved talking to Charles about how art can help me better explain my science and how art helps scientists explain complex process making science more accessible to everyone. His impact on my art/science will always be with me. Marsha taught me fuzzed glass techniques at the craft center, and whenever I had a crazy idea to try someone new or wanted to change/adapt an existing glass fuzzing method to merge my art and science, she would always cheer on my ideas and guide me on how best accomplish them. Her encouragement of my ideas to push the boundaries of fused glass helped me grow not only as an artist, but also boosted my confidence as a scientist and reminded me that is good to think outside the box and create something new. Thank you, Marsha and Charles, for your inspiration and advice. I will always carry them with me. Thank you to all my mentors at OSU, in the various science fields and in art, that also have emboldened me to pursue my passions and to push boundaries; you all have helped me grow and get this far.





Researcher Name: Laura Baker

Co-Authors: Steven Rumrill, Flaxen Conway, and Lorene Yokoyama-Becker
Institution: Oregon State University
Degree: Masters in Marine Resource Management Expected Graduation: 2022

Title: **The ecological, economic, and socio-cultural impacts of razor clams on Oregon coastal communities**
Keywords: economic, fisheries, shellfish, harmful algal blooms, domoic acid

Abstract:
The Pacific razor clam (*Siliqua patula*) can be found on the western coast of the United States from northern California to the southern coast of Alaska. In Washington state, razor clams are important to the ecology, economy, and local culture. However, the economic and social impacts of razor clams have not been studied in Oregon.

Approximately 95% of all razor clams in Oregon are found on a 29-kilometer beach called Clatsop Beach in Northern Oregon. The ecological impacts of razor clams on Clatsop Beach have been updated from the last significant assessment in 1924. An economic update of the impacts of travel for recreational harvesting of razor clams offered an estimated 1.8 million dollars to Clatsop County in 2019, increasing from an estimated 1.6 million in 2008. However, the economic impacts do not take into account the commercial harvesting of razor clams. Through interviews and socio-cultural analyses, we found that razor clams are important to the communities of Clatsop Beach. Overall, the popularity of harvesting razor clams recreationally has increased steadily and become more popular during the beginning of the COVID-19 pandemic. From interviews, we also discovered that the most significant obstacle this industry faces is harmful algal bloom (HAB) events, causing increased levels of domoic acid (DA) in razor clams, shutting the season down. Further evaluation of this fishery led to the recommendations for state agencies would benefit from creating a video showing the testing method for DA.

Researcher Name: **Jennifer Beaullieu**

Co-Authors: Lori Cramer & Flaxen Conway
Institution: CEOAS - Oregon State U.
Degree: Marine Resource Management Expected Graduation: 2022

Title: **Seafood processing's contribution to coastal community resilience: Examining local voices**

Keywords: Seafood Processing Industry, Community Resilience

Abstract:
Studies show seafood production has increased more than any other animal food sector globally to keep up with the steady annual rise in human population. Industry growth has occurred in captured seafood as well as in cultured seafood. Amplification of seafood landings and harvest has meant an increase in seafood processing activities. The greater reliance on seafood resources, and ultimately seafood processing, necessitates an understanding of the role seafood processing may have in the resilience of coastal communities. It is well documented that the seafood processing industry in Oregon adds millions of dollars annually to the state's economy by insourcing seafood value-added techniques, yet research is lacking on the connections between seafood processing and community resilience. This project fills this gap by utilizing a qualitative research method approach incorporating semi-structured interviews in Tillamook County, Oregon that builds upon a pilot study conducted in Coos Bay, Oregon. Preliminary results from conversations with 3 groups: community leaders, seafood processing industry leaders, and the seafood processing workforce, will be presented that examine how the seafood processing sector connects to community resilience, as well as identifying barriers and opportunities to enhancing local seafood processing.

Researcher Name: **Brenden Catt**

Co-Authors: N/A
Institution: University of Oregon School of Law
Degree: Juris Doctor (J.D.) Expected Graduation: 2022

Title: **How a Coastal Nonpoint Pollution Control Program Could Influence Forestry Practices that Threaten Oregon's Coastal Water Resources.**

Keywords: Law, Coastal zone management, CZMA, Nonpoint pollution, Forestry

Abstract:
Clean water is the most basic necessity of biological life. For humans, water is a source of existence, it carries nutrients through our bodies, helps lubricate joints, and protects vital organs and tissues. However, this necessity is becoming less accessible to coastal communities in Oregon. The underlying geology of Oregon's coast makes practical access to groundwater difficult. Additionally, surface water resources are threatened by population growth, climate change, and shortsighted management of coastal forests by the State. Therefore, coastal resource management must be significantly improved to avoid the imminent consequences of water shortage on Oregon's coast. At its fingertips, Oregon has a mechanism that its coastal communities could use to influence state actions that threaten access to viable coastal water resources—A Coastal Nonpoint Pollution Control Program.

My presentation will be composed of six parts. Part I will establish a background of Oregon's coastal waters and forestry. Part II will discuss federal deference in developing Coastal Nonpoint Programs. Part III will summarize Maine's and Washington's fully approved Coastal Nonpoint Programs. Part IV will recommend a proposal for Oregon's Coastal Nonpoint Program using elements of Maine's and Washington's fully approved Coastal Nonpoint Programs. Part V will outline the difficulties of implementing a Coastal Nonpoint Program in Oregon. I will conclude with Part VI, which will consider how a Coastal Nonpoint Program could be used to address contemporary sources of nonpoint pollution in Oregon's coastal zone.

Name: Marcus Chaknova

Co-Authors: NA
Institution: University of oregon
Degree: Marine biology Expected Graduation: 2021

Title: **Developing marine monitoring systems for inclusion in k-12 conservation science**

Keywords: Underwater cameras, conservation, education, robotics, critical thinking, visualization

Abstract:
There is often a gap in knowledge between K-12 classrooms and modern day scientific research. Marine science is a dynamic discipline compared to the static laws of physical and chemical disciplines. This gap between classroom and field research leads to future ignorance relating to the marine conservation field. One major question continuously arrives when given the task of educating k-12 on the sensitive topic of conservation. What techniques can scientists provide teachers to introduce marine conservation field research in the classroom? The purpose of my research is to provide a k-12 educational system with an interactive visual learning system that develops critical thinking skills concerning marine conservation.

