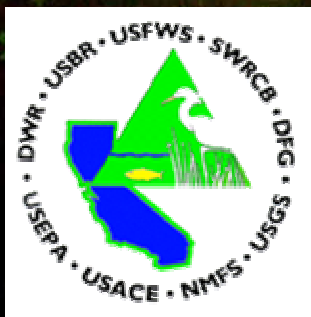


Microcystis aeruginosa

A new toxic alga in the Delta

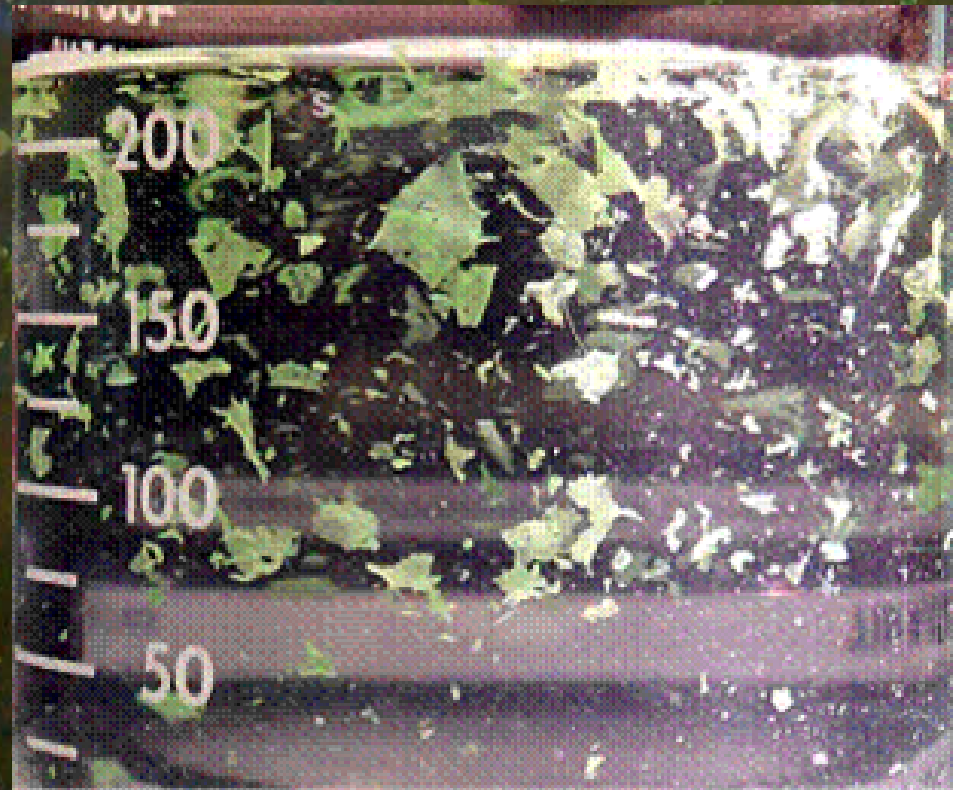
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forms a surface scum of large green flakes up to 1 inch in diameter



An aerial photograph of a large body of water, likely a delta, showing a massive, dense bloom of cyanobacteria. The water is a deep, dark blue-green color, with the bloom appearing as a thick, bright green layer on the surface. The bloom is widespread and covers most of the visible water area. The background shows some darker, possibly forested or undeveloped land, and some lighter areas that might be roads or canals.

- *Microcystis* is a cyanobacteria (blue-green algae)

- present since 1999 between July and November in the Delta

A microscopic view of a cyanobacterial bloom, showing numerous small, green, rod-shaped cells with visible internal structures, likely Microcystis, against a dark background. The cells are densely packed and appear to be forming a biofilm or colony.

Why is *Microcystis* a problem?

