14th Biennial

State of the San Francisco Estuary Conference

October 21-22,

Speaker Abstracts 2019

Abstracts for oral presentations and speaker biographies at the 2019 State of the San Francisco Estuary Conference are compiled in this document. Abstracts are ordered by the conference schedule. In the abstracts, names of presenting authors are underlined.

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Day 1

Plenary

Concurrent Sessions

Day 2

Plenary

Concurrent Sessions

State of the San Francisco Estuary Conference: Opening Plenary Presenters

Kanyon Sayers-Roods (Hahashkani), Costanoan Ohlone and Chumash

Kanyon Sayers-Roods is Costanoan Ohlone and Chumash; she also goes by her given Native name, Hahashkani, which in Chumash means "Coyote Woman." She is proud of her heritage and her native name (though it comes with its own back-story) and is very active in the Native Community. She is an artist, poet, published author, activist, student, and teacher. Kanyon's art has been featured at the De Young Museum, the SOMArts Gallery, Snag Magazine, and numerous Powwows and Indigenous Gatherings. She provides this land acknowledgement as a formal statement that recognizes and respects Indigenous Peoples as traditional stewards of this land, and the enduring relationship that exists between Indigenous Peoples and their traditional territories.

Libby Schaaf, Mayor of Oakland

Mayor Libby Schaaf was inaugurated into office in January 2015 and launched an agenda to elevate one of America's most diverse and progressive cities into an equitable and resilient city. Born and raised in Oakland, Schaaf immediately led new initiatives to offset the cost of living crisis, reduce crime, improve transit and infrastructure, and expand educational and career opportunities for the city's most vulnerable residents. Before her election to City Council in 2010, Schaaf co-founded the non-profit Oakland Cares, which coordinated hundreds of volunteer community projects across the city. She also built and ran the first centralized volunteer program for Oakland public schools. Schaaf served as a legislative aide for former mayor Jerry Brown, and later worked as the Oakland city council's Economic Policy Advisor. She holds a law degree from Loyola Law School. Mayor Schaaf is an Aspen Institute-Rodel Fellow in Public Leadership, a diverse and bi-partisan group of "the nation's most promising young political leaders." She is a member of the Bloomberg Harvard City Leadership Initiative for mayors, and has worked with the Rockefeller Foundation to ensure Oakland is among the foundation's 100 Resilient Cities.

Mark Gold, Executive Director, Ocean Protection Council; Deputy Secretary for Ocean and Coastal Policy, California Natural Resources Agency

Mark Gold joined OPC in July of 2019. As Executive Director of OPC and the Deputy Secretary for Ocean and Coastal Policy for the California Natural Resources Agency, Mark serves as a key advisor to Governor and the Secretary of Natural Resources and directs policy, scientific research, and critical partnerships to increase protection of coastal and ocean resources in California. Prior to his appointment, he was the UCLA Associate Vice Chancellor for Environment and Sustainability where he led their Sustainable Los Angeles Grand Challenge effort. Prior to UCLA, Mark was the first hire at Heal the Bay, where he served as their President for 18 years. During that time, he worked on ocean and coastal legislation and policy, stormwater, watershed management, and marine conservation and coastal restoration issues, projects and programs. Over the course of his career, his research focused on beach water quality and health risks, as well as sustainable water resources management. Mark received his bachelor's and master's in Biology as well as his doctorate in Environmental Science and Engineering, all from UCLA.

Climate Change and the Future of California's Water

Geeta Persad

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Climate change is already transforming California's water cycle, putting stress on our rigidly engineered water infrastructure and our unique ecosystems. As climate change depletes the state's natural snowpack storage, concentrates rainfall into increasingly extreme events, brings salty ocean water farther inland, and dries out vegetation and soils, current water management strategies will need to be fundamentally rethought. The San Francisco Estuary, the heart of the state's natural water infrastructure, will be ground zero for the confluence of these stresses. In this talk, I will review past and new research that paints a picture of the profound transformation that climate change has in store for how, when, and where California gets its water. I will reflect on the implications of these shifts for the Estuary. Finally, I will close by offering strategies we can leverage to achieve resilience for California water and for the San Francisco Estuary in our climate-changed future.

Keywords: Climate Change, Water, Snowpack, Flood, Adaptation, Infrastructure
Session: Plenary Session: Day 1

Speaker Biography:

Dr. Geeta Persad is a Senior Climate Scientist at the Union of Concerned Scientists, where she leads research and analysis for the organization's Western Water and Climate Program. She has over a decade of experience in climate research, working to improve our understanding and prediction of global climate change. She has served as a federal scientist with the National Oceanic and Atmospheric Administration and has spoken on climate issues in a number of international venues, including the United Nations Rio+20 Conference on Sustainable Development and the 23rd United Nations Climate Change Conference of the Parties. Dr. Persad received her PhD in Atmospheric and Oceanic Sciences from Princeton University and a bachelor's degree in Geophysics from Stanford University.

Toward Social-Ecological Resilience: The State of the Estuary Report 2019

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The 2019 State of the Estuary Report (SOTER) is a shorter version of this regular check-in on the health of the San Francisco Estuary. The focus is on how the report is moving toward assessing social-ecological resilience, rather than just ecological health. This shift is based on the urgency of acting upon the inextricable links between human and natural communities in the Estuary. Several key indicators (freshwater flows, tidal marsh habitat, fish communities, beneficial flooding, and urban water use) have been updated, and their status and trends will be shared. And the report explores several new emerging indicators oriented toward resilience, specifically the connection between societal choices and the health of our human and natural communities. These emerging indicators – elevation, nature-based shorelines, urban green space -- which are being assessed across the Estuary for the first time, are the inspiration for a panel of experts working to advance social-ecological resilience in various ways throughout the Estuary.

Keywords: Estuary, Resilience, Health, Social, Indicators
Session: Plenary Session: Day 1
Speaker Biographies:
Letitia Grenier is a Senior Scientist at the San Francisco Estuary Institute, where she co-directs the Resilient Landscapes Program. Her focus is working with partners to develop large-scale, nature-based solutions for restoring ecosystem benefits against the backdrop of development and climate change. She was the science lead for the 2015 and 2019 State of the Estuary Reports and the 2015 climate change update to the Baylands Ecosystem Habitat Goals, heading a team of over 200 environmental scientists, managers, and regulators to develop science-based recommendations for restoring and maintaining the health of SF Bay's tidal wetlands. She is a principal investigator for the Delta Landscapes project, which has completed in-depth analyses on the change in the Delta over time and is now offering science-based guidance on how ecosystem health can be recovered as part of this working landscape. Letitia holds a Ph.D. in Conservation Biology from the University of California at Berkeley.

Will Dominie brings a decade of policy experience helping local health departments and community - based organizations create equitable, health promoting communities. His work bridges health, housing, land-use, transportation, and climate change, and focuses on ensuring that working class communities and communities of color play a lead role in building the future. Will has spent the last four years as a planner and policy specialist with San Mateo and Contra Costa County Health Systems, and has also been a leader in BARHII's work on health and the built environment. Will's research and writing has been published in Progressive Planning, The Informal American City, and by the Labor Community Strategy Center, and has won a top award from the Council of University Transportation Centers. Will has a M.A. in urban planning from UCLA, where he focused on the interactions between transit investment, land use patterns and environmental justice in low-income communities of color.

Jackie Zipkin is the General Manager of the East Bay Dischargers Authority (EBDA), a Joint Powers Authority that efficiently and sustainably manages the discharge of wastewater from approximately one million East Bay residents to the San Francisco Bay. As an owner of infrastructure that runs along the edge of the Bay, EBDA is engaged with other stakeholders in improving the East Bay shoreline's resilience through multi-benefit strategies. Jackie also serves on the Executive Board of the Bay Area Clean Water Agencies. Prior to joining EBDA in 2018, Jackie served as Manager of Environmental Services at East Bay Municipal Utility District. Jackie's career started in consulting, where she supported water and wastewater agencies around the world on a range of projects addressing sustainable water portfolio management. Jackie holds a B.S. and M.S. in Civil and Environmental Engineering from Stanford University and is a registered Professional Engineer in California.

Gabby Trejo is the oldest of six children and first generation in the U.S. She has a B.A in International Relations with an emphasis on Latin America from California State University Chico. Being raised Catholic, Ms. Trejo was called to faith-based organizing after being involved in her community and realizing that there is a clear intersection of faith and justice. She brings over 6 years of direct service experience as the community outreach coordinator for Women Against Gun Violence and Lupus LA. She started working for Faith In Action (a national community organizing network) in early 2013 and is currently the Executive Director for Sacramento All Congregations Together. Her organizing portfolio includes the following issues: immigration, restorative justice, housing, homelessness, healthcare and environmental justice.

Building Trust: Striving Toward Equitable and Inclusive Outcomes

Nahal Ghoghaie Ipakchi [1], LaDonna Williams [2], Violet Saena [3], Deldi Reyes [4], Beth Rose Middleton [5], Josue Medellin-Azuara [6]

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While planning processes for resource management are improving in their efforts to include the contributions and concerns of frontline, impacted communities, there is still much work to be done. This plenary session will discuss which questions should be asked and which solutions need to be put into play to ensure that front-line communities, including those who are land-dependent, are brought to the table and lead the charge on land use planning and resource conservation. The panel will also review the cross-industry methods used to get to this level of equity. This conversation includes representatives from varying experiential perspectives including government, academia, community advocacy, etc. who are all working on various forms of social equity in the scope of natural resource management. Case studies and efforts in place that exemplify the positive impact made by community-led planning or human-dimension studies will be highlighted, along with points of tension and processes that still need improvement. As a result of this session, conference attendees (especially those with managerial/legislative/etc. impact) should walk away with the idea that they have more work to do in order to make sure they are not ignoring community needs and environmental injustice, and explore what actions they should take back to their agencies to bring equity into their processes.

Keywords: social, equity, human, dimensions, eco, stewardship, health, injustice
Session: Plenary Session: Day 1
Speaker Biographies:
Nahal Ghoghaie Ipakchi is a researcher, educator and advocate dedicated to making environmental justice and social equity central to climate and environmental planning and policy processes. Through her role as Director at EcoEquity Consulting, Nahal helps agencies and organizations work with community leaders on collaborative projects to embed environmental justice and social equity throughout their operations. Bringing close to two decades of experience on collaborative water management, climate adaptation policy, Tribal sovereignty, watershed protection, environmental justice, social equity, disaster preparedness, and coalition building, Nahal has built a solid reputation as a trusted bridge-builder with underrepresented communities and government agencies.

LaDonna Williams is the Programs Director at All Positives Possible, a grassroots, community-based organization serving the extended Bay Area. Through All Positives Possible and independently, LaDonna assists efforts by low-income, underserved communities of color to confront the growing injustices they face including environmental health, economic crisis, and social inequity. She helps to provide outreach, trainings, advocacy and mentoring support to affected communities in order to promote positive non-violent action as a means of community empowerment and social involvement to improve health,

environmental conditions, and quality of life. LaDonna is a powerful and active community advocate for environmental justice, heath, anti-environmental racism and social injustices.

Violet Saena has served as a climate change expert for the past 15 years, being sought after internationally to speak with, mentor, and make presentations to various groups to assist them in improving their communities. As the Resilient Communities Program Director, she now leads Acterra's Resilient Communities program serving communities on the frontline of climate change and sea-level rise. Violet has assisted with climate change policy improvement in Samoa; liaised with other Pacific islands and the Caribbean on climate change issues and projects to ensure regional coordination and support for small island states. Her current focus is on providing climate change solutions locally, nationally, and worldwide.

Deldi Reyes is the Environmental Justice (EJ) Program Manager at the California Environmental Protection Agency where she provides training on EJ and racial equity to state employees. She co-leads CalEPA's racial equity team. CalEPA is a member of the Government Alliance on Race and Equity, a national network of state and local jurisdictions working to achieve racial equity and advance opportunities for all. She has trained close to a thousand government employees on environmental justice. Deldi worked for over 25 years at the U.S. Environmental Protection Agency's Rocky Mountain West Region as an inspector and enforcement officer under Clean Air and Clean Water Act programs. Deldi helped launch the EJ program in US EPA's Rocky Mountain West Region and managed the EJ program at USEPA's Pacific Southwest Region. At the national level, Deldi helped develop US EPA's Community Action for a Renewed Environment program—a grant program to support community-driven environmental health priorities. Deldi has a M.Sc. in Environmental Science and a B.S. in biology. She was born and raised in the Rio Grande Valley of South Texas.

Beth Rose Middleton Manning is Associate Professor of Native American Studies at UC Davis. Beth Rose's research centers on Native environmental policy and Native activism for site protection using conservation tools, and her broader research interests include intergenerational trauma and healing, rural environmental justice, and Indigenous analyses of climate change. Beth Rose has written two books: Trust in the Land: New Directions in Tribal Conservation (University of Arizona Press 2011), on Native applications of conservation easements, and Upstream (University of Arizona Press 2018), on the history of Indian allotment lands at the headwaters of the California State Water Project. Beth Rose is passionate about increasing under-represented perspectives, especially Indigenous perspectives, in academia and in environmental policy and planning.

Josué Medellín-Azuara is an acting associate professor in Civil and Environmental Engineering at UC Merced. He also serves as associate director at the UC Davis Center for Watershed Sciences and the UC Agricultural Issues Center. He is an adjunct research fellow at the PPIC Water Policy Center. His research and expertise includes socio-economics of agricultural, environmental and urban water use; development of large-scale economic models for water supply and policy analysis, adaptation to climate change, and integrated water management. Josue has consulted for government agencies, NGOs, industry, and academia, including the Natural Heritage Institute, the Stockholm Environment Institute, the Catholic University of Chile, and the World Bank and has been a visiting professor at the Federal University of Rio Grande do Sul in Brazil. Josue obtained his Ph.D. from UC Davis with his dissertation on environmental water uses in the Colorado River Delta.

A Regional Vison for Coordinated Monitoring: The Wetland Regional Monitoring Program

Luisa Valiela [1], Xavier Fernandez [2]

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Monitoring of tidal wetlands in the San Francisco Estuary has typically been implemented on a project-by-project basis to fulfill regulatory permit requirements. Although this has provided valuable insights into conditions and processes at specific sites, it has not provided a comprehensive understanding of regional tidal wetland status and trends. This has made it difficult to identify how regional drivers, such as sea level rise and development, are impacting tidal wetlands. A more regional approach to monitoring tidal wetlands would better prepare us for decisions that will need to be made on where and how to implement restoration and enhancement projects that provide the greatest benefit to the diversity and resilience of estuarine habitats. The U.S. Environmental Protection Agency has funded the development of a WRMP Plan through a collaborative and science-based process led by the San Francisco Estuary Partnership. San Francisco Bay Regional Water Quality Control Board have participated in the core team and steering committee for this process and played an integral part in developing the scientific framework for the WRMP Plan. This framework for regional monitoring focuses on five management questions that will (1) inform decision makers of the condition of the Bay's tidal marshes on a regional scale and (2) improve the effectiveness of permitting and monitoring of tidal wetland restoration projects, such as those funded by the San Francisco Bay Restoration Authority. This presentation will describe the goals and objectives of the WRMP, the development process, and the Program Plan that will be released by the end of 2019.

Keywords: Wetlands, Monitoring, Regional, San Francisco Bay, Bay, Estuary, Tidal, WRMP
Session: From Regional to Local: Integrated Monitoring for Healthy Wetlands

Speaker Biographies:

Luisa Valiela is an Environmental Protection Specialist in the Watershed Division of U.S. EPA Region 9. As the EPA's lead for advancing Clean Water Act programs in the San Francisco Bay Area, she collaborates with state authorities, local agencies, scientific organizations and interested stakeholders to protect and restore water quality and related habitats, such as wetlands and riparian areas. She also oversees the San Francisco Bay Water Quality Improvement Fund, a competitive grant program begun in 2008 to support projects that restore wetlands and watersheds, and reduce polluted runoff. She received a B.A. in International Relations from Boston University and an M.S. in Wildland Resource Science from the University of California at Berkeley.

Xavier Fernandez is the Chief of the San Francisco Bay Water Board's Planning Division. He is responsible for a number of Board programs, including water quality standards, TMDLs, and policy development. He is currently leading in the Water Board's Climate Change and Wetland Policy Update and is heavily involved with the SF Bay Regional Monitoring Program. He previously led the Water Board's creek and wetland permit program, and administered permits for large wetland restoration projects, such as the Bair Island and Cullinan Ranch Restoration Projects. Prior to the Water Board, he worked as an Environmental Scientist for the consulting firm TtEMI, where he assessed ecological risk, monitored tidal marshes, and evaluated habitat quality. He received a B.S. in Environmental Science from Dominican College of San Rafael and an M.S. in Environmental Management from the University of San Francisco.

Connecting the Dots on Regional Sediment Management: Coordinating Sediment Monitoring and Modeling in the Watersheds, the Bay, and the Wetlands

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Growing research focus on Bay sediment supply and transport has been driven by two trends. Historically, restoration of subsided, diked baylands has required significant sediment supply to support tidal marsh accretion, through natural processes or placing dredged sediment. Recently, likely impacts of climate change and rising sea levels on Bay natural and built communities have further highlighted the critical importance of sediment delivery to support estuarine and nearshore restoration, adaptation, and resilience. Since 2000, large-scale beneficial reuse of dredged sediment has been demonstrated at Sonoma Baylands, Hamilton Wetlands Restoration Project, and other sites. To respond to heightened concerns, scientists and engineers have emphasized the need for this approach, and are developing innovative strategies such as thin-layer placement to enhance tidal wetland elevations (e.g., at Seal Beach NWR). The Bay's limited supply, cost of placement, and magnitude of near-term project demand for sediment necessitates strategic study and regional management of sediment. Four ongoing, complementary efforts in the Bay will support sediment-related decision-making and help prioritize project implementation. The San Francisco Bay Conservation and Development Commission (BCDC) has been working on regional sediment management programming, and developed a Monitoring and Research Sediment Strategy to identify information gaps, and where further monitoring and modeling can help fill these gaps. The Wetlands Regional Monitoring Program (WRMP) is developing a Program Plan to monitor physical and ecological conditions and processes within intertidal marshes and mudflats, including sediment supply and accretion. The Regional Monitoring Program (RMP) Sediment Workgroup is developing an integrated monitoring and modeling strategy focused on processes within open water portions of the Bay. The RMP Sources Pathways and Loadings Workgroup (SPLWG) leads watershed sediment monitoring, and models estimates of watershed sediment supply. This presentation will describe these efforts, their coordination, and the roles each will play in informing Bay sediment management.

