

2017 UWaTERS

Capstone Awards and Honors

2017 Mary Cline Undergraduate Research Awardees

- Fontaine, Brendy "Spinules in the Visual Cortex"
- Kennedy, Katherine "The Correlation Between Glacial Melt and Glacial Lakes and the Impacts on the Lake Bathymetry"
- Partridge, Mackenzie "Nemertean of the Caribbean"

2017 Mathematics Awards

- Exceptional Capstone Paper Award - Alexandra Gore
- Exceptional Capstone Presentation Award - Megan Sharp
- Outstanding Senior Award - Kevin Bednar
- Outstanding Junior Award - Emily Hoang
- Outstanding Sophomore Award - Judge Gomez
- Interdisciplinary Award - Victor Fontaine
- Math Community Award - Marion LaRocque
- Math Ambassador Award - Marion LaRocque
- Mathematical Growth Award - Richard Yang

2017 SAM Awards

- Best Poster Presentation (Environmental Science Category): Chris Wu
- Best Poster Presentation (Environmental Studies Category): Racheal Babcock & Robb Todd
- Best Poster Presentation (General Category): Ben McKinnon
- Best Oral Presentation: Jennifer Gonzaga

Abstracts

- **Oral Presentation by Marion LaRocque**

Emissions from wildfires can be estimated from dynamic fuel loadings including litter, duff, and rotten wood. The accuracy and uncertainty of fuel loading estimates are generally not well understood, which is the basis of our research. Fuel loading inventories were taken from multiple sources including the Environmental Protection Agency's 2011 National Emissions Inventory and builds on the Fuel Characteristic Classification System fuelbeds (FCCS). Analysis focused on using maximum likelihood to estimate empirical fuel loading distribution from a vegetation database compiled from these multiple sources. After applying necessary data transformations, we then fit each fuel loading to a multivariate normal distribution. Using the multivariate fit, we can make draws from the

empirical fuel distribution which are then used to estimate emissions under a set of environmental conditions. In this manner, we can evaluate how uncertainty in fuel loading propagates to uncertainty in wildfire emissions estimates. These results will create a more robust method of mapping fuel-loading distributions, producing both point and interval estimates of wildfire emissions.

- **Oral Presentation by Christine Robles**

Dinoflagellate genus named *Alexandrium* contains the largest number of toxic species. The highest number is due to the genus's features – a life cycle including a vegetative phase in which the genus actively swims and divides and the dormant phase in which a cyst is formed. The *Alexandrium* genus is shielded with cellulose known as a cyst wall made of a complex, thick, sticky layer. The issue in this case is that the cysts are continuously identified as a member of the *Alexandrium* genus. In other words, finding the exact species is complicated when based on only morphology. It is thus important to determine the species of *Alexandrium* by examining DNA sequences. The students aimed to determine the species of *Alexandrium* by examining the rDNA sequences of the different species of *Alexandrium* (such as *A. catenella* and *A. tamarense*). This has been accomplished by utilizing protocols of sediment purification, DNA purification, and PCR amplification. DNA sequencing and analysis was also done with the NCBI database, NCBI's BLAST tool and computer software program UGene. The students overall hypothesized and found that amplifying and sequencing part of the rDNA locus of the *Alexandrium* genus resulted in the presence of the *A. catenella* and *A. tamarense* species.

- **Oral Presentation by Jennifer Gonzaga**

The Olympia oyster (*Ostrea lurida*), Washington's only native oyster, was brought to near extinction due to over harvesting from late 1800s to early 1900s. *O. lurida* provide ecosystem services including filtering water, providing habitat, food, and increasing the overall diversity of the ecosystem. Additionally, Olympia oyster populations have failed to recover naturally leading to a need for active restoration. In order to restore the Olympia oyster to healthy population numbers in Puget Sound, WA, larval dispersal and population connectivity of *O. lurida* planktonic larvae need to be studied to provide efficient and targeted restoration for the species. It can be difficult to track larvae due to high larval mortality, small size, and wide range of potential dispersal distances. During the 1-2 week brooding period, trace elements in the natal body of water are embedded into the natal shell during early life development. By following methods of Carson 2010, using trace elemental fingerprinting, it is possible to track planktonic larvae back to predicted natal subpopulations. This was achieved by comparing the chemical signatures of planktonic and brooded larvae using analysis by laser ablation inductively coupled plasma mass spectrometer (LA-ICP-MS). Preliminary results suggests that Central Sound is highly self seeding and is a source of larvae to North Sound. In contrast, we found that North Sound subpopulations have a low retention rate or may not be producing a lot of larvae. It is essential to understand larval dispersal in order to be successful in restoring the Olympia oysters.

