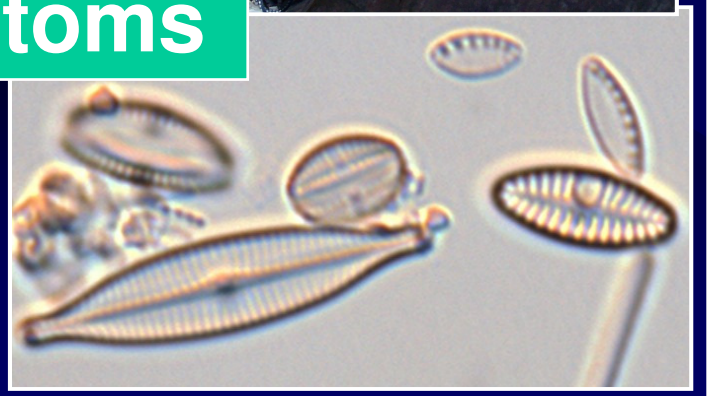
Status of Algae Bioassessment Research in Southern California

Algae as a Valuable Component of California's Stream Assessment Toolkit

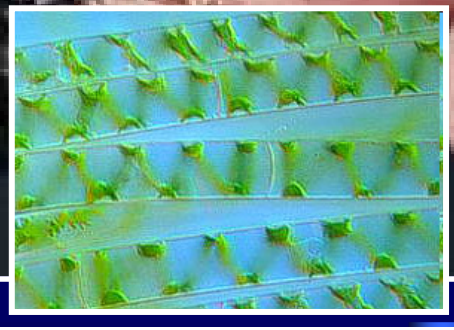
- 2nd bioindicator
  - ***Weight of evidence***
- Need for tools to monitor short-lived streams
  - ***Algal assemblages develop rapidly… may complement bugs***
- Difficult to diagnose and regulate nutrient impairment
  - ***Algae = primary producers & provide an integrative indicator***

What Are “Benthic Algae”?

diatoms



soft-bodied algae
(& cyanobacteria)



Building a Stream-algae Assessment Program for California

TECHINCAL TOOLS
- Index of Biotic Integrity (IBI)
- Nutrient Numeric Endpoints
- Biological Objectives

IMPLEMENTATION TOOLS
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- Std. Operating Procedures
  - Training workshops
- Database
- QA guidelines

SUPPORT TOOLS TO BUILD CAPACITY
- Regional floras
- Taxonomic standards workgroup
- Taxonomic ID resources

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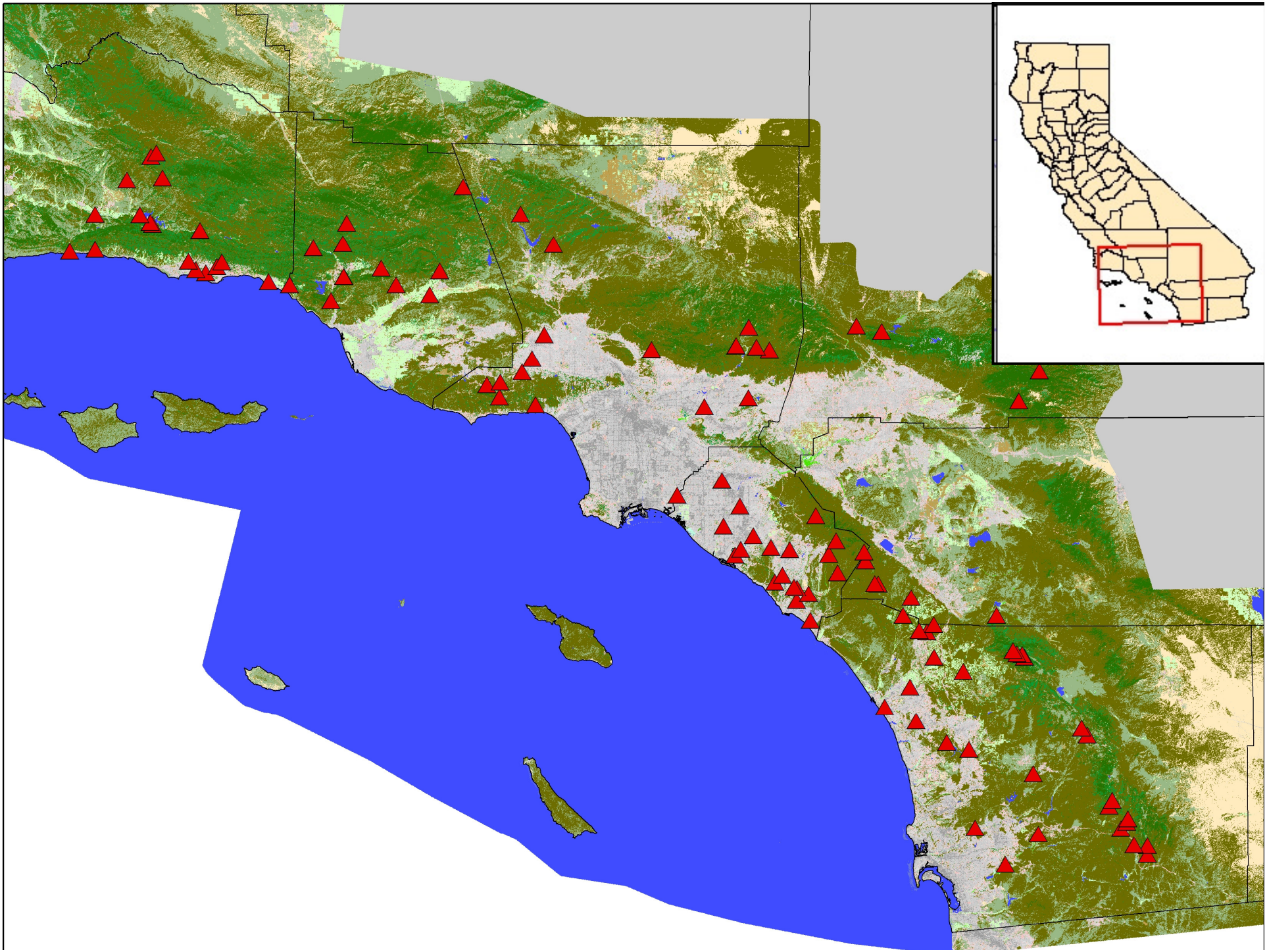
Current Algal Bioindicator Development Projects (Prop 50)

Lead institutions:

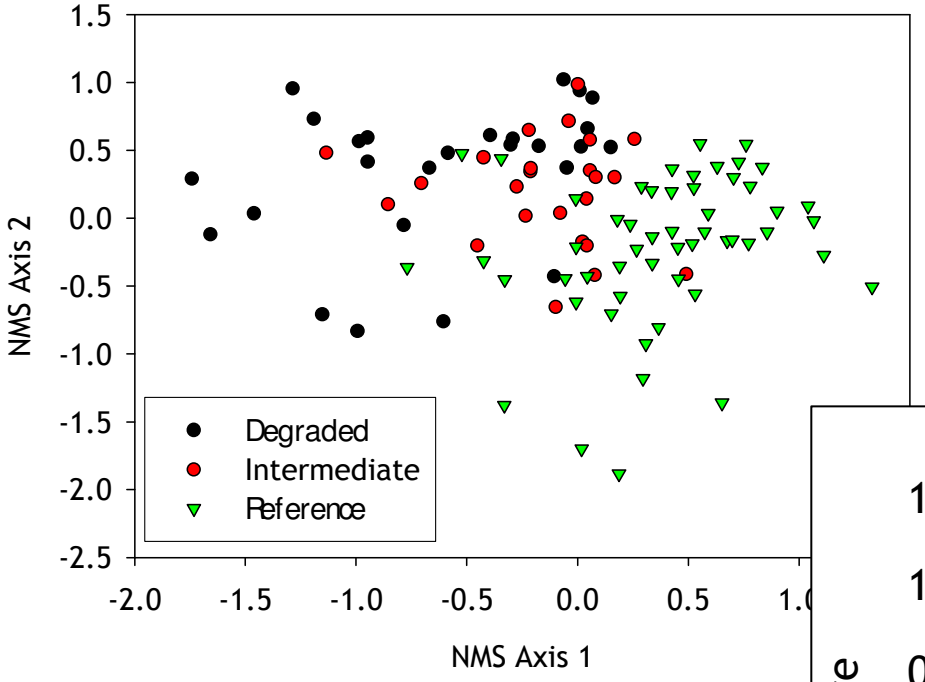
- SCCWRP (B. Fetscher)
- CSU Monterey Bay (M. Los Huertos)

