Spatial and Temporal Trends in Quartermaster Harbor Phytoplankton
Nannette Marie (Nannette) Huber, Senior, Environmental Science, UW Tacoma
Mentor: Julie Masura, Environmental Science, Interdisciplinary Arts & Sciences

The dinoflagellate, *Alexandrium catenella*, a phytoplankton species living within Puget Sound is known to produce harmful algal blooms (HABs) when present in sufficient abundance. *A. catenella* secrete a powerful neurotoxin, saxitoxin, which is known to bioaccumulate in shellfish. Because human death from paralytic shellfish poisoning can occur in as little as 30 minutes after ingesting infected shellfish, state and local authorities monitor mussel populations for their saxitoxin levels. While the toxin levels in Puget Sound are routinely monitored, little is known about the organisms producing the toxin. To better understand the dynamics of *A. catenella* HABs, eight stations in Quartermaster Harbor were sampled approximately monthly since January 2007. Phytoplankton from these samples were identified, enumerated, and archived. To determine if mean phytoplankton populations varied both spatially and temporally, a two-way analysis of variance (ANOVA) was performed. The average phytoplankton abundance was statistically lower in January-February as compared to March-April and May-June. Additionally, a statistically significant difference was found between stations in the outer harbor and the inner harbor. Future analyses will examine species diversity between stations and the environmental parameters that drive these distinctions. Through this research, it is hoped a HAB forecast model can be developed, to help focus local and state monitoring efforts, saving money and helping to ensure public health.

Quartermaster Harbor Monitored Water Properties for 2010
Julianne Marie Ruffner, Senior, Interdisciplinary Arts & Sciences (Environmental Studies), UW Tacoma
Mentor: Julie Masura, Environmental Science, Interdisciplinary Arts & Sciences

Shellfish bed closures in Puget Sound have increased due to saxitoxin, a potent neurotoxin produced by the dinoflagellate *Alexandrium catenella*. *A. catenella* is the primary cause of Paralytic Shellfish Poisoning in the Puget Sound. Quartermaster Harbor (QMH), a bay between Vashon and Maury Islands, has one of the highest documented cyst concentrations of *A. catenella* in the Puget Sound. Since *A. catenella* favors stable water column conditions, water properties (temperature, salinity, conductivity, dissolved oxygen, fluorescence, and pressure) were monitored in 2010. Monthly sampling of seven stations in QMH included a CTD profile with each parameter being recorded at one meter intervals. Cross sections of each CTD profile were created for each parameter to compare monthly sample data. The CTD profiles for each month were then compared to the corresponding monthly meteorological data and collected identified plankton counts. CTD and meteorological data indicate that optimal growing conditions for *A. catenella* took place during the month of June 2010. Prior to the June sampling, the area experienced rainfall followed by warmer temperatures. Plankton samples confirmed the presence of *A. catenella* in June and also in November. Although CTD profiles for November do not indicate that this month presented overall favorable conditions, it did reveal low water column salinity and density levels. Meteorological data show the area experienced rainfall prior to the November sampling as it had in June indicating that fluxes in weather, such as rain and temperature, influence water column conditions. Results of this study are being used to look at meteorological influence on plankton ecology in order to better understand why QMH experiences such a high concentration of *A. catenella*. Applying monitoring data to a model will help predict environmental and climate conditions in our
Spatial and Temporal Microplastic Concentrations in Puget Sound and Chesapeake Bay
Christopher La Rocque, Senior, Environmental Science, UW Tacoma
Mentor: Julie Masura, Environmental Science, Interdisciplinary Arts & Sciences

Plastic debris is found in coastal and marine waters worldwide. The sources and fate of microplastic debris, defined as particles composed of synthetic polymers between 0.3 and 5 mm, in the ocean are unclear. Microplastics may remain buoyant or neutrally buoyant, become fouled and sink, or become bioavailable to benthic fauna. Reports of microplastics in the oceans have increased around the globe. The main issues causing concern are possible ingestion, transfer of pollutants from plastics to organisms and the slow biodegradation of plastics. The objective of this study is to develop and characterize the spatial and temporal variation of microplastics in the Puget Sound and Chesapeake Bay. Samples were obtained with a Manta Net, sieved in the field between 5 and 0.285 mm, and dried in the lab. Samples were then processed with a wet peroxide oxidation and picked for microplastics. It was found that the net tows collected between 0.1 and 25 µg dry weight/L of material. Microplastic concentration ranged from 0 to 0.3 µg-plastic/L with the highest values found in the Thea Foss Waterway in Tacoma, Washington. As mass of plastic per mass of collected solids, Puget Sound data ranges widely from 0.02% to 22%. The highest maximum concentrations were found at areas classified as industrial and urban. Microplastics in the environment have been found to enter ecosystems at all trophic levels, from the microscopic to megascopic. Spatial and temporal data is needed to begin to understand the sources and fate of microplastics in the ocean.

