Microcystis aeruginosa

A new toxic alga in the Delta

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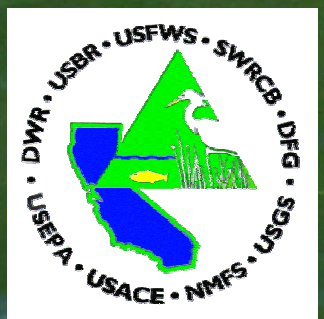
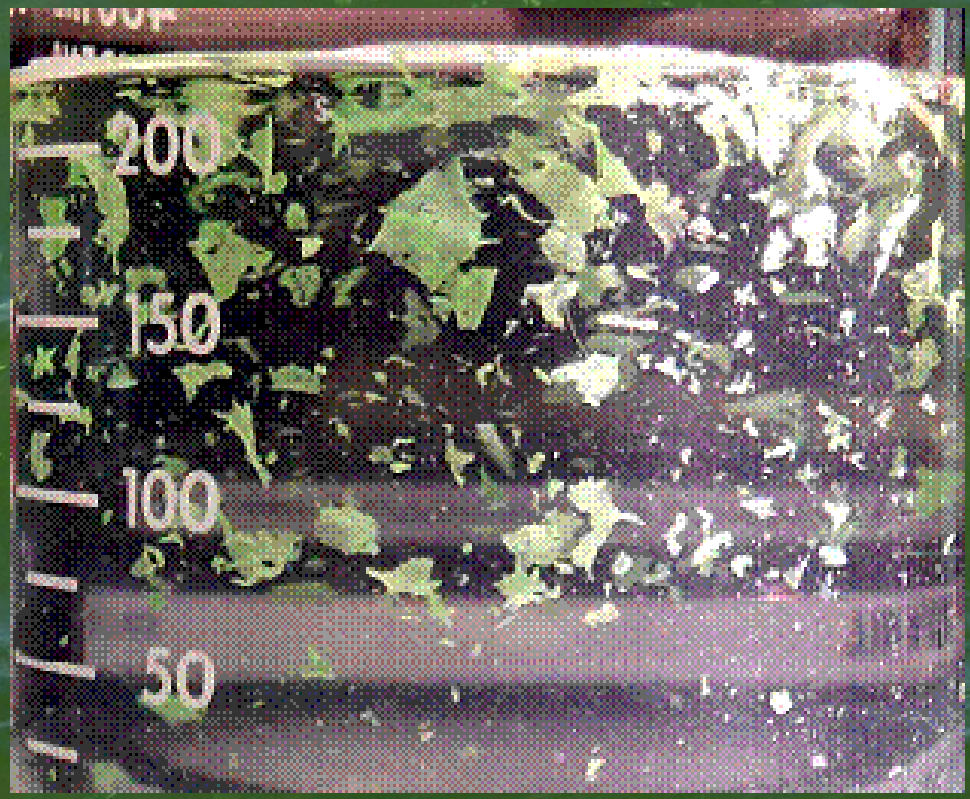


