South Sound Science Symposium

October 16, 2024

2024 Poster Abstracts

The 2024 South Sound Science Symposium (S4) highlights emerging research on ecosystem status, trends, and conditions to help inform recovery, restoration, and protection efforts in the South Puget Sound region (generally, upland areas draining into marine waters south of the Tacoma Narrows, and those marine waters). The slate of posters featured at this year's event covers research conducted by scientists and technical staff from educational institutions, government and tribal natural resource agencies, non-profit groups, and the private sector across the South Sound region, as well as research conducted elsewhere that can be directly related to the South Sound.

For more information on the South Sound Science Symposium, visit:
https://southsoundscience.org/

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Statewide Kelp and Eelgrass Health and Conservation Plan: Sub-basin Engagement and Site Selection

Cynthia Harbison, Washington Department of Natural Resources

Max Showalter, Washington Department of Natural Resources

In 2022, the Washington state legislature passed legislation that was signed into law directing the Washington Department of Natural Resources to develop a prioritization plan that identifies at least 10,000 acres of priority kelp and eelgrass habitat. A prioritization plan was collaboratively developed that outlined a two-step process to identify priority habitat: 1) Statewide high value identification; and 2) Sub-basin engagement and site selection. The prioritization plan also identifies three pilot sub-basin to begin deeper engagement and site selection, Grays Harbor, the Eastern Strait of Juan de Fuca, and South Puget Sound.

DNR has further refined the prioritization framework to better support decision-making using the extensive literature on environmental decision-making as guidance. The decision-making framework is based on a qualitative evaluation of how each preliminary priority area will achieve the objective of identifying priority habitat that can be conserved and recovered through stressor mitigation and collective action.

One priority area has already been identified in South Puget Sound - the Squaxin Island Kelp Bed. However, in the winter of 2024-25, DNR plans to initiate further focused conversations in the South Puget Sound to identify additional priority kelp and eelgrass habitats. This will be achieved through Tribal consultation, community and partner input, and expert solicitation. In this poster, we will overview the work of the Plan to date including how data were gathered and analyzed and discuss upcoming opportunities for input focused on South Puget Sound.

Pinniped Predation on Salmonids Project

Megan Moore, NOAA Fisheries

Casey Clark, Washington Department of Fish and Wildlife

Sarah Colosimo, Hans Daubenberger, Khadija Homolka, Julianna Sullivan, Chris Ellings, Sayre Hodgson, Jed Moore, Jennifer Stern

Harbor seal populations in the Pacific Northwest have grown significantly since the enactment of the Marine Mammal Protection Act in 1973, leading to increasing predation impacts on multiple life stages and multiple species of ESA-endangered and -threatened salmonids. However, managers lack the population-specific predation rates needed to understand and quantify predator-prey interactions, which is vital to making sound salmon management decisions for the region. Outmigrating smolts and returning adult salmon must pass through estuaries, where channel constriction at the interface of fresh- and saltwater may make them more vulnerable to harbor seal predation. Previous research demonstrated that harbor seals may consume up to 30% of the outmigrating Nisqually steelhead run over only 5 kilometers. Using bioenergetics models, the Pinniped Predation on Salmonids Project (PPSP) aims to quantify the magnitude of harbor seal predation on juvenile, resident, and adult life stages of steelhead, Chinook Salmon, Chum Salmon, Coho Salmon, and Pink Salmon as they migrate through two representative estuary sites in Puget Sound (the Nisqually and Duckabush/Dosewallips River deltas). In addition, acoustic telemetry will be used to tag and track Chinook and steelhead smolt outmigrants, providing complementary estimates of predation and predator-prey interactions. Predation estimates can be used to parameterize life cycle models, Models of Intermediate Complexity (MICE), and ecosystem models examining losses in the estuarine environment and effects on protected population recovery.