Keywords: sediment, San Francisco Bay, monitoring, modeling, process, geomorphology, marshes, mudflats
Session: From Regional to Local: Integrated Monitoring for Healthy Wetlands
Speaker Biographies:
Brenda Goeden is the Sediment program manager for the San Francisco Bay Conservation and Development Commission with 19 years of experience working in San Francisco Bay managing navigation dredging, beneficial reuse of dredged sediment, aggregate mining, wetland restoration, and beach nourishment projects. Career highlights hosting three sediment science workshops, the construction and breaching of Hamilton Wetlands, and project management of the South Bay Salt Pond Restoration and South Bay Shoreline Projects. She has lived in the Bay Area since 1993, had a former

career in marine science education, and is a wild bird rehabilitator and beach surveyor for the Greater Farallones Marine Sanctuary of 25 years.

Jeremy Lowe is a coastal geomorphologist at the San Francisco Estuary Institute with 30 years of experience in tidal wetland restoration and sea-level rise adaptation planning on the Pacific Coast and in Europe. Career highlights include designing sea defenses to reduce flooding in Venice, Italy; designing marsh restorations for the Ballona Wetlands in Venice, California; and authoring tidal wetland guidelines for San Francisco Bay, Puget Sound, and Lower Columbia River Estuary. He has lived in the Bay Area since 1999 and is currently working on sea-level rise adaptation planning for the counties of Marin and San Mateo, as well as the beneficial use of sediment in wetlands.

South Bay Salt Pond Restoration Project: Science and Adaptive Management in Action

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The South Bay Salt Pond Restoration Project is the largest tidal wetland restoration project on the West Coast of the United States. As planned, the Project will restore 15,100 acres of former industrial salt ponds to a mosaic of tidal wetlands and managed ponds for the benefit of native wildlife, public access, and flood risk reduction. Beginning in 2003, the Project committed to implementing a phased restoration approach using a science-based, adaptive management decision-making process with a high degree of transparency. As we finished Phase 1 and began implementing Phase 2, we created a scorecard to gauge progress of our science and adaptive management program and investigations of key uncertainties. We'll review highlights from this Phase 1 summary, which was presented in detail at the 2017 SOE conference and then delve into development of our Phase 2 Science approach.

Using the stoplight summary as a starting point, the Project contracted with Point Blue Conservation Science to review literature and conduct workshops to synthesize existing science on wetland restoration and management, identify knowledge gaps, and evaluate opportunities for the Project to conduct interdisciplinary research and integrate Project science with regional efforts. The Project is one of several large-scale restoration and management projects around the San Francisco Bay, many of which are collecting data that could be shared and analyzed together (e.g., bird use, sedimentation patterns, water quality). Such regional data integration can provide a more complete understanding of ecosystem linkages. We'll discuss our first workshop and some of the early products of this process, including our understanding of key science uncertainties identified in the Adaptive Management Plan and the status of applied studies and monitoring associated with wetland restoration efforts that are underway throughout the S.F. Bay and beyond.

Keywords: Tidal Marsh, Restoration, Adaptive Management, South Bay, Wetlands
Session: From Regional to Local: Integrated Monitoring for Healthy Wetlands

Speaker Biography:
Rachel Tertes is a Wildlife Biologist with the U.S. Fish and Service. She started as an intern at the Don Edwards San Francisco Bay National Wildlife Refuge in 1999 after graduating from Virginia Tech with a BS in Forestry and Wildlife. She worked for the Missouri Department of Conservation before returning to the San Francisco Bay National Wildlife Refuge Complex in 2001. She has worked at the riverine sand dunes of the Antioch Dunes NWR, the coastal sand dunes of Salinas River NWR, the oak woodlands of Ellicott Slough NWR and oversaw the least tern colony at the former Alameda Point NAS. She is currently a Wildlife Biologist for the Don Edwards Refuge where she is the lead for tidal marsh species, including salt marsh harvest mice and California Ridgway's rails. She joined the South Bay Salt Pond Restoration Project- Project Management Team in 2011.

Integrating our Past and Future Monitoring in the South Bay Salt Pond Restoration Project

Dave Halsing [1,2], Laura Cholodenko [1], Rachel Tertes [3]

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This presentation will link the preceding talks on integrated regional monitoring with the technology-centered ones that will follow it, within the context of the South Bay Salt Pond Restoration Project. Our Project's Adaptive Management Plan requires monitoring and applied studies to inform decisions about current and planned restoration actions and about ongoing management practices, as part of meeting the Project goals and implementing NEPA/CEQA and permit requirements. Building on the insights from our Phase 1 Science Program, we are now planning our Phase 2 science. But the Project needs more science and monitoring than it can fund or conduct on its own. Further, those efforts need to be made across a wider area of the Bay-Delta estuary than simply on Project lands.

This presentation will discuss several current examples of the tensions between the breadth and depth of what we need to do and our constraints on staff, funding, and other resources. We need to assess regional or flyway-level populations of certain types of wildlife, better understand the distribution of water quality effects around the South Bay, evaluate long-term changes in sediment dynamics, track and manage invasive plant species, and continue to evaluate offsite, indirect effects of our restoration actions.

We must bridge the gap between our recent monitoring and our needs for increased regional monitoring. Doing so requires us to integrate our Science Program with regional efforts like the WRMP, the Bay Regional Monitoring Program, and others. Another approach is a "sandbox" where multidisciplinary studies and monitoring could be organized, planned, and conducted around a particular location of interest to multiple parties. In addition to the collaborations necessary for integrated regional monitoring, emerging technologies are also part of that long-term solution. This presentation will explore ways in which we will seek to build these links and use these technologies.

Keywords: Regional Monitoring, Adaptive Management, Integrated Monitoring, Wetland Restoration, Wildlife Management
Session: From Regional to Local: Integrated Monitoring for Healthy Wetlands

Speaker Biography:

In 11 years of consulting, Dave Halsing led projects in environmental and infrastructure management, restoration, and enhancement in and around San Francisco Bay. He worked on many aspects of the South Bay Salt Pond Restoration Project, including Phase 2 alternatives development, design, NEPA/CEQA documents, and permitting. He also worked at Bolinas Lagoon and McInnis Marsh for Marin County Parks; Creosote Removal and Herring Habitat Restoration Project and the Terminal Four Wharf, Warehouse, and Piling Removal Project for the State Coastal Conservancy; and other projects involving levees, roads, and trails on the margins of the Bay. Prior to consulting, Dave was a researcher at the U.S. Geological Survey in Menlo Park. His work focused on integrating economics, spatial data, and policy analysis with natural and physical sciences. Dave has a Bachelor's Degree in Biology from Stanford University and a Master of Science in Natural Resource Policy from the University of Michigan.

Using Satellite Imagery to Detect Turbidity Levels in Relation to Freshwater Flows

Christine Lee [1], Nicholas Tufillaro [2], Erin Hestir [3], Christiana Ade [3], Shawn Acuna [4], Ted Sommer [5], Amye Osti [6], Brendan Palmieri [6], Bryan Downing [7], Russell Ryan [4], Gregory Halverson [1], Glynn Hulley [1]

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Water quality is fundamental to maintaining healthy aquatic ecosystems and for water supply management. The San Francisco Estuary (SFE), the largest estuary on the Pacific Coast, provides water supply benefits for over 25 million people, supports a $27 billion agricultural industry, and serves as habitat for many endemic fish, bird, and mammal species that are at risk or endangered. Under continued and projected climate change impacts, such as greater frequency or intensity of drought events, and human disturbances, endangered species such as the *Hypomesus transpacificus* (Delta Smelt) continue to be high risk for further decline. In the SFE, turbidity has been shown to have a strong effect on Delta Smelt distribution and is therefore one of the key water quality variables used to manage water operations and monitor ecosystem restoration outcomes. In this applied sciences project, we evaluate match-ups between turbidity data available through California Data Exchange Center (CDEC), cruise transects, and derived turbidity from two satellites (NASA/USGS Landsat-8 Operational Land Imager and the European Space Agency - Sentinel-2A/B). We then assess whether satellite-derived turbidity datasets can be used to increase spatial coverage and understanding of turbidity field information, prior to, during, and following various water flow operations, such as Suisun Marsh Salinity Control Gates Action, a management action initiated to evaluate how targeted flows can improve habitat quality for Delta Smelt. Turbidity, along with water surface temperature and chlorophyll-a, are now being incorporated into the BayDeltaLive.comworkflow, designed to improve access to value-added analysis using and visualization of remote sensing datasets.

Keywords: remote sensing, water quality, turbidity, water operations, water flows, smelt
Session: Monitoring with New or Emerging Technologies
Speaker Biography:
Christine Lee joined the Science Applications and Data Interactions group at the NASA Jet Propulsion Laboratory in 2014 after a 2-year term at NASA Headquarters in Washington, D.C as an AAAS Science and Technology Policy Fellow. Her professional interests include working to improve the utility of remote sensing for water quality monitoring through conducting applied research and developing partnerships within the water resources/water quality management practitioners community. Christine is also an Associate Program Manager for the NASA Applied Sciences Water Resources program. Christine has a Ph.D. in Civil and Environmental Engineering from UCLA studying coastal water quality issues and developing rapid, viability-based detection methods for monitoring water quality.

New Applications of Remote Sensing for Mapping Vegetation

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Remote sensing tools provide a fundamental capability for vegetation mapping and monitoring via non-invasive, repeated and spatially comprehensive observations of ecosystems at different scales. These advantages have been especially critical in systems such as wetlands, where limited field access and presence of vulnerable species can significantly constrain the scope of field vegetation surveys. However, historically mapping efforts targeting high taxonomic levels, such as plant species, have been often constrained by relatively coarse spatial resolution and/or lack of spectral sensitivity in many popular instruments. This presentation discusses several recent advances in satellite, aerial, and unmanned remote sensing that promise to improve the capacity for vegetation discrimination via enhanced spatial, temporal and/or spectral detail, as well as opportunities to account for three-dimensional vegetation structure with tools such as light detection and ranging (lidar). These novel opportunities can serve regional ecosystem management in multiple ways, from repeated multi-purpose vegetation mapping building on the legacy of previous initiatives to tracking the dynamics of specific local and alien species and improving spatial models of ecological habitats and critical ecosystem functions. Fully capitalizing on this progress, however, still requires high-quality ground-truthing field data on vegetation composition and change, which calls for a careful alignment of remote sensing studies with field monitoring campaigns. In turn, it may be possible to reduce the cost and increase the spatial scope of the latter by engaging alternative in situ remote sensing systems, such as fixed-view digital cameras (phenocams). Finally, while many of the discussed new remote sensing instruments still have individual trade-offs and constraints, collectively they show a potential for integrated multi-scale mapping frameworks that could serve multiple individual users and collaborative initiatives and enable sustained long-term monitoring efforts in our Estuary.

Keywords: remote sensing, monitoring, wetland, satellite, aerial, unmanned, lidar, phenocam, mapping
Session: Monitoring with New or Emerging Technologies

Speaker Biography:

Iryna Dronova is an Assistant Professor at the Department of Landscape Architecture and Environmental Planning, UC Berkeley. She has a PhD from Environmental Science, Policy & Management at UC Berkeley. She is a former Delta Science postdoctoral fellow and a recent recipient of a NASA Early Career award for using remote sensing to monitor wetland vegetation diversity at a national scale. Her research combines ecosystem ecology, GIS and remote sensing to study wetland change in response to natural and human-induced drivers and develop cost-effective tools for monitoring restoration projects, particularly here in the San Francisco Bay-Delta region.

The Use of High-Resolution In-Situ and Remote Sensing for Water-Quality and Mercury Monitoring

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Mercury continues to be a contaminant of concern in the San Francisco Bay-Delta estuary and watershed. One of the impediments to addressing this concern across the ecosystem is that there has been insufficient water-quality data collected at the spatial scale and temporal intervals necessary to fully understand the hydrodynamic and biogeochemical processes controlling mercury chemical speciation, transport and bioaccumulation. In large water bodies and complex ecosystems such as the Bay-Delta, traditional approaches to water-quality monitoring rely on the collection of discrete water samples, an approach that is both labor-intensive and expensive, and which typically results in low spatial and temporal data density. With recent advances in both remote sensing platforms and deployable in-situ water-quality sensor arrays, the ability to collect data at higher spatial and temporal resolution has increased dramatically. Recent efforts have focused on linking discrete data with in-situ and remote sensing data to model surface-water mercury and methylmercury concentrations at high spatial and temporal resolution to a degree not previously achievable. This presentation will focus on a number of recent and ongoing studies that have leveraged this capacity for high-resolution monitoring of in-situ water-quality parameters (e.g. turbidity, fluorescent dissolved organic matter, chlorophyll, flow, etc.) by coupling it with traditionally collected (lower resolution, discrete samples) surface water mercury data. Examples from the South San Francisco Bay salt ponds restoration area, the Grizzly Bay / Suisun March region, and the Delta region will be highlighted.

Keywords: mercury, remote sensing, water quality
Session: Monitoring with New or Emerging Technologies
Speaker Biography:
Dr. Marvin-DiPasquale is a lead scientist at the U.S. Geological Survey (USGS) in the 'Earth System Processes Division', where he leads a research program entitled 'Biogeochemical Cycling at Regional Scales'. He completed a B.S. in Chemistry at SUNY StonyBrook in 1987, and a Ph.D. in 1995 from University of Maryland, Marine and Estuarine Environmental Science Program, with a focus on the microbial ecology of Chesapeake Bay sediments. He began a career at the USGS (Menlo Park, CA) as a 'National Research Council' post-doc in 1995, and became a project chief in 2004. During much of his tenure at USGS his research focus has been on mercury biogeochemistry in various ecosystems, including: the San Francisco Bay watershed and associated mining areas throughout CA; FL Everglades; Carson River, NV (mercury Superfund site); Great Salt Lake, UT; coastal, Louisiana; Pategonia region of Argentina; and multiple USGS study locations throughout the U.S..

Forward-looking Science in the San Francisco Estuary

Steve Goldbeck, Mike Chotkowski, Jessie Lacy, Liz Whiteman, Steven Brandt, Yumiko Henneberry

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The San Francisco Estuary is rapidly changing and the need is urgent for more strategic and forward-looking management and science to respond to these changes. In the Delta alone, the Delta Independent Science Board (Delta ISB) has noted that interagency science efforts are not organized in a way that efficiently "support[s] the kinds of science-driven policies and solutions needed to address the Delta's diverse, interacting, and rapidly changing management challenges which routinely span the mandates of multiple agencies". There is a need for more forward-looking science to guide accompanying policy decisions and for more aggressive multi-agency organization to implement approaches to integrating science and technical information in the Estuary.

To address this need, the Delta ISB recommended a Science Needs Assessment Workshop to guide a forward-looking science strategy to support management decisions in the Delta and a report summarizing approaches to improve science governance to better prepare for rapid change. Moving forward will require scientific leadership and vision, identification of major scientific priorities, and organizational and funding structures to greatly expand interagency science integration. As part of the greater San Francisco Estuary, however, the Delta cannot address these issues alone and needs to be in constant conversation and coordination with the San Francisco Bay.

This panel will begin to discuss how forward-looking science could be better supported across the estuary. The panelists will bring a mix of scientific and on-the-ground knowledge and experience to the discussion.

Keywords: change, forward, climate, science, policy, management, stakeholders, estuary, strategic, rapid

Session: Forward-Looking Science in the San Francisco Estuary

Speaker Biographies:

Steve Goldbeck is Chief Deputy Director of the San Francisco Bay Conservation and Development Commission (BCDC) where he oversees staff operations, legislative affairs and the Commission's sea level rise adaptation program. He has been on BCDC's staff basically forever, specializing in technical planning and policy issues. He was a principal architect of the interagency Long Term Management Strategy (LTMS) dredging program including overseeing the beneficial reuse studies, creation of the award-winning Dredged Material Management Office (DMMO), and the Hamilton Wetlands Restoration Project.

Mike Chotkowski serves as San Francisco Bay-Delta Science Coordinator for the U.S. Geological Survey. Mike has a biology doctorate from UCLA and began his Federal career as a research fish ecologist at Reclamation. Mike has since worked on Bay-Delta issues at the management level at Reclamation, the U.S. Fish and Wildlife Service, and most recently the USGS, where he manages a landscape science research program focused on Bay-Delta issues. Mike has a long-term interest in the role of science as a factor in decisions and policy. In addition to work with partner organizations in the Bay-Delta arenas, Mike works with a national group of ecosystem coordinators within USGS to improve sharing of

scientific information and science management know-how among major multi-party regional science enterprises around the country.

Jessie Lacy is a physical oceanographer in the Pacific Coastal and Marine Science Center of the US Geological Survey. She conducts research in hydrodynamics and sediment transport in estuaries and coastal waters, including San Francisco Bay, the Sacramento-San Joaquin Delta, Puget Sound, and Monterey Bay. Her research interests include sediment dynamics in estuarine shallows; hydrodynamic controls on sediment delivery to marshes; interaction between aquatic vegetation and hydrodynamics; and the role of the physical environment in defining habitat function in aquatic systems. She has served on science panels for conservation and restoration of Elkhorn Slough, Pescadero Lagoon, and the South San Francisco Bay Salt Ponds. Jessie worked for eight years in water quality regulation for the State of California before earning her PhD in Civil and Environmental Engineering from Stanford University.

Liz Whiteman is the Executive Director of the California Ocean Science Trust, a non-profit organization dedicated to accelerating progress towards a healthy and productive ocean future for California. Created by state legislation, OST bridges the gap between cutting-edge scientific research and sound ocean management. Liz leads a team with science, policy and management expertise to bring diverse perspectives together and foster innovative approaches to difficult problems. OST serves as the Science Advisor to the California Ocean Protection Council and Liz co-chairs the OPC Science Advisory Team. Liz has over a decade of experience working at the science-policy interface in California on topics ranging from marine protected areas to sea-level rise and ocean acidification. Trained as a marine ecologist in the UK, Liz also spent a decade in the Caribbean, promoting science-informed decisions for fisheries and protected area management. Liz received her PhD from the University of East Anglia.

Dr. Stephen Brandt is past chair of the Delta Independent Science Board, a Professor of Fisheries at Oregon State University, and past Director of Oregon Sea Grant. He studies food webs, fish bioenergetics, coastal hypoxia, and physical/biological interactions in both marine and freshwater ecosystems. He has produced over 400 scientific publications and presentations, and led over 80 research cruises spanning the Great Lakes, Chesapeake Bay, Gulf of Mexico, the Pacific, and Adriatic Sea. He directed the NOAA Great Lakes Environmental Research Laboratory for 12 years. At NOAA, Brandt briefed over 400 congressional offices, gave formal congressional testimony on various NOAA issues and created NOAA Centers of Excellence on Human Health and Invasive Species. Brandt has held faculty positions in Maryland and New York and spent 5 years in Australia studying deep-sea biology. He received his M.S. and Ph.D. in Oceanography and Limnology from the University of Wisconsin, Madison.