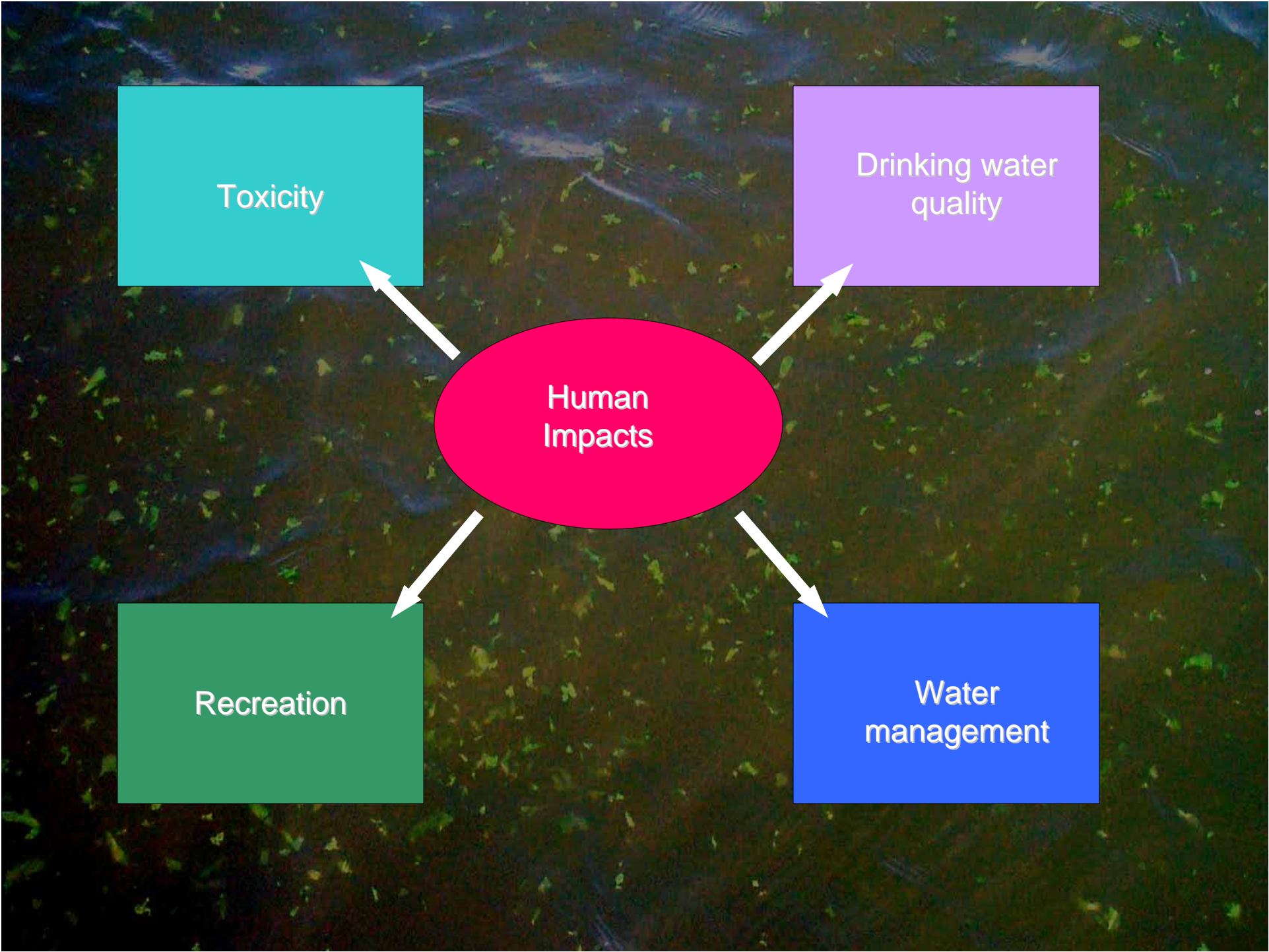
Toxicity

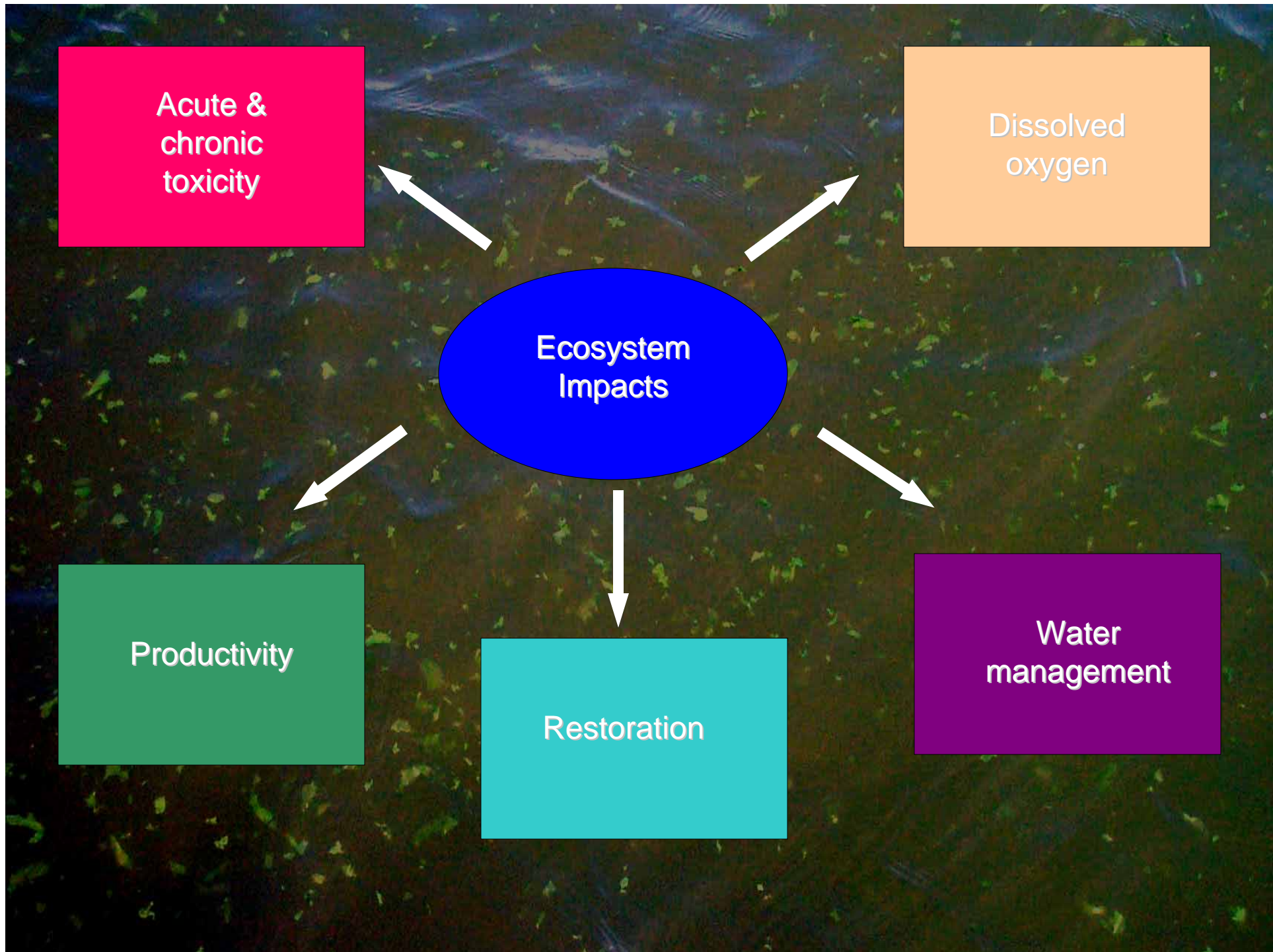
Drinking water quality

Human Impacts

Recreation

Water management





2003 & 2004 Study Goals

- Determine the spatial and temporal variation of the bloom
- Assess bloom toxicity
- Assess the bloom impact to the estuarine food web

Methods

- One day sampling event in October 2003 and biweekly sampling in 2004
- Sampled at up to 16 stations from brackish to freshwater
- Collected phytoplankton biomass samples for chlorophyll *a* concentration and microcystin toxins
- Measured ancillary water quality data (pH, specific conductance, water temperature and nutrient concentration)
- Measured microcystins concentration in animal tissue
- Conducted initial feeding test with *Eurytemora affinis*

