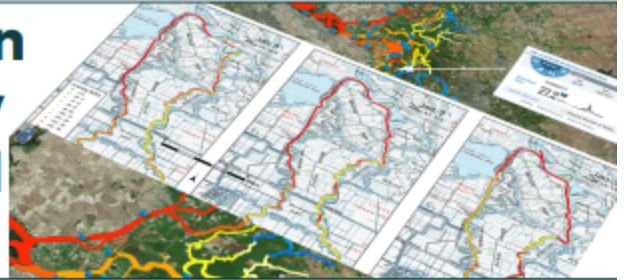


Sacramento San Joaquin Bay-Delta Water Quality Constituent Tracker and Decision Support



In collaboration with USGS and DWR, this research and development project will advance the Bay-Delta Live data management platform to provide data and decision support tools for viewing and analyzing continuous water quality conditions at finer spatial scales within the Delta. We envision that, once developed and demonstrated, this numerical model implemented within the BDL data platform may be incorporated into existing monitoring programs to evaluate current conditions, assess turbidity and nutrient conditions, supplement and replace DWR early warning turbidity transect operations, as well as help to evaluate changes due to wetland restoration, flow alteration and other management actions.

Modeling of Expected Constituent Concentration Field

The ability to quantitatively understand constituent dynamics in the Delta is hindered by the ability to accurately calculate and visualize data from the existing flow measurement network (USGS and DWR collect flow (stage, velocity, discharge)). Current spatial distribution plots (www.baydeltalive.com/turbidity) show that constituent distributions in the Delta appear to be well-behaved fields when in fact the spatial constituent gradients vary significantly over the tidal excursion. These current methods of interpolation yield the approximate spatial distribution of constituents, but for management action and water operations, the true details of the gradients in the constituent fields are needed. To accomplish this goal, USGS is developing a 1D transport equation and data assimilation method (funded by DWR and DSP) to fill in the details of the spatial structure in the constituent fields between sampling stations in the North Delta using a conservative tracer. Building on the USGS transport equations and techniques, 34 North will develop a web based real time tool to visualize the detailed constituent field throughout the Delta. While the algorithms will be most accurate in the North Delta, stakeholders will be able to explore spatial maps throughout the watershed where continuous monitoring is present. Additionally, 34 North will incorporate the DWR turbidity transect operations data for viewing and assessing early warning programs.

What Decisions Must Be Made?

Real-time delta hydrologic operations decisions to protect endangered and threatened anadromous fish species. These management decisions for threatened and endangered species must be balanced with water supply and quality regulations.

About BDL

Bay-Delta Live is a decision support data platform that serves a robust scientific community with the goal of expanding open and transparent sharing of information essential in understanding the complex and dynamic hydrodynamics and water quality conditions of the Sacramento-San Joaquin Rivers and Bay Delta. Bay-Delta Live federates information from hundreds of disparate data sources and displays the data using enhanced visual interfaces. The platform provides resource managers, scientists, conservationists, policy makers, academics, and other stakeholders with tools for collaborative resource management, monitoring, and reporting. Support for BDL is provided by financial contributions from Non-profits, Federal, and California State Agencies.

Project Highlights

- ✓ Develop pilot-level data aggregation tools, databases, real-time data processing procedures to operationalize real time sensor network.
- ✓ Implement transport equation models and information dissemination techniques in collaboration with DWR and USGS.
- ✓ Provide pilot feasibility study to supplement and replace DWR turbidity transect operations.
- ✓ Provide stakeholders with data dashboards and visualizations for easy access to data and spatial maps.
- ✓ Development of machine learning techniques for improving details of the spatial structure.
- ✓ Set up routines for daily map production and reporting at key locations.
- ✓ Integration of fisheries and operations data.
- ✓ Provide feasibility and recommendations for implementation in Central Delta.