- **ANIMAL CARE INTERNSHIP AT NORTHWEST TREK**

Sydney Westerland

Mentor:

By displaying, interpreting and researching native northwest wildlife species and their habitats, Northwest Trek aims to help conserve and educate the public on the importance of each species. Interning at Northwest Trek was a great way to learn about a variety of species to help further my effort in conserving wild populations. As a result of Northwest Trek's goals being closely affiliated with conservation efforts, I learned more about the conservation of species, such as grey wolves. Grey wolves are an important keystone species in Washington and it's important to communicate the conservation efforts to the public. Being able to observe how the zoo keepers communicate with the public on issues surrounding these species was insightful and will be helpful in the future when communicating with the public on conservation efforts. When conserving species, such as grey wolves, it's meaningful to recognize their natural history. Due to wolves living in packs, it's necessary to have more than a few individuals to sustain genetic diversity and allow the growth of the population. It's essential to understand how each species play a part in the ecosystem to conceptualize the long-term goals and effects. After interning at Northwest Trek, I am more aware of what each species embodies and how each one thrives differently in nature. Through animal husbandry and enrichment, I can understand certain behaviors that each species exhibit. With this knowledge, I received a better insight of how to enhance the natural behaviors of certain species. The information I learned while interning at Northwest Trek will be useful when working to conserve certain species, and while communicating with the public on conservation efforts.

- **SUPPLEMENTATION OF HOOD CANAL STEELHEAD AND FRESHWATER SURVIVAL**

Nickolas Dyer

Mentor: Erik McDonald

Puget Sound steelhead populations have been petitioned to be listed as threatened under the Endangered Species Act. Modern hatchery programs have developed to aid the conservation of depleted steelhead populations. Though, controversy has risen in the scientific and public communities on the benefits and risks of modern hatchery practices. One of these practices is releasing hatchery smolt 1 year into their life history in comparison to natural populations that smolt at 2 years. Also, hatcheries offer no sexual selection, which directly effects the genetics of the next generation. A novel supplementation was introduced in this study that released smolt at the 2-year stage and allowed for sexual selection of adult steelhead and determined if novel supplementation has no effect on the survival of steelhead in freshwater during and after supplementation.

Steelhead smolts were captured via rotary screw trap where scale and fin clip samples were taken for age and DNA analysis, and mark and recapture method to determine smolt population. Freshwater survival was calculated using: $\text{Egg to smolt survival} = (\text{smolt population} / \text{estimated egg deposition})$. Data for this study is still being gathered and results will be presented at UWaTERS.

- **CLASSIFYING INDIVIDUALS USING MATHEMATICS**

Benita Beale, Matthew Lyons, Megan Sharp

Mentor: Julie Eaton

The Preparation for Industrial Careers in Mathematical Sciences (PIC MATH) Program engages students in real world research problems. Through this program our team was provided with the opportunity to help a company with an open-ended classification problem. Lenati, a marketing and sales strategy consulting agency, presented our team with survey data that dealt with customer segmentation for one of their clients. After some exploratory analysis of the large data set, our team focused on applying logistic regression as a way of predicting an individual's insurance type using their age, household income, and industry. We will also illustrate the process of building our predictive model and how to assess the errors.

- **ECOLOGICAL RESTORATION OF TITLOW PARK IN SOUTH PUGET SOUND, WASHINGTON TO A NATIVE CONIFER-DOMINATED FOREST SYSTEM**

Tim Allcock, Krystal Hedrick, Keith Bergeron, Amy Bocher, Regan Churchill

Mentor: Cynthia Updegrave

The substantial presence of invasive species at Titlow Park inhibits the ability of the environment to mature into a coniferous forest system. English ivy (*Hedera helix*) and Himalayan blackberry (*Rubus discolor*) thrive in the temperate coastal environment of Washington, but removal of these species and addition of coniferous trees and other native vegetation is expected to encourage the establishment of more diverse flora and fauna. A site assessment was conducted initially in order to determine topography, hydrology, habitat, disturbance, impaired ecological functions, and the likelihood of autogenic repair. A proposal was then developed with detailed goals and objectives, a comprehensive approach, and long-term prospects of a restoration project. In the winter of 2017, native plants were selected based on site environmental conditions and fulfillment of specified goals. A work plan was created for the client which described project approaches, site preparation and planting plans, budgets, timelines, and stewardship expectations. Native plants were carefully selected and planted throughout the late winter and early spring. Finally, in the spring of 2017 a thorough stewardship plan was developed that included post-installation site information, a maintenance and monitoring plan, and a long-term site management plan. An as-built plan and final report

concluded the University of Washington – Restoration Ecology Network 2016-2017 Titlow Park restoration, and with continued community involvement and stewardship training, it is the hope of this team that the ecosystem will begin healing for the benefit of human, plant, and animal life.

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- **IMPLEMENTING GREEN ROOFS ON THE UNIVERSITY OF WASHINGTON TACOMA CAMPUS' BIRMINGHAM BLOCK BUILDING**

Joseph Aguilar, Rebecca Jean Smith, Maryssa Tippet

At the University of Washington-Tacoma, students from different educational backgrounds (Environmental Science, Psychology, and Ethnic/Gender Labor Studies) collaborated and saw particular areas of sustainability the campus could improve on. Implementation of a green roof on the Birmingham Block Building would combat the Urban Heat Island Effect and overtime decrease energy costs, leading the campus to become more environmentally sustainable. Within the confines of the proposal details the material needs, costs, physical environmental impacts, physical building infrastructure

impacts, and psychological benefits. This was the near feasible vision for the campus made by the student collaboration; a social, environmental, and economical positive.