Restored Salmon Spawning Habitat and Marine-derived Resources in Aquatic and Riparian Ecosystems in the Puyallup River Watershed - a Stable Isotope Approach

Sam Dossa, University of Puget Sound, Geology Department

Naomi Wurtzel, University of Puget Sound, Geology Department

Aimee Baldwin, University of Puget Sound, Biology Department

Kristin Williamson, South Puget Sound Salmon Enhancement Group

Kena Fox-Dobbs, University of Puget Sound, Geology Department

The status of Pacific salmon depends upon a wide range of factors that influence species throughout their anadromous life history. For Puget Sound salmon populations the restoration of channel and riparian habitats in spawning streams is a key strategy for recovery. Here we focus on a large-scale restoration project on South Prairie Creek (SPC) which provides critical spawning areas in the Puyallup River watershed. The project restored the geomorphology, hydrology, and ecology of SPC at a site with a legacy of agricultural impacts. Since project completion in 2023 there has been substantial streambed aggradation, flooding of side channels, and native vegetation regrowth. In the fall of 2023 both Chinook and pink salmon were observed spawning at the project site.

We investigated whether the use of the restored spawning habitat influenced freshwater and riparian food webs via marine-derived nutrients and energy provided by salmon carcasses. The importance of spatial subsidies provided by spawning salmon in inland areas has been well-documented and routinely characterized using stable isotope analysis (SIA). We collected benthic macroinvertebrates and riparian vegetation in early 2024, and our sampling for SIA focused on taxa previously studied in nearby Puget Sound watersheds. Specifically, we sampled macroinvertebrate species across all ecological functional groups in order to estimate the cycling of marine-derived nutrients and energy within the restored ecosystems.

Our carbon and nitrogen isotope results demonstrated that marine resources from salmon carcasses were present in the aquatic food web, and riparian vegetation at the SPC site. We used a Bayesian mixing-model to estimate the role of the salmon subsidy across all ecological functional groups. These data provide a metric for assessing the success of management and policy decisions. In the case of the SPC project, use of the restored spawning areas by salmon, and the rapid integration of marine resources into the local ecosystem, highlight the importance of salmon recovery in Puget Sound watersheds.

Analysis of Channel Width Change on the Nisqually and White River Watersheds within Mount Rainier National Park

Paige Shinall, University of Puget Sound

Gwen Lindberg, University of Puget Sound

Robby Jost and Taylor Kenyon, NCR Geology Mount Rainier National Park

Kena Fox-Dobbs and David Birlenbach, University of Puget Sound

The dynamic and turbulent nature of steep mountainous rivers necessitate the development of new methods to better understand historic and ongoing geomorphic changes in these watersheds. The migration of these types of rivers has direct implications for visitor access and land management in Mount Rainier National Park (MORA), especially when located near major visitor areas such as the Nisqually River, occupying the southwest region of the park, and the White River, in the northeast region of the park. It is more important than ever to understand the historical effects of hydrologic events, such as floods and debris flows, in order to better prepare responses to the likely increasing frequency and/or intensity of these events in the face of climate change.

This study used open-source GIS software to quantify the change in active channel width using historical satellite imagery available through USGS EarthExplorer for the Nisqually and White River. The study area encompassed a 10 km stretch of the Nisqually and 15 km along the White River, each with a time series including five images spanning from 1955-2019. This included imaging from 2006 and 2009 to encompass a special interest in a historic flooding event that took place on November 6th and 7th of 2006 throughout MORA. This flood damaged park infrastructure and created limits to visitor access with repercussions that are still being addressed in the park to this day.

A GIS model was created to automate the process of extracting channel width measurements from active channel margins. The resulting widths were assessed to evaluate channel width over time and identify areas of significant change as a result of flooding or other environmental processes. Following the 2006 flood, we noted a 27% increase in the average channel width of the Nisqually and a 21% increase in the average channel width of the White River. Combining our results with field surveys and hydrologic records allowed us to confirm flooding events as drivers of the mapped channel width change in these areas. Using these river monitoring efforts in MORA can aid park management in making scientifically-backed decisions. This procedure can be applied in other river systems to analyze channel margin change and, when coupled with site specific data and context, can assist in understanding past and future hazards.

