



## Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

## Online Proceedings

**POSTER SESSION 1**

Commons West, Easel 17

11:00 AM to 12:30 PM

**The Effect of Flow on Plankton in the Possession Sound Estuary***Alexa Wied, Sophomore, Bio-Chemical Oceanography, Everett Community College**Rikki Tsoi**Jamie Kisela**Mentor: Robin Araniva, Life Sciences, Everett Community College**Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

Possession Sound is located at the Snohomish River estuary system between Everett and Whidbey Island in the greater Puget Sound. Mixing between fresh and saline water occurs as a result of the river's influence and varying tidal exchange. It was hypothesized that more plankton will be present at North Jetty, a site near the mouth of the Snohomish River compared to Buoy, a site located on the opposite side of the jetty, farther from the river. Therefore, it is expected that the plankton biodiversity of North Jetty will be greater when compared to Buoy. Plankton samples were collected at flood and ebb tide at North Jetty to observe the effects of both location and tide height on plankton biodiversity. At North Jetty, there was a wider variety of phytoplankton and zooplankton species during flood tide while ebb tide demonstrated less biodiversity in a smaller population according to data collected in February of 2013. The data from North Jetty depicts that at flood tide there is a greater influence of salt water flow moving planktonic organisms up river. Gaining an understanding of the effect of flow on plankton in this local area will help strengthen students' understanding of the Possession Sound estuary system.

**SESSION 1H****AQUATIC ECOLOGY AND BIODIVERSITY***Session Moderator: Julia Parrish, Aquatic & Fishery Sciences***248 MGH**

1:15 PM to 2:45 PM

\* Note: Titles in order of presentation.

**Temporal Habitat Usage, Range, and Diet of *Lontra canadensis* in Washington State's Snohomish River Estuary***Anna Russell, Sophomore, Public Health, Everett Community College**Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College**Mentor: Robin Araniva, Life Sciences, Everett Community College**Mentor: Josh Searle, ORCA, Everett Community College*

The North American river otter, *Lontra canadensis*, population is widely distributed throughout the Northern Hemisphere, but has become increasingly rare in some areas due to anthropogenic effects. *L. canadensis* feeds primarily on shallow-water fish. Research has shown that *L. canadensis* feeds on crustaceans, insects, and birds. Feces are deposited in communal latrine sites along with scented mucilaginous material to mark territory. Foundational research was conducted between October 2012 and March 2013 in the Snohomish River Estuary to uncover the population distribution, predominant food sources, and presence of protozoa contaminants near Jetty Island at Everett, WA. Remote camera deployment recorded two individuals frequenting one of the latrine sites centrally located on Jetty Island, however, there have been no cameras deployed on North Jetty. Protozoan presence was not observed in preliminary samples. Thirty percent of collected samples are predominately fish scales and bones, while the remaining samples are crustaceans. Fifty-three percent of otoliths analyzed were *Sebastes* sp., which has been endangered since 2010. This research will help further understanding of the apex predator's behavior and predator-prey relationship in the estuarine system.

## POSTER SESSION 4

**Balcony, Easel 110**

*4:15 PM to 5:45 PM*

### **Marine Bird Distribution during Tidal Stages in Possession Sound**

*Hannah Toutonghi, Sophomore, Biology, Everett Community College*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

*Mentor: Josh Searle, ORCA, Everett Community College*

The wintering migration of marine birds in Possession Sound due to tidal influence is a complex and challenging study. Possession Sound provides habitat for the Pacific Flyway migration of marine birds, and the dynamic estuarine environment influences distribution of these birds due to tidal variation. The working hypothesis of this study was that birds were more active feeding during high tides in the morning hours. The data collected for this study was done by land surveys and small vessel trips along transects on North Jetty Island near the Port of Everett. The species of interest included Bald Eagles, Buffleheads, Common Loons, Double Crested Cormorants, Northern Pintails, and Pigeon Guillemots. The status of recovery from the Washington Department of Fish and Wildlife was compared to data collected. Preliminary data suggests that high tides influence the sandy substrate in Possession Sound, which provides optimum feeding grounds for Buffleheads, Northern Pintails, and Pigeon Guillemots as they have been observed more frequently.