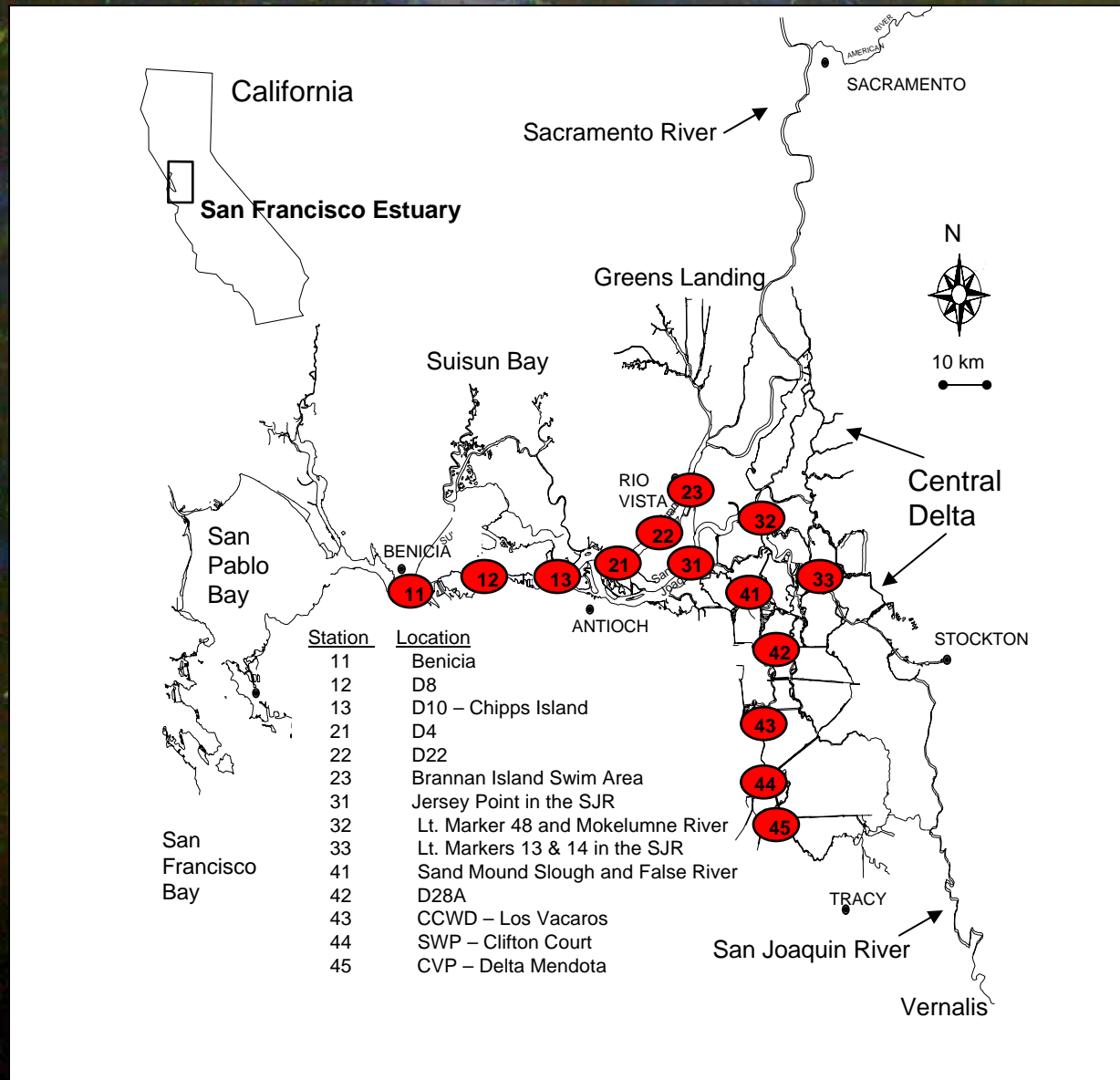
Net sampling

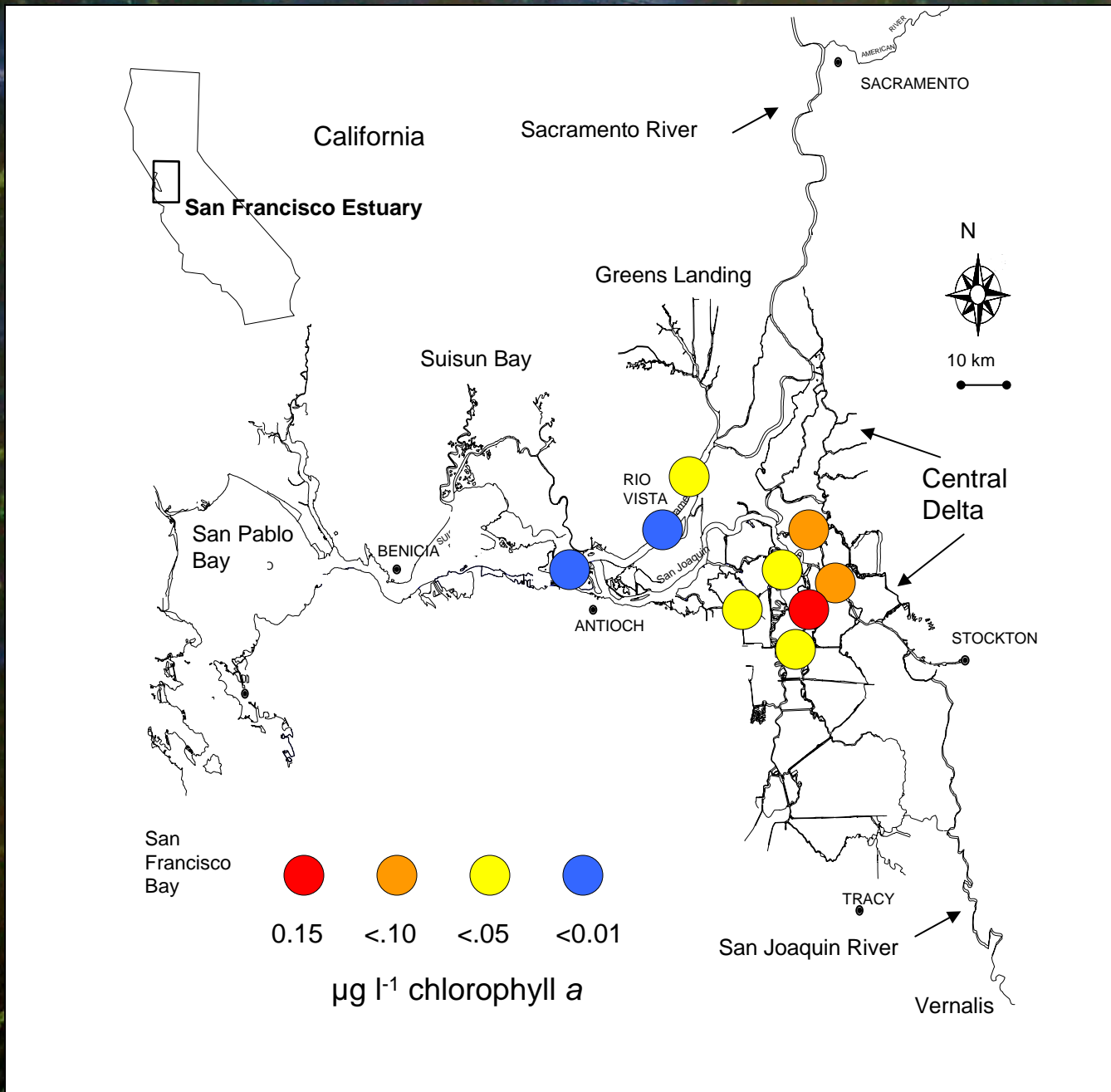


Findings