Data

Ops, Hydrodynamic and Water Quality Data

- ✓ NDOI, X2, QWEST, Pumping, Percent Inflow Diverted, Unimpaired Runoff, Total Delta Inflow, OMR Index, and Delta Conditions
- ✓ National Water Information System (USGS NWIS): Turbidity, Electrical Conductivity and Flow
- ✓ California Data Exchange Center (CDEC): Flow, Temperature, Electrical Conductivity, Turbidity
- ✓ NOAA Tide and River Forecast Data

Fisheries Data

- ✓ USFWS Delta Juvenile Fish Monitoring Program
- ✓ USFWS Enhanced Delta Smelt Monitoring

Data Providers and Project Collaborators

Monitoring Water Quality in California

Summary

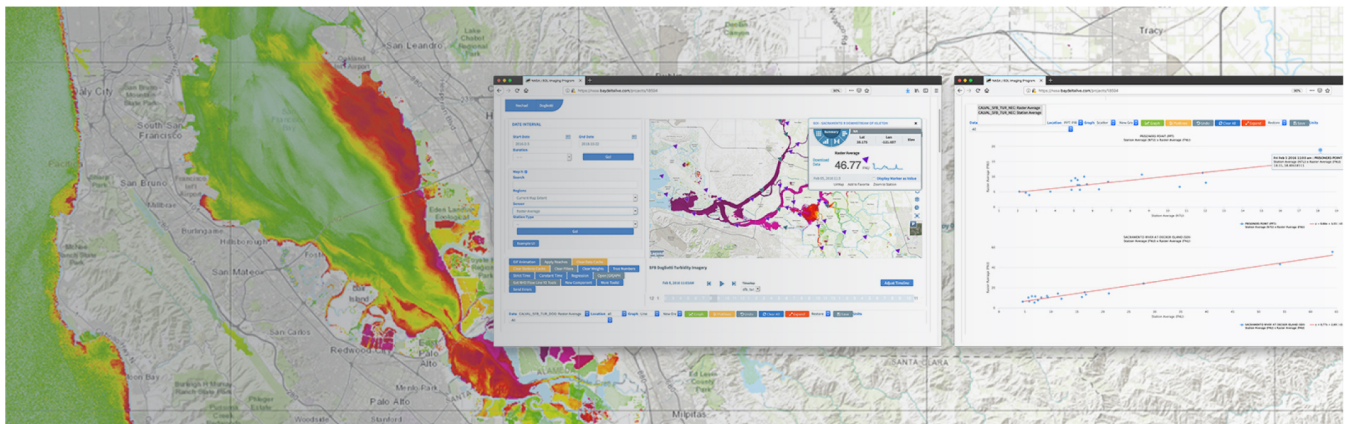
This project will advance the capability of multiple stakeholders in California's water resources management community to routinely access and utilize Earth observations-based water quality products to support operational or institutional decision-making related to water management practices. Our project is based on the intersection between water quality parameters used in our partners' respective organizations and the data products that can be derived from remote sensing datasets.

This effort is supported by the NASA Applied Sciences Program.

www.baydeltalive.com

Project highlights:

- ✓ Collaboration with California Department of Water Resources, U.S. Geological Survey, Metropolitan Water District to assess water quality conditions for water operations
- ✓ Developing new capabilities to use satellite and airborne remote sensing information to monitor key water quality indicators (turbidity, temperature, and chlorophyll-a)
- ✓ All data products will be freely available in multi-agency supported web portal



Background

Water quality is a critical element of freshwater supply, particularly in times and areas of drought, in part due to less dilution of point contaminant sources. Limited water resources can be further strained if water quality is not managed properly. While there are measures in place to protect human and environmental health from poor and risky water quality conditions, implementation of these measures are reliant on collecting physical water samples, or using station data, both of which provide a spatially and temporally incomplete understanding of water quality conditions. This consideration is especially important in environments that are highly complex and heterogeneous such as the California Bay Delta, as well as in budget-constrained systems, or with sites that are remote and have limited access.

Remotely sensed information is valuable to improving water management and has gained traction primarily in managing water supplies, land use practices related to water resources, and mapping consumptive use and agriculture water demand. There is also considerable potential for application of remote sensing to specific water quality management challenges, and this project is combining satellite and airborne data with existing networks and datasets that are comprised of ground or field-based point measurements.