## POSTER SESSION 4

**Balcony, Easel 107**

*4:15 PM to 5:45 PM*

### **Seasonal Effects on Dissolved Oxygen and Temperature in Possession Sound**

*Andras Mihaly, Freshman, Engineering, Everett Community College*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

Possession Sound is a complex estuary system branching off of NE Puget Sound. It is home to an abundance of organisms, primarily birds and mammals, and a multitude of environmental factors which influence them constantly, including the Snohomish River, tides, and anthropogenic factors. Buoy, the station we studied, is one of four stations in Possession Sound used by Ocean Research College Academy (ORCA)

students to collect data on the state of Possession Sound. Its position in the Sound, at the mouth of the Snohomish River, allowed us to analyze data that is more diversified than the information from other stations. We compared dissolved oxygen (DO) and temperature trends from past years at the Buoy station. We found that in the winter of 2012, in comparison to 2010 winter data, the range was less extreme, with DO ranging from 7.58 mg/L at 8 meters and 11.02 mg/L at sea level, while winter data from 2012 showed DO being 11.47 mg/L at 0 meters and 6.91 at 7 meters. Based on our findings at Buoy we can infer that there has been a change in the seasonal conditions affecting DO and temperature between 2010 and 2012, resulting in increasingly extreme ranges of data in the water column. This suggests that DO and temperature trends could develop wider ranges of data in the future if the factors contributing to the increase in variability of the ranges of these two parameters remain prevalent.

## POSTER SESSION 4

**Balcony, Easel 109**

*4:15 PM to 5:45 PM*

### **Heavy Metal Distribution in the Snohomish River Estuary**

*Mayan Shaw, Freshman, Biology, Everett Community College*

*Danica Buse*

*Hannah McCollum, Freshman, Oceanography, Everett Community College*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

Possession Sound is an estuarine system in Puget Sound's northeast arm that is influenced by freshwater input from the Snohomish River. The Snohomish River carries sediments from upriver and deposits them in Possession Sound. Over the past three years, Ocean Research College Academy (ORCA) students have collected sediment samples at specific locations within Possession Sound that are analyzed by Everett Environmental Laboratory for concentrations of various heavy metals: mercury, zinc, copper, cadmium, lead, and arsenic. This area's history of industrial development, including the Asarco Smelter in Everett 1900s, focused our attention on the lead and arsenic concentrations in Possession Sound. The purpose of this research is to discern any changes in concentrations of lead and arsenic observed at three stations within Possession Sound in the last three years. It was hypothesized that the station Buoy would experience greater fluctuations than the other two stations due to its proximity to the Snohomish River. The heavy metal concentrations are expected to be greater in the spring than during the other seasons

because of increased river discharge from melting ice in the mountains, which results in increased stirring of benthic sediments. Dolphin 1 is a shallower location near Hat Island that is expected to have similar fluctuations that correlate with ice melt in the spring. Mukilteo is located farther south in Possession Sound, which would lead to a subtler influence from the Snohomish River, if any at all. Other factors that may impact the concentrations of lead and arsenic at Mukilteo include its proximity to the Mukilteo Ferry, a potential source of runoff containing toxins from human sources.