Puget Sound Starts Here: Making Habitat From Stormwater Pond Infrastructure

Jessica Sandoval, Washington Department of Fish and Wildlife

Kylie Hackett, Washington Department of Fish and Wildlife

Simone Des Roches, Washington Department of Fish and Wildlife

Stormwater ponds are common infrastructure throughout the Puget Sound region designed to minimize the impacts of flooding, erosion, and pollution to surrounding water bodies. While habitat is rarely intentional in the design and management of stormwater ponds, they are often used by wildlife and may provide similar functions to the freshwater wetlands lost to development. Our objective is to determine which stormwater pond conditions and management actions promote wildlife species diversity and abundance. Our study sites span the Puget Sound area from Thurston County north to Whatcom County and include 10 county and city jurisdictions. From January-August 2024, we surveyed over 230 stormwater ponds and natural wetlands for birds, amphibians, and beavers and assessed habitat characteristics including baseline water quality metrics, water level fluctuation, aquatic and riparian vegetation cover, plant diversity, and surrounding landcover. We completed point count surveys for birds and used passive acoustic recorders for a two-week period in the winter and summer to further assess avian diversity. Amphibian species presence and abundance were determined with egg-mass surveys completed from February to April, followed by larval trapping with dip-nets and minnow traps in late spring and summer. We will complete another year of surveying in 2025. In addition to biological surveys, we are evaluating socioeconomic conditions in the neighborhoods surrounding the ponds to assess whether stormwater ponds, and associated wildlife viewing opportunities, are equitably distributed throughout the region. Our first-year data indicates that many species of native amphibians and fishes are utilizing stormwater ponds. Northwestern salamanders (Ambystoma gracile), northern red-legged frogs (Rana aurora), long-toed salamanders (Ambystoma macrodactylum), and Pacific chorus frogs (Pseudacris regilla) were found in stormwater ponds in all 6 counties surveyed. We also captured native fishes in stormwater ponds, including the three-spined stickleback (Gasterosteus aculeatus) and the endemic Olympic mudminnow (Novumbra hubbsi), a Species of Greatest Conservation Need (SGCN) in Washington. Ultimately, we hope to inform the management of stormwater infrastructure as habitat for native species and reduce the potential deleterious effects of stormwater pond design and maintenance.

Giving a Dam: Designing a Low-cost, Low-impact Plan for Beaver-related Restoration at Sapp Road Park in Tumwater, WA

Dashiell Paulson

Phill Harris

Nick Baker

Charlies Hastings

Beaver-related restoration (BRR) is a low-tech, low-cost, process-based strategy that aims to satisfy multiple ecological restoration objectives by encouraging beaver activity in degraded stream systems.

Sapp Road Park is a publicly owned, 11.8 acre, degraded wetland site along Percival Creek, a salmon-bearing stream in the City of Tumwater, Washington. City planners want to restore Sapp Road Park in order to increase wetland functions including flood storage, water quality improvement, and wildlife habitat. We designed and reported on the feasibility of using a BRR strategy to help city planners sustainably accomplish their restoration goals.

Our research involved the development of a GIS workflow designed to identify suitable water bodies for BRR based on vegetation, stream characteristics, 303(d) impaired water body listings, beaver habitat connectivity, and land parcel data. We completed watershed assessments at fine, mid, and broad scales to determine if salmon habitat limiting factors could be addressed by implementing BRR at Sapp Road Park. A hydrologic model was developed to simulate different water capacity scenarios.

We ultimately recommended two common BRR tactics at Sapp Road Park: restore riparian vegetation and install a complex of artificial structures like BDAs. We designed plans for a BDA complex along Percival Creek to increase water storage and improve floodplain connectivity and crafted a beaver-centric planting plan to restore riparian vegetation in order to increase the availability of food and building materials for future beaver families and to suppress invasive plant species on the site.

Based on our research, we determined that BRR, in conjunction with beaver conflict resolution tools and tactics, can help city planners achieve common wetland restoration goals, including increased water storage, aquifer recharge, growth and recruitment of riparian vegetation, water quality improvement, and habitat for wildlife.

