Undergraduate Research Symposium May 18, 2018 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Balcony, Easel 106

11:00 AM to 1:00 PM

Species and Abundance Variability of Larval Fish in the Puget Sound Eelgrass Ecosystem

Ella Conway, Senior, Ocean Research College Academy , Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Josh Searle, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College

Eelgrass, Zostera marina, is a critical nursery for numerous marine organisms in Puget Sound. A variety of fish species benefit from eelgrass ecosystems, using the blades of sea grass as anchor points to ensure the safety for eggs through larval fish stages. This study compared larval fish densities in eelgrass beds versus offshore from the eelgrass sites. Higher numbers of larval fish are expected to be found in samples collected within eelgrass beds rather than those collected further offshore. A variety of local fish species are expected to be found both within and outside of the eelgrass beds, including forage fish and rockfish. Samples were at three sites of eelgrass beds located in the Possession Sound in Puget Sounds' Whidbey Basin. The samples were collected once a month from December to March with a 500-micron net deployed for three minutes at speed of 1 knot at a depth of 2 to 3 meters below the surface directly over the eelgrass bed and repeated offshore from the site. After collection, the larval fish were extracted and sent to the Shoreline Community College Laboratory for DNA barcoding to allow for species identification. Preliminary data indicates that higher numbers of larval fish were present within eelgrass beds as opposed to the offshore areas. A greater understanding of the important role that these eelgrass ecosystems play as nurseries for larval fish is necessary to provide context and further reason for conservation efforts and general awareness of human impact on these lively nearshore environments. Identification of the larval fish species that inhabit eelgrass beds provides a greater understanding of these species' preferred laying conditions.

POSTER SESSION 1

Balcony, Easel 108

11:00 AM to 1:00 PM

Osprey (*Pandion haliaetus*) Populations, Dietary Habits, and Behavior in the Snohomish River Estuary

Vienna Canright, Sophomore, Ecology, Wildlife Biology, Animal Behavior, Everett Community College
Holden Fox, Sophomore, Ecology, Organismal Biology, Everett Community College
Zoe Denckla, Sophomore, Marine Biology, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Josh Searle, Ocean Research College Academy, Everett Community College

The Possession Sound's Snohomish River Estuary (PSSRE) provides a prime habitat for a large nesting population of North American osprey (*Pandion haliaetus*) in the Puget Sound region. The ospreys that nest in the Possession Sound are migratory, arriving between mid-March and mid-April to nest and leaving between late-August and late-September to winter in Southeastern Texas, Mexico, and Central America. Male and female ospreys migrate separately, with males returning first to prepare the nest and females leaving first to travel farther south. Juvenile ospreys do not make the return migration from their southern winter location until their second spring. As of 2016, osprey attendance reached 24 nesting pairs in the PSSRE. As apex predators whose diets are comprised primarily of fish, ospreys are considered sentinel species for studying contaminant levels in marine environments. Therefore, monitoring behavior, breeding success, and contaminant levels of ospreys can provide a census for the health of the local marine ecosystem. This study will take place on the return of the ospreys to the PSSRE in 2018 and will entail visually surveying the estuary to determine the nesting locations, return rates for both males and females, and dietary habits of ospreys. Past nest locations and populations will be compared to 2018 data. Additional research will utilize a remote camera with pan/tilt/zoom capabilities to observe and record three nest sites near the Port of Everett for nesting behaviors, fecundity, and identification of prey targets for potential heavy metal analysis.

POSTER SESSION 1

Balcony, Easel 107

11:00 AM to 1:00 PM

Concentrations of Heavy Metals in Eelgrass, Sediment and the Water Column

Chase Nielson, Senior, Biochemistry, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College

Eelgrass (*Zostera marina*) is a vitally important organism to the Puget Sound that exists along the shallow, muddy seabed. Many different living creatures of all trophic levels rely on the eelgrass beds to survive and absorbed contaminants could be a real threat. Toxics metals in the eelgrass, sediment and water column could have critical implications to the ecosystem. The heavy metal concentrations in the eelgrass, sediment and the water column of two locations in the Possession Sound (Mukilteo and Buoy) were analyzed in order to determine the specific levels of metals and contaminants that travel up through the trophic pyramid. The study endeavors to determine the metal absorbance ability of eelgrass and check if factors including temperature of the water column, seasonality or time of day influenced heavy metal uptake by eelgrass. A sediment grab was utilized to collect the sediment and eelgrass samples. Sample analyses were conducted at the Everett Environmental Laboratory and in partnership with a University of Washington trace metals laboratory to find the concentration of the metals arsenic, copper, lead, zinc and cadmium in the surrounding water column and the eelgrass. It was predicted that greater concentrations of copper and zinc would be found near Buoy because they are legacy chemicals and due to anthropogenic influences near the Everett Port of Everett. It was also hypothesized that a higher concentration of metals would be found in the eelgrass during the spring and summer as more direct sunlight leads to greater primary productivity and uptake of chemical constituents. Determining these types of correlations and catalysts is significant to the entire Possession Sound ecosystem as it would lead to possible strategies on how to prevent further contamination of eelgrass. Furthering our understanding of the connected network of interactions here can only benefit the future inquiries.