Determination of Carbon and Plastic Fluxes off the Washington Margin
Allison Nicole (Allison) Myers Pigg, Senior, Oceanography
Mentor: Rick Keil, Oceanography

The ocean’s biological pump is an important process that moves carbon in and out of active cycles at the earth’s surface. An integral part of this process, the flux of carbon into the interior of the ocean, is directly affected by the sinking of organic materials. Sinking fluxes vary considerably because they are influenced by such things as proximity to land, rates of local primary productivity, and the efficiency of the bacterial community regenerating (degrading) material in the surface ocean. Sinking carbon fluxes along the Washington Margin are not well understood. The influence of human materials (plastics) on the carbon flux is relatively unknown, but these synthetic materials are estimated to make up between 0.01 - 4.0% of this flux. Sinking organic matter was collected from the region in Autumn 2010 using drifting sediment traps. Flux was analyzed for total carbon, organic carbon and total nitrogen, and the stable isotopic composition of organic carbon was also determined. Land-derived components (lignin phenols) and man-made compounds (phthalate esters) were quantified in order to determine the relative influence of land and human activity on the quantity and composition of sinking material. Lignin polymer and phthalate contributions were analyzed by alkaline CuO oxidation and gas chromatography-time-of-flight mass spectrometry (GC-TOF). By determining these constituents I was able to discern the terrestrial carbon, man-made carbon, and marine carbon contributing to the overall flux into the interior of the ocean from the Washington Margin.

Analysis of Sea Turtle Stranding Data from the Pacific Northwest and Creation of a Field Guide to Stranded Sea Turtles
Josh W. (Josh) Stewart, Fifth Year, Aquatic & Fishery Sciences
Mentor: Julia Parrish, Aquatic & Fishery Sciences

Sea turtles of the family cheloniidae are rare and accidental migrants to the temperate waters of the Pacific Northwest. As such, our understanding of the environmental factors responsible for their sporadic occurrence has been limited by an historical paucity of data and of data collection effort. This knowledge gap prohibits us from assessing whether observed stranding frequencies, in future, present a concern requiring further investigation or mitigative measures. I have sought to compile the first comprehensive catalogue of sea turtle sightings and strandings in Washington and Oregon states and to explore these data for trends in spatiotemporal distribution and the possible influence of environmental correlates such as moon phase, sea surface temperature and prey distribution. Preliminary examinations of 74 stranding events from 1950 to 2010 reveal a strong spatial bias toward regions of high human density, suggesting that recorded stranding frequency reflects observation effort and that many more turtles strand in the Pacific Northwest than have been historically documented. Temporal anomalies of high stranding frequency occurred during the winters of 1989-1990 and 1999-2000, driven primarily by increases in green turtle strandings. Potential causative agents for these events currently being explored include disease, fishery bycatch mortality, and climatic and oceanographic influences. In addition I aim to promote the improvement of data collection efforts through the creation of a globally relevant field guide and identification key to beached sea turtles. The guide is intended to provide protocols for the rigorous compilation of stranding data by volunteer citizen-scientists and will aid in long-term monitoring of coastlines where it is simply not feasible to employ trained scientists at length. The collection of information by volunteers will not only enhance coastline coverage but also educate the general public about sea turtle ecology and conserva-
Flora and fauna in the Puget Sound region have changed dramatically over the last hundred years due to logging, industrialization, and development. One hundred years of sediment history was chosen due to the sedimentation rate in Sequim Bay, and also because that is about the time that the region began to change due to industrialization. Pollen analysis is a valuable way to learn about the paleoclimates of this region and can give valuable insight into the historic landscape. This study is the first one done in the Sequim Bay area, and looks at the pollen distribution of the surface sediment in Sequim Bay. With the analysis of the diversity of the pollen surface samples we hope to see if they relate to the present condition of the watershed. In the summer of 2009, 10 surface sediment samples were collected using a van Veen, and then processed to concentrate the pollen. One hundred individual pollen grains were identified in each sample to determine the concentration and variability of pollen in the bay. Preliminary analyses show that water lily pollen dominated the samples, with a smattering of large conifers and alder. Findings of alder, an early successional species, indicate the clearing of land in the area, a direct result of development in this region. Future work will include palynological analyses of Kasten cores collected during the same field season.