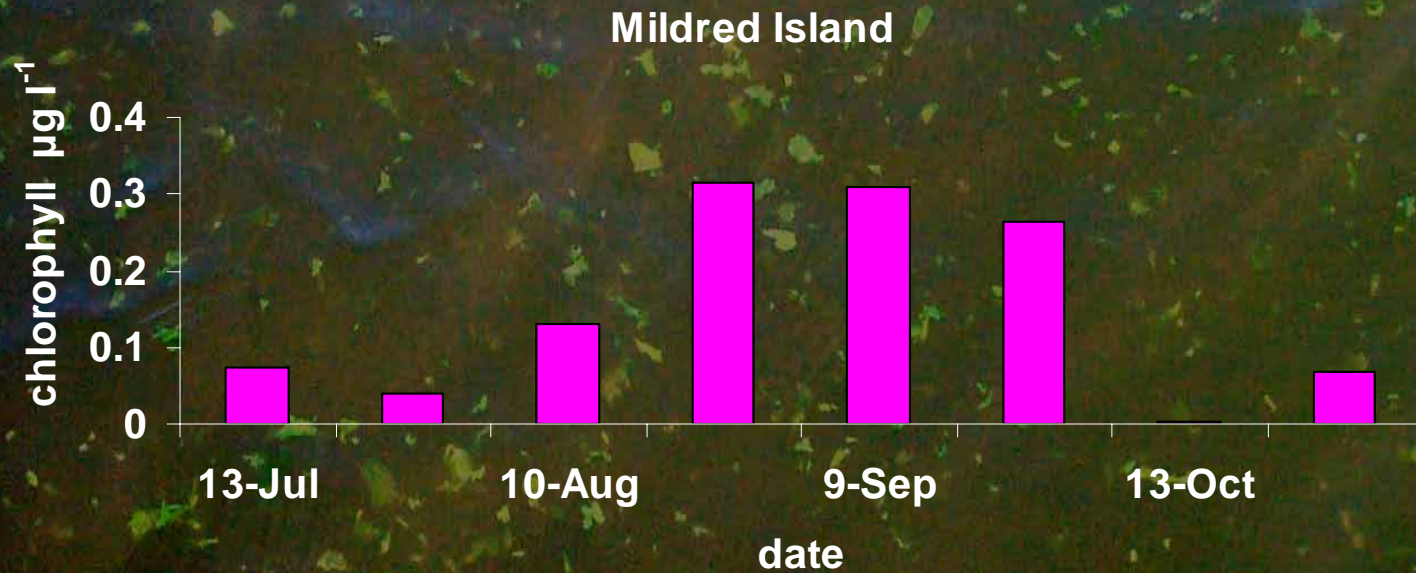


bloom occurred throughout the Delta

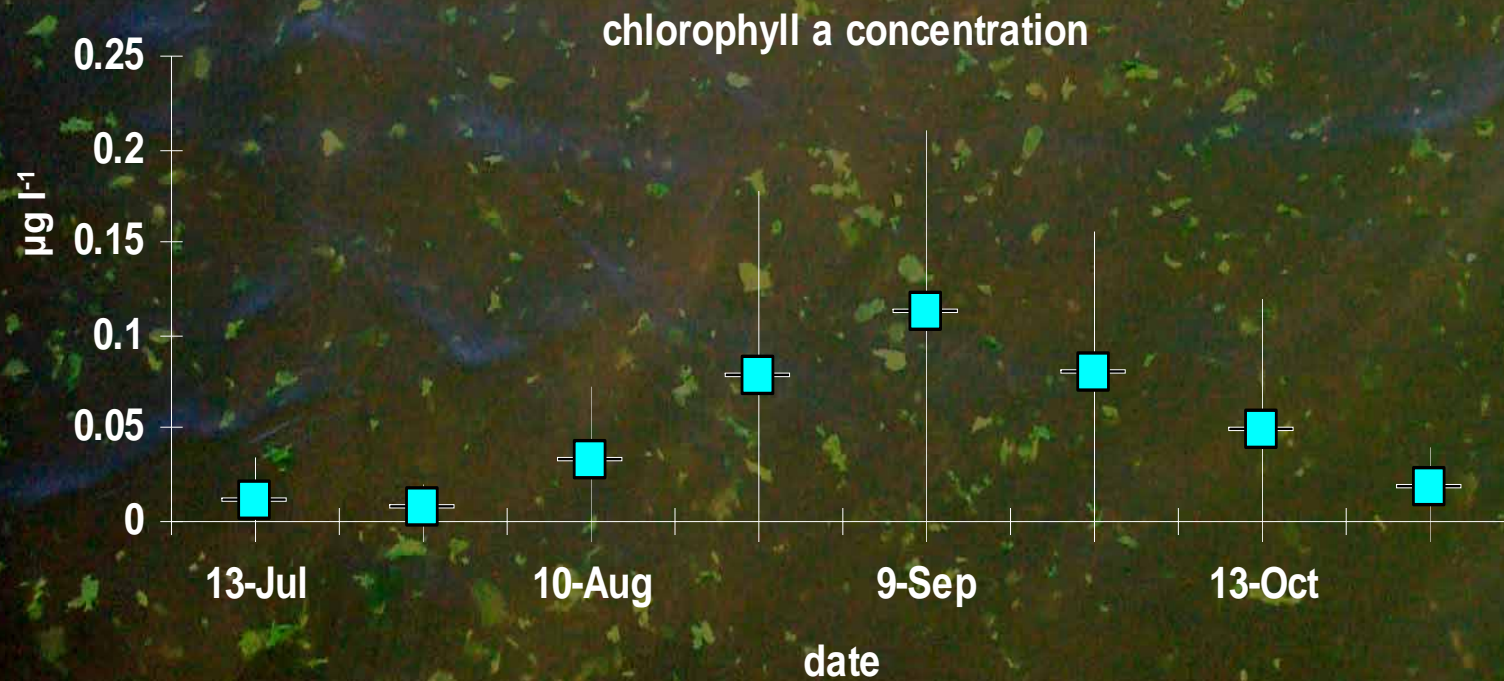