Within the last year and a half I have worked on developing an autonomous, underwater, livestream, camera system that is reliable and affordable. I believe I have developed such a system that within the next year will be setup in 15+ locations along the Oregon and Californian coast. These locations will be located in a wide range of marine ecosystems to present students with a diverse knowledge of the PNW coastline. One ongoing aspect of the project is developing fish counting software to provide students with biotic data. Abiotic data will be provided through temperature, salinity and pH sensors in every camera system. Students will be able to login every morning to the livestream websites to watch and observe real time marine ecosystems. The combination of visual observation and stored data will help students develop simple hypotheses concerning marine science.

Researcher Name: Elissa Connolly-Randazzo
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Co-Authors: Dr. Catherine E. de Rivera, Dr. Shon Schooler, Dr. Yangdong Pan
Institution: Portland State University
Degree: Master of Science: Environmental Science and Management Expected Graduation: 2021

Title: **Temperature and Predator Effects on Green Crabs (Carcinus maenas) and Their Distribution in South Slough National Estuarine Research Reserve**

Keywords: invasive green crab, temperature and predation effects, distribution in South Slough National Estuarine Research Reserve

Abstract:
The invasive green crab (*Carcinus maenas*) has increased in abundance and distribution among Oregon's estuaries. Its global success in settling into new environments and tolerance for abiotic stressors, such as temperature, raises concern for *C. maenas* to prevail native crab species. To improve in predicting invasion influence, this work analyzed the results from a controlled tank experiment at Portland State University and the field data on a population of *C. maenas* in South Slough National Estuarine Research Reserve (SSNERR). The aquarian experiment observed the behavioral responses of prey *C. maenas* when exposed to temperatures 9° to 30°C and three predator species (*C. maenas, Callinectes sapidus*, and *Cancer productus*). There were five categories of behavioral responses measured in time duration. Polynomial regression of the behavioral responses from prey resulted in the following strongest correlations of 'Still' with *C. maenas* predators (R^2= 0.17), 'Feeding/Foraging' with *C. sapidus* (R^2= 0.21), and 'Feeding/Foraging' with *C. productus* (R^2= 0.20). Crab trap data from SSNERR was plotted on a map to identify surrounding habitat and bottom substrate of areas with high catch per unit effort (CPUE) of *C. maenas.* Mean CPUE of *C. maenas* was below three throughout the SSNERR region with traps that were within habitats and bottom substrates with little to no structure. The CPUE of *C. maenas* was plotted against the CPUE of native crabs found in SSNERR. These values were low and did not provide any patterns of CPUE of native species influencing CPUE of *C. maenas.*

Artist Name: **Chloe DaMommio**

Institution: University of Oregon
Degree: Marine Biology, Expected Graduation: 2021

Title (Linked to art): Un-Objective Lens (https://beav.es/Umg)
Digital Portfolio
UO Science and Comics Initiative

Artist Statement: Oregon's rocky tidepools are rich with life, both diverse and abundant, and the organisms within them have long captivated our collective imagination. It is necessary that we, as scientists, conservationists, visitors to the intertidal, etc., acknowledge the biases we bring with us to our observation of these ecosystems. What we tend to focus on, as individuals or in groups, within intertidal ecosystems. reflects our goals and values as much as it does the intrinsic properties of those organisms and abiotic factors. A biologist who specializes in sea slugs and the owner of one of Oregon's few urchin-diving permits will not go looking for the same things, and therefore what they see will be very different. All of us tend to be distracted by the life that is larger, that is more brightly colored, that is more abundant—those organisms which are literally easier to see. Our perceptions of ecosystems, of the populations within them, affect the questions we may ask, both with regard to science and policy.

This piece seeks to illustrate some of these biases, by making some common and well known intertidal organisms far larger than they appear in real life—to represent the space they may take up in our discussions of this place. The organisms depicted out of proportion with the landscape,(*Mytilussp., Strongylocentrotus purpuratus, Tegula funebralis, Pisasterochraceous, Anthopleura xanthogrammica, Hermissenda crassicornis,Thalassiosira sp.*and *Noctiluca scintillans*), have genuine biological significance as they relate to their community—most play important ecological roles, and *P. ochraceous*is oft the classic example given of a 'keystone species'. These are organisms we talk about, look for—both as biologists and laymen; because many also have visual appeal, ex. the bioluminescent *Noctiluca* (a dinoflagellate) or the Giant Green Anemone (*A. xanthogrammica*) for which Oregon's tidepools are so well known. The background, the rocky coast, which allows for this habitat to exist, is a backdrop for what has been elected as more interesting.

This collection of organisms is hardly representative of all those studied in Cape Arago (the area from which I collected reference imagery), or even those most studied, but this is not so much a flaw as a further illustration of bias. Via the choices I've made of which organisms to use in order to convey my point, I've brought my own individual skewed point of view to the piece. It is perhaps most evident in my omissions; there are no vertebrates or arthropods depicted despite their strong presence in this environment—clearly I am an invertebrate specialist with no particular love for crabs.

Conservationists are often forced to prioritize, to decide which populations or habitats have greatest value, and then define how such things may be valued. This piece is not about conservation, but it is about value—what we prioritize, upon entering an iconic natural space, for every reason, and none at all.