Yumiko Henneberry is a Senior Environmental Scientists with the Delta Stewardship Council, Science Program. She works primarily on supporting initiatives that catalyze exchange of scientific information to support effective natural resource decision making. She has led the collaborative development of various regional documents such as the 2019 Delta Science Plan and 2017-2021 Science Action Agenda. These documents identify mechanisms to improve how scientific information is organized and communicated to decision-makers and the top science actions needed to answer important management questions. Other efforts include coordinating independent scientific review panels to help identify what is best available science to inform water and environmental management decisions (e.g. the Delta Regional Monitoring Program and California WaterFix) and organizing synthesis workshops to communicate the most recent state of knowledge on a topic (e.g. Delta mercury dynamics).

Advancing Policies for a Rising Bay: BCDC's Long-Range Planning Efforts

Shannon Fiala

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BCDC was created in 1965 to address a shrinking San Francisco Bay due to haphazard filling and to increase shoreline public access. Today, we know the Bay is getting larger due to sea level rise, presenting new challenges. In 2016, through a process called "Policies for a Rising Bay," BCDC evaluated its law and policies in light of the threats to the Bay presented by sea level rise to determine whether changes were needed to advance regional adaptation actions. The process identified four areas where the San Francisco Bay Plan could be improved: adaptive management; social equity and environmental justice; and allowing Bay Fill for habitat restoration and shoreline protection. In 2019, BCDC will adopt the first two of these San Francisco Bay Plan amendments: to allow larger volumes of Bay Fill for habitat restoration; and to incorporate analysis of environmental justice and social equity into BCDC permits. The third long-range planning effort at BCDC is an update the San Francisco Waterfront Special Area Plan, which applies Bay Plan policies to the Port of San Francisco's jurisdiction. Among other changes, the amendment will facilitate an adaptive management strategy for the Embarcadero Historic District that will maximize the useful life of the Port's piers, including flood protection measures to manage future risk from sea level rise. Fourth, BCDC is beginning to update the Suisun Marsh Preservation Plan, which is BCDC's primary policy document in Suisun Marsh, to address the threats of rising sea level. Finally, BCDC is creating a Bay Plan Climate Change Policy Guidance document to provide clarity for permit applicants on how BCDC applies the policies that it adopted in 2011, which require "large" shoreline projects to prepare a risk assessment, and within areas that are determined to be vulnerable, that projects are designed to be resilient to mid-century.

Keywords: policy; wetland; restoration; equity; justice; Suisun; sea level rise; historic
Session: Policy Updates to Support a Healthy Resilient Estuary

Speaker Biography:
Shannon Fiala is BCDC's Long-Range Planning Manager. She has over 15 years of experience working in natural resource management and coastal land use planning in the Bay Area: managing invasive plants and mapping vegetative communities on Mount Tamalpais at the Marin Municipal Water District; assisting grape-growers in implementing habitat restoration projects at the Napa County Resource Conservation District; implementing the Ocean Beach Master Plan at SPUR; and leading updates to the Marin and San Francisco Local Coastal Programs at the California Coastal Commission. At BCDC, Shannon manages a team of four planners, who are working on policy updates to the Bay Plan, Special Area Plans, and the Suisun Marsh Protection Plan. Shannon holds Masters degrees in City and Regional Planning and Landscape Architecture in Environmental Planning from UC Berkeley and a Bachelor of Science in ecology from the University of Michigan, and she loves biking on the Bay Trail.

Water Board Policy Update on Wetlands and Climate Change

Christina Toms

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Climate change and rising seas threaten to drown many of the San Francisco Estuary's tidal wetlands, expose low-lying communities around the Bay margins to increased flood risks, and significantly impact beneficial uses of the Bay and its nearshore environments. Regional planning efforts such as the Baylands Ecosystem Habitat Goals Update and the San Francisco Bay Shoreline Adaptation Atlas highlight the need to accelerate the pace of tidal wetland restoration in the estuary, as well as the role that nature-based, multi-benefit infrastructure can play in improving the resilience of both built and natural communities along the estuary's shoreline. This talk describes a proposed Basin Plan Amendment that will support climate change adaptation, and highlight ways that the Water Board's planning and permitting processes can support and accelerate the implementation of thoughtfully designed wetland restoration and shoreline adaptation projects. The Water Board anticipates that the Basin Plan Amendment will tackle several important issues such as beneficial fill in wetlands, cumulative impacts of shoreline hardening, "No Net Loss" principles, and preferred strategies for climate change adaptation.

Keywords: wetlands, climate change, regulatory, permits, policy, sea level rise
Session: Policy Updates to Support a Healthy Resilient Estuary
Speaker Biography:
Christina Toms is an Ecological Engineer and Senior Environmental Scientist at the San Francisco Bay Regional Water Quality Control Board, where she serves as the agency's lead staff on estuarine wetland restoration and climate change adaptation.

The BRRIT: Coordinated Permitting for San Francisco Bay Restoration Projects

Amy Hutzel

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The Bay Restoration Regulatory Integration Team (BRRIT) has been formed to improve the permitting process for multi-benefit wetland restoration projects and associated flood management and public access infrastructure in San Francisco Bay by dedicating agency representatives to review project information and prepared permit applications for consideration as a team in the most efficient manner. Participating agencies include U.S. EPA, U.S. Army Corps of Engineers; U.S. Fish and Wildlife Service, NOAA Fisheries, San Francisco Bay Regional Water Quality Control Board, California Department of Fish and Wildlife, and San Francisco Bay Conservation and Development Commission. The BRRIT Management Team is led by agency managers and will coordinate with the BRRIT as necessary to resolve policy issues and provide direction for any elevated project decisions.

The BRRIT has been funded for five years by the San Francisco Bay Restoration Authority, State Coastal Conservancy, Santa Clara Valley Water District, East Bay Regional Park District, and Bay Area Toll Authority. Projects are screened for inclusion on the project list for BRRIT review by San Francisco Bay Restoration Authority staff, using the eligibility criteria for San Francisco Bay Restoration Authority funding, as described in Measure AA. The BRRIT will be evaluated annually to assess performance against performance measures, which lay out timelines for processing of permits. Additionally, the participating agencies have developed a Permit and Policy Improvement List and will implement initiatives to increase efficiency in permit review and/or resolving policy issues that have been identified as limiting flexibility in the design and permitting of multi-benefit restoration projects.

Keywords: permitting, regulatory, wetlands, restoration
Session: Policy Updates to Support a Healthy Resilient Estuary
Speaker Biography:
Amy Hutzel is a Deputy Executive Officer at the State Coastal Conservancy, which works to protect open space, increase public access and recreation, and restore wildlife habitats along the California Coast and in the Bay Area. She worked in the San Francisco Bay Area Program of the Coastal Conservancy for 15 years, on wetland restoration, public access, and land acquisition projects. She has served on the boards or advisory committees of the San Francisco Bay Joint Venture, the Bay Area Open Space Council, the San Francisco Estuary Partnership, and Resilient by Design. She has a bachelor degree in urban and environmental planning from the University of Virginia. She worked as an educator at the San Francisco Bay National Wildlife Refuge, Kilauea Point National Wildlife Refuge, and Save The Bay prior to joining the Coastal Conservancy.

Using Best Available Science to Update the Ecosystem Chapter of the Delta Plan

Ron Melcer

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The Delta Stewardship Council has prepared a proposed amendment to the Delta Plan – Chapter 4, that addresses the protection, restoration, and enhancement of the Delta ecosystem. An overarching objective of this amendment is the integration of best available science on climate change, sea-level rise, and restoration approaches, which re-establish ecological resilience within the region. Science synthesis papers and technical analyses directly supported the development of the proposed Delta regulatory policies, recommendations, and formed the basis for the metrics, baselines, and targets of performance measures. Each of these steps have undergone technical peer review and received feedback from public and interagency stakeholders. Key ecological objectives of the Delta Plan amendment of Chapter 4 are to recover food web function, support recovery of threatened and endangered species through tidal marsh and riparian restoration, and ensure that restoration actions are implemented in a way that anticipates the effects of climate change and sea-level rise. The proposed chapter is founded on 5 core strategies which include 1) Create More Natural Functional Flows, 2) Restore Ecosystem Function, 3) Protect Land for Restoration and Safeguard Against Land Loss, 4) Protect Native Species and Reduce the Impact of Nonnative Invasive Species, and 5) Improve Institutional Coordination to Support Implementation of Ecosystem Protection, Restoration, and Enhancement. The proposed amendment includes regulatory policies that seek to improve restoration project design and protect restoration opportunities at priority locations. Performance measures include a set of quantitative objectives for re-establishing land water connections, restoration of natural vegetation communities and fish habitat connectivity, and target elevation zones where subsidence reversal could be implemented to create new tidal restoration opportunities. The proposed amendment also incorporates lessons learned from adaptive management, and calls for important institutional changes to improve the success and durability of ecosystem restoration investments.

Keywords: sea-level rise, food web, ecosystem restoration, resilience, permitting, adaptive management
Session: Policy Updates to Support a Healthy Resilient Estuary

Speaker Biography:

Ron Melcer is a Program Manager II at the Delta Stewardship Council with 20 years of experience in conservation biology, avian ecology, and western riparian ecosystems. Ron leads the Ecosystem Restoration, Land Use, and Science Integration Unit at the Council, focused on policy development and science synthesis to support Delta Plan amendments and implementation of the Council's regulatory authority. Ron is a doctoral candidate at UC Davis, and is developing a dissertation investigating the breeding requirements of the State threatened Bank Swallow as a function of soil characteristics, and river channel migration. Prior to his work at the Council, Ron was a senior scientist at the Department of Water Resources where he led the development of 14 endangered species conservation plans and quantitative restoration objectives for the Central Valley Flood System Conservation Strategy, which is focused on improving geomorphic and ecological conditions of the Sacramento and San Joaquin River systems.

Elevating the Status of Emerging Contaminants in San Francisco Bay

Melissa Foley, Meg Sedlak, Diana Lin, Ila Shimabuku, Nina Buzby, Rebecca Sutton

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Over 100,000 chemicals have been registered or approved for use in the U.S., with many present in a wide variety of products we use on a daily basis. For many of these chemicals, major information gaps limit evaluations of their potential risks to humans and aquatic life. Contaminants of emerging concern (CECs)—chemicals that are not regulated or commonly monitored but have the potential to cause adverse effects on ecosystems—can enter San Francisco Bay via a range of pollution pathways, including wastewater, stormwater, and airborne deposition. The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) leads cutting edge science to identify CECs that are present in water, sediment, and aquatic life; understand potential contaminant pathways; assess the ecological effects of CECs; and monitor the effectiveness of management actions aimed at reducing CECs in the Bay. In order to prioritize which CECs are monitored, where, and how frequently, the RMP developed a Tiered Risk-based Framework to classify CECs based on their occurrence and probability of adversely affecting Bay aquatic life. CECs classified as moderate or high concern are priorities for regular monitoring in the Bay. While the RMP has not identified any "high concern" CECs to date, an increasing number are being added to the "moderate concern" category. CECs in this category have a high probability of at least a low-level effect on Bay aquatic life. In this presentation, we will present the latest updates to the Framework, including the data used to elevate four classes of CECs from possible to moderate concern: bisphenols (plastic additives), imidacloprid (insecticide), organophosphate esters (flame retardants and plastic additives), and microplastics.

Keywords: Emerging contaminants, Regional Monitoring Program, bisphenols, imidacloprid, organophosphate esters, microplastics
Session: Contaminants of Emerging Concern in the Estuary

Speaker Biography:

Melissa Foley is the Program Manager for the San Francisco Bay Regional Monitoring Program. She is a marine ecologist by training but an interdisciplinary scientist in practice. She has extensive experience working with scientists, lawyers, decision makers, tribes, and stakeholders on a wide range of topics, including water quality, wildfire, dam removal, cross-habitat connectivity, ocean acidification, spatial planning, cumulative effects, ecological tipping points, and ecosystem-based management. Melissa received her PhD from the University of California Santa Cruz. Most recently, she was a Senior Scientist with Auckland Council in New Zealand, where she worked at the science-policy interface using long-term environmental monitoring data to inform regional and national management and policy strategies.

California's Safer Consumer Products Program Overview and Efforts to Protect Aquatic Health

Anne-Cooper Doherty [1], Daphne Molin [2], Andre Algazi [1], Karl Palmer [1]

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in 2013, the Department of Toxic Substances Control's (DTSC) Safer Consumer Products (SCP) regulations outline a framework for DTSC to regulate product-chemical combinations (Priority Products) that require manufacturers to evaluate alternatives. The SCP program selects Priority Products based on the potential for exposure to a chemical in the product to contribute to adverse impacts to human health or the environment. The SCP regulatory framework uses a novel approach to regulating potentially harmful chemicals in consumer products by demonstrating the potential for harm from Priority Products using a narrative standard. This allows DTSC to take a precautionary approach and integrate emerging data and approaches into its prioritization decisions. DTSC can influence the reduction of harmful chemicals in aquatic environments like the San Francisco estuary by requiring manufacturers to consider the full life cycle of their products when selecting alternatives to avoid regrettable substitutions. This talk will provide an update on the Priority Products adopted and proposed to date that are most relevant to the aquatic environment, including products containing flame retardants, perfluoroalkyl and polyfluoroalkyl substances (PFASs), and nonylphenol ethoxylates (NPEs). It will also highlight other products and chemicals under consideration including a petition to list motor vehicle tires with zinc-containing tread. Finally, the talk will highlight how SCP is working with others within California to advance understanding of chemicals of emerging concern in the aquatic environment.

Keywords: CECs, contaminants, PFAS, NPEs, regulations, consumer products
Session: Contaminants of Emerging Concern in the Estuary
Speaker Biography:
Anne-Cooper Doherty is a Senior Environmental Scientist in the Department of Toxic Substances Control's (DTSC) Safer Consumer Products program. There she focuses on evaluating chemicals in products for potential listing as Priority Products, with a focus on chemicals that might adversely impact the aquatic environment. She also assists in developing DTSC's CalSAFER information management website. She received a Ph.D. from the Stony Brook University's School of Marine and Atmospheric Science with a focus on the presence and environmental fate of quaternary ammonium compounds (QACs) in the aquatic environment.

Pesticides in Surface Water: Sources, Pathways, and Fate

Jennifer Teerlink, Nan Singhasemanon, Yuzhou Luo, Robert Budd, Michael Ensminger, Xin Deng, Sue Peoples, Dan Wang, Xuyang Zhang, Aniela Burant, Kevin Kelley, Kaylynn Newhart, Scott Wagner, Yina Xie, Anson Main, Jason Carter, Emily Edgerton, Andrea Blaine, Mason Zoerner, Leslie Gould-Earl, Sarah Albright, Edgar Vidrio

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The mission of the California Department of Pesticide Regulation's Surface Water Protection Program (SWPP) is to protect surface water from pesticide contamination caused by the use of pesticides in agricultural and urban environments. To achieve its mission, the program integrates the following key components: a) the evaluation of pesticide products submitted for registration in California, b) the monitoring of surface water and sediment for high use pesticides with high aquatic toxicity potential, c) the modeling of fate and transport of pesticides to predict environmental concentrations and assess environmental risk, d) the evaluation of the effectiveness of best management practices to mitigate the offsite movement of pesticides, e) the outreach to pesticide users to implement best management practices, and f) the implementation of regulatory measures. To implement the program mission, our scientists and analytical chemists work collaboratively with pesticide registrants, county agricultural commissioners, State and Regional water boards, pesticide users, and university researchers.

Keywords: Pesticides, Mitigation, Outreach, Monitoring, Modeling, Emerging Contaminants, Prevention
Session: Contaminants of Emerging Concern in the Estuary

Speaker Biography:
Dr. Jennifer Teerlink is a Senior Environmental Scientist Supervisor with the Department of Pesticide Regulation, Surface Water Protection Program. She serves as interagency liaison to State and Federal Agencies to coordinate and communicate efforts related to pesticides in surface water. Her current research focuses on identifying and quantifying pesticide inputs to wastewater catchments. Dr. Teerlink has a B.S. and M.S. in Geology and a PhD in Environmental Engineering.

Microplastics Everywhere: Understanding Microplastics in the Bay and Recommended Actions

Diana Lin [1], Rebecca Sutton [1], Meg Sedlak [1], Alicia Gilbreath [1], Elizabeth Miller [1], Adam Wong [1], Amy Franz [1], Carolynn Box [2], Rusty Holleman [3], Keenan Munno [4], Xia Zhu [4], Chelsea Rochman [4]

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Microplastics (particles less than 5 mm) are ubiquitous and persistent pollutants in the ocean, and a pervasive and preventable threat to the health of marine ecosystems. Microplastics come in a wide variety of shapes, sizes, and plastic types, each with unique physical and chemical properties and toxicological impacts. Accurate measures of the occurrence of microplastics in the environment and identification of likely sources are necessary to form an understanding of the magnitude of the problem, identify the highest priorities for mitigation, and inform effective management actions. To develop critical baseline data and inform solutions, the San Francisco Estuary Institute and The 5 Gyres Institute have completed the first comprehensive regional study of microplastic pollution of a major estuary - San Francisco Bay. Microplastics concentrations and characteristics throughout the Bay and surrounding ocean were assessed in five environmental matrices (stormwater, treated wastewater effluent, surface water, sediment, and prey fish), showcasing the power of large collaborative efforts in environmental sampling and analysis. This work resulted in seminal findings regarding microparticle sources and loads, as well as the development of novel methods for sampling and analysis of microplastics in different matrices, and supported development of the first microplastics transport model linking estuarine and ocean environments. This science has informed discussions on innovative solutions and recommendations for policies to mitigate microplastic pollution. The scientific information, tools, and recommended solutions developed via the San Francisco Bay Microplastic Project are intended to catalyze similar efforts to understand and reduce plastic pollution around the globe.

Keywords: microplastics, San Francisco Bay, stormwater, effluent, surface water, sediment, fish
Session: Contaminants of Emerging Concern in the Estuary

Speaker Biography:
Diana Lin is a senior environmental scientist in the Clean Water Program at the San Francisco Estuary Institute. She studies microplastics, other contaminants of emerging concern, and legacy contaminants in the San Francisco Bay surface water, sediment, fish, effluent, and stormwater. Diana earned a B.S. in Chemical Engineering from the California Institute of Technology, and a Ph.D. in Environmental Engineering and Science from Stanford University. After completing her Ph.D., Diana was a science and policy fellow in the California State Legislature through the California Council on Science and Technology Fellowship Program.

