



State and Federal Contractors
Water Agency

Science Research Plan

February 2014



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SFCWA Origin and Purpose

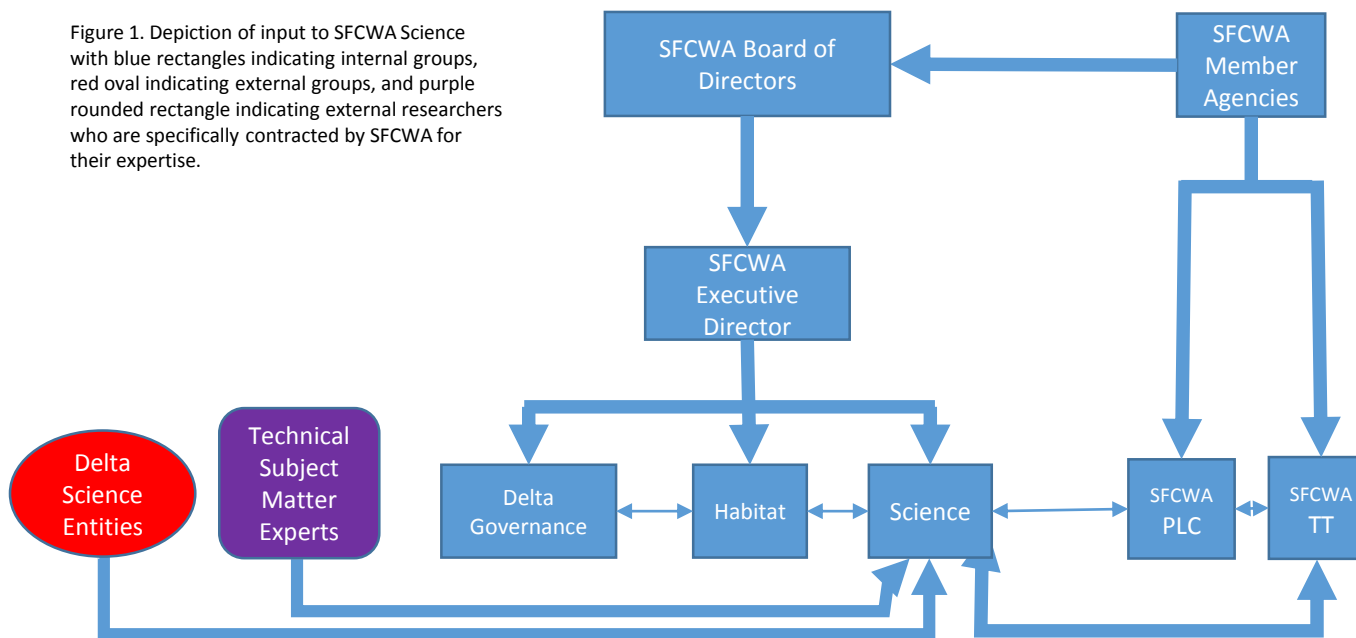
The State and Federal Contractors Water Agency (SFCWA) was formed in August of 2009 as a Joint Powers Authority by various water agencies that receive water transported across the Sacramento-San Joaquin Delta (Delta) by the State Water Project (SWP) and Central Valley Project (CVP). The organization's mission is to assist its member agencies in assuring a sufficient and reliable high-quality water supply for their customers. The core activities in pursuing this mission are centered on facilitating habitat conservation measures and research related to the restoration of the Delta ecosystem while assuring sufficient and reliable export water supplies.

The SFCWA Board of Directors oversees SFCWA staff activities and is comprised of nine members; three representatives from San Luis & Delta Mendota Water Authority, two representatives of the SWP Contractors Authority, and one representative each from Santa Clara Valley Water District, Metropolitan Water District of Southern California, Kern County Water Agency, and Westlands Water District.

The three major focal areas of SFCWA are Delta governance, habitat restoration, and science; and they make up the three programs within SFCWA. The Delta Governance Program focuses on furthering the co-equal goals of ecosystem health and water supply reliability, while the SFCWA Habitat Program focuses on restoring tidal habitat. The Science Program is detailed in the next section.

The Policy Liaison Committee (PLC) and Technical Team (TT) advise SFCWA staff, and are comprised of policy specialists and technical staff, respectively, from each of the member agencies. SFCWA staff pursue studies and projects to implement the SFCWA Mission and Implementing Strategies (see Strategic Plan at <http://www.sfcwa.org/about/strategic-plan/> or Appendix A).

Figure 1. Depiction of input to SFCWA Science with blue rectangles indicating internal groups, red oval indicating external groups, and purple rounded rectangle indicating external researchers who are specifically contracted by SFCWA for their expertise.



SFCWA Science Program

The SFCWA Science Program strives to support management decisions in a relevant and timely manner by facilitating research and communicating information that improves the understanding of water quality, ecosystem processes, and habitat restoration in the Sacramento-San Joaquin Delta. Although relevance and rigor are necessities of SFCWA Science, projects that are collaborative and promote diverse integration of ideas and expertise are given priority. Additionally, projects that are coincident and multi-disciplinary are given special consideration.

Subjects of particular interest to SFCWA include (in alphabetical order):

- Contaminants,
- Fish,
- Habitat restoration,
- Modernizing monitoring,
- Nutrients,
- Phytoplankton, and
- The dissemination of information through the CA Water Quality Monitoring Council's Estuaries Portal (Portal).

These are detailed in the following pages.

Purpose of This Document

Although SFCWA's three programs are interconnected, this Research Plan focuses on the SFCWA Science Program's research needs. This Research Plan will help guide selection and support of projects that aid in implementation of SFCWA priorities as outlined in SFCWA Strategic Objectives. The intended audiences include, but are not limited to, individuals who directly participate in SFCWA Science studies, those who want to collaborate on scientific studies in a cooperative manner, and others interested in reviewing science programs outside their own.

