2025 Conference Abstracts

If you have questions for presenters and are unable to get in contact, please reach out to info@walpa.org and we will try our best to connect you.

Oral Presentations

SESSION 1: SCABLAND LAKE FORMATION AND MOSES LAKE

Unique lakes formed by catastrophic Ice Age megafloods

Chad Pritchard, Department of Geosciences, Eastern Washington University

Eastern Washington has a unique geologic history, from being the shoreline of past supercontinents from about 1 billion to 150 million years ago to ragging Ice Age megafloods that scoured the topography thousands of years ago. Pleistocene megafloods from glacial lakes sculpted “butte and basin” topography, deposited sand and gravel, and formed anastomosing wetland and lake systems across the scablands. Lakes formed from the megafloods as classic scabland development through plucking and erosion of basalt stratigraphy as wells as turbulent flow and kolks in the megafloods interacting with resistant geologic features (granite or metamorphic rock). Lakes are commonly connected to proximal wetland systems in scabland basins, making many scabland lakes spring fed and without surface water outfalls, which can lead to interesting lacustrine systems. For example, Soap Lake, WA is at the hydrologic end of Grand Coulee and is an extreme example of build-up of alkaline materials from springs fed by basaltic aquifers. Lakes of eastern Washington have distinct and unique properties due to their catastrophic formation by the megafloods.

Forty-eight years of diluting phosphorus in Moses Lake

Shannon Brattebo, Tetra Tech, Inc.
Co-authors: Dr. Gene Welch

Moses Lake has been rehabilitated by dilution with low-phosphorus Columbia River water (CRW) to improve lake quality over the past several decades. Dilution was initiated by a Clean Lakes project starting in 1977. Inflows of low-TP CRW at 8 µg/L have ranged from around 61,000 to 325,000 AF, usually entering the lake during April through June, with occasional additions during summer. The CRW inflows represent about 0.5 to 2.5 lake volumes. Dilution inflows lowered the May-September average lower lake TP from 152 µg/L during 1969-1970, to 65 µg/L during 1977-1988 when CRW averaged 106,000 AF, to 25 µg/L during 2000-2023 when CRW averaged about 200,000 AF. Increased CRW inflow since 2000 reduced TP to less than 30 ug/L and has greatly improved lake quality and lowered the cyanobacteria fraction of phytoplankton biomass. Cyanobacteria have decreased as TP decreased below 30 µg/L, especially in 2021-2023 with an average TP of 22 µg/L and cyanobacteria at only 20% of algal biovolume. Even in the more enriched upper lake (Rocky Ford Arm), TP in 2021-2023 averaged about half that of the previous 4 years and cyanobacteria averaged just 33% of the phytoplankton biomass. Total P was relatively low throughout the lake in 2024 until August and

September when TP increased to unforeseen high concentrations following a breach in the East Low Canal, which is the source of low-TP CRW. Nevertheless, the fraction of cyanobacteria remained low in 2024 at 26% of algal biovolume. Internal loading is the largest source of TP during spring-summer and was 50% the total load in 2020 and 2021. Total P was reduced some in middle and lower Rocky Ford Arm in 2024 following a Eutrosorb-G treatment.

Integrating Phosphorus Sequestration Approaches into Water Quality Management of Moses Lake, WA

Ryan Van Goethem, EutroPHIX
Co-authors: Terry McNabb, Alexis Fischer Ph.D., Scott Shuler

Moses Lake in Washington, USA is a 6,800-acre lake and has experienced poor water quality and harmful algal blooms (HABs) dating back to the 1960s. Previous water quality improvements included diversion of wastewater in the 1980s and decades of low-phosphorus Columbia River Water routed through the lake which seasonally dilutes excess nutrients. This talk will review the results of a 2024 and 2025 phosphorus sequestration program focused on managing external and internal loading. Injection of EutroSORB® WC into the Rocky Ford Creek, a major inflow, reduced soluble-reactive phosphorus by an average of 40% during 2024. The surface water total phosphorus in the central project area was expected to be ~75µg/L for the summer due to the measured extent of Columbia River Water dilution/mixing in 2024 . Yet, application of EutroSORB® G (10% lanthanum modified bentonite) to Moses Lake sediments was followed by a ~30% decline in total phosphorus in the bottom waters and surface water total phosphorus in the central project area averaged 35.4 µg/L for the summer (~50% lower than expected). Shifts in the algal community were detected and the extent and severity of HABs was reduced in 2024. Integrating both external and internal P management approaches into water quality management can provide significant benefits, which are applicable to other water bodies across the US.