- **IN-DEPTH ANALYSIS FOR UNIVERSITY OF WASHINGTON TACOMA SOLAR POWERED COMPACTING BINS**

Rachael Babcock

The project was developed by analyzing efficient and sustainable use of campus waste, recycling, and composting. It will determine the feasibility of relocating a select number of the five Bigbelly Solar Powered Triple Station collection bins from the Prairie Line Trail (PLT), to more effective and high traffic locations on campus. This proposal will eliminate the need for the overabundance of the unsustainable, exterior purple standard trash bins that do not offer separation of campus waste and recycling. By examining data provided from Stanley Joshua, UWT Campus Facilities Director, we will determine which of the “Bigbelly” solar powered triple bin stations can be moved to more efficient locales and how many standard exterior trash bins can either be permanently removed or relocated. Ultimately, this proposal would include future University of Washington Tacoma (UWT) “Sustainability in Action” and “Eco Art” students to continue with the implementation of this project. The completion of this project will improve proper usage and the aesthetic appearance for the Bigbelly bins, increase campus awareness, and continue collaboration between departments for educational and sustainable missions in the future.

- *Nathan Beseau*

The population here in Tacoma, Washington is ever increasing. Many new job opportunities are arriving, and many people from all directions like Seattle are coming down to live here in Tacoma, Washington. What this means is that more land is required to house more people, more people need more food, and space in general is a commodity. Living in an urban and suburban environment can present many problems for the average person as well as the environment. The issue or problem that our capstone focused on is because of the lack of green space in the University of Washington insects especially ones that are pollinators are either being killed by chemicals, or not being able to populate because of factors like fragmentation. The idea that we have presented for our capstone hopes to battle both of these issues as well as many more. The University of Washington has developed and carried out the idea of Giving Garden. This vegetable and fruit garden has provided fresh organic produce for both the Pantry an organization that gives fresh produce among other items for people that are hungry, and also for homeless population that live here or near the University of Washington Tacoma. The main focus of our capstone project was to create an insect habitat in which encouraged biodiversity in an urban or suburban area to encourage the increase of population of pollinating insects in these urban or suburban settings. The reason why we would increase the population of insects especially in urban or suburban areas would be the increase of yield of produce for the U.W Tacoma Giving Garden also the everyday urban suburban or urban gardener. For these reasons the insect hotel is a necessity not only for the

University of Washington, Tacoma Giving Garden but also can be presented to the everyday gardener.

- **LET'S GET GROWING: GIVING GARDEN**

Stephanie Dickman, Taylor Russell

The beautiful and ever growing University of Washington Tacoma Campus sits in the heart of downtown Tacoma, an urban and fast pace setting. With such a setting, it is refreshing to see the university's sustainability efforts. The Giving Garden serves as one of these efforts. It is a student led garden that provides an outlet for UWT students to get involved and learn about gardening. Currently, there is an issue with student turnover for the garden, leading to an unsustainable future. The goal of this project is to increase awareness of the garden and by doing so, creating more student involvement.

- **OLYMPIA OYSTER (*OSTREA LURIDA*) LARVAL ABUNDANCE IN NORTHERN AND CENTRAL PUGET SOUND**

Axton Bullock

Mentor: Bonnie Becker and Megan Hintz

The Olympia oyster (*Ostrea lurida*) is the only native oyster along the west coast of the U.S. and has been commercially extinct in Puget Sound since the 1940s. Olympia oysters are a beneficial part of the ecosystem by increasing intertidal species diversity through construction of oyster reefs that provide filtration, habitat, and food. Within the last two decades, they have been the subject of restoration efforts in Washington State. It is important to track the oyster in its larval planktonic stage to aid in restoration of the species because, during this stage, bivalves may travel vast distances of coastline as veliger larvae. To better understand larval transport, plankton samples were collected from two bays in Western Washington during the summer of 2015, Fidalgo Bay to the north, and Dyes Inlet in central Puget Sound. Plankton samples were collected weekly for 5 weeks during ebb and flood tides from two different depths in the water column, one meter from the surface and 0.25m from the bottom of the bay at both locations. *O. lurida* larval abundance in plankton samples were hand counted and identified using microscopy. The results indicate a high larval abundance in the ebb tide at Fidalgo bay between June 30 and July 14. In Dyes Inlet there is an abundance peak of larvae in the ebb tide between July 2 and July 9. Larvae were found in both surface and bottom samples at each site. Looking at the densities of oyster larvae in two bays and different tidal conditions can suggest where larvae are dispersing within their natal bays.