forms a surface scum of large green flakes up to 1 inch in diameter



Study Goals
2003 & 2004

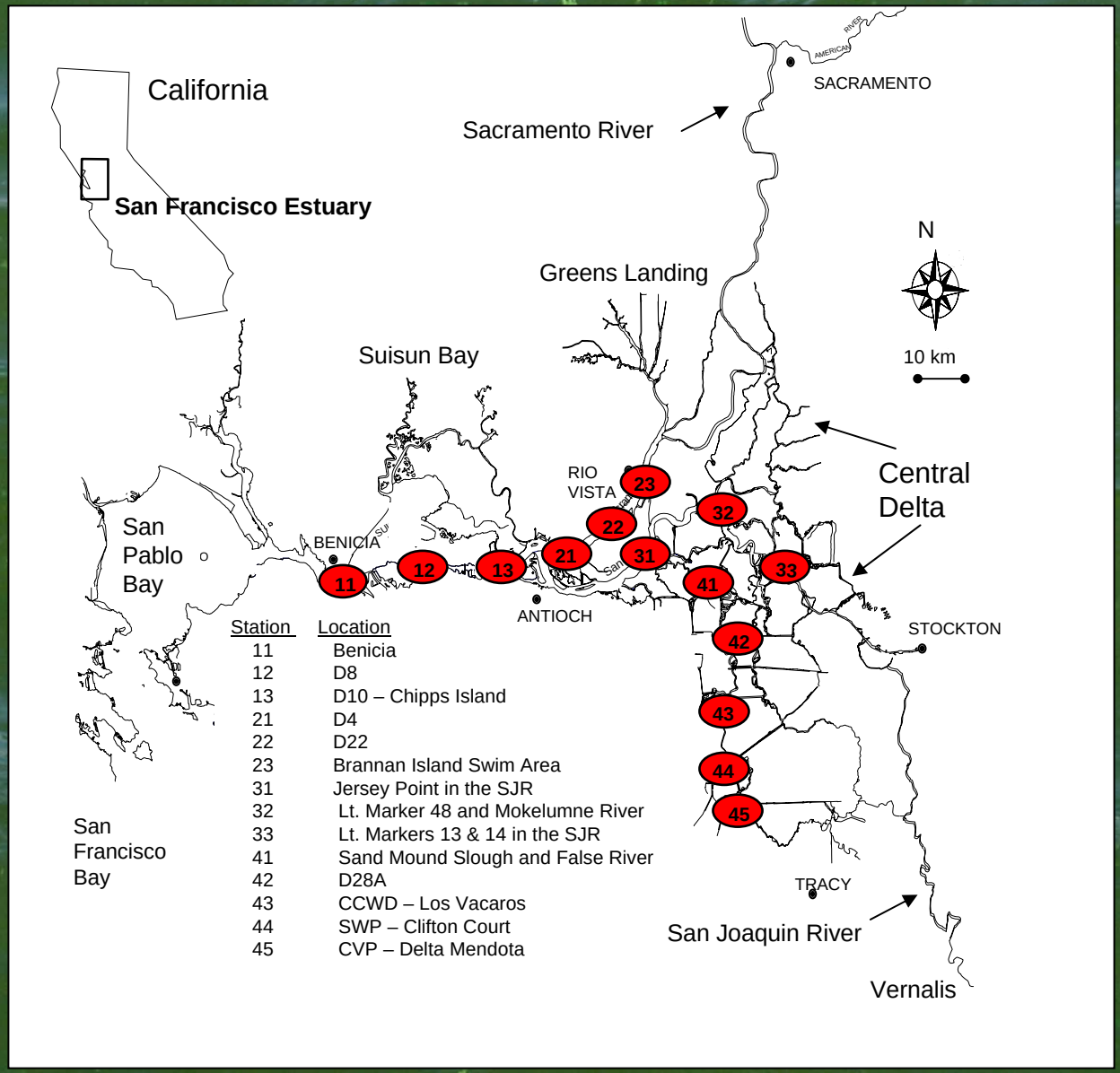
- Determine the geographic distribution of the bloom
- Assess bloom toxicity
- Assess the bloom impact to the estuarine food web

