Regional Water Quality Monitoring in the San Francisco Bay Area

April 15, 2010

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SF Bay Regional Water Quality Control Board

California Water Boards

SWAMP Surface Water Ambient Monitoring Program

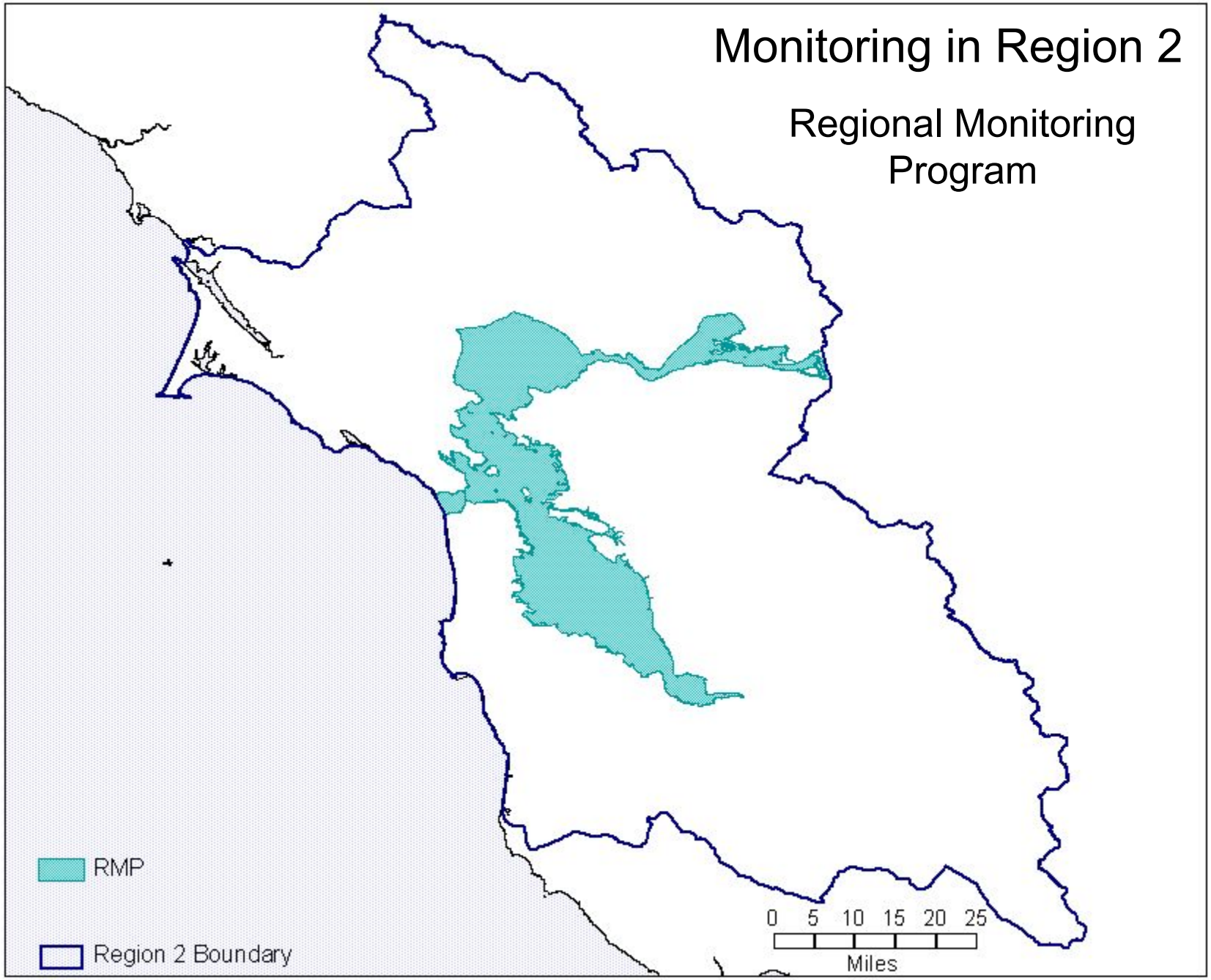
Presentation Outline
and cast of characters

- Overview of regional water quality monitoring
- Regional SWAMP monitoring
- Enlarging the SWAMP umbrella
- SF Estuary Regional Monitoring Program (RMP)


