



## Real Time Fisheries Decision Support

Accessing more than 48 disparate datasets, the Bay-Delta Live (BDL) decision support and data dashboards for fisheries provides the Delta Operations for Salmonids and Sturgeon and Smelt Working Group technical teams with a platform for visualizing, comparing and analyzing data from surveys and real-time monitoring. The dashboards move beyond real-time data availability to real-time data analysis and synthesis. Users are provided an interactive and collaborative tool for developing and testing new hypotheses about fishery responses to water operations in the San Francisco Estuary.

## What Decisions Must Be Made?

Real-time Delta water 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 in and South of the Delta.

Examples include:

- Use of the Sacramento Trawl, Sacramento Seine, and Knights Landing Catch Indices as indications of out-migrating salmonids to trigger a closure of the Delta Cross Channel Gates (NMFS BiOps Action IV.1.2).
- Monitor the Net Negative flows of Old and Middle River (towards the pumps) to reduce the likelihood of entrainment of fish species of management concern (NMFS BiOps IV.2.3).
- Watch upstream environmental conditions (Flow and Water Temperature) as an indication of juvenile fish out-migration into the Delta (NMFS BiOps Action IV.1.1).

## Project Highlights

- Data aggregation and web service development.
- Data dashboard and visualization development.
- Early warning indicators for fish migration.
- Indices and data calculations.
- Web and mobile access.
- Customize application for random sampling designs.
- Easy access to data for all stakeholders.

## Data

### Fisheries Data:

- USFWS Delta Juvenile Fish Monitoring Program
- USFWS Enhanced Delta Smelt Monitoring
- USFWS Red Bluff Diversion Dam RST
- CDFW Salvage
- CDFW Knights Landing and Tisdale RST
- Glenn Colusa Irrigation District RST
- CDFW Surveys (SKT, FMWT, SLS, 20MM, Bay Study)

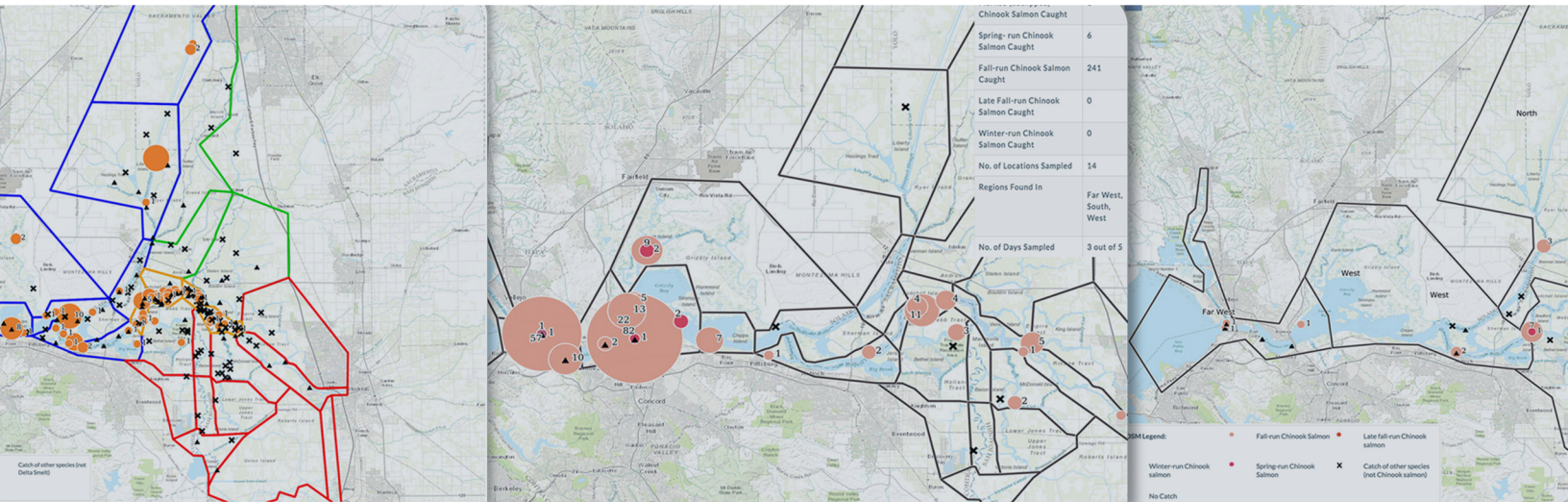
### Hydrodynamic and Water Quality Data:

- California Data Exchange Center (CDEC): Flow, Temperature, Electrical Conductivity, Turbidity, Reservoir Outflow, Reservoir Elevation, Reservoir Storage and Capacity.
- National Water Information System (USGS NWIS): Turbidity, Electrical Conductivity, and Flow
- NOAA Tide and River Forecast Data

### Operations Data:

- Delta Operations data and information aggregated from pdfs posted by state and federal agencies. Data includes: NDOI, X2, QWEST, Pumping, Percent Inflow Diverted, Unimpaired Runoff, Total Delta Inflow, OMR Index, Salvage and Delta Conditions.