2023 Analysis of Microplastics in Bed Sediments of the Salish Sea in the Puget Sound

Mia Robbins, University of Washington - Tacoma

Julie Masura, University of Washington - Tacoma

Cheryl Greengrove, University of Washington - Tacoma

Pollution of bays and estuaries by microplastics is an increasingly pressing concern, especially in bodies of water surrounded by densely populated areas. Microplastics have been found in studied waters virtually everywhere. Microplastics are known to be vectors for harmful chemicals and can impact digestion and other physiological processes in organisms. In partnership with the Puget Sound Ecosystem Monitoring Program, quantifying the number of microplastics in the Puget Sound can give a clearer picture of the local scope of this issue. With this work, we monitored the levels of microplastics in sediments at 50 sites of the Puget Sound and related them to past levels so informed policy decisions can be made. Sediments were disaggregated and density separated to isolate plastics, then samples were examined under light microscope. Plastics were characterized by type, color, and length. Of the 50 samples, which all contained microplastics, 736 total microplastics were counted with an average of 15 plastics per sample and 1.72 mm in length. 66.3% of microplastics found were clear, 95.5% of plastics were fibers and 4.5% were films, the dominance of clear fibers being consistent with past findings. Microplastics from 5 samples were confirmed by FT-IR spectroscopy. The most abundant type of plastic found was polypropylene followed by polyethylene. Other plastics found were styrene, vinyl chloride, nylon, BBP, and poly ethyl methacrylate. Future work will involve additional sampling of the 50 sites for monitoring of pollution levels. Acquiring data on microplastic levels can aid policy makers regarding decisions that reduce pollution.

2023 Analysis of Harmful Algae in Bed Sediments of the Salish Sea in the Puget Sound

Peyton Scheschy, University of Washington Tacoma

Julie Masura, University of Washington Tacoma

Cheryl Greengrove, University of Washington - Tacoma

Alexandrium catenella is a toxic dinoflagellate that has two life stages, a dormant cyst form within bed sediment, and a vegetative form that swims freely in the water column. Both produce a saxitoxin that can bioaccumulate within shellfish and when ingested by mammals, could potentially lead to paralytic shellfish poisoning (PSP). This project looked at the distribution of cysts of A. catenella in the Salish Sea to inform shellfish harvesters of the likelihood of harmful algal blooms in their region. In order to analyze for cysts, sediment was collected at 50 stations throughout the Salish Sea in Spring of 2023. These samples were processed and stained with Primulin, then viewed under a fluorescence microscope to identify and quantify the cysts present. The average cyst counts for all stations were 8 cysts/cc(wet), and 3 cysts/cc(dry). The highest cyst counts came from Central Basin- North and Hood Canal-Central. Both stations had 40 cysts/cc(wet), and 12 cysts/cc(dry). Many stations had no cysts. Compared to 2022, there was an increase in cysts in areas around the Sound, more specifically Hood Canal, Dyes Inlet, and the Central Basin. This year, there was a decrease in cysts in Bellingham Bay, which is known to be a hotspot/seedbed for A. catenella. This data was shared with stakeholders to be used to determine if increased monitoring would be needed in locations where cysts were found.

Effects of Insulated Oyster Bags on Pacific Oyster Temperatures and Growth

Isabella York, Pioneer School District

Milo Matsuda, Pioneer School District

Tim B. Smith, Pioneer School District

The shellfish industry loses millions of dollars every year due to shellfish heat mortality driven by climate change. Methods are needed to reduce heat during low tides in peak heating seasons. This research tests a variety of methods to insulate oysters in oyster bags from heat. Data was also collected to test the effectiveness of aluminum and HDPE insulation panels. We made a heating arena for controlled tests in school using ten 75 watt Fluker heating lamps. HOBO MX pendant temperature/light monitors were installed in oyster cages and Vernier surface temperature monitors taped to the inside of Pacific oyster shells. Effects of a biofouling were assessed using cages with barnacle encrustations and simulated Ulva covers. Insulated cages were created using reflective plastic covers. Paired trials testing effects of insulated bag growth were also conducted in Totten Inlet during July 21 to September 16, 2024. Field trial temperatures were monitored using HOBO MX pendant temperature/light monitors zip-tied into the center of each bag. Both Ulva simulations and barnacle incrustation effectively lowered temperatures in oyster bags and oysters in heating arenas. No mortality was observed in any bags during paired bag experiments. Insulated bags effectively reduced temperatures of oysters in laboratory trials. Insulated oyster bags reduced maximum temperatures by 10C, but did not affect average temperatures. Growth of oysters in the field differed with depth, but were not affected by oyster bag insulation. Effects of insulation on bag temperature and temperature on oyster growth will be further assessed along with the performance of an HDPE and aluminum paneled oyster bag deployed in Totten Inlet with the paired oyster bag experiment. Relatively low temperatures during summer of 2024 may have reduced effects of insulated bags on oyster survival and growth.