Details

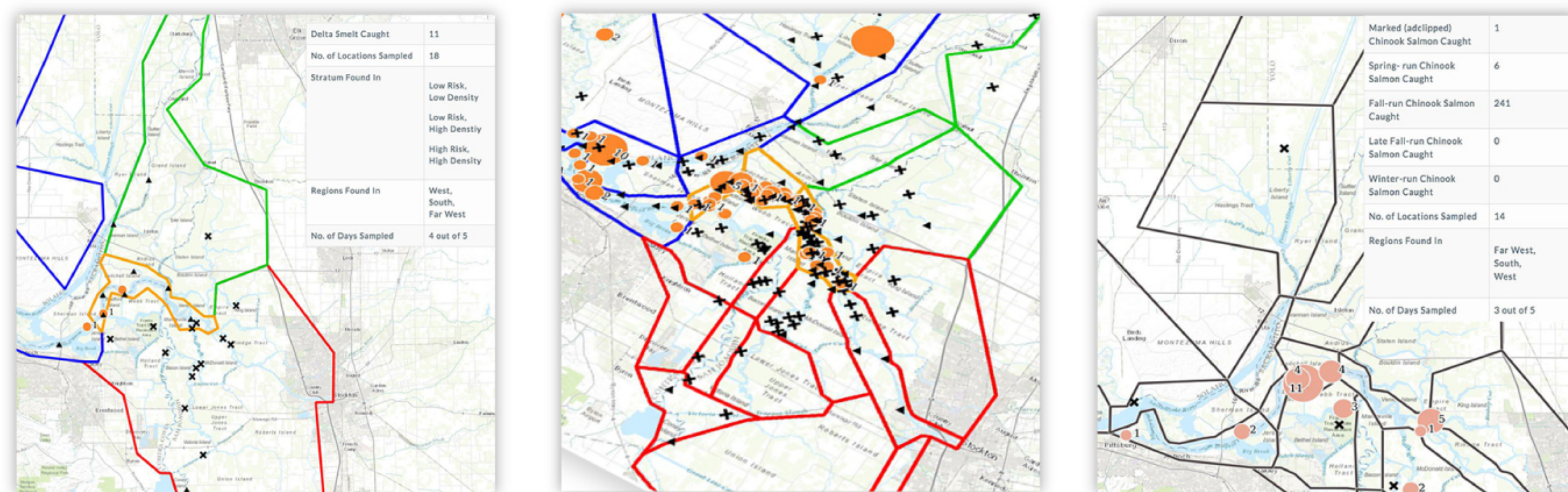
Project objectives include: (1) develop and/or strengthen existing algorithms from various platforms for the identified water quality products; (2) centralize and automate processing for water quality products for access through the Bay Delta-Live (BDL) www.baydeltalive.com web application; and (3) develop a suite of data decision dashboards that encompass specific use cases or management use scenarios.

Collaborative Adaptive Management Decision Support Tools for Data Analysis of USFWS Enhanced Delta Smelt Monitoring



USFWS Enhanced Delta Smelt Monitoring

The current BiOps and RPA decisions affecting real-time water operations highlight the need to improve sharing of data and information within the Bay-Delta scientific and management community. To support these mandates a wide array of information is collected and developed to facilitate management decisions pertaining to the effects of water operation on fishes of management concerns. Efforts are currently underway to aggregate, organize and analyze key operations data using the Bay-Delta Live (BDL) data platform. Expansion of these efforts has been evaluated by the BDL Work Team and it was decided that the new enhanced monitoring data to be collected by USFWS is a critical dataset for real time operations and RPA implementation.



THE EDSM project on BDL develops web services for the USFWS expanded data stream for BDL dashboards and explore data formats. The data is then packaged and processed for viewing and analysis by the Delta Operations for Salmonids and Sturgeon (DOSS) and Smelt Working Group and Collaborative Adaptive Management Team. The BDL platform combines EDSM data with other regional fisheries, hydrology and water quality data in a platform for visualizing, analyzing and sharing data in a collaborative way.

All data is available for the Delta community as a web service.

Project Highlights

- ✓ Data aggregation and web service development
- ✓ Data dashboard and visualization development
- ✓ Early warning indicators for fish migration
- ✓ Improved management actions for RPAs.
- ✓ Web and mobile access
- ✓ Customized application for random sampling designs

Data

- ✓ EDSM Catch and CPUE data by region, sub-region and strata
- ✓ Water Quality and Hydrodynamic Conditions
- ✓ Fisheries (current catch and indices for species of concern)
- ✓ Delta Operations

Data Providers and Project Collaborators



Delta Stewardship Council By the Numbers Reporting



Delta Conditions At-a-Glance

The "By the Numbers" Watershed Conditions Report is a monthly aggregation of data developed to summarize Delta Conditions. The report aggregates more than 39 datasets and is created to supplement the Delta Science Program Lead Scientist's report given at the Delta Stewardship Council (Council) meeting. The report gives a summary of current conditions compared to historical trends for Delta water and environmental management.



