Undergraduate Research Symposium May 19, 2017 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Balcony, Easel 107

11:00 AM to 1:00 PM

Possession Sound Phosphorus Concentration in Relation to Salinity

Emily Martin, Junior, Environmental Science, Everett Community College
Connor Cheney

Taya Shoemaker, Freshman, Biology, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College

Located in the Whidbey Basin, Possession Sound is a body of water within the Puget Sound that is directly influenced by the Snohomish River. Water runoff from rain events takes phosphorus from the soil and eroded rocks, and introduces it into the Snohomish River, which eventually travels into Possession Sound. Additionally, irrigation, agriculture, construction and other human influences on the environment affect the chemistry of the water. Students of the Ocean Research College Academy (ORCA), a Running Start program through Everett Community College, have been collecting water chemistry and nutrient data in Possession Sound for the past ten years. Our research group compiled data from previous years to study the relationship between phosphorus concentration and salinity. Salinity levels were determined by EXO Sonde or YSI 650 and water samples were captured with a Niskin bottle, which were sent to the University of Washington Marine Chemistry Laboratory for nutrient analysis. The data were collected at three different research stations. Two sites are located near the mouth of the Snohomish River and the Port of Everett, while the third is further south and not as directly impacted by the freshwater from the Snohomish River, however there is some freshwater impact due to storm drains near the data collection site. It was hypothesized that, higher phosphate levels would be found in lower salinity water nearest the Snohomish River. Over several years, we expected to see different patterns in phosphorus levels based on Snohomish River discharge. Data and findings from this research project will aid in our understanding on our Spring Quarter research project, which will focus on plankton concentrations in the Possession Sound.

POSTER SESSION 1

Balcony, Easel 104

11:00 AM to 1:00 PM

Investigating the Effects of Freshwater Inputs on the Concentration of Microplastics in Possession Sound

Dylan Krause, Senior, Biology, Chemistry, Marine Science, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College

The appearance of plastic in the world's oceans has increased since the early 1970s. As these plastics get older, they begin to break down and erode, which causes microscopic fibers of these plastics to end up in the ecosystem. These microplastics end up in the world's oceans through runoff and other freshwater inputs. The main issue with these plastics is that they can be toxic to marine organisms. This study can bring awareness to this problem that the world is facing. A localized study in Possession Sound to monitor these microplastics incorporates two components: visual surveys from plankton tows and a targeted sieving of seawater. I hypothesize that there will be higher concentrations of microplastics in areas that are closer to the Snohomish River. The data that is being looked at is from 2013 plankton counts to present day, as well as data that I have collected by pumping surface seawater through three different sieves (with mesh sizes of 60 microns, 150 microns, and 250 microns) for three minutes. With the data collected by plankton counts, the most microplastics were found at a station called Buoy (an area just outside of the Snohomish River) with 42 counted, and the least plastics that were found was at North Jetty (an area that is adjacent to the mouth of the Snohomish River) with one plastic fiber counted. My hypothesis was not supported because there was only one fiber that was found at the mouth of the river, while 42 fibers were counted were counted further away from the river.

POSTER SESSION 1

Balcony, Easel 105

11:00 AM to 1:00 PM

Spatial Variation of Heavy Metal Concentrations in the Possession Sound

Joshua Johnson, Sophomore, Computer Science, Everett Community College
Vienna Canright, Sophomore, Ecology, Wildlife Biology, Animal Behavior, Everett Community College
Kerstin Orkney, Freshman, Engineering, Everett Community College
Zoe Denckla, Non-Matriculated, Marine Biology , Forensics , Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College

