

Catching the impacts of wild steelhead populations and the environment

Madison Benson

Mentor: Erik McDonald

Historic Puget Sound steelhead populations ranged from 325,000 to 800,000 fish. However, factors such as human influence and environmental change have led populations to decline to 13,000. To keep up with supply and demand, fish hatcheries have long been used to supplement depressed populations. Traditional hatchery practices have proven detrimental to wild populations; thus a unique approach is being considered to supplement natural wild populations. Screw traps were used to gather steelhead smolts from two control streams (Tahuya and Little Quilcene), and one supplemented stream (Dewato) in the Hood Canal. Stream habitat was also characterized within different sections (upper, middle, lower) of each stream. This study aims to assess the effectiveness of this novel supplementation technique on wild steelhead populations inhabiting said streams. Data have not been analyzed at this time but will be done prior to the presentation date.

Rhododendron Preserve: A brief look into the health of forests, wildlife, and streams

Andrea Biddle

Site Supervisor: Mindy Roberts, Mountaineers Foundation

Faculty Sponsor: Jim Gawel

The Mountaineers Foundation Rhododendron Preserve, located on the Kitsap Peninsula, consists of 386 acres of protected conservation land. The Preserve is not only home to native and older growth forest and plant communities, but is also a refuge for a variety of terrestrial and aquatic wildlife. Because human disturbances from land development can heavily affect the health of the natural landscape and therefore everything in it, the Preserve needs to be carefully monitored in order to anticipate future potential threats from both land and water. Data in the form of land, wildlife, and water features was collected from several organizations and the results were then compiled into a single summary report that is designed as reading-friendly to the general public. In addition, this compilation of the Preserve acts as a kind of access point which provides researchers with more opportunities in looking for more extensive analysis of environmental parameters.

Titlow Park southern lagoon restoration project

Mary Birchem, Kasie McAfee and Martha Meade

Mentor: Carleen Weebers (REN)

The purpose of this restoration project located within Titlow Park in Tacoma, WA is to improve the park's urban-wildlife setting. The major restoration goal is to enhance the primary productivity of native plants typical of low elevation Puget Sound. The capstone restoration team removed and suppressed invasive vegetation along the southern lagoon. Where invasives were removed, native plants were installed and the bare soil was protected with mulch. This was done to improve diversity and provide food and habitat resources. The capstone team's vision is to keep consistent with the purposes of the park and promote community involvement and stewardship for ecosystem and park health, while maintaining a functional barrier between the park and the lagoon. The team established a monitoring plan to measure the future success of the project. It is anticipated the site will always require maintenance; however, this will provide continuous educational opportunities for the public.

Vertical pallet gardens: a demonstration of alternative gardening techniques

Ryan Brookman

Mentor: Erica Cline

Access to gardening is limited in rental properties due to the inability of tenants to alter the land. Two effective ways of increasing these residents' access to garden space is through community gardens and the use of vertical gardens constructed out of inexpensive, portable materials such as reused shipping pallets. This project involved the demonstration of vertical pallet garden construction during a community event at the Giving Garden on the UWT campus. Prior to the event, 7 shipping pallets were converted into vertical garden planters and used to build the letters "U" and "W". During the event, three teams were guided through the construction of pallet planters which were then used to create a "T" to accompany the "UW" already built. The project's intent was to increase community access to gardening via inexpensive and approachable methods. Additionally, the project sought to increase community awareness of the Giving Garden.

Location analysis for automated vending kiosk machines: Bettery Inc.

William Callow

Mentor: Matt Kelley (GIS)

The proper disposal of recyclable material has become a greater concern with the anthropogenic discoveries in the last decade. Batteries contain metals and toxins that have the ability to leach into the surround environment if not disposed of properly. The purpose of this project is to provide Bettery Inc. with locations for their automated vending kiosks machines that have the capability of taking used batteries for proper recycling, and offer rechargeable batteries to prevent further waste from non-rechargeable batteries. The project was conducted using GIS to analyze Pierce County, Washington for high density battery users in high commercial and easily accessible retail zones. The results from the analysis show areas that met the criteria Better Inc. desired and can be used when making future decisions on where to place their kiosk. Providing these kiosks for battery recycling is a vital step to lessening the negative impact humans are having on our surrounding environment.