Bay-Delta Nutrient Science Update

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San Francisco Bay (SFB) receives high nitrogen (N) and phosphorus (P) loads, with the majority of those N and P loads entering the system via effluent from the region's 37 wastewater treatment plants. Despite its nutrient-enriched status, SFB historically has not experienced some of the water quality impacts common to other nutrient-enriched estuaries, such as excessive phytoplankton blooms and low dissolved oxygen. However, studies in SFB over the past decade have identified substantial changes in responses or sensitivity to nutrients, raising concerns that SFB's resistance to its high nutrient inputs is waning. Responding to those concerns, regulators launched the San Francisco Bay Nutrient Management Strategy (NMS), a program tasked with building the necessary scientific foundation to inform regional nutrient management decisions. Priority NMS focus areas include: nutrient sources and cycling within SFB; factors regulating phytoplankton production and dissolved oxygen levels in deep subtidal and shallow margin habitats; harmful algae blooms (HAB); and fate and impacts of SFB-sourced nutrients after their export to the coastal ocean. Through collaborations with other research programs in the region, the NMS is addressing priority science and management questions through a range of activities, including: expanded monitoring; targeted field studies; data analysis and synthesis; and developing numerical models to simulate ecosystem responses under current and future scenarios. This presentation will provide an overview of recent NMS work, key findings, and future directions.

Keywords: nutrients, phytoplankton, HABs, dissolved oxygen
Session: Nutrients in the Estuary
Speaker Biography:
David Senn is co-Director of SFEI's Clean Water Program and Lead Scientist of the San Francisco Bay Nutrient Management Strategy

Wastewater Treatment Plant Upgrades and Nature-Based Solutions for Reducing Nutrient Loads from Wastewater

Holly Kennedy, PE [1], Mike Falk, PhD, PE [1], J.B. Neethling, PhD, PE [1], Dave Williams, PE [2]

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THE ISSUE
A regional nutrient permit was issued in 2014 (R2-2014-0014) that required 37 Water Resource Recovery Facilities (WRRFs) across the Bay Area (combined 827 mgd permitted capacity) to evaluate nutrient reduction through optimization, sidestream treatment, and plant upgrades. The individual WRRFs range in permitted capacity from 1.1 million gallons per day (mgd) to 167 mgd.
Objective: This presentation will discuss the overall findings for this single coordinated study and the next steps.
THE SOLUTION/APPROACH
A single coordinated study was performed for all 37 WRRFs (BACWA, 2018) based on three nutrient levels that ranged from optimizing existing assets to enhanced treatment that required plant upgrades. This presentation will discuss the cost per treatment level (capital, O&M, and net present value) and overall trends. The net present value cost for all 37 WRRFs ranged from <$300 Mil for optimization (7% total nitrogen load reduction) to >$12 Bil for meeting the advanced treatment levels (>80% total nitrogen load reduction). As part of this planning effort, unit metrics ($/gpd and $/lb nutrient removed) were implemented as a means to compare and contrast findings for all 37 WRRFs.
In addition to this study, other scientific studies are underway in the Bay to determine nutrient load impacts on water quality. All these efforts will be combined to develop a strategy to preserve all assigned beneficial uses in the Bay.
CONCLUSIONS
The coordinated nutrient load reduction study in the Bay Area provided a uniform assessment of strategies, costs, and unit costs for nutrient reduction via WRRFs to the Bay.
The approach from this effort to use science to identify the health of the Bay coupled with strategies for nutrient reduction by WRRFs around the Bay is serving as a template for other watersheds considering nutrient load reduction strategies.

Keywords: Nutrient Management, Nutrient Regulations, Estuary Nutrients
Session: Nutrients in the Estuary
Speaker Biography:
Ms. Kennedy specializes in strategic planning, master planning, and capital planning, having consulted with various public agencies in addressing complex water system issues. She excels in structuring decision problems, identifying critical information, integrating and translating information across disciplinary lines, understanding organizational structures and dynamics, and facilitating deliberation and consensus. Holly has nearly 20 years of consulting experience in the water and wastewater industry, in both the United States and abroad. Holly received her bachelor's degree from the Cooper Union in New York City, and her master's degree in water resources engineering and management for the University of Stuttgart, Germany.

Potential Effects of the Sacramento Regional Wastewater Treatment Plant Upgrade

Tamara Kraus [1], David Senn [2]

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Anthropogenic activities have resulted in elevated ambient nutrient concentrations in many regions of the San Francisco Estuary (SFE). In the northern region, the Sacramento Regional wastewater treatment plant (Regional San WWTP) currently acts as the largest nitrogen point source to the system, discharging 13,000-15,000 kg/d of nitrogen in the form of ammonium. By end of 2021, Regional San will complete major upgrades that will reduce its effluent dissolved inorganic nitrogen (DIN) loads by >65% and release the remaining DIN as predominantly nitrate. This major change in nitrogen inputs provides a unique opportunity to study ecosystem-scale responses to an altered nutrient regime. While, in general, the nSFE has not experienced some classic symptoms of nutrient over-enrichment typical in other estuaries—e.g., large phytoplankton blooms and hypoxia—other concerning nutrient-related impacts have been hypothesized, including: excessive growth of invasive aquatic vegetation; occurrence of harmful algal blooms (HABs) and the production of cyanotoxins; and declines in the abundance and nutritional quality of phytoplankton. These impacts have repercussions for the system's food web, habitat quality, transportation, recreation, water conveyance, and drinking water quality. To help managers and policy makers understand the potential responses to the WWTP upgrade and why there is uncertainty about these responses, we developed a framework for i) identifying and examining the primary mechanisms and drivers of ecosystem response, and ii) identifying opportunities and constraints for investigating those responses, including key data needs or knowledge gaps. This information should help regulators, managers, and the scientific community identify and prioritize science needs that address ecosystem management and ecosystem processes questions.

Keywords: nutrients, nitrogen, wastewater, phytoplankton, HABs, aquatic vegetation, management
Session: Nutrients in the Estuary

Speaker Biography:
Tamara Kraus received a master's degree in Agronomy and a doctoral degree in Soils and Biogeochemistry from the University of California, Davis. She has been working at the USGS California Water Science Center (CAWSC) in Sacramento since 2004, where she does research on sources and cycling of carbon and nutrients, and the linkages between terrestrial and aquatic systems. Her projects span a range of topics from identifying sources of dissolved organic carbon and to inform drinking water quality management, to using constructed wetlands to reverse subsidence, to the application of in situ coagulation to remove organic carbon and mercury from surface waters, to understanding the links between nutrients and phytoplankton.

Designing the Colma Creek Connector

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Communities that have settled around our Bay over time have been disconnected from it. South San Francisco, like many others, has residents that recall a time when they would daily walk the length of their creek that drained to the bay, and gather to swim and fish. With the introduction of major regional infrastructure (Hwy 101, the Caltrain corridor, SFO and the water treatment plant, this relationship severed this link to the Bay while associated industrial development on historic marshlands led to flood risks along the creek corridor.

The HASSELL team began working with the community of South San Francisco during the Rockefeller sponsored Resilient By Design Bay Area Challenge. Establishing a community hub in the 100-year-old vacant Bank of South San Francisco building, we called on the community to set a vision for a more resilient city, then developed a plan together with a broad demographic spread of residents. Since then, we have been developing adaptation scenarios for the Colma Creek corridor that; reduce flood risk, increase public access along the creek to the Bay, and restore native ecologies.

Keywords: Restoration, sea-level rise, adaptation, flood management, public access
Session: The Next Wave in Conservation - Design and Community-Based Approaches
Speaker Biography:
Richard is a qualified architect, urban designer and urban planner with extensive experience leading multidisciplinary master planning teams in delivering innovative place-oriented outcomes. Richard aims to unlock the potential of sites within cities, creating unique local experiences created through a deep understanding of context and community. He has worked in London, Sydney and Shanghai, now leading HASSELL's urban design projects in the USA from the San Francisco studio. A strong advocate for collaborative and site-responsive design, Richard also contributes to key urban projects globally across HASSELL. He has extensive experience in transport, education and waterfront precincts, as well as being a knowledge leader in the areas of urban resilience and China’s urban transformation.

Parks as Resilient Infrastructure in the Wild West: A Houston Example

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Parks provide a huge range of benefits, especially for those who face the greatest socioeconomic challenges. Parks increase opportunities for exercise and relaxation; improve community cohesion; and protect air and water quality while reducing the risk of flooding and extreme heat. All of these benefits make communities more resilient—particularly in the face of climate change and increasingly frequent extreme weather events. Harris County, Texas was hit hard by Hurricane Harvey in 2017. This presentation will examine two park planning projects—one in Houston and one in nearby Pasadena—that have focused on parks as crucial green infrastructure for increasing resilience and decreasing health inequity.

Keywords: Conservation, parks, open space, equity, health, green infrastructure, climate risk
Session: The Next Wave in Conservation - Design and Community-Based Approaches
Speaker Biography:
Amy Wilson Morris has led community-based open space planning projects throughout the United States. She specializes in expanding access to nature through equity-driven community engagement and in community-based priority-setting for parks and conservation. Amy is a principal at Nature Close to Home Consulting, and she was previously the Associate Director of Planning at The Trust for Public Land. She has a PhD in Environmental Studies from UC Santa Cruz and a BA in Environmental Biology from Columbia University.

Nature as Infrastructure in SF Bay Area: A Brief History of the Long Path to Conservation for Coyote Valley

Amanda Brown-Stevens

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Coyote Valley, just south of San Jose, is an open space gem unlike any other—a 7,400 acre network of natural and agricultural lands at the urban edge of the 10th largest city in the nation. From proposals for technology campuses to sprawling subdivisions to warehouses, the future of Coyote Valley's open space has long been in jeopardy. For decades conservationists have worked to protect the valley from these development threats.

The land in the valley's north is particularly rare and valuable. The valley was once part of a vast and thriving Native American region, and at its heart was a village site called Matalan—or Coyote. The Tribal Band and the Muwekma Ohlone Tribe share Coyote Valley as ancestral lands. They seek to restore it and re-establish wildlife, grow native plants, and teach people the values and the stories of this unique place. Its wildlife corridors, agriculture, and recreation value are a few more reasons Coyote Valley must be preserved. The land is home not only to coyotes, but also to birds, bobcats, and foxes, and in the future, many hope, tule elk will return to the area. Coyote Valley is also hugely important to Silicon Valley's groundwater. It is the largest undeveloped landscape overlaying Silicon Valley's groundwater aquifer, and it serves to mitigate flooding.

Learn more about the decades of efforts that have help preserve this land and recent successes including the passage of Measure T in San Jose in 2018 that provides up to $50 million in funds to permanently protect this unique natural resource.

Keywords: Conservation, flood control, Coyote Valley, Bay Area, Restoration
Session: The Next Wave in Conservation - Design and Community-Based Approaches
Speaker Biography:
Greenbelt Alliance CEO Amanda Brown-Stevens is a nationally recognized expert in climate-smart development and resilient communities. Her strategic vision for Greenbelt Alliance and the Bay Area as a whole are informed by her experience in advocating for well-planned cities and towns and the protection of our region's iconic greenbelt lands. Prior to this role, Amanda oversaw Resilient by Design—a design challenge that saw local communities partner with design professionals and other stakeholders in search of innovative ways to strengthen the Bay Area's resilience in the face of increasing sea level rise. Amanda has helped raise hundreds of millions of dollars to improve and support communities throughout California. The public finance measures she worked on included funding to permanently preserve iconic landscapes around the region, restore essential habitat for fish and wildlife, and increase public access to open space for the Bay Area's growing population.

An Ecological Framework for Urban Infrastructure Planning to Improve Human Health

Brent Bucknum

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Cities are a sickness & Nature is our drug. Brent will focus on two project-specific case studies in the Oakland California & Louisville, Kentucky that are helping redefine how nature and the built environment interact to determine human health; one of our greatest contemporary existential challenges. Brent will provide an in-depth look at how they are distilling global health challenges to neighborhood-scale health-outcome-driven green infrastructure solutions with community, academic and philanthropic and governmental participation. He will discuss novel greening intervention design and measurement tools, being developed hyphae to help create, measure and value the effects of ecological, health-centric multiple-benefits green infrastructure.

Adapt Oakland is a novel, multibenefit ecosystem service and health-based adaptive management framework for implementing green infrastructure in West Oakland, as well as a toolkit for other neighborhoods with high impact from Port, T.O.D. and industrial land uses. The project was developed in partnership with West Oakland Environmental Indicators Project (WOEIP) and funded by the Governor's Office of Research & Planning. Brent will discuss the plan and multiple ongoing subprojects including a neighborhood specific citizen science and greening designs, as well as community-based air quality planning with AB 617. adaptoakland.org

Greenheart is a research study developed in partnership between Dr. Aruni Bhatnagar, the director of the Envirome Institute at the University of Louisville and Hyphae Design Laboratory. Greenheart is one of the first longitudinal clinical trials to evaluate the health impacts of urban greening, and will look specifically at cardiovascular health outcomes as well as other enviro-pyscho-social determinants of health. The project is supported by the National Institute of Health (NIH) and The Nature Conservancy and a diverse team of researchers. http://louisville.edu/greenheart

Session: The Next Wave in Conservation - Design and Community-Based Approaches
Speaker Biography:
Brent Bucknum is the founder of Hyphae Design Lab, an Oakland based multi-disciplinary design and innovation firm. Brent also co-founded Urban Biofilter, an environmental-health focused research and policy joint venture developed with West Oakland Environmental Indicators Project (WOEIP). As an urban ecologist, Brent's work aims to improve the health and diversity of all species in the urban environment, but with a particular focus on cities dominant megafuana; humans. Brent brings a systems thinking perspective to environmental health and urban infrastructure challenges, by building diverse teams to create practical solutions to global challenges through academic research, community participation, design innovation and earth systems engineering and public policy. Brent also lectures, researches, advocates in California and throughout the US for how urban infrastructure planning to provide multi-benefit that improves air, soil, water and human health and environmental justice.

Humanizing Homelessness for Healthier Creeks and Communities

Mike Antos [1], Talia Yaffa Rubin, LCSW [2], Cori Ring-Martinez [3], Chris Brokate [4], Julia Lang [5]

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[5] Downtown Streets Team

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This session asks, how can humanizing people who experience homelessness and addressing the human needs of unsheltered communities result in improvements to water quality and estuarine health? A report recently released by the Bay Area Council Economic Institute declares “by virtually every measure, the Bay Area’s homeless crisis ranks among the worst in the United States.” As the population of unhoused people grows throughout the Bay and Delta, encampments are cropping up along creeks and waterways with increased persistence; resulting in. These encampments pose a complex web of human rights, water quality, public health, water quality, human rights, and sanitation challenges to resource managers, public works staff, regulators, and others.

Around the Estuary and throughout California, practitioners are working across departments and traditional divides to take a human-centered approach to the challenges created by unsheltered communities along creeks, resulting in benefits to people, creeks, habitat, and wildlife. Speakers from different sectors will share their stories about where they're making headway, where there are pain points, and where they are forming innovative partnerships to foster collaborative approaches and solutions to this regional crisis.

Keywords: homelessness, creeks, trash, water quality,
Session: Humanizing Homelessness for Heathier Creeks and Communities
Speaker Biographies:
Mike Antos specializes in supporting the integration of physical and social systems, whether it is helping different technical experts align efforts for multiple benefits or facilitating open and trustworthy dialog between agencies and communities. He is an established thought leader on how water policy and planning, when just and empowering, can support members of overburdened communities. As a social scientist with over sixteen years of experience in integrated watershed management and planning, Mike is a key member of the Stantec water planning and management team. A consummate team member or team leader, Mike enhances the effectiveness of multi-party planning and implementation efforts. He has a PhD in Geography from UCLA and holds an appointment as Visiting Scholar at the UC Irvine department of Anthropology. Mike is a fellow of the Robert & Patricia Switzer Foundation, and serves as co-chair of the American Water Resources Association Integrated Water Resources Management Committee.

Talia Yaffa Rubin, LCSW, is a Program Analyst III with the City of Oakland’s Human Services Department, Community Housing Services Division. Ms. Rubin manages programs serving unsheltered individuals including Outreach, Encampment Management, Health and Hygiene interventions, Hunger Relief Efforts, Emergency Shelter, and Community Cabins programs. She has extensive experience in the field of social work including direct clinical practice, research, project design and implementation, and community

development. Ms. Rubin has worked with various populations; at different intersections of lifespan and presenting various needs throughout the Bay area and Southern CA. She has a bachelor's degree from UCLA in Cultural Anthropology with a concentration in Sub-Saharan Africa, and earned her MSW from California State University Los Angeles with a concentration in Forensic Social Work in 2010. Ms. Rubin has worked for Oakland since 2014 and offers a 'tool-kit' and holistic perspective to the issues impacting the lives of people experiencing homelessness.

Cori Ring-Martinez is the Sacramento Area Program Coordinator for the Environmental Justice Coalition for Water (EJCW), where she is working on a community-driven creek revitalization project in South Sacramento, as well as involving disadvantaged communities in water policy planning and decision-making processes, especially the unhoused population's access to water, sanitation and hygiene services in the Sacramento area. She holds a bachelor's degree in Anthropology from Fordham University in New York City, and brings years of labor and community organizing experience to EJCW. Cori lived in El Salvador for two years doing solidarity work with rural communities, many facing challenges to accessing basic rights like clean drinking water and advocating for a mining ban and a human right to water law, and maintains close ties with friends and family there. She dedicates her free time to organizing for racial and housing justice in Sacramento.

Chris Brokate has been volunteering in his community since he was a teenager. After moving to the Russian River area in 2009, Chris started volunteering for Russian Riverkeeper. He was awarded Volunteer of the Year in 2010. In 2014, noticing the devastating effects of all the trash coming down the Russian River after heavy rains, Chris started his first beach cleanup event and started thinking about ways to prevent and clean up the river more often. With the help of friends and with fiscal sponsorship through Russian Riverkeeper, Chris founded Clean River Alliance. Since its founding, Clean River Alliance volunteers have helped remove over 650,000 pounds of trash from the Russian River watershed. In 2016, the organization started partnering with local houseless folks through the Vets Connect program in Guerneville. In the past year alone, homeless volunteers have collected over 60,000 pounds of trash from the river.

With a degree in Sociology with a Concentration in Community Change from San Jose State University, Julia Lang got her start in the nonprofit sector working on food justice issues. With her passion for food access and social justice sprang a deep desire to address San Jose's mounting homeless crisis. In 2013, Julia took on a role as a Case Manager for Downtown Streets Team where she connected unhoused individuals to critical resources. Downtown Streets Team is a volunteer work experience program that empowers unhoused people to reach self-sufficiency. At DST community members experiencing homelessness are part of the solution. Team Members improve the environment while transforming their lives. Julia has helped grow and evolve the work of Downtown Streets Team to create more holistic communities in the South and East Bay.

