

Regional Monitoring Program for Water Quality in San Francisco Bay

Summary of the Study Design for the Status and Trends Monitoring Program (2014-2023)

Program	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Continuous: Basic Water Quality (5 targeted sites) ^a										
Water temperature, Salinity, SSC	X	X	X	X	X	X	X	X	X	X
Monthly: Basic Water Quality in Deep Channel (38 targeted sites)										
CTD profiles, light attenuation, SSC, DO, Chl-a, Phytoplankton speciation, Nutrients (NO ₂ , NO ₃ , NH ₄ , PO ₄ , Si) ^b	X	X	X	X	X	X	X	X	X	X
Every 2 Years: Toxic Contaminants in Water (5 targeted sites and 17 random sites)										
MeHg, Cu, Se, CN, Hardness, SSC, Chl-a, DOC, POC, Nutrients (NO ₃ , NO ₂ , PO ₄ , Si)		X		X		X		X		X
Aquatic Toxicity (9 stations) ^c		X		X		X		X		X
PCBs, PAHs, Pesticides										X
CTR parameters (10 samples at 3 targeted stations) ^d		?								?
Every 2 years: Toxic Contaminants in Bivalve Tissue (7 targeted sites) ^e										
Se, PAHs, PBDEs	X		X		X		X		X	
PCBs	X								X	
Every 3 Years: Toxic Contaminants in Bird Egg Tissue										
Cormorant Eggs: Hg, Se, PCBs, PBDEs, PFCs (3 targeted sites) ^f		X			X			X		
Tern Eggs: Hg, Se, PBDEs (variable fixed sites) ^g		X			X			X		
Every 4 Years: Toxic Contaminants in Sediment (7 targeted sites and 20 random sites) ^h										
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PAHs, PCBs, Pesticides, TOC, N, % Solids, Grain Size	X				X				X	
PBDEs	X				X					
Sediment Toxicity ⁱ					X				X	
Benthic Macroinvertebrates ^j					?				X	
Every 5 Years: Toxic Contaminants in Sport Fish Tissue (7 targeted sites)										
Hg, Se, PCBs, PBDEs, PFCs, Dioxins	X					X				

Notes:

"X" = Planned sampling event. "?" = Event that is planned but must be approved by the RMP Steering Committee before implementation. Additional parameters can be added to sampling events to support RMP Special Studies.

- a. The RMP Status and Trend Program provides direct support to the U.S. Geological Survey (PI: Dave Schoellhamer) for 5 SSC stations. However, this contribution leverages SSC data at 2 more stations and salinity at 8 stations funded by other partners. In addition, since 2012, the RMP has used Special Studies funds to add DO sensors at 6 stations and nutrient-related sensors to 3 stations.
- b. Monthly cruises are completed by the U.S. Geological Survey (PI: Jim Cloern). Phytoplankton speciation and nutrient sampling only occurs at 14 of stations.
- c. Aquatic Toxicity is measured following EPA Method 1007.0 (*Americamysis bahia*).
- d. CTR sampling occurs at the Sacramento River, Yerba Buena Island, and Dumbarton Bridge sites. Sampling for CTR was planned for 2015 but this effort was canceled to reduce program costs.
- e. Mussels (*Mytilus californianus*) are collected from Bodega Head State Marine Reserve, an uncontaminated "background" site of known chemistry, and are transplanted to 7 targeted locations in the Bay. After ~100 days, mussels from the transplanted sites and a sample from Bodega Head are collected for analysis. Three of the 7 transplant sites serve as back-ups in case something goes wrong with the transplants at the 4 primary sites. At the same time, resident clams (*Corbicula fluminea*) are collected from 2 sites in the Sacramento River and San Joaquin River.
- f. Double-crested Cormorants (*Phalacrocorax auritus*). Cormorant eggs are collected at three sites: Don Edwards National Wildlife Refuge, the Richmond-San Rafael Bridge, and Wheeler Island.
- g. Forster's Tern (*Sterna forsteri*). Tern eggs are typically collected from multiple sites in the Don Edwards National Wildlife Refuge and the Hayward Shoreline Regional Park.
- h. Sediment samples are collected in alternate seasons: a dry season (summer) collection event in 2014, wet season (winter) collection event in 2018, etc.
- i. Sediment toxicity is measured using the following methods: EPA 600/R-94-025 (*Eohaustorius estuaries*), EPA 821/R-02-012M (*Ceriodaphnia dubia*), EPA 600/R-99-064 (*Hyalella azteca*), and EPA 600/R-95-136M (*Mytilus galloprovincialis*)
- j. Benthic macroinvertebrates are measured during dry-season sediment sampling events (2014, 2022). Sediment samples are sieved through nested 1.0 and 0.5 mm sieves. Organisms are sorted into major taxonomic categories and taxonomy and abundance are determined to the lowest practical taxonomic level.

Acronyms:

SSC: Suspended Sediment Concentration
CTD: Conductivity, Temperature, and Depth
DO: Dissolved Oxygen
Chl-a: Chlorophyll-a
NO₂: Nitrite (dissolved)
NO₃: Nitrate (dissolved)
NH₄: Ammonia (dissolved)
PO₄: Phosphate (dissolved)
Si: Silica (dissolved)
MeHg: Methylmercury
DOC: Dissolved Organic Carbon
POC: Particulate Organic Carbon
PCBs: Polychlorinated Biphenyls
PAHs: Polynuclear Aromatic Hydrocarbons

CTR: California Toxics Rule, see
<http://water.epa.gov/lawsregs/rulesregs/ctr/>
PBDEs: Polybrominated Diphenyl Ethers
PFCs: Perfluorinated Compounds
TOC: Total Organic Carbon