SESSION 1B

FROM RIVERS TO THE SEA

Session Moderator: Virginia Armbrust, Oceanography
MGH 082A
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Generating a Geochemical Model Using Collaborative Continuous Data Streams: A Tool to Help Understand the Effects of River Discharge on the Snohomish River Estuary

Satya Fawcett, Senior, Computer Science, Oceanography, Everett Community College
Owen Boram, Senior,
Mentor: Kylie Rexroat, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College
Mentor: Marina McLeod, Mathematics, Ocean Research College Academy

Located in the Whidbey Basin of the northern reaches of Puget Sound, Possession Sound contains the Snohomish River estuary, encompassing a river system that is the third largest contributor of freshwater to the Puget Sound. Myself, and several of my fellow students have had the opportunity to collaborate with the University of Washington, the Washington State Department of Ecology, and a local environmental consultant – Gravity Marine. Utilizing data collected by permanently moored Sea-Bird CTD probes, during research cruises, and by the United States Geological Survey (USGS), my research partner and I have created a model to facilitate an investigation of how both tides and the discharge of freshwater from the Snohomish River influence the water quality of Possession Sound. To better understand the complex patterns of the water entering Possession Sound from the Snohomish River, we analyzed the relationship between a continuous stream of water quality data (temperature, salinity and turbidity) from a Sea-Bird CTD probe at the mouth of the Snohomish River and continuous discharge data gathered by the USGS at a station 12 miles up the river. The distance between these two sites results in a delay between when river discharge data is recorded up river and when it influences the water quality at the river mouth. From the analysis of these two locations and with guidance from ourcollaborators as well as outside professionals, we used the statistical analysis language R to create a model that predicts the travel time of water from the USGS stream gage to Possession Sound. This model can be applied when considering the effect on the estuary of important factors from the river, such as nutrient loading; influxes of cold water, which promotes upwelling; and the river's contribution of heavy metals and other pollutants.

SESSION 1G

PSYCHOSOCIAL AND PHYSIOLOGICAL DYNAMICS OF RESILIENCE AND WELL-BEING

Session Moderator: Judith A Howard, Sociology
MGH 238
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

An Investigation of Gender Effects on the Relationship between Adult Attachment Style and Coping Strategies

Savannah Marie Miller, Senior, Anthropology, Psychology
Lena Lucia Snyder, Senior, Psychology, Sociology
Mentor: Katherine Manbeck, psychology
Mentor: Jonathan Kanter, Psychology

Individuals with ambivalent and avoidant adult attachment styles are more likely to use negative coping strategies such as denial and disengagement, while individuals with a secure adult attachment style are more likely to use positive coping strategies such as reappraisal and support seeking. Certain negative coping strategies are linked with mental health problems such as depression and anxiety. Most research regarding the relationship between coping strategies and adult attachment style has been done on undergraduates and veterans. No research to date has examined gender as a moderator of the relationship between adult attachment style and coping strategies. However, research suggests that both coping strategies and adult attachment styles vary by gender. In the present study, a series of multivariate regression analyses were conducted to determine whether gender moderated the relationship between close, and anxious adult attachment styles and emotional support seeking, and substance abuse coping mechanisms. Participants (N=385) completed self-

report measures of coping strategies and adult attachment styles online. This project may reveal that gender changes the relationship between adult attachment style and coping strategies. This information may help inform psychological interventions for individuals with maladaptive coping strategies and improve our ability to predict who might engage in maladaptive coping strategies.

SESSION 1T

BRAIN FUNCTION, DYSFUNCTION AND REPAIR

Session Moderator: Kathleen Millen, Pediatrics
JHN 175
12:30 PM to 2:15 PM
* Note: Titles in order of presentation.