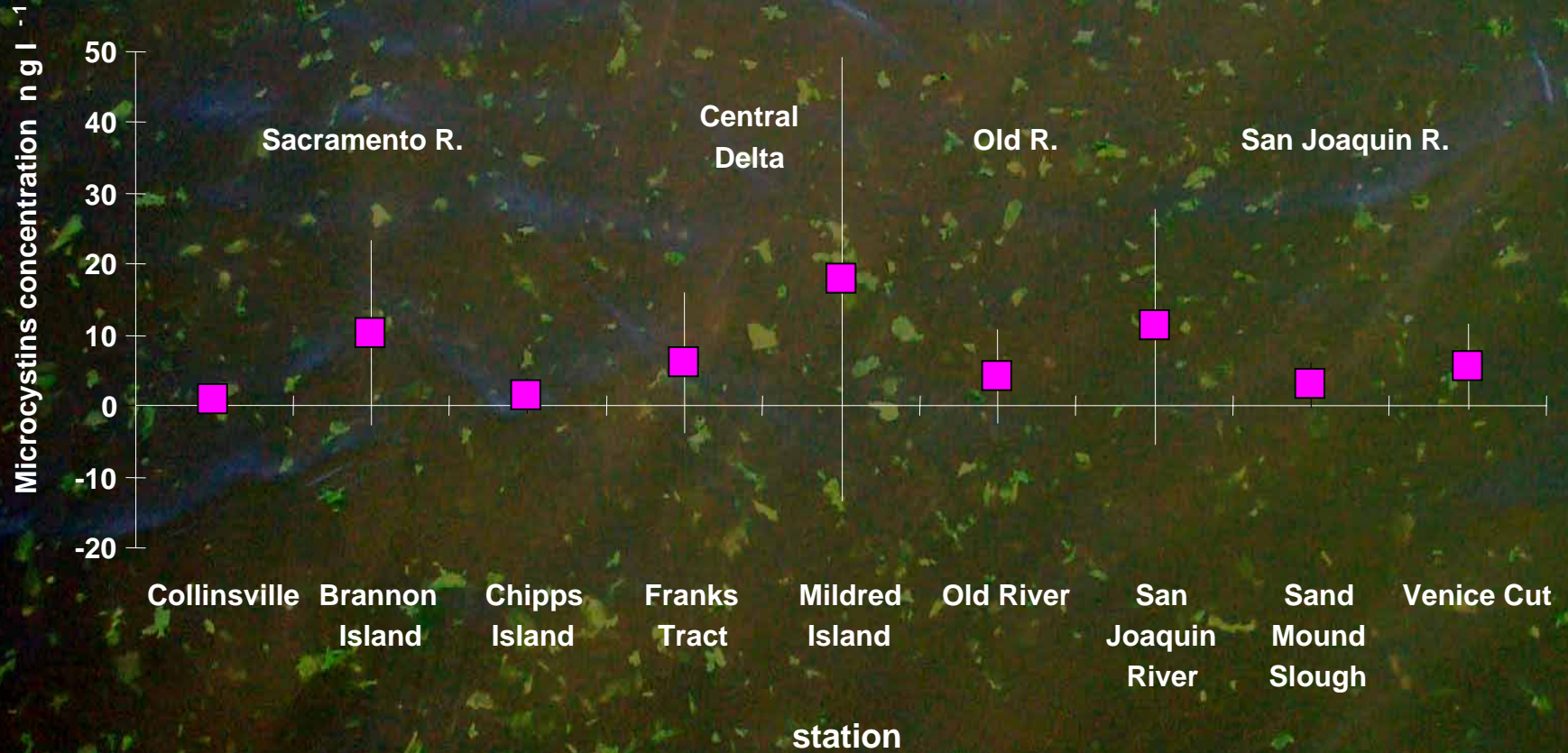
biomass was highest in shallow freshwater habitat of the central Delta