The Possession Sound is located in the north Whidbey Basin of the Puget Sound between Whidbey Island and Snohomish County. Due to its proximity to multiple cities and the Snohomish River, both natural and anthropogenic influences can affect the distribution of heavy metals in this area. While normal heavy metal concentrations provide benefits to the ecosystem, anthropogenic sources can result in elevated concentrations, harming the environment. Students at the Ocean Research College Academy (ORCA), a dual enrollment program through Everett Community College, have studied this issue since 2004. A ponar-type sediment grab was deployed from ORCA's research vessel to collect sediment samples, which were analyzed by the Everett Environmental Laboratory using an inductively coupled plasma mass spectrometer (ICP-MS). This study focused on zinc and lead concentrations during 2014-2016 at three sites in the Possession Sound: Dolphin 1, Mt. Baker Terminal (MBT), and Howarth. MBT and Howarth are in close proximity to the coast, while Dolphin 1 is in the middle of Possession Sound. These sites were chosen to investigate whether coastal sites would exhibit increased zinc and lead concentrations due to anthropogenic influences. Results show that mean lead concentrations were elevated in areas closer to the coast, MBT (3.13 mg/kg) and Howarth (3.15 mg/kg), in comparison to Dolphin 1 (2.277 mg/kg). Zinc concentrations didn't follow the same trend; Dolphin 1 had a higher average zinc concentration (27.4 mg/kg) than MBT (22.2 mg/kg) and a similar concentration to Howarth (28.5 mg/kg). While anthropogenic influences appear to dominate the distribution of lead in the Possession Sound, zinc distribution may be controlled by multiple sources. High zinc concentrations at Howarth suggest that Snohomish River outflow may be one of these sources. Future sampling at monthly intervals is necessary to determine if there is a temporal influence and explain outliers in the data.

POSTER SESSION 1

Balcony, Easel 108

11:00 AM to 1:00 PM

Effect of El Niño on the Relationship between Surface Salinity and pH in Possession Sound

Natalie Parry, Freshman, Biochemistry, Everett Community College
Ariel Shiley

Hailey Dearing, Freshman, Astrobiology , Everett Community College
Collin Chung

Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College

This study was conducted by students at the Ocean Research College Academy (ORCA), a dual-enrollment program for high school juniors and seniors at Everett Community College. The study utilized data from the longitudinal State of Possession Sound survey conducted by ORCA students since 2004. Possession Sound is located in the northern reaches of the regional Puget Sound basin, between Everett and Mukilteo, and has a significant freshwater influence from the Snohomish River on its eastern boundary. This study examines the effect of the El Nino weather pattern on the relationship between surface salinity and pH in the Sound at the Buoy site, which, due to its proximity to the river, is directly affected by temporal variation in river discharge. Within an estuarine system pH levels influence the biological processes of many organisms and are critical to the health of the estuary, by regulating the solubility of toxic chemicals. The pH of the Sound is affected by both the salinity of the water and biological productivity. For this study, measurements of surface salinity, pH, temperature, and chlorophyll were taken during the most recent La Nada and El Nino periods, June 2012 to Sept 2014 and December 2014 to June 2016 respectively. Data were collected with various Yellow Springs Instruments (YSI) probes (specifically the YSI 85, YSI 650, and YSI EXO-2 sonde). It was hypothesized that during La Nada, salinity would directly affect pH, with surface pH increasing during summer due to lower river discharge, and decreasing during spring and fall when precipitation and mountain runoff create higher river discharge. During El Nino, it was hypothesized that warmer temperatures and the related decrease in river discharge would cause pH to be more significantly influenced by biological factors, causing a correlation with temperature and chlorophyll instead of salinity.

POSTER SESSION 1

Balcony, Easel 103

11:00 AM to 1:00 PM

Seasonal Variation of North American River Otter (*Lontra canadensis*) Predation on Local Fish Species
Alena Eldridge, Freshman, Marine Science, Everett Community College
Mentor: Robin Araniva, Everett Community College

Lontra canadensis, or the North American river otter, is a member of the mustelid family residing in estuarine and riparian environments such as the Snohomish River estuary system in Everett, WA. Ocean Research College Academy (ORCA) collected *L. canadensis* scat samples near the Port of Everett for dissection and seasonal diet analysis. Past research found that the diet of *L. canadensis* is comprised of fish, crustacean, and avian prey at the mouth of the Snohomish River. Current research to identify prey species in the scat are now underway with the extraction of bony parts for genetic analysis at Shoreline Community College. Other species markers were also determined through the identification of otoliths in the scat itself through dissection and visual analysis. Camera traps were set and monitored weekly using motion sensors at known latrine sites and surface temperature were monitored monthly using a YSI probe. Preliminary genetic results identified *Oncorhynchus gorbuscha*, or pink salmon, during the fall of 2013, demonstrating opportunistic predation on available salmon species during the biennial migration. Other species identified include sculpin and flatfish. Further questions being explored include a correlation with increased consumption of faster swimming fish during colder seasons or with larger groups gathering at latrine sites through camera monitors. Characterization of seasonal, interannual, and social factors affecting the diet of *L. canadensis* can raise awareness of other environmental stressors in the ecosystem, such as fish population changes and changes in prey availability.