Grant County Healthy Lakes Algae Tracker: Restoring Public Confidence in Moses Lake

Ronnie Sawyer, Columbia Basin Conservation District
Co-authors: Deanna Elliott, Stephanie Shopbell

Launched in 2023, the Grant County Healthy Lakes Algae Tracker is modeled after a successful program on Lake Champlain in Vermont. The initiative was prompted by a sharp decline in recreational activity on Moses Lake during 2019 and 2020 due to elevated levels of microcystin toxin in the water. In response, the Grant County Tourism Commission, Columbia Basin Conservation District, and Grant County Health District collaborated to secure funding and technical support to develop a web-based interactive map. This map displays water quality at thirteen key locations around the lake, indicating areas safe or unsafe for recreational use. Volunteers collect weekly water samples and photos at these sites, which the Health District evaluates. Water quality results, with photos, are updated on the map using a simple color-coded system to communicate safety levels. The map is promoted through local newspapers, tourism publications, multiple websites, and Spanish-language radio stations, increasing accessibility and outreach. This transparency has helped restore public confidence, leading to the return of recreational users. This presentation will highlight the importance of partnerships and community engagement, provide a technical overview of the survey methodology, and discuss how public health decisions are informed by the data collected.

You Win Some, You Lose Some: Macroinvertebrate Temporal Beta Diversity Analysis of Mountain Lakes in Washington's Cascade Range Reveals High Community Turnover

Ty Stephenson, Western Washington University
Co-authors: Angela Strecker, Ashley Rawhouser, Hugh Anthony, Carmen Archambault, Rebecca Lofgren, John Boetsch, Kristen Bonebrake, Katherine Braun

High mountain lakes are unique ecosystems that are especially vulnerable to the threats of climate change and introduced species, due to their high elevation and isolation from other waterbodies. Benthic macroinvertebrates are a large part of the aquatic community of these lakes and are used in aquatic community bioassessment as indicators of disturbance and biological integrity. Temporal beta diversity, change in species composition at a site over time, is an important metric in characterizing communities and understanding how and why ecosystems change over time. Temporal beta-diversity index scores range between 0 (completely similar) representing no species losses or gains and 1 (completely dissimilar) representing no shared species between the samples. Using long-term monitoring data collected by the National Park Service at twelve mountain lakes in Washington State, USA, community data representing a series of 12-15 years were analyzed. Using the Jaccard index, temporal beta diversity values averaged ~0.5 across the long-term monitoring lakes, with significant variability across lakes. The results of this study indicate that these mountain lake macroinvertebrate communities exhibited relatively high rates of taxa turnover, and that some climatic, biotic, and physical variables had significant relationships with the rate of gains and losses in the community.

SESSION 2: SOAP LAKE AND LAKE COEUR D'ALENE

The Unique Properties of Soap Lake, a Meromictic Gem

Leo Bodensteiner, Western Washington University

In 2023 Soap Lake was designated as an Outstanding Resource Water by the Washington Department of Ecology based on its unique chemical and physical environments and its recreational values. The limnological classification of the lake as meromictic is based on the long-term stratification seen in its vertical profile and is caused by an abundance of dissolved substances in the deepest part of the lake – essentially, it is a less saline lake on top of a highly saline pool of un-circulating mineral water. After the inception of the Columbia Basin Irrigation Project in the 1950s, groundwater gains into the lake approximately doubled, flooding the shoreline, diluting the surface waters, and shrinking the size of the underlying mineral pool. During 2002-2005 we developed a water budget and characterized seasonal profiles of physical and chemical conditions. Water from above and within the mineral pool was analyzed for microchemical constituents. We concluded that the interception wells at the ends of the lake were effective in managing lake levels, but dilution of surface waters continued with a projected reduction of 5.6 million kg of minerals per decade. The depth of the mineral pool was projected to recede approximately 8 cm per year. Chemical constituents in the lake and the underlying pool underscore the uniqueness of this lake and provide insight into some of the positive health effects that have been reported. Unchecked, the mineral pool seems likely to be completely eroded this century with factors associated with climate change exacerbating the rate of loss.

Phosphorus and Nitrogen from Coeur d’Alene Lake’s Tributary Network

Craig Cooper, Idaho Department of Environmental Quality

Coeur d’Alene Lake is a valuable natural resource with sediments extensively contaminated by historic mining practices. This contamination is managed by limiting lake productivity through nutrient inputs into the lake. The lake’s watershed includes two major rivers and many smaller tributaries. While the rivers are regularly monitored, relatively little is known about the phosphorus and nitrogen contributions from the network of smaller streams that feed into the lake. These streams combine to drain a 468 mi^2 watershed that is facing heavy development pressure. Nitrogen and phosphorus load for 20 watersheds comprising 35% of the watershed’s area were monitored from 2019 – 2022 for both the total mass and the soluble reactive fraction. These data provide information to prioritize nutrient management activities. Nutrient loads are highly variable over both space and time, with fluctuation in discharge describing approximately 50% of the observed variability. Initial estimates for the potential contribution indicate that these streams provide < 10% of the total annual phosphorus load but are an important contributor to the productivity in winter and early spring. Data will be presented to identify high priority watersheds, describe seasonality, and evaluate changes over time.