Researcher Name: **Maddie English**

Co-Authors: Tom Calvanese, Sara Hamilton
Institution: Oregon State University
Degree: Environmental Science w/ an Aquatic Biology Option
Expected Graduation: Fall 2021

Title: **An Analysis of the Reproductive Status and Health of Pacific Purple Sea Urchins (*Strongylocentrotus purpuratus*) on the Southern Oregon Coast**

Keywords: urchins, kelp forests, ecology,

Abstract:
Pacific purple sea urchins (*Strongylocentrotus purpuratus*) are marine invertebrates commonly found in rocky intertidal zones from Mexico to Alaska. Populations of urchins in the Redfish Rocks Marine Reserve have been increasing and negatively impacting kelp forests. Because organisms generally cannot be removed from the reserve, the urchin population cannot be effectively controlled. The main source of food for Oregon urchins is bull kelp. Kelp is an integral part of coastal ecosystems, providing protection for juvenile fish and critical habitat for many other marine species. Even after a kelp forest has been diminished, urchins survive, creating a positive feedback loop and permanent lack of kelp. The aim of this research was to analyze the health of the urchins outside the Redfish Rocks Marine Reserve in order to predict reproductive status and population patterns within the reserve. I conducted research at four sample sites off the coast of Port Orford, OR. I hypothesized that urchins taken from sites with kelp would be healthier and thus, would have larger gonadal indices and brighter gonads. I found that with an R-squared value of 0.4057 and a p-value of 3.729e-10, there was a significant positive correlation between the color of the gonad and size. I also found that 8.8% of the urchins were reproductively viable and only 24.7% were marketable quality. Future research on this topic could help us make informed management decisions concerning urchin populations in Oregon's marine reserves, including possible removal of urchins, for the sake of preserving bull kelp and fostering biodiversity.

Researcher Name: Laurel Field

Co-Authors: Dr. Kirsten Grorud-Colvert, Dr. Jenna Sullivan-Stack
Institution: Oregon State University
Degree: Marine Resource Management Expected Graduation: 2022

Title: **The MPA Guide: Informing understanding of effective MPAs**
Keywords: Marine protected areas, 30x30
Presented at SOTC before: No

Abstract:
Marine protected areas (MPAs) are widely used and studied biodiversity conservation tools that can provide benefits for both marine biodiversity and the people that it supports. Oregon has been a leader in dialogues about MPA planning and monitoring, and these conversations are also taking place at the federal level. The federal government along with some states and Tribal leaders has recently set a target of conserving at least 30% of US waters by 2030 in Executive Order 14008. What will count as conservation? How do we know how close we are to conservation targets? Effective and equitable MPAs are an important part of achieving that target; both quality and quantity of MPAs matter for sustaining biodiversity and its benefits. To improve clarity regarding quality of MPAs, a new science-based, policy-relevant evaluation framework, *The MPA Guide,* was developed through a multi-year, highly collaborative international process. We discuss the four core elements of the *Guide* and how they provide useful and usable information for evaluating MPAs: (1) Stage of Establishment: the current status of an MPA in its progression towards being Actively Managed and most effective; (2) Level of Protection: protection of biodiversity and habitats from impacts of abatable human extractive or destructive activities; (3) Enabling Conditions, or the important social and ecological considerations that are prerequisites for effective MPAs; and (4) Outcomes that can be expected from an MPA at a given *S*tage and Level, if Enabling Conditions are met.

Researcher Name: Jessica French

Co-Authors: Tommy Swearingen and Hailey Epperly
Institution: Oregon State University
Degree: BS Biology Expected Graduation: 2022

Title: **A Review of Business Surveys (2012-2021) From Communities Proximate to Oregon Marine Reserves**

Keywords: Marine Reserves, Coastal Communities, Socioeconomic Impacts

Abstract:
In 2008 the state of Oregon began the process of designating five marine reserves in Oregon's territorial waters. Part of the implementation plan was a requirement to monitor the socioeconomic impact of marine reserve designation on coastal communities and businesses. To accomplish this, survey research conducted through the Marine Reserves Human Dimensions Project in 2021 collected data about marine reserve awareness and perceived impact on business demand among business representatives in the coastal communities of Newport, Lincoln City, Florence, Yachats, Depoe Bay, Garibaldi, and Otter Rock. These data were then compared to baseline data collected prior to restrictions being implemented at Oregon's five marine reserves; Otter Rock, Cascade Head, Cape Perpetua, Cape Falcon, and Redfish Rocks. Statistical analyses of the survey responses and comparison to past studies showed that awareness of marine reserves among business representatives had not changed over time. The perceived impact of marine reserves on business demand, on the other hand, did change significantly with a decline in the proportion of business representatives who felt marine reserves would negatively affect their business and an increase in the proportion of business representatives who responded that marine reserves had no impact on business demand or that they were unsure.

Researcher Name: **Bryan Gaspich**

Co-Authors: Jung Kwon, Mike Penner
Institution: Oregon State University
Degree: MS in Food Science Expected Graduation: 2023

Title: **Maximizing Extraction of Protein Isolates from Pacific Whiting By-products**

Keywords: Pacific Whiting, Fish by-products, protein isolates

Abstract:
In 2020, 690 million people in the world were affected by hunger. World hunger is projected to increase to 840 million people or roughly 10% of the population by 2030 without greater intervention. One practical approach that can tackle this issue is a better utilization of currently wasted dietary resources. Seafood is a critical part of a nutritious diet, but its commercial processing is associated with a high rate of underutilization of harvested resources. Global marine catch by commercial fisheries was an estimated 96.4 million tonnes in 2018 with the average yield of edible product typically less than 55%. Pacific Whiting are one of the most sustainable fisheries in the US pacific northwest with estimated commercial landings of 697.5 million pounds in 2019. Current uses for Pacific Whiting by-products include fishmeal or fertilizer when not discarded. The primary byproducts; heads, frames, and viscera, all contain significant amounts of food grade protein at the time of catch that is underutilized in current products. This study aims to maximize the extraction of protein isolates from Pacific Whiting by-products by comparing solubilization methods. There are a number of different mechanical methods to extract proteins from fish tissue and determination of the most efficient method is crucial to increasing yield. Producing high concentrations of protein is the first step in better understanding how maximum utilization of these materials could be upscaled and incorporated into food products. Future studies will highlight the nutritional value and functional properties that make these isolates desirable as food additives.

