

Are Zooplankton and Clams Dining on Super Food or Junk Food?



Application of a Phytoplankton Food Quality Index



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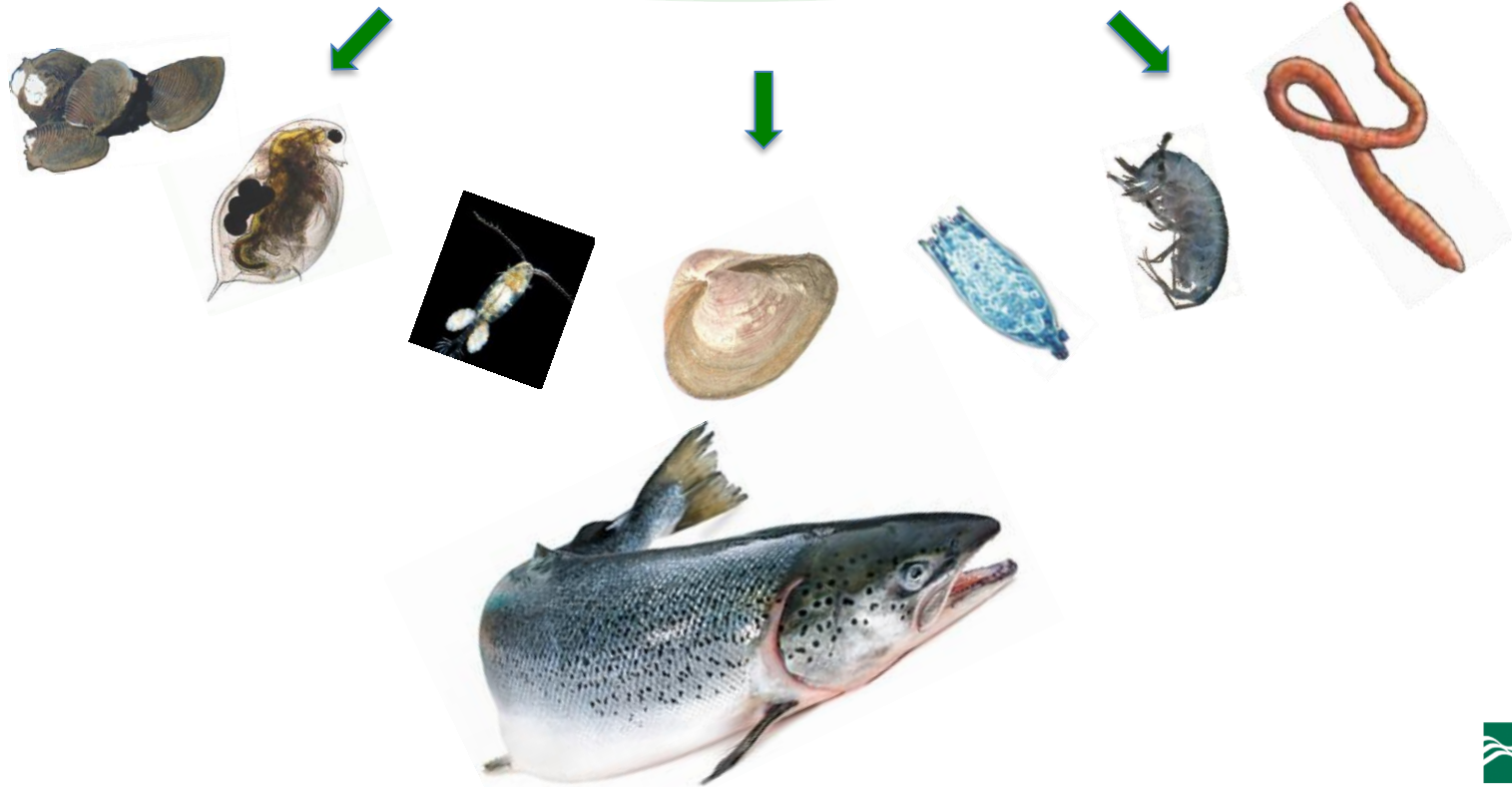
³ University of Oregon, Charleston, OR