Oakland
San
Francisco
San Jose
CALIFORNIA

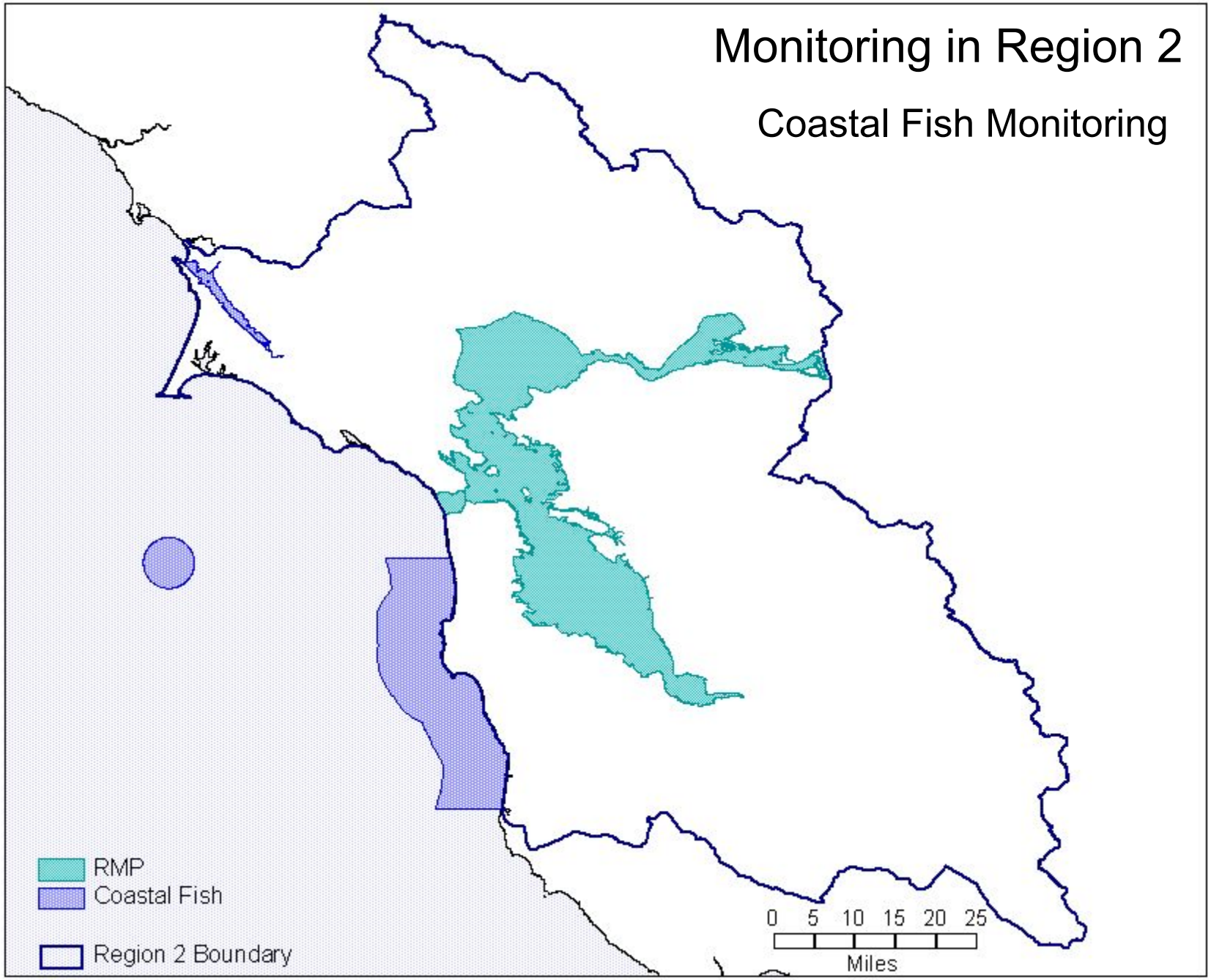
Monitoring in Region 2

Regional Monitoring Program



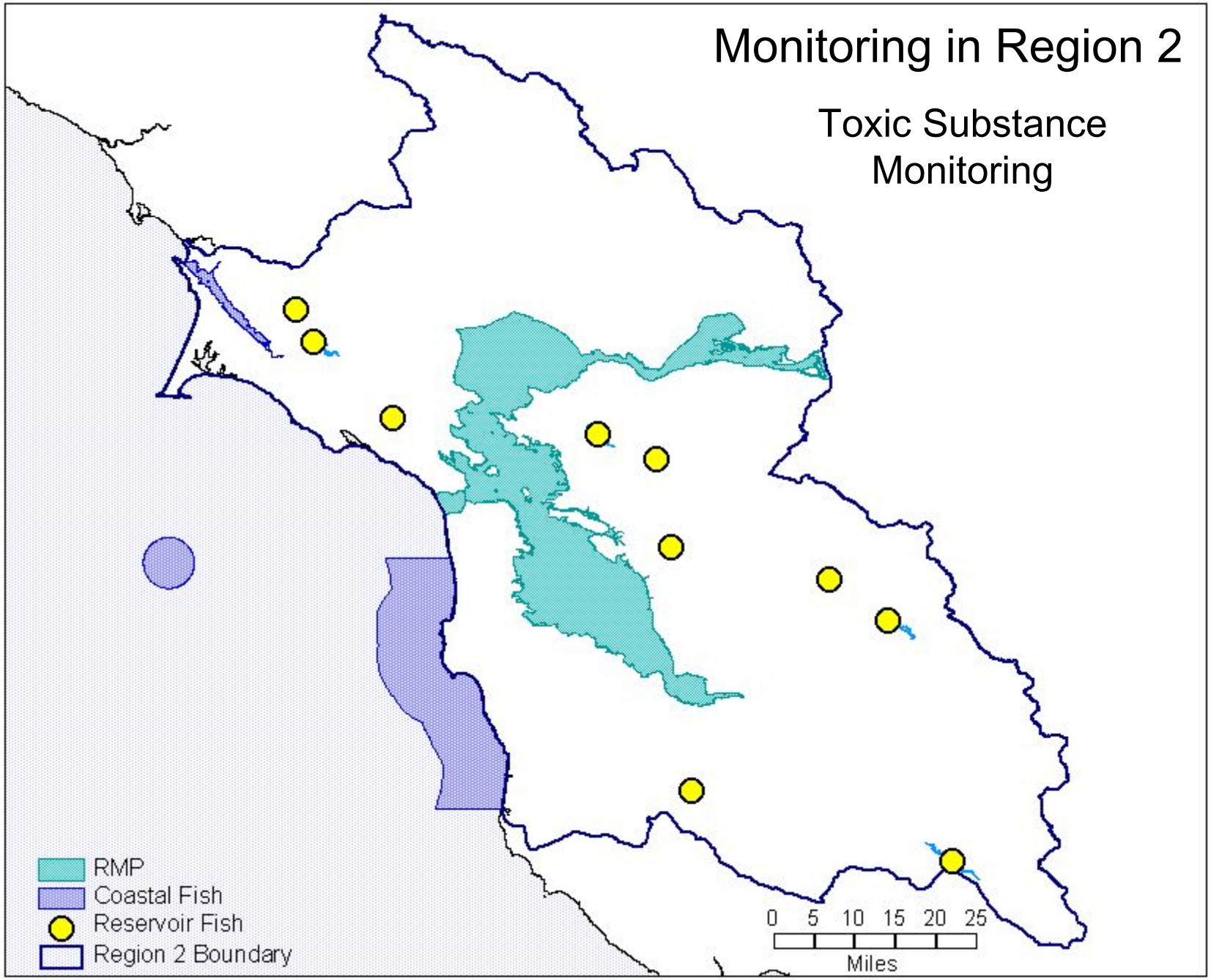
Monitoring in Region 2

Coastal Fish Monitoring



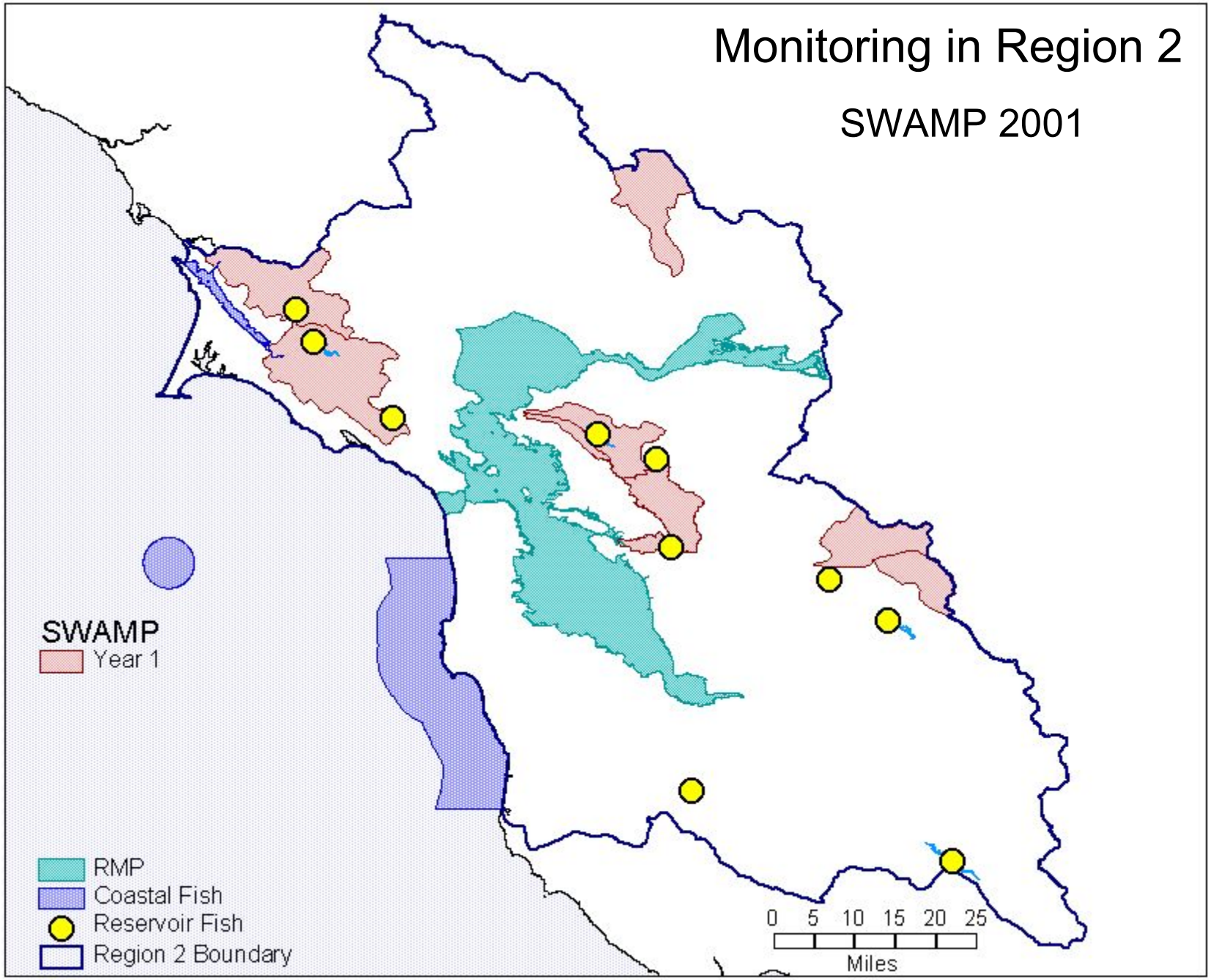
Monitoring in Region 2

Toxic Substance Monitoring



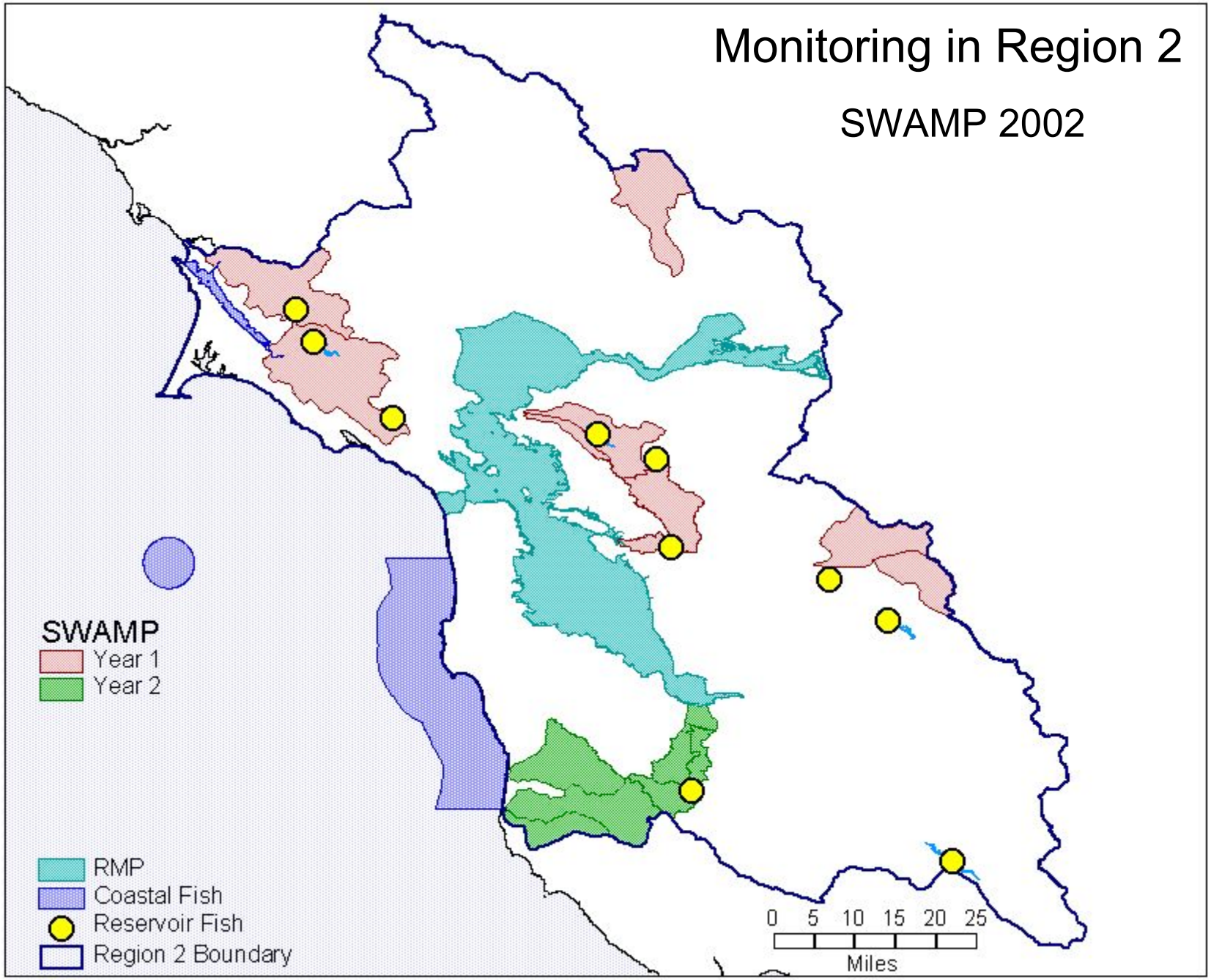
Monitoring in Region 2

SWAMP 2001



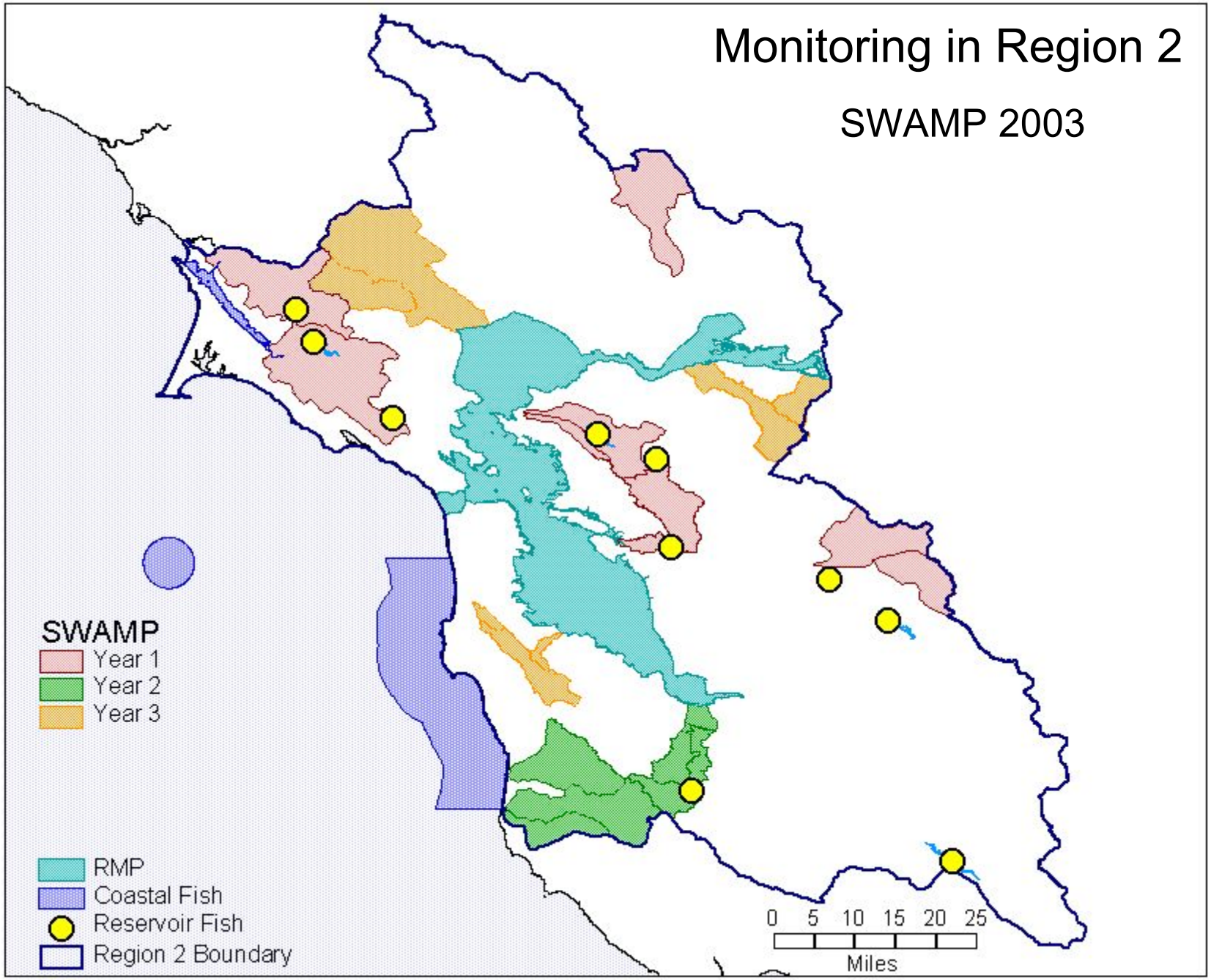
Monitoring in Region 2

SWAMP 2002



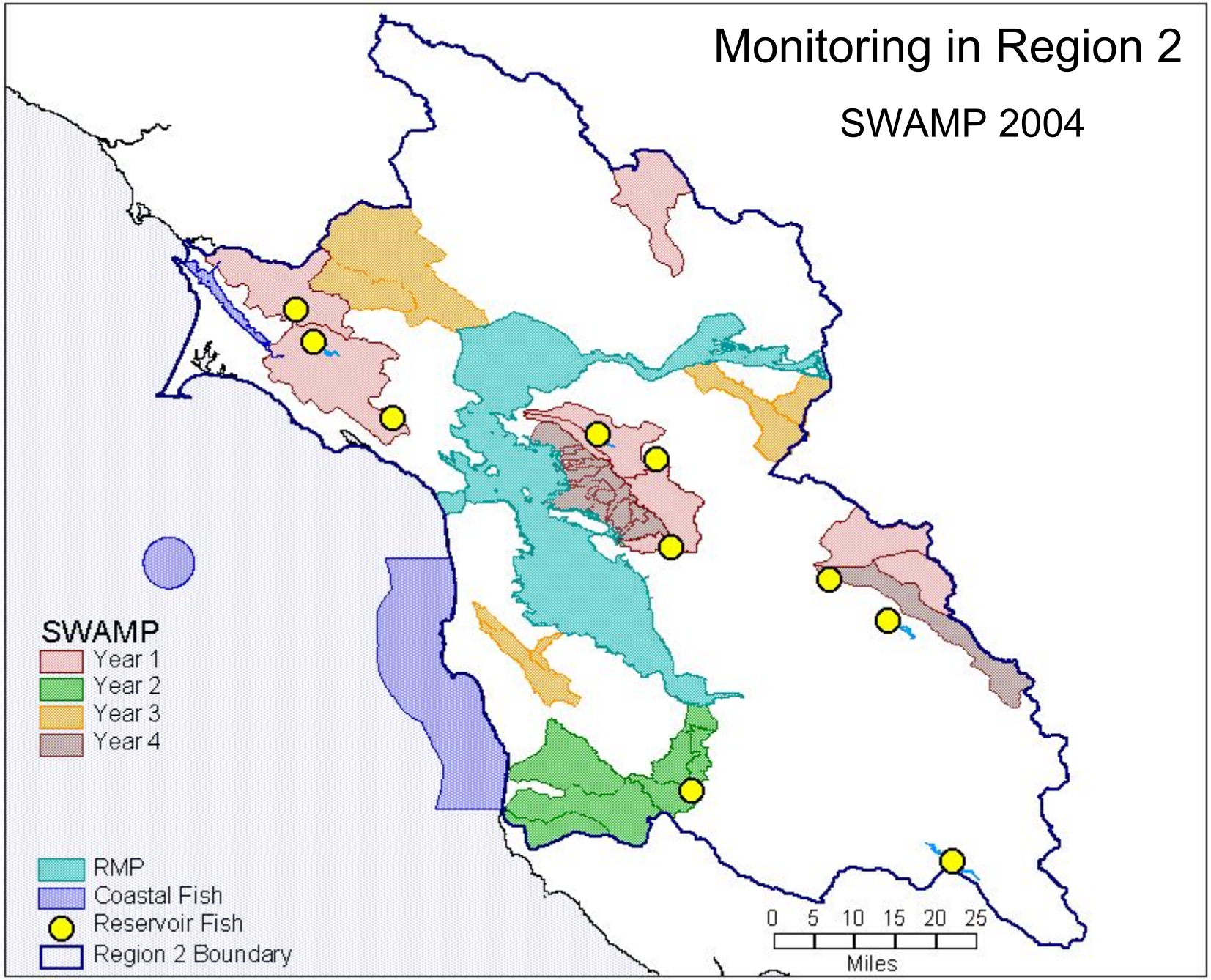
Monitoring in Region 2

SWAMP 2003



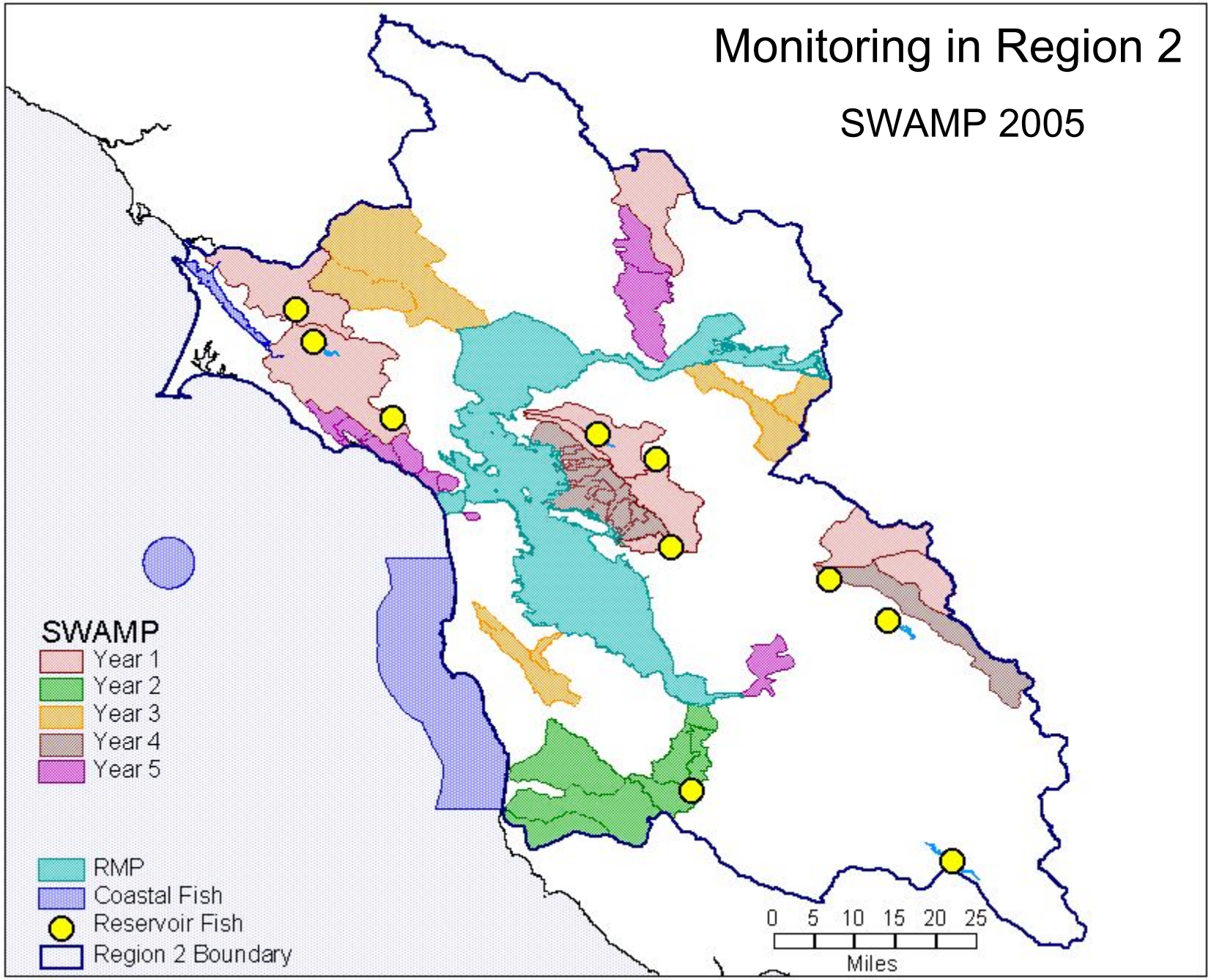
Monitoring in Region 2

SWAMP 2004



Monitoring in Region 2

SWAMP 2005

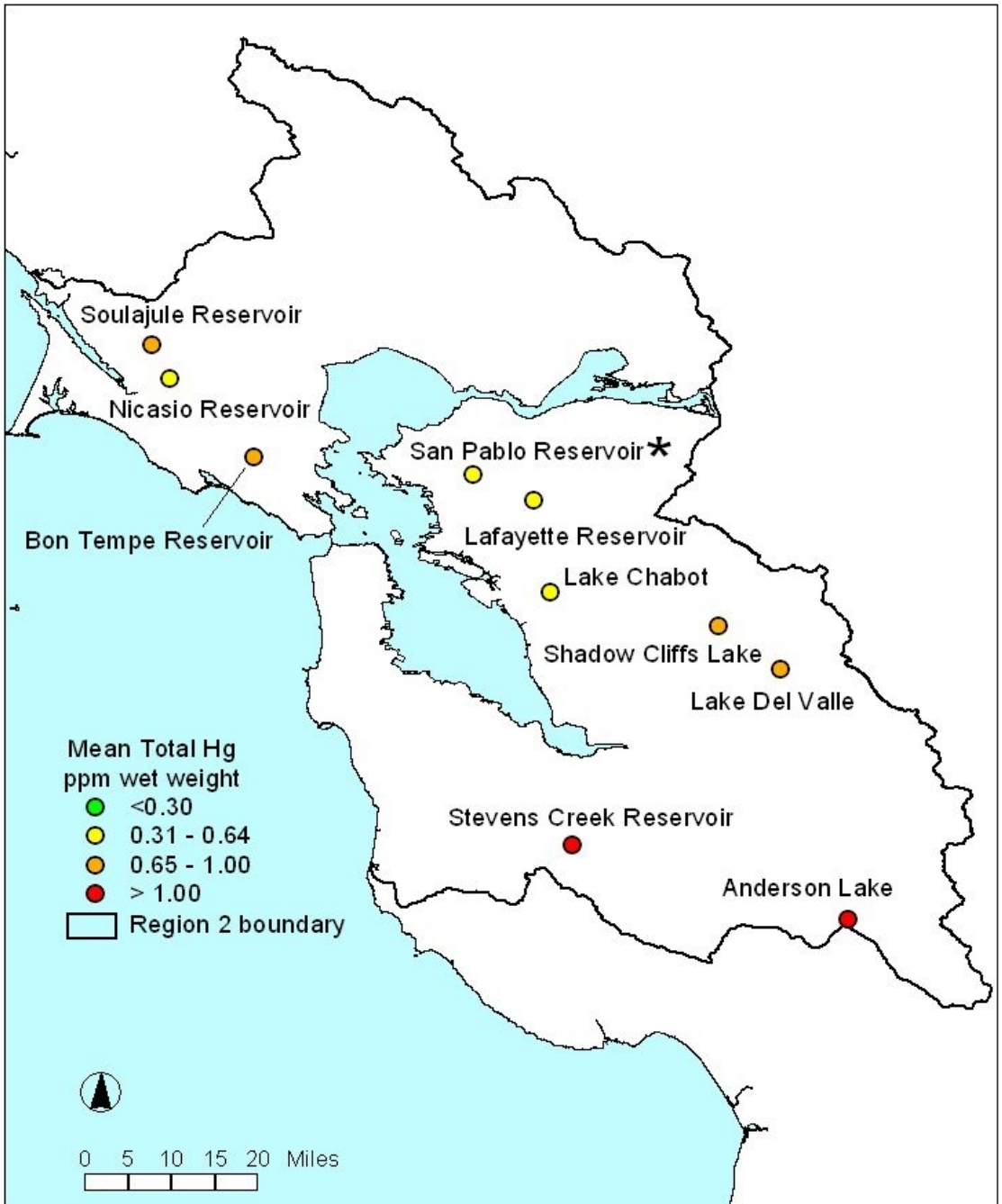


Regional Studies

Fish Sampling for Contaminants (1998 - 2002)

- 10 Reservoirs
- Tomales Bay
- San Mateo coast
- San Francisco coast
- Farallone Islands

Mercury Concentrations in Largemouth Bass



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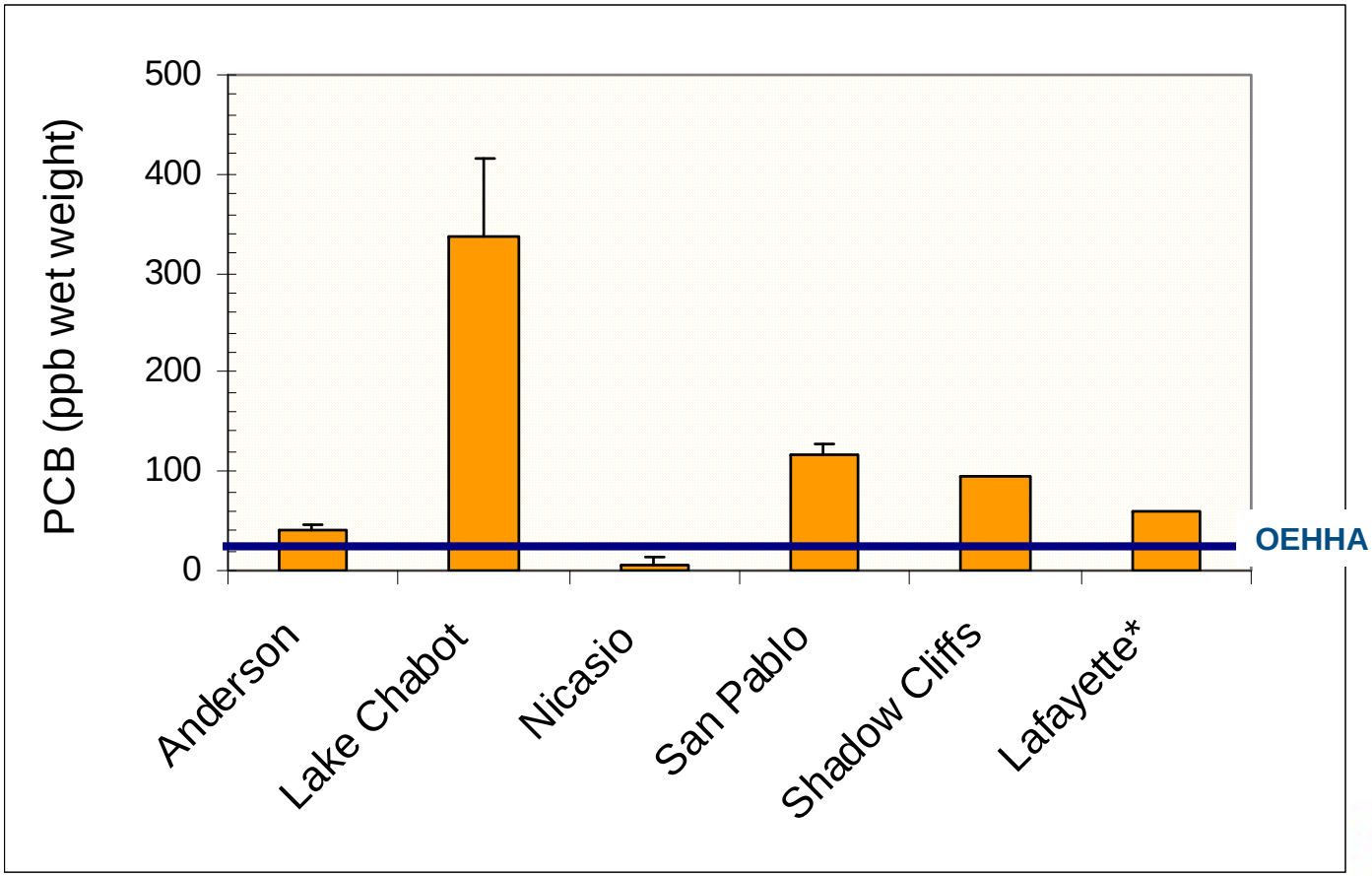
Total PCBs in Carp



* The Lafayette sample was from Goldfish

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Response to Fish Contamination Data

- **Fish Contamination Committee**

Committee Products

- Evaluated data
- Developed fish consumption advisories
- Developed signs and FAQ sheets
- Translated in to 5 different languages
- Joint press release
- Ongoing education and outreach
- 303d list

CONTRA COSTA HEALTH SERVICES

康縣
公共衛生部

食用 SAN PABLO 水庫魚類的臨時衛生警告*

SAN PABLO水庫

Coastal Results

- OEHHA fish consumption advisory for Tomales Bay
  - Based on elevated Hg
  - Does not apply to commercially grown oysters, mussels or clams
- Along San Mateo coast 2 of 4 crab samples and 3 of 11 fish samples had mercury concentrations above SV (0.3 ppm wet wt.). One fish sample exceeded SV for PCBs
- Salmon composites had no SV exceedences