Researcher Name: **Emily Griffith**

Co-Authors: Dr. Ana Spalding
Institution: Oregon State University
Degree: Masters of Public Policy Expected Graduation: 2022

Title: **Adaptive Capacity of Historical and Current Policy Concerning California Abalone**
Keywords: Adaptive Capacity, abalone, policy

Abstract:
Abalone are an iconic species all over the world. Two of California's abalone species, black and white, are currently endangered, with recreational and commercial fisheries closed for the foreseeable future. Abalone play a vital role in maintaining a healthy coastal ecosystem. Abalone also hold an important cultural value among human populations. For these reasons, policy impacting abalone and consequently, the communities using abalone, must be researched, and analyzed to determine what has been successful, what opportunities still exist for the industry, and what will need to be improved upon within future legislation and management.

The history of abalone fishing policy in California along with many abalone species near extinction suggest it is highly relevant to understand how California policy and legislation can better facilitate adaptive capacity for human communities utilizing abalone in a changing marine environment. This information is exceedingly transferrable to Oregon policymakers, as it can help inform Oregon marine policy considering the overlap of many of the same abalone species, shared occurrence of commercial fishery closures, and the common potential for increasing rates of environmental stress.

In conducting a literature review and policy analysis, as well as semi-structured interviews with state and federal abalone and aquaculture experts, we hope to answer the questions:

1. Given the legislative history with California abalone, how did policy support or hinder sustainable abalone populations for commercial harvest of wild abalone?
2. Moving forward, how can California policy support sustainable abalone populations for current aquaculture restoration activities?

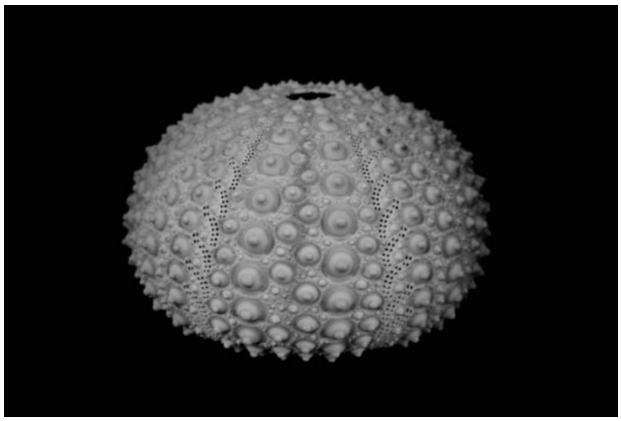
Artist Name: **MacKenna Hainey**

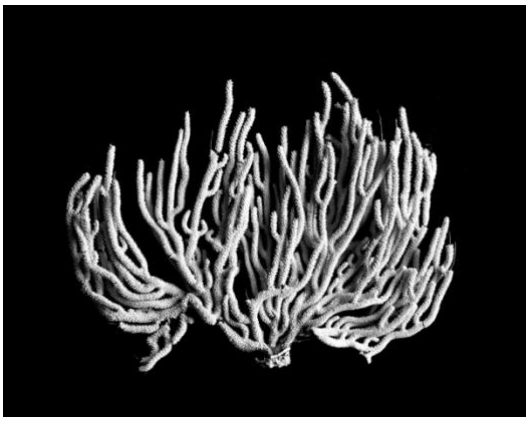
Institution: Oregon State University
Degree: PhD, Expected Graduation: 2025

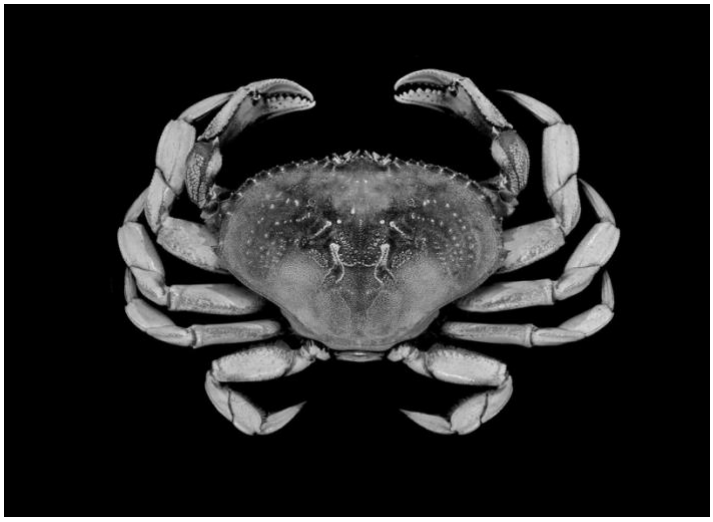
Title (Linked to art): A Focus on Form (https://beav.es/UmM)

Artist Statement: MacKenna is a Ph.D. student in the College of Veterinary Medicine (Biomedical Sciences) and takes portrait-style photographs of marine and terrestrial invertebrates. She uses a plain black or white background to draw attention to these animals' forms, shapes, and behaviors. She focuses on species not typically encountered on a day at the beach and uses photography as an education and outreach tool to communicate marine science.

MacKenna also shoots landscape photography as well as astrophotography as a way to start conversations around light pollution and conservation. She hopes to share the beauty of the natural world with all who enjoy her photos. She has published photographs in magazines, academic journals and is working on a conservation photo series.