Collaborators:

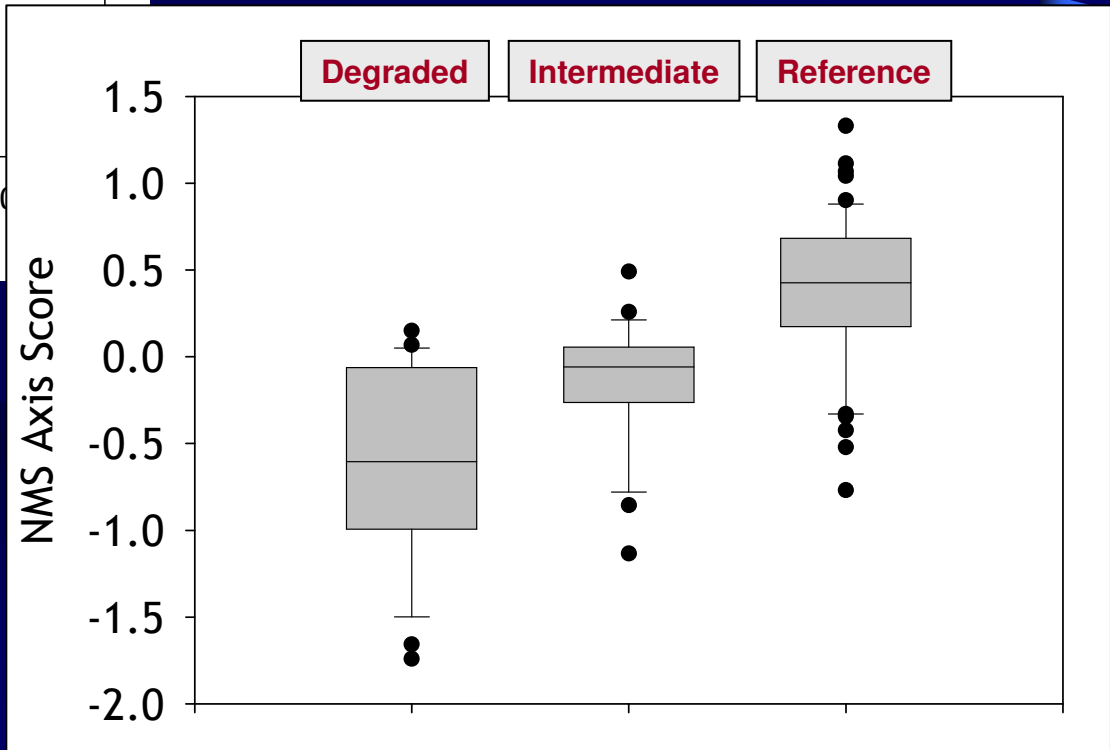
- CSU San Marcos (R. Sheath)
- University of Colorado, Boulder (J.P. Kociolek)
- UC Santa Cruz (S. Rollins)
- Portland State University (Y. Pan)
- Michigan State University (R.J. Stevenson)



