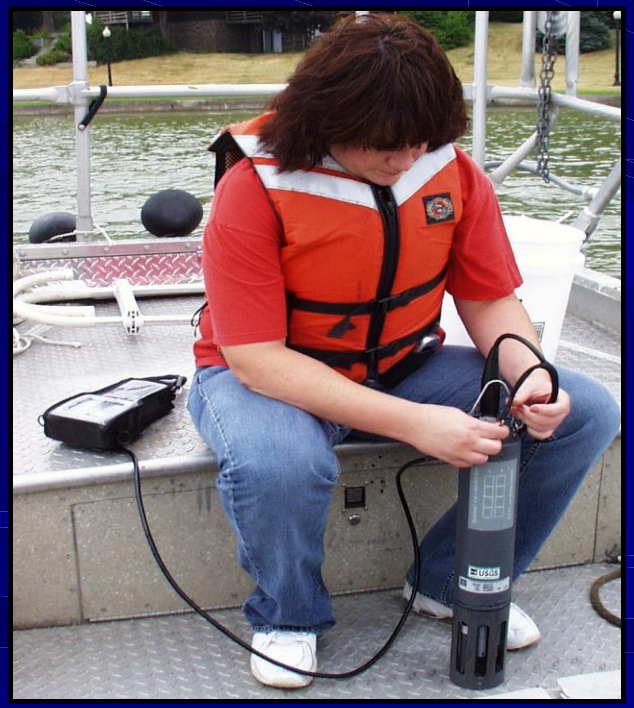
Linking Real-Time Water Quality Data to Biology and Management of Delta Smelt



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The Bottom Line

- Why is water quality data important to the management of Delta Smelt?

- Why do we need a better turbidity network?

- What is Central District's Water Quality Section's role in providing that network?

Delta Smelt's Sensitive Side

- Most live only one-year.
- Females only produce between 1000 and 2600 eggs.
- Larvae are planktonic (float with the water currents).
- Limited diet.
- Reside primarily within the interface between salt and freshwater.
- Spawning occurs in narrow temperature range (15-20ºC).

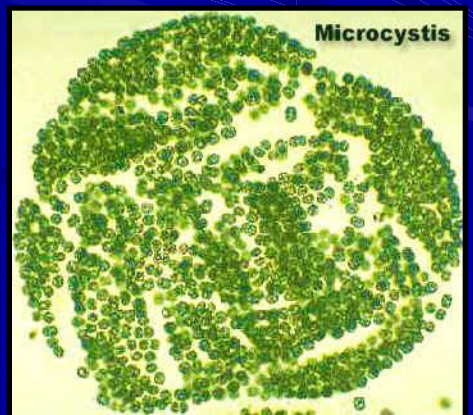
Factors Affecting Delta Smelt Habitat

Small Agricultural Diversion and Drainage

Corbula amurensis
(Asian clam)

Hypomesus transpacificus
(Delta Smelt)

Contaminants/toxins



Invasive Species

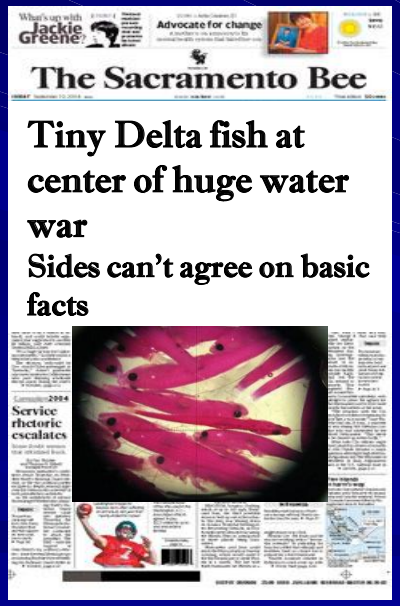
Egeria densa
(Brazilian elodea)

Water Exports are a major concern!

- This year water exports have been the focal point of delta smelt impacts.


Where are all the black baseball players?
2-MINUTE TAPAS
Smells like Father's Day | 1E
San Jose Mercury News
MERCURY NEWS.COM