Measuring restoration efforts of *Ostrea lurida* using demographic analysis

Ly Dang and Hannah Yang

Mentor: Bonnie Becker

Ostrea lurida (Olympia oyster) provide an essential service to Puget Sound's diverse ecosystem. *O. lurida* provide food, water filtration, denitrification, removal of heavy metals, and habitat for other organisms. The shell height frequency and population density were measured at Fidalgo Bay and Dyes Inlet. The data was recorded in randomly placed quadrats within 2 sections (25m x 30m) at both sites. The results are still being analyzed, but from the data we currently have, there is a high population density and distributed height frequency at Dyes Inlet compared to Fidalgo Bay. *O. lurida* are being introduced around the Sound, and we are making sure that they are able to repopulate and be sustainable on their own. The data and results can help to predict the responsiveness of native oyster populations after years of restoration efforts.

Tricholomas of the Pacific Northwest

Diantha Dougil

Mentor: Erica Cline

One genus of fungi we find in the PNW is *Tricholoma*, native also to Europe and the East Coast of the United States. Most have assumed that based simply on the morphological characteristics of these mushrooms, they are the same species that had been previously described and defined in other parts of the world. However, phylogenetic analysis suggests that many of our native species have either been misnamed and may even exhibit speciation. Because of this, we have been working to genetically describe samples of *Tricholoma* that had previously only been morphologically defined. Two portions of the nuclear ribosomal RNA gene, the internal transcribed subunit (ITS) and large subunit (LSU), have been sequenced using the polymerase chain reaction (PCR) technique for molecular analysis. Results obtained thus far have been compared to published phylogenetic data, revealing possible misnomers and speciation. Further analysis is required in order to assign correct species names to our Pacific Northwest *Tricholomas*.

Characterizing marine microplastics in the surface waters of the Gulf of Alaska

Madison Drescher

Mentor: Julie Masura

Plastic marine debris is found in marine waters worldwide. There has been an increase in the study of microplastics, synthetic polymers < 5 mm, throughout the world. Researchers at University of Washington Tacoma have collaborated with NOAA to establish a baseline of the abundance and spatial and temporal variability of marine microplastics in the Gulf of Alaska, a region of the Pacific well known to be impacted by larger marine debris. This presentation describes the surveys sampled by NOAA from 2004 to 2013. Researchers analyzed the environmental samples using a wet-peroxide oxidation method. The variable concentrations of microplastics in this region's surface water ranged from 0.0 to 100% microplastics in solids and an average concentration of 6.5% microplastics in solids. The general trend is microplastics in the solids increasing from year to year. The results from this study will inform the potential environmental impacts of microplastics in the future.

Department of Fish and Wildlife and City of Lacey Storm Water Maintenance internship

David Edwards

Site Supervisors: Ben Lowry, Clark Creek Hatchery, WA Department of Fish & Wildlife

Faculty Sponsor: Joyce Dinglasan-Panlilio

The effects of supplementation on Hood Canal steelhead

Brittany Eisel

Mentor: Erik McDonald

Historic Puget Sound steelhead populations ranged from 325,000 to 800,000 fish. However, factors such as human influence and environmental change have led populations to decline to 13,000. To keep up with supply and demand, fish hatcheries have long been used to supplement depressed populations. Traditional hatchery practices have proven detrimental to wild populations; thus a unique approach is being considered to supplement natural wild populations. Screw traps were used to gather steelhead smolts from two control streams (Tahuya and Little Quilcene), and one supplemented stream (Dewato) in the Hood Canal. Stream habitat was also characterized within different sections (upper, middle, lower) of each stream. This study aims to assess the effectiveness of this novel supplementation technique on wild steelhead populations inhabiting said streams. Data have not been analyzed at this time but will be done prior to the presentation date.