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Regional Objectives for Watershed Monitoring

- Evaluate spatial and temporal trends
- Identify reference areas
- Identify impaired waterbodies
- Determine if impacts are associated with specific land uses
- Develop and evaluate monitoring tools
- Develop assessment tools
- Use standard sampling protocols, SWAMP QAPP and SWAMP database to provide statewide consistency and availability of data

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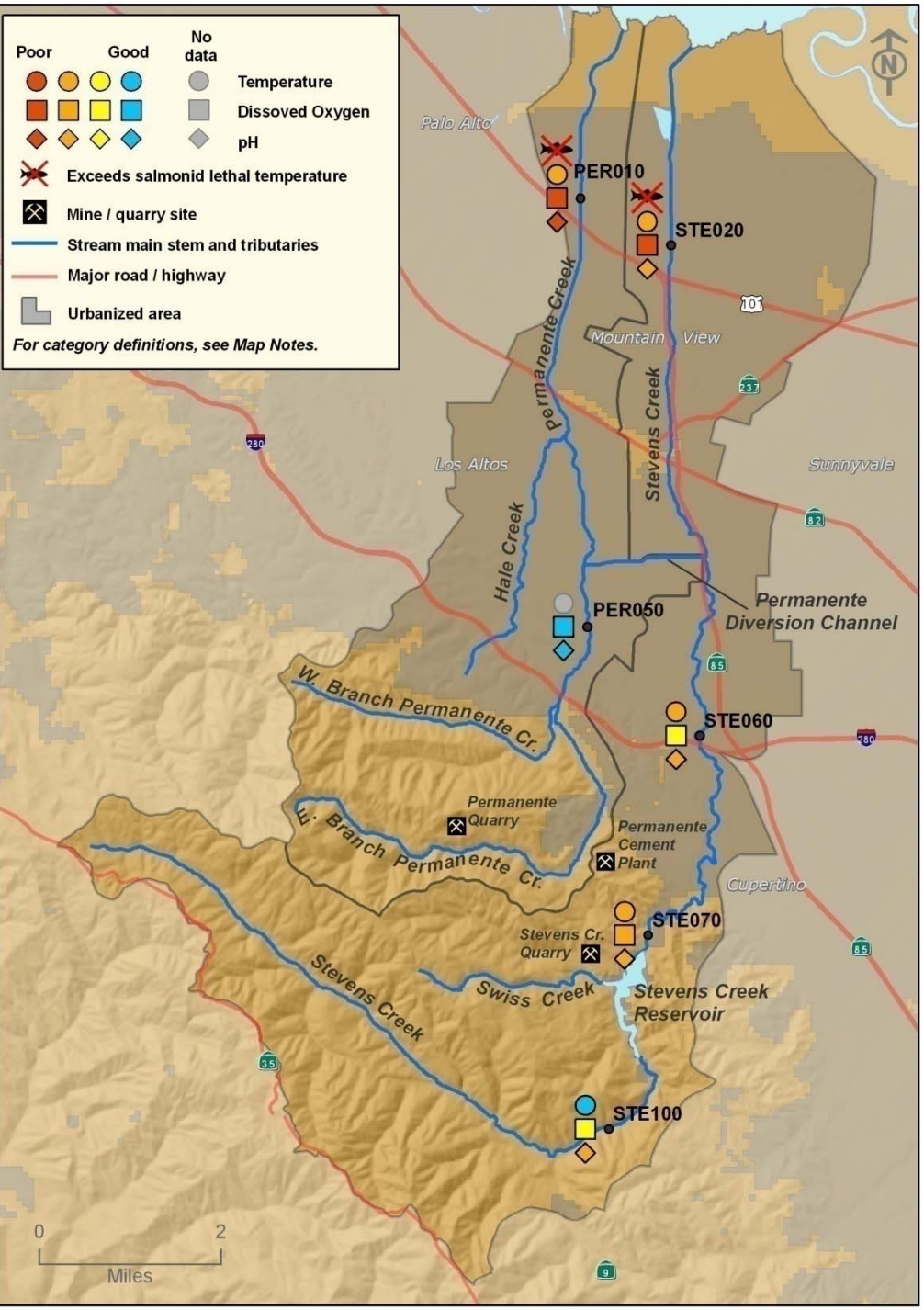
Water Quality Indicators

- Tier 1 (all stations/spring)
  - Bioassessments (benthic macroinvertebrate)
  - Physical habitat assessments
  - Basic WQ parameters
- Tier 2 water (subset of stations/3 hydrologic regimes)
  - Chemical analysis (pollutants)
  - Toxicity (EPA 3 species)
  - Nutrients
  - Continuous WQ measurements (YSI sonde)
  - Trash assessment (RTA)
- Integrator site (bottom of watershed) sediment (chemistry and toxicity), tissue
- E. coli measured at sites with water contact recreation (5x during summer**)**

General Watershed Results

- Water quality problems in streams related to elevated temperature, low DO, elevated nutrients and poor physical habitat
- Nutrients highest in urban creeks
- Contaminants low in ambient water and sediment relative to objectives/guidelines.
- Diazinon toxicity declining in urban creeks, pyrethroid toxicity increasing.
- Most important indicators for ambient monitoring:
  - Bioassessment/PHAB
  - Continuous temperature & DO
  - Nutrients
  - Toxicity (urban/industrial/agricultural)
- BMI assemblages grouped in to 3 land use categories: 1) open space & rural residential, 2) ag/grazing, 3) urban
- High levels of trash were found in all urban watersheds monitored w/ highest levels at the bottom of watersheds
  - Parks, schools, fast food restaurants
- Need reference site study