This Research Plan is a living document that will be updated annually to provide accurate descriptions of the priorities and directions of SFCWA Science, but will be re-evaluated every three years to determine the effectiveness of actions. This Research Plan will help guide Requests For Proposals (RFPs) and selection of projects as part of SFCWA competitive grants as well as directed contracts. More detailed descriptions of current and past SFCWA projects can be found in Appendix B and at <http://www.sfcwa.org/category/projects/> along with available factsheets, reports, and publications from those projects.

FY 2014 and 2015 RFP Planning Calendar

Release RFP.....February 20, 2014
Concept proposals due.....April 11, 2014
Review concept proposals and
request full proposals.....June 2, 2014
Full proposals due.....July 11, 2014
Review proposals.....July – Aug 2014
Award and begin contract negotiations
after Board Meeting.....September 18, 2014

Request for Proposals and Priority Topics

February 2014 marks the release of the first SFCWA Request for Proposals (RFPs) (see <http://www.sfcwa.org/proposal/>). For this, funding from both Fiscal Year (FY) 2014 and 2015 will be combined and awarded by September 2014. The SFCWA FY starts March 1st, so contracts will be negotiated across the fiscal years.

Although many priority questions are outlined later in the “What We Need to Know” sections, two particular topics were selected for this RFP. These topics represent a generalized summation of identified research needs.

- Factors affecting the distribution and abundance of fish prey within the Cache Slough Complex and
- Quantification of entrainment losses.

We recognize that there are a multitude of detailed issues that fall within, or are part of, full examination of these issues. Also recognized is the overlap in relevant details required to understand these topics. In our assessment, there was a reoccurring need to know more about indirect effects on fish that affect their distribution and abundance. The Cache Slough Complex was selected as a focal region because it supports resident delta smelt, it is connected to habitat restoration projects, there are many management changes planned for the Yolo Bypass, there is a known contaminant risk in the region, and nutrient dynamics there are not well understood. SFCWA and others have investigations in other priority areas like Suisun, but there is a lack of resources devoted to understanding the Cache Slough Complex's intricate dynamics. Quantification of entrainment losses was also identified as a priority because entrainment impacts are the direct responsibility of water exporters.

Factors affecting the: sampling efficiency of fishes in long-term monitoring programs, population of longfin smelt at various life stages, and survival of salmonids migrating through the south Delta are also key interests to SFCWA, but the CA Department of Fish and Wildlife, National Marine Fisheries Service, and the US Bureau of Reclamation are leading efforts to address longfin and salmonid issues. SFCWA is tracking their efforts for future collaboration opportunities. Factors affecting sampling efficiency is the topic of a Request for Qualifications that SFCWA is releasing in parallel with its RFP.

Current and Anticipated Management Decisions, Policies, and Actions by the Regulatory Agencies that Manage Delta Resources with Bearing on SFCWA Interests

Relevance	Decisions, Policies, and Actions (Lead Entity*)	Timing
Development and implementation of Delta flow objectives affects water supply reliability for state and federal water contractors.	Bay Delta Water Quality Control Plan Phase II Flow Objectives Sacramento Inflows (SWRCB)	2015
	Bay Delta Water Quality Control Plan Phase II Flow Objectives Sacramento Outflow (SWRCB)	Proposed Adoption 2016
	Bay Delta Water Quality Control Plan Phase I Flow Objectives San Joaquin River Inflows (SWRCB)	Proposed Adoption Fall 2014
Endangered Species Act regulations require habitat restoration and physical improvements to protect native endangered fish species.	Biological Opinion on Salmon (NMFS)	February 1, 2017
	Action I.6.1- Restoration of Floodplain Rearing Habitat- 17,000-22,000 acres to be seasonally inundated	Half total acres restored prior to 2016
	Action I.6.3- Lower Putah Creek enhancements	December 31, 2015
	Action I.6.4- Improvements to Lisbon Weir	December 31, 2015
	Action IV.1.3 (engineering solutions to Georgiana Slough immigration)	March 20, 2015
	Action IV.4.2 (Decrease by 40%pre-screen losses, through predator control methods at Clifton Court Forebay)	March 31, 2014
	Biological Opinion on Delta Smelt (USFW)	December 1, 2014
	Reasonable and Prudent Alternative 4: Habitat Restoration- 8,000 Acres Restored	December 15, 2018
	Coordinated Science and Adaptive Management Program Coordinated Adaptive Management Team	Joint Status Report to Court: February 15, 2014
	Longfin Smelt Incidental Take Permit (CDFW)	Expires December 31, 2018
Actions relevant to attaining co-equal goals of water supply reliability and ecosystem restoration.	Fish Restoration Program Agreement (CDFW/DWR)	October 2020
	Bay-Delta Conservation Plan Formal Public Review	April 2014
This identifies science priorities for research, monitoring, data management, modeling, synthesis, communication, and building science capacity.	Delta Science Action Agenda	2014

Current and Anticipated Management Decisions, Policies, and Actions by the Regulatory Agencies that Manage Delta Resources with Bearing on SFCWA Interests (continued)