Identification of atrial fibrillation

Kirnjit Ghag

Site Supervisor: Kathleen Smith, Assistant Manager, Ambulatory Surgery Center, Group Health Cooperative, Tacoma, WA
Faculty Sponsor: Jutta Heller

Heart disease is the leading cause of death for both men and women: about 610,000 people die of heart disease in the United States every year. Heart disease can range from heart attacks to atrial fibrillation. Atrial fibrillation is when an individual has an irregular heartbeat. Having a regular heartbeat is important as it delivers oxygen to the heart, which allows it to function properly. At an internship with the Group Health Cooperative Ambulatory Surgery Center in Tacoma, the student was able to watch two cardioversions - one of the treatments for patients with Atrial Fibrillation. To prepare patients for cardioversions, the student was responsible for calling the patient in, getting them dressed, and taking their vital signs (blood pressure, temperature, pulse, and oxygen level). This internship taught the student skills that she will use in her future career as a cardiologist.

Fish consumption and water quality standards for surface waters of the State of Washington: A review of the regulatory impacts in Federal Way

Maggie Gipson

Site Supervisor: Daniel Smith, City of Federal Way Water Quality Coordinator
Faculty Sponsor: Jack Vincent

Per the 1972 Clean Water Act, the Environmental Protection Agency in conjunction with state agencies are responsible for enforcing standards of surface water quality to maintain human and environmental health. In the Washington State Department of Ecology's recent triennial review of the State's water quality standards and after a comprehensive stakeholder's public involvement process, a policy brief revising Washington's standards was released by Governor Inslee on July 9, 2014. Included were changes associated with basing the surface water quality standards, in part, on an updated human fish consumption rate. The new figures, included in the brief, were suggested for use in calculating surface water quality criteria for toxics. Through literature research, in addition to phone and in-person interviews with various stakeholders, it was determined that numerous economic, social, and environmental impacts associated with new standards must be considered to ensure that Federal Way's and Washington's businesses, residents, and ecosystems thrive.

Consumer chemicals in Puget Sound: June 2013

Donny Glaser

Mentor: Joel Baker

Contaminants of Emerging Concern (CECs) are anthropogenic compounds with varying uses such as stimulants, pesticides, and pharmaceuticals. Most CECs are not monitored or regulated; accordingly most Wastewater Treatment Systems do not remove CECs as they pass on into the environment. CECs in the environment have been shown to have an array of detrimental human and ecological effects despite low environmental concentrations. This study analyzed surface water samples collected across Puget Sound on June 21-23 2013 for CECs in aqueous phase and adsorbed onto Solid Particulate Matter (SPM). The partitioning of analytes was studied between aqueous and SPM phase within Puget Sound, with Atrazine, Ethylparaben, Ibuprofen, Methylparaben, Propylparaben, and Sulfamethoxazine exhibiting $\geq 50\%$ of their total concentration in the SPM phase. This study also shows differences in frequency and concentration of CECs between Puget Sound and San Francisco Bay USA.

Development of fluorescence test for prions in yeast cells

Jonathan Habeeb-Ullah

Mentor: John Finke

The purpose for this experiment was to find out whether prions within yeast cell correlate with the yeast color phenotype. The hypothesis was the red yeast cells do not produce the prions while the white yeast do. To test for the presence of the prions, cells were sonicated and added to a fluorescent solution, Thioflavin T (ThT), that increases in signal with prions. Within this experiment the findings were not as expected. The results showed the red yeast cells had slightly higher ThT fluorescence although the differences were statistically marginal. It is unclear if this was due to interference from biological material or different lysis efficiency between red and white strains of yeast. In addition, the ThT test may not be sensitive enough for this application. Further work is necessary to determine these answers.

