UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

# Online Proceedings

## Poster Session 1

**Commons West, Easel 35**

*11:00 AM to 1:00 PM*

### The Relationship between Asthma and Executive Functioning in School Aged Children

*Alexis Dittoe, Senior, Nursing, Oceanography*
*UW Honors Program*
*Mentor: Jennifer Sonney, Child, Family, and Population Health Nursing, UW School of Nursing*

Asthma affects over 6 million children in the United States. Asthma management requires a high level of executive functioning and self-regulation, including attention, planning, problem solving, and self-control. Executive functioning deficits, therefore, may impair asthma management capacity. Therefore, the purpose of this study is to describe the executive functioning of school aged children with asthma. The executive functioning of 33 children ages 6 to 11 years with asthma was tested using the National Institute of Health Toolbox Cognition Battery. The battery assessed numerous executive functioning processes, including attention, inhibition, shifting, episodic memory, working memory, processing speed, receptive vocabulary, and language. Compared to the reference sample, children in this study exhibited significantly lower age-adjusted scores in attention and inhibition $t(33) = 93.06$, $p = 0.001$, shifting $t(33) = 92.64$, $p = 0.003$, and processing speed $t(30) = 82.37$, $p = 001$. They scored significantly higher in receptive vocabulary $t(33) = 113.76$, $p = 0.000$, and language $t(30) = 119.80$, $p = 0.000$. This study revealed significant differences in the executive functioning of school aged children with asthma, specifically deficits in attention, inhibition, and shifting. These functions can be instrumental in the consistent use of controller medications and as a result impact the effectiveness of asthma management. Implications of these findings may include developing asthma management strategies within the capacity of the child. Future studies should explore the possible causes for executive functioning deficits as well as interventions that align with the executive functioning capacity of school aged children with asthma.

## 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.

### Suspend your Disbelief: Variation and Controls on Suspended Sediment Concentration in the Elwha River Nearshore Region

*Anna Weitkamp Boyar, Senior, Oceanography*
*Mary Gates Scholar*
*Mentor: Andrea Ogston, Oceanography*

Suspended sediment in the bottom boundary layer impacts both ecosystems and geomorphology. High concentrations of suspended sediment affect light attenuation, harming benthic plants, and sediment resuspension and transport can affect the distribution and size of sediment on the seafloor. The purpose of this project was to determine the variations and controls on suspended sediment in the Elwha River nearshore region and to find relationships between bed shear velocity and suspended sediment concentration. The 2011 Elwha River dam removal released a large pulse of sediment, giving us the opportunity to study a coastal environment with fine sediment deposits, and varying hydrodynamic conditions. Data collection measured near-bed turbidity and wave conditions, and sediment grab samples were collected to characterize bed conditions. Harmonic tidal analysis was used to predict tidal current velocity. Over the sampling period, on the east side of the river mouth, currents ranging from ˜0 to 100 cm/s and wave heights up to 1.0 m were sufficient to resuspend sediment. Suspended sediment concentrations generally ranged from 1.5 to 25 mg/L. In Freshwater Bay, currents ranging from ˜0 to 31 cm/s and wave heights up to 0.86 m were not sufficient to resuspend sediment. Instead, fine sediment settled out of the water column, resulting in near-bed sediment concentrations generally ranging from 1 mg/L to 101 mg/L. These findings show how variable the processes controlling sediment in suspension can be in a tidal environment with complex morphology.

## 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.

**Understanding the Temporal Variation of Methane Seepage at Southern Hydrate Ridge (SHR) Using Acoustics**
*Bing Yu Lee, Senior, Earth and Space Sciences: Geology, Oceanography*
*Mary Gates Scholar, UW Honors Program*
*Mentor: John R. Delaney, School of Oceanography*
*Mentor: Susan Hautala, Oceanography*
*Mentor: Brendan Philip, Oceanography*

Methane reservoirs are commonly found throughout the world's oceans and the release of methane from seafloor reservoirs is thought to make up 5 to 10% of the global atmospheric methane. In fact, the greatest deep-sea mass extinction in the last 97 Myr during the Paleocene-Eocene Thermal Maximum (PETM) may have been caused by methane release from seep sites along the upper continental slope margin. Recently, methane reservoirs along this margin have been gaining attention due to their potential to accelerate current global warming. Changes in seafloor pressure and temperature could destabilize these seafloor deposits and cause methane bubble plume release into the ocean. At SHR, an extensively studied active seep site located ˜90 km offshore Oregon, discontinuity in methane plume release was observed, but still not well understood. Hence, using Acoustic Doppler Current Profiler (ADCP) and pressure data archived by the Ocean Observatories Initiative (OOI) Cabled Array, we are investigating the potential correlation between tides and the presence of methane plume at SHR. Our study detects methane plume structures based on the proxies of echo contrast caused by acoustic-bubble interaction. By analyzing the derived plume structures and their correlation with 226 tidal cycles, we expect a trend of plume release triggered by low tides. Our study provides the first high-temporal-resolution analysis on the methane plume release at SHR using OOI acoustic data.