- **WILD PUGET SOUND STEELHEAD SMOLTS: IS THEIR MIGRATION TIME CHANGING IN SUPPLEMENTED STREAMS?**

Tanya Eison

Mentor: Erik McDonald

The Puget Sound Steelhead (*Oncorhynchus mykiss*) distinct population segment is currently listed as threatened under the Endangered Species Act. Attempts have been made to increase the population, however traditional hatchery techniques can alter hatchery steelhead behaviors from their wild steelhead counterparts. Because of this, a 16 year study was implemented in 2007 to test if supplementation from new hatchery techniques has any effects on productivity or demographics, life-history, and genetic characteristics of wild Hood Canal steelhead populations during and after hatchery supplementation. Three streams were assessed in this study: Dewatto (supplemented), Tahuya (control), and Little Quilcene (control). A screw trap was used to collect and identify out-migrating salmonids. Weight, fork length, a fin clip, and scales were collected from steelhead, which they use for further genetic sampling. Data will also be analyzed to see if there is a significant change in the migration timing of steelhead that are in supplemented streams. The sampling season is still currently in effect but the results will be available for UWaTERS.

- *Santiago Gonzalez*

Alaxandrium catenella is a dinoflagellate and the species cause of paralytic shellfish poisoning (PSPs) that consist neurotoxins affect to human health and especially to marine wildlife in geographical areas; PSPs can cause lead to death. In addition, *A.catenella* is affected by the environmental factors that affect to its growth of this genus in field population (Bravo et al 2008).It became a seriously problem in the 1920s after a PSP killed six people and more than 100 people got sick in California (Jester et al. 2009). PSPs in many ecosystems affect to Zooplankton and planktivorous fish species and kill Atlactic herring, Argentine mackerel and Atlantic salmon. In addition, PSPs in toxic planktivorous Wsh in Southeast Asia and Papua New Guinea cause of human illnesses and fatalities. PSPs is also found abundance in crabs and lobsters in the US, Canada and Japan (Jester et al. 2009). Relationship between samples of cysts on twenty-four different locations in Quartermaster Harbor, Puget Sound will be studied. Samples will be process and analyzed to find any correlation. Particle size and total organic compounds will be analyzed for every station. Results will be compared to previous studies as well. Maps with results will help to visualize the process as well as the results.

- *Morgan Holman*

Nemerteans are a phylum of soft-bodied coelomate protostomes worms with specialized organ, the proboscis, that is used for prey capture and are known as voracious ambush predators on other marine worms and crustaceans. Several neurotoxins have been extracted from nemertean tissues, including tetrodotoxin (TTX), a paralytic neurotoxin, suggesting a potential role in both prey capture and predator deterrence. TTX is used by a variety of marine animals for defense and is produced by a symbiotic bacterium, *Vibrio alginolyticus*. Past research has demonstrated the presence of TTX on the epidermis and

lining of the intestine in several local species of Nemertean. This research examines the bacterial community of local nemertean species and attempts to identify the presence of *Vibrio* spp. through DNA barcoding. The process with which we analyzed the worms was to rub them onto highly selective agar media that selects for *Vibrio* species of bacteria. Then we tried to use PCR in order to amplify the barcoding gene 16S so that we could compare it to other species in the database.

- *Jean Jensen*

Steelhead populations have been on the decline since the 1980s, caused by a changing climate, degradation of fresh water streams, and the genetic damage due to hatchery practices. In the Hood Canal watershed, there is a 16-year project evaluating the effectiveness of supplementing freshwater streams with hatchery raised steelhead. Instead of raising the steelhead from a brood stock, the eggs are pumped hydraulically from the redds found in nature, collected and then raised in hatcheries. The benefit to this technique is that it allows for the female to choose her mate with the selective pressures she is currently facing. Red pumping allows for more genetic diversity, therefore doing less damage to the gene pool than traditional hatchery practices. Predicting the population size of streams that were supplemented versus control streams using a mark and recapture technique, as well as collecting data on the size and species of fish. This data allowed us to evaluate the stream on its health and the health of the steelhead population size.

- *April Luu*

When you lead a busy life, it's easy to get caught up in stressors. One stressor being that we can get sick from time to time. What if we could create a device that can detect the onset of illnesses early enough that we can combat against it? We have just a device to test for that. We want to create a Fitbit like device that can warn us when illnesses are imminent. With this device, we wanted something that was not completely invasive and can contribute to overall health. For our research, we will be using Fitbit to see if there's a way to correlate illness. Currently we are in the process of approval by IRB board at the University of Washington Seattle with hopes that we can conduct our clinical trials soon.

- **THE IMPACTS OF NEW SUPPLEMENTATION PRACTICES ON STEELHEAD POPULATIONS IN THE HOOD CANAL**

Jade Markley

Mentor: Erik McDonald

Yearlong hatchery programs seem to increase residualism in steelhead, posing several ecological risks including increased competition and predation of wild fish. A new supplementation approach to allow for non-bias sexual selection and mimic natural growth regimes has been implemented to measure its impacts on genetics, demographics, and behavior of wild steelhead populations. This strategy will enable fish to choose their own mates and hold them for two years instead of one. To conduct this study, screw traps

were constructed in three rivers along the Hood Canal including the Dewatto which was supplemented and the Tahuya and Little Quilcene which were control streams. Every day from April 1-June 3, 2017, steelhead smolts were enumerated and fork length, weight, and smolt index were recorded. A different fin clip was made each week for use as a DNA sample and recapture mark. Scales were also collected to estimate age. Because this project is still ongoing, results and discussion will be presented at UWaTERS. Population estimates over the past four years as well as Fulton's condition factor (K) will be analyzed to compare trends of control and supplemented streams and ultimately determine if this new hatchery practice should continue to conserve this threatened species.