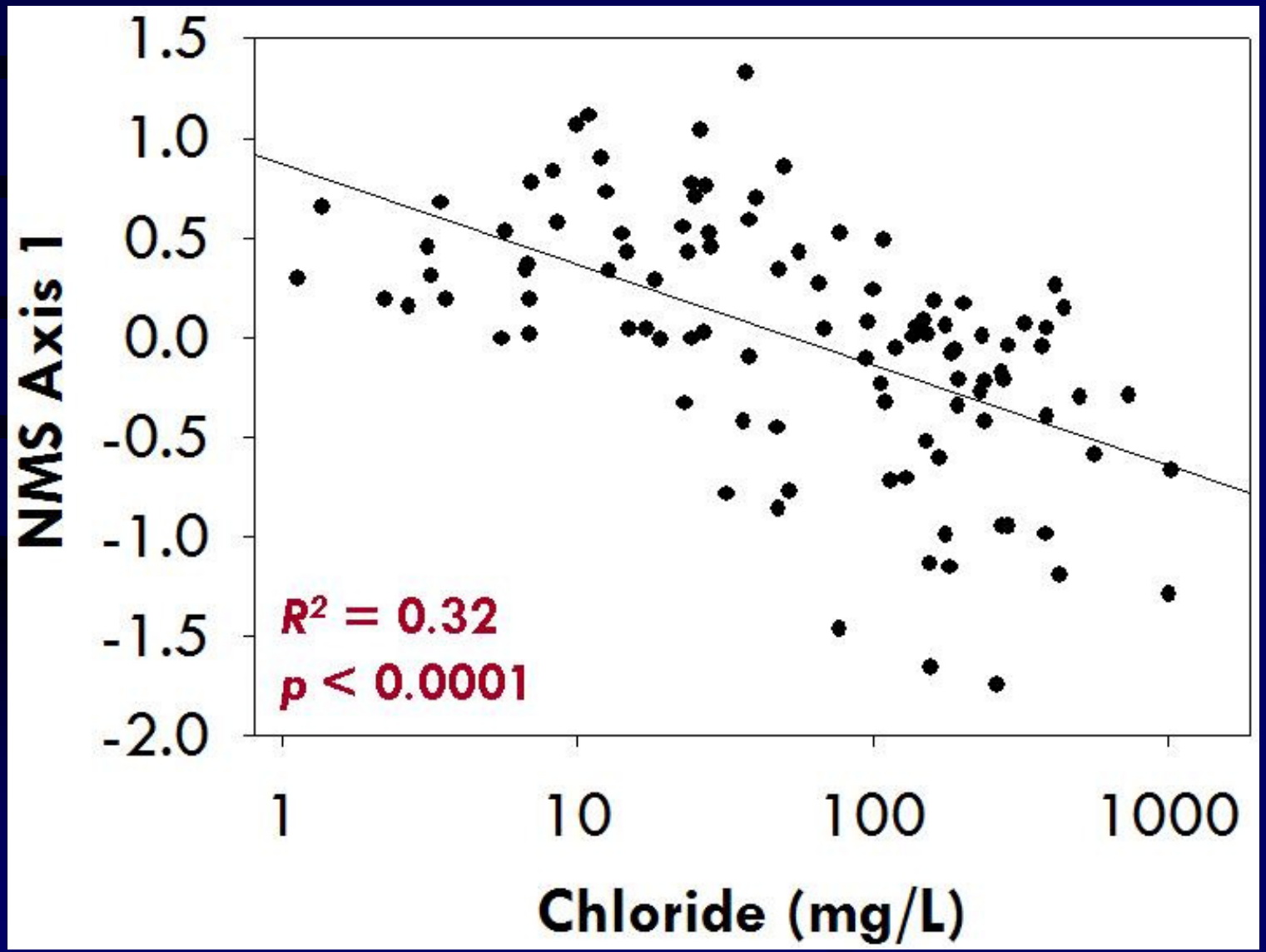
Preliminary Results – *It's Working*



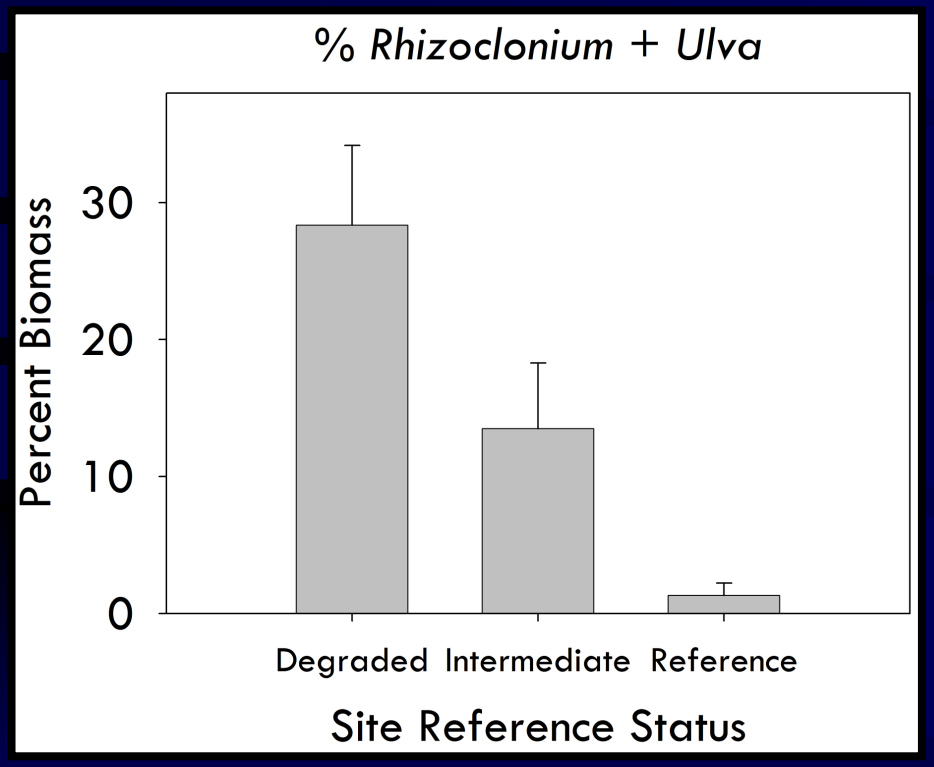
Diatom Assemblages Vary According to Site Reference Status

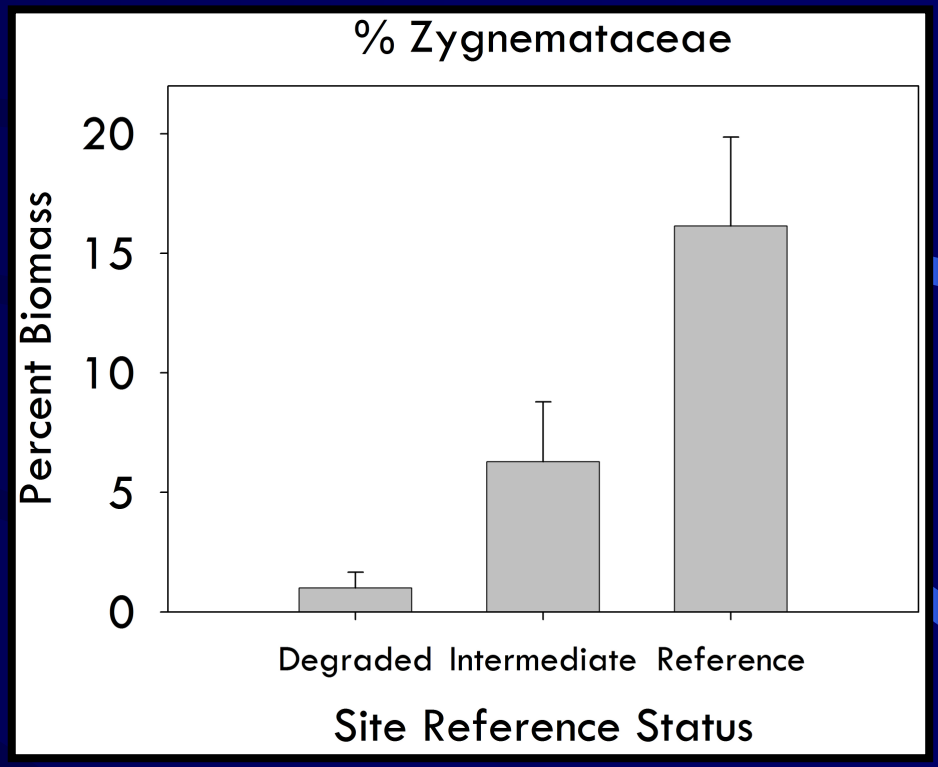


Diatom Assemblage Relationship with Chloride



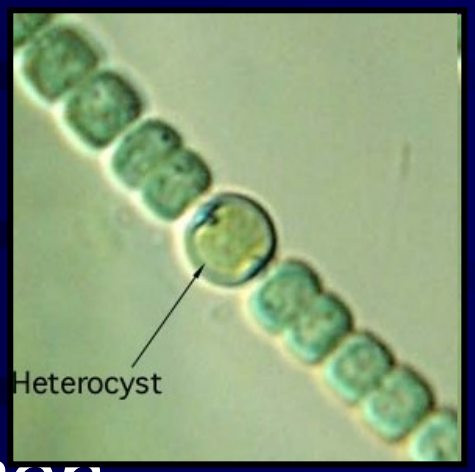
Soft-bodied Taxa Relationships with Site Reference Status