Stevens/Permanente

Temperature, DO, pH

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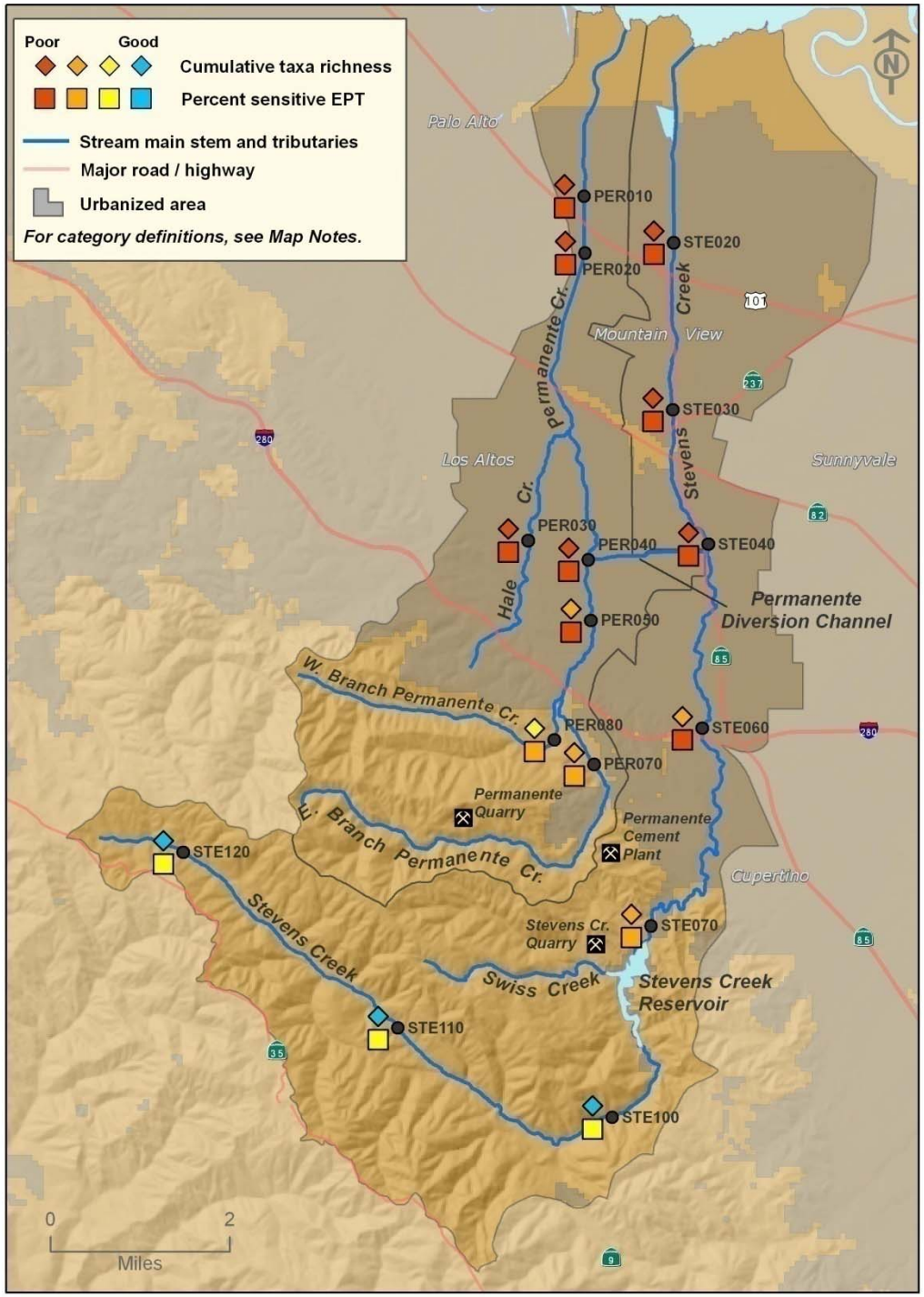

Stevens/Permanente
Bioassessment (BMI)

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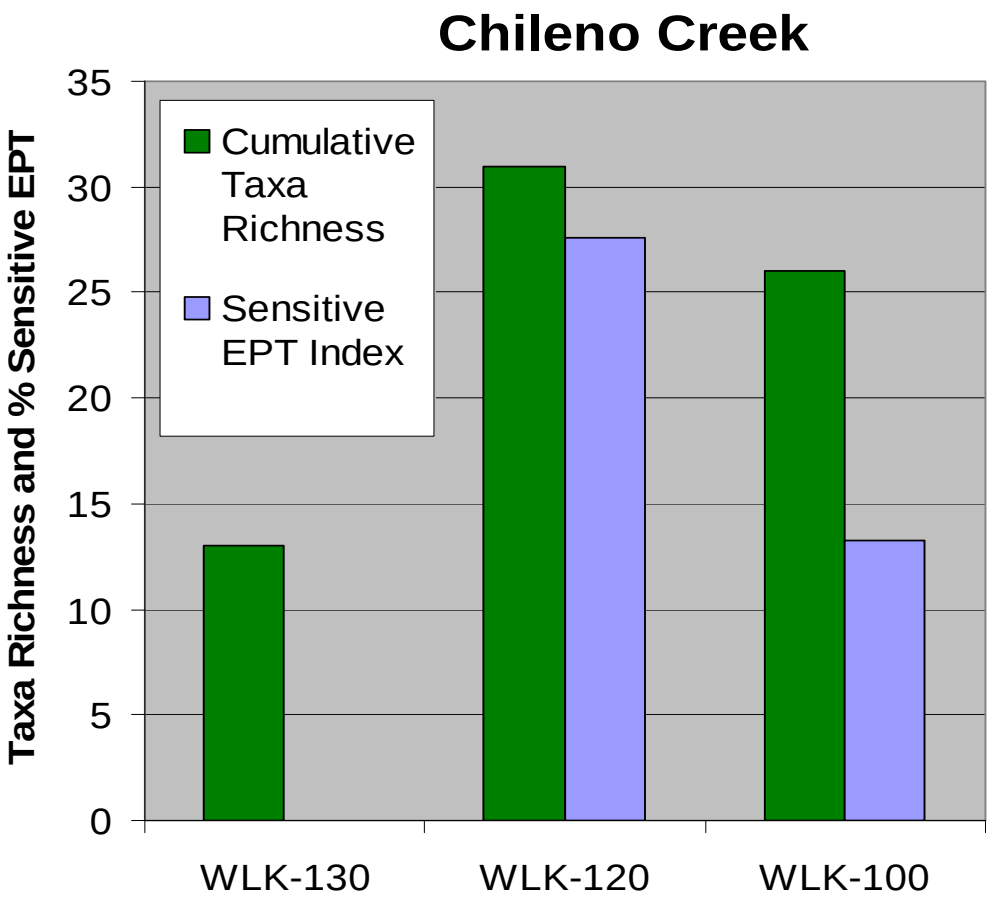
Restoration Effectiveness



2006 & 2008 303d
Existing and proposed listings (50 listings)

- Trash (26 listings based on SWAMP revised RTA, 11 based on SWAMP data)
- Arroyo Mocho – temperature
- Codornices – temperature
- Kirker – pyrethroids
- Mount Diablo – water toxicity
- Permanente – Se, water toxicity
- San Mateo – sediment toxicity
- Suisun – DO, temperature
- Stevens – temperature, toxicity (2006)
- 2006 listings based on fish contamination
  - Lake Chabot, Stevens Creek, Anderson, Del Valle, Lafayette, Nicasio, San Pablo, Shadow Cliffs, Soulejule, Stevens
  - Pillar Point

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Region 2 SWAMP 2008 Current /Future Monitoring

1. Reference site study
   - Describe and track reference condition
     - Long-term and seasonal trends
     - IBI development (BAMBInet)
     - Urban “best attainable”
   - Develop better assessment tools
     - Nutrients – threshold development
     - algae
     - PHAB- flexigrid
   - Future – Watershed Monitoring Coalition
2. Develop information for OEHHA fish consumption advisories (follow-up on BOG statewide study)
3. Suisun Bay study
   - Relationships: ammonia and phytoplankton
   - Sources of ammonia

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Reference site study design

- 6 Reference sites selected
  - Ecoregion
  - Perennial/intermittent
  - Size of creek
- 2 urban creeks “best attainable” gradient (3 sites on each)
- Indicators + frequency
  - BMI + PHAB 1x yr (May)
  - Algae + PHAB 3x yr (May/June/August)
  - Nutrients 6x yr (May/June/August/Oct./Dec./Feb.)
  - Continuous DO, temp, pH, conductivity (May- Sept.)

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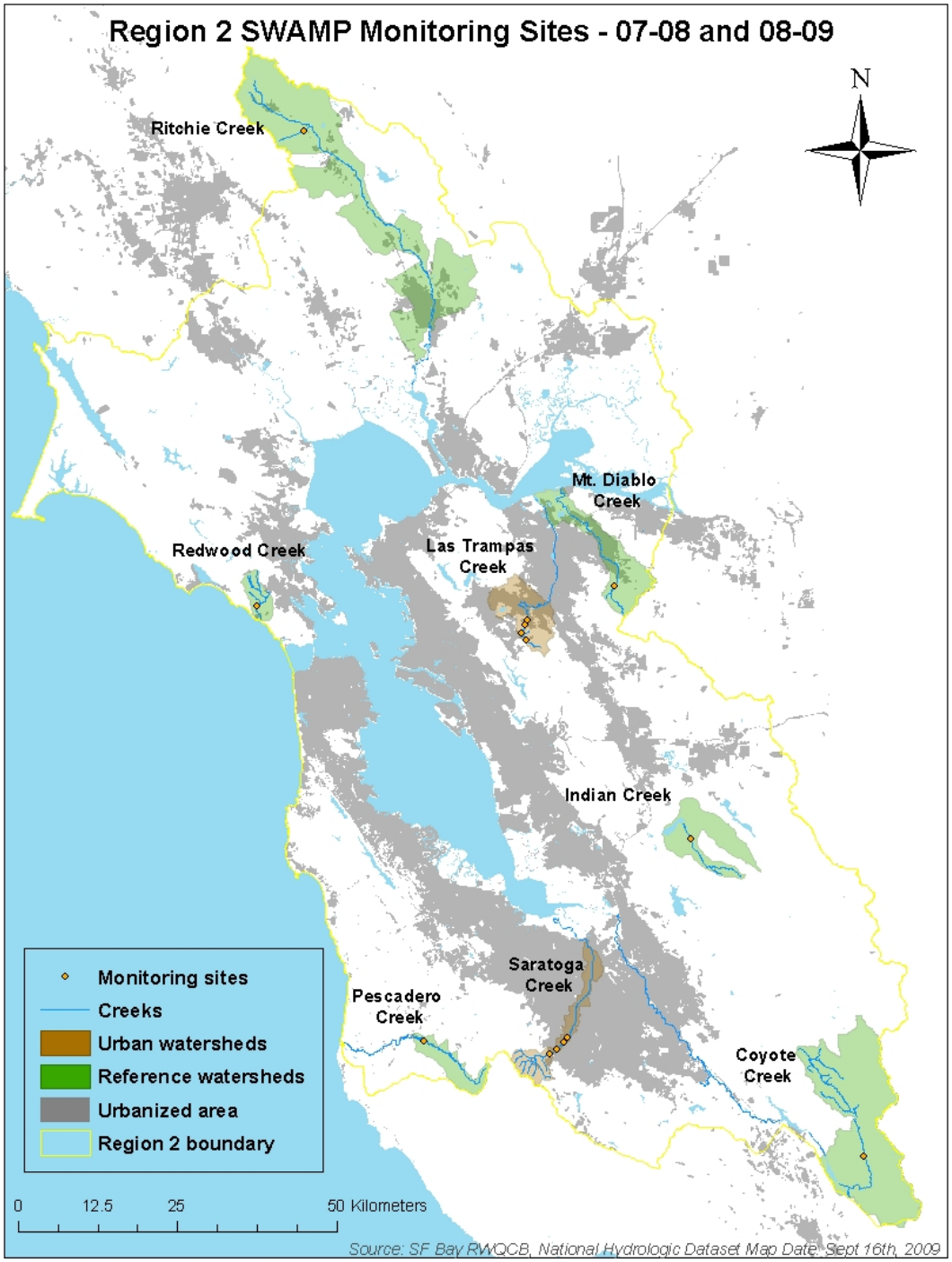

Map of Regional Reference Sites

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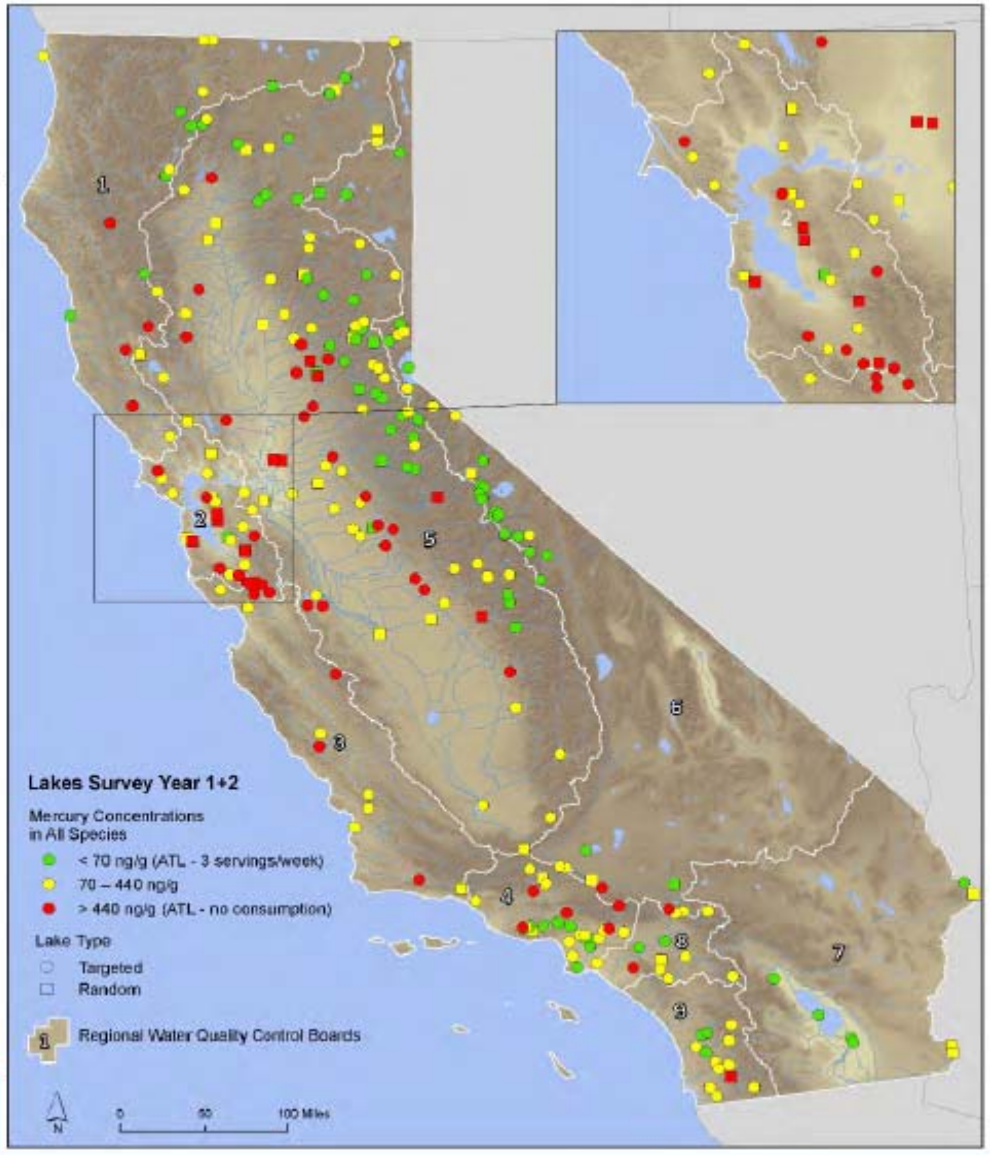
SWAMP BOG Study Bioaccumulation in sportfish from lakes
Mercury in largemouth bass