Effects of Nesting Tube Color and Rosemary on Mason Bee Nest Site Choice

Henry McClaran, Pioneer School District

Sam Simmons, Pioneer School District

Aurora VanDrew, Lunara Rakestraw, Tim B. Smith

Mason bees are efficient native North American pollinators, frequently used in orchards to promote production of fruit trees and other commercially important crops. Mason bees nest in tubes and reeds, protecting their eggs with thin mud wall partitions and adding pollen pellets gathered from local flowers to each partition. In horticultural settings, nesting tubes are deployed in the spring, removed from the field and kept over summer. Cocoons are kept over summer in a warm, secure setting and cocoons are removed from nests and placed near nesting tubes again in spring. This research tests variations in nesting tube deployment to promote the survival and reproduction of mason bees in horticultural settings. Tests were conducted at Pioneer Garden in 10 wooden nest boxes from late April to June 6, 2023. Nesting tubes were collected from the garden, kept over summer and processed in October 2023. Number of cocoons, cocoon mass, cocoon sex, and the presences of parasites and predators were noted. Three types of nesting tubes were deployed. One was a standard commercial cardboard tube with a paper liner. Natural reed tubes were also placed in each box. Another was a cardboard tube painted with blue latex paint at the tip. Half of the nesting boxes chosen at random received a stalk of rosemary halfway through the experiment. Mason bees typically prefer blue flowers, and rosemary was hoped to repel parasitic In 2023, mason bees preferred reed tubes, followed in preference by blue tipped tubes. Blue tubes were found to have more cocoons, larger cocoons and a higher female percentage of cocoons than either reed or standard cardboard tubes. Egg deposition declined in boxes after rosemary was placed in them. Pollen mites were present in all types of tubes, but no wasp larvae were found in any tubes. The choice of blue nesting tubes may correspond with a perceived performance advantage for bees depositing eggs or may be a result of aids in navigation to a specific tube among an array of many tubes. Additional experiments will extend these tests to tease apart these effects, compare mason bee development in forests and gardens and examine the effect of temperature on nesting tube selection.

Puget Sound Freshwater Monitoring Network - Continuous Water Quality Monitoring in Puget Sound Tributaries

Sean Studer, WA Department of Ecology

Stephanie Estrella, WA Department of Ecology

Dan Dugger

Markus Von Prause

Ansel Abbett

Department of Ecology's Ambient Monitoring Project has collected discrete water quality data in rivers and streams throughout Washington since the 1950s. In 2023, the Ambient Monitoring Project was expanded to include continuous monitoring stations on seven river systems entering the Puget Sound. Continuous monitoring has the advantage of providing real-time water quality conditions with finer detail on the diurnal and other natural cycles of the Puget Sound tributaries.

Collectively, these continuous monitoring stations make up Ecology's Puget Sound Freshwater Monitoring Network (PSFMN). The PSFMN supports the Puget Sound Nutrient Reduction Project, which aims to reduce nutrient inputs to the Puget Sound in support of salmon and orca recovery while also increasing resiliency to climate impacts.

The PSFMN stations are equipped with a suite of water quality instruments, including SUNA V2 nutrient sensors, that measure and transmit water quality data at 15-minute intervals. These data are used to inform modeling efforts such as the Salish Sea Model, providing a more complete picture of the dynamics of riverine inputs into the Salish Sea.

Currently, the PSFMN data can be found online on Ecology's Freshwater DataStream website. Ideally, these data will support a variety of water quality projects while serving as a model for expanded continuous monitoring efforts throughout the state of Washington.