## POSTER SESSION 4

**Balcony, Easel 105**

*4:15 PM to 5:45 PM*

### **Effects of Ocean Acidification on Planktonic Organisms in Possession Sound**

*Alexis Dittoe, Freshman, Marine Biology, Everett*

*Community College*

*Haley Beranbaum*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

Possession Sound is an estuary system on the North East arm of Puget Sound, where the delta of the Snohomish River is located. Along the shoreline lies a highly industrial and populated area where there are large amounts of CO<sub>2</sub> being put into the atmosphere. Because the ocean is a carbon sink, most of the CO<sub>2</sub> that is put into the atmosphere dissolves in the water, and as a result of the excess H<sup>+</sup> ions the pH lowers, acidifying the water. With the lowered pH, carbonate becomes less available and it could become increasingly difficult for planktonic organisms with calcium carbonate shells to survive, possibly decreasing their abundance at the halocline (depth of rapid increase or decrease in salinity), while the planktonic organisms with silica shells could possibly thrive in this environment because of decreased predation and competition. To study this, pH data was collected using a multiparameter probe, and plankton samples, using a 20 $\mu$ m net and cod end, were collected at the halocline for three consecutive years in the fall (using only November data), to see if a change in pH was followed by a change in the planktonic organisms present. Quantified species include Chaetoceros, Odonotella, Psuedonitscha, Barnacle nauplius, Crab Zoea, Amphipod. The pH ranged from 5.89-7.9. In the data collected, there were more planktonic organisms with silica shells when there were lower pH levels, although more data is needed to rule out other contributing factors. The working hypothesis is, as the pH levels decrease, the planktonic organisms with calcium carbonate shells will decrease.

## POSTER SESSION 4

**Balcony, Easel 106**

*4:15 PM to 5:45 PM*

### **Heavy Metal Legacy in Possession Sound**

*Maddy Jerome, Freshman, Nutrition, Everett Community College*

*Christine Heisen, Sophomore, Undecided, Everett Community College*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

Possession Sound, an estuary system located at the mouth of the Snohomish River in Everett, Washington, is home to a large group of industrial sites which greatly influence the types of runoff affecting the ecosystem. Industrial sites often output heavy metals, which can be dangerous at certain levels, as determined by the Environmental Protection Agency (EPA). Possession Sound is home to three primary industries with historical evidence of leaching copper, lead, and arsenic into the ecosystem: the Everett Naval base, the Kimberly-Clark paper mill, and American Smelting and Refining Company (ASARCO), respectively. We hypothesize that higher levels of these heavy metals will be found in areas close in proximity to the aforementioned industrial sites and combined sewer outfalls. To show these correlations we utilized Washington Department of Ecology 2009 data in conjunction with independent heavy metal sampling at two additional locations: one location offshore, near the historically influential sites and another two nautical miles westward, away from the shore. After collecting samples with a Ponar grab, they were analyzed for heavy metal concentrations through the Everett Environmental Lab per EPA approved methods. Results have shown high concentrations of heavy metals terrestrially, which has caused mandated cleanups of the area. Marine sampling demonstrates a seasonal trend. The concentrations of heavy metals are higher in the spring, correlating with a higher river discharge. Other variables that contribute to these trends include dredging of the river. Should concentrations of heavy metals in the sediments in Possession Sound reach levels deemed unsafe by the EPA, the health of the local aquatic ecosystems may be put at risk through bioaccumulation, particularly near industrial sites.

## POSTER SESSION 4

**Balcony, Easel 108**

*4:15 PM to 5:45 PM*

### **Stratification and Seasonal Trends of Fecal Coliform and Other Bacteria in the Water Column**

*Olivia Navarro, Freshman, Science, Everett Community College*

*Chloe Yugawa, Freshman, Science, Everett Community College*

*Aiden Bernhardt, Freshman, Engineering, Architecture, Everett Community College*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

Possession Sound is a smaller estuary within the northeast arm of Puget Sound, with influence from the Snohomish River. As a result of the watershed runoff into the Snohomish River, fecal coliform and other bacteria are present in the Possession Sound water column. We hypothesized that the most fecal coliform and other bacteria would be found at the surface and halocline (the zone of rapid increase in salinity) of the water column. The density difference would therefore trap the bacteria in or above the halocline. Low salinity surface water from the Snohomish River is the vector of fecal coliform due to warm-blooded animals. To determine the distribution of fecal coliform and other bacteria we referenced historical data from past State of Possession Sound (SOPS) cruises collected by Ocean Research College Academy (ORCA) students at the research station Buoy. The location Buoy is near the Snohomish River and therefore has a strong influence from the river discharge. We tested for fecal coliform at North Jetty (NJ) another location near the river. Using a sediment grab we collected samples of sediment and tested them for fecal as well. River discharge and watershed runoff change seasonally, affecting the depth and strength of the halocline so we categorized the data by season in order to find any correlation. The data shows during times of strong stratification, only a single fecal coliform at the surface, whereas an average of twenty other bacteria colonies were found at the surface. At the halocline there were no fecal coliform, but on average four other bacteria. In the deep layer there were no fecal coliform and on average two other bacteria found. The seasonal analysis of the same data demonstrates that fall months had the highest concentration of other bacteria and winter contained the most fecal.