Project Highlights

- ✓ Delta conditions, "real-time" and historical trends.
- ✓ Automated data updates.
- ✓ Web and mobile access.
- ✓ Reduction in time needed to aggregate data by agency staff.
- ✓ Easy access to data for all stakeholders.

Data

- ✓ Precipitation (Rainfall and Snow Water Equivalent)
- ✓ Water Supply (Reservoir storage at key reservoirs)
- ✓ Water Quality and Hydrology
- ✓ Fisheries (current catch and indices for species of concern)
- ✓ Operations Data

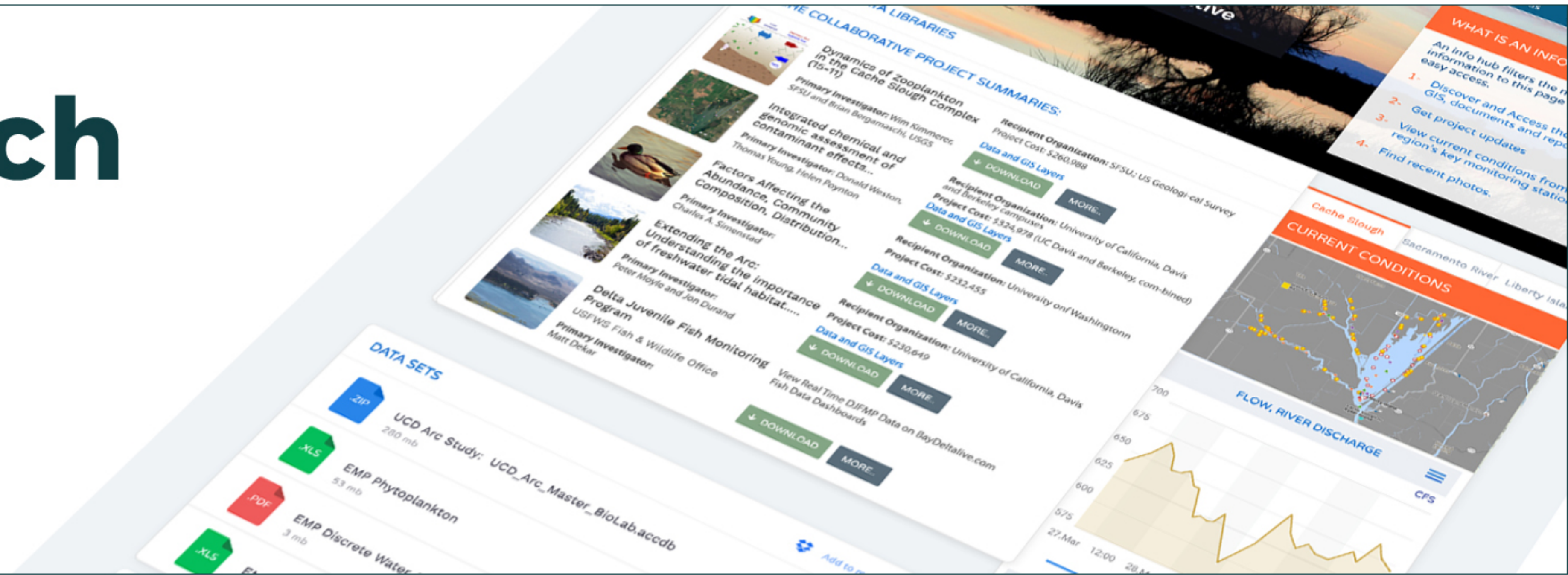
The Bay-Delta Live (BDL) platform expands the "By the Numbers" reporting framework and creates a data dashboard which updates as new information becomes available. An interactive and frequently updated data dashboard provides the Council with a continuous data picture of Delta conditions for real-time operations and management.

Agency staff are provided a sub-domain and access to the BDL content management system to manage their own data needs and to report data to their constituents.