Researcher Name: **Dylan Heppell**

Co-Authors: N.a.
Institution: Oregon State University
Degree: Environmental Sciences Expected Graduation: 2022

Title: **Identifying water use processes and opportunities for increasing water-use efficiency at the Pacific Shrimp plant in Newport, Oregon**

Keywords: Water, conservation, shrimp, fisheries, drought

Abstract:
My project at Pacific Shrimp in Newport, Oregon focused on identifying areas within Pacific Shrimp where water conservation can be achieved and researching methods to conserve water in those areas. I identified 4 key ways that water conservation can be achieved. (1) Installing master cut-off switches which will allow the floor workers to quickly shut off the water to the peelers flumes and washers when going on break to prevent water from running when production is not occurring. These switches are expected to save 2,800,000 – 3,000,000 gallons annually. (2) Replacing the current 1” diameter washdown hoses with ¾” diameter hoses and adding a nozzle to each will allow the floor workers more control over where, when, and how much water is used to clean the facility. These changes are estimated to save 1,700,000 gallons annually. (3) Installing a water recirculation system will allow for a portion of the water used at Pacific Shrimp to be recirculated back into the system, rather than just going down the drain. This system is estimated to save 9,000,000 gallons annually. (4) Replacing the current Laitram peelers at Pacific Shrimp with the more modern SeaPeeler Flex which will not only save water but also increase yield of shrimp due to better peeling mechanisms. Switching to the SeaPeeler Flex is estimated to save 31,000,000 gallons annually and the increase in yield is estimated to increase wholesale revenue.

Name: Jennifer Hesser

Co-Authors: David Madison, Ryan Mueller, Chris Langdon, Carla Schubiger
Institution: Oregon State University
Degree: M.S. Comparative Health Sciences Expected Graduation: 2022

Title: **Probiotic-induced disease resistance of pacific oyster larvae**
Keywords: Oysters, Aquaculture, Probiotics, Vibrio coralliilyticus

Abstract:
Pacific oyster larvae face harsh mortality rates due to bacterial infection. Specifically, *Vibrio coralliilyticus* (Vcor) has been identified as the major pathogen responsible for oyster hatchery morbidity events along the U.S. West Coast. A cocktail of four beneficial bacteria (probiotics) has been isolated by the Schubiger and Langdon labs at Hatfield Marine Science Center to prevent mass-mortality events. This cocktail has shown to drastically reduce Vcor-induced mortalities and also improve general robustness of uninfected larval cultures.
Therefore, we hypothesize that our cocktail also stimulates the larvae's innate immune response, besides direct antagonistic properties. This project will investigate the differential expression of immune genes of Pacific oyster larvae when infected with Vcor and treated with the probiotic cocktail. We suspect that the probiotics cause an upregulation of immune genes for pattern recognition receptors and corresponding signaling pathways and immune effectors such as antimicrobial peptides. In response to Vcor infection, we expect to find upregulation of genes related to metabolism and stress and downregulation of immune signaling pathways. When the probiotics are added to counteract Vcor, we expect to see a reversal of the Vcor differentially expressed genes.

Researcher Name: Maya Hurst-Mayr

Co-Authors: None
Institution: Portland State University
Degree: Masters of Environmental Management Expected Graduation: 2022

Title: **Evaluating the perceptions of microplastics management in Oregon**

Keywords: Microplastics, survey, environmental management, Oregon

Abstract:
Microplastics (MP) are an emerging contaminant in marine ecosystems, water resources, and seafood that lack widespread standardized measurement or regulation in the United States. Concern has grown not only for the effect of microplastics on the environment, but also for the potential to affect human health. The presence of microplastics in food and water supplies requires management action. California has established policy to measure and manage the quantity of MP in state waters. However, Oregon lacks such management structure. As a coastal state with many marine resources and interests, Oregon will likely face increasing pressure to set measurement standards to quantify microplastics contaminating waterways and possible source reduction. Understanding the priorities of the major groups involved in microplastic issues in Oregon is essential to providing a state-wide solution to limit source output of MPs. Major players in MP pollution may include state agencies, non-profit organizations, the fishing industry, and any other groups whose well-being is impacted by water quality. Using surveys, this study evaluated baseline attitudes towards microplastics management and identified the priorities, concerns, and barriers to controlling MP pollution in Oregon. Discerning what challenges and data gaps there are to addressing pollution reduction will inform future endeavors to manage MP in Oregon waterways.

Researcher Name: David Kemp

Co-Authors: Jung Kwon
Institution: Oregon State University
Degree: Master of Science Expected Graduation: 2021

Title: **The Anti-inflammatory Potential of Alaska Pollock Roe Byproduct**

Keywords: seafood byproduct; marine; bioactive; hydrolysate; peptides; anti-inflammatory; inflammation

Abstract:
Alaska pollock (AP) is the largest fishery in the United States by live weight and the second-largest globally. Alaska pollock is an excellent sustainable protein source; its fillet has a firm texture, mild flavor, pleasing appearance, and its harvest has a minimal environmental impact. However, commercial AP processing results in large amounts of byproduct material that has limited applications. Many seafood processing byproducts (SPB) go to waste, which takes a toll economically and environmentally. There is a commercial market for female AP gonads (commonly known as roe). However, the substantial amount of off-grade roe goes to very low-value applications like fertilizer and livestock feed or straight into the garbage. A promising use for protein-rich SPB is to digest it into protein hydrolysates enzymatically. Hydrolysate mixtures often contain biologically active peptides that are used in cosmetics, nutritional supplements, and pharmaceuticals.

Our research explored the potential of AP roe hydrolysates for alleviating systemic chronic inflammation (SCI). We generated digested AP roe hydrolysates by employing commercial proteases. The resulting hydrolysate mixture (RAD) had excellent radical-scavenging capacity and reduced nitric oxide production in lipopolysaccharide-stimulated RAW 264.7 macrophage cells, indicating anti-inflammatory potential. Next, we fractioned RAD by molecular weight and found that the RAD >3 KD fraction reduced the expression of several inflammation-related genes in the RAW 264.7 cells. Though more work is needed to establish the mechanism of action as well as clinical safety and efficacy, the production of RAD is an exciting avenue for the utilization of AP roe byproducts.

Researcher Name: Montana McLeod

Co-Authors: Will White
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Degree: Fisheries Science Expected Graduation: 2021

Title: Can we Calculate the Death Rate of Sub-legal Dungeness Crabs?