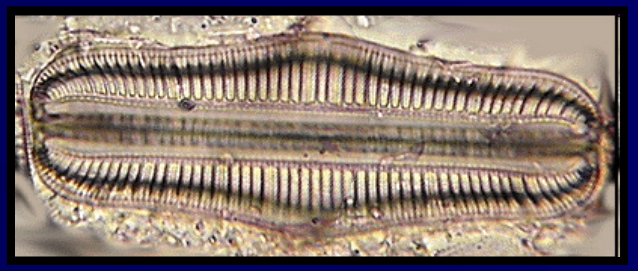




So Cal Flora: Genera with Nitrogen-Fixing Capability

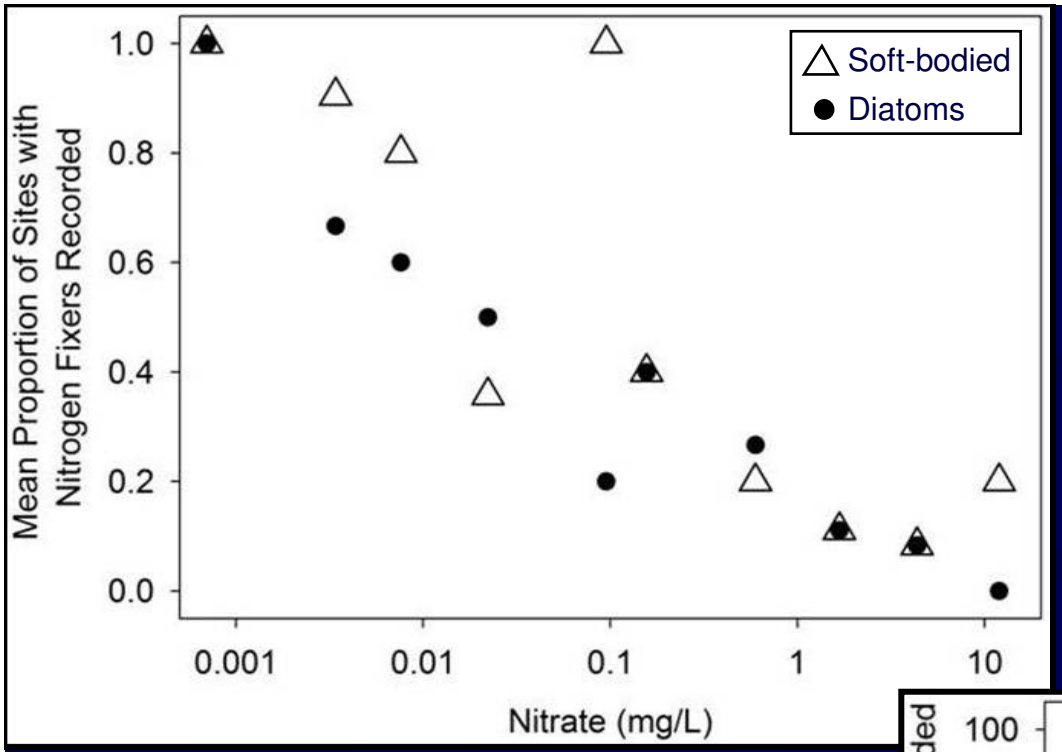
- *Anabaena*
- *Calothrix*
- *Chamaesiphon*
- *Cylindrospermum*
- *Nodularia*
- *Nostoc*
- *Nostochopsis*
- *Rivularia*