⁴ Stockholm University, Sweden

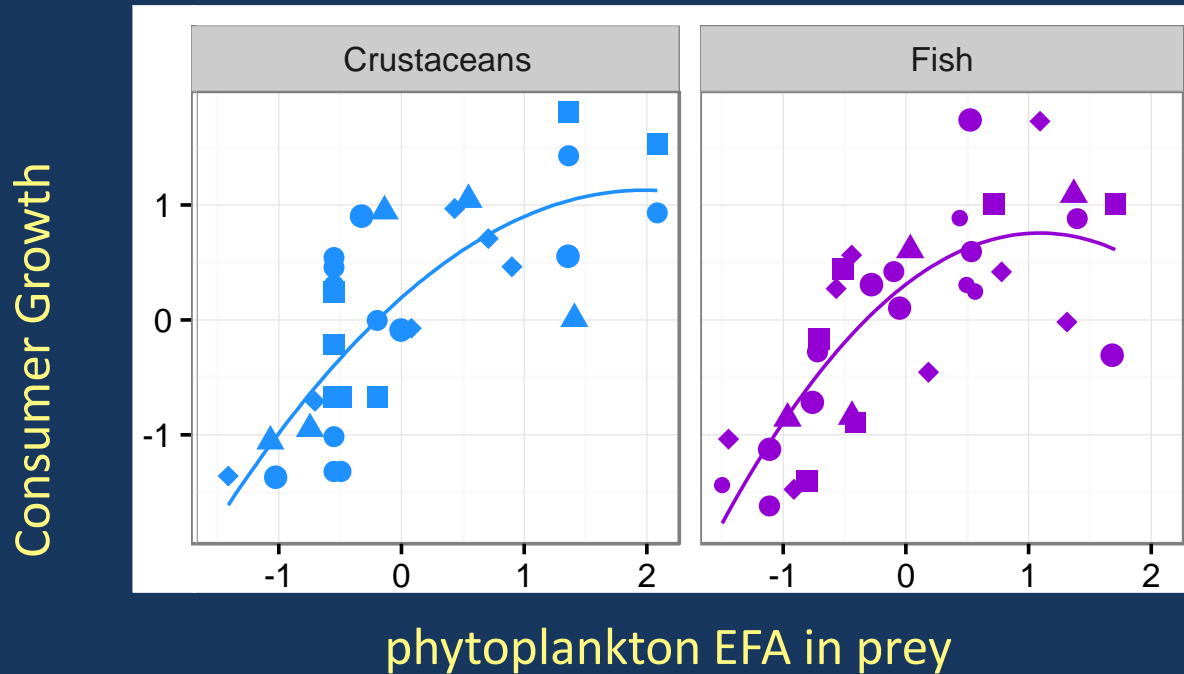
⁵ San Francisco Estuary Institute, Richmond, CA

Why do we care about the nutritional value of the phytoplankton community?

Phytoplankton
long chain essential fatty acids



EFA matters to growth and survival of animals









From Winder, M et al. In review

Increasing dietary EFA improves:


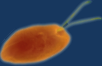




- growth in juvenile bivalves, fish larvae, cladoceran zooplankton, and isopods
- fecundity in marine copepods
- gonad development in sea urchins

Community determines EFA content





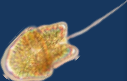

	Group	%LCEFA
	Chlorophytes	2.28
	Cryptophytes	14.13
	Cyanobacteria	0.19
	Diatoms	16.80
	Dinoflagellates	21.69
	Haptophytes	11.13

Based on studies of over 200 species cultured under diverse conditions

100 fold range in phytoplankton EFA content!

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Food Quality Index (FQI)

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FQI is a weighted average - each group's biomass is multiplied by the associated LCEFA proportion

**Lower Sac River
(confluence to Rio Vista)**

San Pablo Bay

Suisun Bay

Central Bay

**FQI applied to 1146 samples
Feb 1992 – May 2016**

South Bay

Lower South Bay



10 taxonomic groups (phyla) of SF Bay phytoplankton

- **Bacillariophyte - diatom**
- **Chlorophyte**
- **Chrysophyte**
- **Cryptophyte**
- **Cyanophyte**
- **Dinophyte - dinoflagellate**
- **Euglenophyte**
- **Eustigmatophyte**
- **Haptophyte**
- **Raphidophyte**