Court ruling on delta alarms water officials


What's up with Jackie Greene?
Advocate for change
The Sacramento Bee

Tiny Delta fish at center of huge water war

Sides can't agree on basic facts

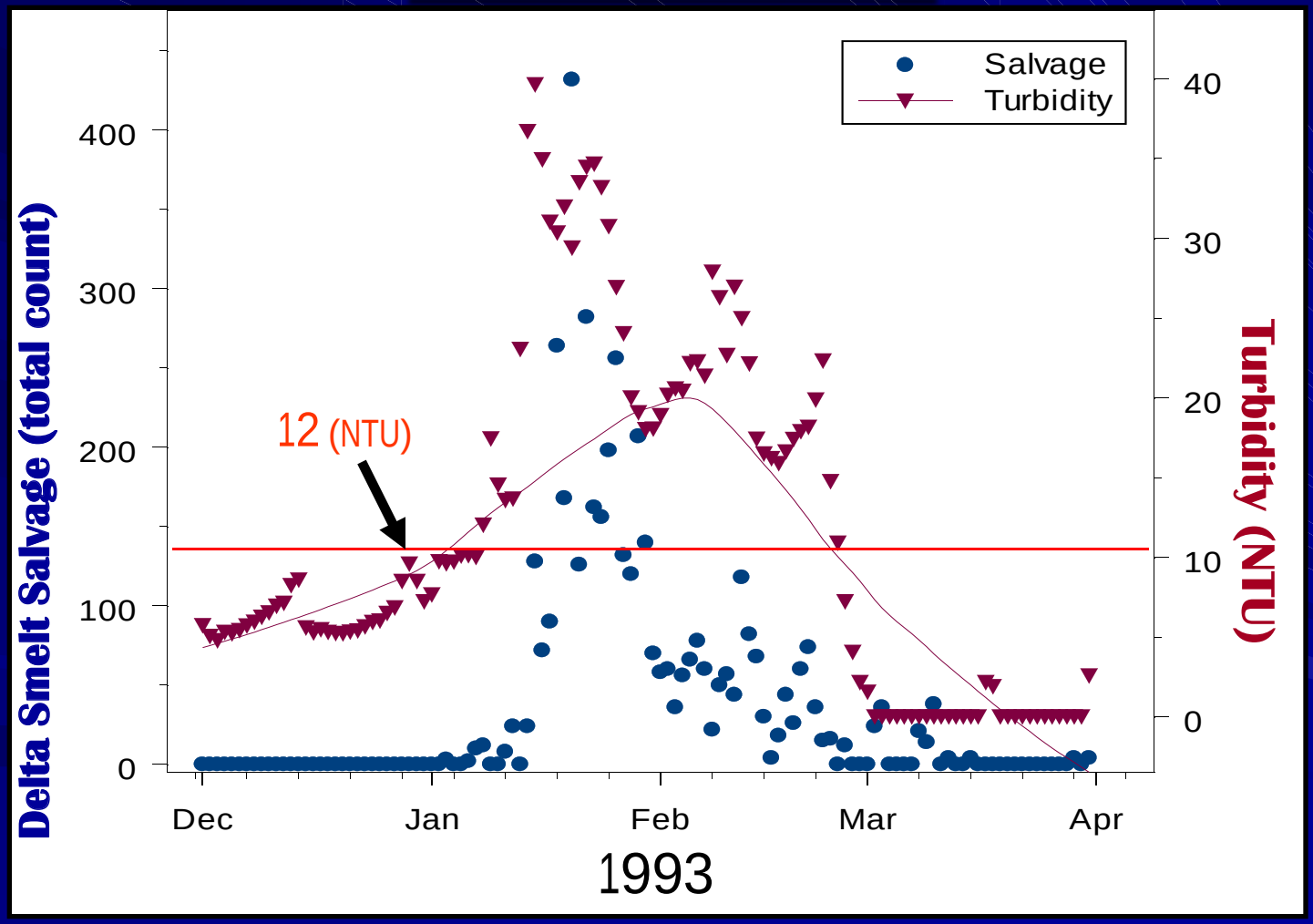
Service rhetoric escalates


The Fresno Bee
One small step back into space
Dages to fight

Judge limits Delta pumps

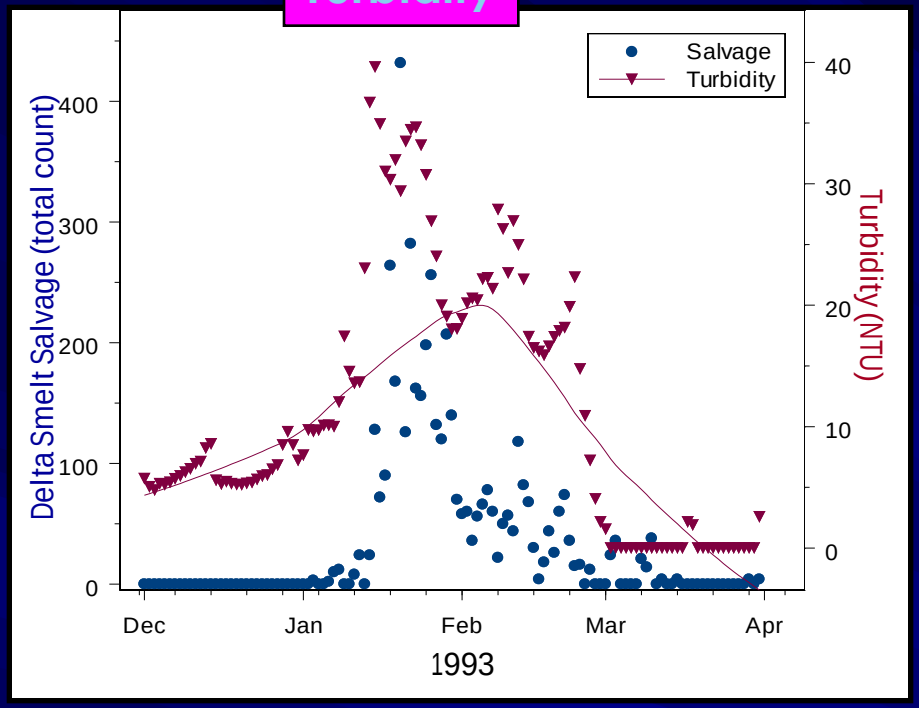
Effort to save fish will hurt farmers and others, the state says.