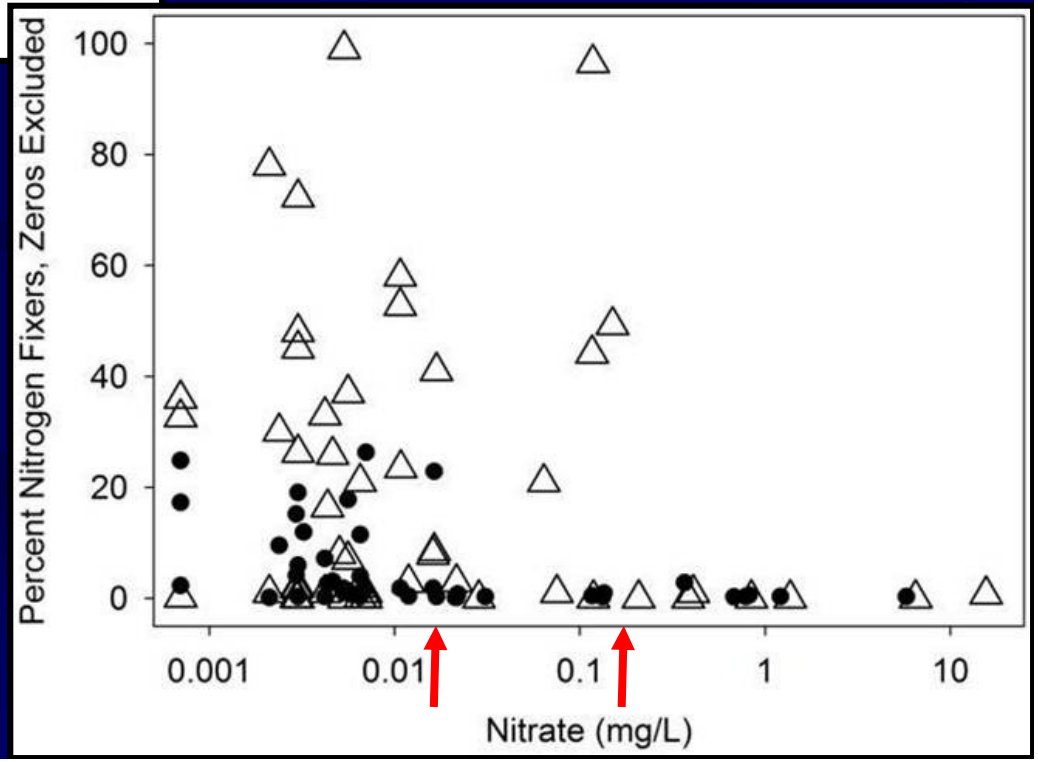




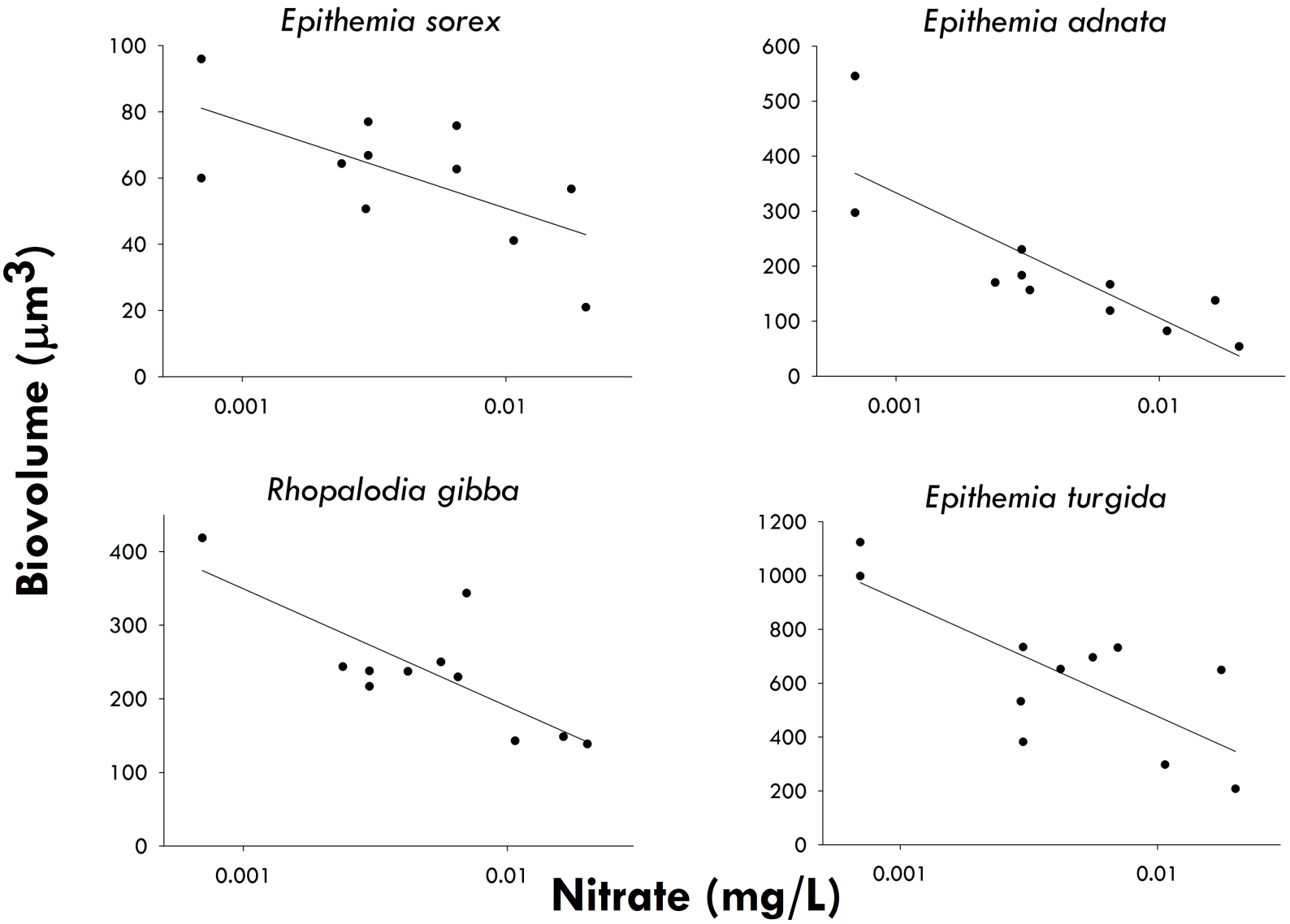
- *Epithemia*
- *Rhopalodia*

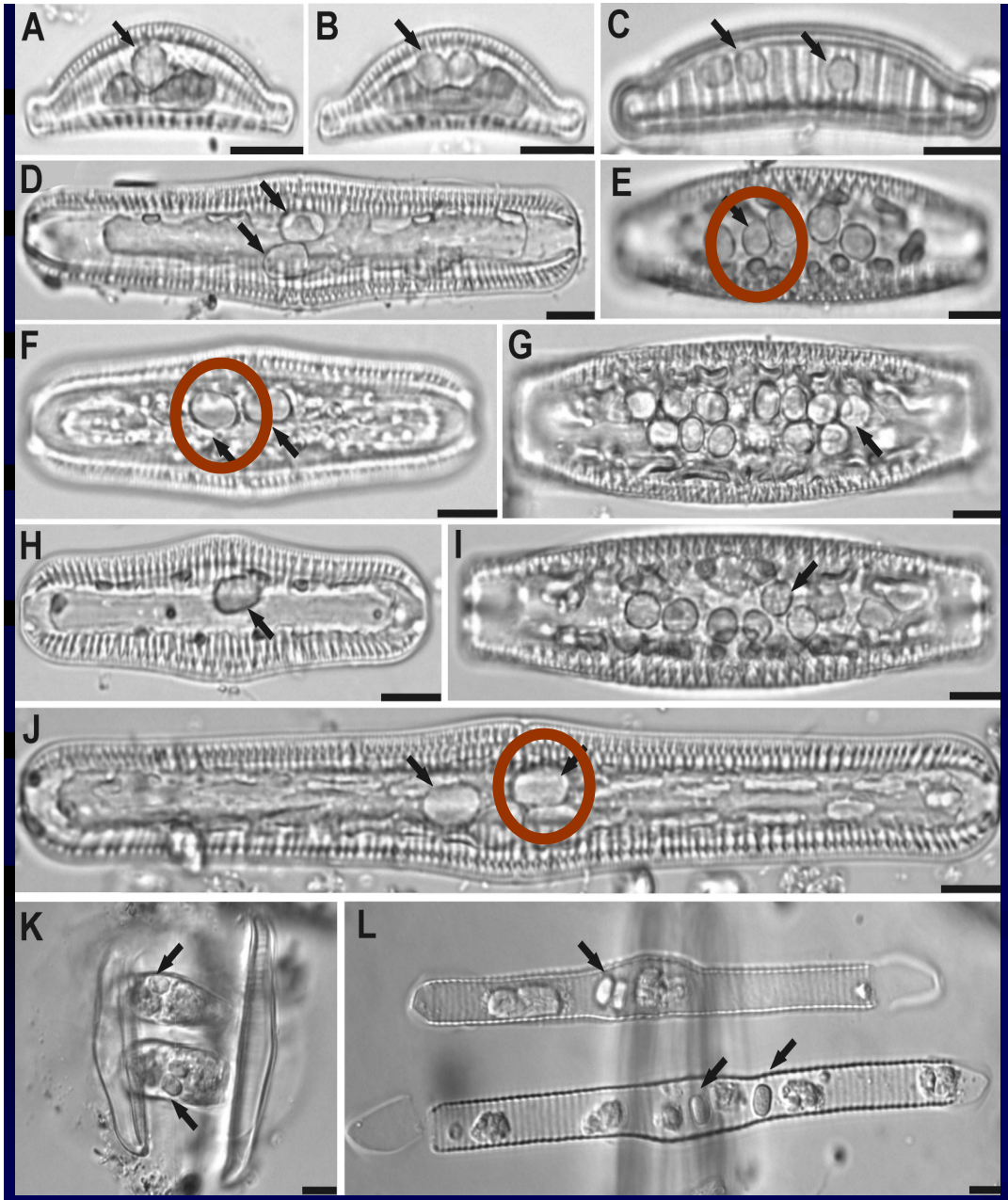
Occurrence & Abundance of N-fixers Relates to Stream Nitrogen Concentration

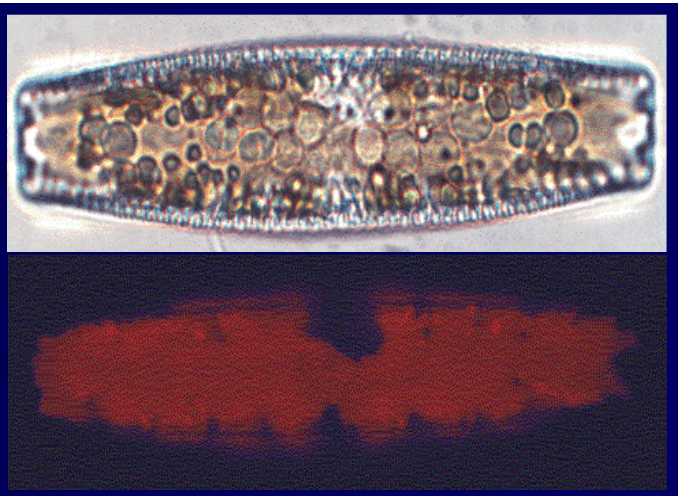




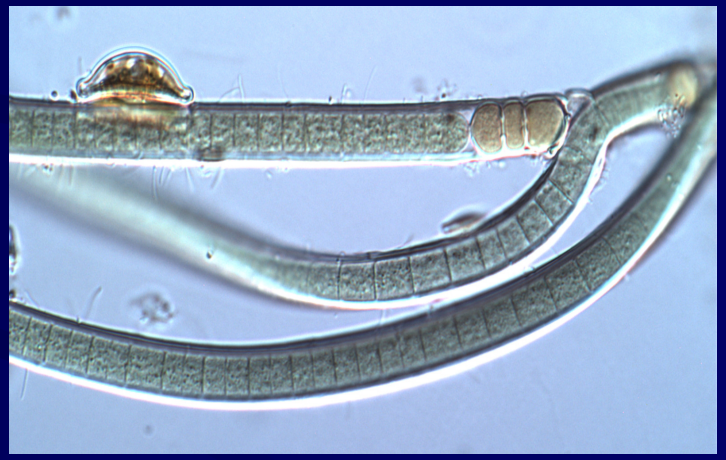
Diatom Cyanobacterial Endosymbionts: Subcellular Indicators of Ambient Nitrogen Levels