Methods

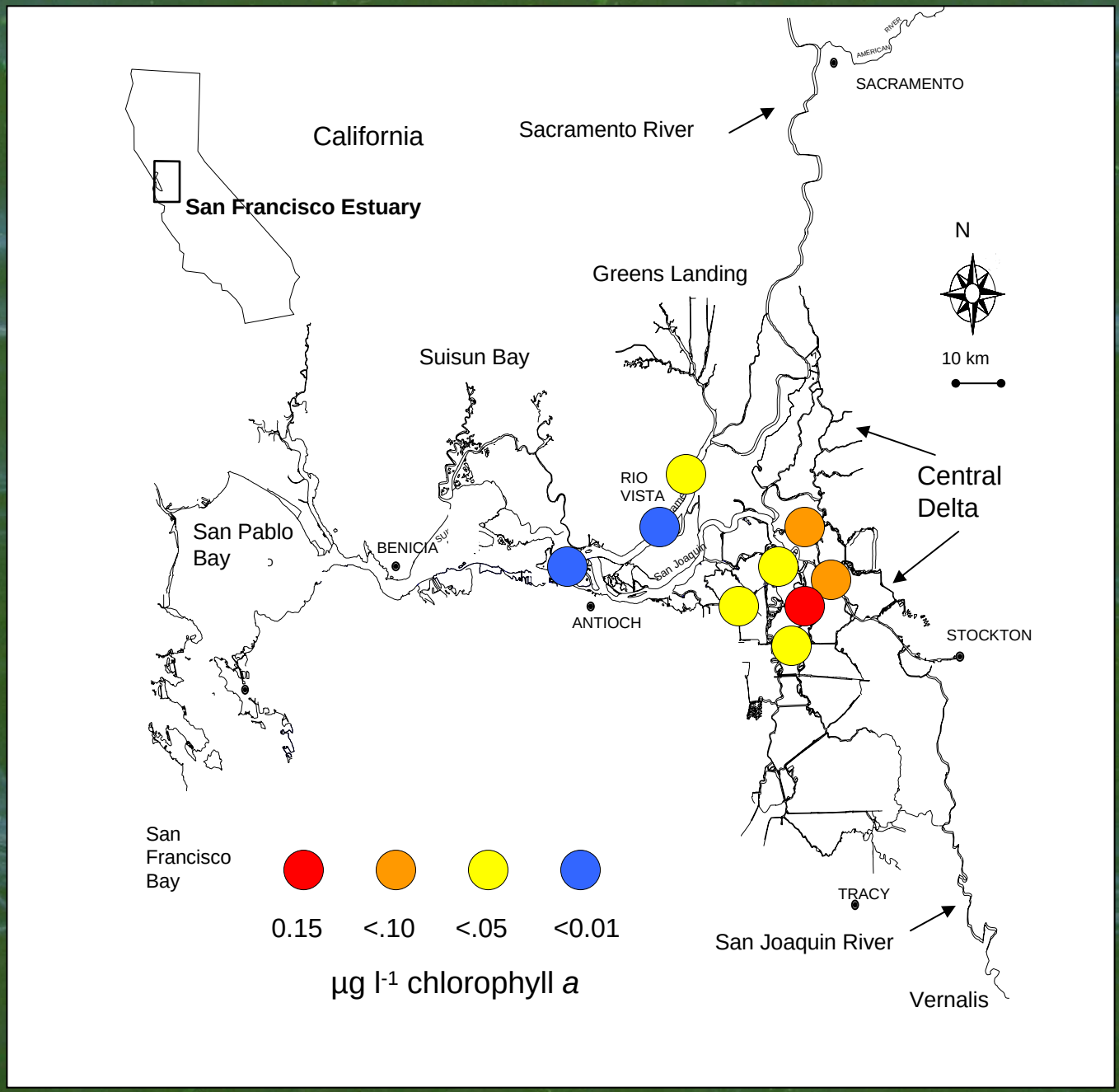
- Single day in October 2003 & biweekly sampling in 2004
- Sampled at 10 to 14 stations from brackish to freshwater
- Collected phytoplankton samples for chlorophyll *a* concentration and *Microcystis* toxin analysis
- Measured ancillary water quality data (pH, specific conductance, water temperature and nutrient concentration)
- Conducted initial laboratory feeding tests with *Eurytemora affinis*