What factors influence smelt salvage at the Water Export Facilities?

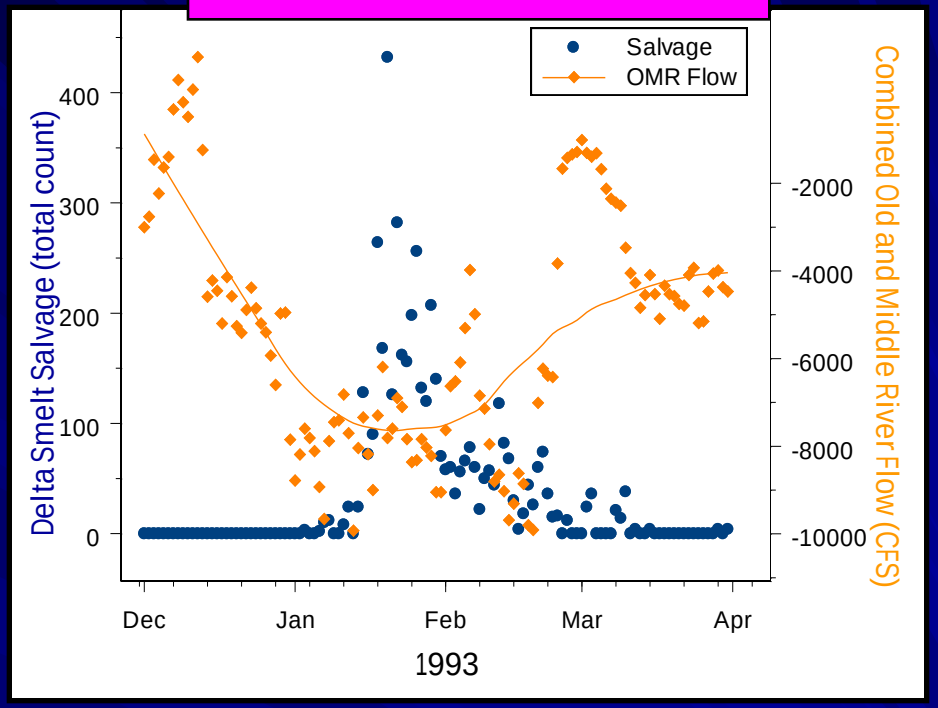


Graph provided by: Lenny Grimaldo, Environmental Scientist DES

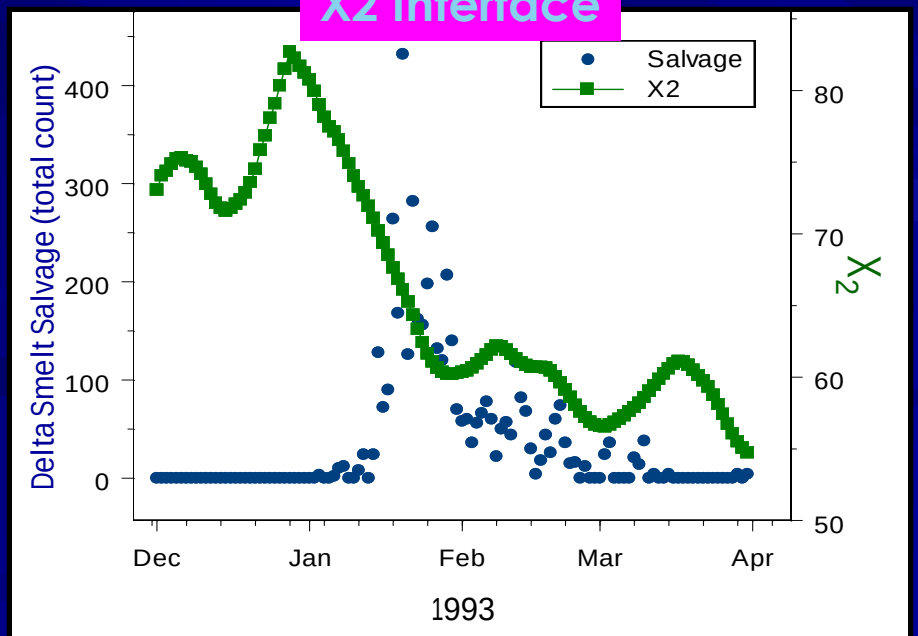
Turbidity



Old and Middle River Flow



X2 Interface



Graphs provided by:
Lenny Grimaldo
Environmental Scientist
DES

Monitoring turbidity is now an operational standard!