Keywords: Dungeness Crab

Abstract:
The Oregon Dungeness crab fishery is strategically managed such that in a given year, the entirety of the legal-sized male crabs (4 - 5 year-olds) are expected to be harvested within the season. As such, our ability to predict the scale of the harvest in a season depends on developing reliable estimates of the mortality rate of young sub-legal-size crabs in the previous year. The natural mortality rate, which is the rate that the population will die due to natural causes, is an important factor used in computational models that are applied to the Dungeness crab fishery. By conducting trap surveys off the Oregon coast (approximately monthly, April to September), we estimated the natural mortality rate of sub-legal crabs. Estimating the mortality rate of crabs from such surveys is challenging because the sampling period spans the molting season, when crabs molt out of their shell and grow into the next size class. These estimates must account for the probability of molting and the change in size due to molting. With these variables in mind, we have developed an equation using data from pre-molting and the post-molting season to calculate the natural mortality rate for the sub-legal sized males. We are implementing this equation to additional size-based datasets in the PNW to gain a stronger estimate of natural mortality rates. Mortality rates can improve our understanding of crab populations and our ability to forecast crab landings.

Researcher Name: **Rufa Mendez**
Co-Authors: Rufa Mendez
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Title: **Potential Health Application of Seaweed Pacific Dulse (Devaleraea mollis) Proteins and Peptides: A Prospecting Approach**

Keywords: Pacific Dulse, seaweed protein, bioactive peptides

Abstract:
Algal functional foods and nutraceuticals is an expanding food product industry segment which aims to provide supplementary strategies for health promotion and disease prevention. Pacific dulse (*D. mollis*) is fast-growing macroalgal resource in the Pacific Northwest originally used as aquaculture feed, but now increasingly cultivated as human food. To investigate the nutraceutical potential of this seaweed, *in vitro* and *in silico* prospecting tests were conducted. Seaweed proteins were extracted and precipitated using Osborne method and isoelectric precipitation, respectively. Protein pellets were then digested with different commercially available proteases to prepare test hydrolysates. Samples exerted antioxidant and anti-inflammatory effects, coupled with enzyme inhibitory activities for dipeptidyl peptidase IV (DPP-IV) and angiotensin-converting enzyme-1 (ACE-1) *in vitro*. Since these bioactivities are of value in the context of lifestyle diseases like Type 2 diabetes (T2DM) and hypertension, an *in silico* bioactivity prospecting was done using the *de novo* identified dulse peptides (<10% out of ~ 50,000 peptide sequences) from the promising test hydrolysates. Of these, anti-inflammatory, antihypertensive, and DPPIV inhibitory peptides were identified, with about 33-54% being multifunctional, bearing at least two predicted bioactivities *in silico*. These suggest that dulse protein when consumed from the whole seaweed, isolated pellet, and/or hydrolyzed form can potentially give rise to bioactive peptides that can exert beneficial effects *in vivo*. While much is still to be known about the stability and bioavailability of dulse protein and peptides, this work provides some evidence and direction for future research on dulse seaweed for health application.

Researcher Name: **Annie Merrill**

Co-Authors: Brett Dumbauld, George Waldbusser, Fiona Tomas Nash
Institution: Oregon State University
Degree: M.S. Marine Resource Management Expected Graduation: 2022

Title: **Assessment of juvenile Pacific oyster performance and food resources in eelgrass habitat**

Keywords: Pacific oyster, shellfish aquaculture, eelgrass, estuarine ecology

Abstract:
While the global demand for seafood is increasing each year, there is a growing need to expand aquaculture practices in the interest of food security and coastal resilience. Pacific oysters, *Crassostrea gigas,* are grown in West coast estuaries- where cultures often overlap with native eelgrass, *Zostera marina.* It is critical to understand how these two ecosystem engineer species interact to inform ecosystem-based management in a way that conserves essential fish habitat while stimulating the regional oyster aquaculture industry. My thesis project explores how co-locating Pacific oysters in eelgrass habitat might influence oyster growth and performance by altering food sources and availability. Juvenile oysters (~860) were outplanted in eelgrass habitat during the summer season in Tillamook Bay, Oregon. Culture sites ranged in eelgrass density to determine how structure influences food access. Water quality (salinity, temperature, pH, turbidity, depth, and dissolved oxygen) and velocity were monitored in each habitat type with monthly short-term instrument deployments and paired with bi-monthly discrete water sampling. Water samples were filtered to obtain a concentration of suspended particulate organic matter and chlorophyll-a as a metric of food resources available to the oysters in each habitat type. Oyster growth and biomass were determined at the end of the season. Stable isotope biomarkers from oyster mussel tissues will be compared with water and sediment samples from each habitat treatment to identify food sources and trace nutrient assimilation. These data will be analyzed to determine if eelgrass facilitates or hinders oyster growth and characterize habitat conditions most suitable for culture.

Researcher Name: Tate Scarpaci

Co-Authors: Tate Scarpaci, Amelia Vaughan, Laurel Kincl, Angee Doerr, Viktor Bovbjerg, Amanda Gladics
Institution: Oregon State University
Degree: Marine Studies Expected Graduation: 2022

Title: **Production of first aid videos to reinforce skill retention of commercial fishermen as part of the Fishermen First Aid and Safety Training.**

Keywords: fisherman, first aid, commercial fishing, safety training.

Abstract:
Commercial fishermen are required by the U.S. Coast Guard (USCG) to have at least one crew member certified in first aid/CPR. Fisherman First Aid and Safety Training (FFAST) is a program designed specifically for fishermen to meet the USCG requirements. Since emergency medical care is not immediately available in many commercial fishing scenarios, FFAST was designed based on wilderness first aid (WFA) training. The first aid/CPR certification is valid for two years but the USCG does not require a refresher course. Previous research from WFA trainings indicates that after multiple months only 50% of participants could pass skills assessments. With this in mind a series of micro-lesson videos were developed to address the loss of skill retention over time. Six micro-lessons were created, each specifically chosen to illustrate an important set of first aid skills: primary assessment, treating wounds, treating burns, treating orthopedic injuries, spine assessment, and stabilizing the spine. Each video was designed to provide a succinct demonstration, on demand that would help fisherman review skills. As a student-led project, I developed the story lines, wrote the scripts, then filmed, directed, edited and produced each video. The micro-lessons were shot on a Panasonic Lumix GH4 at 30fps. All videos will be published on the OSU College of Public Health and Human Sciences YouTube channel and on Oregon Sea Grant website and social media platforms. The videos will be utilized during future trainings. Videos will be evaluated based on views, social media interactions and direct feedback from fisherman.