- *Ben McKinnon*

This project details a locational analysis completed using ArcMap GIS software to determine the location of a treasure chest hidden by an antiquities collector. The analysis was done by using clues from a poem written by the hider of the treasure that if deciphered correctly will lead explorers directly to the treasure. Some of the clues both within the poem and posted on the authors website yield valuable parameters such as, which state the treasure is in, what elevation the treasure can be found at, and details of unsafe locations of where the treasure is not located. Clues in the poem also include hints only valuable if deciphered correctly, but are otherwise ambiguous. Using a line from the poem as an example: "Begin where warm waters halt." Clues like this could mean anything from a dam, reservoir, hot spring, etc. The definite clues such as containing state and elevation were the first utilized using USGS raster's and a reclassifying toolset within ArcMap software. After this was completed qualitative traits from the more indefinite clues were used by including point features through the interpretation of the clues, then a density analysis was done using these point features to determine where the largest density grouping of point features that overlap with the "green" area on the reclassified elevation rasters.

- **SUSTAINABLE FOOD RESOURCES ON UWT CAMPUS**

Maureen Medrzycki, Jacob Tomashek, Rebekah Taylor

With the student population of University of Washington Tacoma (UWT) expected to grow in coming years, food and drink options must be provided to the student body while maintaining a concern of eco-efficiency and sustainability (social, economic, and environmental) as a priority. According to a survey taken during Winter quarter 2016, students are dissatisfied with the availability, quality and costs of food available on campus. By providing healthier, locally sourced, and environmentally friendly options, the ecological footprint of the campus should be reduced considerably. This move towards sustainable food resources would make UWT's status on par with other UW locations (Seattle and Bothell). Proposed ideas include establishing a food court type environment, have stores serve more items that cater to students' desires while providing more products that are eco-friendly and nutritious, and as a result increase hours of the surrounding stores for the satisfaction of early morning and late night students that have only a few minutes in

between classes. By measuring the satisfaction of students, via surveys and statistics on what is purchased, there is a focus to better prepare UWT for the future. Other factors that will contribute to footprint deduction include conventional and clearly detailed recycling bins on campus, along with a reduction in the amount of foods served in non-compostable containers. Further research will be done to examine which methods can be put forward to meet these goals.

- *Thanh-Thuy Nguyen*

Alexandrium catenella is a dinoflagellate and the species cause of paralytic shellfish poisoning (PSPs) that consist neurotoxins affect to human health and especially to marine wildlife in geographical areas; PSPs can cause lead to death. In addition, *A.catenella* is affected by the environmental factors that affect its growth of this genus in field population (Bravo et al 2008).It became a seriously problem in the 1920s after a PSP killed six people and more than 100 people got sick in California (Jester et al. 2009). PSPs in many ecosystems affect Zooplankton and planktivorous fish species and kill Atlactic herring, Argentine mackerel and Atlantic salmon. In addition, PSPs in toxic planktivorous in Southeast Asia and Papua New Guinea cause of human illnesses and fatalities. PSPs is also found abundance in crabs and lobsters in the US, Canada and Japan (Jester et al. 2009). In this study, I will examine a relationship between samples of cysts on twenty-four different locations in Quartermaster Harbor, Puget Sound. I will process sediment samples with *Alexandrium* cysts present in Quartermaster Harbor. Also, the results will be compared with previous studies and created on a concentration map.

- *Amy Self*

Plastics in the marine environment are a known concern. It is only recently that microplastics (<0.5mm) in marine environments have been studied. Even more recently studied is the deposition of these microplastics into marine sediments. In this research we are looking to quantify and characterize the microplastics found in Puget Sound sediments. Samples were collected using a van Veen grab from various locations within Puget Sound. 17 samples were then processed in the laboratory. This project is part of an ongoing study in partnership with the Washington State Department of Ecology's, Marine Sediment Monitoring Team (MSMT) and the Puget Sound Ecosystem Monitoring Program (PSEMP). This ongoing study will tell us how much and what type of microplastics are in Puget Sound sediments to get a better understanding of their impact on the marine environment.

- *Melissa Stebbins*

Marine invertebrates play a critical role in their ecosystems as both predator and prey. Ribbon worms (Phylum Nemertea) are important predators that structure their marine microhabitat communities. These worms are characterized by their use of a specialized feeding organ, the proboscis, to paralyze and capture prey. Despite their ubiquity in all marine biotopes, most of the world's ribbon worms are understudied and undocumented. We document the nemertean biodiversity found around Carrie Bow Cay, Belize through

DNA barcoding using two markers; the protein coding gene cytochrome oxidase 1 (COI), and the mitochondrial ribosome subunit 16 (16S) to identify nemertean samples to species and populations. Through barcoding we uncovered six new species, three of which are only known from Belize. Two of the new species have identical external morphology and coloration and would not have been recognizable without DNA sequencing. Our results concur with previous estimates of undocumented nemertean biodiversity in the Caribbean. In an era of climate change and ceaseless urbanization, our discovery of new species demonstrates the serious need for both modernization of species identification through DNA barcoding and for biodiversity inventory.