FQI = 97% of SF Bay phytoplankton biomass



Bacillariophyte - diatom



Chlorophyte



Cryptophyte



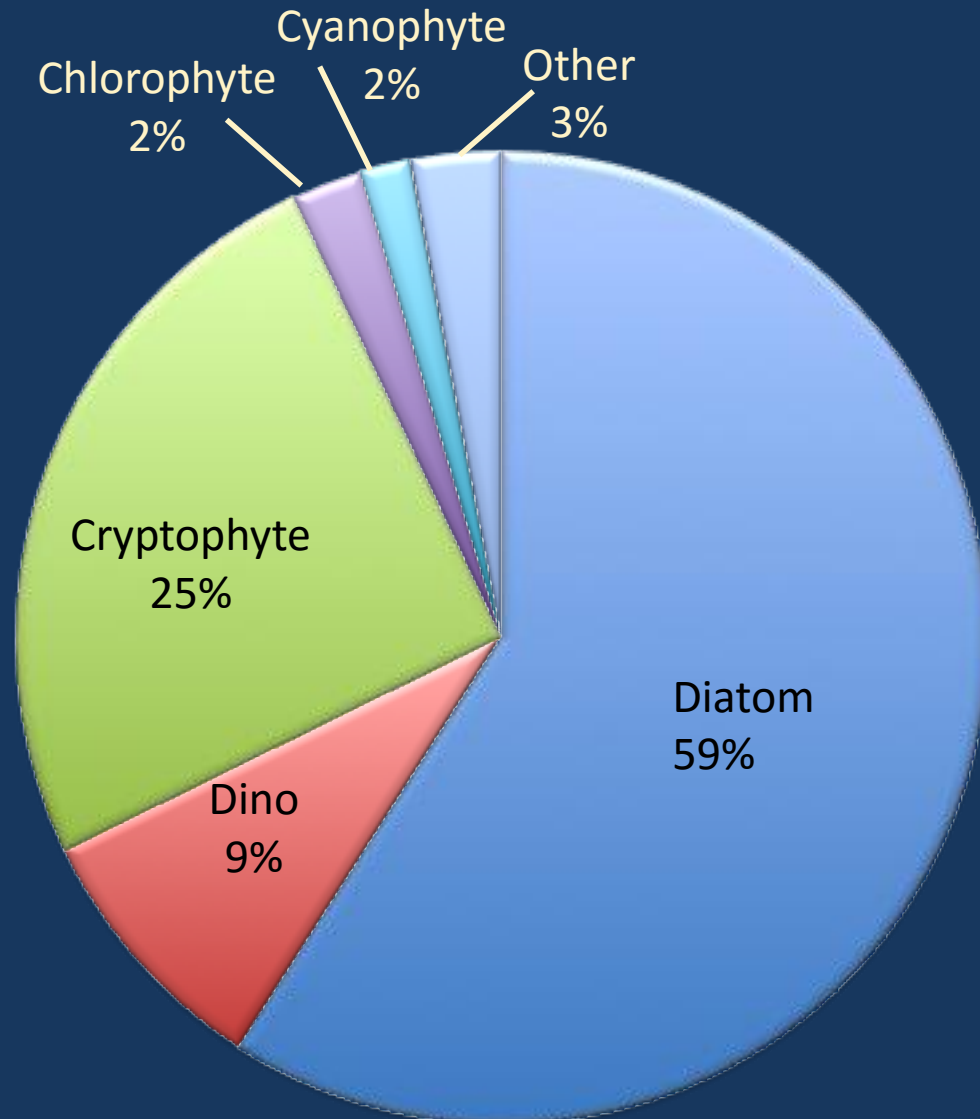
Cyanophyte