A paleo-limnological investigation of Coeur d’Alene Lake sediments – Year 1 of 3

Ben Scofield, Coeur d'Alene Tribe - Water Resources Program
Co-authors: Daniel Gavin, Jeffery Stone, Hirak Parikh, Craig Cooper, Dale Chess

Sediments deposited in lakes preserve materials that can be used to infer past lake conditions and watershed disturbance. While sediment chemistry with regard to mining wastes has been studied extensively in Coeur d’Alene Lake, examination of biological remains has received less attention. We have embarked on a study to describe biological remains along with bulk sediment characteristics and chemistry. In this presentation, we will provide an update on year-one activities. We collected sediment cores in September 2024, from multiple sites along a north-to-south transect and have begun analyzing the sediments. Cores were collected using a Livingstone corer for long core sections and a gravity corer for surficial sediments. Most of the cores show distinct sections with light and dark banding, which presumably correspond to periods of direct mine waste disposal in the Coeur d’Alene River Basin. Initial analyses have included optical imaging, micro-XRF, and computed tomography scans of core cross sections, as well as sediment chronology using Pb-210 and Ra-226. Future work will include analysis of sediment chemistry, biogenic silica, algal pigments, diatom frustules, and macroinvertebrate remains. The goal of the project is to use multiple lines of evidence to reconstruct lake conditions through time. We are particularly interested in the pre-colonial period, the land development/mining era, and the recent period following major cleanup and restoration efforts in the Coeur d'Alene River Basin. We will use the fuller context of past lake conditions to update lake management goals and restoration targets.

Bay Watchers: Lake Coeur d Alene Citizen Science Water Quality Monitoring Program

Meg Wolf, University of Idaho - Idaho Water Resources Research Institute

Bay Watchers is a collaborative citizen science program focused on water quality monitoring and public education in Coeur d'Alene Lake. Led by the Idaho Water Resources Research Institue (IWRRI), and in partnership with state agencies, governments, and local lake communities, the program engages residents in data collection efforts while fostering a network of informed and connected neighbors. Participants collect key water quality parameters, including temperature, water clarity, dissolved oxygen, pH, and specific conductivity, using accessible tools such as Secchi disks, temperature loggers, and multiprobe sensors. The primary goal of the program is to promote environmental literacy and stewardship through hands-on involvement, while a secondary goal focuses on tracking long-term water quality trends. Data that indicate potential impairments are flagged and shared with partnering agencies for further investigation. Through ongoing community engagement and scientific collaboration, Bay Watchers contributes to the sustained health and understanding of the Coeur d'Alene Lake ecosystem.

SESSION 3: HABS MANAGEMENT

Between The Tides: Managing HABs in a Constructed Freshwater Canal System along the Washington Coast

Katie Rodriguez, Herrera Environmental Consultants
Co-authors: Tim Clark, Herrera Environmental Consultants

On a narrow peninsula between the Pacific Ocean and Grays Harbor, the City of Ocean Shores hosts 23 miles of winding freshwater lakes and canals, providing wildlife habitat, drawing visitors, and offering a rare place for calm amidst the tides. However, since the canals' construction in the 1960s they've been plagued with toxic algae blooms and nuisance plant growth driven by naturally nutrient-rich groundwater. Partnered with the City, Herrera developed the Ocean Shores Fresh Waterways Algae Management Plan (FWAMP) to manage these issues. We centered the FWAMP on a combination of community engagement and comprehensive monitoring and analysis to evaluate feasible algae control options that aligned with community values. Due to elevated phosphorus in groundwater and strong connectivity to surface waters, source control strategies are not feasible, and watershed nutrient reductions alone are not enough. Given the variable conditions across the lakes and canals, we developed an adaptive management framework focused on creating nine distinct "management units"—

independently managed segments of the waterway system defined by shared hydrology and water quality. This enables targeted interventions, performance tracking, and testing of innovative treatments tailored to local conditions. By customizing strategies to each unit, the City and residents can address local challenges while building a coordinated, system-wide response. Recommended actions include phosphorus inactivation, surface mixing, monitoring, and active public communication. This flexible yet structured approach offers a clear path to improving Ocean Shores' fresh waterways and offers a model for other complex waterways facing similar issues.