## 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.

## POSTER SESSION 2

**Commons East, Easel 64**
*1:00 PM to 2:30 PM*

**Euphausiid Layer Homogeneity in Puget Sound**
*Zeta Lai, Senior, Oceanography*
*UW Honors Program*
*Mentor: Julie Keister, Oceanography*

Euphausiids (krill) are zooplankton that play a large role in Puget Sound's marine ecosystem. They are widespread and numerous and have been suggested to play a large role in energy cycling and food web dynamics. Vertical layering of species is not uncommon, and patterns can persist between years, suggesting a significance to the layering. During the day, euphausiids form deep layers in the water column with a thickness in the tens of meters where ecosystem dynamics may differ between the top and bottom of the layer. These layers can be detected by acoustic systems, but characteristics of individuals cannot be resolved. In this study, we used net tows to sample euphausiids at different relative depths within a layer. We recorded the length, sex, and species for statistical analysis to assess the homogeneity of the layer. Comparisons against other locations in Puget Sound will allow us to see if vertical structures are consistent or if other factors such as the presence of predatory fish can explain for differences. This project will provide insight on ecosystem dynamics and carbon cycling.

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# SESSION 2D

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## 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 Influence of Chlorophyll-A and Sea Surface Temperature on Magellanic Penguin Reproductive Success

*Anna Sulc, Senior, French, Oceanography*
*UW Honors Program*
*Mentor: Dee Boersma, Biology*

Organisms in the ocean depend ultimately on phytoplankton as it is the base of the marine food web. Through the use of satellite imaging, indicators of photosynthesis such as chlorophyll-A are used as an index of primary production in the ocean over large areas and variable time scales. Phytoplankton is dependent on large-scale ocean processes such as water temperature and water column mixing. Such estimates might provide insights in food availability for larger predators that eat plankton eating fish such as the Magellanic penguin. Located on the southeast coast of Argentina, Punta Tombo is among the largest breeding colonies for Magellanic penguins. The Boersma Lab at the University of Washington has studied the colony since 1982 and have determined reproductive success for 35 years. Although many factors influence the overall success of the colony, starvation of chicks is responsible for 40% of chick deaths. Through the use of spatial analysis tools, we have looked at chlorophyll-A patterns and seasonal water temperature variation around Punta Tombo and compared these two variables with reproductive success of Magellanic penguins. We expect a strong positive relationship between the two datasets: water temperature and chlorophyll-A. Further we expect that when values are higher closer to the colony, reproductive success of birds is higher, and parents forage closer to the colony.

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# SESSION 2D

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### Characterization of Benthic Habitat in the San Juan Archipelago and Divergence in Settling Mechanics for Shell Hash

*Elisa Nicole Aitoro, Senior, Oceanography*
*Mary Gates Scholar*
*Mentor: Matthew Baker, School of Aquatic & Fishery Sciences*

Pacific sand lance (*Ammodytes personatus*) are an important forage fish in the Salish Sea that spend large portions of their time buried in sediment. Five important *A. personatus* habitats, including San Juan Channel (SJC), Sucia Island (SI), North Peapod Island (NPI), Salmon Bank (SBnk), and Iceberg Point (IP), have been documented by students in the Pelagic Ecosystem Function apprenticeship at Friday Harbor Labs since 2010. Continued sampling efforts have led to extension of an important time series at these sand wave fields throughout the San Juan Archipelago, as well as three new sites. New sites include Hein Bank (HB), North Waldron Island (NWI), and Puffin Island (PI). Both HB and NWI had *A. personatus* present, while PI did not. A synthesis of data from previous years showed sediment type at Sucia Island and North Peapod Island are most similar to each other, while San Juan Channel and Salmon Bank both have a large variation in sediment type. Shell hash is a prominent portion of many *A. personatus* habitats. Previous studies of these wave fields have treated shell hash as analogous to typical geologic sediments, however this study aimed to examine the divergence of shell hash physical dynamics from what is generally expected. The irregular shape of these biologically-derived sediments leads to a relationship between diameter and minimum settling velocity that is the opposite of what is expected for geologically-derived sediment particles. Of the shell hash tested (n=70), the maximum velocity was relatively consis-

tent, and differences in settling velocity between diameters was seen in minimum velocities. These results have implications for understanding net transport throughout the system where different sediment types are present, understanding how sorting and packing of shell hash impact the habitat quality for *A. personatus*, and how differing amounts of these materials may distinguish these important benthic habitats.

## POSTER SESSION 4

**Commons East, Easel 72**

*4:00 PM to 6:00 PM*

**Testing Modeled Ocean Phytoplankton Fields Using Satellite and Ship-Based Data**

*Bridget M. Ovall, Senior, Oceanography*
*Mentor: Parker MacCready, Oceanography*

LiveOcean is a computer model of the Pacific Northwest Coastal Ocean created by the UW Coastal Modeling Group. It forecasts chemical and biological properties of the ocean much the same way that atmospheric models forecast the weather. One of the many parameters that LiveOcean forecasts is phytoplankton, which form the basis of the marine food web. This study compares LiveOcean forecasts of phytoplankton populations with remote-sensed estimates of chlorophyll concentrations from satellites. The assumption is that satellite sensors, which base their chlorophyll estimates off of the color of reflected light from the ocean, represent something near the true concentration of phytoplankton. To validate this assumption, we obtained ship-based data from NOAA along a frequently sampled line near Newport, OR. Using these two sources for comparison, we were able to get an idea of how accurate the model was. Evaluating over 8-day and 32-day time periods, we started by looking at the continental shelf over the entire geographic range of the model. Then we broke it up into five zones from north to south. What we found was that the model and satellite showed the same general annual pattern of growth and decline, but they differ in many of the specifics. Most notably, the model fails to show the decrease in phytoplankton populations from north to south that satellite observations reveal and has been observed through oceanographic fieldwork. This project provides a basis for future revisions and improvements to the LiveOcean model.