Net sampling

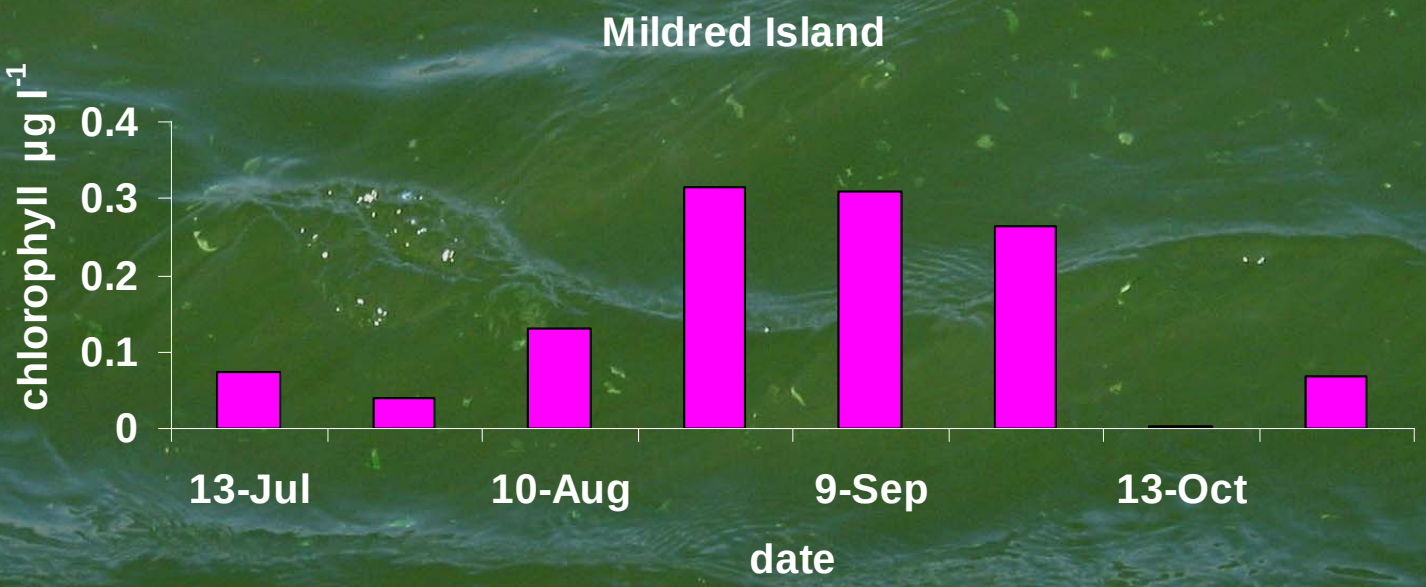
bloom occurred throughout the Delta



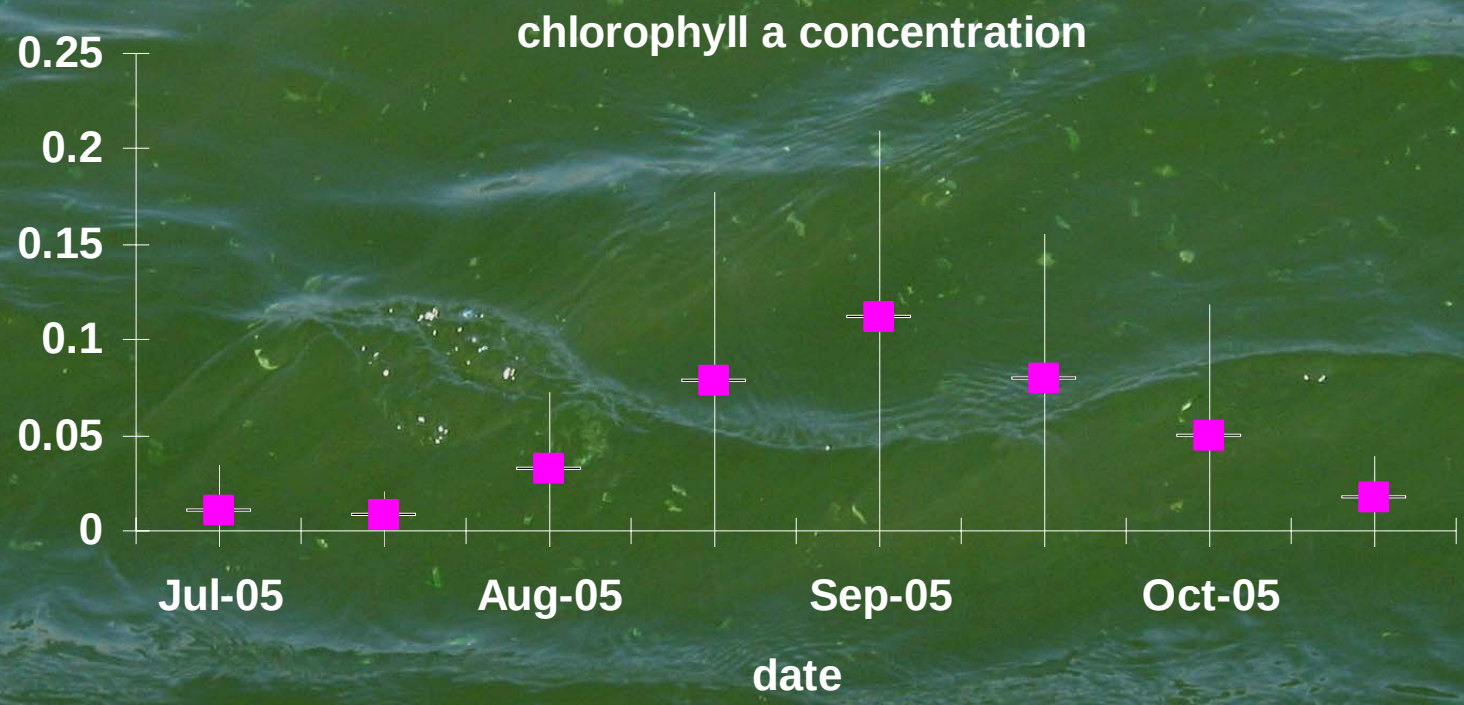
Station	Location
11	Benicia
12	D8
13	D10 – Chipps Island
21	D4
22	D22
23	Brannan Island Swim Area
31	Jersey Point in the SJR
32	Lt. Marker 48 and Mokelumne River
33	Lt. Markers 13 & 14 in the SJR
41	Sand Mound Slough and False River
42	D28A
43	CCWD – Los Vacaros
44	SWP – Clifton Court
45	CVP – Delta Mendota