Developing a Lake Management Plan for Wiser Lake through Monitoring, Modeling, and Stakeholder Engagement

Mark Rosenkranz, Aquatic Insight LLC
Co-authors: Robert Annear, Zoe Rodriguez del Rey and Dr. Lizbeth Seebacher

Wiser Lake, located in Whatcom County, Washington, is a shallow, eutrophic lake that has experienced cyanobacteria blooms and related water quality concerns. In response, the Whatcom County Health and Community Services partnered with consultants and stakeholders to develop a Lake and Watershed Management Plan aimed at identifying practical strategies to improve lake water quality. This presentation outlines the structure and findings of the planning process and resulting plan, which included (1) a comprehensive review of existing data (2) review of sediment and macrophyte surveys, (3) development of a nutrient budget and phosphorus model(s) and (4) stakeholder engagement, which was central to the project. Monitoring data collected by the County showed a well mixed lake, with dissolved oxygen trending lower near the sediment, which could lead to diurnal stratification. A cyanobacteria bloom in October followed a period of nutrient buildup possibly from internal loading. Nutrient budget modeling confirmed that internal loading is a dominant source of summer phosphorus, though external inputs also contribute. Based on these findings, the completed Lake and Watershed Management Plan recommended a dual focus: reducing watershed nutrient inputs over the long term and pursuing in-lake strategies to address internal loading in the near term. The Plan identifies potential funding strategies for lake restoration activities. Wiser Lake shares characteristics with other small, nutrient-enriched lakes across the Pacific Northwest. This work offers a scalable model for communities aiming to integrate local knowledge, targeted monitoring, and modeling tools into lake management.

Lacamas Watershed Path to Recovery

Rodger Hauge, Lacamas Watershed Council
Co-author: Vicky Wessling

The Lacamas Watershed Council is a five-year-old 501(c)(3) nonprofit dedicated to improving water quality in the Lacamas Watershed. We are proud to be part of NOAA's Phytoplankton Monitoring Network. What began with three littoral monitoring sites has grown into a comprehensive program that includes monitoring all three lakes in the system, conducting aquatic plant surveys, sampling mid-lake conditions, and beginning macroinvertebrate assessments in watershed creeks.

We have also supported the launch of a water quality monitoring initiative at Vancouver Lake, and are currently exploring the use of floating islands to help reduce phosphorus levels in the watershed. Our public outreach efforts focus on phosphate reduction, as excessive phosphorus is a key driver of water quality issues. While our findings reflect typical patterns observed in eutrophic lakes, we are now shifting our focus more directly toward identifying and managing sources of phosphorus entering the system.

Adaptive Monitoring and Management of Cyanobacterial Blooms in Lacamas Lake System

Zoe Rodriguez del Rey, Annear Water Resources
Co-authors: Rob Annear: Mark Rosenkranz; Brian Monnin; Noah Benitez-Nelson

Lacamas Lake and its connected water bodies in Camas, Washington, have been experiencing frequent cyanobacteria harmful algal blooms (cHABs), driven by internal and external nutrient dynamics. In response, the City of Camas is implementing a targeted, adaptive monitoring program to improve the detection, understanding, and management of bloom conditions in Lacamas, Round, and Fallen Leaf Lakes. This presentation outlines their updated Monitoring Plan and preliminary data which includes four core components: (1) baseline monitoring of lakes and tributaries; (2) targeted cHAB surveillance; (3) storm event sampling to assess phosphorus inputs and mixing; and (4) pre- and post-treatment monitoring. The plan emphasizes actionable, high-frequency summer sampling and strategic expansion to high-risk areas like the Cove, a shallow embayment of Lacamas Lake. Microcystin concentrations in the Cove have historically exceeded Washington State's recreational thresholds, triggering health advisories and site-specific management considerations. The focused effort in the Cove includes summer monitoring, sediment sampling, and vegetation surveys to assess its role as a possible bloom source. The monitoring framework is designed to support adaptive lake management, guiding the timing and location of in-lake phosphorus treatments and was put to use in early summer 2025. By prioritizing monitoring activities that directly inform management decisions, the Plan ensures available resources are used efficiently. This targeted, adaptive Plan supports cost-effective treatment strategies and offers a transferable model for other lakes navigating similar challenges with cHABs.

Scale Application of Zero Valent Iron for Phosphorus Sequestration in Lake Steilacoom, Pierce County, Washington

Jake Walker, Northwest Aquatic Management, LLC
Co-authors: Jeffrey Tepper, University of Puget Sound, Don Russell, City of Lakewood Monitoring Program, Kyle Steelhammer, Northwest Aquatic Management, LLC

Lake Steilacoom (320 acres, avg. depth 11 feet) is a flow-through lake with a long history of harmful algal blooms (HABs). In 2023, a two-phase treatment plan using Zero Valent Iron (ZVI) was initiated to mitigate internal phosphorus loading. Coarse ZVI was applied at inflow points in spring to intercept phosphorus before entering the lake, followed by fine ZVI in summer to strip soluble reactive phosphorus (SRP) from the water column. The strategy eliminated HABs in 2024 and proved more economical than previous algaecide treatments. Based on this success, the lake association continued ZVI use in 2025 with enhanced monitoring to refine timing, dosage, and location of applications. This project represents one of the first broad ZVI applications for lake nutrient management in the Pacific Northwest. We present water quality data from before and after treatments and discuss key lessons learned in logistics, permitting, and stakeholder communication. This project provides a replicable model for nutrient management in eutrophic lakes.