Greenhouse for labs

Phaneal Haimanot

Mentor: Kim Davenport

The Greenhouse for Labs project is designed to grow and maintain plants that are commonly used for labs through the utilization of UWT rooftop greenhouse instead of them being bought quarterly. The project aims to provide readily available plants to science labs and has financial and sustainable incentives. Results showed that the University could save between \$76.80-\$115.20 per year from plant purchases, reduce the carbon footprint by removing drives to pick up plants which were found to be 9 to 14lbs per round trip, and create a more sustainable science lab. The Greenhouse for Labs project has the potential to provide an effective solution to a campus sustainability issue and initiate the use of the UWT greenhouse.

Finding Bigfoot: a habitat analysis

Tiawania Harris Dalton

Mentor: Matt Kelley (GIS)

How can the existence of a species be proven without traditional physical evidence being present? This was the question that inspired this study. Based on habitat suitability theory and ecological niche theory; a presence-absence interpretation of geolocated data from BFRO was spatially analyzed to complete a habitat analysis based on the potential ecosystem needs of a large omnivorous mammal in order to determine the areas in Washington State that Bigfoot might call home. By analyzing the densest areas of visual sightings and the presence or absence of certain species or ecosystem needs, Bigfoot's niche or the edge of its niche was hypothesized.

Biogeographic patterns of planktotrophic, indirect-developing nemertean larvae, of the Southern Ocean

Kristi Kilgore

Mentor: Megan Schwartz

Antarctica is surrounded by a complex and unique environment and is thought to be a biogeographic barrier to species dispersal due to oceanographic and physical factors. The continental shelf of the Antarctic plate is vastly understudied due to the difficulty of access, however, when biodiversity is sampled, a unique fauna emerges. This research seeks to understand the biogeographic patterns of ribbon worms (phylum Nemertea) possessing an indirect-developing larva, the pilidium, in its life history. This study provides a summary of the nemertean species found around Antarctica and their biogeographical patterns. Our results demonstrate that commonly occurring species of nemerteans with pilidium, are dispersed around the continent and their populations are genetically connected. This pattern was documented through DNA sequencing of COI and 16sRNA and examined phylogenetically with haplotype network analysis. This further

contributes to our understanding species biodiversity and biogeography as we documented the geographic range of multiple species.

Determining sources of nutrients in a shallow, eutrophic, kettle lake in Lakewood, Washington

Corey King

Mentor: Jim Gawel

Lake eutrophication is a natural process that occurs slowly over thousands of years. However, this process can be greatly accelerated by human influences. Waughop Lake, a small, shallow, kettle lake located in Lakewood, Washington, has been drastically impacted by agricultural and residential pollution sources for more than a hundred years. As the first half of a year-long study, water quality, groundwater, stormwater and waterfowl were investigated to determine sources of nutrients to the lake. Preliminary results suggest that the lake is phosphorus limited. Groundwater was easily the largest source of water for the lake, entering primarily through the southwest corner. Groundwater also exceeded precipitation and waterfowl in load of nutrients to the lake, accounting for 65.6% of total phosphorus and 96.9% of total nitrogen. As the hypolimnion has begun to become anoxic, the remainder of the study will also investigate the role of sediments as a nutrient source.

Biodiversity and geographic distribution of Antarctic hoplonemertean ribbon worms.

Constance Kuhnly

Mentor: Megan Schwartz

The continent of Antarctica has a unique biota due to its isolated habitats and extreme climatic conditions. Ribbon worms, a phylum of animals which possess a unique feeding appendage called the proboscis, are prominent members of the benthic community of the Southern Ocean. It is not known, however, how many species are present and if there are areas of endemism in each particular sea of the Southern Ocean. I used DNA sequence barcodes for 16S rDNA to identify unique hoplonemertean lineages and mapped their geographic ranges. I found five unique lineages, some of which are potentially new species, and one of which is distributed around Antarctica. In addition several lineages seem to be endemic to the Weddell Sea and/or the Antarctic Peninsula. This data is the first record relating to biogeographic patterns in the Southern Ocean.

