Online Proceedings

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.

Investigating the Biogeochemical Influence of the Freshwater Plume in a Salt Wedge Estuary

Ingrid Phillips, Sophomore, Undeclared, Everett Community College
Mentor: Kylie Rexroat, Ocean Research College Academy, Everett Community College

In Possession Sound, a salt wedge estuary in the Whidbey Basin in Northwest Washington State, interactions between the saltwater of Puget Sound and the freshwater of the Snohomish River create a dynamic environment. Students from the Ocean Research College Academy deployed two Sea-Bird Conductivity-Temperature-Depth (CTD) probes within the estuary to monitor water chemistry in this complex system. A grant from the National Science Foundation supported eleven students to analyze water chemistry data from summer 2018 to increase their understanding of biogeochemical processes in the estuary and communicate their knowledge to the general public. Data from the month of May were analyzed to investigate the river's influence on the temperature and salinity. Lower levels of salinity correlated with peaks in freshwater input as indicated by river discharge data. Salinity also correlated with tide height. To further investigate the spatial influence of the Snohomish River on Possession Sound, this study endeavored to manufacture a Fast Oceanographic Automated Measurement (FOAM) sampler in collaboration with Gravity Consulting. This device uptakes surface water and pumps it over an EXO 2 Sonde to measure surface water chemistry while traveling on a research vessel, associating data with GPS points, to track the freshwater plume. Salinity was used to examine the relationship between the spatial extent of the plume, river discharge, and tidal patterns, and temperature and pH was analyzed to explore the influence of the river. Lower salinity levels were used as indicators of higher freshwater influence. During periods of high river discharge, average salinity values will be lower and the freshwater influence will cover a larger area. During high tides, higher average salinity values are expected and there will be smaller areas of freshwater influence. It is hypothesized that areas of higher river influence will be warmer and more acidic than areas of increased saltwater influence.

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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.

POSTER SESSION 2

MGH 258, Easel 184

1:00 PM to 2:30 PM

The Effects of Isoflurane Exposure, Length of Surgery, and Rest before Hypoxia on Ferret Mortality and Gross Brain Injury

Vivienne Etain Riggs Acuna, Senior, Biology (General), Sociology
Mentor: Thomas Wood, Pediatrics
Mentor: Kylie Corry, Pediatrics
Mentor: Daniel Moralejo, Pediatrics

The most recent National Vital Statistics Report reports that approximately 9.85% of babies in the United States are born preterm, with 72% of those born late-preterm (at 34-36 weeks of gestation). Using neonatal ferrets at age 17 days old, the Juul lab in the Division of Neonatology at the University of Washington Medical Center has developed a preliminary model of brain injury to mimic late-preterm neonatal injuries. In this species-specific adaptation of the Vannucci Model, the left carotid artery is permanently ligated, along with a temporary (4h) occlusion of the right carotid artery. Ferrets are then exposed to periods of hypoxia and hyperoxia. By looking at data and outcomes from our surgeries, I aim to examine the effects of certain surgical parameters on ferret mortality. These parameters include: time the animal is exposed to isoflurane, the length of surgery, and the amount of time the animal is given to recover between surgery and hypoxia. Aside from mortality, I will also analyze the effects of these parameters on respiratory rate after surgery as well as gross brain injury and data from behavioral testing in an attempt to discern the level of injury in living animals and the most common predictors of death in those that died prior to their determined endpoint.

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.

Session 2D

Biological Responses to Environmental Factors

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

MGH 234

3:30 PM to 5:15 PM

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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

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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.

POSTER SESSION 4

MGH 258, Easel 186

4:00 PM to 6:00 PM

Late Behavioral Effects of Early Neonatal Injury in Rats

Simar Virk, Senior, Psychology
Mentor: Pratik Parikh
Mentor: Kylie Corry, Pediatrics

Hypoxic-ischemic encephalopathy (HIE) and inflammatory responses are commonly seen in premature infants which can lead to cognitive delay and behavioral problems. A novel rodent preterm brain injury model is being developed to simulate histological and behavioral changes seen in preterm brain injury. It was hypothesized that injured pups [(*in-utero* hypoxia-ischemia followed by post-natal inflammation with lipopolysaccharide (LPS) + hypoxia + hyperoxia] will have a significant late behavioral deficit compared to controls. The rodent model of preterm brain injury includes: intrauterine hypoxia at embryological day 18, with LPS administration on Postnatal (P) day 2 followed by hypoxia (8% oxygen) and hyperoxia (80% oxygen). In order to assess late behavioral effect of early neonatal injury, I conducted motor tests on rats. The motor testing included: gait analysis via CatWalk XT and Rotarod analysis. For the Rotarod analysis, I performed testing on both, the injured rats and controls, on P28 to test their locomotor ability. Gait analysis was performed on P35. The results will be tested for significant differences between the groups. Future research will be conducted by repeating this experiment to verify these results and clarify what aspects of late behavior are impacted most by this injury model.