Based on Judge Wanger's Ruling regarding NRDC vs. Kempthorne . . .

➢ **3 New Continuous Water Quality Compliance Stations, monitoring turbidity, have been established:**

1. **Holland Cut near Bethel Island**
2. **Victoria Canal near Byron**
3. **San Joaquin River at Prisoner's Point**

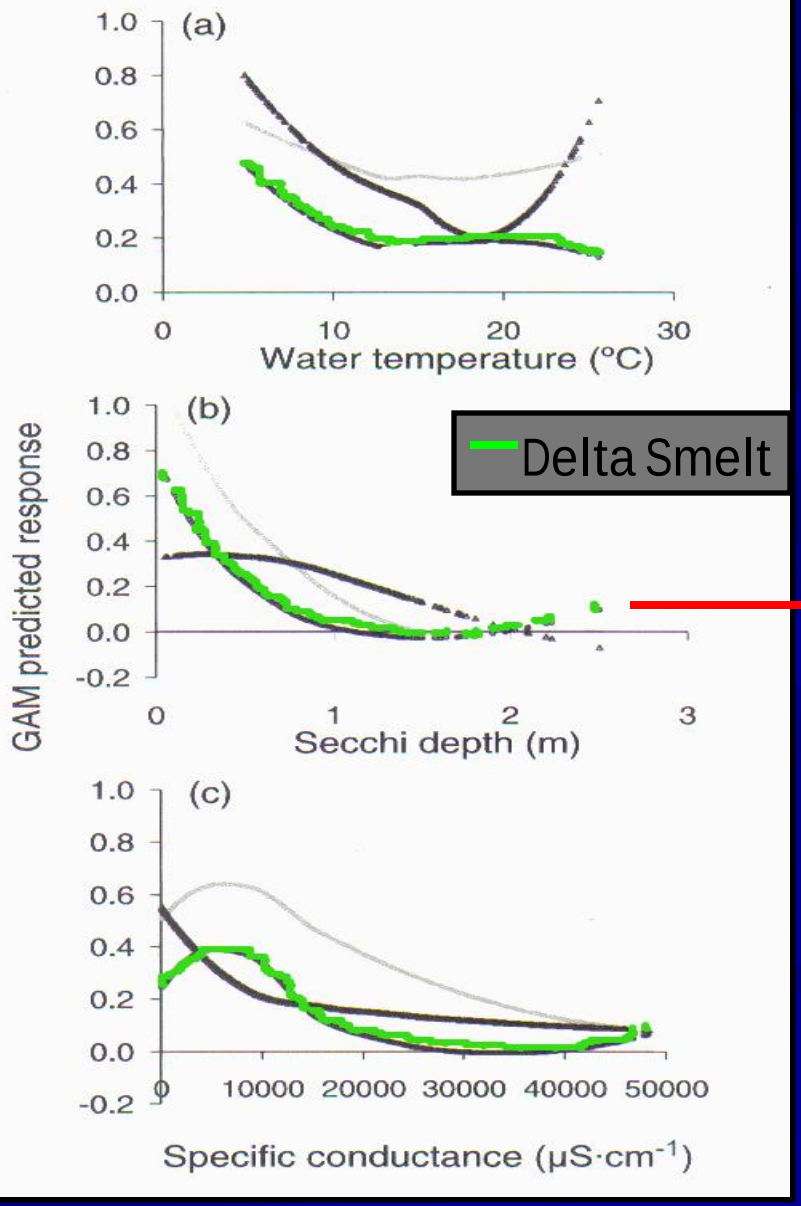
➢ **After December 25th, if turbidity exceeds specific levels in the San Francisco Estuary, upstream flows from Old and Middle River will be reduced to no more than 2,000 CFS for 10 days.**

➢ **Only implemented if Sacramento River does not exceed 80,000 AF.**

Who is the Delta Smelt Working Group?

- **Consists of several knowledgeable experts in Delta smelt biology.**
  From such agencies as…
  - **U.S.F.W.S.**
  - **U.S.B.R.**
  - **U.S.E.P.A.**
  - **C.D.F.G.**
  - **D.W.R.**
- **In charge of reviewing all available monitoring data and decide whether to recommend change in water project operations in regards to Delta Smelt protection.**

How can a turbidity network help scientists better understand Delta Smelt biology?



- Recent studies by Fredrick Feyrer, Matt L. Nobriga, and Ted Sommer, have revealed that combined effects of fall stock abundance and water quality predicted annual recruitment abundance, during the recent years of low food supply.

- **Predicted occurrence of delta smelt decreased as Secchi depth increased.**

F. Feyrer, M.L. Nobriga, and T.R. Sommer. "Multidecadal trends for three declining fish species: habitat patterns and mechanisms in the San Francisco Estuary, California, USA. Can. J. Fish. Aquat. Sci. Vol. 64, 2007.

How can a turbidity network help scientists better understand Delta Smelt biology?

UC-Davis Laboratory research by, Bradd Baskerville-Bridges, Bill Bennett, Andy Rockriver, and Peter Moyle has shown turbidity to be a key factor in larvae feeding and survival.