## **POSTER SESSION 4**

**Balcony, Easel 111**

*4:15 PM to 5:45 PM*

### **Water Chemistry Influence on Diversity and Abundance of Plankton in Possession Sound**

*Roland Upeniks, Freshman, Chemistry, Everett Community College*

*Rien Grootveld*

*Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College*

*Mentor: Robin Araniva, Life Sciences, Everett Community College*

In the Puget Sound marine ecosystem, a large estuary complex located in the Pacific Northwest, plankton species are impacted by both seasonal variations and water chemistry. Salinity and pH data are collected monthly by Ocean Research College Academy (ORCA) students during State of Possession Sound (SOPS) trips, near the urban center of Everett and the Snohomish River delta. We studied salinity and pH data in parallel to plankton samples collected in a vertical tow by a 20 $\mu$  plankton net. By collecting these data at different stations within the Possession Sound subsystem, we are able to compare varied salinity and pH data to account for spatial differences, in tangent with the collected plankton samples. We focused on *Coscinodiscus spp.*, *Pseudonitzschia spp.*, and adult *Copepoda spp.*, for our plankton species, as they were typically the largest populations in every cruise. The data we collected showed that plankton were most numerous within water of a pH between 6.3-6.7 and a salinity of 28ppt-31ppt. Samples collected that strayed from the 6.3-6.7 pH range or went above or below 26-31ppt had either no, or significantly fewer amounts of plankton.

## **POSTER SESSION 4**

**Balcony, Easel 124**

*4:15 PM to 5:45 PM*

### **Validation of Prognostic Biomarkers in Total Tumor Areas on Prostate Cancer Tissue Microarrays**

*Michael Tang, Junior, Biochemistry*

*Mentor: Anthony Rizzardi*

*Mentor: Steve Schmechel, Pathology*

In the United States prostate cancer (PCa) is one of the most commonly diagnosed cancers and estimated to affect 239,000 men in 2013. Although few prognostic biomarkers are currently used in the clinical setting, biomarkers that predict the risk of disease aggressiveness leading to prostate specific antigen (PSA) failure after prostatectomy may assist clinicians in selecting adjuvant therapies following prostatectomy. In studies utilizing co-registered pre-operative imaging data with post-operative pathology data, validated prognostic biomarkers may also be highly useful as "gold standards" against which to train imaging methods to assess disease aggressiveness pre-operatively. We previously identified 33 po-

tentially prognostic biomarkers from the analysis of multiple gene expression datasets and current literature. Using tissue microarrays containing PCa tissue from 170 prostatectomy specimens from men with detailed PSA and follow up data, we quantified immunohistochemical (IHC) staining for these markers within selective tissue sub-regions (malignant epithelium) and identified 16 of the 33 biomarkers which were associated with shorter time to PSA failure. While our aim is to use validated biomarkers to pre-operatively train *in vivo* imaging methods, current imaging capabilities have lower resolution than digital histology and it is unclear whether biomarker expression in total tumor areas (encompassing malignant epithelium, benign epithelium, stroma, and other tissue structures) which are resolvable by imaging methods will also be prognostic. In this study, we have re-evaluated our list of 16 strong candidate biomarkers to determine if IHC expression within total tumor areas are associated with PCa aggressiveness (PSA failure following prostatectomy) using our TMA cohort.