Detection of perfluorinated compounds in household dust samples from Vancouver, Washington

Thao Le

Mentor: Joyce Dinglasan-Panlilio

Perfluorinated compounds (PFCs) are manmade chemicals that are used as water repellent; these compounds get into human bodies by ingestion of contaminated foods, including drinking water and inhalation of dust. PFCs can affect lungs, nervous systems, the reproductive rate, behavior and memory in many species. This study was performed to determine the concentration of PFCs, especially the perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) in dust samples in Vancouver, Washington State, USA. PFCs were extracted from the dust using acetonitrile and analyzed by chromatography-mass spectrometry. The average concentration of PFOA and PFOS were 109ng/g and 78 ng/g with a range from 66 to 223 ng/g and 43 to 155 ng/g respectively. Even though these averages of PFCs were much lower than the findings in 2008 of household dust samples from Ohio and North Carolina USA, other findings show consumption of more than 0.3 ng/g of PFOA or PFOS is harmful for humans.

Route to nowhere: Seattle's transportation Infrastructure

David Lee

Mentor: Matt Kelley (GIS)

The greater Seattle-Tacoma-Bellevue region is a convoluted web of overlapping public transportation options. A number of bedroom communities emerged around the Puget Sound area after Seattle's founding, and a lack of foresight led to contemporary traffic congestion concerns that stymie growth. The 1890s once had but dismantled an inter-city electric railway and in the 1970s local voters rejected federal funding for a transportation network, yet nearly half a century worth of planning, projections, and budgeting barely begins to approach the scale of those networks by 2035. By interpolating census data and numerous network analyses, this GIS project evaluates the efficacy of the existing systems, proposed and funded expansions, and the various modes of transportation infrastructure. Based on an index of factors, various routes were considered for their ability to serve both the underprivileged and how effective they might be in making mass transit a preferable alternative for would-be drivers.

Supplementation and habitat Impacts on wild Hood Canal steelhead populations

Ashley Loudermilk

Mentor: Erik McDonald

Historic Puget Sound steelhead populations ranged from 325,000 to 800,000 fish. However, factors such as human influence and environmental change have led populations to decline to 13,000. To keep up with supply and demand, fish hatcheries have long been used to supplement depressed populations. Traditional hatchery practices have proven detrimental to wild populations; thus a unique approach is being considered to supplement natural wild populations. Screw traps were used to gather steelhead smolts from two control streams (Tahuya and Little Quilcene), and one supplemented stream (Dewato) in the Hood Canal. Stream habitat was also characterized within different sections (upper, middle, lower) of each stream. This study aims to assess the effectiveness of this novel supplementation technique on wild steelhead populations inhabiting said streams. Data have not been analyzed at this time but will be done prior to the presentation date.

Pierce County watershed analysis project: an examination of impervious cover and TMDL

Shirley Low

Mentor: Matt Kelley (GIS)

The purpose of this GIS (Geographic Information Systems) project is to provide a data-modeled cartographic reference of Pierce County watersheds along with an analysis of specific topographic features and ground cover issues that may contribute to increased surface water runoff and decrease the capacity for natural ground filtration. The evaluation of proximity and slope between highly impervious parcels and non-attainment of Total Maximum Daily Load (TMDL) has been constructed utilizing known 303d list water bodies. Through spatial analysis, this study has set out to determine whether a positive pattern exists in a multiple variable setting in which slope, percentage of impervious cover, and proximal factors are assessed in relation to 303d water bodies. The overall goal for this project was to provide baseline data for these variables and to provide a static watershed model and map to facilitate surface water management and water quality management for the five major watersheds in Pierce County.