SESSION 4: INVASIVE SPECIES MANAGEMENT

Early Detection Monitoring for Invasive Mussels in Washington State

Rody Seballos, Washington Department of Fish and Wildlife
Co-author: Nicholas Plants

The potential introduction and establishment of invasive mussels like the zebra, quagga and golden mussel pose a catastrophic threat to Washington State's ecological, economic, cultural, and recreational resources. These aquatic invasive species can rapidly colonize water infrastructure, disrupt aquatic food webs, limit recreational opportunities, and cause billions in damages. Early detection monitoring is paramount to preventing widespread infestation and enabling a rapid, effective response. The Washington Department of Fish and Wildlife (WDFW) serves as the lead agency in this effort, implementing a multi-faceted approach to early detection monitoring across Washington. This includes watercraft inspection stations at key entry points, monitoring techniques such as environmental DNA (eDNA), plankton tows, artificial substrate deployments, visual surveys, underwater ROV surveys, and more. WDFW's strategies aim to intercept mussels before they establish and detect newly established populations quickly to minimize the enormous costs associated with managing established infestations. Crucially, the success of early detection hinges on broad public engagement. Lake associations play a vital role in augmenting WDFW's efforts through education and outreach initiatives. By disseminating information on the "Clean, Drain, Dry" protocol for watercraft, promoting citizen science reporting of suspicious findings, and fostering a sense of shared responsibility, these associations empower waterfront communities to become frontline defenders against invasive mussels. This collaborative approach, combining lead agency expertise with informed community vigilance, is essential to safeguarding Washington's precious aquatic ecosystems.

Permitting chemical applications for lake management

Shawn Ultican, Washington State Department of Ecology

If you are involved in treating lakes with aquatic herbicides, algaecides or other chemicals, please attend this session to share your questions and concerns with Ecology staff. Chemical treatments are one tool available for successful lake management. Aquatic pesticides or other chemicals can be used to effectively control aquatic plants, algae blooms or limit nutrients like phosphorus. Before these treatments can take place, coverage under Ecology's

Aquatic Plant and Algae Management general permit (APAM) is usually required. The APAM permit has recently been revised, and is now open for public comment. This session will provide an overview of proposed changes to the APAM permit, and the reasons behind them. We welcome your input. We can also discuss when permit coverage is required, how to apply for coverage, a realistic timeline to get coverage, and other topics such as monitoring and reporting requirements.

Effectiveness of florpyrauxifen-benzyl for invasive milfoils in Washington State

Lauren Kuehne, Omfishient Consulting
Co-authors: David Heimer, Ben Peterson

Invasive Eurasian and variable-leaf milfoils pose immense ecological and economic challenges, including management and control, reduced property values and recreational opportunities, and loss of habitat to support native plant and animal species diversity. Prior to 2018, the most common herbicides used to treat submersed milfoils were 2,4-D and fluridone, which have limitations in terms of herbicide selectivity and use in waterbodies that support salmonids. The new product of florpyrauxifen-benzyl [trade name ProcellaCOR] was registered with the EPA for aquatic use in 2017, and has seen growing use. It is a synthetic auxin with many reported desirable features for management of non-native milfoils, including low toxicity profile, short exposure time requirements, and high selectivity. Our work reports on two years study of ProcellaCOR efficacy in natural lakes in Washington State. Our objectives were to evaluate short-term (2-months post-treatment) and long-term (>1 years post-treatment) outcomes in lakes treated with ProcellaCOR, invaded with either Eurasian milfoil (*Myriophyllum spicatum*) or variable-leaf milfoil (*Myriophyllum heterophyllum, Myriophyllum heterophyllum x Myriophyllum hippuroides*). We report on before-after sampling in ten Washington lakes, using grid-based sampling that documented all aquatic species present to evaluate herbicide selectivity. We also report on retrospective surveys of lakes treated with ProcellaCOR between 1-4 years previously. These data are intended to support managers and lake associations in decision-making for management of invasive milfoils.