Relevance	Decisions, Policies, and Actions (Lead Entity)	Timing
Development of these nutrient and herbicide Water Quality Objectives and control measures will determine success of native phytoplankton, the base of the food web. Dramatic changes in phytoplankton are likely causing changes in food quality and availability for zooplankton.	Nutrient Numeric Endpoints-Inland (SWRCB)	2017 Completion of 5 year project 2015 Significant Decision process
	Nutrient Numeric Endpoints-Delta (SWRCB)	TBD
	Central Valley Nutrient Strategy (Delta Plan Recommendation)	January 2014 (on hold)
	San Francisco Bay Nutrient Strategy (Delta Plan Recommendation)	January 2014
	Central Valley Diuron Total Maximum Daily Load (CVRWQCB)	February 2014
Control of these insecticides has direct effects on the species composition and availability of invertebrates as food for fish. Some insecticides have also been shown to alter salmonid olfactory senses.	Central Valley Pyrethroids Total Maximum Daily Load (CVRWQCB)	June 2014
	Central Valley Diazinon and Chlorpyrifos Total Maximum Daily Load (CVRWQCB)	March 2014
Mercury is methylated in wetlands and may negatively impact habitat restoration.	Phase II Delta Methylmercury Total Maximum Daily Load (CVRWQCB)	October 2018
	Statewide Reservoir Methylmercury Total Maximum Daily Load (CVRWQCB)	Fall 2014
Providing data to inform these efforts determines where water quality controls and resources are focused.	Chemicals of Emerging Concern program development (SWRCB)	Ongoing
	Clean Water Act 303(d) list of Impaired Waterbodies and 305(b) Integrated Report (CVRWQCB)	2015
	Clean Water Act 303(d) list of Impaired Waterbodies and 305(b) Integrated Report (SFBRWQCB)	2017

* Lead Entities as they appear: State Water Resources Control Board (SWRCB), National Marine Fisheries Service (NMFS), CA Department of Fish and Wildlife (CDFW), US Bureau of Reclamation (USBR), Central Valley Regional Water Quality Control Board (CVRWQCB), and San Francisco Bay Regional Water Quality Control Board (SFBRWQCB).

Past and Current Collaborators Organized by Subject

Throughout this document, programs are alphabetically ordered, not inferring priority. This list is not inclusive of all groups working on these subjects, simply those who have been collaborating with SFCWA.

Contaminants

- CA Department of Pesticide Regulation
- Central Valley Regional Water Quality Control Board
- Regional Sanitation District
- San Francisco Bay Regional Water Quality Control Board
- State Water Resources Control Board
- US Geological Survey

Fish

- CA Department of Fish and Wildlife
- Interagency Ecological Program
- US Bureau of Reclamation
- US Fish and Wildlife Service

Habitat Restoration

- CA Department of Fish and Wildlife
- CA Department of Water Resources
- Delta Conservancy
- US Bureau of Reclamation
- US Fish and Wildlife Service

Modernizing Monitoring

- Interagency Ecological Program
- Delta Science Program

Nutrients

- Central Contra Costa Sanitation District
- Central Valley Regional Water Quality Control Board
- Interagency Ecological Program
- Sacramento Regional Sanitation District
- San Francisco Bay Regional Water Quality Control Board
- San Francisco Estuary Institute
- Southern California Coastal Water Research Project
- State Water Resources Control Board
- US Geological Survey

Phytoplankton

- CA Department of Fish and Wildlife
- Central Contra Costa Sanitation District
- Central Valley Regional Water Quality Control Board
- Interagency Ecological Program
- Sacramento Regional Sanitation District
- San Francisco Bay Regional Water Quality Control Board

Portal (CA Water Quality Monitoring Council's Estuaries Portal)

- | | |
|---|--|
| • Interagency Ecological Program | • Agency |
| • Delta Science Program | • Delta Conservancy |
| • CA Department of Fish and Wildlife | • San Francisco Estuary Institute |
| • CA Department of Water Resources | • San Francisco Estuary Partnership |
| • State Water Resources Control Board | • Sacramento Regional Sanitation District |
| • Central Valley Regional Water Quality Control Board | • The Bay Institute |
| • US Geological Survey | • US Fish and Wildlife Service |
| • US Environmental Protection | • San Francisco Bay Regional Water Quality Control Board |

SFCWA Special Studies: Fiscal Years 2011-2015

SFCWA expenditures already committed to special study topics are summarized for 2011-2015 below. The “Other” category includes topics like BDCP, remote sensing, and preparation of summaries.

FY	2011	2012	2013	2014	2015	TOTALS
Contaminants	\$ -	\$ 60,000	\$ 334,055	\$ 248,597	TBD	\$ 642,652
Fish	\$ 453,355	\$ 545,429	\$ 75,000	\$ 73,241	TBD	\$ 1,147,025
Habitat Restoration	\$ -	\$ -	\$ 14,985	\$ 376,310	TBD	\$ 391,295
Modernizing Monitoring	\$ -	\$ -	\$ 14,000	\$ 154,000	TBD	\$ 1618,000
Nutrients	\$ 526,880	\$ 827,138	\$ 1,125,497	\$ 281,266	TBD	\$ 2,760,781
Phytoplankton	\$ 70,400	\$ -	\$ 15,000	\$ 24,000	TBD	\$ 109,400
Portal	\$ 65,000	\$ 140,000	\$ -	\$ 175,000	TBD	\$ 380,000
Request for Proposal	\$ -	\$ -	\$ -	\$ 500,000	\$ 500,000	\$ 1,000,000
Staff	\$ 180,000	\$ 220,955	\$ 358,739	\$ 421,475	TBD	\$ 1,181,169
Other	\$ 249,145	\$ 96,000	\$ 233,610	\$ 99,298	TBD	\$ 678,053
TOTALS	\$ 1,544,780	\$ 1,889,522	\$ 2,170,886	\$ 2,353,187	\$ TBD	

Changes in Program Funding Over Time

Changes in funds devoted to specific topics over time reflect growing interests in contaminant issues, habitat restoration monitoring, modernizing monitoring, and communication.

Resource changes for fish reflect changing needs as other agencies increased their efforts, and a more focused program has led to fewer projects in the “Other” category. Additional focus has moved into the staff category to reflect the Board’s desire to move away from primarily producing scientific publications to being involved in collaborative science and research.