Name: Rebecca Smoak

Co-Authors: Maria Kavanaugh
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Degree: Marine Resource Management Expected Graduation: 2022

Title: **The Effect of Interannual Variability of Phytoplankton Communities off the Oregon Coast on Northwest Fisheries: Analysis through Imaging Flow Cytobot**

Keywords: microscopic organisms, plankton, fisheries, fatty acids

Abstract:
Phytoplankton and microzooplankton are a crucial component of pelagic food webs, responding rapidly to environmental changes, and providing a first step in the acquisition and transfer of macronutrients to life in the ocean. In addition to carbon, phytoplankton provide essential fatty acids and can limit the growth of zooplankton, juvenile and larval fishes, and indirectly limit the growth of other organisms further up the marine food web. Thus their utility as an indicator of ecosystem potential energy is of great interest to marine ecosystem management. The National Oceanographic Atmospheric Administration has tasked researchers with collecting data on the Newport Hydrographic line for better understanding implications of the trophic transfer in marine food webs. Using archived discrete samples taken on the Newport Hydrographic line from 2012 through 2020, the relationship between phytoplankton and microzooplankton community composition and lipid class and fatty acid profiles will be quantified through time at multiple levels of taxonomic resolution. An Imaging FlowCytobot (IFCB) will be used to determine biovolume-based indicators and taxonomic identification of phytoplankton to microzooplankton from archived samples. This instrument provides high taxonomic resolution, precise biovolume estimates, and high potential throughput improving accuracy, spatial coverage, and timeliness of indicator reporting to stakeholders. The role of different environmental drivers on IFCb-based community indicators, and their relationships to fatty acid composition will also be explored in order to determine how plankton community composition responds to environmental change, and how those changes translate to different energy availability to higher trophic levels. Using this novel instrument and the development of lipid-relevant phytoplankton indicators, we hope to understand how changing ocean physical factors reverberate through lower trophic levels to affect energy availability to commercially and ecologically important fisheries and provide a robust indicator of energy availability to inform near-real time fisheries management.

Researcher Name: **Reagan Thomas**

Co-Authors: Ali Helms
Institution: Portland State University
Degree: Environmental Science Expected Graduation: 2023

Title: **Eelgrass Sediment Characteristics in South Slough Estuary, OR**

Keywords: Eelgrass, Sediment, Restoration, Estuary

Abstract:
Seagrasses provide many ecosystem services that support industry as well as diverse coastal habitats. Around the world, seagrasses have declined in recent decades due to stressors linked to global environmental change. Sharp declines in eelgrass (*Zostera marina*) abundance at South Slough have prompted efforts to understand eelgrass stressors in the estuary. Sediment characteristics including organic matter, carbon content, grain size distribution, bulk density, and porosity were investigated and compared with shoot density (eelgrass abundance) data at several sites along the salinity gradient. These data were used to study the sediment characteristics of intertidal eelgrass beds in the South Slough estuary, how characteristics vary between sites along the salinity gradient, and to determine the relationship of sediment characteristics and eelgrass abundance. Results show that eelgrass was present at sites characterized by high percent sand and low percent silt/clay, low porosity and high bulk density, and low organic matter and carbon content. Eelgrass was absent from sites characterized by low percent sand and high percent silt/clay, high porosity and low bulk density, and high organic matter and carbon content. These results appear to suggest that fine sediment can be a significant stressor on intertidal eelgrass in the South Slough estuary. These findings can be used to inform eelgrass restoration efforts in South Slough, especially regarding habitat suitability for replanting.

Researcher Name: Rhianna Thurber

Co-Authors: Andy Szabo, Renee Albertson
Institution: Oregon State University
Degree: M.S. Marine Resource Management Expected Graduation: 2022

Title: **Comparison of mark-recapture and distance sampling as estimators of North Pacific humpback whale (Megaptera novaeangliae) abundance throughout Alaska's Inside Passage as means to inform distinct population segment policy and management**

Keywords: humpback whales, distinct population segments, distance, mark-recapture, ESA

Abstract:
North Pacific humpback whales have been negatively affected in terms of habitat degradation, prey availability, migration patterns, and fecundity. This population has been widely studied through an international collaborative effort called SPLASH to gain a better understanding of their population dynamics. After being divided into distinct population segments (DPS) under the Endangered Species Act (ESA) in 2016, regions throughout the North Pacific witnessed declines in observed sightings over the next several years, especially for cow-calf pairs between the feeding and breeding grounds. Under the ESA, the threatened Mexico DPS was entitled to critical habitat designation by NOAA at the time of the 2016 relisting, however this designation did not come to fruition until 2021 after multiple lawsuits for ESA violations; while the delisted Hawaii DPS has seen continual declines in abundance between migratory habitats since their removal from the Endangered Species List. Utilizing a comparison of mark-recapture and distance sampling, the goal of this project will be to identify and answer whether there is variability in humpback whale abundance between years and establish potential factors that are driving these observed trends. The summer data collection process includes point count surveys as well as ventral surface fluke photo identification. The data is analyzed using DISTANCE and MARK software to evaluate population structure and demographics over spatial and temporal scales. The anticipated results will provide anecdotal evidence supporting observational and unpublished data showing fluctuations in whale abundance on a large scale correlated to documented oscillations in oceanic conditions and prey availability.