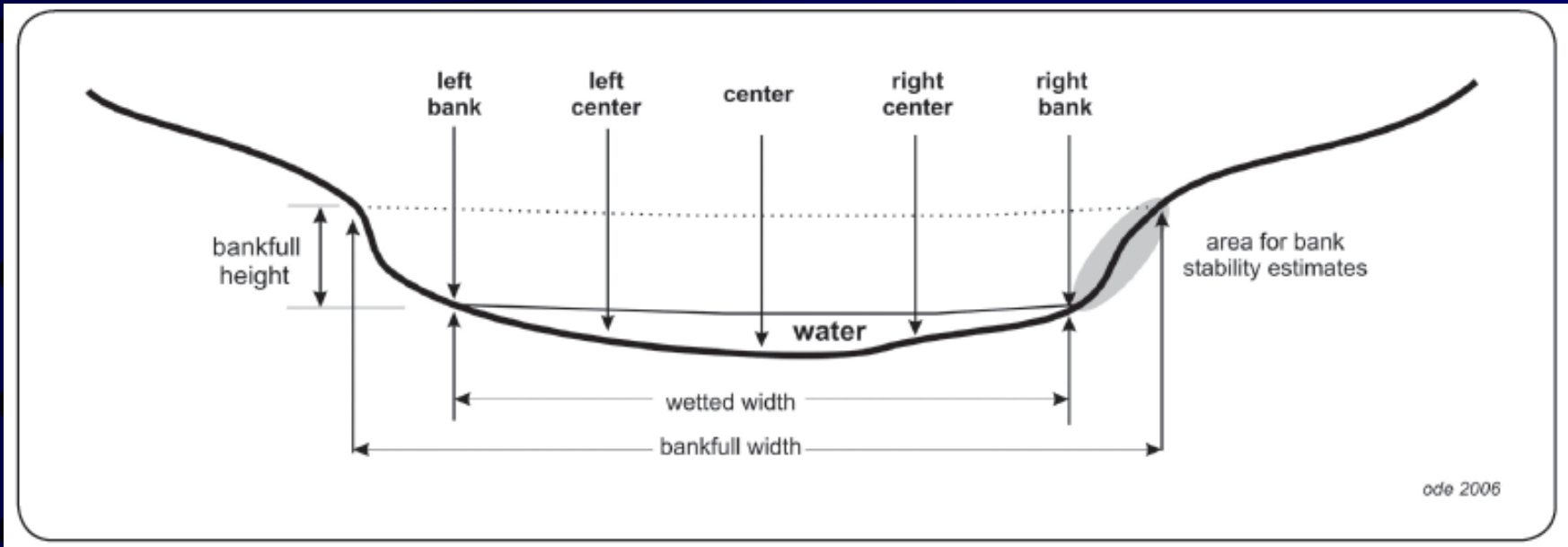
Autofluorescence of *Epithemia adnata*.



T*olypothrix distorta* and *Epithemia sorex*.

LM pictures of *Epithemia* and *Rhopalodia* endosymbionts (A, B), *Epithemia sorex* valve view (C), *Epithemia adnata*, valve view (E, G, I), *Epithema turgida* dorsal girdle view (D, F, H, J), *Rhopalodia gibba* dorsal girdle view (K) *R. gibba* gametes (L), *R. gibba* auxopsores. A to L scale bars 10 μm. Arrows show endosymbionts.

Estimating Stream Algal Productivity



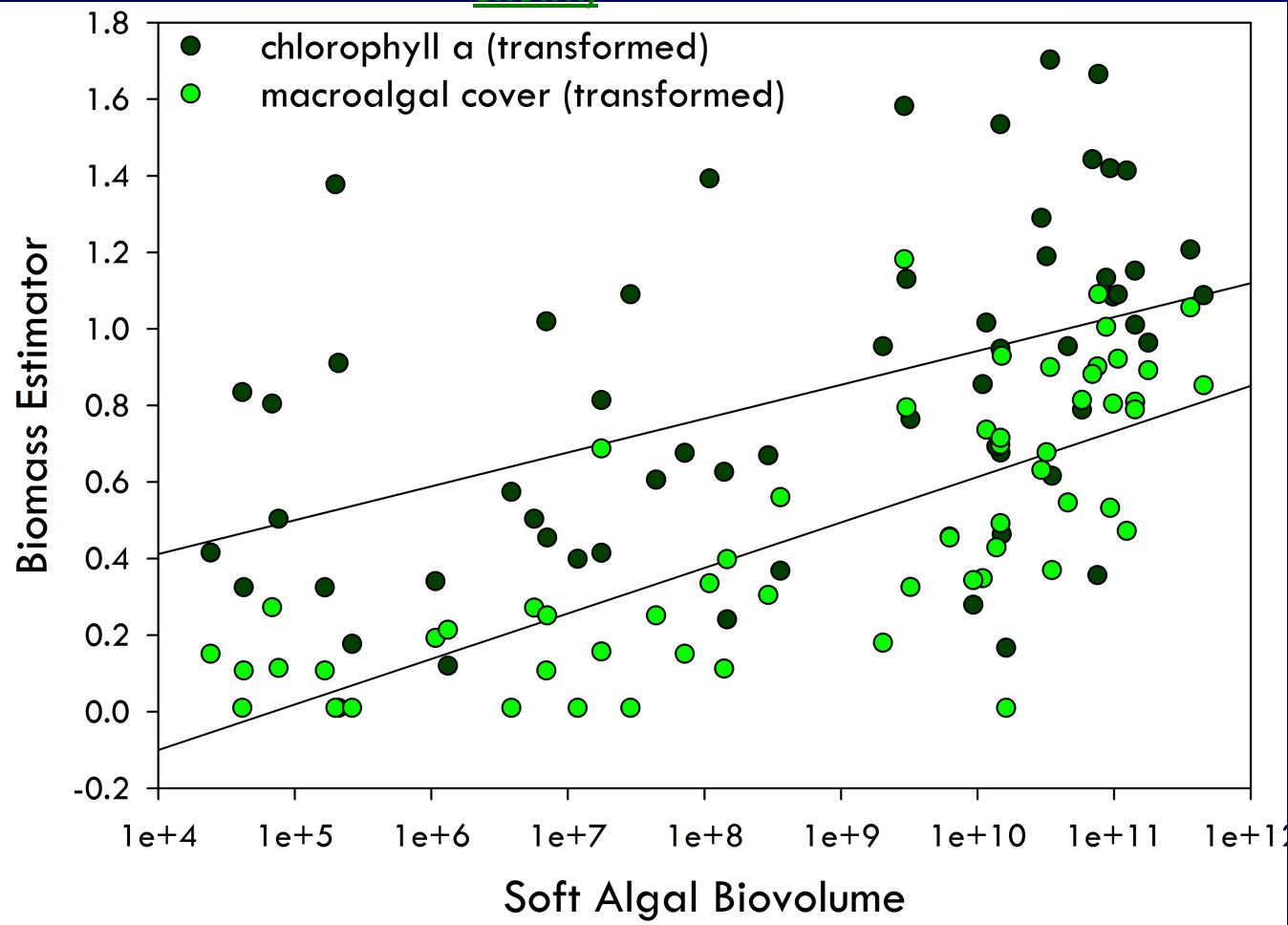
Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A
Left Center					P A		P A D	P A D	P A
Center					P A		P A D	P A D	P A
Right Center					P A		P A D	P A D	P A
Right Bank					P A		P A D	P A D	P A
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Code:
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
Z = Cannot determine if microalgae present, substrate too small or covered with silt.
D = Dry, not assessed

Comparison of Approaches to Estimating Stream Algal Productivity

Biomass Estimator	R^2	*F* ratio, *p*	coefficien t
Percent Cover (field, PHab)	0.59	82.9, <0.0001	0.12
Benthic chlorophyll *a* (lab)	0.21	16.3, 0.0002	0.09
Benthic chlorophyll *a* + phaeophytin (lab) (not shown)	0.15	11.0, 0.0016	0.07



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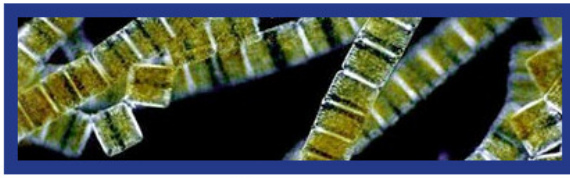
Diatom Data Capture Web - Development Site - SCCWRP Samples - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://dbmuseblade.colorado.edu/Diatom/09Sample.php