Findings from their Delta Smelt Culture Program included:

- **Few larvae fed in clear water, but fed well when either organic or inorganic particles were introduced.**

- **Hypothesized that this was possibly do to contrast between the prey and their background.**

- **By the time the larvae reach 15 to 20 mm, they were less dependent on turbid conditions.**

Brown, Randall and Kimmerer, Will. "Delta smelt and CALFED's Environmental Water Account" December, 2001. http://science.calwater.ca.gov/pdf/2001_Delta_Smelt_Workshop.pdf

How is CD Water Quality Section lending a hand?

Through our experience in continuous water quality monitoring in the San Francisco Estuary, we plan to:

1 - Initiate coordination with other agencies that are also collecting water quality data.

Agency Collaboration is Key

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CD DES

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

How is CD Water Quality Section lending a hand?

Through our experience in continuous water quality monitoring in the San Francisco Estuary, we plan to:

2 - Use accurate water quality equipment, and maintain an up-to-date accessible database.

Water-Quality Data Collection, Analysis, and Database Entry

Hydstra.hk

WDL

Water Data Library

Real-Time Telemetry

CDEC

California Data Exchange Center

Real-Time Event / Hourly Data

Several YSI sensor's have passed rigorous testing to achieve EPA's Environmental Technology Verification Program:

-6560 conductivity/temp. sensor

-6561 pH sensor

-6136 optical turbidity sensor

www.epa.gov/etv/

www.ysi.com

YSI 6136 Optical Turbidity Sensor

- Mechanical self-cleaning wiper for long-term deployment.
- Accurate *in situ* measurement of turbidity in fresh or brackish water.
- Verified through the US EPA's Environmental Technology Verification Program.

Range:	Accuracy:
0 – 1,000 NTU	± 0.3 NTU

Field Instruments for Confirming Accuracy of Removed and Newly Deployed Sondes.

HACH

2100P Portable Turbidimeter

- Turbidity accuracy range: 0 -1000 NTU
- Meets EPA Method 180.1 criteria

YSI

YSI 63 Handheld

Measurement	Range	Accuracy
Conductivity	0 – 4999 µS/cm	0.5%
Temperature	- 5 – +75°C	± 0.1°C
pH	0 to 14	± 0.2 unit

New Technological Upgrades

- Luminescence lifetime detection.
- Microprocessor-controlled measurement system – reduces drift.
- Integrated wiping system.
- Durable membrane w/ a usable life of one year.
- Recommendation for interim approval has been made by the EPA.

WHY?

YSI

6150 ROX
Optical Dissolved Oxygen Sensor

YSI 6562 Rapid Pulse
Dissolved Oxygen Sensor

Out with the old . . . and in with the new!

YSI 6600EDS

YSI 6600V2-V4

How is CD Water Quality Section lending a hand?

Through our experience in continuous water quality monitoring in the San Francisco Estuary, we plan to:

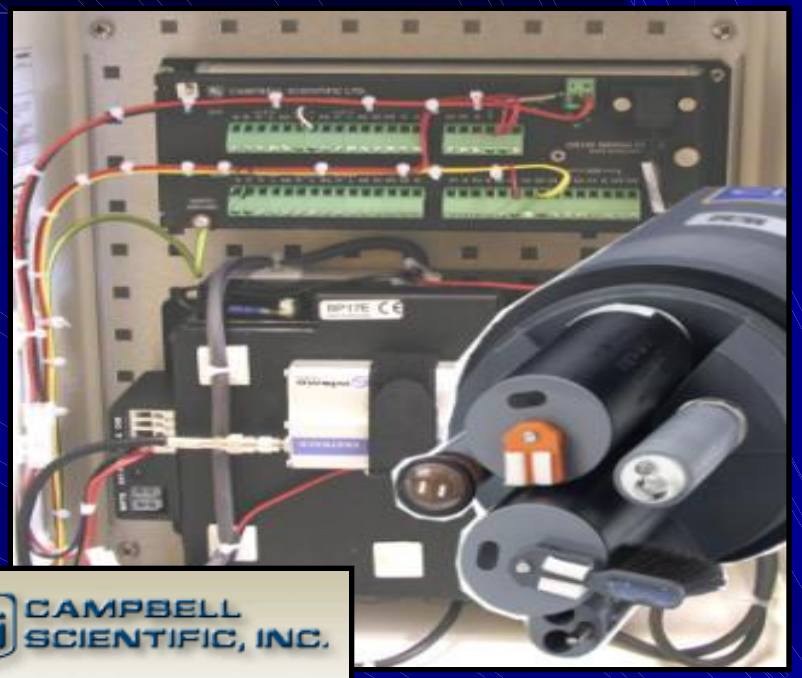
3 - Expand to provide real-time telemetered data.

Real-Time Telemetered Data

1. Allow Delta modelers the ability to predict possible movement of the Delta smelt.

2. Allow water export operators the time to adjust pumping operations to reduce impacts to delta smelt.

3. Allow biologists the ability to conduct site specific fish sampling to correlate water quality conditions to delta smelt movement.