- Follow-up in coordination with OEHHA
- 4 Lakes/yr for advisory information

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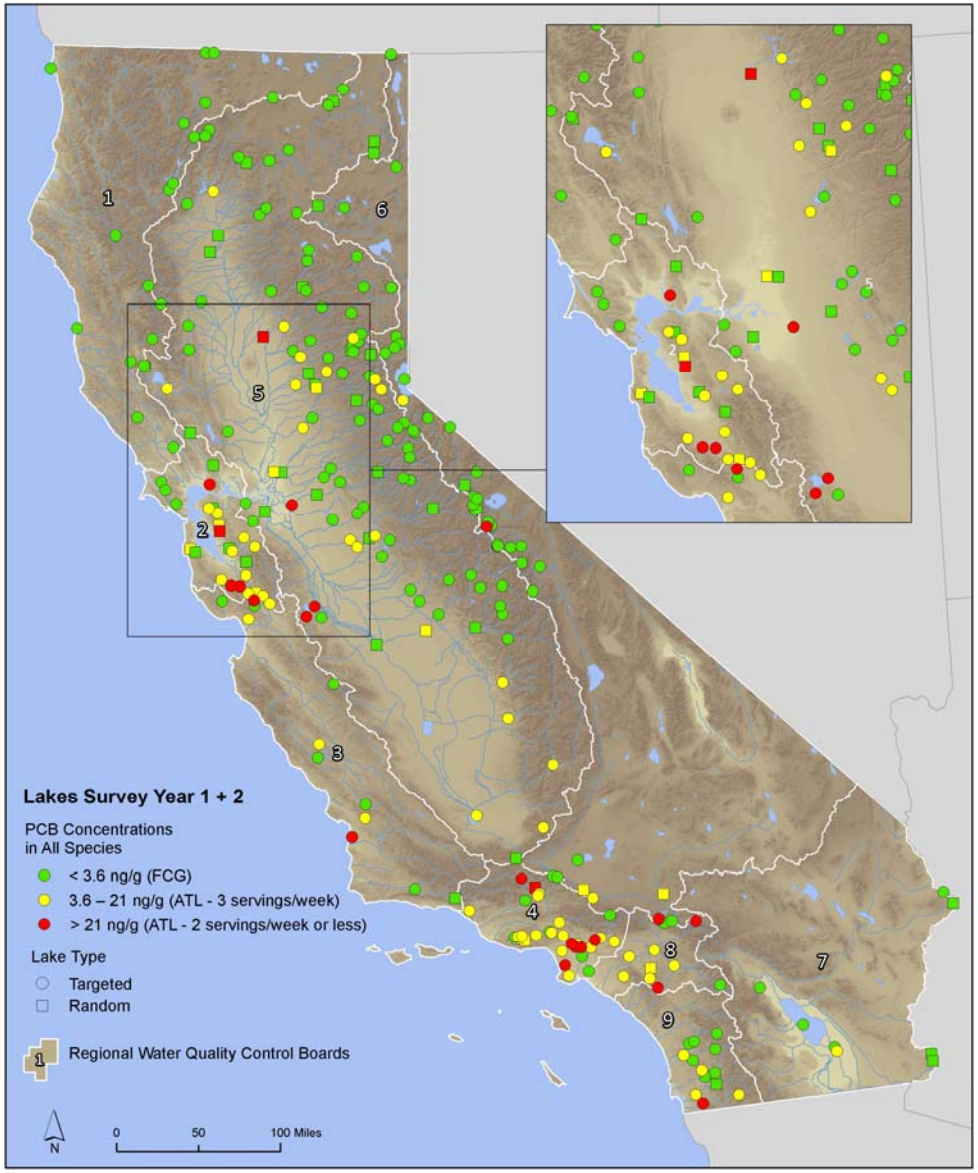
PCB concentrations in all species



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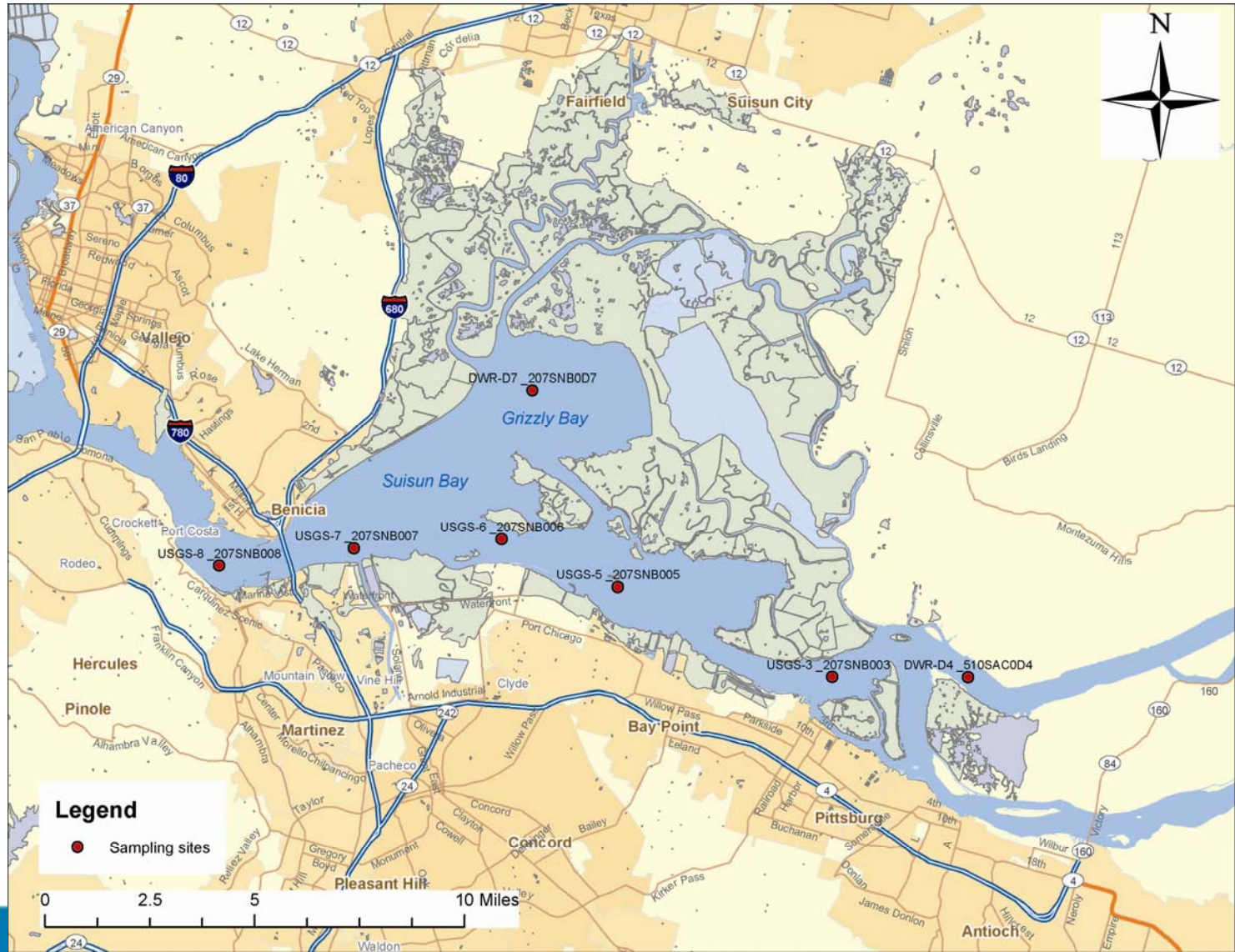
Suisun Bay Study

- Timing
  - 1x week
  - 12 weeks (March – June
- Indicators
  - nutrients
  - chl a
  - algae tax



Region 2 Reports

- *Chemical concentrations in fish tissues from selected reservoirs and coastal areas in the San Francisco Bay Region* (2005).
- *Water quality monitoring and bioassessment in nine San Francisco Bay region watersheds in 2001-2003;Walker, Lagunitas, San Leandro, Wildcat/San Pablo, Suisun, Arroyo Las Positas, Pescadero, San Gregorio, Stevens/Permanente* (2007).
- *Water quality monitoring and bioassessment in four San Francisco Bay region watersheds 2003-2004; Kirker, Mt. Diablo, Petaluma, San Mateo* (2007).
- *Water quality monitoring and bioassessment in selected San Francisco Bay Region watersheds in 2004-2006* (2008)
- *A rapid trash assessment method applied to waters of the San Francisco Bay Region: trash measurement in streams* (2007).
- *2008 Integrated Report; 303(d), 305(b)* (2009).

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R2 SWAMP Comparability

Need Help???

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We'll give you a hand

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Under the SWAMP umbrella
Comparability

- Internal R2 SWAMP comparability
  - 2009 Algae training
  - 2 hour Brown Bag for R2 staff
  - Lab contract
  - Division meetings
- SF Estuary RMP
  - SWAMP comparable
  - Contributed to BOG study
- Municipal Regional Stormwater Permit (MRP)
  - SWAMP comparable
  - Builds on SWAMP design
  - Watershed Monitoring coalition
    - SWAMP monitors
      - ✓ Reference sites
      - ✓ “Bottom of watershed” long-term sediment toxicity & chemistry

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Regional Monitoring Program

- Founded in 1993 & administered by SFEI

- History
- Budget
- Structure
- Program elements

The Big Stick

- 1986 SF Bay Basin Plan with toxic pollutant standards
  - By 1987, $1.2 billion on infrastructure upgrades
  - Almost no data to judge whether management actions were effective in meeting WQ standards
- Section 13267 CWA requests on June 12 1992
  - Part of the NPDES and dredging permits

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The Big Carrot

- Reduction in required receiving water monitoring
  - 48 permit holders participated in collaborative 1st year (1993)

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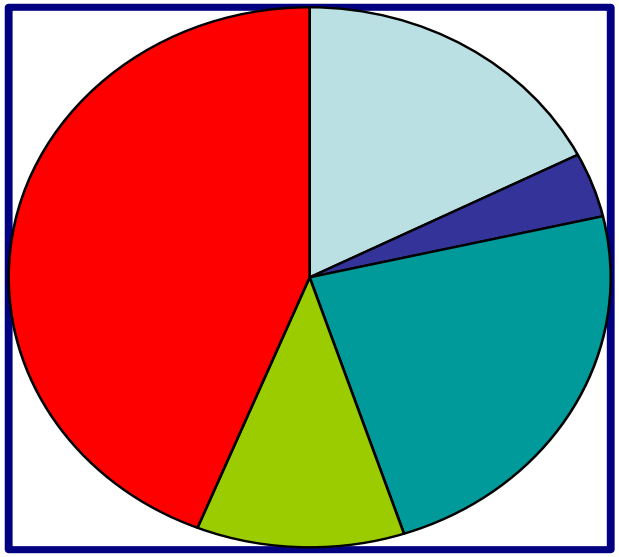
Contribution by Sector

Allocation of Fees



- Dredging (17.5%)
- Cooling Water (4%)
- Stormwater (23.5 %)
- Industrial (11%)
- Municipal (44%)

Funded by NPDES dischargers & dredgers

- RWQCB issues permits; MOU with SFEI for fees
- Total budget 2009: ~ $3.9 million

RMP Structure

Steering Committee

Technical Review Committee

- RWQCB Reg. 2
- POTWs (EBMUD & SFPUC)
- Refineries
- Stormwater Agencies
- USEPA
- City of San Jose
- South Bay Dischargers
- Industry (USS POSCO Steel)
- City and County of SF
- US Army Corps of Engineers

RMP Structure

Steering Committee

Technical Review Committee

4 Workgroups

Sources Pathways & Loading

Contaminant Fate

Exposure & Effects

Emerging Contaminants

6 Strategies

- Mercury
- PCBs
- Dioxins
- Modeling
- Air deposition
- Small Tributary loading

One Goal…

Collect data and communicate information about water quality in the San Francisco Estuary to support management decisions

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… and many Management Questions

- **MQ1:** Are chemical concentrations in the Estuary potentially at levels of concern and are associated impacts likely?
- **MQ2:** What are concentrations and masses of contaminants in the Estuary and its segments?
- **MQ3:** What are sources, pathways, loading, and processes leading to contaminant related impacts in the Estuary?
- **MQ4:** Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?
- **MQ5:** What are the projected concentrations, masses & associated impacts of contaminants in the Estuary?

How does the RMP answer MQs?

Status & Trends Monitoring (1993 -)

Sediment and water (annually)
Bivalves (every 2 years)
Sport fish (every 3 years)
Bird eggs (every 3 years)

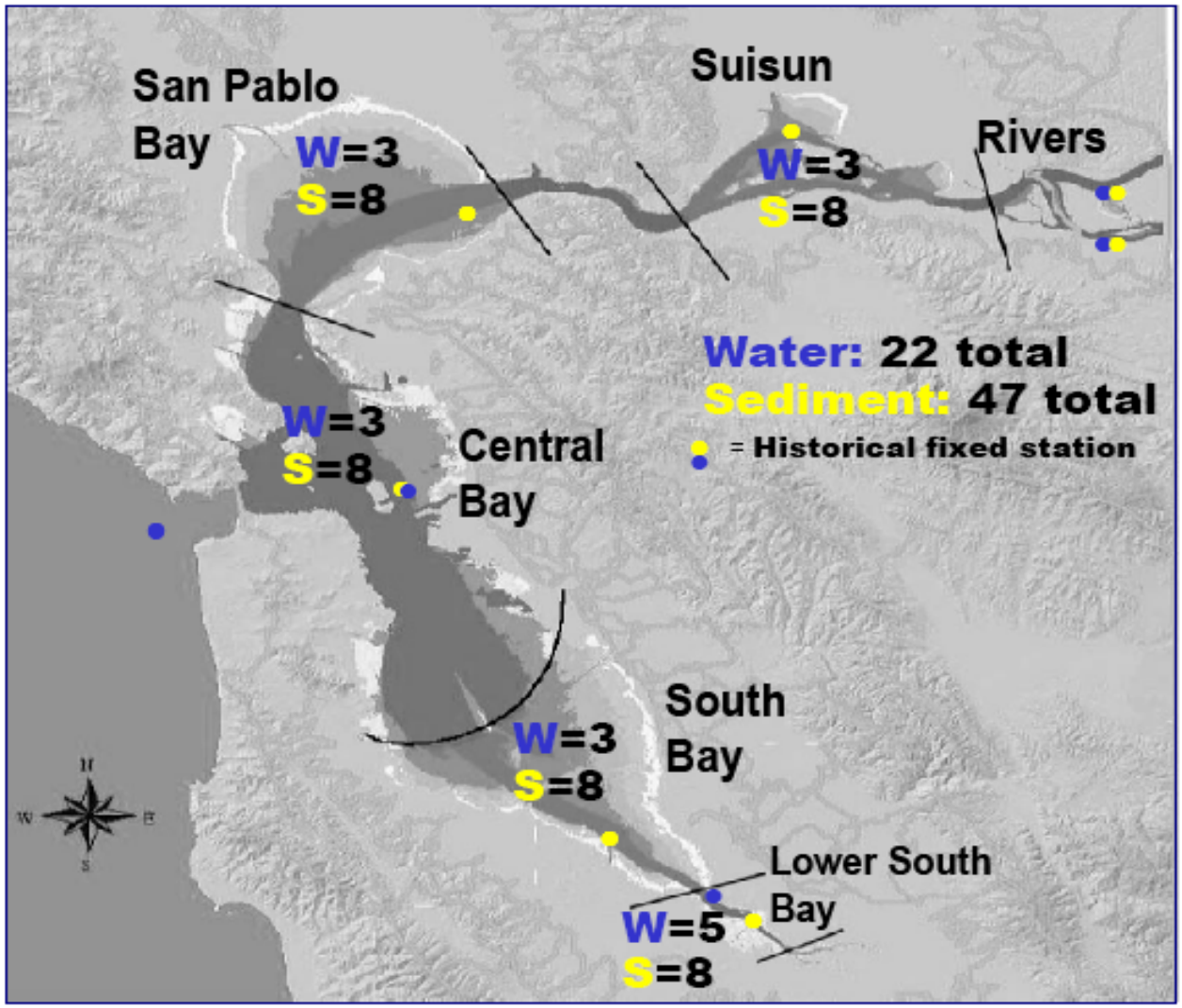
Pilot and Special Studies

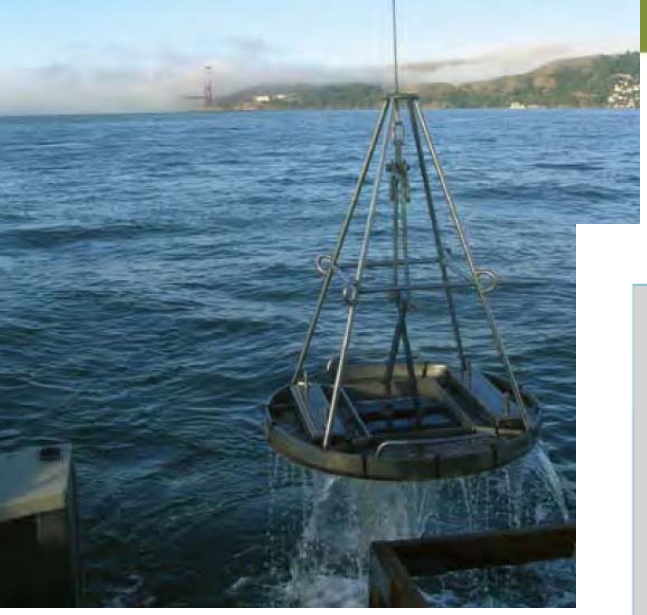
- Provides framework for adaptive management
- Responsive to changing needs