Dinophyte - dinoflagellate

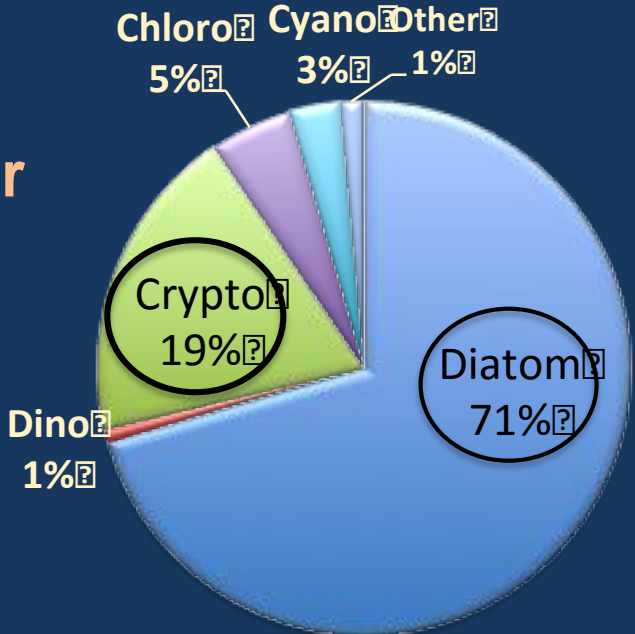


Haptophyte

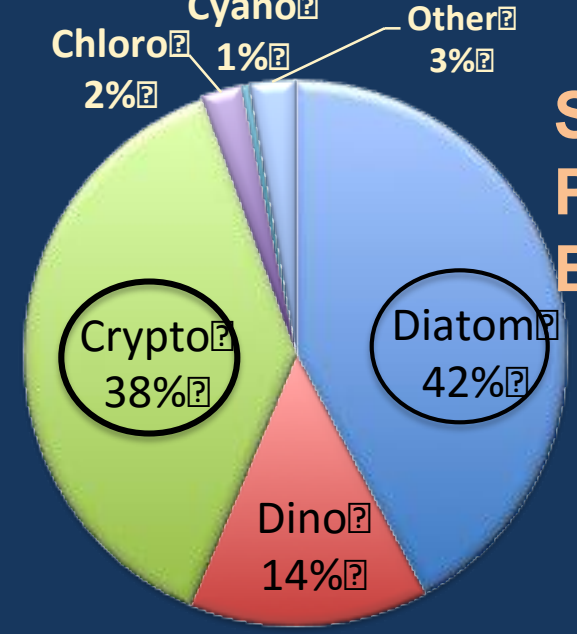


Data from all stations (1992-July 2016)