Accuracy of GFS weather model during PNW cold weather events

Abby McFall

Mentor: Julie Masura

Some weather is hard to predict even with the help of advanced weather models. This project focuses on two winters weather systems from February 2014 in order to locate potential weaknesses in prediction on the Global Forecasting System (GFS) weather model. The more knowledgeable scientists are of the weaknesses of the GFS model, the more prepared those who depend on that information will be. For the purpose of gaining knowledge on weather prediction and weather accuracy, the GFS model predictions during lowland snow events in Portland and one in Seattle were compared to surface radar data. These maps shows fronts, high and low pressure systems, and moisture in the atmosphere and temperature in the atmosphere as well as where the GFS believed the systems would fall. This information shows the difference between what was predicted to happen and what actually occurred in each area.

Energy and waste reduction at Two Beers Brewing Company

Alexander J. McVicker

Site Supervisor: John Sittser, Operations Manager, Two Beers Brewing Co.

Faculty Sponsor: Julie Masura

An internship was participated in at Two Beers brewing company to observe operations in a successful local brewery. Water and electricity consumption were analyzed. A sustainability survey was conducted utilizing the BEST certification from Citizens for a Healthy Bay. Research was conducted on a small number of waste reduction and energy reclamation options. It was concluded that a brewery of this size would benefit from a Carbon Dioxide reclamation device. Electricity costs could be reduced through the purchase of a solar panel array and installation of high efficiency led lights throughout the brewery. If a substantial investment were to be made, an EcoVolt water purifier could be purchased. This machine uses microorganisms to filter potable water from effluent, and produces electricity in the process. Through implementation of some or all of these practices, Two Beers can save money while practicing sustainable brewing.

The effects of soil treatments to Douglas-fir seedlings for the restoration project at the Elwha Dam

Pedro Mendoza

Mentor: Erica Cline

The removal of the Elwha Dam allows the free migration of salmon but has raised more challenges for re-vegetation at the site due to the lack of nutrients and organic matter in the sediment. Ectomycorrhizal fungi (EMF) have been known to facilitate the uptake of nutrients and water helping in seedling establishment, survival and growth. Douglas-fir (*Pseudotsuga menziesii*) seedlings were planted in either nursery potting soil (control) or forest soil was added to the potting soil (inoculated). EMF species were identified by morphology, PCR using ITS-1F and ITS-4 primers, and sequence analysis using published fungal sequences and the BLAST algorithm. There was no considerable effect on EMF diversity and percent colonization for Douglas-fir seedlings that were inoculated compared to the control in this experiment. The results suggest that inoculation using mature forest soils may not be an effective nursery practice for Douglas-fir seedling preparation for restoration projects.

Tracking growth of Olympia oyster larvae and testing doping techniques

Jared Mosier and Brittany Eisel

Mentor: Bonnie Becker

The Olympia oyster, *Ostrea lurida*, plays an important role in the ecosystems in which it lives by creating habitat and filtering water. However, unsustainable harvesting practices nearly wiped out wild populations. In this study, we measured growth rates of cultured Olympia oyster larvae from Port Gamble and South Sound, which are thought to differ. We also investigated a method for relaxing brooding adults by non-destructively remove their larvae, which doesn't result in death to the brooding adult. This information will help Olympia oyster recovery by identifying the ones with the fastest growth, which results in a better chance of survival and can be raised more quickly. Brooded larvae were also stained with calcein in order to later identify their larval shells, which carry the chemical signatures of their natal sites. Tracking the dispersion of *O. lurida* and raising the fastest growing type of larvae will help to maximize conservation efforts.