Data Providers and Project Collaborators



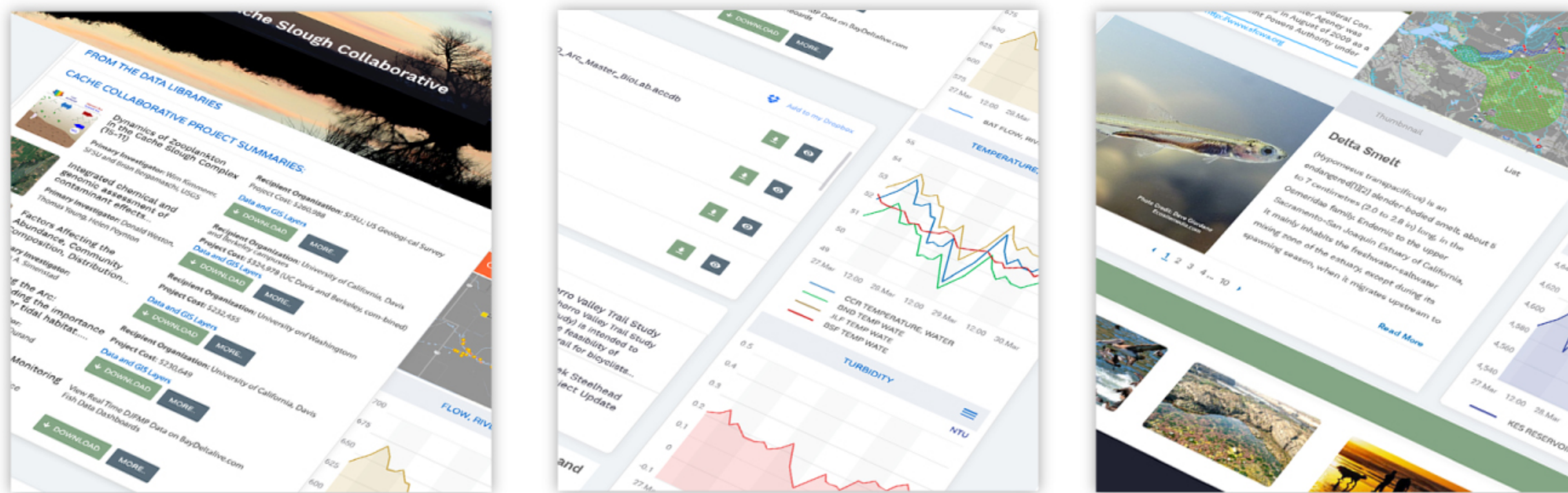
Connecting Research in the Cache Slough Complex



Cache Collaborative

The decline of fish populations (specifically delta smelt, Chinook salmon, and steelhead) has increased the number of scientific research studies in the Sacramento-San Joaquin Bay Delta. A key area of interest for the future health of the Delta and potential native fish rearing habitat is the Cache Slough Complex.

In addition to gaining a better understanding of the complex food web dynamics in the Cache Slough region these research projects will help to inform the planned habitat restoration (EcoRestore) in this region. Restoration in this region is part of the 2009 Biological Opinion Action Suite 1.6, in order to target the most productive areas there needs to be intensive data collection of the habitat, primary producers, fish species, and environmental factors currently influencing the Cache Slough ecosystem. This research will help to inform restoration design in this region.



The development of the Cache Collaborative data channel on Bay-Delta Live (BDL) will allow for individual researchers to upload, share and comment on the data. The platform creates a forum for dialogs between PIs related to QA/QC, method changes, conditions at the time of data collection, concerns about current conditions, include field photos, and to collect feedback from their colleagues. In addition, stakeholders will have access to data analysis tools to perform preliminary analysis on their own and others data. This preliminary analysis can be coupled with real-time water quality and hydrodynamic conditions (from CDEC, NWIS, CEDEN, etc). When dealing with such a complex and dynamic system it is necessary to utilize the data to its fullest potential, which is possible through data sharing and near real-time data analysis.