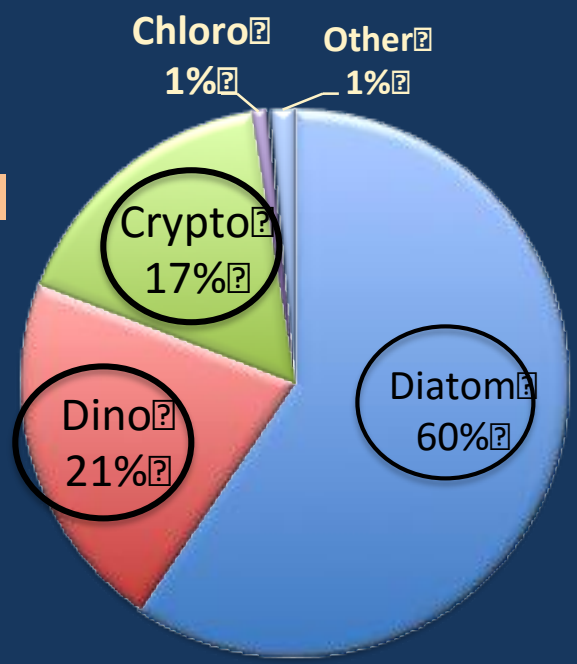
River



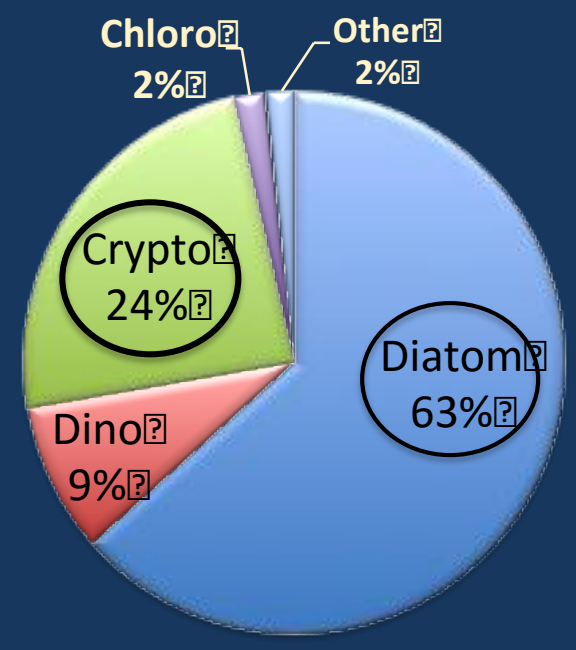
San Pablo Bay