Most Visited Release Notes Plug-ins Extensions Support Mozilla Community



Diatom Data Capture Web

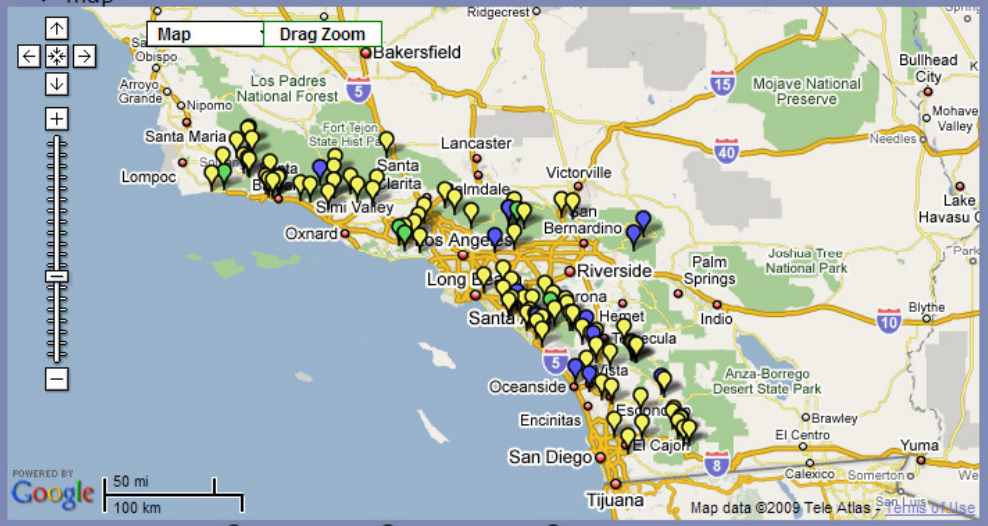
Database Resources

SCCWRP Data

- Sample Summary
- Occurrence Summary
- All Images
- All Samples (Map)
- All Locations (Map)

Sample Information For All Samples

<- map



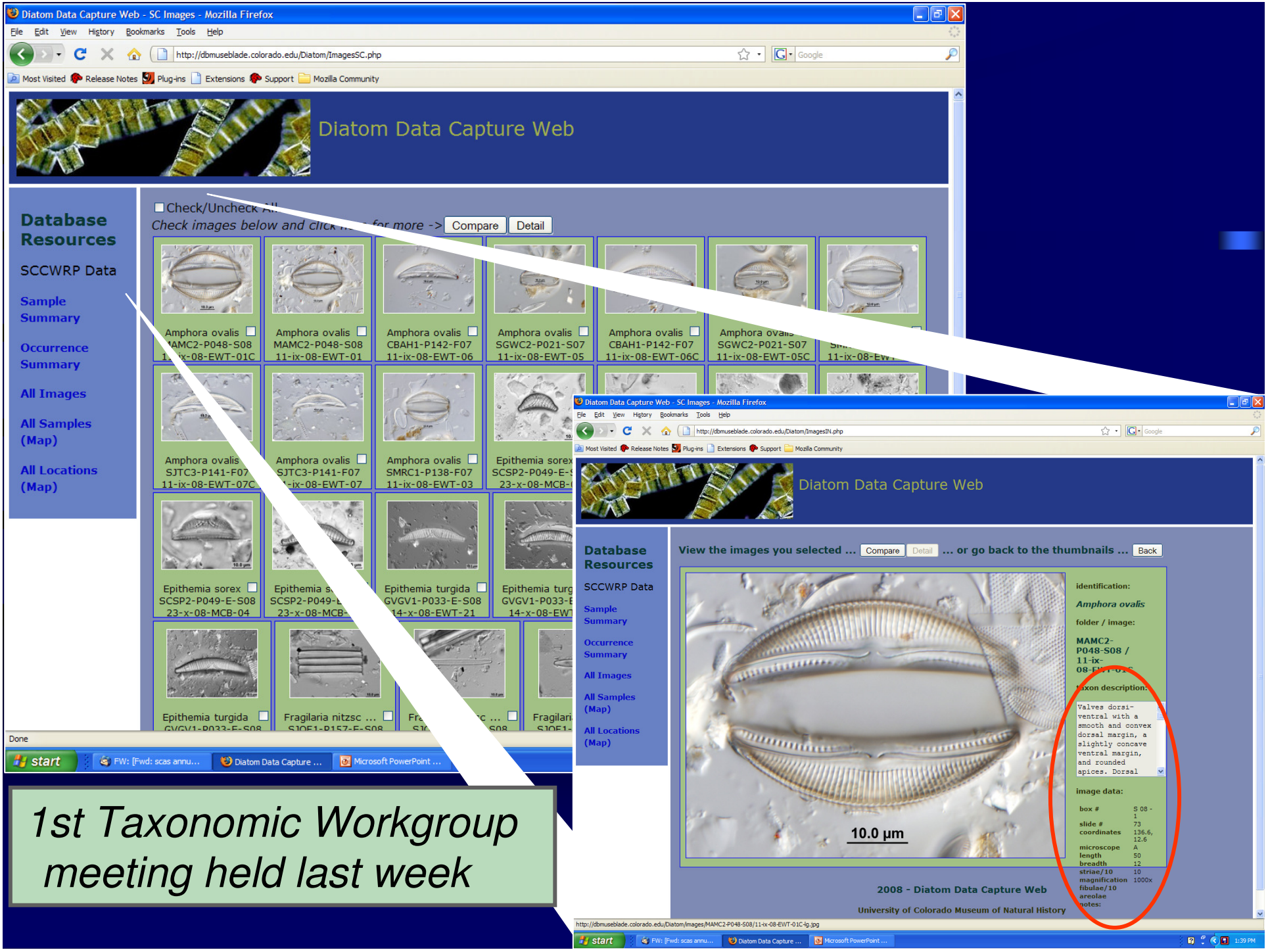
= 1 sample = 2 samples > 2 samples

Sample Events (Sample ID / Acc#) in the Database

Site Code (Filter: All)	Sample ID (Filter: All)	Acc#	Season (Filter: All)	DateCollected (Filter: All)	Water Body	Basin	County	Latitude	Longitude	
ABAB1	P055	2663	Summer 2008	2008-06-19	Arroyo Burro Creek	Arroyo Burro	Santa Barbara	34.42430	-119.75018	Map
AHAH1	P032	2665	Summer 2008	2008-06-04	Arroyo Hondo	Arroyo Hondo	Santa Barbara	34.48235	-120.14086	Map
AHAH1	P110	2465	Summer 2007	2007-06-17	Arroyo Hondo	Arroyo Hondo	Santa Barbara	34.48235	-120.14086	Map
ALAC2	P012	2467	Summer 2007	2007-06-18	Aliso Creek	Aliso Creek	Orange	33.57332	-117.71618	Map