Arsenic Toxicity in Lake Ecosystems

Monique Rockefeller, University of Washington, Tacoma

Alison Gardell, University of Washington, Tacoma

Sarah Alaei, University of Washington, Tacoma

In the Puget Sound region, some lakes' ecosystems have been contaminated with metals from ASARCO copper smelting. Although the century-long operation ended in 1985, effects of the heavy metal toxin, arsenic, on the lakes are currently unknown. Lake Killarney contains the highest level of arsenic contamination and Steel Lake contains an intermediate level of arsenic, while Trout Lake is a reference with minimal levels of arsenic. Periphyton is the growth of algae and microorganisms, and holds the highest accumulation of arsenic compared to varying species in each lake. Utilizing a ubiquitous freshwater snail species that feeds on periphyton, the Chinese Mystery Snail (CMS), this research tested the hypothesis that bioaccumulation of arsenic will be higher in CMS gut tissue, and biotransformation genes will be prevalent in periphyton due to its high accumulation of arsenic. ICP-MS was used to measure total arsenic concentration in field-collected samples from Trout Lake and Lake Killarney of varying CMS tissues. The Lake Killarney CMS gut tissue contained the highest amount of arsenic among all samples. With PCR testing of periphyton from Trout Lake, Steel Lake, and Lake Killarney it was revealed that the arsM gene, which encodes for arsenite methylation, is present. Altogether, periphyton biotransformation may impact arsenic accumulation in snail gut tissue. Future research aims to examine arsM expression and its effect on tissue-specific accumulation in snails.

Habitat Recovery Pilot Program (HRPP) and the Multi-Agency Review Team (MART): Streamlining Permits for Restoration Projects Beneficial to Fish and their Habitat

Gina Piazza, WA Department of Fish and Wildlife

Casey Vaughn, WA Department of Ecology

Diane Hennessey, Environmental Protection Agency

Permitting projects is one of the bigger challenges for practitioners constructing restoration projects. The habitat recovery pilot program (HRPP) is a product of Washington State House Bill 1382 and has successfully created a streamlined pathway by reducing the number of permits required for habitat restoration projects that would have otherwise gone through a standard process. This State program has been recognized nationally as landmark legislation helping to "cut the green tape", thereby increasing the pace of salmon habitat recovery.

With this new program, there are now two avenues for streamlining permits for restoration projects. Washington state has the Fish Habitat Enhancement Project (FHEP), and now the HRPP. While both are similar in that they eliminate the requirement for many local and state permits, the difference is that FHEP is limited to four project types. HRPP has no limit to project types and so opportunities for streamlining are expanded and can include projects such as marine shoreline armor removal and restoration, estuary restoration, and floodplain reconnection. Also unique to the HRPP is the creation of a multi-agency permitting (MAP) team consisting of six Washington Agencies to cooperatively help applicants navigate the permitting process.

Forty-eight projects have been applied for and forty-one HPA permits issued since HRPP began in July of 2021. Twenty-four of those permitted projects have started or completed construction and more than half of those were able to construct within the same year as the permit was issued. Applicants report a 3-12 month time savings and a $1,000- $80,000 cost savings from going through the HRPP.

Recognizing that projects will not be constructed until all local, state, and federal permits are obtained, the HRPP is partnering with the Multi-Agency Review Team (MART) that helps coordinate and streamline permitting from start to finish, with a focus on federal permitting. The MART is a subgroup of the federal Puget Sound Recovery National Program. It is a team of federal and state agencies that assist applicants with streamlining and expediting ecologically beneficial projects in the Puget Sound Basin through coordination, tracking, and accountability throughout the entire permitting process.

This poster will help applicants understand the HRPP program, how to qualify and apply. Applicants can learn what the best pathway is for their project and what permits are exempt and what is still required. They will also learn more about the HRPP partnership with the MART and how to further streamline the permitting process at the local, state, and federal levels with assistance from the MART for Puget Sound Basin projects.

Arsenic Bioaccumulation in Chinese Mystery Snail Anatomical Regions

Nicole Kovalchuk, University of Washington, Tacoma

Salma Wairimu, University of Washington, Tacoma

Dr. Alison Gardell, University of Washington, Tacoma

Dr. Sarah Alaei, University of Washington, Tacoma

Arsenic (As) is a metalloid contaminant that disrupts many physiological pathways resulting in neurotoxic, cytotoxic, and mutagenic effects. The Puget Sound area has been impacted by As contamination due to 100 years of ASARCO smelter activity located in Ruston, WA. Organisms, such as the Chinese Mystery Snail (CMS), that live in freshwater lakes within the smelter deposition zone experience chronic As exposure. In this study, we aimed to compare the concentrations of As present in the head/foot, mantle, gut, and visceral tissue from Lake Killarney CMS to determine whether or not As bioaccumulates differently throughout the body. We hypothesized that CMS collected from Lake Killarney will bioaccumulate As at higher concentrations in the gut compared to other anatomical regions, due to direct consumption of periphyton which is known to contain approximately 600 ppm As. To test this hypothesis, head/foot, mantle, gut, and visceral tissue samples from male CMS collected from Lake Killarney were sliced, dried, acid digested, diluted, and analyzed using ICP-MS. As concentrations varied among anatomical regions, with significantly higher concentrations observed in the gut. When comparing the concentrations, the gut was at least 5x higher than the other anatomical regions. If repeating this analysis, it may be ideal to collect and include female samples to examine sex-specific bioaccumulation responses. Overall, higher gut concentrations raise questions in regard to the potential host-gut microbiome interactions that could play an important role in the biotransformation and metabolism of As.