POSTER SESSION 1

Balcony, Easel 106
11:00 AM to 1:00 PM

Seasonal Water Chemistry Trends in the Possession Sound
Emma Kadyk, Freshman, Food Science, Everett Community College
Annalee Erickson, Freshman, Political Science, Everett Community College
Tanner Kooistra, Freshman, Undecided , Everett Community College
Katelyn Tanis, Freshman, pre veterinary medicine, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Katherine Dye, Everett Community College

This study compares water chemistry data during different seasons in Possession Sound at a location near Mukilteo. Possession Sound is part of the larger Puget Sound. Entering the Possession Sound is the Snohomish River which creates an estuary, providing critical habitat for numerous species that undergo a wide variety of changing water quality parameters. Studying this area can assist in determining the ecological health of the local marine environment. Water chemistry data were collected by the students of the Ocean Research College Academy (ORCA) program. Long-term data are collected at this location as part of an archival set, however, the authors contributed data in the fall of 2016 through spring 2017. Using multi-parameter water chemistry probes (YSI 650 and EXO2 Sonde), at the top three meters of the water column, pH, dissolved oxygen, and temperature were recorded monthly. It was predicted that pH levels at the surface would decrease and dissolved oxygen would increase during the winter months. This can be expected because temperature and dissolved oxygen have an inverse relationship, so as the surface water temperature decreased, dissolved oxygen amounts increased. By studying these seasonal changes, the correlating alterations to the ecological health of the Possession Sound can be determined.

POSTER SESSION 2

Commons West, Easel 34
1:00 PM to 2:30 PM

The Effect of Temperature on Dissolved Oxygen
Annika Goranson, Sophomore, Environmental Science, Actuarial Science, Everett Community College
Lucas Franz, Freshman, Biology, Everett Community College
Kyle Ness, Freshman, Music Performance, Music Education, Everett Community College
Phillip Stiles, Freshman, Oceanography, Everett Community College
Mentor: Katherine Dye, Everett Community College

The Ocean Research College Academy (ORCA), a running start program in partnership with Everett Community College has been conducting research in the Possession Sound since 2004. Those carrying out this investigation added to ORCA's longitudinal data set in 2016 and 2017. Possession Sound is part of the north Whidbey Basin of the Puget Sound and is bordered by Snohomish County to the east and Whidbey Island to the west. Dissolved oxygen (DO) is an important factor in the survival of many aquatic species, and the loss of these species due to a lack of dissolved oxygen can disrupt the lives of other predatory animals and negatively affect marine industries. As DO levels fall below 4 mg/L, waters become hypoxic which can be fatal to marine life. This study investigates the effect of temperature on DO levels in the Possession Sound from a single site location (referred to as Deep) during 2015 and 2016. Water samples were collected from a

depth of about 20 meters by deploying a Niskin sampling bottle. Then DO and temperature were measured with a YSI-85 handheld instrument. Results show that DO levels are lower in waters with warmer temperature. For instance, a DO level of 7.7 mg/L was observed at 11oC, while a DO level of 4.78 mg/L was surveyed at 12.16oC. These results are attributed to water molecules being less dense in colder water, allowing for more volume to be occupied by dissolved oxygen. This suggests that warmer temperatures in Possession Sound may not be suitable for sustaining diverse and healthy marine life. Since this research only investigated dissolved oxygen at 20 meters deep, it would be of interest to investigate DO levels of surface waters in order to probe the effect of photosynthesis on DO in the future.

POSTER SESSION 3

Balcony, Easel 88

2:30 PM to 4:00 PM

Larval Fish Population Comparison between Eelgrass Beds and Open Water

Jordan Lindgren, Sophomore, Pre-Med, Biotechnology, Everett Community College
Joe Sisneros, Sophomore, Environmental Science, Geology, Oceanography, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College