Aquatic Plant Management in Lake Tapps, Pierce County

Rich Miller, Environmental Science Associates
Co-authors: Toni Pennington, Paula Anderson, Melina Thung

In 2009, Cascade Water Alliance acquired the Lake Tapps Reservoir to serve as a future drinking water source for its member agencies. Although the reservoir is not expected to be used for potable water for several decades, protecting its current water quality remains a top priority to prevent costly restoration efforts down the line. A central component of this stewardship is the management of aquatic vegetation. Cascade developed its first Integrated Aquatic Vegetation Management Plan (IAVMP) in 2010, initially focused on eradicating the invasive spiked milfoil (*Myriophyllum spicatum*) using herbicide treatments and diver-assisted hand pulling. Treatments have ranged up to 240 acres annually. While these efforts significantly reduced the milfoil population, complete eradication proved elusive. Updates to the plan in 2015 and 2025 shifted the focus from eradication to long-term control and expanded the scope to potentially include other invasive and nuisance native species. This presentation will cover the history of aquatic plant management in Lake Tapps, provide an overview of the 2025 IAVMP, and share insights from the comprehensive lakewide aquatic plant surveys conducted in 2023 and 2024 that informed the latest management strategies.

Seeing Beneath the Surface: Interactive Mapping of Plants, Animals, and Change in Our Lakes
Dominick Leskiw, Snohomish County Surface Water Management
Co-authors: Marisa Burghdoff, Jennifer Oden, Ethan Fleming

Snohomish County's snorkeling surveys, conducted annually at 3–4 local lakes, provide a dual benefit: rigorous mapping of aquatic plants and valuable observations of other aquatic life, including sponges, mollusks, fish, amphibians, and more. These surveys offer a multi-dimensional view of lake ecosystems, helping track both native and invasive vegetation, as well as broader biodiversity. Plant data is cataloged, mapped to specific locations, and converted into an interactive format using ArcGIS Pro and ArcGIS Experience Builder. The latter platform enables stakeholders to visualize plant community distributions, identify locations of invasive species, and, in lakes with multiple years of data, assess changes across time in response to environmental conditions or management actions. This presentation will detail our survey methodology, highlight advancements in mapping accuracy and data variety, and explore innovative approaches for making plant and aquatic life data accessible to lake managers, residents, and beyond.

SESSION 5: DIVERSE LAKE MANAGEMENT STRATEGIES

Protecting Lake Tapps Reservoir as a Future Water Supply in the Puget Sound Region of Washington
Tim Clark, Herrera Environmental Consultants
Co-authors: Rob Zisette, Owen Reese, and Melina Thung

The Lake Tapps Reservoir is a planned future drinking water source and current regional recreational asset surrounded by residential developments and municipal parks along its 42 miles of shoreline. This offline reservoir is fed by a diversion of the White River, which turns white in summer from phosphorus-rich glacial flour from Mount Rainier. The 4.5-square-mile reservoir is oligotrophic with good water quality, but cyanobacteria blooms have occasionally resulted in health advisories and Eurasian watermilfoil has become well established. Increased nutrient input to Lake Tapps Reservoir is the primary water quality concern for the future municipal water supply because the resulting increased algae growth could result in higher operating costs and reduced treatment system reliability. Modeling predicts that reservoir phosphorus loadings would significantly increase from the planned more than doubling of river input for the future water supply. A reservoir water quality management plan was developed to determine how best to protect existing water quality for up to and beyond operation of a water treatment plant in about 40 years. Considerations include demonstrating the benefits of monitoring and controlling watershed phosphorus inputs now given the good water quality but projected increases in internal phosphorus loading, and beyond water supply operation given the overwhelming phosphorus inputs from glacial flour in the White River. This plan and presentation are based on the collaborative work of a drinking water supplier, local governments, climate change scientists, hydrologists, and limnologists to develop data-driven and adaptive management solutions to changing conditions for effective source water protection.

Revisiting Kammer: Does Urban Development Truly Have No Impact on Lake Trophic State?
Curtis DeGasperi, King County

In 2004, University of Washington graduate student Nora Kammer conducted an independent study using King County Lake Stewardship data to examine the relationship between watershed characteristics and lake health. Her research explored three key hypotheses: (1) High-density land use negatively impacts lake water quality, (2) Forested land use benefits lake health, and (3) Septic systems degrade water quality. Lake health was assessed through summer surface water measurements of total phosphorus, chlorophyll a, and Secchi depth. Predictor variables included watershed, riparian, and lakeshore development patterns, lake physical characteristics, and wastewater treatment systems (sewer vs. septic). Kammer's findings suggested that high-density development correlated with improved water quality, while low-density development and extensive forest cover were associated with degraded water quality. Additionally, lake watersheds relying on sewer systems exhibited better water quality than those dependent on septic systems. Building on Kammer's work, I compiled a larger and more recent dataset spanning the Puget Sound lowlands. This study revisits Kammer's questions, providing updated insights into the factors influencing lake health in the region.