Researcher Name: Laura Vary

Co-Authors: Dr. Lorenzo Ciannelli, Dr. Lauren Rogers, and Rebecca Howard
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Degree: M.Sc. Expected Graduation: 2022

Title: **Behavior and Biogeography: Flexibility of Spawning Behavior and Subsequent Impacts on Larval Biogeography in a Large Marine Ecosystem**

Keywords: fisheries oceanography, spawning behavior, climate change, larvae, biogeography, temperature regimes

Abstract:
Variability of marine environments has led to reproductive behavior adaptations that increase the likelihood of survival and recruitment of fishes' early life stages. Some fishes are spatially constrained, relying on physical features of the marine environment for retention of larvae in ideal feeding and nursery areas while others are temporally constrained, relying instead on seasonal hydrographic features for larval transport to favorable areas. Additionally, there is limited understanding of how fish larvae interact with local, identifiable water masses. The Bering Sea, a region of intense environmental variability, provides an interesting case study in which researchers can evaluate reproductive flexibility as it relates to geographic or temporal constraints as well as larval biogeography. As climate change progresses, behaviorally static fisheries may experience more pronounced vulnerability. We sought to examine the interannual flexibility of spawning behavior and the patterns of larval associations of four groundfishes with discrete local water masses in the Bering Sea using generalized additive models (GAMs). We found that the most parsimonious models for spawning behavior were those in which geography varied differently above and below a threshold temperature. Larval biogeography was best explained by models that included a two-dimensional interaction between temperature and salinity, with shape that varied by species. Collectively, these results indicate some flexibility of spawning geography but not phenology, and that larval stages are advected with species-specific water masses. While this research focused on the Bering Sea ecosystem, such analyses can be applied to many ecologically and commercially important fisheries in Oregon and worldwide.

Researcher Name: **Carson Williams**

Co-Authors: Maureen Walczak, Joe Stoner, Angelica Robles-Rivera
Institution: Oregon State University
Degree: Atmospheric Science and Ocean Studies Expected Graduation: 2022

Title: **Correlating Wave Power with Grainsize of Accumulating Sediment: Development of a Paleo Proxy for the Pacific Northwest Continental Shelf**

Keywords: Paleoceanography, Geology, Wave Climate, Sedimentology

Abstract:
Mounting evidence indicates that climate change is impacting the heat budget of the oceans, which in turn has the potential to affect storm intensity and wave power. While observations of increasing storm intensity are now global, some of the earliest buoy evidence for changing wave climate comes from the Pacific Northwest margin, where buoy observations indicate annual average Significant Wave Height (SWH) is increasing at a rate of 1.5 ± 1 cm/yr with winter waves increasing at a faster rate over the past 40 years (Ruggiero et al. 2010). On the PNW margin these current systems are closely tied to the prevailing wave climate (Sternberg 1986). In theory, in the absence of changes in sediment supply, the size of transported grains will scale to the energy of bottom currents, thus offering a potential paleo proxy for prevailing wave climate. Here we analyze ~100 years of depositional history from three sediment cores from the mid-shelf mud belt of the undammed Umpqua River system using grain size of sortable silts and/or weight percentage of sand interpreted on an independent ^{210}Pb chronology. If this approach is successful and an apparent correlation of grain size with wave power is observed, we will be able to extend the independently dated reconstruction of PNW wave climate back ~100 years, improving our understanding of what may drive these changes.

Researcher Name: **Anne Wolke**

Co-Authors: none
Institution: University of Oregon
Degree: Law Expected Graduation: 2022

Title: **Coastal Cultural Resources in the Age of Climate Change: Strengthening the Legal Framework for Historic Preservation**

Keywords: environmental law, cultural resource management, archaeology, Indigenous rights

Abstract:
The cultural and historic resources in Oregon's coastal zone reflect the contribution of many ethnic and cultural traditions and are a product of several millennia of human habitation along the coast of the Pacific Northwest. Today, as a result of catastrophic climate change, these resources are under threat. To address the challenges coastal communities are facing in preserving cultural resources for future generations, the legal framework governing historic preservation should be strengthened to empower local communities, promote public participation, and reinforce Indigenous sovereignty. My research examines the nature of cultural and historic resources in the coastal zone of the Pacific Northwest through the lens of anthropological and archaeological research methods, discusses the existing legal framework for the preservation of cultural and historic resources, and examines potential changes to this framework to fortify laws and policies that bolster Indigenous cultural rights and support coastal communities in preserving resources of historic significance. This paper suggests innovative changes to the Coastal Zone Management Act that could leverage policy change at the state level to drive federal protection of cultural resources. Additionally, it will explore the basis in international law that supports the extension of a requirement for the free, prior, informed consent of Indigenous communities for actions that would impact cultural resources in the coastal zone.

Name: Petra Zuñiga

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Degree: Geology Expected Graduation: 2022

Title: **Links between vegetation, hydrology, and soils in undisturbed and restored wetlands**

Keywords: Restoration, South Slough NERR, Estuaries

Abstract:
Healthy wetland ecosystems provide significant ecological and economic value. Recent efforts to restore impaired wetlands have garnered investment from government and private organizations. However, investment in understanding long-term restoration efficacy remains low. In 2001, the South Slough National Estuarine Research Reserve (SSNERR) began construction to reestablish stream complexity and hydrologic connectivity at Anderson Creek, a freshwater wetland that was converted to farmland in the early 1900s. Data collection shortly after restoration demonstrated that wetland characteristics at Anderson more closely resemble a nearby impacted and unrestored site than one undisturbed by human modification (Brophy 2005). This study investigated the vegetation, hydrology, and soils at Anderson and a nearby undisturbed freshwater wetland (Tom's Creek) within the SSNERR (Oregon) nearly 20 years post-restoration. By comparing plant community composition, water table elevation, and soil characteristics (moisture content, organic matter %, total carbon, nutrients, texture), between sites, this study elucidates information about the relationship between these variables and the long-term recovery of wetland health. Results indicate that moisture content, organic matter %, and total carbon remain lower at Anderson than Tom's, though values have increased since 2005. These results have implications for restoration practices at SSNERR, as staff currently prepare to undertake new restoration projects within the reserve. Further monitoring is needed to determine the long-term impacts of restoration on wetland health and adapt practices for improved restoration success.