## USFWS Expanded Monitoring Program

The current BiOps and RPA decisions affecting real-time water operations has highlighted that the Bay Delta scientific and management community need improvements in sharing the wide array of information that is collected or developed to support management decisions pertaining to the effects of water operations on fishes of management concern. Efforts are currently underway to aggregate, organize and analyze key operations data using the 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 formulating RPA's.

THE EDSM project on BDL develops web services for the USFWS expanded data stream for Bay-Delta Live (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 (SWG) and CAMT technical teams. 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 RPA's.
- Web and mobile access.
- Customize application for random sampling designs.
- Easy access to data for all stakeholders.

## Data

- EDSM Catch and CPUE data by region, sub-region and stratifications.
- Water Quality and Hydrology
- Fisheries (current catch and indices for species of concern)
- Operations





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CALIFORNIA DATA EXCHANGE CENTER



## 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 BDL 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

- Baseline data for Electrical Conductivity, Flow and general Delta Conditions. 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, 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 Indices data.





## Report to the State Water Resources Control Board in Accordance with Water Right Decision 1641

This web enabled interactive report summarizes and provides a platform to explore water monitoring and special studies conducted by the Environmental Monitoring Program (EMP) within the Sacramento-San Joaquin Delta and Suisun and San Pablo Bays. This monitoring is mandated by Water Right Decision 1641 (D-1641). The interactive report provides the most current monitoring data and access to all historical data and trends.

The development of 1641 Water Quality Report on BDL will provide content and data access to BDL users as well as power the State of California's Estuary Portal pages for the public. The platform creates a forum for collaborative management and data collection between agencies, QAQC routines, method review and documentation, extensive metadata development, a view of conditions at the time of data collection, species backgrounders, field photos, and much more. Monitoring programs (including the Interagency Ecological Program) will have access to data analysis tools to perform preliminary analysis on their own data as well as EMP data and have the ability to combine it with real time delta conditions (from WDL, 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

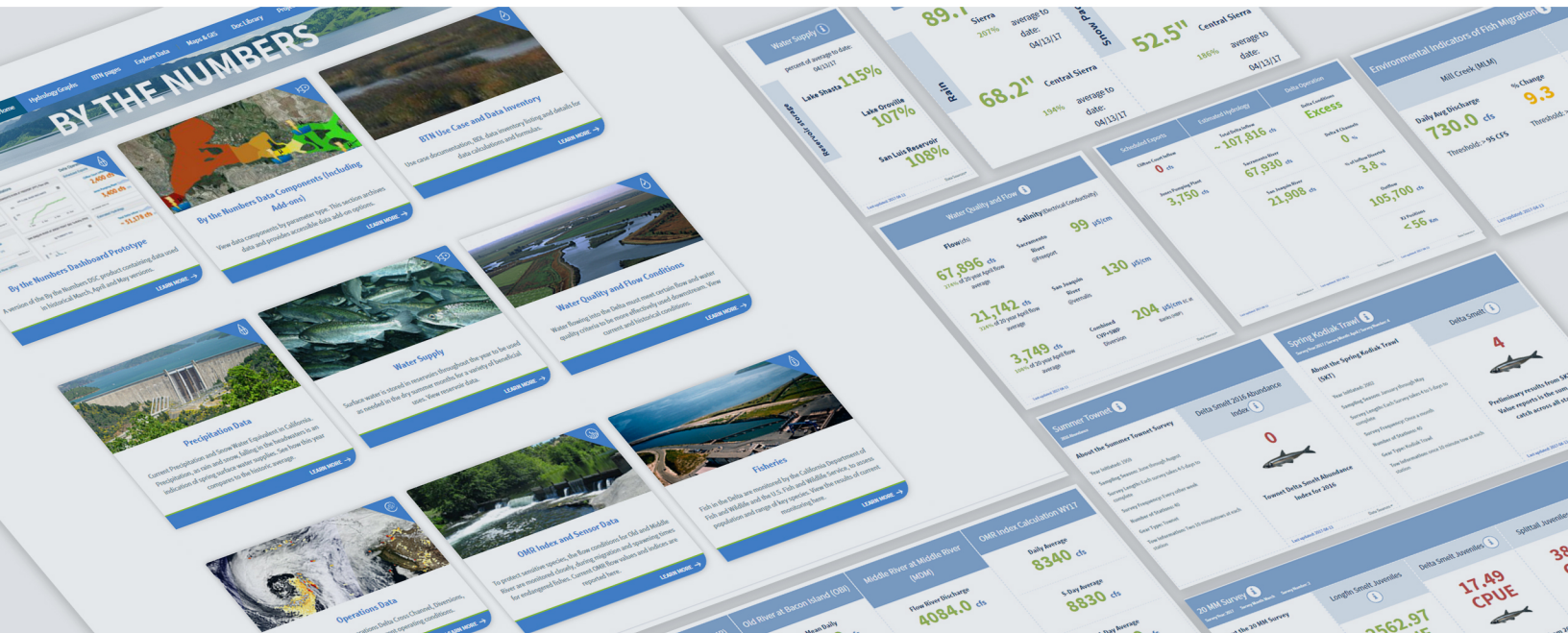
- Extensive Data Collection from 6 Monitoring Programs
- Data Management and Interoperability Planning
- Custom Data Filters and Analytics
- California State Website Template Development
- Reporting Dashboards
- Training