Relevance to SFCWA

- Contaminant effects may curtail restoration efforts.
- Contaminants have been shown to have population effects (e.g., in the 1990's, organophosphorus insecticides caused high magnitude and high frequency toxicity to cladocerans, regulatory actions decreased and later banned use of those insecticides, which resulted in the return of cladocerans), therefore there is potential for contaminant effects throughout the food web from current-use pesticides.

What We Know

- New contaminants are going undetected because new products are developed and used before tools to detect them at relevant concentrations are developed.
- The State's 303(d) list of impaired waterbodies includes many Delta contaminant hotspots, yet many have not been addressed through implementation of Total Maximum Daily Loads (TMDLs).
- Contaminants effects on the food web are a growing concern for both direct and indirect effects. Contaminants have been found in concentrations exceeding species' tolerance in priority areas, like the Cache Slough Complex.
- Use of biomarkers is growing as it has become essential to understanding the effects of contaminants in a complex system with diverse contaminant inputs and physical stressors (see <http://www.dfg.ca.gov/erp/biomarkers.asp>).



Red dots indicate fish with bent spines collected from the field.
Photo credit: Fred Feyrer



Photo credit: Dr. Swee Teh laboratory

What We Need to Know

- What are direct and indirect contaminant effects on delta smelt and other species of concern, and which contaminants pose the greatest risk and when?
- Are the historical hotspots still a problem, and if so, is it due to the same chemicals or replacement products?
- What is the extent of contaminant effects on the food web, particularly with respect to abundance, distribution, species composition, and availability?
- What trophic levels and life stages are at greatest risk for negative contaminant effects?
- What are the best management practices to keep contaminants out of surface waters, and are control programs effective?
- How can new tools with use standards help identify problems at warning stages and prevent declines to important species?

SFCWA's Contributions to Contaminant Science Understanding

- Pesticides in Suisun Bay and Potential Effects: Kathy Kuivila- U.S. Geological Survey
- Contaminant Monitoring of Current Use Pesticides at Freeport and Vernalis: James Orlando- U.S. Geological Survey
- Occurrence of Current Use Pesticides in Suisun Bay: James Orlando- U.S. Geological Survey
- Methylmercury Issues and Regulations: Stephen McCord- McCord Environmental
- Delta Regional Monitoring Program (RMP) Technical Advisory Committee co-chair: Stephen McCord- McCord Environmental
- Participation in the development of the Delta (RMP): staff time

How and Where Information Will Be Used

- Bay-Delta Conservation Plan
- Central Valley Diuron Total Maximum Daily Load
- Chemicals of Emerging Concern and Recycled Water Policy development
- Central Valley Pyrethroids Total Maximum Daily Load
- Clean Water Act 303(d) list of Impaired Waterbodies and 305(b) Integrated Report
- Development of Delta RMP
- Development of tools and indicators to identify contaminant effects
- Irrigated Lands Regulatory Program Long-term program
- National Pollutant Discharge Elimination Systems (NPDES) permits for wastewater treatment plants
- Sediment Quality Objectives
- Stormwater (MS4) permits

Relevance to SFCWA

- Biological Opinions for delta smelt and salmonids have direct implications for SFCWA habitat restoration efforts.
- Delta flow objectives for fish have direct implications for water supply and its reliability.
- The success of various fish species will influence water supply reliability.
- Science efforts will influence consultations under the Endangered Species Act (ESA), flow objectives, and levels of success of fish and habitat restoration.

What We Know

- Increased water clarity over time in the Bay-Delta Estuary likely resulted from decreased sediment loading, and invasive clams and vegetation. This seems to have resulted in turbidity below critical levels for successful larval delta smelt feeding in areas of the Delta.
- The Cache Slough complex has relatively high primary productivity with abundant zooplankton supporting young delta smelt, Sacramento splittail, and Chinook salmon compared to other parts of the Delta.
- Longfin smelt abundance has been associated with wet springs.
- The abundance of introduced fishes, including piscivorous species such as largemouth bass, has increased while the abundance of native fishes, including salmon and smelt, has decreased.
- In the south Delta, predator fish abundance is high and salmon survival is low.



What We Need to Know

- What factors (e.g., residence time needs and the degree to which enhanced productivity improves the population of these fishes) affect fish food abundances, distributions, and availabilities in the Cache Slough complex, as well as the Bay-Delta?
- What mechanisms drive longfin smelt distribution and abundance with respect to controllable flow and other factors?
- What drivers influence salmon migration through the Delta, and what are the factors affecting salmon survival?
- What are the impacts of entrainment on delta smelt and salmonid populations?
- What is the risk of predation on juvenile smelt and south Delta salmon, and what can realistically be done to control it?
- What tools can be used or developed to more accurately estimate organismal abundances and productivity of the food web, and assess the effects of multiple stressors?
- What data and life cycle models are necessary to more accurately estimate the effects of environmental factors, including entrainment and controlled flow, on delta smelt and longfin smelt?

SFCWA's Contributions to Fish Science Understanding

- State Water Resources Control Board Flow Criteria-Expert Panelists
- Salmon Predator Experimental Study: Brad Cavallo-Cramer Fish Science
- Delta Smelt Loss to Predators Using Genetics: Brad Cavallo- Cramer Fish Science
- Analysis of SJR Flow and Salmon: Brian Manly
- Delta Smelt Habitat and All Stressors Analysis: Scott Hamilton
- Longfin Habitat and All Stressors Analysis: Scott Hamilton
- Turbidity and Delta Smelt Movement : Marianne Guerin- Resource Management Associates
- Multivariate Analysis of Factors Affecting Delta Smelt Abundance and Survival: William J. Miller
- Support for State Water Resources Control Board Flow Hearings
- Support for draft DFG Quantifiable Objectives Report: Brad Cavallo- Cramer Fish Science
- Purchase of VEMCO tags for CA. Fish Tracking Consortium: Peter Klimley- U.C. Davis
- Assessing Salmon Survival Using CWT Releases: Brad Cavallo- Cramer Fish Science
- Initial Review of Acoustic Tag Database: Brad Cavallo- Cramer Fish Science
- North Delta Predation Study: Brad Cavallo- Cramer Fish Science
- Delta Passage Model Workshop Facilitation: Patti Kroen