Surveying farmlands for Pierce County compliance

Caleb Mott

Site Supervisor: Sofia Gidlund, Key Peninsula, Gig Harbor, Islands Watershed Program Manager, Pierce Conservation District

Faculty Sponsor: Julie Masura

Studies have shown that non-point source pollution can be detrimental to water quality and habitat. The Pierce Conservation District's (PCD) mission is to work with landowners to provide guidance on sustainable farm management practices, including pasture rotation, fencing strategies, and waste storage designs. For PCD to become more far-reaching throughout Pierce County, a comprehensive Farm Inventory must be created to make sure that all farms are being represented and regulated. This project is the result of an internship with the PCD in spring 2015. During this time, windshield surveys and site visits were performed in Pierce County to check the status of inventoried properties and add those that have since been established after the initial studies. All properties are being added to a database using ARC GIS software. The purpose of this database will be used to create an analysis of land use and proper farm management.

A strategy for testing the effect of sialic acid on antibody blood-brain barrier permeability

Amrit Multani

Mentor: John Finke

This project aims to test the hypothesis whether sialylation of existing antibody therapeutics will provide an efficient strategy to increase antibody concentrations throughout the central nervous system. Although prior studies have indicated that sialic acid plays a significant role in the clinical efficacy of IV immunoglobulin, this process has never been fully explained. This project further identifies the effect of IgG sialylation on BBB permeability and whether BBB dynamics can explain the variable outcomes of IgG treatment for central nervous system disorders. According to preliminary results, the greatest presence of sialic acid was found in the antibody 4G8 after being treated with 2,6 sialyltransferase. A correlation between the permeability coefficient and the surface sialic acid fraction will provide support for the proposed hypothesis that sialic acid increases IgG blood brain barrier permeability. However, sialic acid may not be detected if it is sterically hindered or not detected at the surface.

Water quality monitoring and educational outreach

Leslie Parrish

Site Supervisor: Bill Anderson, Director, and Carrie Hernandez, Stormwater Manager, Citizens for a Healthy Bay
Faculty Sponsor: Cheryl Greengrove

My capstone project at University of Washington Tacoma was an internship working on the Puyallup River Pollution Patrol Project at Citizens for a Healthy Bay (CHB) during the months of January - March of 2015. This project consisted of conducting water quality sampling with middle school students from Glacier Middle School in Buckley, Jason Lee Middle School in Tacoma, and Ayleen Middle School in Puyallup. CHB staff and I worked with the students to test for Temperature, pH, Dissolved Oxygen, Phosphorus, Nitrates and Turbidity in the Puyallup and White River. While sampling, I had the opportunity to teach students how all of these indicators play a role in the health of our local waters. It is hoped that students will then take the information they learned and tell other classmates, family members, and neighbors about the importance of maintaining water quality in their watersheds. Through this project, citizens learn about the impacts of their actions on the surrounding waters in their hometown.

Antarctic Polar Front and Antarctic Circumpolar Current provide oceanographic barriers to allow *Parabolasia corrugatus* to evolve into separate genetic populations

Tina Philbrick and Grace Allen

Mentor: Megan Schwartz

Parabolasia corrugatus is a well-recognized heteronemertean that inhabits the Southern Ocean that surrounds Antarctica. The Antarctic Polar Front and the Antarctic Circumpolar Front are hypothesized to have created oceanographic barriers that have led to isolated populations of *P. corrugatus*. The DNA of specimens from both sides of the Drake Passage between South America and Antarctica were compared using the well-conserved COI gene. A genetic difference of ~4 percent (p value=0) and ~46 differences in the COI gene were found between the two populations. This indicates that the APF and ACC have indeed provided oceanographic barriers to allow *P. corrugatus* to evolve into two separate species.

Contaminants of Emerging Concern in Wapato Lake, Tacoma, WA: analyzing the source of wastewater contamination via storm drains

Chiara Robertson

Mentor: Cheryl Greengrove

Contaminants of Emerging Concern (CEC) are found in products such as Pharmaceuticals and Personal Care Products (PPCP). PPCPs are common household products used worldwide and are released into the environment in various quantities and concentrations. The purpose of this study was to analyze water from two storm drains located at the North Basin of Lake Wapato to determine if they are the main source of wastewater contamination in the lake. Four replicates at all three sampling sites were collected during peak flow over a three week period in order to perform data analyses using a Liquid Chromatograph Tandem Mass Spectrometer (LCMS-MS). Analyzing CECs in the samples indicate the storm drain system is releasing wastewater into the lake. The results showed Storm Drain 1 was the primary source of contamination entering the lake. Further studies are needed to review the effects of CECs in the environment; however, enhanced treatments are recommended to reduce the impacts of CECs in the environment.