- **DOES PAPAIN CLEAVE MOUSE IgG2b ANTIBODIES?**

Sheerin Sulaiman, Ekaterina Aladjieva, Ryan Brisbin

Mentor: John Finke

Immunoglobulins are key players of the human immune system. The N-terminus of the fragment Fc of the antibody IgG has shown to change during pathological events and is strongly correlated with antibody inflammatory properties. This study focused on trying to determine if an enzyme, such as papain can cleave the F(ab) and Fc fragments of the antibody. Two separate methods were used to manipulate, cleave and expose the 3 fragments of the antibody. The SDS page gel resulted in no cleave of the antibody. However, the Native page gel showed some evidence of cleavage of the IgG. Upon successful digestion of the antibody, the next step is to investigate the protein to protein interaction using two different techniques.

FINDINGS:

1. SDS page gel showed no conclusive evidence of Papain cleaving the IgG
2. Native page gel showed some evidence of Papain cleaving the IgG
3. More studies need to be conducted before the two techniques are used

- **ASSESSING NOVEL TECHNIQUES OF HATCHERY SUPPLEMENTATION ON WILD HOOD CANAL STEELHEAD POPULATIONS**

Nichole Taini

Mentor: Erik McDonald

While hatchery supplementation has been in place for over a century now, there has been an alarming lack of studies conducted on how we can successfully manage wild populations of salmon and steelhead over time. Outcomes of traditional hatchery techniques that have been critiqued include: increased residualism, decreased genetic diversity, along with ensuing negative ecological effects. As Puget Sound Steelhead have been listed as Threatened under the Endangered Species Act since 2007, this study has sought to determine the demographic effects of such hatchery supplementation programs.

The novel techniques addressed include releasing age-2 smolts (as compared to age-1), along with allowing females to choose their mates naturally (as opposed to human chosen). Experimental and control streams were compared to assess the impact on smolt abundance numbers over time, along with marine survival rates. Rotary screw traps were checked daily from April to June and steelhead smolts were individually weighed, measured, along with scales and fin clips taken (for DNA and mark-recapture purposes). To calculate smolt-to-adult abundance (marine survival), a formula of 1.5 redds per female was referenced, in combination with a given sex ratio for each stream. Results will be analyzed, and discussion presented at the time of UWaters event, as data collection for this study is presently ongoing through the month of June 2017.

- *Felicia Thornton*

There are a few issues that as a group we tried to address within the UWT community, these issues include students not being able to focus in class due to lack of food, students not knowing what the school offers to help them succeed. The object of this project was to ensure that every person in the UWT Community has an opportunity to thrive. There were many things that my team and I wanted to accomplish with this project. Some of these things include connecting The Pantry with the Giving Garden and keeping students up to date on what it is that they can access. There were a few obstacles that we came across during this process, we had to contact and communicate with many people and being able to coordinate how it is that these things can be accomplished or where activities can be held. During this capstone my group was able to assess the amount of food coming out of the giving garden, what students can do to be a part of the giving garden, making students aware of The Pantry, as well as working with the community YMCA to teach those students how to cook meals and create in home (Apartment) gardens. Overall this project was a kick-starter for projects to branch off and help as many people in the UWT community to be as successful as possible.

- *Tsehainesh Tilahun*

Marine invertebrates play a critical role in their ecosystems as both predator and prey. Ribbon worms (Phylum Nemertea) are important predators that structure their marine microhabitat communities. These worms are characterized by their use of a specialized feeding organ, the proboscis, to paralyze and capture prey. Despite their ubiquity in all marine biotopes, most of the world's ribbon worms are understudied and undocumented. We document the nemertean biodiversity found around Carrie Bow Cay, Belize through DNA barcoding using two markers; the protein coding gene cytochrome oxidase 1 (COI), and the mitochondrial ribosome subunit 16 (16S) to identify nemertean samples to species and populations. Through barcoding we uncovered six new species, three of which are only known from Belize. Two of the new species have identical external morphology and coloration and would not have been recognizable without DNA sequencing. Our results concur with previous estimates of undocumented nemertean biodiversity in the Caribbean. In an era of climate change and ceaseless urbanization, our discovery of new species demonstrates the serious need for both modernization of species identification through DNA barcoding and for biodiversity inventory.

