Jim!

How long do you have to keep studying San Francisco Bay?

Haven’t you got this figured out yet?
April 10, 1969

John Conomos 1968
Dave Peterson 1967
Fred Nichols 1969/70

An Era of Discovery Begins
Estuarine Circulation & Turbidity Maximum

Nutrient Concentrations, Seasonal-Spatial Patterns

Benthic Infauna

Fig. 2. Total number of benthic macroinfauna species collected during February and August 1973 in replicate 0.1-cm³ samples and assayed on a 1.6-mm sieve.

Era of Discovery
Estuarine Circulation & Turbidity Maximum

Benthic Infauna

Nutrient Concentrations, Seasonal-Spatial Patterns

Metals

Plankton & Modeling

Era of Discovery
1986: End of an Era

Contaminants & flows

Landscape changes

Nutrient enrichment

Water management
1986: Beginning of a new Era

Basin Plan includes Pollutant Standards (without data)

Russ Flegal (UCSC)

RMP Begins
1986: Beginning of a new Era

Basin Plan includes Pollutant Standards (without data)

Russ Flegal (UCSC)

RMP Begins

RMP Begins

Pilot Project

USGS

text: science for a changing world
What has this partnership meant?

Basin Plan includes Pollutant Standards (without data)

Russ Flegal (UCSC)

RMP Begins

What has this partnership meant?
#1 We are engaged

Toxic Phytoplankton in San Francisco Bay
Kristine M. Rodgers and David L. Garrison,
University of California, Institute of Marine Sciences, Santa Cruz, CA
and James E. Cloern, United States Geological Survey, Menlo Park, CA

Water Quality Variability in San Francisco Bay, Some General Lessons from 1996 Sampling
James E. Cloern, Brian E. Cole, Jody L. Edmunds, and Jelirza I. baylowski
United States Geological Survey, Menlo Park, CA

Lessons from Monitoring Water Quality in San Francisco Bay
James E. Cloern (jcloern@usgs.gov), Tara S. Schraga, Cary B. Lopez, and Rochelle Labiosa — U.S. Geological Survey, Menlo Park, CA

What is Causing the Phytoplankton Increase in San Francisco Bay?
James E. Cloern1 (jcloern@usgs.gov), Alan D. Jassby2, Tara S. Schraga1 and Kate L. Dallas1

Patterns of Water-Quality Variability in San Francisco Bay During the First Six Years of the RMP, 1993-1998

Late Summer Chlorophyll in the South Bay

The Pulse of the Estuary
Tracking Contamination with the Regional Monitoring Program 1993-1998

The Pulse of the Bay
The State of Bay Water Quality, 2015 and 2065
#2 Continuity of Measurements

Dissolved Oxygen

- Sacramento River
- Suisun Bay
- San Pablo Bay
- Central Bay
- South Bay
- Lower South Bay

#2 Continuity of Measurements

Dissolved Oxygen

Sacramento River

Suisun Bay

San Pablo Bay

Central Bay

South Bay

Lower South Bay

Since 1968, the USGS has sustained a research program to understand how coastal ecosystems function and how those functions are altered by human disturbances.

One component of this program is directed towards following and understanding changes in the

WATER QUALITY OF SAN FRANCISCO BAY

Latest Cruise Data
July 31, 2017
Who Accesses the Data?

88 countries
How are the data used?
Data used in assessments

Scientific Basis to Assess the Effects of Nutrients on San Francisco Bay Beneficial Uses

Novel analyses of long-term data provide a scientific basis for chlorophyll-a thresholds in San Francisco Bay

Martha Sutula, Raphael Kudela, James D. Hagy III, Lawrence W. Harding Jr., David Senn, James E. Cloern, Suzanne Bricker, Gry Mine Berg, Marcus Beck
Data used to measure:

**Status**

**DIN**

**Phosphate**

**Trends**

- Earlier Upwelling
- Higher Chlorophyll
Data used to set scientific directions:

(a) STI (d)

(g) Chlorophyll (µg L⁻¹)

Higher Chlorophyll

Nutrient Management Strategy
The USGS San Francisco Bay Water Quality Research Program... plays a critical role, and provides an essential and unparalleled service for Bay-Delta regulators, managers, and stakeholders, especially as it pertains to informing high-stakes decision-making related to nutrients.

Thomas Mumley
Assistant Executive Officer
San Francisco Bay Regional Water Quality Control Board
Data used by the scientific community

50 examples, from archaeology to zooplankton ecology
Data used to build & test models

Three-Dimensional Modeling of Tidal Hydrodynamics in the San Francisco Estuary

Edward S. Gross, Michael L. MacWilliams, and Win J. Kimberer
Dear Jim, Thanks very much for the material. I'd really like to get the students working on more USGS data. I teach an undergraduate interdisciplinary course (Water Resources Management) every spring and this will be a great addition.

Professor Katherine Cushing
Department of Environmental Studies
San Jose State University
Dear Jim,

Thanks very much for the material. I'd really like to get the students working on more USGS data. I teach an undergraduate interdisciplinary course (Water Resources Management) every spring and this will be a great addition.

Professor Katherine Cushing
Department of Environmental Studies
San Jose State University
Data used by graduate students

Hi, I am Khushali Desai. I am Graduate Student at San Jose State University, currently working on my thesis. I am using "USGS Measurements of Water Quality in San Francisco Bay (CA), 1969-2015" data as part of my thesis analysis. I have few questions, it would be great if you answer them for my study. Thank you for your precious time.
Hi, I am Khushali Desai. I am Graduate Student at San Jose State University, currently working on my thesis. I am using "USGS Measurements of Water Quality in San Francisco Bay (CA), 1969-2015" data as part of my thesis analysis. I have few questions, it would be great if you answer them for my study. Thank you for your precious time.

Data used by graduate students

Contrasting biogeochemistry of six trace metals during the rise and decay of a spring phytoplankton bloom in San Francisco Bay

Allison C. Luengen
Environmental Toxicology Department, WIGS Group, University of California at Santa Cruz, 1156 High Street, Santa Cruz, California 95064
Dear Mr. Cloern, I am following up with you to say thank you so much for your time and attention. I got so much good information from you, and I am very grateful. I am almost done with my article, and will send it to you as soon as I finish!! Thanks again, Noa