Status and Trends
Water and sediment

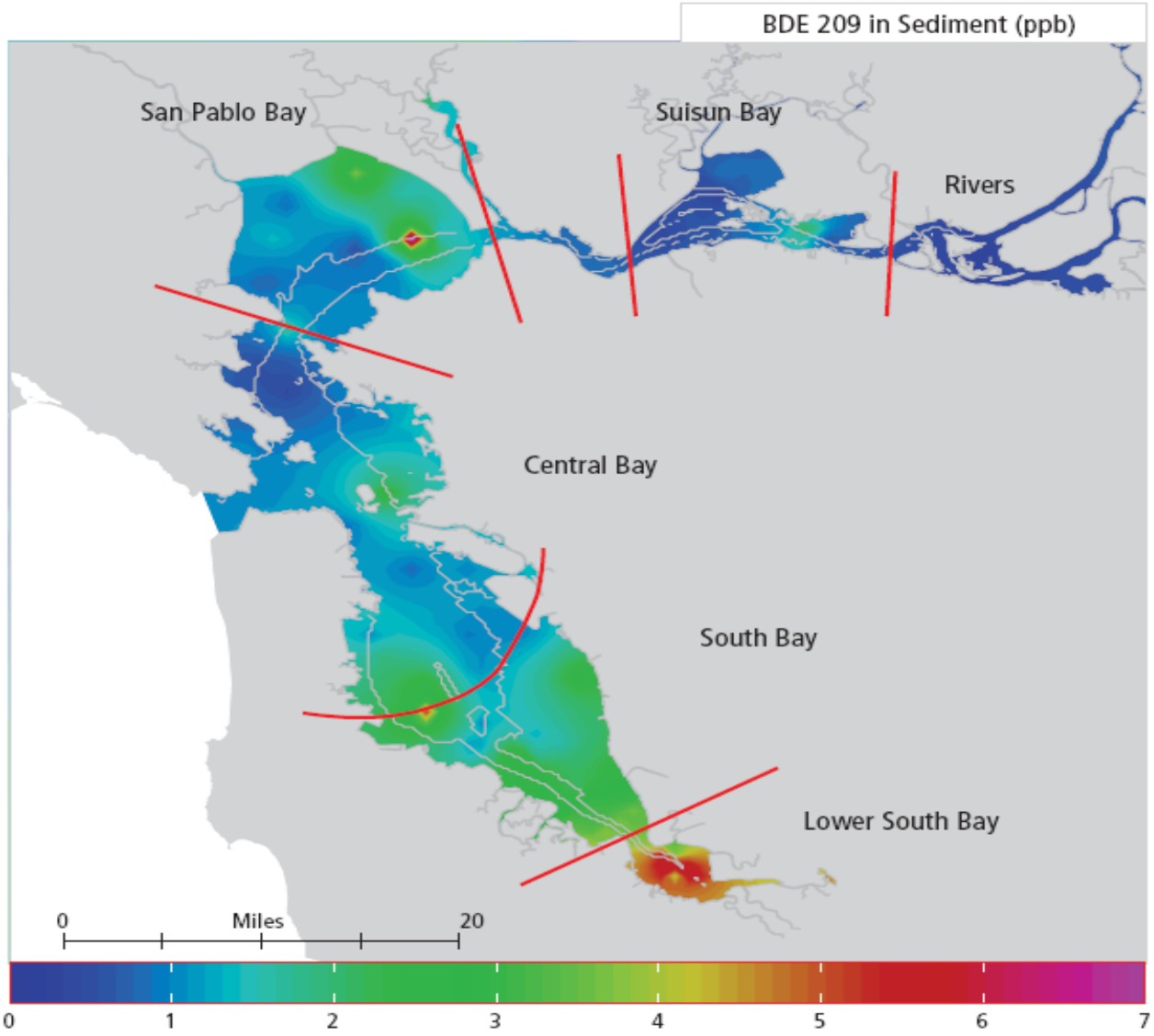
Water chemistry
- annually summer

Sediment
- toxicity
- chemistry
- benthos
- annually
- summer/winter

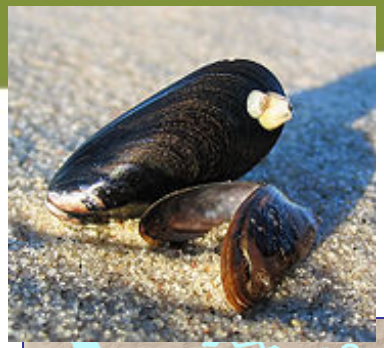




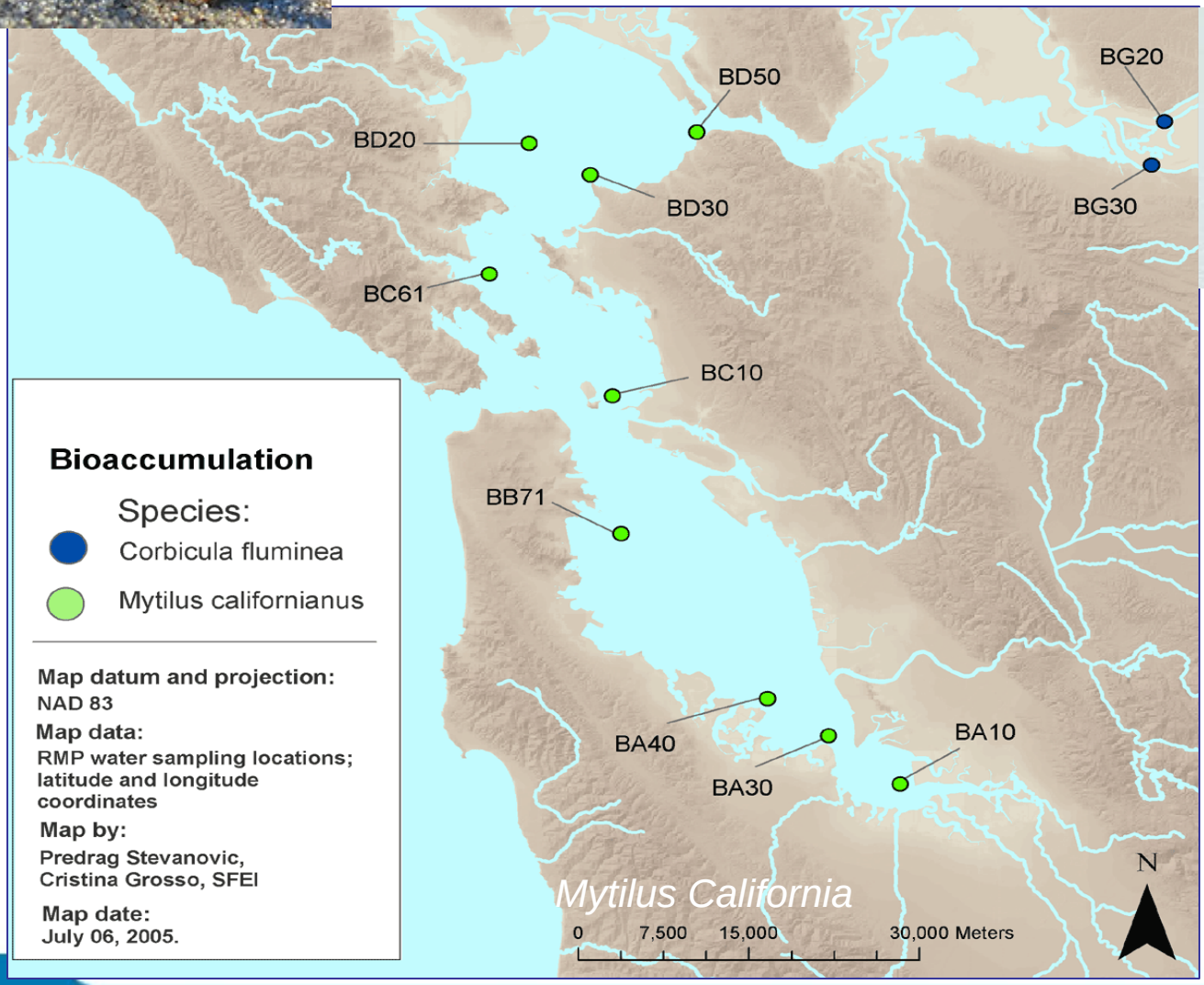
Status & Trends
Sediment monitoring results



Footnote: BDE 209 shown as an index of the "deca" PBDE mixture. Plot based on 135 RMP data points from 2004, 2006, and 2007 maximum concentration was 52 ppb in San Pablo Bay in 2007.



Status &Trends
Bivalve Monitoring



- **11 Sites (all historical RMP)**
- **Organics and inorganics**

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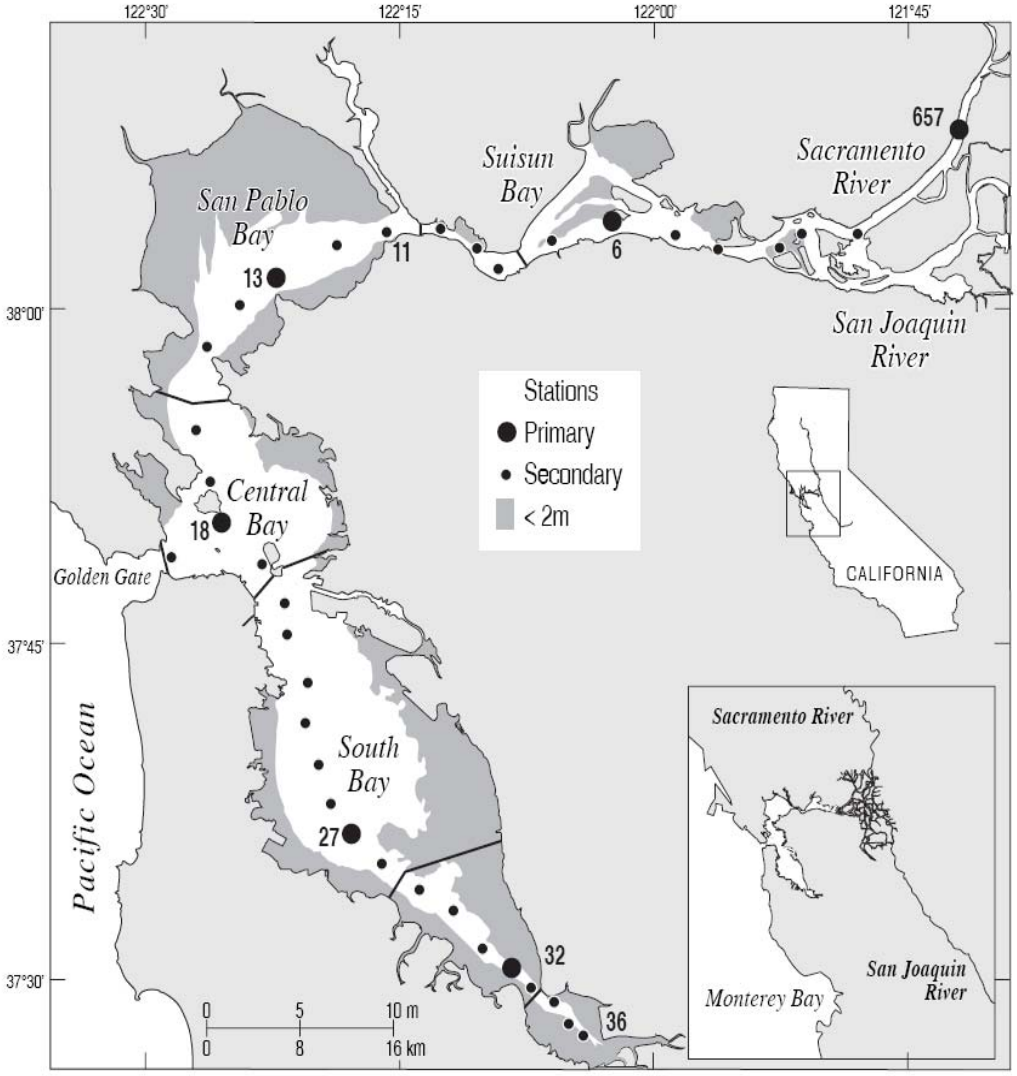
Status and Trends

36 sites monthly nutrients, chl a & basic WQ
5 sites continuous suspended sediment (USGS)



Status and Trends
Bird Egg Monitoring

Cormorants better for trend monitoring of average condition in the Bay (larger range and prey)

- Hg, Se, PBDEs, PCBs, pesticides & emerging contaminants

Terns better for effects-oriented monitoring (high exposure, shallow habitat)
TMDL target for mercury
Hg, Se, PBDEs

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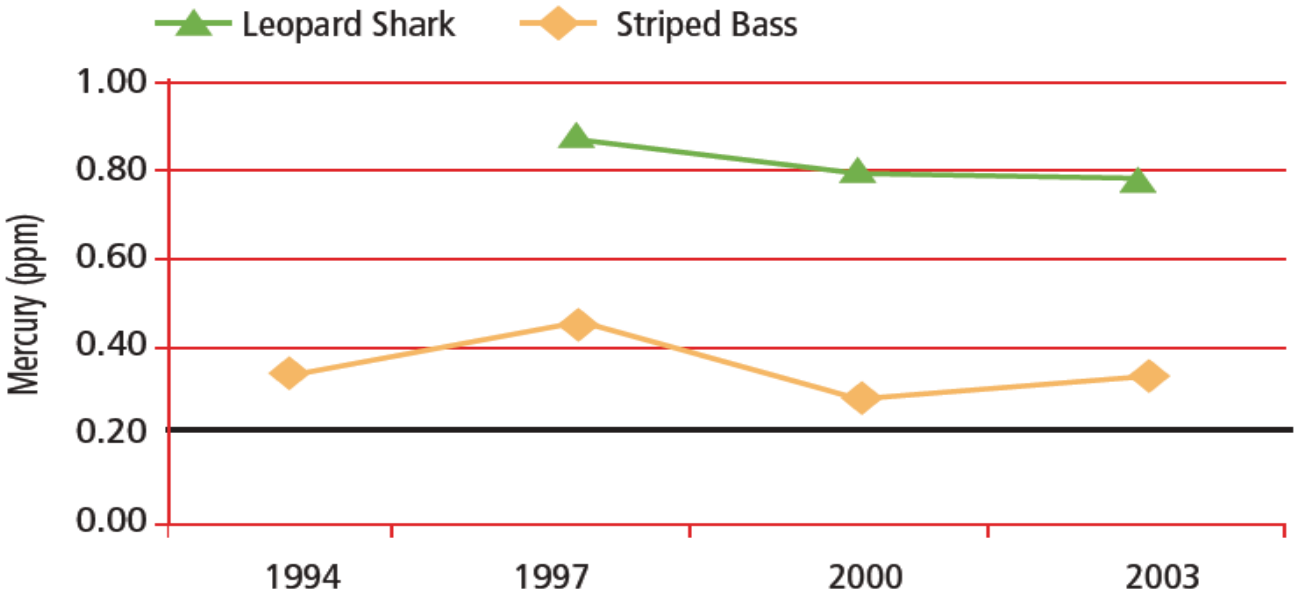
Status and Trends
Sportfish Monitoring

- Monitoring to inform management actions (TMDLs, advisories)
  - PCBs, PBDEs, PAHs, dioxin, pesticides, Se, Hg, emerging contaminants

Figure 1. RMP fish sampling locations in San Francisco Bay in 2006.