Washington State Acidification Nearshore Monitoring Network (ANeMoNe): Community Science, Education, And Workforce Development

Kyra Anderson, WA Department of Natural Resources

Rachel Skubel, WA Department of Natural Resources

The Acidification Nearshore Monitoring Network (ANeMoNe) is a Community Science, Education, and Workforce Development program that began in 2015 as a targeted research project to investigate the ameliorative effects of eelgrass habitats on local pH conditions. Since then, the program has expanded to 12 locations around Puget Sound and the Outer Coast Estuaries to monitor climate change and acidification in nearshore environments and to support the testing of practical management options to reduce or mitigate detrimental habitat impacts of changing ocean conditions. Each year, during the spring and summer low tide series, our staff and volunteers, called ANeMoNe Site Guardians, monitor eelgrass beds and maintain sensor arrays. Environmental sensors continuously measure water temperature, pH, dissolved oxygen, salinity, light availability, and water levels both inside and outside of eelgrass beds at each of the sites though the entire year to capture and understand long term trends in environmental condition. Biological data, including eelgrass density, bird behavior, and shellfish recruitment are also collected during the spring and summer seasons to explore the ecological effects of climate change in the nearshore environment. With trends from these data, we have created a segment of our program to address hypotheses-based research so we can better understand local environmental change and better inform state policies. Leveraging the activities of the community science program, we have also developed K-12 curricula focused on climate resilience, local ecology, and environmental justice with training materials, worksheets and learning objectives specific to each age group. Another aspect of our curriculum is a climate resilience youth internship and established youth internships with our tribal partners and nonprofit organizations to engage young climate leaders, particularly from communities most vulnerable to climate change. This presentation will explore how through collaboration, education, and mentorship, the ANeMoNe program contributes to a deeper understanding of climate change effects in the nearshore and informs collaborative solutions that can directly benefit both local communities and the global environment.

Investigating Tire-Derived Contaminants in South Puget Sound Watersheds

Kiersten Maxwell, University of Washington

The presence and impact of tire-derived contaminants, particularly 6PPDQ and related Contaminants of Emerging Concern (CECs), in aquatic environments remain largely understudied, especially in regions outside of greater Seattle, Washington. The recent data indicates that 6PPDQ is primarily responsible for the acute mortality observed in coho salmon in stormwater impacted watersheds throughout the Puget Sound basin; however, significant knowledge and data gaps persist in South Puget Sound watersheds. This project will study watersheds in South Puget Sound, by building on previous 6PPDQ research and focusing on specific tire-rubber and PPD-quinone CECs in roadway runoff, with sampling set to begin in Fall 2024. The chosen areas of study include watersheds that have been prioritized by tribal communities, and where monitoring has been limited despite documented stormwater-related mortality in coho salmon. These include the Puyallup, Nisqually, and Deschutes watersheds. Along with addressing data gaps in these small but critical watersheds, this project will enhance analytical methods and gather occurrence data, including improving sample collection strategies while measuring concentrations of 6PPD, 6PPDQ, and other PPD-quinones.

Arsenic-Related Human Health Risk from Consumption of Doryteuthis opalescens (Market Squid) in Puget Sound, WA

Tyler Hall, University of Washington Tacoma

Jim Gawel, University of Washington Tacoma

Doryteuthis opalescens, or market squid, is a growing and popular recreational fishery in Washington State. Despite their growing popularity, there is very little research conducted on squid that enter the Puget Sound. Collaborating with the Washington Department of Fish and Wildlife, who are conducting their own population and creel surveys on market squid, we have collected samples at four locations using jigging methods. The two purposes for which we analyzed metal concentrations in squid mantle tissue was to fingerprint differences within the squid population based on location, and to assess for possible carcinogenic pollutants. I hypothesized that squid caught in the South Sound would have trace, but distinctly different concentrations of metals compared to squid caught closer to the entrance of the Pacific Ocean. My results showed very high levels of arsenic, averaging 4.95 mg/kg dry weight of squid mantle tissue. This concentration equates to a human health risk for average consumers that is 83 times greater than the cancer risk threshold (1 in 100,000), and four times greater than the non-cancer illness threshold. These results will be reported to the WA Department of Health to determine if a consumption advisory is warranted, which we believe is the case. Our results constitute a significant finding of public health risk, and ultimately will be useful for bolstering public health.