To Resiliency and Beyond: Multi-Benefit Highway 37

Ashley Nguyen

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The 21-mile State Route (SR) 37 traverses along the northern shore of San Pablo Bay from US 101 in Novato, Marin County to Interstate 80 in Vallejo, Solano County – making it California's northernmost east-west link between US 101 and Interstate 5 via I-80 and I-505. The recent flooding and road closures on SR 37 near Novato Creek due to the heavy rains during Spring of 2017 and 2019 have directed a spot light – a call to action – to maintain, improve mobility and modernize an overworked highway that connects workforce housing and jobs in the North Bay. The challenges are many – seasonal flooding, traffic congestion, potential disruption of sensitive and valuable marshes, wetlands and special-status species, equity, lack of transit options, and vulnerability to sea level rise due to climate change. The opportunities to rise to the challenge are before us. Resilient SR 37 is an initiative lead by MTC, Caltrans and the four North Bay County Transportation Authorities to provide near-term, intermediate and ultimate solutions to relieve congestion, protect and adapt to sea level rise, and "integrate, don't mitigate," transportation and ecology as one.

Keywords: resiliency, Highway 37
Session: Plenary Session: Green is the New Gray: Nature-Based Infrastructure
Speaker Biography:
Ashley Nguyen is the Director of Design and Project Delivery with the Metropolitan Transportation Commission – a regional transportation planning, financing and coordination agency for the nine-county Bay Area. Her team of creative planners and engineers incubate, evaluate and deliver operational strategies that move more people in fewer cars, shift commuters into shared rides, and improve overall transportation system operations and safety. Her current focus area is to maximize person throughput and operational efficiencies on congested bridge corridors, including east-west crossings such as State Route 37, where a significant number of commuters travel long distances every day from home to work and vice versa. Ashley and her Design and Project Delivery team have and will continue to deliver high-impact, multi-modal and multi-benefit transportation projects that move the Bay Area.

Green Infrastructure Implementation Challenges and Opportunities: Navigating Constraints and Issues of Scale

Keith Lichten

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Green infrastructure can be a resilient, multi-benefit approach to address issues including urban runoff pollution and climate change adaptation. A substantial number of stormwater green infrastructure projects have been built since the SF Bay Regional Water Board's 1994 "Staff Recommendations for New and Redevelopment Controls for Stormwater Programs" and BASMAA's 1997 publication of Start at the Source. Similarly, green infrastructure has been a key tool in flood management projects like Wildcat Creek and the Napa River. With the publication earlier this year of the San Francisco Bay Shoreline Adaptation Atlas, green infrastructure is becoming a more-formalized tool for Bay margin climate change adaptation, as well.

With that in mind, there are lessons learned from more than twenty years of green infrastructure implementation. While we have made substantial progress, there are productive opportunities for collaboration, change, and addressing constraints to green infrastructure as a useful tool. The talk will offer reflections from the Bay Area as well as lessons learned from U.S. cities implementing large-scale green infrastructure programs to control combined sewer overflows.

Keywords: Green infrastructure, nature-based solutions, climate change adaptation, multi-benefit solutions, stormwater
Session: Plenary Session: Green is the New Gray: Nature-Based Infrastructure
Speaker Biography:
Keith Lichten is chief of the Watershed Management Division at the San Francisco Bay Regional Water Quality Control Board, which manages work including the Board's storm water, creek and wetland fill, and water recycling programs. He received his Bachelor's in environmental engineering from MIT and completed a Master's in Landscape Architecture at UC Berkeley, studying environmental planning and green infrastructure. He is on the Governing Board of the ASCE's Environmental and Water Resources Institute (EWRI) and recently chaired EWRI's inaugural conference on the operation and maintenance of stormwater control measures.

Living Shorelines: Linking Estuary Habitats & Building Capacity to Adapt to Rising Seas

Katharyn Boyer [1], Marilyn Latta [2]

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Living Shorelines are promising nature-based climate adaptation and restoration design approaches that include strategically siting natural shoreline features to achieve biological habitat enhancement and physical shoreline protection goals. The Coastal Conservancy, San Francisco State's Estuary & Ocean Science Center, and other academic and resource agency partners are engaged in several demonstration projects in SF Bay that are linking sound science into regional management actions, testing experimental methods on the ground, and providing a model for other efforts around the state. Project manager Marilyn Latta will share the state agency perspective on current best practices with designing multi-objective projects that are the first of their kind in the bay, and lessons learned on building capacity to conduct these types of projects. Science Lead Kathy Boyer will review results from five years of monitoring our 2012 San Rafael project, and describe how our team has integrated best practices and lessons learned into the design of our 2019 project installation on the North Richmond Shoreline to include additional habitat types, elevations, species, and methods. The ultimate goal is to use such living shorelines as alternatives to traditional shoreline armoring where possible; however, there is a need to first test and better understand optimal methods, timing, and outcomes for specific nature-based site approaches. With accelerating sea level rise and other climate changes, we see an urgent need to provide a model for others to take on similar demonstration projects and to grow the expertise and capabilities of contributors at all phases, from design to permitting, construction, monitoring, and interpretation of results that can inform the next projects. This rapid capacity-building will require forming diverse collaborative partnerships and will be critical to scaling up projects that can maintain natural shoreline habitats as we adapt to rising seas in the coming decades.

Keywords: living shorelines, nature-based climate adaptation, subtidal, intertidal, eelgrass, oysters
Session: Plenary Session: Green is the New Gray: Nature-Based Infrastructur

Speaker Biographies:

Dr. Katharyn Boyer is a coastal ecologist specializing in science-informed restoration, with a focus on improving the design and resilience of estuarine habitat restoration projects in the intertidal and subtidal zones. A biology professor at San Francisco State University's Estuary & Ocean Science Center for fifteen years, Dr. Boyer teaches undergrad and grad students to apply basic ecological understanding and scientific methodology to conservation and management problems. She and her students work primarily in tidal marshes and seagrass beds, studying their ecology and developing and testing restoration techniques to maximize native species diversity and ecosystem functioning. Much of their work is focused on climate change adaptation, testing "green infrastructure" enhancements to reduce shoreline erosion, provide refuge for wildlife during flooding, build carbon stores, and locally mitigate acidifying waters. Growing up on Maryland farmland near the Chesapeake Bay sparked her life-long fascination with the connections between human society and the sea.

Marilyn Latta is a is a Project Manager at the California State Coastal Conservancy, managing the SF Bay Living Shorelines Project, SF Bay Creosote Removal Projects, SF Estuary Invasive Spartina Project, and additional regional projects and collaborative planning efforts in San Francisco Bay and statewide. She

studied Marine Biology/Zoology at Humboldt State University, and prior to joining the Conservancy she worked for a variety of non-profit organizations to educate and involve the public in the protection and restoration of ocean and estuarine resources. Marilyn grew up in the bay area and develops and coordinates long-term projects with many partners in a large network of local, state, and federal agencies engaged in subtidal and estuarine restoration in San Francisco Bay.

One Delta, One Estuary--Connecting California through Water

Felicia Marcus

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One of the most enduringly fascinating and beautiful things about estuaries is their role in connections: connecting across freshwater and saltwater, connecting across species lifecycles, connecting people across vast distances who share in their relationship to the waters and species that cross their varied landscapes. In the case of the San Francisco Bay-Delta Estuary—it connects so much more. From the rim of the Northern and Southern Sierras to the Pacific Ocean its sheer scale is massive. If you factor in water diversions above and throughout the Delta—diversions that have a direct impact upon the natural functioning of the estuary--the estuary connects nearly the entire population of the State of California. Yet few Californians understand those connections, let alone their own connection to, dependence on, and impact upon this mighty estuary. Angelenos, oddly enough, may understand it better than San Franciscans. And, as a result, focused attention on this remarkable ecosystem is hard to maintain. Even among those who engage in public policy efforts and discourse around "the Delta," conversations tend to be balkanized, perhaps because of the enormity of the scale and complexity of the estuary; perhaps because of convenience or design. How do we break through to gain the broader engagement we need to implement the complex policy and effective adaptive management we need? Not by doubling down on talking about the Delta louder and slower, but
By talking about "one water" for all of California to make the connections beyond the inner circle;
By celebrating what connects us rather than what divides us, including our natural heritage, our vibrant agriculture, our treasured rural centers, and our energetic urban centers;
By using modern data, technology, and transparency to lay a foundation for fact based discussion and monitoring;
…and more.

Keywords: bay-delta, connection, state water board, water quality control plan
Session: Plenary Session: Zooming Out to the Full System
Speaker Biography:
Felicia Marcus is an attorney/consultant who has served in positions in government, the non-profit world, and the private sector. In government, Felicia was most recently was Chair of the State Water Resources Control Board, with responsibility for drinking water, water quality, and water rights. As Regional Administrator of the U.S. EPA Region IX was responsible for the range of environmental issues under EPA's jurisdiction. Prior to that, Felicia headed Los Angeles Department of Public Works dealing with wastewater, recycling, stormwater and other environmental issues. In the non-profit world, she was the Western Director for the Natural Resources Defense Council and the EVP/COO of the Trust for Public Land. Throughout these roles she was known as an adept leader of large institutions while promoting progressive policies and greater public engagement. She has a JD from NYU School of Law and an AB cum laude in East Asian Studies from Harvard College.

Viewing the Estuary from a Macroscope

James Cloern

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San Francisco Bay and the Sacramento-San Joaquin Delta are two parts of one Estuary. This estuary, like others around the world, is in a continuing state of change. Changes are driven by many processes having different origins, from local to regional to global. For example, we know that ecosystem productivity is influenced by connectivity between rivers and floodplains, and between marshes and sloughs. Presence of the algal toxin microcystin in mussels might reflect connectivity between the Bay and *Microcystis* blooms in the Delta. Supplies of water and sediments have been altered by upstream water consumption and retention of sediments behind dams, far from the Estuary. Biological communities were transformed after the North Pacific shifted from its warm to its cool phase in 1999. These examples illustrate why we need to study and manage the Estuary from a macroscopic view that considers ecosystem connectivity across a range of scales, from small (across habitats), to regional (across landscapes), to global (across ocean basins). Our learning from this view implies that:

- Monitoring is essential, because change is never ending.
- We will never fully understand changes until monitoring data across local to global scales are integrated in one place and easily accessible for syntheses.
- We can advance our pace of learning if planned actions (e.g., floodplain inundation, reservoir releases) are coordinated and communicated broadly so they can be exploited as experiments.
- The Bay and Delta are tightly interconnected, so perhaps we should think about “One Estuary One Science”.
- Outcomes of ecosystem restoration will be determined by the way newly constructed habitats are connected.
- We can anticipate variability of global-scale processes and build adaptability to it in our policies.
- We need to work harder on another kind of connectivity – between those who produce scientific information and those who use it to make challenging decisions.

Keywords: ecosystem connectivity, one estuary one science
Session: Plenary Session: Zooming Out to the Full System

Speaker Biography:

James (Jim) Cloern is a senior scientist emeritus at the U.S. Geological Survey in Menlo Park, California. His research over four decades addresses comparative ecology and biogeochemistry of estuaries to understand how they respond as ecosystems to climatic-hydrologic variability and human disturbance. His team investigation of San Francisco Bay included studies of primary production, nutrient cycling, algal and zooplankton community dynamics, ecosystem metabolism and food web dynamics, disturbance by introduced species, ecosystem restoration, and past and projected future responses to a changing climate. His career achievements have been recognized with selection as Fellows of the American Geophysical Union (AGU) and Association for the Sciences of Limnology and Oceanography (ASLO), and as recipient of the Woods Hole Oceanographic Institution B.H. Ketchum Award, Delta Science Program Brown-Nichols Achievement Award, ASLO Ruth Patrick Award, Coastal and Estuarine Research Federation Odum Lifetime Achievement Award, and Department of Interior's Distinguished Service Award.

Standing Too Close to the Elephant: Addressing Scales in Restoration and Fisheries Conservation

Rachel Johnson

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The San Francisco Estuary (estuary) is an important habitat for native fishes at different life stages. In order to understand the important role it provides for growth, survival, and reproductive success of these organisms, it is critical to explore the science and policies of the estuary at broad and finer spatial and temporal scales. The issue of scale is fundamental to the ecology and management investments for resident and migratory species. Indeed, discrepancies in scientific understanding can often be attributed to differences in these scales. Here, I will highlight two case studies that bridge the importance of developing a holistic framework among aquatic ecosystems and management authorities. First, I will highlight emerging science that focuses on the conservation sweet-spot in fisheries harvest, flow regulation and habitat restoration for Central Valley Chinook salmon. We show the likelihood that juvenile salmon will use targeted restoration sites in the Delta and estuary is a function of adult spawning abundance, flow thresholds, and landscape connectivity. Secondly, I will focus on sub-lethal levels of contaminants (selenium) that imperiled migratory fishes like Sacramento splittail confront across the watershed (estuary and river). Using new methods in measuring contaminants in biominerals, we revealed that juveniles with spinal deformities were exposed to elevated levels of selenium at multiple life stages and aquatic habitats. These case studies highlight the importance of scale and the opportunities for science to inform often fragmented authorities across freshwater, estuarine, and ocean systems. The aim of this talk is to contribute to a dialog about science and policy-based solutions that span habitat-specific boundaries in fisheries restoration and conservation.

Keywords: native fishes, selenium, scale, restoration, conservation, management
Session: Plenary Session: Zooming Out to the Full System

Speaker Biography:

Dr. Rachel Johnson has 15+ years experience as a professional fisheries ecologist working on various aspects of conservation and fisheries biology and its application to resource management in California. She has pioneered isotope tools to better understand migration, habitat use, contaminant exposure, and connectivity in fish populations. Her work focuses on understanding mechanisms of population viability and aids in determining critical habitats for reproduction, survival, and growth of endangered species and those targeted by fisheries. Rachel is a translational ecologist and explicitly works with scientists and decision-makers to reduce key scientific uncertainties around complex resource management decisions in California's Central Valley.

The Sacramento-San Joaquin Delta National Heritage Area - California's First Heritage Area

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Delta Protection Commission

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The Sacramento-San Joaquin Delta National Heritage Area was created in 2019 federal legislation and will be California's first National Heritage Area. Designated by the National Park Service as areas where humans have made a significant contribution to the natural landscape, the Delta NHA was proposed in legislation by Congressman John Garamendi and Senator Dianne Feinstein. It includes much of the legal Delta boundary, as well as the Carquinez Strait and nearby areas. The NHA will be administered by the Delta Protection Commission and will provide a platform to showcase the rich cultural heritage and historic character of the Delta region. Delta Protection Commission Executive Director Erik Vink will describe the Commission's plans to adopt a NHA management plan and the initial thinking on Delta NHA focus areas.

Keywords: Delta, heritage, communities, historic, Delta Protection Commission
Session: Plenary Session: Zooming Out to the Full System
Speaker Biography:
Erik Vink is Executive Director of the Delta Protection Commission, a State agency that protects, maintains, enhances and enriches the overall quality of the Delta environment and economy, with a focus on agriculture, recreation and natural resources. The Commission is the local coordinating entity for the newly designated Sacramento-San Joaquin Delta National Heritage Area.

San Francisco Bay is a Hope Spot for People and Ocean Wildlife

Karina Nielsen

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In 2018, a group of coastal science allies, inspired by Dr. Sylvia Earle's Mission Blue Hope Spot campaign to protect the health of the ocean, came together to propose a San Francisco Bay Hope Spot. The allies included people working as scientists, educators, and conservationists and local residents, who care deeply about the San Francisco Estuary and its ecological health. In 2019, we launched the San Francisco Bay Hope Spot to start planning for new, coordinated protection goals for our growing portfolio of habitat restoration, conservation and climate adaptation projects in the Bay. We know that enhanced biodiversity and climate adaptation benefits can accrue within marine protected area networks. These special places can help the estuary thrive, provide a refuge for marine life and connect people to the wonders of bay nature. The Bay is inextricably connected to our coastal ocean and local marine sanctuaries. The Hope Spot designation provides inspiration for our community to take the next steps to coordinate a protection and insurance plan, building on the work and successes already won, much of it accomplished by attendees of this conference, to enhance the ecosystem and social justice benefits of a healthy San Francisco Bay, for all.

Keywords: Hope Spot, wildlife, people
Session: Plenary Session: Zooming Out to the Full System
Speaker Biography:
Karina Nielsen is Executive Director of the Estuary & Ocean Science Center and Professor of Biology at San Francisco State University. She is a marine ecologist addressing questions at the intersection of conservation, climate change and policy in coastal ecosystems, including rocky shores, sandy beaches, surf zones and estuaries. She completed a BS in Biology at Brooklyn College, a PhD in Zoology at Oregon State University, and did postdoctoral research at Universidad Católica's Estación Costera de Investigaciones Marinas, and with the Partnership for Interdisciplinary Studies of Coastal Oceans. Dr. Nielsen was a Professor in the Department of Biology at Sonoma State University before joining SF State. She is a fellow of the California Academy of Sciences and serves on the Ocean Protection Council Science Advisory Team, and the Management Advisory Board for the San Francisco Bay National Estuarine Research Reserve.

From the Bay to the Gulf and Beyond: What 20 Years of Seabird Monitoring Tells Us About Food Webs

Dan Robinette, Meredith Elliott

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Seabirds are conspicuous marine organisms, often breeding in large colonies and consuming fish and other marine forage species near their breeding sites. They are central place foragers during the breeding season because they must return to their nesting site throughout the day. As such, they are good indicators of prey availability often within 10s of kilometers of their nesting sites. Here, we ask how the species composition of forage fish communities within food webs of San Francisco Bay, the Gulf of the Farallones, and nearshore central and southern California have changed over the past two decades. We use trends in the diets and breeding dynamics of two seabird species, Brandt's cormorant (*Phalacrocorax penicillatus*) and California least tern (*Sternula antillarum browni*), to illustrate shifts in the occurrence of key forage species like northern anchovies (*Engraulis mordax*) and young-of-the-year rockfish (*Sebastes* spp.). Breeding success has shown low variability among years at colonies within the Bay, higher variability at colonies in the Gulf and along the coast, and chronically low values throughout southern California. Diets of seabirds breeding within San Francisco Bay have shown little variability, indicating that forage fish populations are more stable within the Bay. Diets in the Gulf and central California have been more variable and reflect interannual variability in oceanographic conditions. Diets in southern California have shown increasing species diversity over time, suggesting that seabirds breeding in southern California are having difficulty finding important prey species. These findings are consistent with studies that have shown declines in the abundance of multiple fish species throughout the Southern California Bight. Overall, our results suggest that food webs have changed little within the Bay, have shifted in response to ocean climate within the Gulf and along the central California coast, and have been degraded within the Southern California Bight.