Biomass varied seasonally and was highest in early September



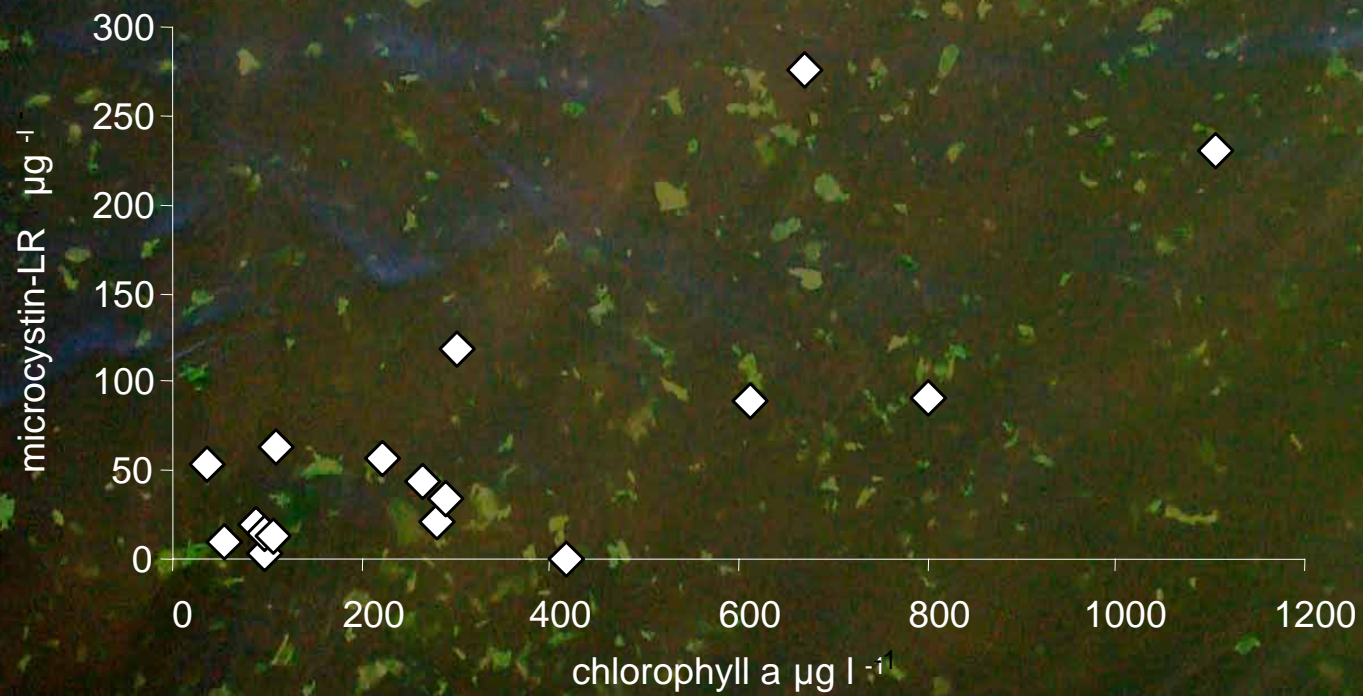
the bloom was toxic



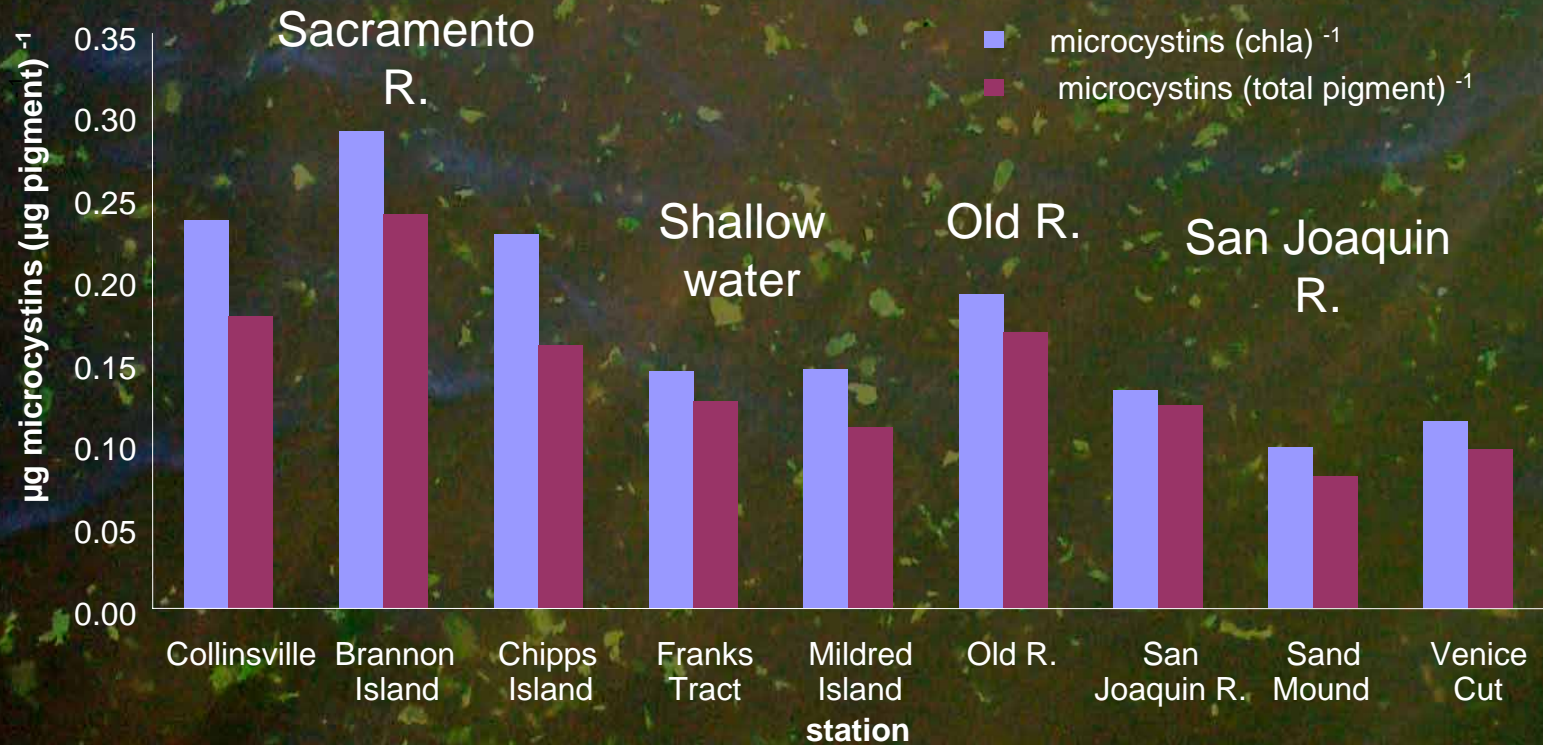
The Delta contains more than one strain of *Microcystis*

station	percent microcystins							
	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	