How and Where Information Will Be Used

- Development of the Delta Science Action Agenda
- Bay-Delta Conservation Plan
- Biological Opinions for salmonids and delta smelt
- Development of flow objectives
- Implementation of the restoration projects and Fish Restoration Program Agreement
- Coordinated Science and Adaptive Management Program
- Longfin smelt California ESA



Relevance to SFCWA

- Preliminary answers to priority questions, including the likely potential of the Lower Yolo Ranch restoration project to produce more habitat and food to support young delta smelt and salmon.
- The Biological Opinions for delta smelt and salmon, and the Incidental Take Permit for longfin smelt require habitat restoration.
- To inform the design, implementation and performance monitoring of habitat restoration measures under the Bay Delta Conservation Plan.

What We Know

- Extensive changes to the Bay-Delta landscape have reduced, fragmented, and isolated many of the channels from their floodplains, freshwater and tidal wetlands, open water, and upland habitats. There is a great need for restoring sufficiently large and well-connected wetland habitats in order to benefit wildlife.
- Wetland restoration without increasing mercury methylation may be more complex than previously expected.
- Climate change has not only resulted in warmer ambient temperatures, but also decreased snow reserves, altering timing and amount of available cold water.



What We Need to Know

- Which types of habitat are the most essential to restore, and where?
- Will aquatic life use restored habitat as predicted?
 - Do individual restoration projects show net-positive flux of (suitable) productivity off of restored wetlands into adjacent open water areas at spatial and temporal scales relevant to listed fish species?
 - Does access to restored tidal wetlands enhance growth and contribute to increased survival of juvenile salmon?
 - Are tidal restoration projects providing better refugia for endangered species than reference habitat?
 - Are restored tidal habitats more, or less, hospitable to non-native species than reference sites?
- To what extent can potential negative outcomes (e.g., mercury methylation, invasive aquatic vegetation, harmful algal blooms, invasive clams, and non-native predatory fish) be minimized through project design and best management practices?
- How can we use models and other information to best estimate effects of climate change and how do we account for it in restoration efforts?
- What restoration design features provide greatest benefit to native fish species, or greatest deterrent to non-native species?
- How can we design and implement performance monitoring that is informative, feasible, and integrated with regional monitoring?

SFCWA's Contributions to Habitat Restoration Science Understanding

- Lower Yolo Monitoring Plan: Ramona Swenson-Cardno Entrix
- Lower Yolo Habitat Restoration Expert Panel: Jon Durand, Bruce Herbold, Eric Ginney
- Lower Yolo Habitat Restoration Expert Panel Technical Support: Robin Grossinger- Aquatic Science Center
- Liberty Cut Monitoring Station: Brian Bergamaschi-U.S. Geological Survey
- Participation in development of a monitoring framework to assess the effectiveness of tidal wetland restoration actions: staff time

How and Where Information Will Be Used

- Implementation of restoration projects
- Implementation of the Delta Restoration Framework
- Bay-Delta Conservation Plan design, implementation, and performance monitoring
- Biological Opinions for salmonids and delta smelt
- Development of the Delta Science Action Agenda
- Phase II of the Delta Methylmercury Total Maximum Daily Load
- Statewide Reservoir Methylmercury Total Maximum Daily Load as its recommendations affect reservoir operations and flow

Relevance to SFCWA

- More relevant data and information about health, distribution, and abundance of species of concern; and the estuarine ecosystem to better address current and future management questions.
- New tools to better understand (or calibrate) data previously collected.
- Develop new tools and improve use of existing tools to enhance current monitoring of water quality and its effects on living resources, and the living resources themselves to better address current management questions.

What We Know

- Historical monitoring was designed to answer specific questions that are no longer the primary focus, yet those data have been used to estimate answers to modern questions.
- New tools (barcoding and SmeltCam) have shown that certain fish species are not inhabiting the areas once believed, fish are eating invertebrates that they weren't previously believed to, and species that were believed to be different are genetically similar.
- Fish salvage facilities are likely under-sampling delta smelt, and large correction factors are used to estimate entrainment of fish to Clifton Court Forebay and the Jones (CVP) facility.



What We Need to Know

- How can a Regional Monitoring Program be designed to avoid overlap, but still answer diverse questions across multiple trophic levels, for multiple organizations?
- Which new tools or modifications could be used to enhance historical monitoring to create a better picture of the ecosystem?
- What historical monitoring, if any, can be terminated and replaced with new monitoring; or how can new monitoring be phased in to provide continuity with legacy monitoring programs?
- What are the best methods to determine health, distribution, and abundance of species of concern?