Characterizing the Market Squid Fishery in the Puget Sound

Roy M. Clark, WA Department of Fish and Wildlife

Jeff K. Anderson, WA Department of Fish and Wildlife

Jack F. Dudding, WA Department of Fish and Wildlife

Camille A. Speck, WA Department of Fish and Wildlife

The Washington Department of Fish and Wildlife (WDFW) undertook monitoring of the recreational fishery for market squid (a.k.a., opaline squid, Doryteuthis opalescens) across the Puget Sound from September 2023 to February 2024. While the market squid fishery has had harvest management plans in place since 1996 through the co-management process, active monitoring of the fishery has been sparse and exploratory; limited in scope, duration, and frequency. The primary objectives of this monitoring were to estimate and document the recreational catch and angling effort for market squid within the Puget Sound, including timing of near shore assemblages, and changes in squid size (e.g., length and weight). The secondary objectives of this monitoring were to conduct exploratory investigations and document the spatial and temporal extent of the recreational squid fishery within Puget Sound. WDFW conducted creel and effort surveys of publicly accessible recreational fishing piers across the Puget Sound to characterize the recreational squid fishery and estimate harvest. Market squid were collected and dissected throughout the sampling window for morphometric analysis, sexing, and assessing gonad development for sexual maturation. In total, 230 creel survey events were conducted, in which 4,048 anglers were interviewed, with an additional 263 effort survey events. Recreational squid catch and effort both peaked in late November and early December, with nightly effort peaking 2 hours after local sunset. Market squid biometric samples were collected from 11 sites, totaling 416 samples. Size (i.e., length and weight) and gonadal development peaked in samples collected in November and December. This pilot study will serve to set a baseline for future market squid fishery monitoring and management, as well as shed light on the poorly understood ecology of market squid within the Puget Sound.

Floating Kelp Monitoring Update for South Puget Sound: With a Focus on Squaxin Island

Julia Ledbetter, WA Department of Natural Resources

Helen Berry, WA Department of Natural Resources

Floating kelp forests provide vital habitats and important ecosystem services in temperate nearshore ecosystems worldwide. Kelp forest losses are a major concern globally, and in portions of Washington State. While floating kelp on the outer coast of Washington is relatively stable, extensive losses of bull kelp (Nereocystis leutkeana) have occurred in the inner basins of Puget Sound, especially South Puget Sound, making them management and research priorities. To reliably monitor this important resource in these areas of concern, intensive kayak-based surveys collect kelp bed area and depth annually at six sites in South Puget Sound (SPS) where floating kelp has been present currently or historically. Following major losses in SPS over the last century, recent years show strong continued signals of loss at individual sites. Of the five sites in SPS with more than five years of data, floating kelp at two sites completely disappeared, two sites declined significantly (Squaxin Island and Fox Island), and one site had no trend in bed area. Squaxin Island, the innermost bull kelp bed in Puget Sound, experienced massive losses in 2022 constituting a 97% decline in bed area since 2013. A partial natural recovery occurred in 2023 (78% decrease relative to 2013). This documented floating kelp loss at Squaxin Island provided evidence of the need for restoration efforts, which were initiated in 2023 by the Squaxin Island Tribe and Puget Sound Restoration Fund. Fox Island also saw dramatic declines in the last 10 years, only two individuals were observed in 2023. Many possible stressors could be driving the observed losses. For example, losses in the last decade in SPS coincide with elevated water temperature during the 2014 Marine Heatwave. Collaborative research found that temperature thresholds for physiological damage were met or exceeded at some sites. In striking contrast, floating kelp in the Tacoma Narrows has remained stable and the area experiences low water temperatures due to strong mixing. Looking forward, monitoring of these sites will continue to drive research into stressors and to inform restoration efforts.