SESSION 1L

SOUND TO MOUNTAINS: WATER, LIFE, AND CLIMATE IN THE SALISH SEA

Session Moderator: Peter Selkin, School of Interdisciplinary Arts & Sciences

MGH 271

12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

The Impact of Water Column Mixing in a Salt-Wedge Estuary

Joshua Johnson, Sophomore, Computer Science, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Josh Searle, Ocean Research College Academy, Everett Community College

The Puget Sound is a complex estuarine system within the Salish Sea, fed by both high salinity water from the Pacific Ocean and freshwater from a number of rivers. The Snohomish River is the second largest input, transporting freshwater from the Skykomish and Snoqualmie rivers to Port Gardner Bay off the coast of Everett. At its mouth, the higher density salt water from the Puget Sound intrudes into the freshwater, forming a salt wedge that causes a highly stratified water column which rapidly changes with the tidal cycle. These mixing dynamics may be the primary driver of biological productivity in the estuarine system. To characterize the density profile relative to tidal patterns and season, current speed and velocity were recorded utilizing a Nortek ADCP. During normal outflow (3,500 fˆ3/s) of the Snohomish River, upward velocities were positive during flood tide and negative during ebb tide, following a typical salt-wedge trend. During a peak outflow event (56,000 fˆ3/s) on October 22nd, this tidal cycle dependence was disrupted and downwelling dominated in the form of negative vertical velocities throughout the water column. In addition, the magnitude of east/west velocities increased during peak outflow. This signaled a period of intense turbulence at the bottom of the water column. During the same time span, data concerning turbidity and chlorophyll levels were recorded utilizing a Seabird CTD. No clear trend was evident in chlorophyll levels at both normal and peak outflow timespans. Turbidity maintained high levels (35 NTU) following peak outflow, possibly reflecting the transportation of sediment from the river bed into the water column. This transportation would be caused by the turbulence reflected in the higher magnitude of the east/west velocity data.

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El Niño Southern Oscillation and pH in the Possession Sound

Collin Chung, Freshman, International Relations, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Josh Searle, Ocean Research College Academy, Everett Community College
Mentor: Robin Araniva, Everett Community College

Possession Sound is a salt-wedge estuary influenced by both sea water entering through the Puget Sound and fresh water entering from the Snohomish River. Regionally, upwelling off the Pacific Coast during spring and summer months brings acidic deep water into the Puget Sound. Locally in the Possession Sound, previous research has shown that seasonal cycles in both temperature and river discharge are the primary influencers of pH. These cycles are affected by the El Niño Southern Oscillation (ENSO) climate pattern, which alternates between a cooling phase (La Niña), a warming phase (El Niño), and a neutral period. The biological processes of many organisms are influenced by pH levels, and few studies have examined interannual pH variation in estuaries. This study seeks to identify the influence of ENSO on pH cycles in two different areas of Possession Sound, based on proximity to the Snohomish River. Surface pH and temperature data were analyzed at two sites, Buoy (closer to the river) and MBT (farther from the river) from January 2010 to September of 2017, using Yellow Springs Instruments and a Niskin Bottle. River discharge data was ascertained from United States Geological Survey data recorded near Monroe, Washington (2010-2017). The hypothesis of spatial variability in pH due to proximity to the river was not supported. Many of the trends at Buoy were the same or more pronounced at MBT, suggesting that the influence of the Snohomish River at Buoy did not make that site more sensitive to ENSO than MBT. Surface pH was more variable at MBT than at Buoy during the summer months, presumably due to eutrophication and subsequent decay during periods of intense biological productivity. Future studies are planned for seasonal variations of biological factors along with dissolved oxygen variation with depth to further analyze these pH trends.

POSTER SESSION 4

MGH 258, Easel 189

4:00 PM to 6:00 PM

Seasonal Variation in Abundance of Nutrients and Heavy Metals Present in Eelgrass Beds

Annika Goranson, Sophomore, Environmental Science, Actuarial Science, Everett Community College
Mentor: Robin Araniva, Everett Community College
Mentor: Ardi Kveven, Ocean Research College Academy, Everett Community College
Mentor: Josh Searle, Ocean Research College Academy, Everett Community College

The focus of this research is on the abundance of nutrients and which non-toxic heavy metals concentrations in estuarine eelgrass (*Zostera marina L.*). Eelgrass beds are an important factor in the marine environment, providing a secure habitat for marine life to forge, obtain shelter, spawn, and stabilize the sediment. Also, eelgrass beds reduce costal erosion, meaning healthy eelgrass beds maintain stability in the marine ecosystem. Nutrients and heavy metal concentration is an important element to eelgrass health. Eelgrass plants rely on nutrient abundance to fuel growth, and non-toxic heavy metals in the sediment are absorbed by the plants. Previous research has shown that productive eelgrass beds reduce coastal erosion and cycle carbon dioxide and nutrients into the surrounding ecosystem, acting as a filter for an estuarine habitat. Data collected by the Ocean Research College Academy (ORCA) between 2009 and 2017 were analyzed. It was hypothesized that phosphate and nitrate in the water column would be most abundant during the cold seasons due to high intake of nutrients during the spring and summer, and heavy metal concentration would be more abundant during the spring and summer due to industrial runoff. Results support the original hypothesis, as the data indicate that the highest nutrient abundance occurred December-February each year. Phosphate levels at Site 1 had an abundance of 2.47 [PO_4] μM in December of 2010, which was the highest phosphate level observed. The lowest phosphate abundance throughout the year occurred during the spring of each year. Arsenic, copper, zinc and lead were found to be the most common non-toxic metals concentrated in the eelgrass, which also appeared to have some seasonal influence, likely do to industrial runoff during the spring .