Done

start FW: [Fwd: scas annu... Diatom Data Capture ... 1:36 PM


Diatom Data Capture Web - SC Images - Mozilla Firefox
http://dbmuseblade.colorado.edu/Diatom/ImagesSC.php
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Sample Summary
Occurrence Summary
All Images
All Samples (Map)
All Locations (Map)
Check images below and click ... for more ->
Compare
Detail
Amphora ovalis MAMC2-P048-S08 11-ix-08-EWT-01
Amphora ovalis CBAH1-P142-F07 11-ix-08-EWT-06
Amphora ovalis SGWC2-P021-S07 11-ix-08-EWT-05
Amphora ovalis CBAH1-P142-F07 11-ix-08-EWT-06C
Amphora ovalis SJTC3-P141-F07 11-ix-08-EWT-07C
Amphora ovalis SMRC1-P138-F07 11-ix-08-EWT-03
Epithemia sorex SCSP2-P049-E-S08 23-x-08-MCB-04
Epithemia turgida GVGV1-P033-E-S08 14-x-08-EWT-21
Epithemia turgida
Fragilaria nitzsc ...
Done
start
FW: [Fwd: scas annu...
Diatom Data Capture ...
Microsoft PowerPoint ...
1st Taxonomic Workgroup meeting held last week
Diatom Data Capture Web - SC Images - Mozilla Firefox
http://dbmuseblade.colorado.edu/Diatom/ImagesIN.php
Diatom Data Capture Web
Database Resources
SCCWRP Data
Sample Summary
Occurrence Summary
All Images
All Samples (Map)
All Locations (Map)
View the images you selected ...
Compare
Detail
... or go back to the thumbnails ...
Back
10.0 µm
identification:
Amphora ovalis
folder / image:
MAMC2-P048-S08 / 11-ix-08-
taxon description:
Valves dorsi-ventral with a smooth and convex dorsal margin, a slightly concave ventral margin, and rounded apices. Dorsal
image data:
box #
slide #
coordinates
microscope
length
breadth
striae/10
magnification
fibulae/10
areolae
notes:
2008 - Diatom Data Capture Web
University of Colorado Museum of Natural History
http://dbmuseblade.colorado.edu/Diatom/images/MAMC2-P048-S08/11-ix-08-EWT-01C-lg.jpg

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SWAMP
Surface Water Ambient Monitoring Program

SCCWRP

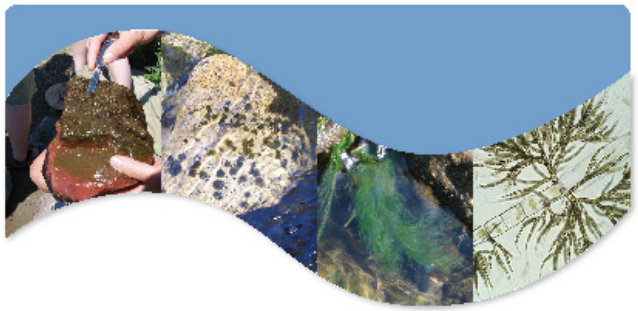
Draft Technical Report 2008

Incorporating Bioassessment Using Freshwater Algae into California's Surface Water Ambient Monitoring Program (SWAMP)

Water Boards

California's "Algae Plan"

completed March 2008



SWAMP
Surface Water Ambient Monitoring Program

SCCWRP
Established 1969

SWAMP Algae Field SOP 2009

Standard Operating Procedure
for Collecting Stream Algae Sa
and Associated Physical Habita
and Chemical Data for Ambien
Bioassessments in California

July 2009

A. Elizabeth Fetscher
Southern California Coastal Water Research Project
3535 Harbor Blvd., Suite 110
Costa Mesa, CA 96262

Lilian Busse
San Diego Regional Water Quality Control Board
State Water Resources Control Board
9174 Sky Park Court
San Diego, CA 92123

Pete Ode
Aquatic Bioassessment Laboratory/Water Pollution Control Laboratory
Department of Fish and game
2005 Nimbus Road
Rancho Cordova, CA 95670

Water Boards

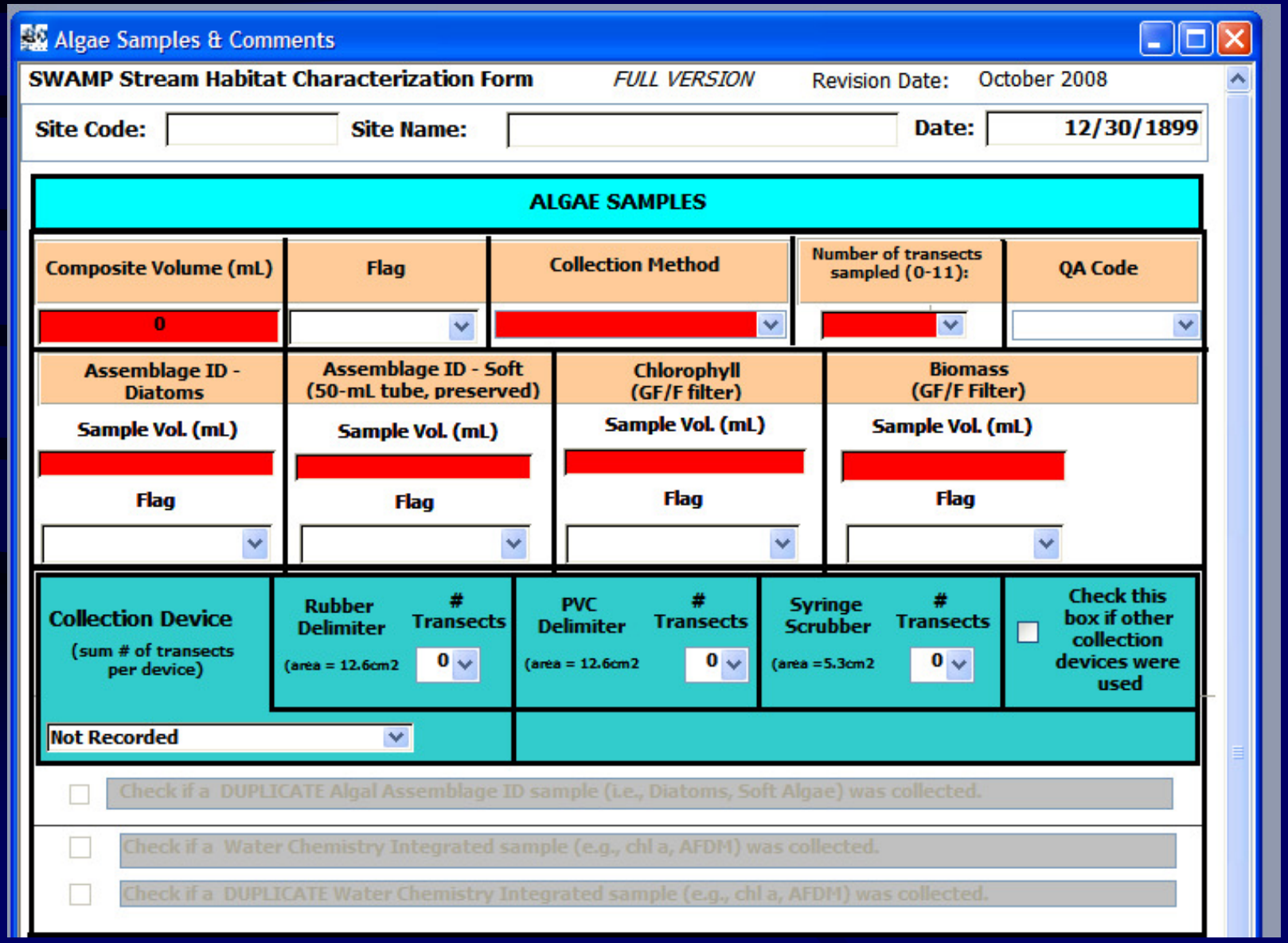
http://www.waterboards.ca.gov/water_issues/programs/swamp

California's Algae Field SOP

completed June 2009

- *Field training ongoing*
- *QAPP development to begin later this year*

Algae Incorporated into SWAMP Database



Summary of Preliminary Findings – Index Development

- Broad taxonomic diversity
  - Diatoms: > 450 taxa
  - Soft-bodied: > 300 taxa
- Algal relationships to anthropogenic factors (*e.g.,* surrounding land use, water chemistry parameters)
- Indicator taxa candidates (*e.g.,* nitrogen-fixers) and possible thresholds
- Useful rapid field indicators of algal nuisance


More information:
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714-755-3237