Project Highlights

- ✓ Extensive Data Collection
- ✓ Data Management and Interoperability
- ✓ Planning
- ✓ Data Access via BDL
- ✓ Project Page Development
- ✓ Data Dashboards
- ✓ Training

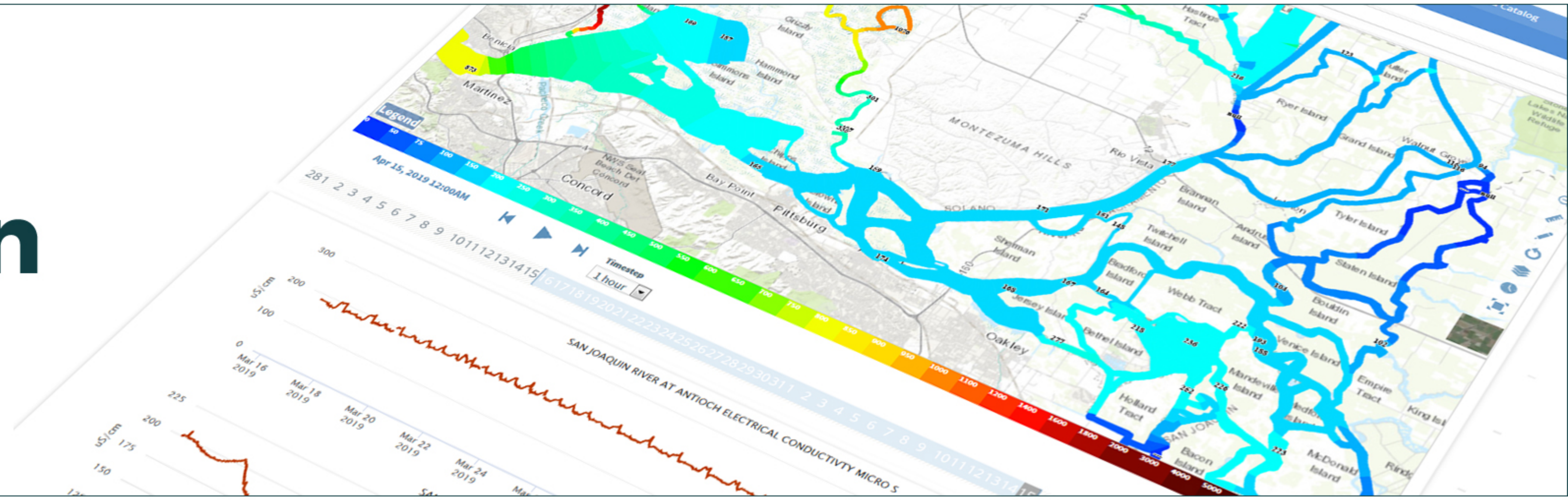
Data

- ✓ UC Berkeley UCB and UC Davis UCD: *Hyalloella azteca*, a prominent secondary producer, and its response to increased pesticide concentration following storm pulse flows into Cache Slough
- ✓ San Francisco State University SFSU: Zooplankton samples to gauge the productivity and food web health in this ecosystem
- ✓ USGS: High frequency data
- ✓ UC Davis UCD: Hydrodynamic and food web data (phytoplankton, zooplankton, epibenthic invertebrates, and juvenile and adult fish)
- ✓ USFWS + University of Washington: Larval fish surveys in Liberty Island
- ✓ 50+ GIS files: Vegetation, Land Use, Monitoring Locations, Projects