Ichthyoplankton are a very important aspect of aquatic ecosystems. Larval fish populations can be a determining factor of the overall health of the ecosystem. Rockfish, for example, are known for their long lifespans and low survival rate past the larval stage. For this study, specific locations in Possession Sound were sampled for the presence of larval fish, with a specific interest in the potential presence of larval rockfish. Eelgrass beds are ideal spawning locations due to their sheltering and food source benefits. Therefore, a 500μm plankton net was horizontally towed over eelgrass beds located at southern Whidbey Island and the Mount Baker Terminal (MBT), as well as nearby offshore sites with a minimum depth of 20 meters. It was hypothesized that larval fish populations would be higher at the eelgrass bed sites compared to the offshore sites, due to eelgrass being a favorable habitat for the larval fish. Data collection occurred between the months of February 2017 and April 2017. Preliminary results support the hypothesis with a total of 24 individual larval fish being found in eelgrass beds, and only 12 being found in open water tows. The overarching goal of this study is to help determine whether or not the eelgrass beds in Possession Sound are current homes to larval rockfish. Due to their endangered status it is important to know where larval rockfish thrive in order to know how to protect them in the future.

POSTER SESSION 3

Balcony, Easel 87

2:30 PM to 4:00 PM

The Seasonal Variation of Chlorophyll and pH in Possession Sound

Sloane Spencer, Freshman, BioMed, Biochemistry , Chemistry, Everett Community College
Hannah Aaenson, Freshman, Chemistry, Biochemistry, Neuroscience, Everett Community College
William Keogh, Freshman, Computer Science, Everett Community College
Chase Nielson, Senior, Biochemistry, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College

The meeting of the fresh water from the Snohomish River and the salt water from Possession Sound creates a unique habitat that is important for many species that make up the biodiversity within this ecosystem. The purpose of this investigation was to observe seasonal variation trends from the pH, chlorophyll, dissolved oxygen (DO) and temperature data at the Deep site in the Possession Sound in Everett, Washington. The study was conducted using a Yellow Springs Instrument 85 and Exo Sonde to collect temperature, dissolved oxygen, pH, and chlorophyll data between 0-3 meters in comparison to 7-10 meters in the the water column. It was hypothesized that during the spring and summer months, there will be a higher chlorophyll concentration due to photosynthesis causing an increase in pH and DO throughout the water column. We also predicted during fall and winter months, there will be a decrease in photosynthesis causing a decrease in chlorophyll, pH, and DO. The hypothesis was not supported. There was an inverse relationship between temperature and dissolved oxygen; as temperature was increasing during the summer months, dissolved oxygen was decreasing. When the temperature was decreasing during the Fall and Winter months, there was a increase in dissolved oxygen.

POSTER SESSION 3

Balcony, Easel 89

2:30 PM to 4:00 PM

Salinity and pH Comparisons Between Shallow and Deep Sites in the Possession Sound

Andrew Nielsen, Freshman, Medical Laboratory Science, Biochemistry, Pre-Medical, Everett Community College
Kelsey Bassett, Freshman, Biology, Marine Biology, Everett Community College
Mark Yamane, Freshman, Marine Biology, Everett Community College
Aidan Emmons

Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Katherine Dye, Everett Community College

The Possession Sound is formed where freshwater from the Snohomish River and the salt water from Puget Sound creates an estuarine habitat that supports biodiversity within this ecosystem. Decreases in pH make it difficult for calcifiers to produce their calcium-carbonate shells, thus decreasing their survival rate in a higher acidity environment. Ocean Research College Academy (ORCA) has been sampling water chemistry at multiple sites in Possession Sound for 11 years. This study utilized ORCA data to compare two sites, one near shore and a second in a deep, central location. The purpose of this investigation was to study the pH and salinity trends from 2008 to 2016, considering influence of surface runoff, temperature, river discharge, and climate variations. It was hypothesized that the pH would decrease, becoming more acidic over the eight year period, and the salinity would remain within normal limits. Salinity and pH data were collected in 1-meter increments using a YSI 650 instrument. Initial data demonstrates an inverse relationship between salinity and pH. In 2013, salinity ranged with depth from 22.2-29.5 ppt near shore and 19.2-30.2 ppt at the deep site, correlating with higher surface pH that decreased with depth of 6.8-7.3 near shore and 6.5-7.1 at the deep site. This relationship was consistently demonstrated over the eight-year period, with the exceptions of 2011 and 2015. Further investigations include exploring the impact of climate patterns on the Snohomish River discharge and its influence on pH and salinity trends, as well as looking for seasonal trends in primary productivity of phytoplankton and their impact on temporal and spatial trends.