Evaluating the Presence of Microglia Progenitor Cells in the Adult Mouse Brain
Chloe Netania Winston, Sophomore, Pre-Sciences
Mentor: Gwenn Garden, Neurology
Mentor: Katherine Prater, Neurology

Microglia, the immune cells of the central nervous system, are long lived. In mice, microglia have an average lifespan of 15.5 months. When microglia are experimentally depleted from the mouse brain, microglia populations quickly return to steady state levels. The mechanisms of this observed repopulation are unclear. More importantly, the mechanisms of microglia replenishment in the healthy brain are not well understood. The literature supports two competing hypotheses. One is that microglia proliferate simply by dividing. Another possibility is that pools of microglia progenitor cells within the central nervous system divide and differentiate into microglia. I hypothesize that microglia proliferate primarily through the differentiation of progenitor cells. Available data to date suggest CD133 as a potential marker for microglia progenitor cells. In order to study these putative progenitor populations, I used a genetic reporter mouse line in which administration of tamoxifen induces TdTomato expression specifically in CD133-expressing cells. TdTomato, a red fluorescent protein, allows these cells to be visualized under a fluorescence microscope. Importantly, all the progeny of these cells also express TdTomato, allowing us to determine whether CD133 cells generate new microglia over time. After tamoxifen treatment at the age of 10 weeks, mice were sacrificed at three and nine months of age. Brains were fixed, sectioned, and labeled with antibodies to a microglia specific protein and to TdTomato. Daughter microglia that differentiated from CD133-expressing cells express both markers. Using a fluorescence microscope, I identified several microglia daughter cells of CD133-expressing cells. This suggests that microglia populations replenish in the healthy brain at least in part through the division of CD133-expressing cells. We can apply this new knowledge about how new microglia are generated in the healthy mouse brain to further our understanding of how microglia population dynamics are affected in both health and disease.

SESSION 2D

BIOLOGICAL RESPONSES TO ENVIRONMENTAL FACTORS

Session Moderator: Frieda B. Taub, Aquatic & Fishery Science
MGH 234
3:30 PM to 5:15 PM
* Note: Titles in order of presentation.

The Role of Eelgrass in Heavy Metal Cycling within Possession Sound
Hannah Weinrich, Sophomore, Undeclared, Everett Community College
Mentor: Kylie Rexroat, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College
Mentor: Robin Araniva, Life Sciences, Everett Community College

Eelgrass (*Zostera marina*) is an ecologically important species of marine angiosperm that inhabits sublittoral sediments in the northern hemisphere. Eelgrass beds provide critical food and habitat for many species of fish, invertebrates, and birds. Its root system has the capacity to interact with both the water column and sediment, making it uniquely poised to influence metal cycles within the ecosystem, including those affected by anthropogenic activity. Eelgrass, sediment, and water samples were collected from three sites in Possession Sound, a part of Puget Sound that borders the City of Everett and contains the Snohomish River Estuary. Samples were processed in the University of Washington Isotope Geochemistry Lab before being analyzed for trace metal concentrations using an ICP-MS. In addition, two-meter long sediment cores were taken from three sites in the Possession Sound and the bottom 5cm were analyzed, allowing the researcher to quantify the anthropogenic influence on metal concentrations within sediment. It was hypothesized that the roots, shoots and blades of the eelgrass would exhibit differing concentrations of heavy metals, and that sediment collected within eelgrass beds would contain higher concentrations of metals than sediment collected outside eelgrass beds. Additionally, samples from sites closer to human activity would contain higher concentrations of metals and a greater proportion of metals from anthropogenic sources. Preliminary results of the ongoing study show that concentrations of arsenic, copper, and zinc were higher in eelgrass blades

than roots, and eelgrass tissue had higher metal concentrations than the surrounding sediment. These results suggest that eelgrass uptakes metals from its environment, accumulating as well as translocating them in its tissues. Additionally, study locations nearer to the mouth of the Snohomish River and human activity had higher concentrations of heavy metals overall in both sediment and eelgrass.