Investigating the presence of perfluorinated compounds in commercial car products

Austin Sandell

Mentor: Joyce Dinglasan-Panlilio

Perfluorinated carboxylic acids are potentially toxic compounds found to be persistent in the environment and detected in the blood samples of the general human population. It has been suggested that these compounds are crafted in the metabolic processes of biota using perfluorinated alcohols as a precursor. Recently it has been determined that a very likely source of perfluorinated alcohols in the environment is from residual compounds from commercially available products utilizing fluorinated material such as car polish. Since that time, an attempt has been made by industry to eliminate the residual alcohols from their products. This experiment is examining the products again for residual alcohols for comparison. The volatiles were extracted by a purge and trap procedure and analyzed with gas chromatography and mass spectrometry. A specific car polish was found to contain similar compounds and work is currently being done in our lab to ensure their identity.

Restoration at the Elwha River

Rachel Struck

Mentor: Erica Cline

The Elwha River, located in the northwest corner of Washington, recently had two dams removed which resulted in massive amounts of sediments along the river. These sediments are low in organic matter and nutrients making it difficult for vegetation to establish and return to pre-dam condition. This research uses five environmental variables within the former Lake Mills reservoir to determine ideal locations for planting. These variables include proximity to the forest and the river, number of lupine present, percent of woody debris and percent of fine sediment. Original GPS points were collected and qualitative data was recorded for each point. The information was interpolated through ArcGIS to determine the best locations for revegetation efforts. Based on statistical analysis of the variables, preliminary results show the ideal planting locations are near the forest edge on the east side of the river.

Nutrient and hydrologic budgets of Wapato Lake, Tacoma, Washington

Colleen Suter

Mentor: Jim Gawel

Wapato Lake, Tacoma, WA has a history of toxic algae blooms as a result of excess nutrients. An alum treatment in 2008 was an attempt to limit the availability of phosphorus from sediment releases, a key factor in algae blooms. Primary inputs of nutrients come from runoff, waterfowl and sediment releases. This study was a monitoring program measuring nutrient fluxes and hydrology. Water samples were collected and analyzed to show a pattern of phosphorus and nitrogen concentrations over several months. Total numbers of waterfowl on the lake were determined for phosphorus input. Hydrology was measured by pressure gauges placed in the lake combined with physical readings on staff gauges, atmospheric pressures from nearby station and precipitation data. The majority of phosphorus input, 74%, was found to come from overland flow. This data can be used to aid management programs that will ensure the future recreational use of Wapato Lake.

An in-depth look at traffic impact analyses

Aaron van Aken

Site Supervisor: Greg Heath, President, Heath & Assoc. Traffic Engineering

Faculty Sponsor: Cheryl Greengrove

The project consisted of interning at a traffic engineering firm conducting a mixture of fieldwork and report writing to understand traffic flow and patterns. The project goal was to understand traffic loading in varying sites (i.e. schools, housing developments, retail) and compare the potential impacts and implications the new traffic flow would have on the local environment. Three different case studies were performed that included site scoping, traffic counting, and conducting a Traffic Impact Analysis. Studies included McCarver Elementary School in Tacoma, WA, Morcos Subdivision a residential housing development in Tacoma, WA, and Silver Creek Apartments in Pierce County, WA. Parameters of each case study had to abide by county-specific rules and regulations, ultimately determining the success and/or the recommended modifications that needed to be addressed by the incoming project in order to meet regulations. A comparison of the three case studies will be presented here.