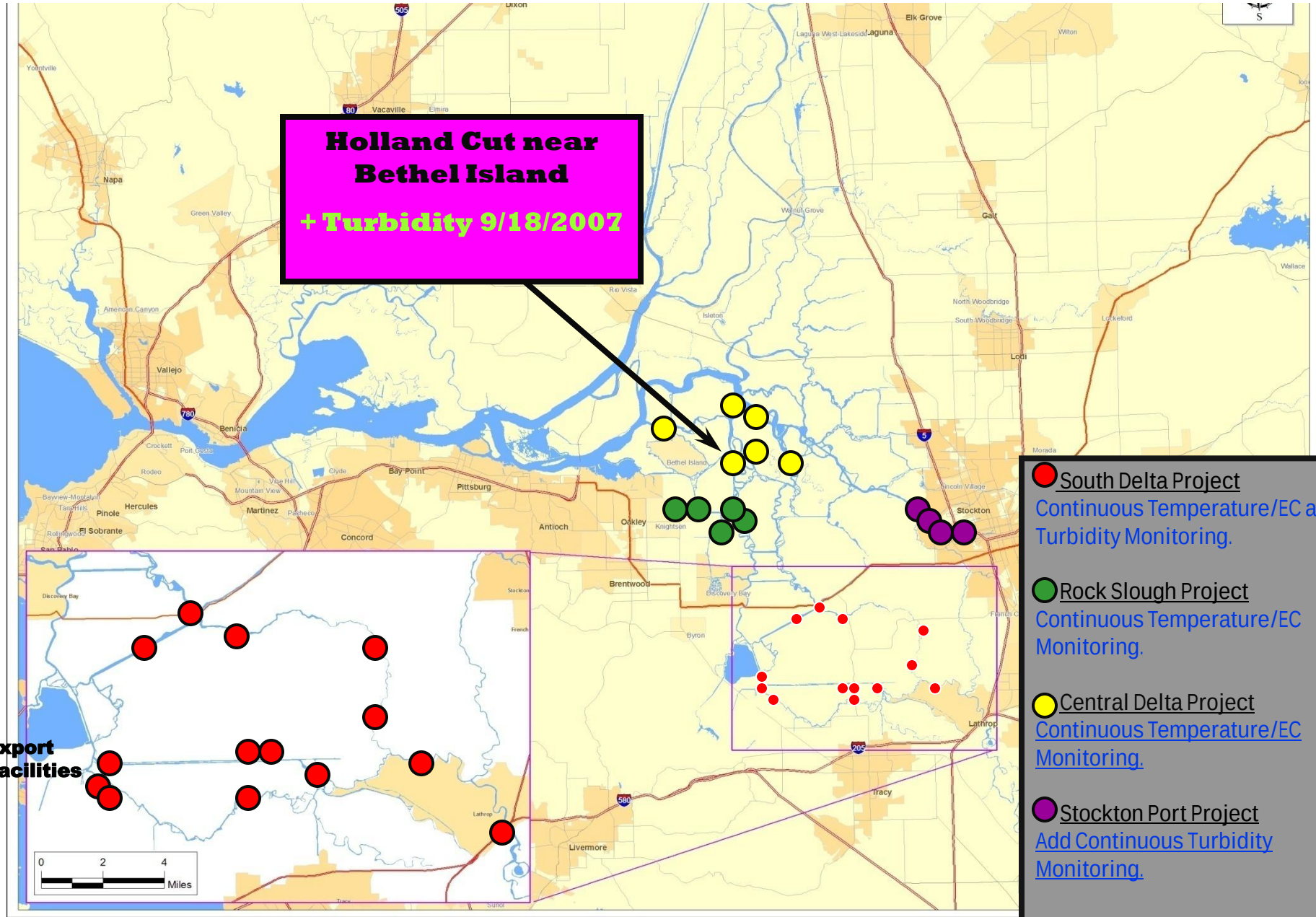
USGS/DWR Flow and Water Quality Station.

How is CD Water Quality Section lending a hand?

Through our experience in continuous water quality monitoring in the San Francisco Estuary, we plan to:

4 - Expand our water quality parameters at our existing stations to include turbidity, where desired.