SESSION 2D

BIOLOGICAL RESPONSES TO ENVIRONMENTAL FACTORS

Session Moderator: Frieda B. Taub, Aquatic & Fishery Science

MGH 234

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Investigating Trends in the Possession Sound

Kara Anderson, Sophomore, Undeclared, Everett Community College
Mentor: Kylie Rexroat, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Life Sciences, Everett Community College
Mentor: Katherine Dye, Everett Community College

Students of the Ocean Research College Academy (ORCA), an early college program through Everett Community College, have monitored bacteria data near Everett, Washington where the Snohomish River meets the Possession Sound since 2004. Used as an indicator of fecal contamination, *Escherichia coli (E. coli)* are found in the intestinal tract of humans and other homeothermic animals. This study investigates the spatial and temporal trends of *E. coli* levels at three sites within the Possession Sound between 2014-2019 in order to better elucidate the ecosystem's health and potentially negative anthropogenic influences. Variation in coliform levels were analyzed with regard to physical and chemical factors such as tidal stage, depth, the Snohomish River discharge, salinity, temperature, dissolved oxygen, pH, and point sources including combined sewer outflows and storm drains. Water samples were collected with a Niskin bottle while a YSI 650 CTD or a YSI EXO Sonde was utilized to measure salinity, temperature, dissolved oxygen, and pH for each of the samples. ORCA students followed the Coliscan®Easygel®Protocol for inoculation, incubation and quantification. Data were reported as colonies of *E. coli* per 100 mL of water. Preliminary results show that *E. coli* levels have a seasonal correlation with river discharge, increasing in the fall, winter, and spring months when river discharge spikes. Coliform levels are higher at the halocline than at the surface or near-deep. Further sampling at additional upriver sites will demonstrate more sources of *E. coli* data. The results of this study will provide a foundation for understanding the fluctuations in the spatial and temporal trends of *E. coli* levels within the Possession Sound in order to better assess threats to the ecosystem health.

SESSION 2D

BIOLOGICAL RESPONSES TO ENVIRONMENTAL FACTORS

Session Moderator: Frieda B. Taub, Aquatic & Fishery Science

MGH 234

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Interactions Of Heavy Metals, Water Chemistry, And Anthropogenic Activity With Marine Mammal Populations In The Snohomish River Estuary: A Study Of The Whidbey Basin

Elizabeth Lee, Sophomore, Environmental Studies, Everett Community College
Mentor: Kylie Rexroat, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College
Mentor: Robin Araniva, Life Sciences, Everett Community College

The Snohomish River estuary serves as a conjoined and biodiverse body of water in Everett, WA, with influence from the freshwater Snohomish River and saltwater from the Pacific Ocean flowing through the Strait of Juan de Fuca into the Possession Sound. Factors of water chemistry and heavy metals, residing in sediment and influenced by surrounding anthropogenic activity, contribute to the estuary ecosystem and support various trophic levels of marine life. This study observes temperature, salinity, pH, and chlorophyll in the water column, and lead, copper, zinc, and mercury in sediment from 2009 to 2018 at three sites with differing proximity to the Snohomish River: MBT, Buoy, and Everett Marina. The parameters were analyzed through boat-based research and Sea-Bird CTD data collected by the Ocean Research College Academy (ORCA) with funding from the National Science Foundation and in partnership with the University of Washington, Gravity Marine Consulting, and the State Department of Ecology. Longitudinal research at ORCA allows students to monitor marine mammal abundance, including sightings of harbor seals, California sea lions, gray whales and harbor porpoise. This investigation is motivated by potential connections between water quality parameters and the abundance of marine mammals. Results indicate heavy metal levels at Buoy reached a maximum in 2011 with mercury, copper, lead and zinc metals averaging 0.05 mg/kg, 29.73 mg/kg,

7.03 mg/kg, and 54.33 mg/kg, respectively; however, average zinc levels were highest at approximately 55.60 mg/kg in 2016. Comparably, MBT heavy metal concentrations were lower and demonstrated greater variability. In 2018, Everett Marina salinity levels show more fluctuation than MBT, while chlorophyll had a max of approximately 46.4 ug/L at MBT. Gray whales that return to Possession Sound to feed on benthic organisms are potentially impacted by these conditions.