SFCWA's Contributions to Modernizing Monitoring Science Understanding

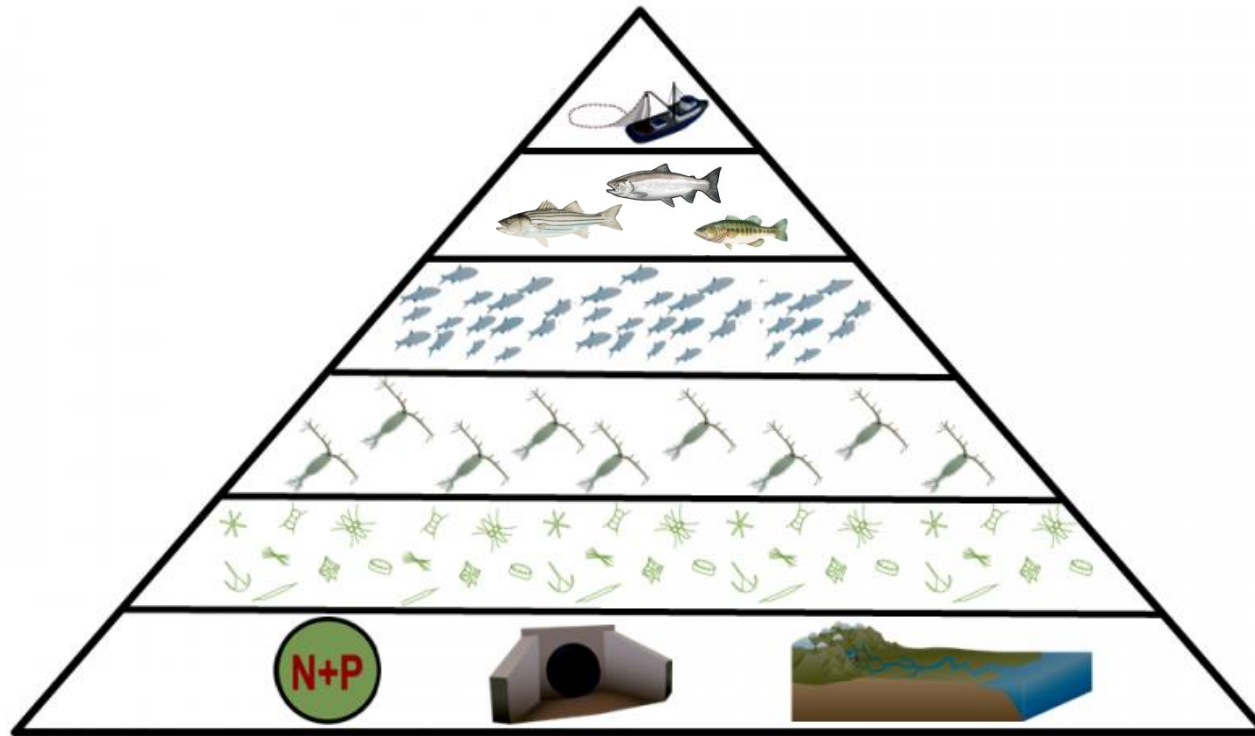
- SmeltCam Improvements: Fred Feyrer- U.S. Bureau of Reclamation
- 2D Salmon Tracking: Eric Chapman- U.C. Davis
- Planning and implementation of the 2013 Biomarker Workshop with CDFW: staff time

How and Where Information Will Be Used

- Annual assessment and reporting required under Water Right Decision 1641
- Bay-Delta Conservation Plan
- Bay Regional Monitoring Program
- Biological Opinions for salmon and delta smelt
- Development of the Delta Regional Monitoring Program
- Development of the Sacramento River Regional Monitoring Program
- Development of the San Joaquin River Regional Monitoring Program
- Real-time operations decisions
- Improved longfin monitoring for CESA regulations

Relevance to SFCWA

- Successful habitat restoration and fishery recovery requires a better understanding of nutrient sources, forms, loads, concentrations, and residence time to encourage primary production by beneficial species and discourage production of nuisance species.
- Project operation costs to member agencies are partially dependent on nutrient control and control over nuisance blooms and invasive aquatic vegetation.



What We Know

- There is a growing body of evidence that not only is nutrient concentration of concern, but also the ratio in which different species of nutrients are present.
- Single nutrient control may no longer be effective to address impairments.

What We Need to Know

- What management practices or regulations are needed to effectively control nutrient balances that encourage beneficial productivity while discouraging harmful production?
- During what conditions can the ecosystem endure higher nutrient inputs without detrimental effects?
- What are the most critical times and areas to control nutrient levels and balances?

SFCWA's Contributions to Nutrient Science Understanding

- Isotope Modeling: Resource Management Associates
- Ammonia Fate and Modeling: Resource Management Associates
- Support for the Sacramento Regional County Sanitation District National Pollutant Discharge Elimination System Permit Renewal- Richard Dugdale (Romberg Tiburon Center), R. Shane Trussell (Trussell Technologies, Inc.), Elain Archibald (Archibald Consulting), Robert Thomson (Cardno ENTRIX)
- Phytoplankton toxicity testing and TIEs of Suisun Bay- Jeff Miller (Aqua Science) and Michael Johnson (Michael L. Johnson LLC)
- Nutrient Fluxes from Sediments: Jeffrey Cornwell- University Maryland Center for Environmental Science
- Nutrient Forms, Ratios, and Light Availability on Lower Food Web: Patricia Glibert- University Maryland Center for Environmental Science
- Effects of ionized ammonia on *Pseudodiptomus forbesi*: Jeff Miller (Aqua Science) and Michael Johnson (Michael L. Johnson LLC)
- Nutrient Sediment Biogeochemistry: Jeffrey Cornwell- University Maryland Center for Environmental Science
- Effects of Changing Phytoplankton Stoichiometry on Copepods: James Pierson- University Maryland Center for Environmental Science
- Nutrient Visualization and Analysis Web Application: David Osti- 34 North
- Advancing the Understanding of Nutrients in the Bay-Delta: Patricia Glibert- University Maryland Center for Environmental Science
- Understanding the Effects of Nutrients and Light Levels on Growth of Phytoplankton: Mine Berg- Applied Marine Sciences
- Habitat Components and Phytoplankton Physiological Structure: Richard Dugdale- Romberg Tiburon Center
- Phytoplankton Production and Nutrient Transformations in Shallow Water Wetland Habitats- Brian Bergamaschi (U.S. Geological Survey), Richard Dugdale (Romberg Tiburon Center), Alexander Parker (CA Maritime Academy)