Current CD Water Quality Assessment Section's Monitoring Program

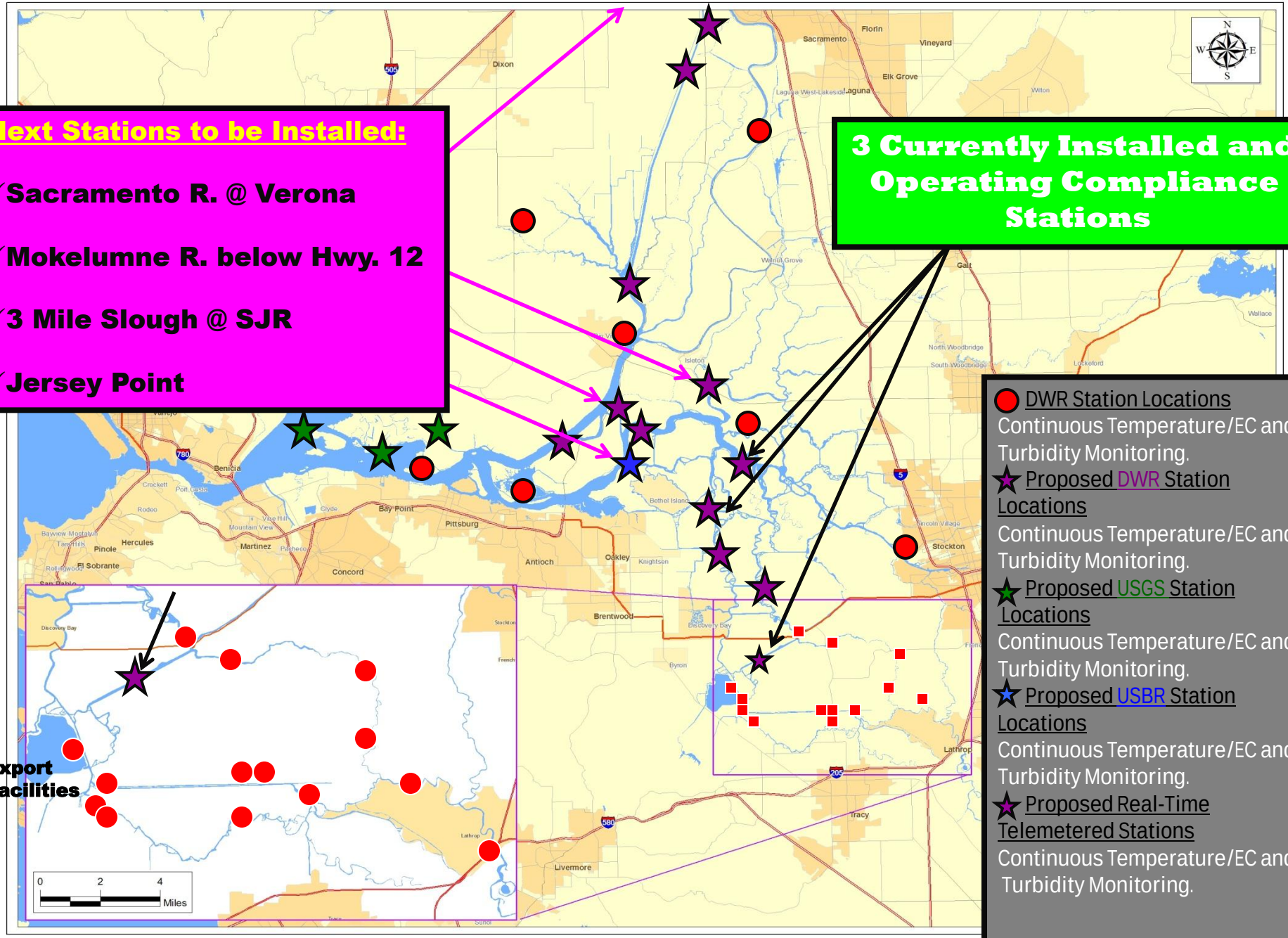


How is CD Water Quality Section lending a hand?

Through our experience in continuous water quality monitoring in the San Francisco Estuary, we plan to:

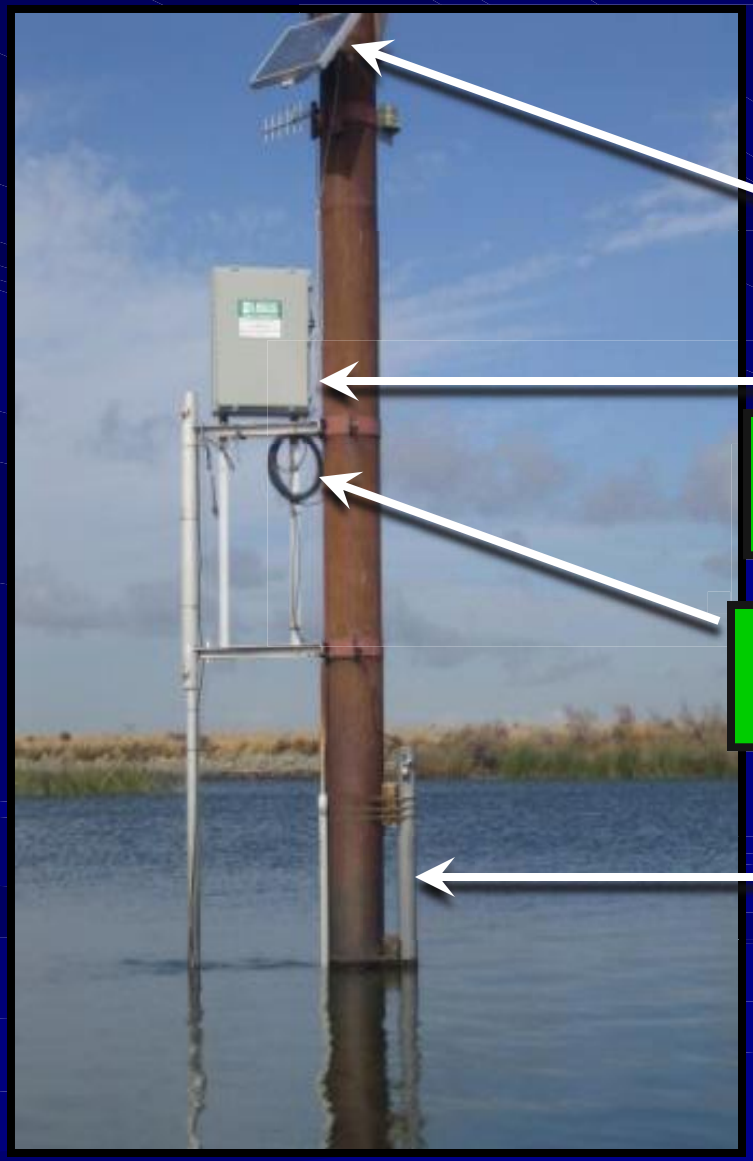
5 - Install new stations where water quality data is needed.