Keywords: California least tern, Brandt's cormorant, seabird diet, seabirds as indicators
Session: The Sierra Nevada to the Farallones: How Birds, Fish, and Mammals Connect the Estuary and Ocean

Speaker Biography:

Dan Robinette is a senior scientist at Point Blue Conservation Science, a non-profit dedicated to developing nature-based solutions to climate change, habitat loss, and other environmental threats to benefit wildlife and people. Dan manages Point Blue's Coastal Marine Program. His research interests include studying the population, breeding, dietary, and foraging ecology of seabirds in relation to local and regional oceanography. Dan is currently developing methods to use seabirds to index spatiotemporal variability in juvenile fish recruitment to nearshore habitats at scales relevant to managing marine protected areas (MPAs). Dan has studied seabird foraging effort throughout California's statewide network of MPAs and has been investigating the diets of seabirds throughout the state since 1999. Dan served on the Science Advisory Team for California's Marine Life Protection Act Initiative and is a current member of science advisory groups for statewide California least tern management and the Montezuma Wetlands Restoration Project.

Whales, Dolphins, and Porpoises: Harbingers of Recovery and Changing Seas

Tim Markowitz[1, 2], William Keener[1], Isidore Szczepaniak[1], Marc A. Webber[1], Allison Payne[2], Rebekah Lane[2]

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Until recently, cetaceans were rarely sighted in San Francisco Bay but use of the estuary has increased dramatically over the past decade. We report here preliminary findings regarding four species now using the Bay on a regular basis: harbor porpoises, bottlenose dolphins, humpback whales and gray whales. Harbor porpoises inhabited the bay historically, but were extirpated by the 1940s. We documented the porpoises' return beginning in 2008 and collected data on foraging and reproduction from the Golden Gate Bridge. Porpoises can now be seen in the central bay daily throughout the year. From 2011 to 2014, we recorded 2,698 porpoise group sightings, with calves in 10% of groups. Coastal bottlenose dolphins recently extended their range into Northern California, moving into Monterey Bay in 1983, before continuing north to San Francisco Bay where they now occur year-round. Since 2010, we photographically identified 100 uniquely marked adults using the Bay, representing 17% of the California coastal stock. Most of these dolphins (93%) have been matched to other study areas, from Monterey Bay to Ensenada, Mexico. Since 2016, we have observed an unprecedented influx of humpback whales into San Francisco Bay feeding on anchovy. Of 70 whales photographically identified in San Francisco Bay, 32 individuals are known from their breeding grounds in Mexico. Conservation implications for this threatened stock using the Bay include potential ship strikes. Gray whales visited San Francisco Bay in unusually high numbers this year, on their way from Mexican breeding grounds to Arctic feeding grounds, with some remaining in the bay for weeks. The bay may be used as a migratory stop-over in times of food stress. We estimate at least 20 gray whales entered the bay in 2019, including 11 that died. Necropsies revealed that 6 suffered from malnutrition, and 5 died as a result of ship strikes.

Session: The Sierra Nevada to the Farallones: How Birds, Fish, and Mammals Connect the Estuary and Ocean

Speaker Biography:
Dr. Tim Markowitz is the Cetacean Field Research Program Coordinator at The Marine Mammal Center. He is a lecturer in the Department of Integrative Biology at UC Berkeley and in the Department of Biology at San Francisco State University where he serves on advisory committees for graduate students. He has over 25 years' experience working with cetaceans in the field, including managing research teams in New Zealand, Alaska and California. His research has focused on behavioral ecology, social organization, population biology, and conservation of whales, dolphins and porpoises. He holds a B.A. in Environmental Studies from U.C. Santa Cruz, a M.S. in Animal Science from U.C. Davis, and a Ph.D. in Wildlife and Fisheries Science from Texas A&M University.

Vital Signs of the San Francisco Estuary Fish Community

Christina Swanson[1], Jon Rosenfield[2,3]

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San Francisco Bay is important habitat for more than 100 fish species, which variously use the estuary for spawning, nursery and rearing habitat, and as a migration pathway between the Pacific Ocean and the rivers of the estuary's watersheds. Environmental conditions in the estuary—the amounts and timing of freshwater inflows, water temperatures, the extent of rich tidal marsh habitats, and pollution—affect the numbers and types of fish that the Bay can support. Thus, the measures of fish abundance, diversity, species composition, and distribution reported by the 2019 State of the Estuary Report are useful biological gauges for environmental conditions in the estuary. We found that the condition of the Bay's fish community varies geographically, from generally good conditions in the marine-influenced lower estuary (San Pablo, Central and South Bay regions) to generally poor conditions in the upper estuary (Suisun Bay, Suisun Marsh and the Delta), which is strongly affected by the amounts and timing of freshwater inflows from the estuary's highly managed watershed. For most regions and many of the measures, the condition of the fish community has declined over the past two to five decades. These declines reflect substantial, long-term declines in abundance and increases in the prevalence of non-native species. In addition, measured values for 2017, the most recent year for which fish survey data were available, were at or near record low levels for many different fish community measures. These recent low values may reflect the influence of the higher than normal water temperatures in 2016 and 2017 and severe reductions of flow during the 2012-2016 drought. These San Francisco Bay fish community results illustrate the connections between the ocean, the estuary, and the estuary's watershed, and underscore the dependence of the estuary's health on healthy conditions both upstream and downstream of the Bay.

Keywords: Fish, fish community, abundance, diversity, species composition, distribution, status, trends
Session: The Sierra Nevada to the Farallones: How Birds, Fish, and Mammals Connect the Estuary and Ocean

Speaker Biography:

Christina (Tina) Swanson, Ph.D., is Director of the Natural Resources Defense Council's (NRDC) Science Center, where she works to expand the organization's scientific capabilities and support its legal and policy work across a range of environmental, public health and sustainable management issues. Prior to joining NRDC in 2011, Tina worked with The Bay Institute, serving as the organization's fisheries scientist and, from 2008-2011, as Executive Director and Chief Scientist. She is an expert in biology, ecosystem protection and restoration, ecological indicators and water resource management. Much of her work has been in the San Francisco Bay-Delta, but she has also worked and conducted research in Hawaii and, as a Fulbright Scholar, in the Philippines. Tina received her B.A. from Cornell University, her doctorate from UCLA and conducted post-doctoral research at UC Davis. She was President of the Western Division of the American Fisheries Society in 2012-2013.

Jon Rosenfield, Ph.D. is Senior Scientist for San Francisco Baykeeper. He is responsible for integrating the best available science into Baykeeper policy positions and legal arguments to protect San Francisco Bay. Prior to joining Baykeeper, Jon worked for over 10 years protecting the Bay's endangered fishes and commercial fisheries as a conservation biologist with The Bay Institute. Jon has conducted scientific

research and translated science for attorneys, policymakers, and the public since the early 1990s, when he first encountered San Francisco Bay and its watershed as a research associate for the Sierra Club Legal Defense Fund (now Earthjustice). Jon earned his Ph.D. in biology from the University of New Mexico. He also holds a B.S. in Natural Resource Ecology from Cornell University and an M.S. in Resource Management and Conservation Biology from the University of Michigan.

Identifying Habitat Needs and Management Goals for Waterfowl Wintering Across the Delta-Bay-Ocean Continuum

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Migratory waterfowl are highly visible sentinels of landscape and climate change that rely on a mosaic of habitats spanning a continuum from fresh to saltwater during part or all of their annual cycle. As the largest estuary on the Pacific Coast of North America, the San Francisco Bay Delta (SFBD) is a critically important waterfowl stop-over and wintering area, yet like many estuaries this resource rich area is also under intense pressure from development and changing climate conditions. Over 700,000 waterfowl, including several frequently harvested species such as northern pintail (*Anas acuta*), American wigeon (*Anas americana*), canvasback (*Aythya valisineria*) and more than 40% of wintering Pacific Flyway scaup (*Aythya affinis* and *marila*), depend on intertidal, subtidal and managed pond habitats in the estuary each winter. However, historic habitat reduction and conversion, as well as projected losses due to sea level rise and other stressors underscore the importance of careful restoration, enhancement and management of remaining tidal areas and ponds to maximize their value for waterfowl. We review on-going studies designed to identify waterfowl habitat needs, optimize food resources and increase habitat value in this changing environment. In addition, we discuss the role of the midwinter waterfowl survey in tracing shifting waterfowl numbers and habitat associations across the past several decades and the current effort to modernize this critical SFBD survey. Our goal is to provide policy-makers and managers with information needed to improve conditions for waterfowl wintering across the Delta-Bay-Ocean continuum.

Keywords: wintering waterfowl, midwinter survey, habitat use, movement ecology
Session: The Sierra Nevada to the Farallones: How Birds, Fish, and Mammals Connect the Estuary and Ocean

Speaker Biography:
Susan De La Cruz has been working on migratory waterbirds and their habitats across the Pacific Flyway for over 20 years. Her research focuses on evaluating threats and restoration benefits to migratory birds, their estuarine habitats, and their food resources. She takes a flyway-wide perspective with the ultimate goal of identifying novel cross-seasonal approaches to furthering scientific understanding, and informing the conservation of waterbirds throughout their ranges and across their annual cycles.

A Fish-Eye View of Habitat Quality in San Francisco's Brackish Tidal Wetlands

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Over the last century, we have polluted, drained, and developed over 95% of the wetland habitats throughout California, often without a strong understanding of the consequences to aquatic life. Fortunately, habitat restoration and improvements to water quality have become management priorities in the San Francisco Estuary; however, the integrity of aquatic communities (e.g., fish and invertebrates) in brackish tidal wetlands have been largely overlooked in southern and northwestern regions of the estuary. As a result, we have a limited understanding of how environmental impacts such as water diversions, eutrophication, overfishing, pollutants, and habitat degradation have affected aquatic organisms, and how various management and conservation actions might benefit these brackish ecosystems.

To address this, the "Biogeochemistry and Fish Ecology Lab" (Hobbs Lab) at UC Davis has sampled fish and invertebrates in wetland habitats in Lower South San Francisco Bay (2010-present) and San Pablo Bay (2015-present). These comparative studies have allowed us to assess the responses of common species to environmental variation and to examine how human interventions (e.g., restoration and wastewater effluent) might affect these brackish aquatic ecosystems. Our studies have revealed a diverse community of fishes and invertebrates with unique ecological niches, many of which readily utilize restored tidal ponds. Relative to wetlands in the northern estuary, Aviso Marsh exhibited exceptionally high abundance and high diversity of aquatic organisms. In particular, we discovered aggregations of adult Longfin Smelt in Alviso Marsh during the winter breeding season, and their larvae were also observed in years of high freshwater outflow (e.g., 2017 and 2019). Based on these data, it appears that aquatic communities in Lower South Bay are abundant and diverse, that restored brackish wetland habitats may be valuable to several native species, and that freshwater outflow is likely key to supporting estuarine species in these habitats.

Keywords: fish, invertebrate, restoration, marsh, wetland, Longfin Smelt, survey, otter trawl
Session: Tidal Wetlands to the Uplands: Fish and Wildlife as Indicators

Speaker Biography:

Dr. Levi Steele Lewis is the PI of the Biogeochemistry and Fish Ecology Lab at UC Davis and a Delta Science Postdoctoral Fellow. His current research focuses on modeling habitat suitability functions for marsh fauna, comparative studies of species assemblages across marshes and environmental conditions, and reconstructing the growth, origins, and life-history traits of threatened species using otolith geochemical and aging techniques, all within the greater San Francisco Bay Estuary. Levi attained his B.S. in Wildlife, Fish, and Conservation Biology at UC Davis (adv. Peter Moyle); M.S. in Biology at San Diego State (adv. Todd Anderson); and Ph.D. in Oceanography at Scripps Institution of Oceanography (adv. Jennifer Smith). He is currently advised by Dr. Nann Fangue (advisor) at UC Davis and Dr. James Hobbs and Randy Baxter at the CDFW.

Mice in the Middle: The Special Case of Terrestrial Wildlife in the Marshes of the San Francisco Estuary

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Habitat protection, enhancement, and restoration throughout the San Francisco Estuary is largely driven by the needs of a select group of special-status fish and wildlife species, each with specific habitat needs, tolerances, and dispersal abilities. Consequently, environmental threats and the actions we take to combat these threats have a variety of effects on special-status species in the Estuary. Sea-level rise will have a greater impact on higher marsh species than those which can utilize low marsh and aquatic habitats. At the same time, restoration actions in the Estuary are largely driven by regulatory requirements, and as such, are designed largely to benefit a limited group of species (e.g., a fish restoration vs. a shorebird restoration). While this is necessary to a degree, it can put the needs of different species at odds. One group of species particularly at risk are the small mammals of the Estuary, especially the endangered salt marsh harvest mouse (SMHM). While recent research has revealed the SMHM is capable of utilizing habitat types outside of the marshes that form their core habitat, research also suggests factors other than habitat type are influencing the distribution of the species. If SMHM are capable of utilizing habitats outside of marshes, then competition and predation are likely responsible for keeping the species largely restricted to wetlands. This could be a serious challenge moving forward as one of the primary strategies for protecting the SMHM from sea-level rise is to create upland refugia; but if aggressive upland-associated species preclude the SMHM from routinely accessing upland refugia—as sea-level rise threatens them from the other side—how is the species to cope? With a more limited ability to escape threats in isolated marshes than any other special-status species, the SMHM might tell us a story no other species can.

Keywords: salt marsh harvest mouse, *Reithrodontomys raviventris*, sea level rise, distribution
Session: Tidal Wetlands to the Uplands: Fish and Wildlife as Indicators

Speaker Biography:
Katie Smith has spent the last decade researching the ecology of the salt marsh harvest mouse. Her research has focused on identifying actionable management avenues though which to promote recovery of the species. For the last 10 years, Katie worked with the California Department of Fish and Wildlife while she completed her Master's degree at New Mexico State University and her PhD in Ecology at UC Davis. Katie's research has involved putting tiny radio collars on mice, preparing tiny buffets for mice, and lots of live trapping of mice, and revealed that salt marsh harvest mice are much more flexible in their habitat use and diet than we previously believed. As a Delta Science Fellow, Katie is currently investigating the response of salt marsh harvest mice to king tides, as a proxy for sea level rise. She is also broadening her skills as a wildlife biologist with WRA Inc.

Tidal Marsh Birds: Indicators of Habitat Quality of the Wetland/Upland Transition Zone

Nadav Nur [1], Julian Wood [1], Megan Elrod [1], Leia Giambastiani [1], Donna Ball [2], David Thomson [3], Isaiah Thalmayer [1]

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Much effort has focused on restoring tidal marsh habitat in the San Francisco Estuary due to extensive habitat loss and degradation that has put wildlife species at risk. Recently, the importance of the transition zone between tidal marsh and the adjacent upland has been recognized as critical to healthy tidal wetland ecosystems. Scant natural transition zone remains and, thus, extensive efforts are under way to restore the transition zone. But what makes for high quality transition zone habitat? What features of transition zones maximize their value to wildlife that depend on tidal marsh habitat? Point Blue, in partnership with Save The Bay and San Francisco Bay Bird Observatory, initiated a study to address these questions and develop recommendations for the conservation and restoration of tidal marsh and the adjacent marsh/upland ecotone that will support the recovery of tidal marsh dependent wildlife. Our study has focused on the population response of a suite of bird species, indicative of tidal marsh-dependent wildlife more broadly, including the endangered California Ridgway's rail and four endemic subspecies of songbirds. Our initial study conducted at 16 marsh sites spanning San Pablo and San Francisco Bays identified features characterizing high quality transition zones: wide areas with tall, dense vegetation. No one plant species was shown to be important; instead, our results suggest that multiple plant species at a given site can best provide the necessary vegetation structure. We describe current efforts, being implemented by Point Blue's Students and Teachers Restoring a Watershed Program, which are evaluating specific vegetation features that may maximize long-term benefits to rails and other tidal marsh-dependent wildlife. Our study highlights the value of implementing a study design to restoration to assess the importance of specific transition zone features and demonstrates the value of using a suite of monitoring protocols to measure wildlife response.

Keywords: San Francisco Bay, High-tide refugia, Ridgway's rail, Restoration, Vegetation structure
Session: Tidal Wetlands to the Uplands: Fish and Wildlife as Indicators

Speaker Biography:
Nadav Nur came to Point Blue Conservation Science in 1989, having been trained as an ecologist (PhD) and biostatistician (MS); he currently is Quantitative Ecology Program Director. His work focuses on statistical analysis and population viability modeling. He co-led the Risks to Wildlife Workgroup for the Baylands Ecosystem Habitat Goals Update Project, focusing on climate change, and led the Bird and Mammal components of the 2015 SOE Report. Nadav was lead author of Statistical Guide to Data Analysis of Avian Monitoring Programs, as well as the statistical lead on three monitoring protocols/frameworks for the USFWS focused on secretive marsh birds, breeding seabirds, and American white pelicans. Since 1996, he has studied the response of birds to tidal marsh restoration, to assess success and guide management. His current work studies impacts of climate change and invasive species on tidal marsh birds and seabirds and how to maximize recovery of threatened populations.

A Risk Management Approach to Delta Water Supply Vulnerability

Andrew Schwarz [1], Patrick Ray [2], Sungwook Wi [3], Casey Brown [3], Minxue He [4], Matthew Correa [4]

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Planning for future conditions has always involved uncertainty but the additional uncertainty about future conditions driven by changing climate necessitates new approaches for exploring system vulnerabilities and potential adaptation responses.

This presentation will describe a relatively new approach to handling uncertainty in climate change impact assessment and how it can inform water resources management. Most past climate change vulnerability assessments have employed a top-down approach, taking a limited number of global climate model projections downscaled to local conditions and using the information as an input to water system models. The study highlighted in this presentation employs a bottom-up approach called decision-scaling to explore how sensitive the Central Valley water system is to changes in temperature and precipitation and developing probabilistic estimates of likely future conditions across the range of future climate uncertainty. Applying this method to numerous performance metrics such as reservoir carry over storage, Delta water deliveries, and net Delta outflow shows that across the range of uncertainty, performance by mid-century will diminish significantly and that many of the most severe impacts will be felt in the driest years. (Schwarz et al.,2018). This approach allows water managers to test hypothetical adaptation strategies and explore how the performance and uncertainty change. Results are provided probabilistically which align well with risk-informed decision-making practices that have historically been used to guide investment in the water resources industry.

Keywords: Climate change, water resources, decision scaling, water supply
Session: Regional Science for Decision-Making in Uncertain Times

Speaker Biography:

Andrew Schwarz is a supervising engineer for the Delta Stewardship Council, a state agency charged with achieving a more reliable water supply for California and protecting, restoring, and enhancing the Sacramento San Joaquin Delta ecosystem. Mr. Schwarz supervises an interdisciplinary team that manages implementation and policy development for the Delta Plan. With over 15 years of water resource management and engineering experience, Mr. Schwarz specialized in climate change impact analysis, management solutions to impacts, and policy development. While working at the California Department of Water Resources, Mr. Schwarz lead the development of a three phase Climate Action Plan covering greenhouse gas management and reductions, a climate vulnerability assessment, and technical guidance for project level climate analysis. Mr. Schwarz has also worked on multiple projects to support local water agency resiliency planning. In his free time, he is an avid backpacker and can still carry more weight than his kids.