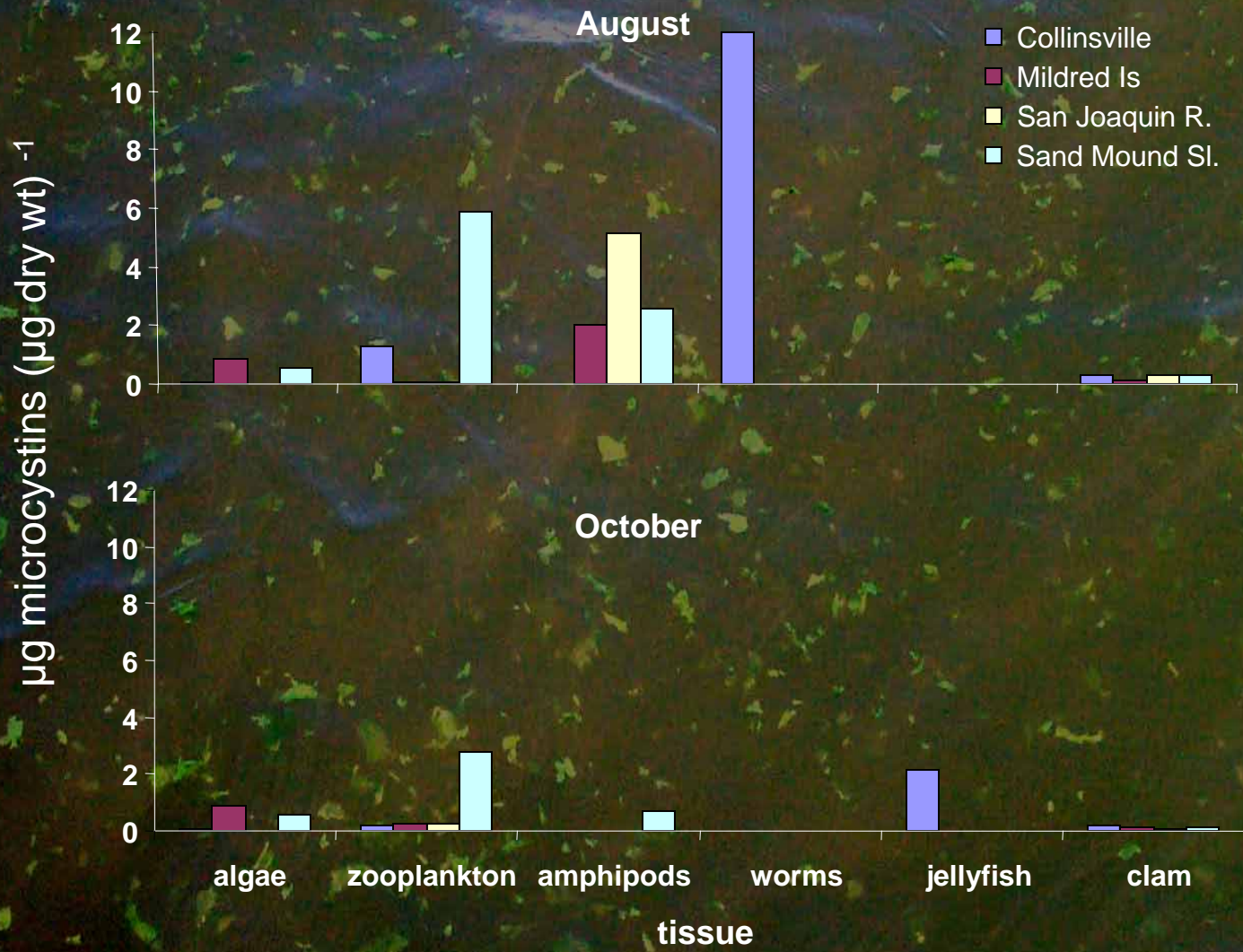
**Biomass and toxicity were
not linear**



the highest toxicity was in the Sacramento River



Microcystis toxins occurred throughout the food web



not readily eaten by
Eurytemora affinis

Control

0.05 ± 0.01

$\mu\text{g l}^{-1} (100 \text{ animals})^{-1}$

Treatment

0.07 ± 0.01

$\mu\text{g l}^{-1} (100 \text{ animals})^{-1}$

Summary

- the new freshwater cyanobacteria bloom was widely distributed and occurred between July and November
- the bloom was toxic and contained toxins that can bioaccumulate and 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
- the long-term impacts of the bloom on drinking water, ecological processes and management in the Delta are unknown

Management implications

- Water treatment
- SWP Project operation & development
- Ecosystem Restoration
- Recreation

An aerial photograph of a forest with a central text overlay. The forest is dense with green trees, and the text "More work is needed" is written in a bold, yellow font in the center of the image. The background is a dark, textured green, suggesting a dense canopy of trees.

More work is needed