- **IN-DEPTH ANALYSIS FOR UNIVERSITY OF WASHINGTON TACOMA SOLAR POWERED COMPACTING BINS**

Robb Todd

UWT is Solar Power Hungry for Trash, this project was developed by analyzing efficient and sustainable use of the campus waste, recycling, and composting. By determining the feasibility of relocating a select number of the five Bigbelly Solar Powered Triple Station collection bins from the Prairie Line Trail (PLT), to more effective and high traffic locations on campus. This proposal will eliminate the need for the overabundance of the unsustainable, exterior purple standard trash bins that do not offer separation of campus waste and recycling. By examining data provided from Stanley Joshua, UWT Campus Facilities Director, analysis will determine which of the “Bigbelly” solar powered triple bin stations can be moved to more efficient locales and how many standard exterior trash bins can either be permanently removed or relocated. Ultimately, this proposal would include future University of Washington Tacoma (UWT) “Sustainability in Action” and “Eco Art” students to continue with the implementation of this project. The completion of this project will improve proper usage and the aesthetic appearance for the Bigbelly bins, increase campus awareness, and continue the collaboration between departments for educational and sustainable missions in the future.

- **PLUG LOAD ENERGY USE: FINDING WAYS TO REDUCE ENERGY CONSUMPTION AND SAVE MONEY**

Andrew Watson

The primary goal of this research project was to reduce unnecessary energy use for the University of Washington Tacoma, through implementation of Smart Power Strips where they can be utilized. Our research team had identified target rooms, SCI 106, 108, and 109, which had several computer monitors which were not in use yet were drawing power through plug load consumption. In formulating a plan to mitigate the use of this unnecessary electricity, simultaneously lowering campus costs, as well as lowering the overall carbon footprint, our team had proposed three different Smart Power Strips which could be used in various applications where they deem fit. Timer-equipped, current sensing, and occupancy sensing power strips were highlighted for use, and were proposed to the Director of Facilities to be implemented within these rooms.

- **ANIMAL CARE INTERNSHIP AT NORTHWEST TREK**

Sydney Westerland

By displaying, interpreting and researching native northwest wildlife species and their habitats, Northwest Trek aims to help conserve and educate the public on the importance of each species. Interning at Northwest Trek was a great way to learn about a variety of species to help further my effort in conserving wild populations. As a result of Northwest Trek’s goals being closely affiliated with conservation efforts, I learned more about the

conservation of species, such as grey wolves. Grey wolves are an important keystone species in Washington and it's important to communicate the conservation efforts to the public. Being able to observe how the zoo keepers communicate with the public on issues surrounding these species was insightful and will be helpful in the future when communicating with the public on conservation efforts. When conserving species, such as grey wolves, it's meaningful to recognize their natural history. Due to wolves living in packs, it's necessary to have more than a few individuals to sustain genetic diversity and allow the growth of the population. It's essential to understand how each species play a part in the ecosystem to conceptualize the long-term goals and effects. After interning at Northwest Trek, I am more aware of what each species embodies and how each one thrives differently in nature. Through animal husbandry and enrichment, I can understand certain behaviors that each species exhibit. With this knowledge, I received a better insight of how to enhance the natural behaviors of certain species. The information I learned while interning at Northwest Trek will be useful when working to conserve certain species, and while communicating with the public on conservation efforts.

- *Sarah White*

The Olympia oyster, *Ostrea lurida*, benefits the ecosystem for the health of marine environments. Olympia oysters provide natural filtration and restore complex nearshore habitats. Along the estuarine habitats of Washington State, native oyster populations have been declining. Invertebrates reproduce by producing thousands of larvae to ensure survival of a few. Most larvae will not survive due to natural causes such as predation or advection, or human causes such as poor water quality or ocean acidification. The larval stage is the most mobile form of development, and it determines whether they settle away from where they were reproduced or remain in the same area. Larval identification allows for the study of larval behavior and provides data for environmental organizations as to whether restored populations self-sustain or export new offspring. In this study, we collected samples from Fidalgo Bay, WA from eight stations: five intertidal and three subtidal including three replicates of each sample. Larval samples have been quantified by microscopy and visual identification to describe spatial and temporal distribution of *O. lurida* larvae. Although the results are pending, data is being collected to find out if larvae will be found in intertidal sites near suitable substrate for adult settlement and adult populations. Results will also indicate if their narrow band as adults is due to their settling everywhere and then die when they get bigger, or if they settle only in their narrow band. If successful, restored populations of *Ostrea lurida* will attract fish, invertebrates and other marine organisms throughout Fidalgo Bay and therefore prevent these species from going extinct.

- *Jordan Williams*

Rain water would generally benefits the trees, plants, and animals as far as nourishment. This study was designed based on the fact that the rain water runoff from the roads could contain metals and chemicals that may be hazardous to the soil. In this study, samples were collected from NOAA up by the University of Washington in Seattle and a second site on 518. A smaller version of the bioswell on 518 was built at the WSU Puyallup

location in order to test how the larger scale one filtered the water. Samples of the storm water were then ran through the system and then sent to the lab for metal analysis. Although the results are pending, data is being collected to find out what types of metals and how much of it are being leached in to the soil due to the rain water. Results will indicate the amount of metals and what type of filtration system needs to be in place for the storm water runoff to be more controlled as to not harm the environment around it.