How and Where Information Will Be Used

- Development of Nutrient Numeric Endpoints
- Development of Nutrient Strategies for the Central Valley and Bay Area
- Possible dissolved oxygen Total Maximum Daily Loads in the Stockton area

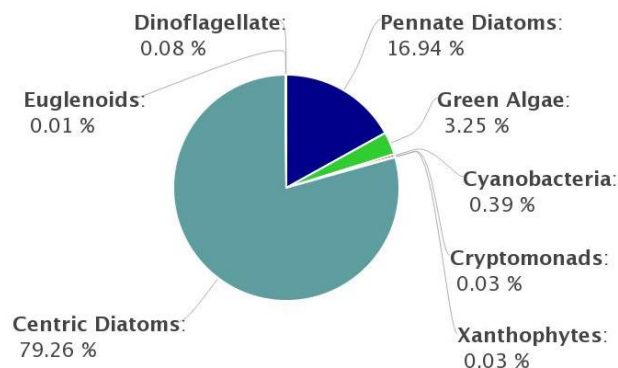
Relevance to SFCWA

- Better understanding of shifts in bloom seasonality, composition, distribution, and abundance as it relates to habitat restoration and fish recovery.
- Control of harmful species and toxin production.
- Better understanding of bloom triggers and control.

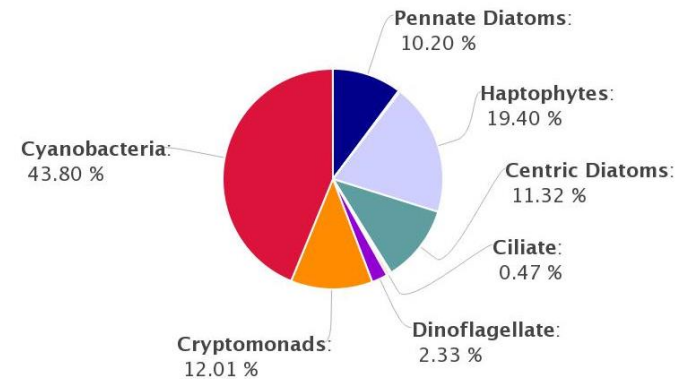
What We Know

- There is a growing body of evidence that shows that there are issues of eutrophication in some areas of the Delta, yet a lack of phytoplankton in other areas.
- Residence time, light availability, nutrients, grazing, and timing of possible chemical inputs affect the ability to produce phytoplankton.
- Imbalances in nutrients play a role in the change in dominant types of phytoplankton produced, particularly the increase of cyanobacteria production and decrease in diatoms.
- Cyanotoxin production may be a coping mechanism for excess nitrogen exposure.
- Phytoplankton changes may contribute to the noted change in zooplankton from more large species to smaller, less nutritious species.

Confluence : Suisun Bay Regional Average 1975
Annually Averaged



Confluence : Suisun Bay Regional Average 2011
Annually Averaged

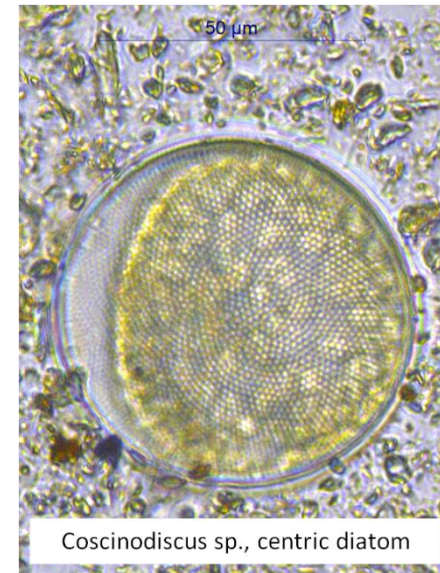


What We Need to Know

- Can phytoplankton growth be better controlled (both production of beneficial phytoplankton and decreasing numbers of less desirable blooms) by controlling balances of nutrients, residence time, and contaminant inputs?
- How are the species composition and abundance changes proliferated into other levels of the food web?
- How and where are changes in phytoplankton impacting zooplankton composition, and are these changes impacting fish health and abundance?

SFCWA's Contributions to Phytoplankton Science Understanding

- Phytoplankton Community Structure of the Sacramento River and San Francisco Estuary: EcoAnalyst
- Phytoflash: Submersible Fluorometer
- Spatial Distribution and Characterization of Cyanobacteria: Raphael Kudela-U.C. Santa Cruz