Underappreciated Effects of Sea-Level Rise on Groundwater

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The effects on the built environment of SLR-induced rises in groundwater levels have been underappreciated. Because of the infinite lateral extent of SLR relative to bayfront improvements, even well-designed levees (or flood walls) may be ineffective at maintaining safe landside groundwater levels. Groundwater rise on the "protected" landside will still be problematic for existing improvements. Mitigation of the effects by retrofitting existing facilities may not be physically or economically feasible. A typical Bay margin development provides an example: Roadway pavement sections rely on the underlying subgrade and aggregate base remaining unsaturated. Rising groundwater that saturates these underlying materials will lead to breakdown of the pavement structural section. Raising paved surfaces will require tremendous fill volumes, modifications to surface drainage, and costly modifications to overcrossings to preserve needed overhead clearance.

Gravity storm drains in low-lying areas may be subject to loss of differential head ("fall") needed to drive flows from sources areas to outfalls. Larger channels, pipes, detention facilities, and possibly pumping systems will be needed.
Basements, elevator shafts, utility vaults, and other below-grade structures will be permanently or episodically inundated. Mechanical and electrical equipment will require waterproofing or relocation.

Buildings with a slab-on-grade and other shallow foundations rely on a separation between the slab and water table, and are not waterproof. A vapor barrier is used to reduce moisture passage through the slab. SLR will result in the local water table rising to above slab elevation, with increased moisture passing through the slab even before that point. Structure foundations designed according to strength of the underlying soil will be compromised.

An overarching question: how will the appropriate design groundwater water surface elevation for existing (and new) facilities evolve, since SLR will continue well beyond the original economic lifespan of a given "improvement?"

Keywords: sea level rise, groundwater
Session: Regional Science for Decision-Making in Uncertain Times
Speaker Biography:
Phil Gregory is a civil and geotechnical engineer who has worked in the Bay area for the past 30 years. The focus of Phil's professional career has been the development and design of measures to mitigate the impact of adverse geotechnical conditions on existing infrastructure. For the past 15 years he has been actively involved with design of infrastructure renewal projects, increasingly focused on previously unforeseen future demands on roads, levees, channels, creeks and flood protection facilities. He is currently involved in the design and construction of upgrades of a major flood control channel in Fremont to accommodate increased flows due to sea level rise and urban development. Mr. Gregory is an active member of the Dams, Slopes, and Embankment Committee of ASCE's Geotechnical Institute. He is a registered civil and geotechnical engineer. Phil earned his BS and MS in Civil Engineering from UC Berkeley in 1983 and 1984, respectively.

Sediment Dynamics and Wave Attenuation at the Marsh Edge

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Estuarine salt marshes in San Francisco Bay provide critical habitat and protect coastal communities by attenuating waves. Marshes are highly vulnerable to sea-level rise, both by drowning due to their low elevations and by wave-driven lateral erosion. Vertical accretion can counter marsh drowning if the sediment supply from adjacent bay shallows is adequate. The transport of sediment between bay shallows and marshes depends on tidal stage, wave energy, marsh-edge morphology, and vegetation in complex ways that are poorly understood. We are investigating these dynamics in the shallows of San Pablo Bay and the adjacent marsh in China Camp State Park. Our results show that supply of sediment to the marsh across the wave-exposed bay margin is comparable to supply through tidal creeks. Sediment delivery across the marsh edge increases with wave energy in the shallows. Suspended sediment concentration and deposition in the marsh are greater in summer than winter, which we attribute to increased sediment trapping in the dense summer vegetation fringing the bay margin. We also found that marsh vegetation decreases incident wave height by more than 80% within 50 m of the marsh edge. As sea level continues to rise, wave attenuation over mudflats will decrease and larger waves will reach the marsh edge. Over time, increased wave exposure can steepen marsh edges and accelerate lateral erosion, reducing the width of the protective buffer provided by marshes. These results support development of predictive models needed to assess marsh resilience and plan management actions.

Keywords: salt marsh, sediment transport, wave attenuation, sea-level rise, marsh resilience
Session: Regional Science for Decision-Making in Uncertain Times
Speaker Biography:
Jessie Lacy is a physical oceanographer in the Pacific Coastal and Marine Science Center of the US Geological Survey. She conducts research in hydrodynamics and sediment transport in estuaries and coastal waters, including San Francisco Bay, the Sacramento-San Joaquin Delta, Puget Sound, and Monterey Bay. Her research interests include sediment dynamics in estuarine shallows; hydrodynamic controls on sediment delivery to marshes; interaction between aquatic vegetation and hydrodynamics; and the role of the physical environment in defining habitat function in aquatic systems. She has served on science panels for conservation and restoration of Elkhorn Slough, Pescadero Lagoon, and the South San Francisco Bay Salt Ponds. Jessie worked for eight years in water quality regulation for the State of California before earning her PhD in Civil and Environmental Engineering from Stanford University.

Informing Development and Evaluation of Nature-based Shoreline Adaptation Strategies in a Changing Climate

Maya Hayden [1], Sam Veloz [1], Leo Salas [1], Nathan Elliott [1], Dennis Jongsomjit [1], Nadav Nur [1], Julian Wood [1], Julie Beagle [2], Jeremy Lowe [2], Katie McKnight [2], Sam Safran [2], Hilary Papendick [3], Kelly Malinowski [4], Jack Liebster [5], Chris Choo [5], Alex Westhoff [6], Leslie Lacko [5], Laurie Williams [5]

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Natural and nature-based adaptation measures, such as tidal wetlands, can reduce the vulnerability of communities to coastal hazards related to climate change, while providing a wide array of additional benefits that most traditional hard armoring solutions lack (e.g., fish and wildlife habitat, recreational opportunities, carbon sequestration). Understanding the broader suite of benefits and assessing trade-offs that go beyond the cost of implementation for different adaptation strategies is a critical need in transitioning from community vulnerability assessment to solution oriented action. Modeling how tidally-influenced elevations may change through time with rising seas is helpful for understanding (1) how implementation timing of nature-based measures affects long-term habitat outcomes, (2) how long certain adaptation measures might last, (3) how benefits may change through time, and thus how adaptation objectives or outcomes may change with sea level rise. We illustrate case study examples from the San Francisco Bay Area of how this type of quantitative, spatially-explicit modeling can be used to inform development and evaluation of coastal adaptation strategies.

Keywords: sea level rise, adaptation, living shorelines, nature-based, marsh accretion, benefits
Session: Regional Science for Decision-Making in Uncertain Times

Speaker Biography:
Maya Hayden is a Senior Ecologist at Point Blue Conservation Science, where she leads the Coastal Adaptation Program. Her current work is focused on supporting integration of climate-smart conservation principles and nature-based solutions into climate adaptation planning efforts along California's coast. Much of her work involves partnerships with coastal resource managers and decision makers to understand and address their science needs, to improve existing or co-develop new decision-support tools, and to build community awareness, access, and capacity to use the best available science for coastal adaptation planning. She holds a PhD in plant ecology from UC Berkeley (Department of Environmental Science, Policy, and Management), and an MS in biology from Stanford University.

Planners and Engineers and Regulators... Oh My! Roles in Regional Governance

Mark Lubell [1], John Bourgeois [2], Jessica Fain [3], Jessica Law [4], Mike Mielke [5], Erika Powell [6,7], Jim McGrath [8]

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Recent work by Mark Lubell out of UC Davis has identified governance as a critical impediment to successful regional implementation of sea level rise adaptation strategies and projects. Numerous agencies and organizations in the Bay Area have been taking action to fill segments of this gap and provide leadership, resulting in a complex landscape. This panel will explore the roles and strategies of various organizations, and how they can fit together to achieve a sound strategy for regional governance.

Keywords: governance, sea level rise, adaptation planning
Session: Planners and Engineers and Regulators... Oh My! Roles in Regional Governance
Speaker Biographies:
Dr. Mark Lubell is a professor of Environmental Science and Policy at UC Davis. His research focuses on human behavior and the role of governance institutions in solving collective action problems and facilitating cooperation. The collective action problems associated with environmental policy provide a laboratory for this research. Dr. Lubell's current projects include watershed management, environmental activism, agricultural best management practices, and institutional change in local governments. Mark also dabble in experimental economics and simulation techniques to further explore collective action theory.

Jessica Fain became BCDC's Planning Director in October 2018, where now she leads a team of talented planners focused on sea level rise adaptation, environmental justice, ecosystems and working waterfronts. Prior to joining BCDC, Jessica worked in planning and resiliency in New York City, as a Waterfront Planner at the New York City Department of City Planning and then as the Program Director at the Science and Resilience Institute at Jamaica Bay. Jessica holds a Bachelor of Arts from the University of Pennsylvania and a Master of City Planning from Massachusetts Institute of Technology.

Jessica Law is the Chief Deputy Executive Officer of the Delta Stewardship Council. In that role, Law has successfully planned and executed semiannual Delta Plan Interagency Implementation Committee meetings for the Council, with focused discussions on adaptive management, ecosystem restoration, interagency priorities for high-impact science actions, and integrated ecosystem modeling. Law has previously worked in the private sector consulting for state, regional, and local agencies on an array of land-use and environmental programs, with a special focus in public outreach and communications. The majority of her work focused on the Central Valley and the Sacramento-San Joaquin Delta. She received a bachelor's degree in Ecological Biology from Connecticut College and a Masters in Regional Planning

from the University of Massachusetts, Amherst. Law is a member of the American Planning Association and the American Institute of Certified Planners.

Mike Mielke is an expert environmental policy advocate, coalition builder and program manager, with over 20 years of experience in the developed and developing world. Mike is regularly called upon to provide experienced counsel to leaders in the business, government and nonprofit sectors. Having launched three different organizations, Mike has extensive experience conceptualizing partnerships that engage the public and key influencers to address some of the most pressing environmental and community development challenges. He is a sought after speaker and is regularly asked to engage on policy and campaigns in areas such as climate change, water, corporate sustainability, and the politics of environmental policy.

Erika Powell is a registered civil engineer and has been leading several multi-jurisdictional Flood Resilience Program planning and implementation projects in San Mateo County. As a native of New Orleans, Erika has a lifetime of experience with flooding and the consequences of extreme weather events. Erika has dedicated her professional career to the implementation of over $1B of multi-beneficial flood protection and restoration projects across California and Louisiana. Her passion for protecting the environment and mitigating the socio-economic impacts of major floods are backed by her numerical modeling skills and her leadership on numerous projects for the US Army Corps of Engineers, Los Angeles County, and consulting for Santa Clara Valley Water District and the California Department of Water Resources. Erika led the information gathering effort for the development of the California's Flood Future Report: Recommendations for Managing the State's Flood Risk.

Mr. McGrath, of Berkeley, has worked in the environmental field for over 30 years, starting at the U.S. Environmental Protection Agency in 1972. He spent five years with U.S. EPA, fourteen years with the California Coastal Commission, and sixteen years with the Port of Oakland, working on a variety of projects and addressing a range of environmental issues. Jim received his formal education at the University of California, Berkeley, initially in the Chemistry Department, and received a B.A. in History in 1973 and a M.S. in Civil Engineering in 1983. Since retiring from the Port of Oakland in 2005, he has a robust volunteer portfolio, is currently Vice Chair of the San Francisco Bay Regional Water Quality Control Board, as well as various non-profit boards including the San Francisco Estuary Institute, US Windsurfing, San Francisco Boardsailors Association, and Bay Access as well as the City of Berkeley's Waterfront Commission.

A 15-year Retrospective: Large-scale Green Infrastructure Changes via Private Redevelopment in the South Bay

Chris Sommers

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Stormwater runoff carries trash, bacteria, mercury, PCBs, and other pollutants from the urban landscape into local waterways. Green Stormwater Infrastructure (or GSI) uses vegetation, soils, and other elements and practices to restore some of the natural processes that are impacted via urbanization and needed to effectively manage stormwater. As early as the 1990's, Bay Area stormwater management programs began promoting the use of GSI via the "Start at the Source" Site Design Guidance Manual, which stressed the importance of considering stormwater quality in the early stages of planning and designing new land development projects. In 2002, the first requirements for GSI were included in municipal stormwater NPDES permits. Under these new regulations, parcel-based development projects of a certain size were required to address stormwater runoff, created via new or replaced impervious surfaces associated with these projects. Municipalities in Santa Clara County began requiring the installation of GSI and other stormwater treatment on development projects in 2003. Since that time, requirements have expanded in Santa Clara County, along with unprecedented levels of redevelopment that have turned older industrial and commercial areas into multi-use, high density urban areas that have incorporated GSI into the designs of their landscapes. As a result, GSI facilities currently operating throughout the County now address stormwater runoff from over 6,000 acres of urban land area. These facilities are largely associated with privately-owned parcels, which has reduced the costs to public agencies in Santa Clara County that are mandated to address pollutant reduction goals via GSI. First of a kind GSI plans outlining current, predicted and planned GSI implementation on public and private properties were recently adopted by all municipalities in the Santa Clara Valley and serve as roadmaps to continued improvements in stormwater quality in the South San Francisco Bay Area.

Keywords: stormwater, green infrastructure, low impact development
Session: Integrating Green Stormwater Infrastructure into the Bay Area's Urban Landscape
Speaker Biography:
Chris Sommers is a Vice President at EOA, Inc., a small environmental engineering and science consulting firm in Oakland. For nearly 20 years, Chris has specialized in assisting Bay Area municipalities with implementing effective stormwater management practices and quantifying their water quality benefits. Chris currently serves as staff to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and leads the Program's ongoing efforts to maintain information on stormwater control and monitoring data, including Green Stormwater Infrastructure (GSI) facilities on private and public properties throughout Santa Clara County.

Getting It Done: Public Right-of-Way Green Stormwater Infrastructure

Amanda Booth [1], Terri Fashing [2]

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Cities across the Bay Area face substantial challenges associated with implementation and maintenance of green stormwater infrastructure (GSI). This presentation will explore how the cities of San Pablo and Oakland are navigating the funding, planning, implementation, and maintenance of public GSI projects on city-owned land and rights-of-way. The regulatory setting is the state's Municipal Regional Stormwater Permit (MRP), issued by the San Francisco Bay Regional Water Quality Control Board. Under the MRP these cities were required to develop a GSI Plan that describes how public and private GSI projects are identified, prioritized, implemented, tracked and reported.

Terri Fashing will provide a brief overview of public GSI projects in the City of Oakland and describe internal communication and coordination tools developed to support GSI implementation. The presentation will identify fiscal constraints and their impacts on GSI implementation and maintenance, and how planning documents throughout the City have embraced GSI. Terri will also describe Oakland's new 2018 Capital Improvement Program Prioritization Policy, which merges quantitative and qualitative criteria with a transparent, equitable and actionable approach to funding projects. This prioritization process will provide the basis for equitable geographic distribution of implemented public GSI projects in Oakland.

Amanda Booth will provide an overview of public GSI projects in the City of San Pablo with an emphasis on lessons learned during the design of GSI in public rights-of-way and the ongoing challenge of maintaining these facilities into the future. Amanda will also discuss various funding strategies the City has used for implementation of GSI in San Pablo.

Keywords: Green Stormwater Infrastructure, GSI, Maintenance
Session: Integrating Green Stormwater Infrastructure into the Bay Area's Urban Landscape
Speaker Biographies:
Amanda Booth received an undergraduate degree from Boston College and a Masters in Sustainable Design and Development from the University of Sydney. She has been working in the water and stormwater field for eight years. Her career started in Sydney, Australia as an Environmental Consultant working with farmers and local government on clean energy and water projects. In 2015, she returned to the United States, working for the City of San Pablo leading their Environmental Programs Division.

Terri Fashing is a Watershed Program Specialist in the Oakland Public Works Watershed and Stormwater Management Division. She's worked for the City for 2 years on creek restoration and stormwater protection projects. Before that she spent more than 10 years managing the Marin County Stormwater Pollution Prevention Program.

Modeling and Planning for Long-Term Green Infrastructure Implementation in San Mateo County

Matthew Fabry

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The 20 cities and towns and San Mateo County are all permittees under the Municipal Regional Stormwater Permit issued by the San Francisco Bay Regional Water Quality Control Board. Under this permit, all permittees are required to develop Green Infrastructure (GI) Plans and an associated Reasonable Assurance Analysis (RAA) to demonstrate sufficient GI can be implemented by 2040 to achieve specified reductions in mercury and PCB loads to San Francisco Bay. The City/County Association of Governments of San Mateo County (C/CAG), a joint powers agency of the 21 jurisdictions, has been assisting its member agencies with GI planning and RAA modeling with a focus on opportunities for stormwater management at the parcel, street, and watershed scales. The presentation will summarize C/CAG's countywide hydrology and pollutant load modeling process and results, provide an overview of the recently completed GI Design Guide, detail efforts to identify, prioritize, design, and build regional stormwater retention projects, including through the creation of a new Flood and Sea Level Rise Resiliency District, summarize progress on developing a Sustainable Streets Master Plan that prioritizes street segments throughout the county for integrating green stormwater infrastructure with other planned investments and community priorities to improve water quality and adapt to precipitation-based climate change impacts, and also discuss policy changes being implemented by C/CAG member agencies to increase implementation of green infrastructure at the parcel-scale via expanded requirements on new and redevelopment.

Keywords: Stormwater, Green, Infrastructure, Sustainable, Streets, Reasonable, Assurance, Analysis, Planning, Modeling
Session: Integrating Green Stormwater Infrastructure into the Bay Area's Urban Landscape
Speaker Biography:
Matthew Fabry serves as Manager for the San Mateo Countywide Water Pollution Prevention Program, a program of the City/County Association of Governments of San Mateo County, which assists the 21 San Mateo municipalities with stormwater compliance issues. He is currently Vice-Chair of the Bay Area Stormwater Management Agencies Association and has over 24 years of experience in water quality and stormwater management. Matthew has worked in municipal, regulatory, and consultant capacities, holds degrees in environmental engineering and music, and is a registered civil engineer in the State of California.

What's so hard about digging a 40" hole? Perspectives on green infrastructure

Keith Lichten

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Green infrastructure includes a range of challenges including funding, design, operation and maintenance, and the need for data collection, feedback loops, and opportunities to improve over time. This speaker will join the panel in conversation, offering a regulatory perspective.