### Data (1970-Present)

- Zooplankton
- Phytoplankton
- Benthic
- Water Quality: Chlorophyll, Turbidity, Nitrogen, Temperature
- Hydrologic Conditions: Outflow, Runoff, Water Year Classification, Outflow
- Special Studies: Stockton Deep Water Ship Channel, Dissolved Oxygen, Suisun Bay







## 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 meeting. The report gives a summary of current conditions compared historical trends for Delta water and environmental management.

The 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 for reporting data to their constituents.

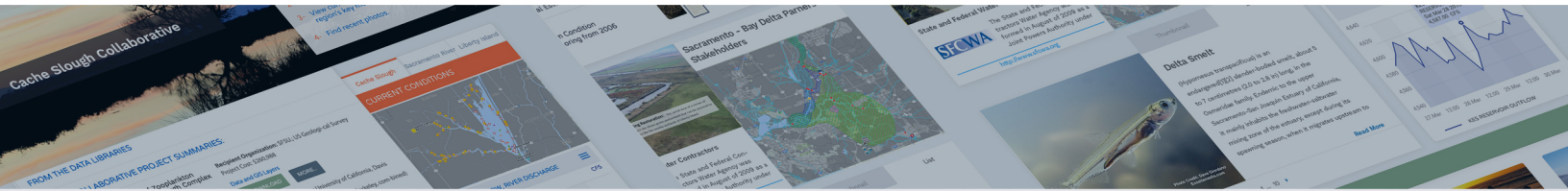
## Project Highlights

- 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





## Cache Collaborative

The decline of fish populations and related regulatory response to this decline (specifically delta smelt, chinook salmon, and steelhead) has increased the number of scientific research studies in the Sacramento-San Francisco Bay Delta. A key area of interest for the future health of the delta and potential juvenile salmonid 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 guide and focus the planned habitat restoration (EcoRestore) in this region. Restoration in this region is part of the 2009 Biological Opinion Action Suite 1.6, and 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 knowledge will help to select the most successful areas for restoration in this region.

The development of the Cache Collaborative data channel on BDL will allow for individual researchers to upload, share and comment on the data. The platform creates a forum for dialogs between PIs about QA/QC, method changes, conditions at the time of data collection, express concern about current conditions, include field photos, and for feedback from their colleagues. In addition, stakeholders will have access to data analysis tools to perform preliminary analysis on their own and other's data, coupled with real time delta 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

- Don Weston and colleagues *Hyallela azteca*, a prominent secondary producer, and its response to increased pesticide concentration following storm pulse flows into Cache Slough.
- Kimmerer and Bergamaschi zooplankton samples to gauge the productivity and food web health in this ecosystem.
- Bergamaschi (USGS NWIS) high frequency data.
- Moyle and Durand hydrodynamic and food web data (phytoplankton, zooplankton, epibenthic invertebrates, and juvenile and adult fish).
- Simenstad and Smith larval fish surveys.
- 50+ GIS files: Vegetation, Land Use, Monitoring Locations, Projects