24 YEAR ASSESSMENT OF THE EFFICACY OF NUTRIENT SUPPLEMENTATION ON LAKE QUINAULT- 2000-2023
Darren Brandt, Advanced Eco-Solutions

In 2003 Lake Quinault was identified as a candidate lake for nutrient supplementation with the first application of nutrients occurring in 2004. The nutrient supplementation methodology and prescription have evolved over the course of the project. We assessed the changes observed in nutrients concentrations, primary and secondary producer status and changes within the fishery community from pre-nutrient supplementation years (2000-2003) through the early nutrient supplementation years (2004-2012) and the most recent years with the newer prescription rates (2013-2023). The long-term data set showed changes in climatological variables as well as significant increases in primary and secondary productivity that have benefited the sockeye recruitment and growth rates.

Holding the Line or Losing Ground? Tracking Shoreline Change in Snohomish County Lakes
Marisa Burghdoff, Snohomish County Surface Water Management

Lake shorelines are dynamic transition zones that provide key functions and values such as habitat and water quality. Yet shorelines are also highly vulnerable to shoreline change as there are pervasive social norms on lakes, such as maintaining lawns to the water's edge, installing docks, or adding bulkheads. Starting in 2008, the county has protected lakeshores through "critical areas" regulations. This talk will discuss the results and next steps of a 2024 analysis to assess the efficacy of these critical area regulations. The county surveyed shoreline conditions at 26 publicly accessible lakes a decade apart (2008–2009 and 2021–2022). Shorelines were classified for armoring, vegetation health and dock areas. Results show that overall shoreline conditions have remained relatively stable, but small increases in armoring and dock density, paired with only modest vegetation recovery, suggest that social behaviors continue to outweigh maintaining natural shorelines. At the same time, there has been some evidence of armoring loss and restoration through the County's LakeWise program. These factors indicate change is not always one-directional, and that policy tools, and outreach programs to shift community values can influence outcomes. These findings underscore the need to protect lake shorelines through multiple methods. While policy tools provide an important framework, lasting progress depends on community engagement and building shared values around natural shorelines. By combining education, incentives, and consistent implementation of existing protections, managers can help sustain the ecological functions and resilience of Snohomish County's lakes.

Working Towards a Better Toxic Algae Monitoring and Advisory Program for Seattle's Green Lake

Rob Zisette, Friends of Green Lake

Seattle's Green Lake has a long history of toxic algae blooms that have been managed using alum treatments in 1991, 2004, and 2016. King County has monitored cyanotoxins weekly at three beaches and in response to observed cyanobacteria scums for many years. These results have shown that microcystin concentrations typically exceed state guidelines in scum samples but not in underlying or adjacent water samples. In 9 years since the 2016 alum treatment, the microcystin guideline of 8 ug/L has been exceeded only 7 times and has not exceeded 16 ug/L, and yet, the lake was closed to recreation for three weeks each time until low values are obtained in two following sets of weekly samples. The most recent closure on June 16, 2025 was due to one sample of a small scum with 8.3 ug/L microcystin while it was not detected in any of the 3 beach water samples, which closed the main swimming beach for 3 weeks including days with temperatures in the 80s. Friends of Green Lake volunteers are working with local jurisdictions to improve toxic algae monitoring and advisory procedures to better protect lake users and avoid unnecessary restrictions to lake recreation.

Poster Presentations

The Impact of Non-Native Trout on Aquatic Food Webs in Mount Rainier Lakes: A Stable Isotope Analysis

Kena Fox-Dobbs, University of Puget Sound
Co-authors: Rebecca Lofgren, Naomi Wurtzel, Sophia Haynes

Over the past century, historically fishless lakes within Mount Rainier National Park (MRNP) were stocked with non-native brook trout (Salvelinus fontinalis) and rainbow trout (Oncorhynchus mykiss). While fish have been completely removed from some lakes, others are still undergoing the removal process. During summers of 2024 and 2025 we collected samples, and used stable isotope analyses (δ13C and δ15N) to understand trophic structure and microhabitat use of organisms in MRNP lake ecosystems. Specifically, we sampled periphyton, algae, macrophytes, benthic macroinvertebrates, amphibians, and fish to estimate food web interactions in four lakes. By comparing these data across lakes in various stages of fish removal, we gain insight into how these aquatic food webs respond to the removal of a non-native predator. Our study will contribute a new ecological perspective that will complement existing data and interpretations about food web interactions. For example, previous research in MRNP has shown that salamanders, which are native top predators, have marked shifts in behavior and abundance in lakes that have undergone fish removal.