Data Providers and Project Collaborators

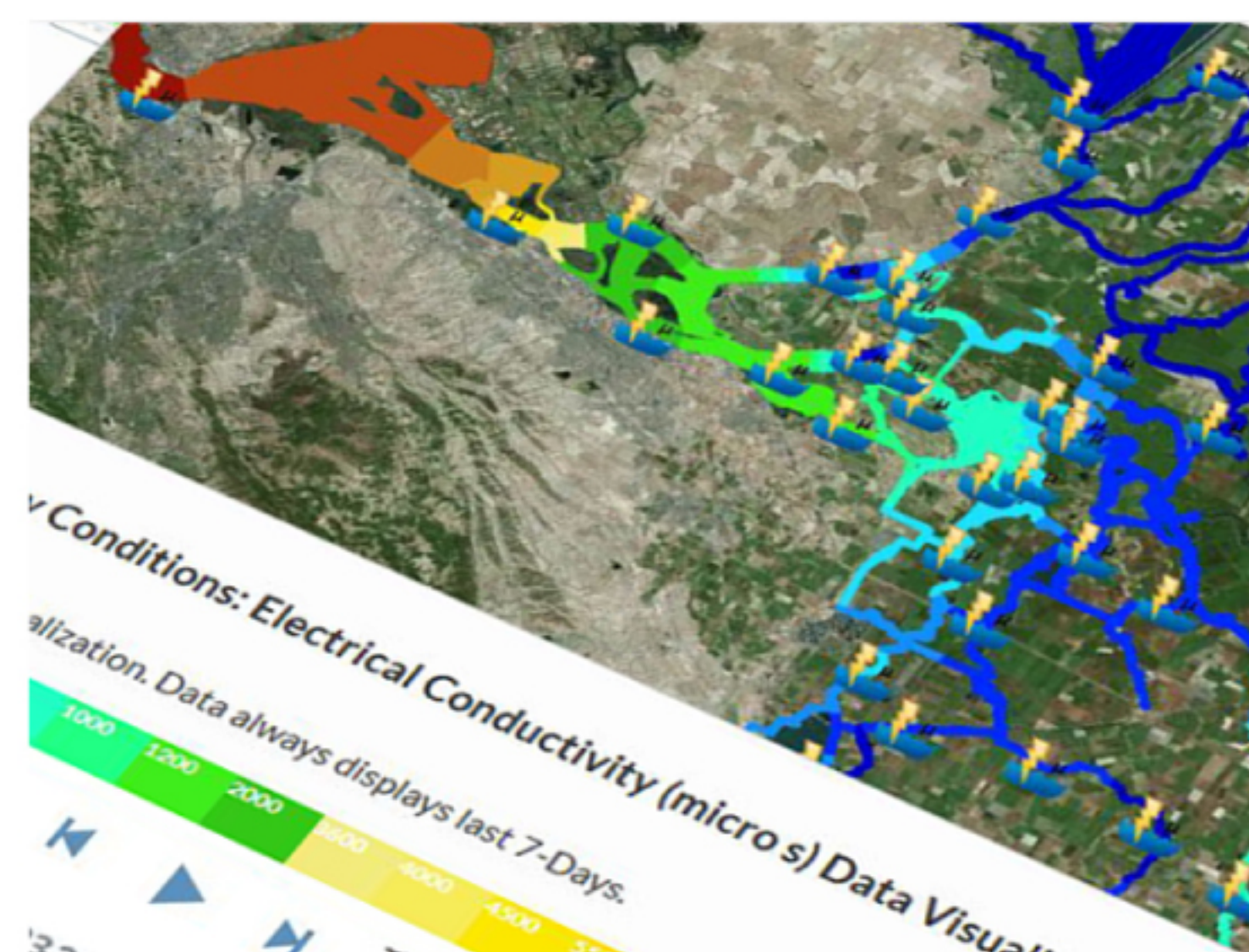
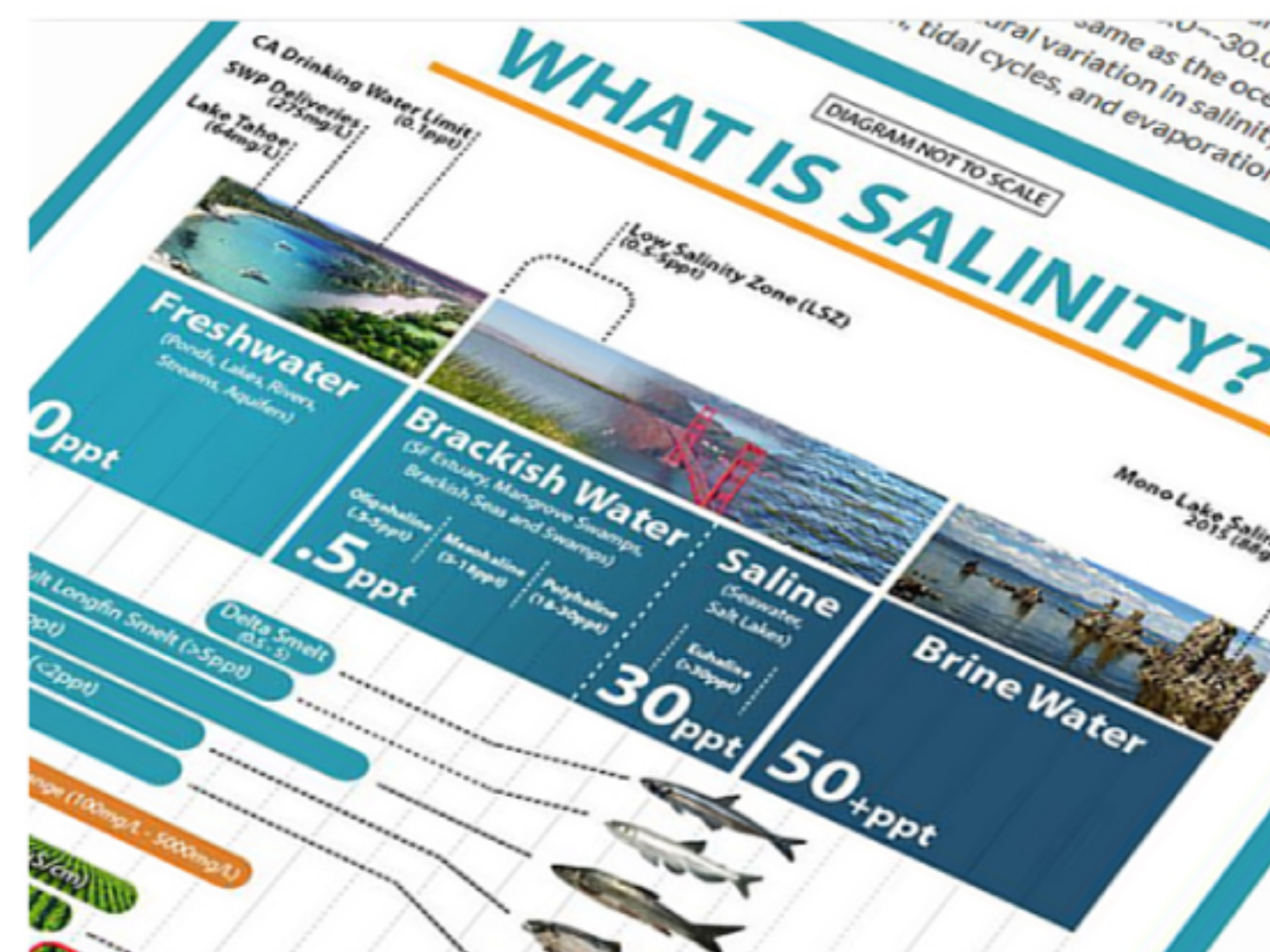