California
San Francisco Estuary
Sacramento River
SACRAMENTO
N
10 km
Greens Landing
Suisun Bay
RIO VISTA
Central Delta
San Pablo Bay
BENICIA
ANTIOCH
STOCKTON
TRACY
San Joaquin River
Vernalis
San Francisco Bay
0.15
<.10
<.05
<0.01
µg l-1 chlorophyll a

biomass was highest in shallow freshwater habitat of the central Delta



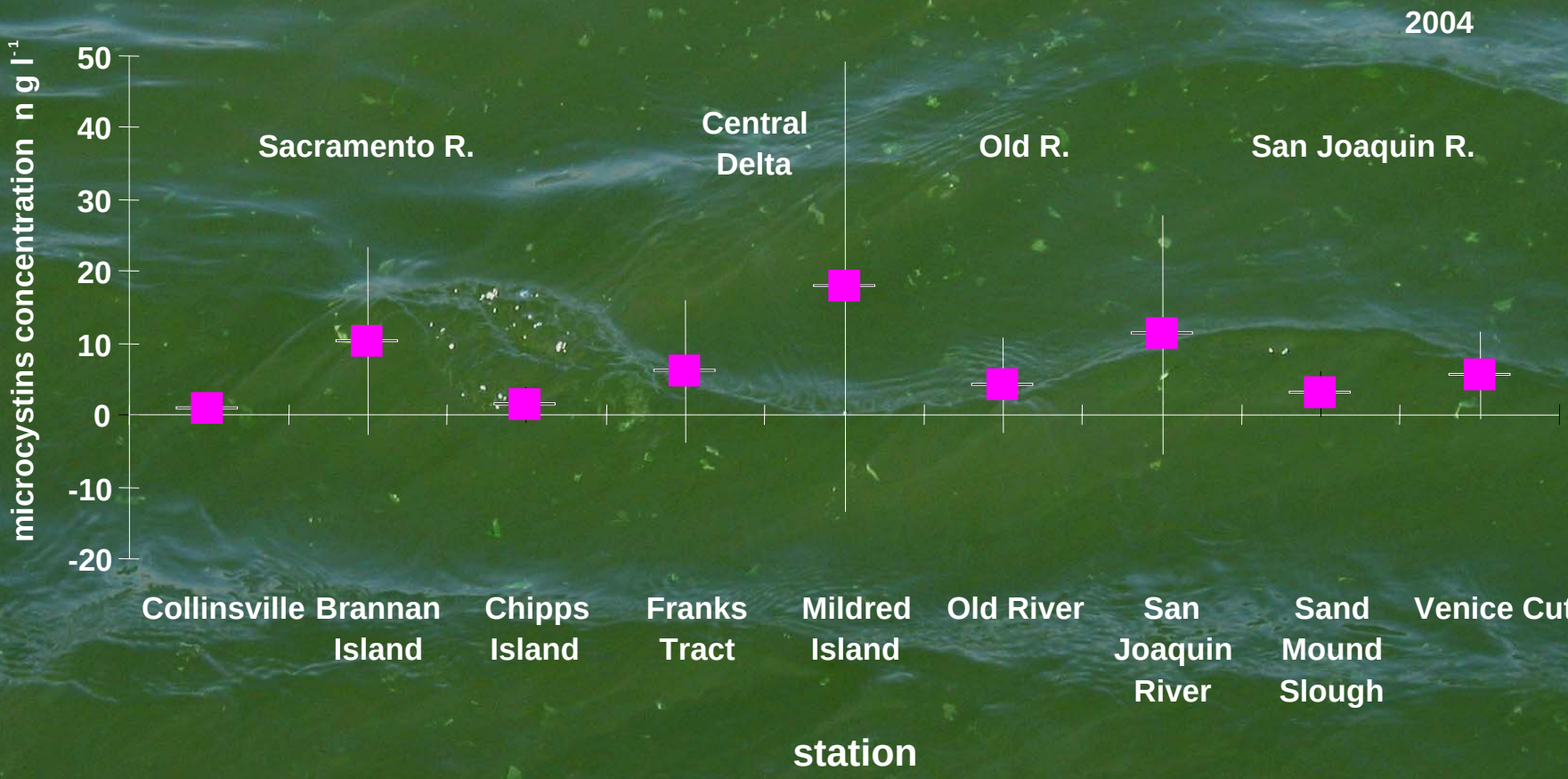
Biomass was highest in early September



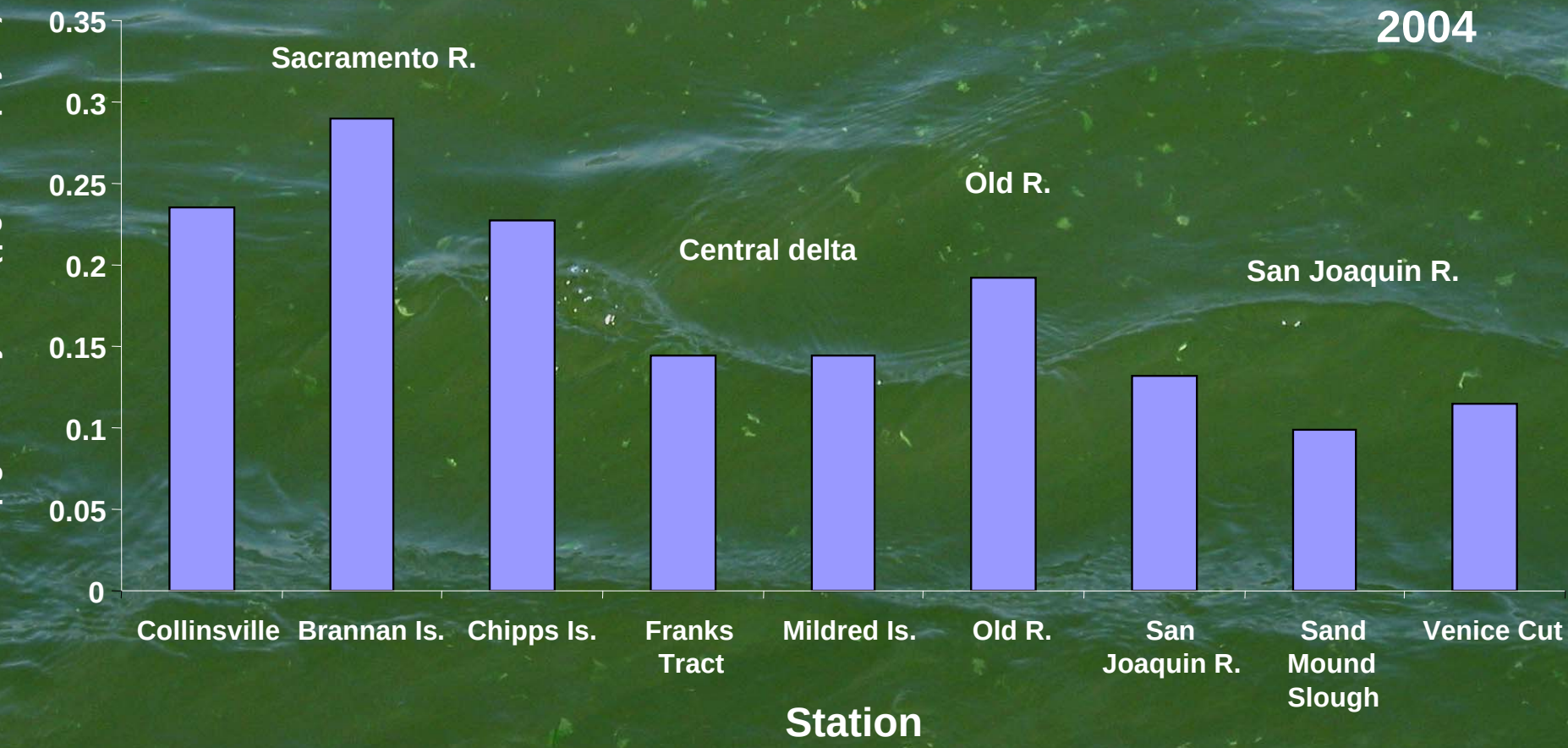
Microcystis contained toxic microcystins