iNaturalist for Lakes: Community Monitoring for Lake Health and Invasive Species

Ethan Fleming, Snohomish County Surface Water Management

Many agencies and lake managers often lack the capacity for consistent monitoring, making it difficult to track changes in biodiversity or identify potential invasive species early. These changes are critical for good lake management as well as preserve the health of these lakes. iNaturalist offers a practical, no-cost tool to address this gap by enabling lake-specific projects that document species, map distributions, and engage local communities in citizen science. Attendees will learn how to set up and manage lake-focused projects that engage lake visitors, residents and researchers in documenting biodiversity in and around lakes through user-submitted observations of plant and animal species, tagged with precise geolocation data. This section covers how to find research grade data and export the observations to GIS software's for mapping and analysis. These methods will provide management agencies tools to track location, analyze species distribution and use results to inform management decisions. These tools provide agencies and resource managers will high-quality ecological data while utilizing community participation to reduce monitoring costs. By combining citizen science with spatial analysis, this approach empowers lake managers and residents to take an active role in ecological monitoring, improve stewardship, and contribute meaningfully to the protection and understanding of their local lake ecosystems.

WALPA
Washington State Lake Protection Association

Reducing human and ecological arsenic health risk in an urban lake using lanthanum modified bentonite

Aurora Alexander, University of Washington Tacoma
Co-authors: Justin Ray, Emese Hadnagy, Jim Gawel

Lake Killarney (Federal Way, WA) has legacy arsenic pollution from the ASARCO smelter that operated in Ruston, WA, for almost a century. The carcinogenic fallout from the smelter has created a need to reduce bioavailable arsenic that can accumulate up the food chain and into humans. Our research group evaluated a commercially available lanthanum modified bentonite (LMB) product called EutroSORB G across six in-lake mesocosms: two untreated controls and four LMB treatments at two doses, low (0.25 kg m-2) and high (1.0 kg m-2). Biweekly sample collections were carried out. A lake background profile outside the mesocosms was measured using a multiparameter sonde for temperature, pH, and specific conductance. Surface and bottom readings were taken for each mesocosm before treatment, but to avoid mixing associated with deploying the sonde we installed oxygen and temperature data loggers in the mesocosms for the duration of the experiment. Water samples were collected into acid washed tubes by hand at the surface of the mesocosms, and bottom samples were collected through pre-installed tubing using a peristaltic pump. Both filtered (0.4 um) and unfiltered water samples were collected for dissolved and total arsenic and unfiltered samples for total phosphorus. Arsenic samples were acidified and analyzed using ICP-MS. Phosphorus samples were digested using potassium persulfate and analyzed by the ascorbic acid method. Our initial results indicate that LMB decreases arsenic concentrations. The results of our full experiment will be presented and will provide a baseline for future efforts aimed at reducing arsenic exposure.

Nutrient-Algal-Grazer Interactions: Do Lakes Behave Like Closed Ecological Systems?

Frieda Taub, University of Washington, School of Aquatic and Fisheries Sciences
Co-authors: Natalie Stillwell, Rachel Kasbohm

In lakes, are algal blooms associated with high pH? Are they associated with high O2? And does high pH and/or high O2 eliminate large grazers such as Daphnia? How much nutrient is recycled within the lake compared to the nutrients that are input and output? In our Closed Ecological Systems, high carbon, nitrogen, and phosphorus conditions are associated with high pH and O2 because they are closed to exchange with the open atmosphere. High pH and high O2 concentrations are associated with successful algal growth, and, consequently, the elimination of the grazers, Daphnia magna. Since the algae can grow faster than the grazers when nutrients are high, conditions associated with high algal abundance can kill the grazers and allow the algae to grow unconstrained. Lakes are open to the atmosphere, allowing CO2 to diffuse in and compensate for photosynthetic uptake, while O2 can be released. A review of the literature has shown a few examples of hypereutrophic lakes in Europe as having high O2 and pH, as well as a dominance of rotifers, some copepods, and few, if any, Cladocera. Although pH and O2 are generally measured in lake studies, they are rarely reported in publications.

Per- and Polyfluoroalkyl Substances (PFAS) in Freshwater Fish of Ten Washington Lakes
Callie Mathieu, Washington State Department of Ecology
Co-author: Katelyn Foster

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that persist in the environment and can accumulate in freshwater fish tissues to levels that pose health risks. Eating locally-caught freshwater fish is a significant source of human exposure for PFAS. In the fall of 2023, the Washington State Department of Ecology conducted a study to fill data gaps on PFAS in various freshwater fish species across a range of waterbodies. Ecology sampled a total of 324 fish (73 composites and 13 individual fish) and 30 water samples from ten lakes in Washington: American, Goodwin, Horsethief, Leland, Loomis, McIntosh, Nahwatzel, Sammamish, Spanaway, and Stevens. Results from this study expand our understanding of PFAS in the state's freshwater systems, inform risk assessments and fish consumption advisories, and provide a foundation for long-term monitoring of PFAS in lakes.