Proposed Temp./EC and Turbidity Monitoring Network



New Station Installations

Victoria Canal near Byron (VCU)



Solar Panels for Rechargeable Batteries.

CAMPBELL SCIENTIFIC, INC.

CR1000 Datalogger and Raven100 Airlink Cellular Modem.

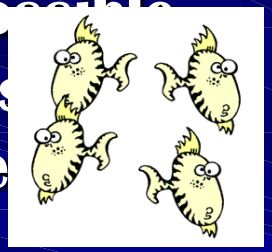
YSI 6091 Field Cable/ Providing Sonde connection to CR1000 Datalogger.

YSI 6600 Sonde secured Inside 4” diameter PVC Pipe w/ lock security.

Holland Cut near Bethel Island (HOL)

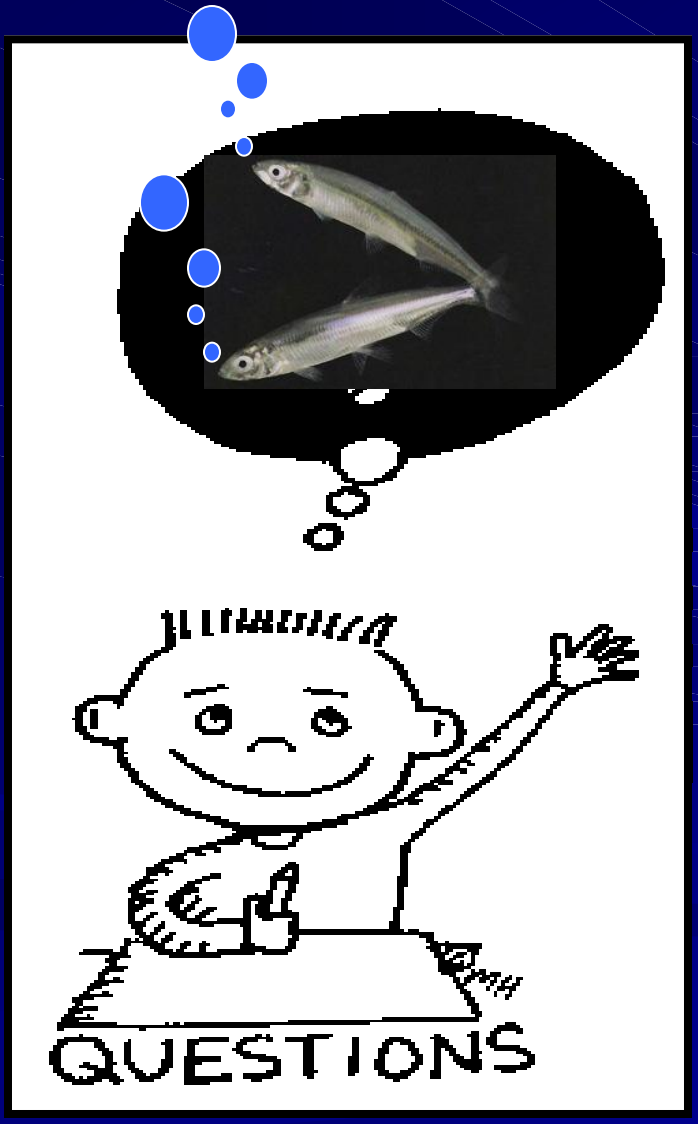
Ultimately…our big dream?

- To predict Delta Smelt Movement and to direct them to specific areas in the San Francisco Estuary in-order to minimize po… entrainment and/or … at the export facilitie…



- Emphasis of making sure Delta Smelt make a left turn to the north as they enter the San Francisco Estuary versus making a right turn South.

Questions?



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