	percent microcystins composition							
station	RR	YR	demethyl LR	LR	non-polar	LW	LF	unknown
Sacramento River								
Collinsville			100					
Brannon Island			88	14	12		29	
Chipps Island			100					
Central delta								
Franks Tract			95		10		24	
Mildred Island	12	*	90	21	31	23	15	3
Old River	9		88	11	5		14	34
San Joaquin River								
San Joaquin River			70	20.5	4	5	25	
Sand Mound Slough			96	20			17	
Venice Cut			86		13		16	

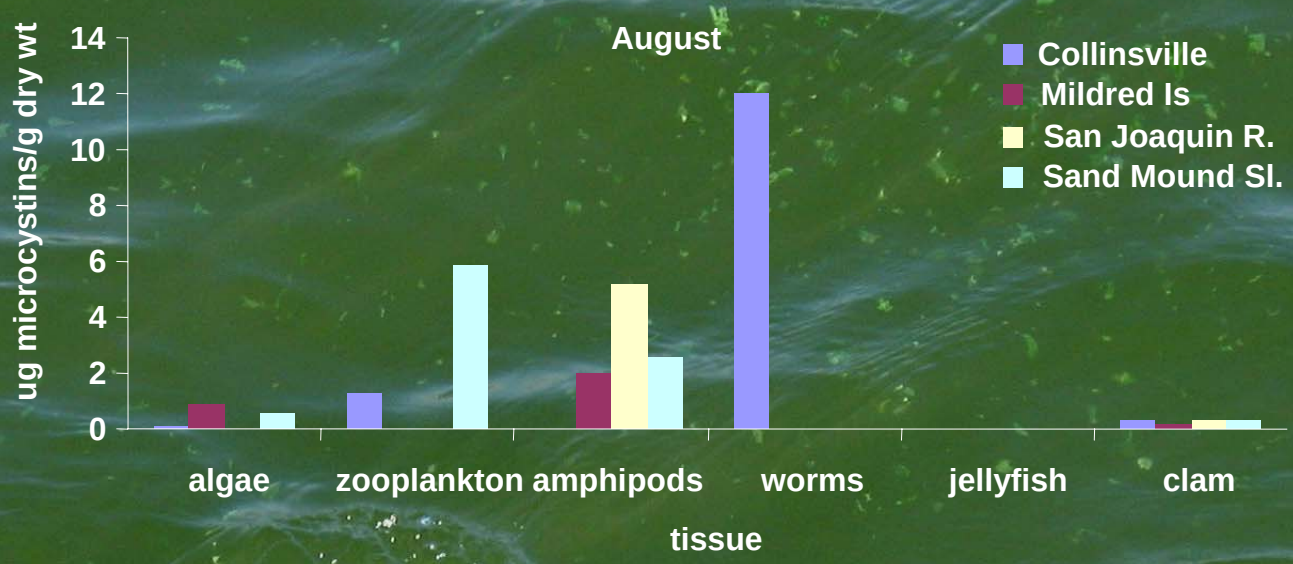
the bloom toxicity was highest in the central delta