Keywords: Green infrastructure, challenges.
Session: Integrating Green Stormwater Infrastructure into the Bay Area's Urban Landscape
Speaker Biography:
Keith Lichten is chief of the Watershed Management Division at the San Francisco Bay Regional Water Quality Control Board, which manages work including the Board's storm water, creek and wetland fill, and water recycling programs. He received his Bachelor's in environmental engineering from MIT and completed a Master's in Landscape Architecture at UC Berkeley, studying environmental planning and green infrastructure. He is on the Governing Board of the ASCE's Environmental and Water Resources Institute (EWRI) and recently chaired EWRI's inaugural conference on the operation and maintenance of stormwater control measures.

Testing Managed Wetlands BMPs for Improving Water Quality and Achieving TMDL Objectives in Suisun Marsh

Stuart Siegel [1], Steve Chappell [2], Sujoy Roy [3], Philip Bachand [4], Dan Gillenwater [5], Barbara Baginska [6]

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Suisun Marsh, in the northern reaches of San Francisco Bay, California, is a mosaic of over 100,000 acres of diked managed wetlands, tidal wetlands, bays and sloughs, and adjacent uplands, and supports a high diversity of resident and migratory terrestrial and aquatic wildlife species. Dead end sloughs in Suisun Marsh have historically experienced episodic low dissolved oxygen (DO) and high methyl mercury (MeHg) events, adversely affecting aquatic life and other beneficial uses. As a result, the Regional Water Quality Control Board added Suisun to the Clean Water Act Section 303(d) impairment list. To help address these problems, the State Board funded an investigation from 2007-2011 that identified a variety of best management practices (BMPs) that were implemented and monitored in selected managed wetlands over 2015-2018 under a USEPA grant. BMPs included structural and operational modifications and were coordinated by the Suisun Resource Conservation District. Water quality effects on wetland discharges and sloughs were field measured from 2016-2018 focused on Peytonia and Boynton sloughs. Monitoring included continuous wetland and slough stage and water quality (temperature, DO, conductivity, and pH) and discrete grab sampling for organic carbon, biochemical oxygen demand in water and sediment, and MeHg. Data collected through this project, combined with previous monitoring data, indicate that slough water quality has improved since BMP implementation, and DO levels—a key metric for aquatic beneficial uses—are generally higher than the new TMDL chronic and acute objectives. Modeling described observed changes in water quality across Peytonia and Boynton sloughs, representing a range of mixing conditions. Modeling explored the extent of DO improvement achievable through more extensive BMP implementation; in general significant improvements are possible, but limited by the level of tidal flushing in the upstream ends of sloughs and physical and environmental constraints.

Keywords: Water quality, dissolved oxygen, methylmercury, best management practice, working lands
Session: Accelerating Improvement of Water Quality and Habitat on Working Lands
Speaker Biography:
Dr. Stuart Siegel is Coastal Resilience Specialist for the SF Bay National Estuarine Research Reserve, Associate Research Professor of Earth and Climate Sciences at SF State University, and Principal of Siegel Environmental. See next abstract "Accelerating Improvement of Water Quality and Habitat on Working Lands," for full biography.

Accelerating Improvement of Water Quality and Habitat on Working Lands

Stuart Siegel [1], Lucas Patzek [2], Alyson Aquino [3], Wendy Rash [3]

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Working lands are a major land use in California's Bay-Delta region, and they can have both positive and negative impacts on our water and watersheds. The makeup of these working lands varies significantly across the region, so there is no single strategy for effectively accelerating conservation in water quality and habitat. This session will explore four case studies for how best management practices, as well as technical and financial assistance programs, have been used to achieve conservation and regulatory compliance goals on working lands in Alameda, Napa, and Solano Counties. In the Suisun Marsh, about 50,000 acres of diked wetlands are managed to support waterfowl hunting on 150 private duck clubs plus extensive CDFW lands. A USEPA funded effort has tested best management practices in select duck clubs over three years aimed at reducing adverse water quality effects resulting from moist soils management strategies employed to promote waterfowl habitat, while concurrently improving the ability of landowners to manage waterfowl habitat and comply with a new TMDL. BMPs centered around water management, soil management, vegetation management, and multi-property coordination. In the Napa River watershed, the LandSmart technical assistance program promotes a range of beneficial stewardship practices and helps vineyard managers reduce erosion and fine sediment loading to the watershed, and thereby comply with a new water quality WDR permit for vineyards. In Alameda county, the largest portions of remaining open space are commonly managed with cattle grazing. Land managers are actively facilitating improvements to soil health, habitat, and water quality through infrastructure upgrades and vegetation management in close coordination with livestock operators. In sensitive areas surrounding North Delta waterways in Solano County, partnerships between ranchers and resource conservation agencies have created productive pasture systems that improve animal health, protect water quality and restore wildlife corridors.

Keywords: Agriculture, Grazing, Vineyards, Waterfowl, Habitat, Erosion, Water Quality
Session: Accelerating Improvement of Water Quality and Habitat on Working Lands
Speaker Biographies:
Dr. Stuart Siegel is Coastal Resilience Specialist for the SF Bay National Estuarine Research Reserve, Associate Research Professor of Earth and Climate Sciences at SF State University, and Principal of Siegel Environmental. He focuses on the intersections of climate change, natural resources resiliency, ecosystem restoration, nature-based adaptation, and regional planning. Dr. Siegel has led design teams for several climate change-ready restoration projects, including Aramburu Island, Sonoma Creek, and Sears Point. He was co-lead scientist for DRERIP, Delta Vision Ecosystem Workgroup technical lead, Suisun Marsh Plan Science Advisor, lead PI for the Integrated Regional Wetland Monitoring project, co-authored the Wetland Carbon Sequestration Road Map to Implementation, and authored the climate change chapter of the Moyle Suisun book. Most recently, Dr. Siegel led the China Camp Community-Based Adaptation Planning project and he serves on the national Technical Advisory Committee for the Delta Climate Change Vulnerability Assessment and Adaptation Plan.

Dr. Lucas Patzek is the Executive Director of the Napa County Resource Conservation District. He believes deeply in the District's collaborative and non-regulatory approach to inspiring better land

management, and has worked with similar Districts across California and Washington States. For the past 14 years he has worked with diverse stakeholders to improve agricultural and natural resource systems by finding common ground and working together on long-term solutions. His experience includes serving as a County Director and Agriculture & Natural Resource Faculty with the Cooperative Extension Service in Washington, the Associate Executive Director of Ag Innovations, a Senior Program Manager of local government energy efficiency programs at PG&E, and as a consultant on international agriculture projects in Algeria, Cambodia, the E.U., and Mexico. He earned a Ph.D. in Crop Science from Washington State University, and a B.S. in Biology from University of California, Santa Cruz.

Alyson Aquino is the District Conservationist for the Natural Resources Conservation Service (NRCS), a federal agency under the US Department of Agriculture. Her office is in Livermore on the easternmost edge of Alameda County. She attended Humboldt State University for Biology and then completed her education in Cal Poly State University's Master's Degree program, studying native plant restoration, forestry, and watershed hydrology. She has worked for NRCS since finishing college in 2005, as the work combines her biology background with local restoration and community support. The NRCS programs in Alameda county focus heavily on the management of grazed rangeland, with the goals of improving habitat for local species while supporting compatible agricultural land uses.

Wendy Rash has been working at the intersection of agriculture and environmental conservation for more than 15 years in California; as a graduate student, a farm worker, at the Solano Resource Conservation District (RCD) and at the USDA Natural Resources Conservation Service (NRCS). She now directs NRCS programs and staff in the Vacaville and Napa Field Offices, working to improve natural resources on private lands in partnership with the producers of Solano and Napa Counties and the Dixon, Solano and Napa RCDs. Wendy has been a Certified Crop Adviser since 2010.

Using Science to Guide Urban Design for Biodiversity and Human Health

Erica Spotswood, Robin Grossinger, Micaela Bazo, Matthew Benjamin, Gloria Desanker

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Over the past few decades, the science documenting the critical role nature exposure plays in human health has grown dramatically. From physical activity to reducing stress and anxiety to promoting social cohesion, access to high quality natural spaces is key to supporting physical health. At the same time, similar evidence from the field of urban ecology is showing where in urban landscapes biodiversity tends to thrive. Yet contemporary urban environments often do not provide equitable, safe, and easy access to nature for all. Here, we bring these two fields of research together, to ask how we can plan for cities that are both healthy for people and supportive of biodiversity.

We synthesize the current state of research in both urban ecology and public health to provide actionable guidance for urban planning for health and biodiversity. Drawing on local data sources from the Bay Area, we identify elements of the current landscape that could be used as anchors to bolster biodiversity and human health. Drawing on these data, we identify gaps in the equity of distribution of green resources, and discuss implications for the most impacted communities.

Keywords: urban biodiversity, human health, nature
Session: Urban Biodiversity & Human Health
Speaker Biography:
Erica Spotswood is a Senior Scientist at the San Francisco Estuary Institute. Her work connects urban ecology and human health, and uses quantitative tools to evaluate the ecosystem services associated with urban greening. Current projects address how regional planning can integrate with local project-scale design, and how urban greening efforts can be coordinated to contribute to broader regional goals. Her areas of expertise include urban ecology and plant community ecology. Before joining SFEI, Erica conducted postdoctoral research with Katherine Suding, and received her PhD from the University of California at Berkeley in the department of Environmental Science, Policy and Management.

Flora, Fauna, and Folks: Re-imagining the City as a Park

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This talk explores ways in which to transverse and dismantle the overarching broad stroke assumptions, imaginaries, and narratives in environmental thought and environmental justice thought with the aim of producing environmentally and socially just futures. By having an open and honest conversations about race and class and their impact on urban environmental and sustainability strategies, more wholistic approaches become possible. As a scholar who studies the *other side* of environmental justice, uneven distributions of environmental goods versus the traditional focus on uneven distributions of environmental harms, closing the chasm between modern environmental and environmental justice policies and practices becomes paramount in how we are able to care for our urban natures, public lands, and shared estuaries. When considering biodiversity, humans and their cultural productions must be as privileged as non-human community habitats. This becomes especially salient when we (re)consider flora, fauna, and folks as the hierarchy for preservation. Centering all, *flora, fauna, and folk*, as an imperatives for sustaining urban biodiversity new climate change mitigation, severe weather policies, and environmental sustainability agendas can be produced without leaving anyone behind. By situating the environmental, economic, political, and social histories, policies, and practices of Oakland, California what is illuminated is how greening and urban environmental sustainable agendas are reproducing environmental atrocities and injustices today and what that could mean for our urban biodiversity futures.

Keywords: urban biodiversity, environmental justice, race, class, equity, urban parks
Session: Urban Biodiversity & Human Health

Speaker Biography:

As an urban environmentalist and political ecologist, Corbin examines the relationships between society and nature within the built environment by investigating the concept of the green city within the context of the United States. Her dissertation focuses on how the relationships between race, class, and access to green space have changed from 1960—prior to the Civil Rights Acts—to 2019, after Oakland, California began establishing its sustainability agenda and during an intensifying gentrification process. Corbin questions how environmental policies and practices in green cities are impacting the lived experiences of low-income residents and communities of color and their access to public green spaces today and what that could mean for future populations living in green cities.

Design and the Interconnected Scales of Well-Being

Chris Garvin

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The industrial revolution began an urbanization process that ignored the human preference for nature. This disconnect was exacerbated by the widespread use of the automobile and air conditioning, effectively sealing people away from the natural world. With the growing understanding of the impact of environmental factors on human health, designers and architects have begun to integrate biophilic design into buildings and communities. Biophilic design is based upon the understanding that the human body responds positively to natural stimulus. This can be achieved by integrating nature directly into a space, providing natural materials and references to nature, and by creating spatial conditions reminiscent of primal experiences in nature. Research around the globe has validated that people manage stress better, are more productive, and maintain a healthier state of mind when exposed to nature.

Biophilic design needs to be integrated into all scales of human experience. At the urban design scale, parks, green roofs/walls, street trees and other natural elements help to clean the air for improved respiratory health, while also reducing the urban heat island effect, providing shade, recreation, and relief from the built environment. Physiologically, these elements help to restore cognitive function and improve the response to stressors. Since we spend the majority of our time indoors, we need to ensure everyone has access to nature and that the interiors of buildings are biophilic as well.

Keywords: architecture, biophilia, biophilic, urban design, well-being, health, cities
Session: Urban Biodiversity & Human Health
Speaker Biography:
For 24 years, Chris Garvin, AIA, LEED AP BD+C, Biomimicry Specialist, has championed the integration of design and performance to address sustainability and wellness. After working with Randy Croxton, Chris joined Cook+Fox Architects to work on the Bank of America tower and, in 2006, helped form Terrapin Bright Green, a strategic sustainability consulting firm dedicated to the rapid transformation of our built environment to create a healthy and sustainable world. Chris served as the managing partner for many of Terrapin's consulting engagements until departing in 2017. His work focused on leveraging collaboration, integrated design, and ecological thinking to achieve radical advances to building performance while addressing resource constraints across the value chain. His clients included Google, Interface Carpet, City of New York, Starwood Hotels, CPG, and global real estate firms. In addition, Chris speaks on sustainable design and has taught at the Pratt Institute and Carnegie Mellon, his alma mater.

Biodiversity for All at the Presidio of San Francisco

Michael Boland

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For 218 years the historic Presidio of San Francisco served the military needs of three nations – Spain, Mexico, and the United States. When it closed in 1994, our nation's longest operating military site became part of the Golden Gate National Recreation Area, the most heavily visited national park unit in the United States. The historic Presidio was protected as a national park site not only because of its rich collection of historic landscapes and buildings, but also because it is a biodiversity hot spot, with nearly 400 plant species, 22 of which are special status species.

Urban national park sites like the Presidio were created to bring national park experiences to urban communities that were historically underrepresented in national parks. Since it was preserved as a national park site in 1994, the three organizations that steward the Presidio – the National Park Service, Presidio Trust, and Golden Gate National Parks Conservancy have worked with the community to preserve the Presidio. This session will explore strategies that the Presidio has used to connect children and adults from across our community to the park's unique natural, cultural, scenic, and recreational resources as part of our effort to transform the site from an army base into a national park for all.

Keywords: urban biodiversity, urban parks, national parks, equity, access, health
Session: Urban Biodiversity & Human Health
Speaker Biography:
Since 2001, Michael Boland has played a key role in making the Presidio a world class national park site. He leads an interdisciplinary team that has delivered an array of projects, including creating a comprehensive trail and overlook system, restoring the Presidio's rich mosaic of natural and cultural landscapes, establishing national park experiences that serve urban youth, and reinventing the historic army post as a unique contemporary national park community. Boland holds a bachelor of arts in architecture, a master's degree in landscape architecture, and a master's degree in city and regional planning, all from the University of California at Berkeley.

Public Learning in an Era of Climate Crisis

Susan Schwartzenberg [1], Shawn Lani [1], Heike Winterheld [1], Pireeni Sundaralingam [2]

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The need for public learning and civic engagement around critical issues of our time is increasingly urgent. For example, despite recent predictions that impacts from sea level rise will be more severe than previously anticipated, many people believe that the effects are "far-away" in time and/or place, or will only affect other people. There is a new and emerging role for science centers, as trusted information sources and agents of change in their communities, to address this need. Through the inception of its Bay Observatory Gallery and Environmental Initiative, the Exploratorium is creating a new model for effectiveness in this role by leveraging its STEM education and public program strengths with deep collaborations and partnerships across science, policy, education, and community sectors. This session will explore how a museum can inspire solutions and action using an interdisciplinary, place-based, and inquiry-driven approach. Through the presentation of a range of recent projects both within the museum and out in communities, the panelists will discuss and evaluate approaches for informal environmental education that integrate the humanities (arts, social science, literature) with science—with particular focus on fostering climate change resilience strategies—and share lessons learned. The session begins with a 20-minute presentation entitled "Public Education at the Exploratorium—Science, Art, and Social Connection;" moves into paired conversations with curators, artists, and social/cognitive scientists; and concludes with robust audience/panel discussion.

Keywords: public learning, engagement, interdisciplinary, Exploratorium, Bay Observatory, resilience, museum, climate
Session: Public Learning in an Era of Climate Crisis
Speaker Biographies:
Susan Schwartzenberg is the Director of the Exploratorium's Fisher Bay Observatory Gallery and holds a Senior Artist position at the museum. In this capacity she leads the Environmental Initiative, a multi-year program to advance the environmental arts and sciences within the museum through a range of exhibits, programs, and partnerships. She also works as a visual artist, photographer, and curator whose work engages the public dialogue through themes of memory, history and the psychology of place. She is based at the Exploratorium and is a Loeb Fellow for Advanced Environmental Studies, Harvard University. She has taught at the San Francisco Art Institute, Stanford University, and the California College of Art.

Shawn Lani is a practicing artist, educator, and curator dedicated to engaging people in public spaces. He has created immersive, interactive installations for more than 60 national and international museums and public settings, and is the recipient of a National AIA award. In 2014 he founded and currently directs the Exploratorium's Studio for Public Spaces, which generates new ways to apply art and inquiry-based learning theories to diverse public landscapes. Shawn is the Principal Investigator on a National Science Foundation grant which brings current social science research to the public realm. Shawn holds a BA in English and Art History from UC Davis, and a MA in Museum Studies (education and design) from JFK University.

Heike Winterheld is a social psychologist and Program Director of Social Sciences at the Exploratorium. She leverages over 15 years of academic experience in psychology to promote public engagement with science by encouraging inquiry into how people think and feel about and influence each other. Her interests include creating informal learning experiences that illuminate reciprocal connections between people and their social, built, and natural environments; encourage exploration of how human psychology shapes these connections; and inspire people to work collectively toward the resilience of their surroundings. Previously, she was a faculty member at Washington University in St. Louis and California State University, teaching and conducting research on interpersonal dynamics. She holds a Ph.D. in Psychology from the University of Minnesota, M.S. in Psychology from Texas A&M University, and DVM from the College of Veterinary Medicine in Munich, Germany.

Poet & cognitive scientist Pireeni Sundaralingam has held scientific research posts at Oxford, MIT, and UCLA, while her poetry has been published in over two dozen literary journals, been translated into five languages, won national awards, and was recently selected for the annual "Best New American Poets" anthology. Committed to exploring the connections between the human brain, creative inquiry, and science, she teaches in the Interdisciplinary Arts MFA program at the California Institute of Integral Studies, and has held several fellowships in interdisciplinary work, including the Salzburg Global Fellowship (investigating the impact of climate change art on mobilizing action), and the Exploratorium's "Urban Fellowship" (investigating the relationships between language, linguistic framing, and conceptualizing environment). She is currently Principal Advisor for Human Potential for UN Live: The Museum of the United Nations, leading research and strategy on human behavior change and the Sustainable Development Goals.