- **SUMMER WATER QUALITY AND IMPLICATIONS FOR FISHERIES MANAGEMENT IN LAKE KAPOWSIN, WASHINGTON**

Christopher Wu

Lake Kapowsin in Pierce County, formed approximately 500 years ago when the Electron Mudflow from Mount Rainer dammed a valley creek, was recently designated Washington's first freshwater aquatic reserve. In light of this new designation, the Washington Department of Natural Resources contracted University of Washington Tacoma staff to collect summertime water quality data to be used in future watershed management decisions. Field sampling was carried out once a month from June to October 2016 at three stations along a lake transect from inlet to outlet. Water samples were collected at surface and near-sediment depths to monitor chlorophyll a, total suspended solids, turbidity, and alkalinity, and in situ vertical profiles of temperature, pH, specific conductivity, and dissolved oxygen were measured. Secchi depth was also recorded and phytoplankton samples were collected by vertical net (20 μm mesh) tows. Elevated chlorophyll concentrations in the water column, coupled with a shallow Secchi depth, give indication of high algal productivity leading to poor light penetration. Consequently, Lake Kapowsin, despite its shallow depth, experiences thermal stratification between June and September due to the inhibited light penetration. This thermal stratification, in concert with the high algal productivity and bacterial aerobic respiration at the bottom of the lake, results in anoxic conditions and reduced pH in the bottom waters. These resultant conditions lead to a release of phosphorus and, to a lesser degree, nitrogen from the sediment. Ultimately, the persistent anoxic bottom waters capped with warmer waters makes the lake more suitable for warm water fish than cold water fish. The elevated productivity and anoxia in Lake Kapowsin is likely due primarily to naturally occurring eutrophication owing to the flooded forest inundated during the creation of the lake.

- **ERROR 404 OYSTER LARVAE NOT FOUND”: TROUBLESHOOTING A MOLECULAR TOOL TO QUANTIFY BIVALVE LARVAE**

Zentner KR¹, McCartha MM¹, Becker BJ¹, Horwith MJ², Smithhisler B¹, Roberts SR³

Restoration of threatened marine invertebrate species necessitates information on cryptic life histories, including the distribution and abundance of the crucial larval stage. The larval stage is the most mobile stage of development, and information on how larvae are interacting with one another, where they are traveling, and how they are surviving gives

insight into whether or not an existing population will be able to continue its restoration after initial aid from an outside organization. Traditionally larval samples have been quantified through visual identification methods that rely on shell morphology. More recently there has been a shift to using molecular methods including DNA extraction and quantitative polymerase chain reaction (qPCR). QPCR is a time efficient and cost effective way to identify species by specific DNA code, which is copied thousands of times and quantified using fluorescent markers. The results, when placed against known standard samples, may determine the abundance of specific larvae in environmental samples. Limited studies have successfully used qPCR with environmental samples due to potential inhibitors within the sample that can influence amplification. In this study, two methods of DNA extraction were tested on native Olympia oysters for qPCR using environmental samples from Puget Sound. Of the two methods, one was a more expensive DNA extraction and isolation kit while the other was a cheaper, modified DNA extraction method using proteinase-K. Preliminary results indicate issues with inhibition in the proteinase-K modified method that could potentially be due to high sediment collected in the samples. The DNA extraction and isolation kit was proven to work, but at a cost 3 times the amount of the modified proteinase-K method. A fast, accurate method of processing environmental samples such as qPCR is a crucial step for successful restoration efforts of marine invertebrates, but cost must also be taken into account moving forward.

- **GLYCAN MAPPING OF IgG ANTIBODIES UTILIZING 2-ANTHRANILAMIDE**

Ryan Brisbin

Mentor: John Finke

Sialic acid (C₁₁H₁₉NO₉) has been shown to have a significant effect on IgG 4G8 antibody's ability to move across the blood brain barrier. Current investigation into mapping the glycan groups on the specified antibody have been undertaken utilizing multiple means, this poster explains the High-Performance Liquid Chromatography utilizing fluorescently labeled glycan groups. Through this research a better understanding can be attained as to how specific glycans can modulate (upregulate/downregulate/normalize) membrane transportation across the blood brain barrier.

- **SIMULATIONS OF PROTEIN UNFOLDING. CAN THEY UNTIE A KNOT?**

Thomas Dahlstrom

Mentor: John Finke

Understanding how proteins fold into their biologically active state is key to identifying the function of proteins from their DNA sequence and also understanding diseases where proteins do not fold correctly.

Big Picture Questions:

Has nature evolved proteins to fold “perfectly”?

Does the protein know when it has folded correctly ?

Is the folded protein the “lowest energy state” ?

- **IMPACTING ANTIBODY MOVEMENT ACROSS THE BLOOD BRAIN BARRIER**

Hali Hill

Mentor: John Finke

We think we know what is going wrong inside the brain (Beta-amyloid forms plaques and sticky oligomers). Unfortunately a cure has been thwarted by the blood brain barrier. We have found a way to increase the amount of time an antibody 4G8 will stay in the brain (add sialic acid). But – it is not know which sialic acids are responsible. This project examines whether sialic acid is present on all of the Fc glycan of 4G8.