Salinity Management in The Delta



A Common Operating Picture

Salinity is simply a measure of the amount of salts dissolved in water. An estuary usually exhibits a gradual change in salinity throughout its length, as fresh water entering the estuary from tributaries mixes with seawater moving in from the ocean. In the State of California, fresh water is released from Sierra Nevada reservoirs to repel saltwater intrusion from ocean tides into areas of the the Sacramento - San Joaquin Bay-Delta. This delicate balance is managed by water operations to provide suitable habitat for species, irrigation water for farmland and freshwater for water suppliers. In normal or wet years, water repels the salt field, but in extremely dry years, management challenges increase when trying to find a balance to support all water needs.



The Bay-Delta Live Salinity Dashboard and Data Story provides Delta scientists and water managers with in-depth analysis of salinity conditions in the Delta. By synthesizing hundreds of remote and localized data sets and web services users can develop a common operating picture to support water managers. Data products include operations dashboards and analytics, live conditions data visualizations and spatial contour maps of point time series data based on linear interpolation for the Sacramento-Bay Delta.

Project Highlights

- ✓ Real-time baseline data for Electrical Conductivity, Flow and general Delta Conditions in real-time
- ✓ Electrical Conductivity visualizations (data interpolations) for viewing “salt field” and freshwater corridor
- ✓ Background data for “How Salinity is Managed”
- ✓ Reduction in time needed to aggregate key data by agency staff to analyze and discuss salinity conditions
- ✓ Easy access to Delta data for all stakeholders

Data

- ✓ California Data Exchange Center: Electrical Conductivity, Flow, and Turbidity
- ✓ California hydrologic conditions: scheduled exports, Delta inflow, River hydrology
- ✓ Reservoirs: inflow, outflow and storage.
- ✓ Salinity background data and its relation to Beneficial Uses: fish, industrial, drinking water, agriculture, etc
- ✓ Old Middle River stations and Index data

Data Providers and Project Collaborators



Department of Water Resources
CALIFORNIA DATA EXCHANGE CENTER