How and Where Information Will Be Used

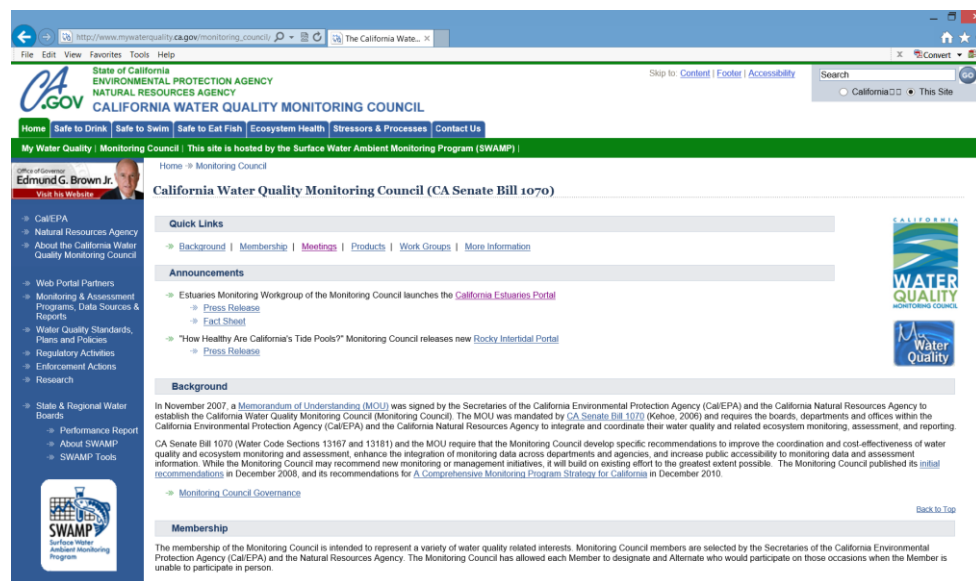
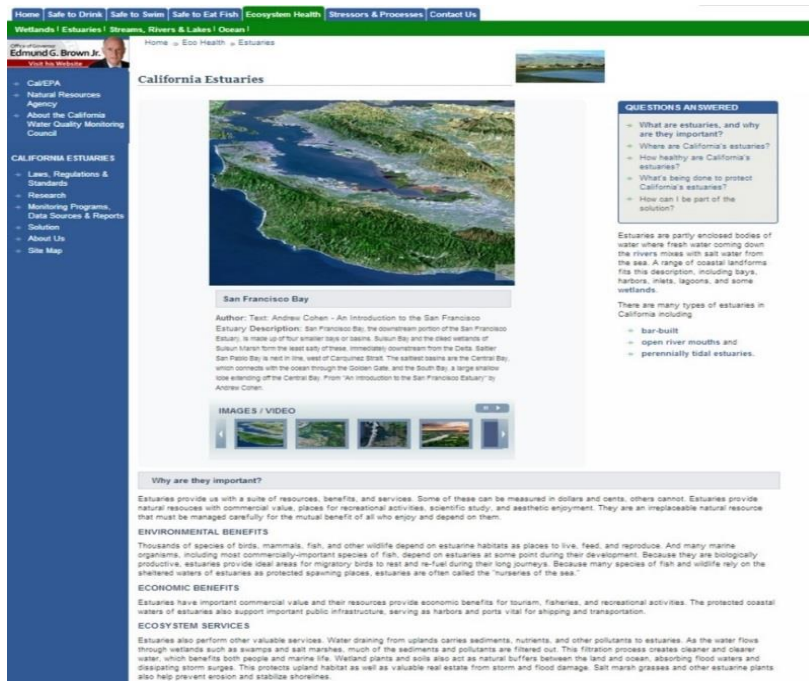
- Interagency Ecological Program monitoring
- Inform habitat restoration efforts
- Suisun Bay Phytoplankton Stakeholder Advisory Group
- Central Valley Diuron Total Maximum Daily Load
- Surface Water Ambient Monitoring Program's Bioaccumulation Oversight Group's cyanoharmful algal bloom workgroup efforts
- Development of the Delta Nutrient Strategy
- Development of nutrient water quality objectives
- Inform flow objectives
- Inform habitat restoration

Relevance to SFCWA

- Greater use of the Portal as a place for diverse groups to conduct analyses using the same data.
- Data comparability across diverse sources and increased access to data, enabling greater use of more data.

What We Know

- Different questions have driven different groups to collect similar, but different data.
- Decreasing resources have made efficiency in data collection a necessity, even when addressing multiple questions.
- Recent summaries have determined that a lack of data accessibility, even with adequate collection has impaired necessary analyses for years.
- Data comparability is lacking in data currently and historically collected.



What We Need to Know

- How can the integrity of analyses be maintained with data compiled from different sources?
- What are the most used data sources that can be prioritized for integration?
- What information technology needs (e.g., minimum server capacity and security level) are required to make all agency data web serviceable, and which agencies have the farthest to come?
- What data visualization tools can prove most useful for the most common questions?

SFCWA's Contributions to Estuary Science Understanding

- Estuary Portal: David Osti- 34 North
- CA Estuaries Workgroup Website: David Osti- 34 North
- Facilitation of the CA Estuaries Monitoring Workgroup and development of Estuary Portal content: staff time

What is Driving Its Development

- Delta Science Plan
- Senate Bill 1070
- Draft Assembly Bill 378
- February 13, 2013 Executive Office of the President Office of Science and Technology Policy Increasing Access to the Results of Federally Funded Scientific Research
- Strategies developed by the CA Water Quality Monitoring Council
- The need for baseline and reference data to monitor the performance of restoration

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Office of Governor
Edmund G. Brown Jr.
Visit his Website

Home → Eco Health → Estuaries → Healthy → San Francisco

How Healthy is the San Francisco Estuary?

Water Quality and Quantity (Click here to learn more)

Habitat (Click here to learn more)

Living Resources (Click here to learn more)

Ecological Processes (Click here to learn more)

Stewardship (Coming Soon)

QUESTIONS ANSWERED

- What is the San Francisco Estuary, and why is it important?
- **How healthy is the SF Estuary?**
 - Water Quality and Quantity
 - Habitat
 - Living Resources
 - Ecological Processes
 - Stewardship (coming soon)
- What is being done to protect California's estuaries?
- How can I be part of the solution? (coming soon)

Assessing Health

The vision for this portal is to assess the health of the SF Estuary by evaluating five ecosystem elements called "key attributes." The key attributes are living resources, water, habitat, ecological processes, and stewardship. These are the same attributes used in **State of the San Francisco Bay 2011 Report** to evaluate the health of the San Francisco Bay (the western portion of the SF Estuary). Measurable elements of each attribute are used to evaluate the condition or health of the five attributes, which are then used to estimate the overall health of the estuary.

The Portal is currently focusing on an evaluation of the health of two key attributes: living resources and water in the SF Estuary. Information about these key attributes is currently under development.

Health of the San Francisco Estuary

There is widespread agreement that the SF Estuary ecosystem is in poor health and many think that it is in crisis. Symptoms of this crisis include: rapidly declining resident and migratory fish