## The Delta Restoration Hub: Demonstration Projects Proving the Potential of Open Data and Advanced Data Tools for Ecosystem Restoration Decisions in the Cache Slough Complex and McCormack-Williamson Tract

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The Sacramento-San Joaquin Delta is a place of state and national importance for its rich farm economy and natural heritage values. It is also the front line of California water issues where societal goals for ecosystem protection and reliable water supply seek a durable balance. The Delta Restoration Network (DRN) was created out of recognition that restoration efforts will require high levels of coordination and integration to be ecologically successful and broadly acceptable. For the past two years, the DRN has worked to develop a Delta Restoration Hub that would provide advanced open data management along with modern analytical and visualization tools to help advance ecosystem restoration projects in the Delta. The Hub would provide best available data and information to all stakeholders in real-time to accelerate project planning and facilitate adaptive management of implemented projects. The Hub is currently applying these open data principles and tools to demonstration projects in the Cache Slough Complex and the McCormack-Williamson Tract. The purpose of these projects is to develop restoration strategies that optimize habitat restoration opportunities, while preserving agriculture, other land uses and infrastructure, flood objectives, and the operation and maintenance of existing water resources infrastructure. This presentation will provide a status report on these two demonstration projects and illustrate the benefits of open data principles and modern analytical and visualization tools for multiobjective ecosystem restoration.

**Keywords:** Open data, analytics, visualization, ecosystem restoration, adaptive management **Session Title:** Data Management and Tools **Session Time:** Tuesday 1:35 PM – 3:15 PM, Room 311-313

# Connecting Scientific Research Projects and Data Through Computer Science: An Opportunity for Collaboration and Data Synthesis

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The decline of fish populations and related regulatory response to this decline has increased the number of scientific research studies in the Sacramento-San Francisco Bay Delta. Connecting research in environmental science is difficult and often at the mercy of a variety of entities. In the Delta, most data are collected and stored within the origination organization (i.e. University, Government Agency, Consulting Company etc). This data is shared at quarterly meetings, after publication, added to state databases or accessible only by request. Consequently, delays sharing data between these entities is too late and no longer current or useful for real time and adaptive management actions.

In an effort to provide solutions to this issue SFCWA has funded four unique but interconnected research projects in the Cache Slough Complex. As part of the effort 34 North has extended the California Estuary and Bay-Delta Live Data Platforms to support these studies and provide a lens into each project as well as try to provide connections using computer science. Each study will collect extensive information including databases, images, reports, presentations and manuscripts focused on specific research questions. Near real time data collected during the study will inform decisions about the future of this region. Through the timely sharing of data, it will be possible to link and compare data collected in the different studies, avoid duplication of data, allow for near real time data analysis and provide updates outside of the normal quarterly report format.

This presentation will explore the process of developing this connected view of the Cache Slough Complex from data collection to data visualization and scientific collaboration. We will share lessons learned and hurdles overcome.

Keywords: Adaptive Management, Data, Food web, Research, Cache Slough Complex, Software, Synthesis
Session Title: Data Management and Tools
Session Time: Tuesday 1:35 PM – 3:15 PM, Room 311-313

## California Estuary Monitoring Workgroup – Using Web Portals to Improve Scientific Understanding

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The California Water Quality Monitoring Council was mandated to improve the efficiency of California's water quality and associated ecosystem monitoring, assessment, and reporting through increasing collaboration between the numerous governmental agencies and non-governmental organizations that monitor California's waters. Under the guidance of the Monitoring Council, the Estuary Monitoring Workgroup is beginning to answer stakeholder questions with a collaborative toolset that brings together peer-reviewed datasets with tools to help practitioners tell their stories. This process has resulted in the development of the California Estuaries Portal, an interactive website that strives to provide data and information for decision makers and the public regarding water quality, living resources, habitat, ecosystem processes, and stewardship for California's estuaries. While there is a current focus on the San Francisco Bay-Delta Estuary, content relating to California's remaining estuaries will be added in future portal updates. Through a partnership with Bay-Delta Live, the Estuary Workgroup is currently developing a series of data dashboards to directly inform real-time resource management decision making, drawing data from a variety of state and federal governmental partners. This collaborative effort involves multiple governmental and non-governmental organizations, working toward improved estuarine science, restoration, and protection of beneficial uses of California's water resources.

**Keywords:** California Water Quality Monitoring Council, Estuary Monitoring Workgroup, Estuaries Portal **Session Title:** Data Management and Tools **Session Time:** Tuesday 1:35 PM – 3:15 PM, Room 311-313

#### Hatch: Moving towards Seamless Database Protocols for Ecological Data

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Re-use of data is important for estimating change over time or over larger spatial scales. Despite the enormous amount of data being collected annually, many government agencies are only now beginning to build coordinated data management systems. With efficient data and metadata capture protocols and coded analysis tools, researchers will be better prepared to answer more effectively key ecological questions across datasets.

In this project, we designed an online platform for seamless data management, called Hatch http://www.datahatch.org/. Our aim is to improve databasing protocols and data access to allow timely analysis of existing data, across time and space. Hatch is being developed for ecological monitoring of stream ecosystems in the Methow River basin in Washington State; however, the platform is general enough for managing multiple forms of data anywhere in the world. Hatch currently applies both a schema and schema-less database structure to link data collection events. It applies data collections standards developed and accepted across the Columbia River Basin. Initial data capture is driven by data needs for a mechanism-based model of ecosystem processes. Input data files, both past and current flows, are validated and stored along with metadata. Data search tools are being designed in accordance with data sharing agreements with appropriate security.

The goal of Hatch is to defragment the analysis workspace by making database tools general and straight forward. Hatch helps researchers capture, search and analyze data in an online, flexible platform while conforming to project specific schemas. With less fragmented database protocols, scientists will be better prepared to answer scientific questions at relevant ecological scales, and better link data to decisions, and back.

**Keywords:** data, database management, software, metadata, data re-use **Session Title:** Data Management and Tools **Session Time:** Tuesday 1:35 PM – 3:15 PM, Room 311-313

#### **Development of Interactive Tools for Fisheries Management**

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Life cycle models often require multiple approaches and complex analyses. In an effort to increase accessibility of the life cycle models to a broad range of practitioners, we developed a graphic user interface tool accessible via the internet that will allow anyone to alter model parameterizations and examine results. Using the Shiny package in R, the web tool operates on user defined parameter inputs and projects population abundance and extinction risk. We developed a model user guide that defines each parameter and summarizes available empirical data relevant to the model, including adult abundance, smolt abundance, age structure, and marine survival data throughout Puget Sound. We anticipate that this graphic user interface will greatly enhance the ease and effectiveness of communication as well as collaboration between the model development team, the Puget Sound Steelhead Recovery Team, and biologists. The model uses stage specific survival rates to simulate successive, linked generations of spawning and recruitment over time. The model has two stages, freshwater production (smolts per spawner) and marine survival. Freshwater production was based on stock-recruit dynamics in which capacity is modeled as a function of habitat capacity and intrinsic productivity. The marine survival stage was informed by recent acoustic telemetry work completed in Puget Sound and smolt to adult return rates. A series of scenarios, including habitat restoration and harvest, have been developed to examine the potential impacts of management actions on a demographically independent population status. We present initial results of model runs using the online tool.

**Keywords:** Steelhead, Shiny, graphic user interface, life-cycle model, population dynamics, management **Session Title:** Data Management and Tools **Session Time:** Tuesday 1:35 PM – 3:15 PM, Room 311-313