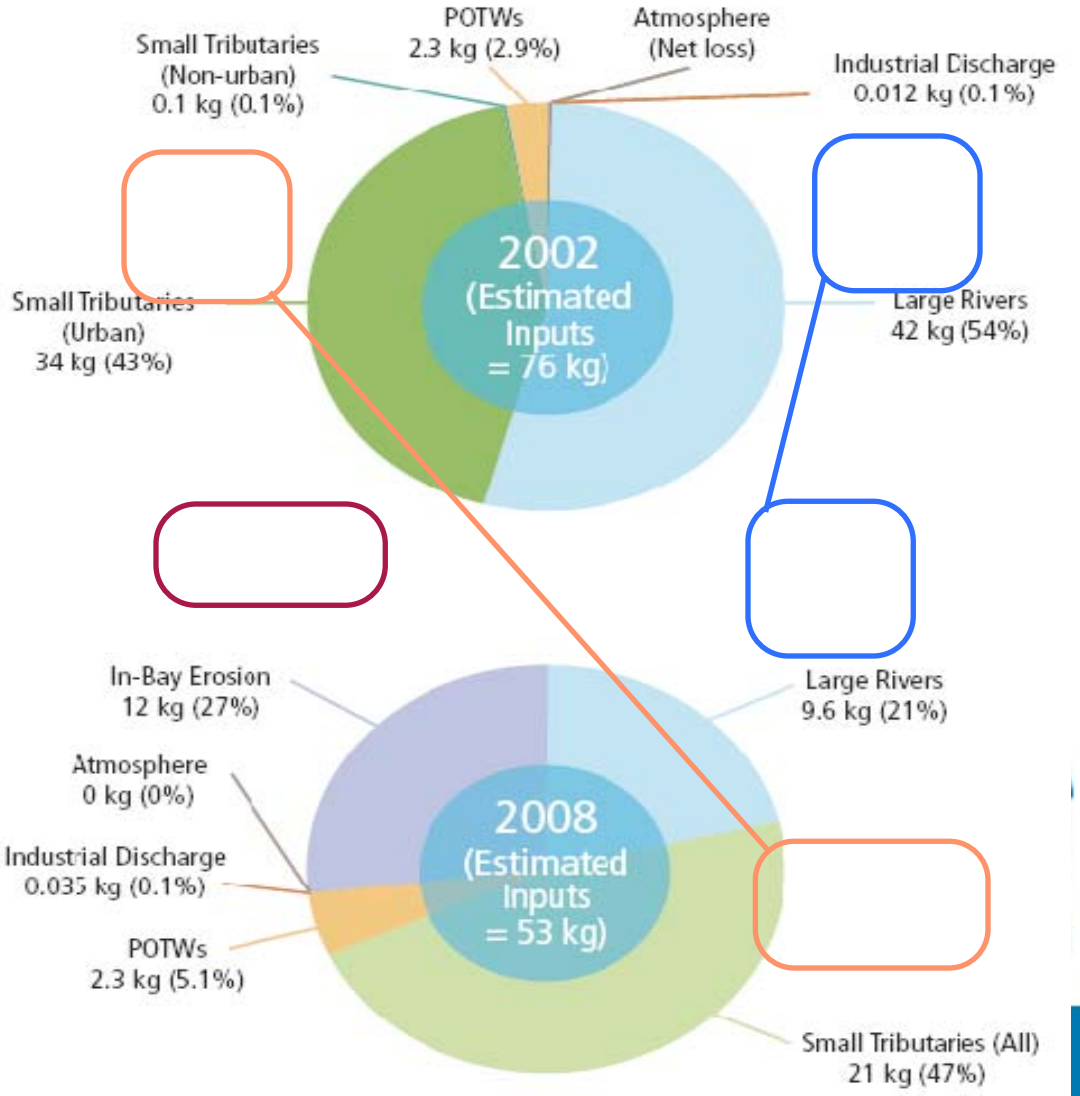


Status and Trends

Tributary Monitoring

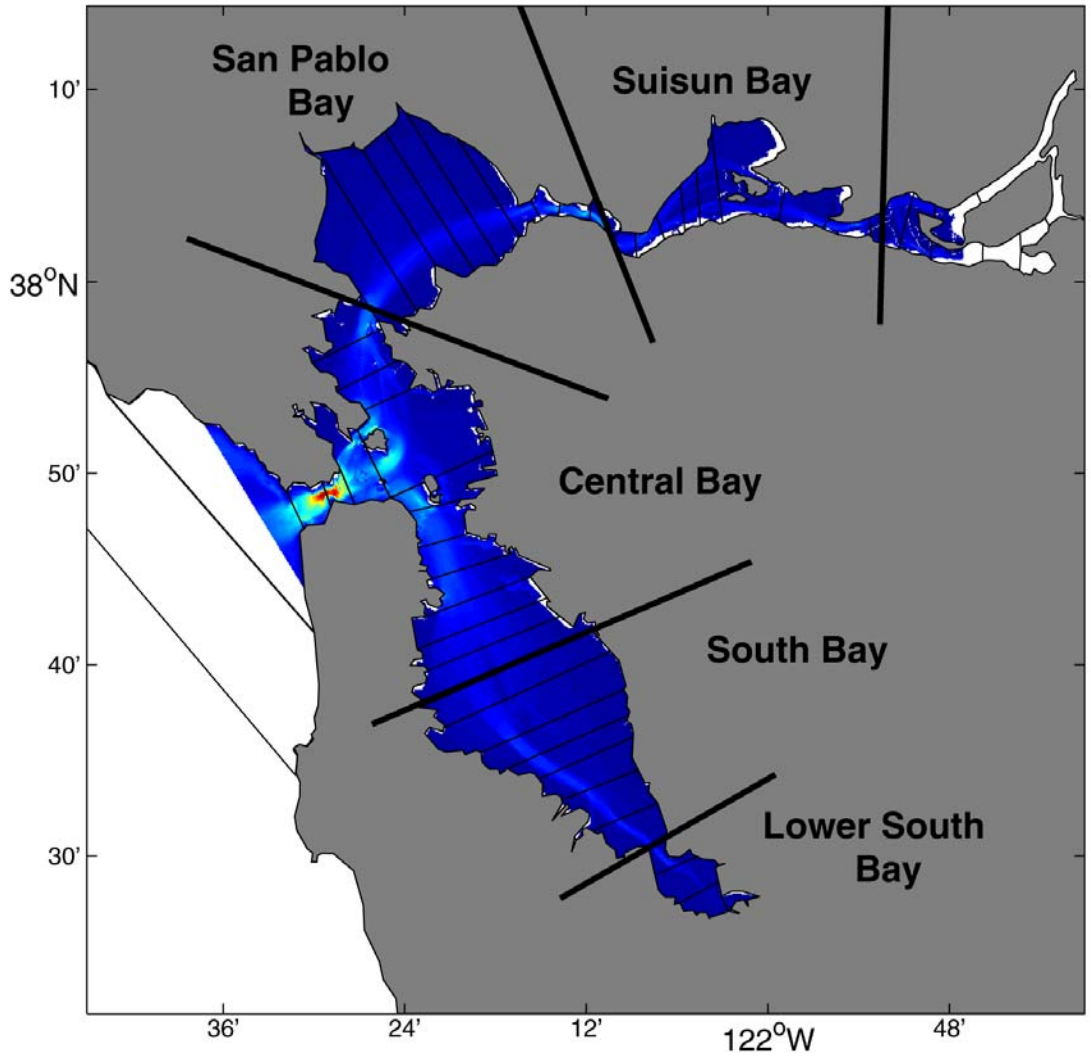
Changing Our Understanding of Loads to the Bay (PCBs)

- Loading information (Sacramento, Guadalupe & small urban creeks
- Modeling important for TMDLs (Hg and PCBs)

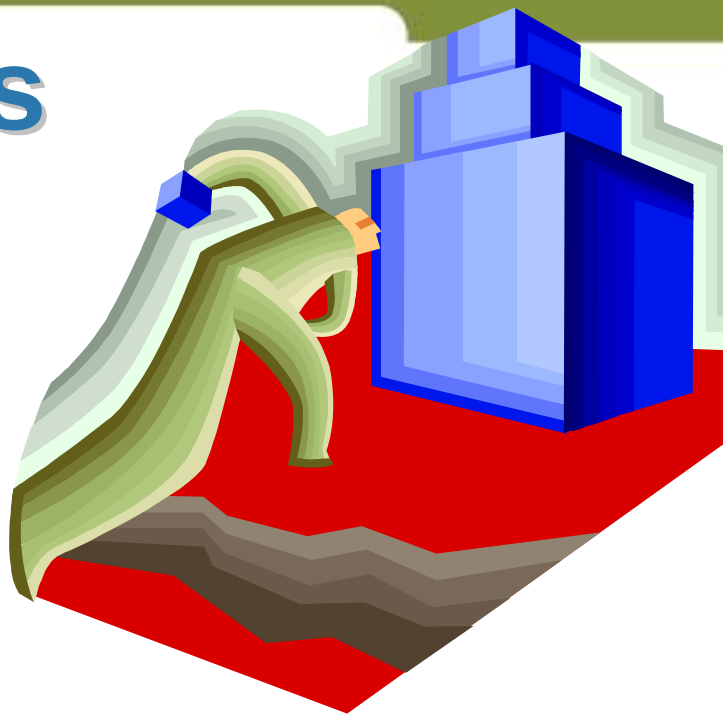


RMP Models

- Foodweb model for PCB TMDL
- Multibox mass budget model
- Watershed/Bay margins model (South Bay)



Strategies



- Strategies for key management issues:
  - Mercury, dioxin, PCBs, modeling, small tributary loading and air deposition
- Mercury strategy
  - Annual S&T (sediment, water, fish, and birds)
  - Special/pilot studies (small fish, isotopes, DGTs)

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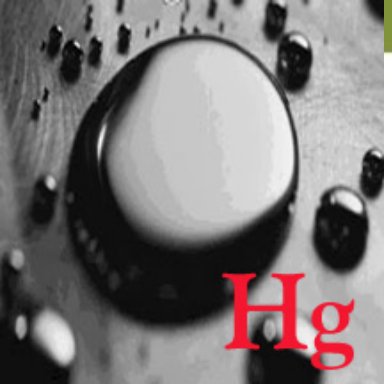


Mercury Strategy

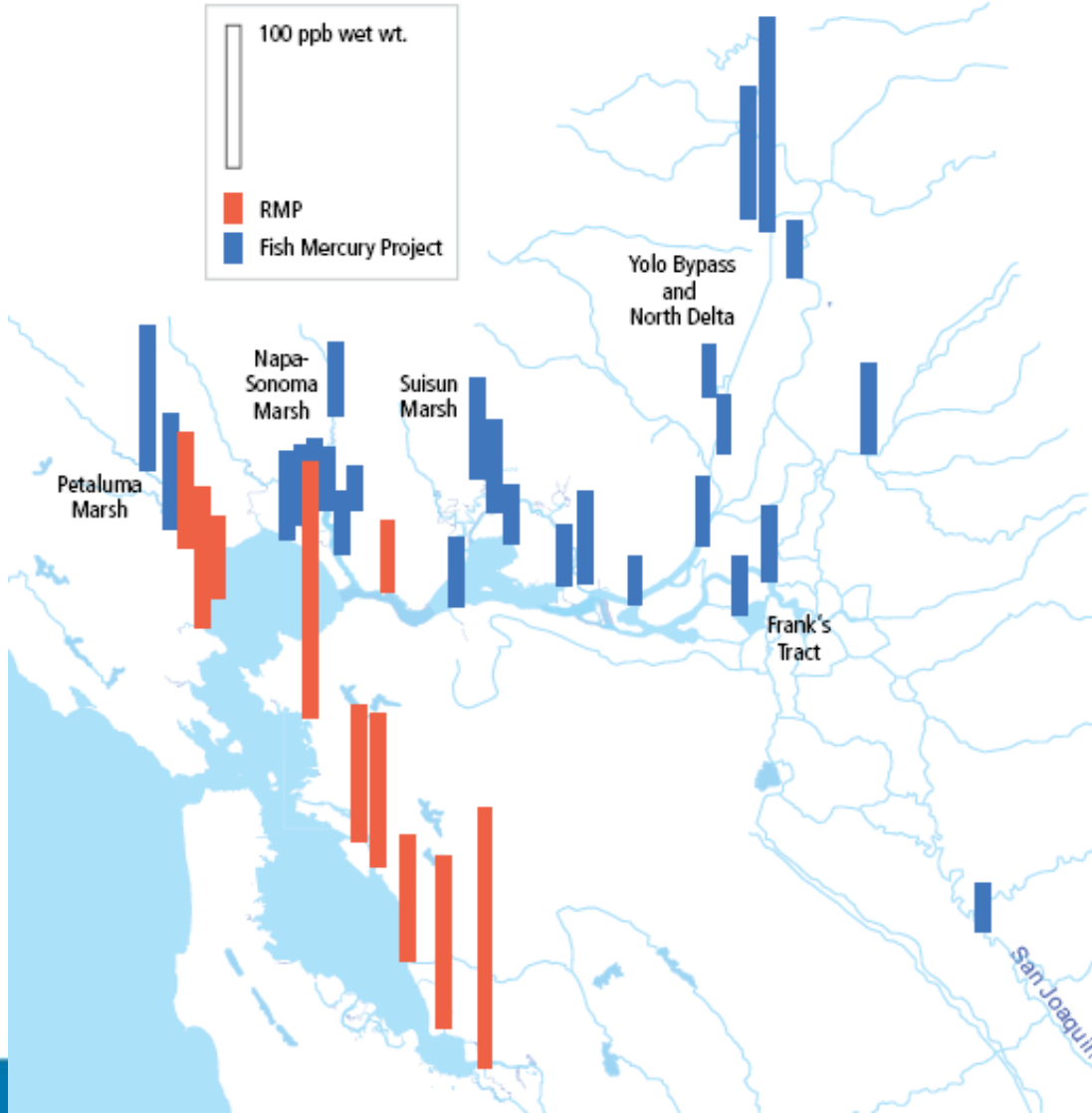
Key questions:

- Q1 Where is mercury entering the food web?
- Q2 Which processes, sources, and pathways contribute disproportionately to the food web accumulation?