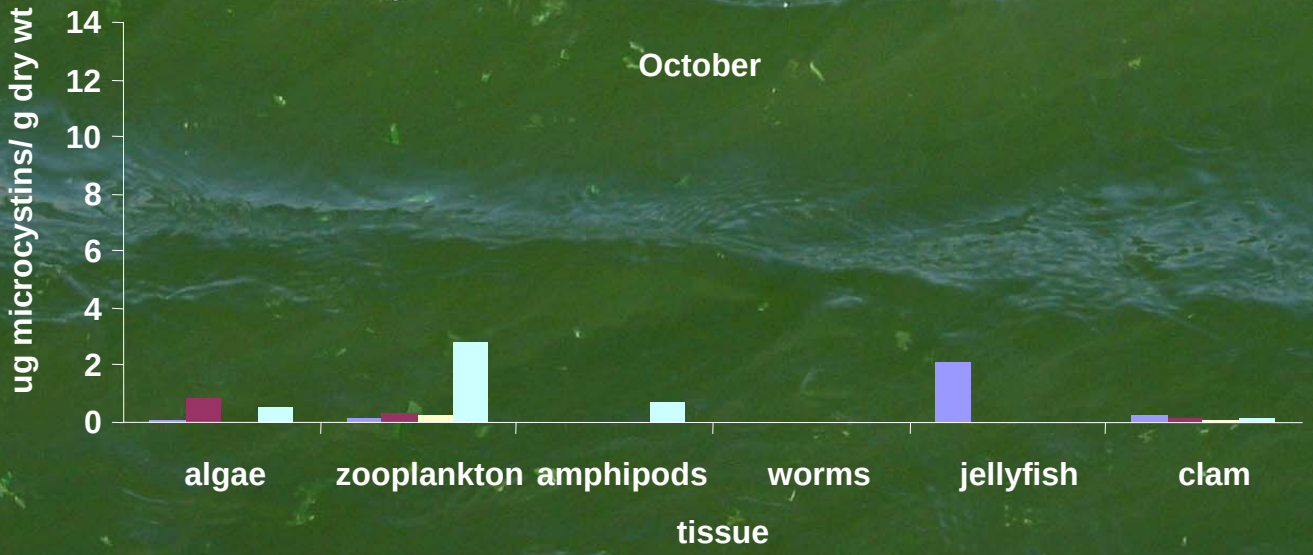


chl *a* – specific toxicity was higher in the western delta



Toxins occurred throughout the food web





it was not eaten by *Eurytemora affinis*

Control	Treatment
0.05 ± 0.01	0.07 ± 0.01
µg l^{-1} (100 animals) $^{-1}$	µg l^{-1} (100 animals) $^{-1}$

Why is it here now?

Environmental conditions

	Napa River	Suisun Marsh	Suisun Bay	Western Delta	Central Delta
Chloride mg/L	6450	1880	2310	316	38
Specific Conductance mS/cm	18.94	5.65	7.53	1.18	0.20
Phosphorus mg/L	0.08	0.13	0.11	0.10	0.07
Nitrite + Nitrate mg/L	0.01	0.21	0.32	0.26	0.14
Temperature °C	21.16	21.38	20.63	21.11	22.99
Secchi Depth cm	59	22	36	40	160
Turbidity NTU	7	42	38	22	3
Total Suspended Solids mg/L	14	33	36	19	2

Summary

- the new freshwater cyanobacteria bloom was widely distributed and occurred between July and November
- the bloom was toxic and contained microcystins that can cause liver cancer in humans and wildlife
- bloom toxins entered at least the base of the food web, but was not readily eaten by a desirable zooplankton food, *Eurytemora affinis*
- ambient toxicity of the largest colonies were below the WHO advisory level for drinking water quality of 1 µg l^{-1}
- the long-term impacts of the bloom on drinking water, ecological processes and management in the Delta are unknown