Q1: Where is Hg entering foodweb?

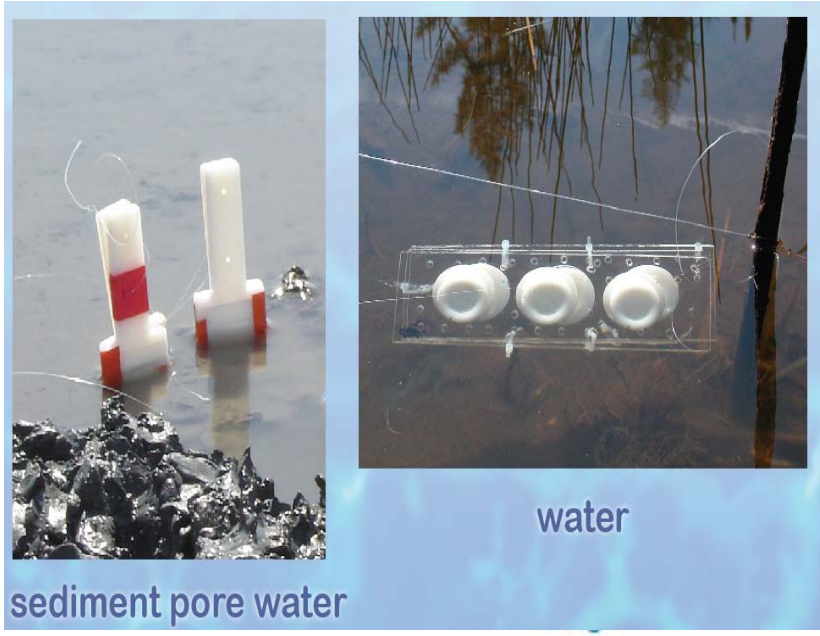
Small Fish

-To evaluate sources and processes (mine, POTWs, urban runoff, etc.)
- Spatial indicator of mercury exposure and uptake
-Temporal indicator – 1 yr time frame
-TMDL target - 0.03 ug/g



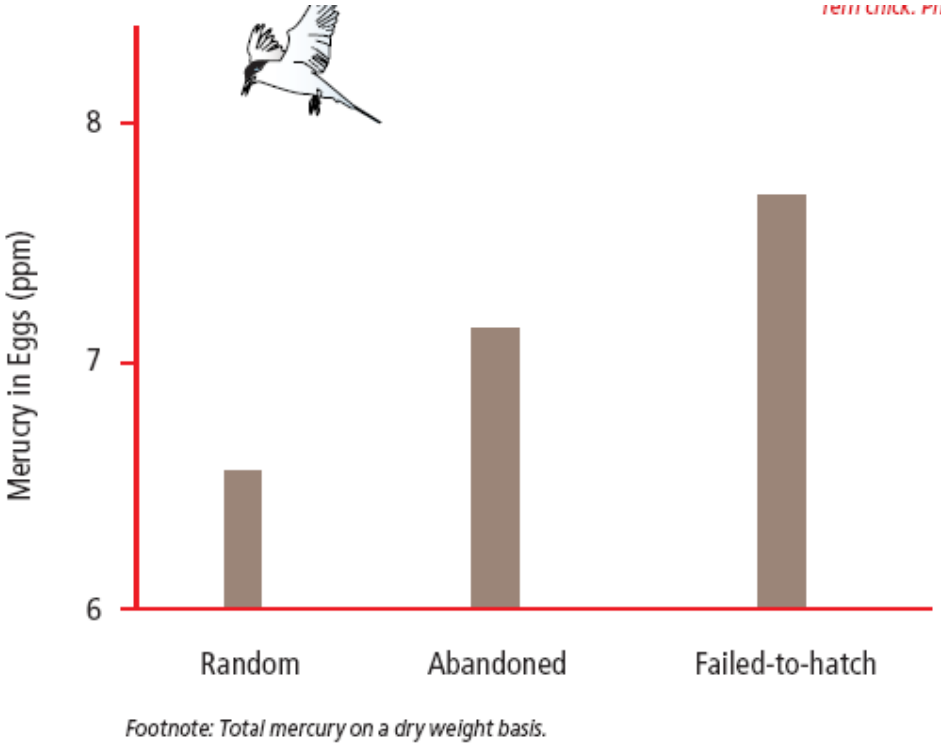
Q2 Hg Strategy: Processes, sources and pathways

- Issued an RFP
- Hg Isotopes (U of Michigan)
  - -Potential to fingerprint sources
- Diffusive Gradient Thin Films – (Trent University)
  - Surrogate for MeHg uptake



Pilot Studies: Hg and bird eggs (USGS)

- Higher Hg correlates with decreased hatching success in terns



- Current TMDL target of O.5 ppm is protective

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Pilot studies: Effects of PAHs on juvenile flatfish

- NOAA study to determine potential endpoints and effects of higher molecular PAHs on developing flatfish in sediment
  - 2 yr study. 1st year working with a model fish
  - 2nd year. Applying first year results to Bay Area fish and environmental sediment samples

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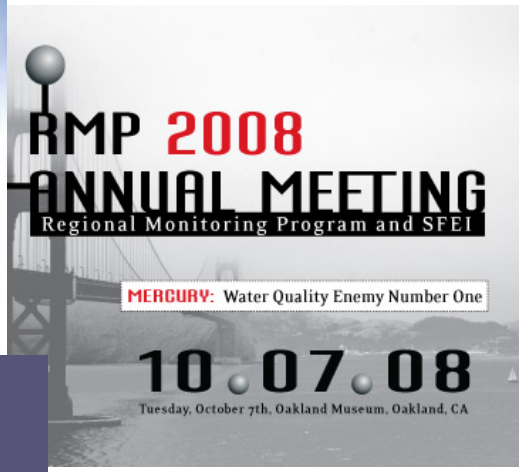
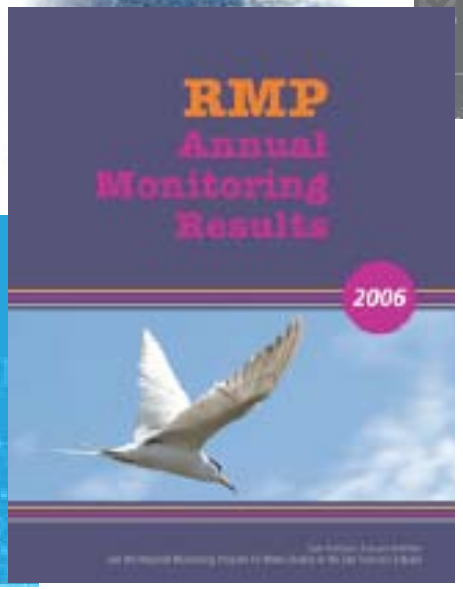
Adaptive management

- Changing regulatory focus
  - Increase focus on biota in TMDLs (e.g., fish and birds)
- New chemicals of emerging concern

Many different ways of disseminating information

- Pulse
- Technical reports
- Journal articles
- RMP annual meeting
- Workshops on select topics
- Web query





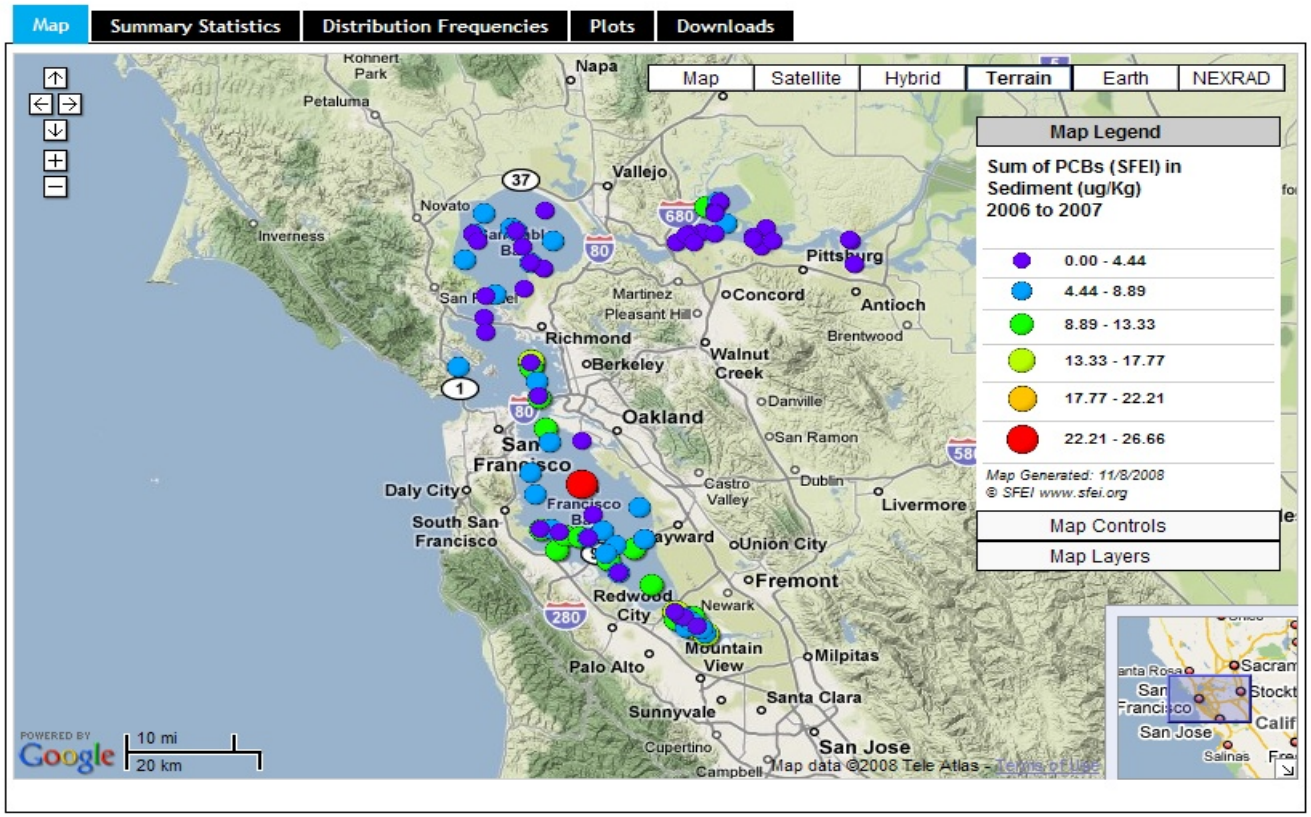
Providing easy access to data

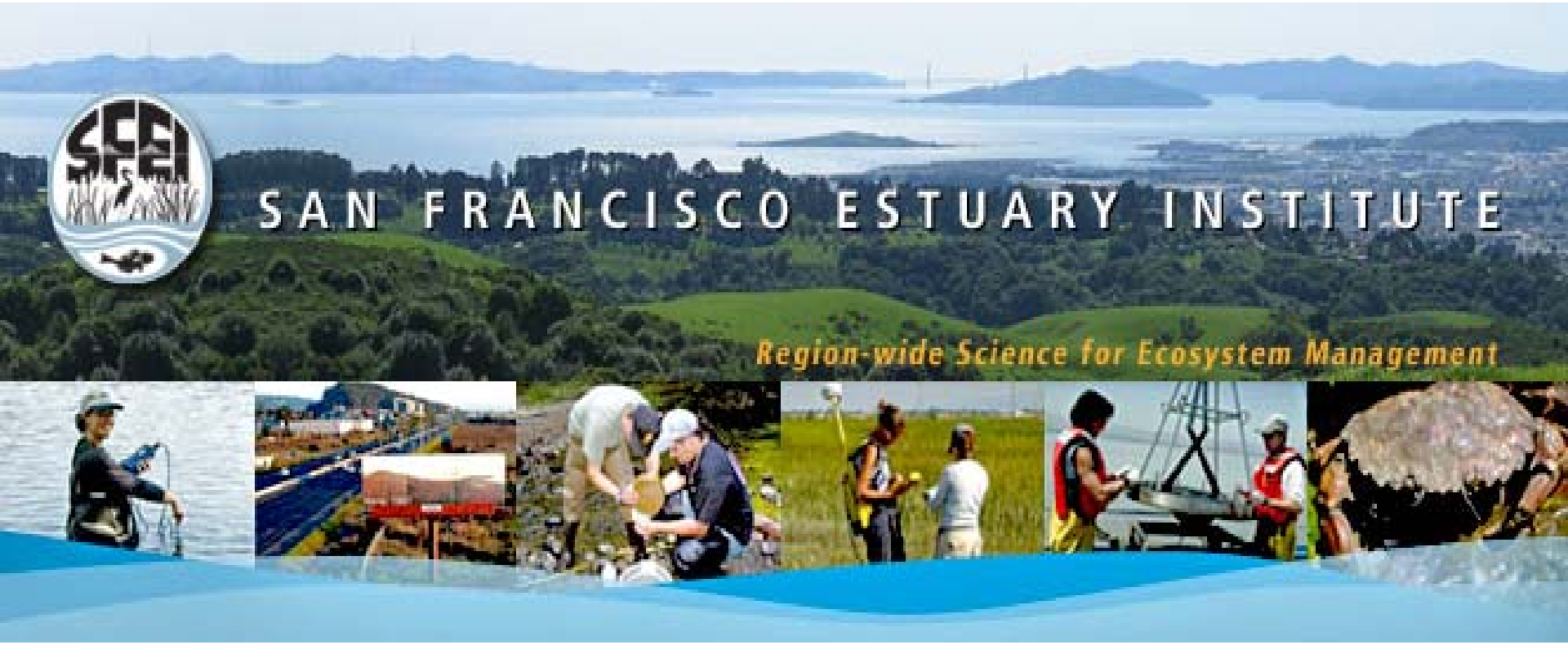
SAN FRANCISCO ESTUARY INSTITUTE
WEB QUERY TOOL Beta

FEEDBACK

RMP FMP

- Test Material: SEDIMENT
- Start Collection Year: 2006
- End Collection Year: 2007
- Parameter Type: PCB
- Analyte: SUM OF PCBS (SFEI)





All of RMP data and reports are available on-line

www.sfei.org

SWAMP
Surface Water Ambient Monitoring Program

Thank you!!!

Karissa Anderson
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Right hand woman

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"Crawdad wrangler"

Peter Otis
Field recon
Tech renegade
Man of all Trades

Jay Davis & Meg Sedlak & RMP participants

Revital Katznelson
Flexigrid Reports
Sage advice

The End