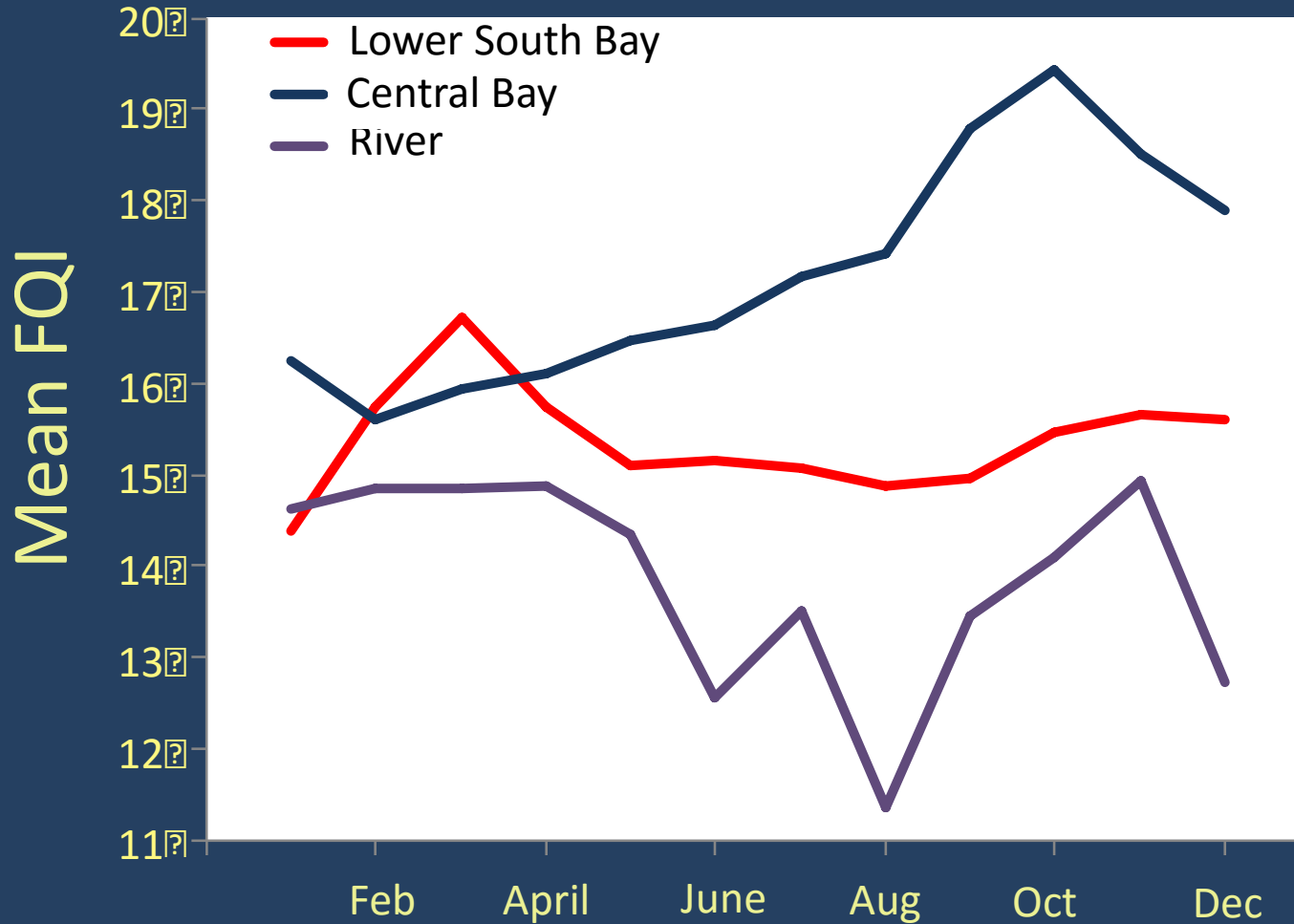
Central Bay



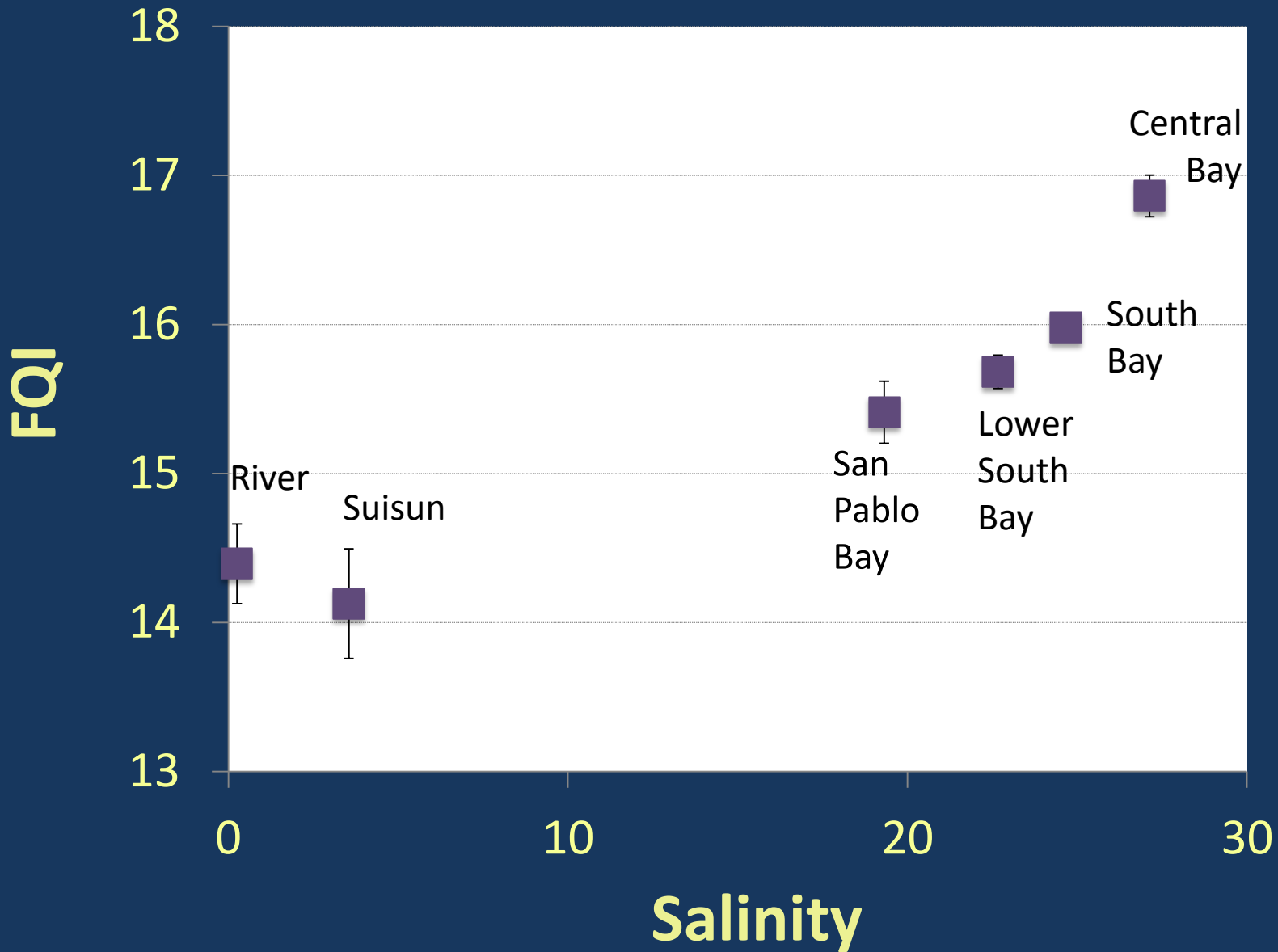
South Bay



Seasonal FQI in 3 regions



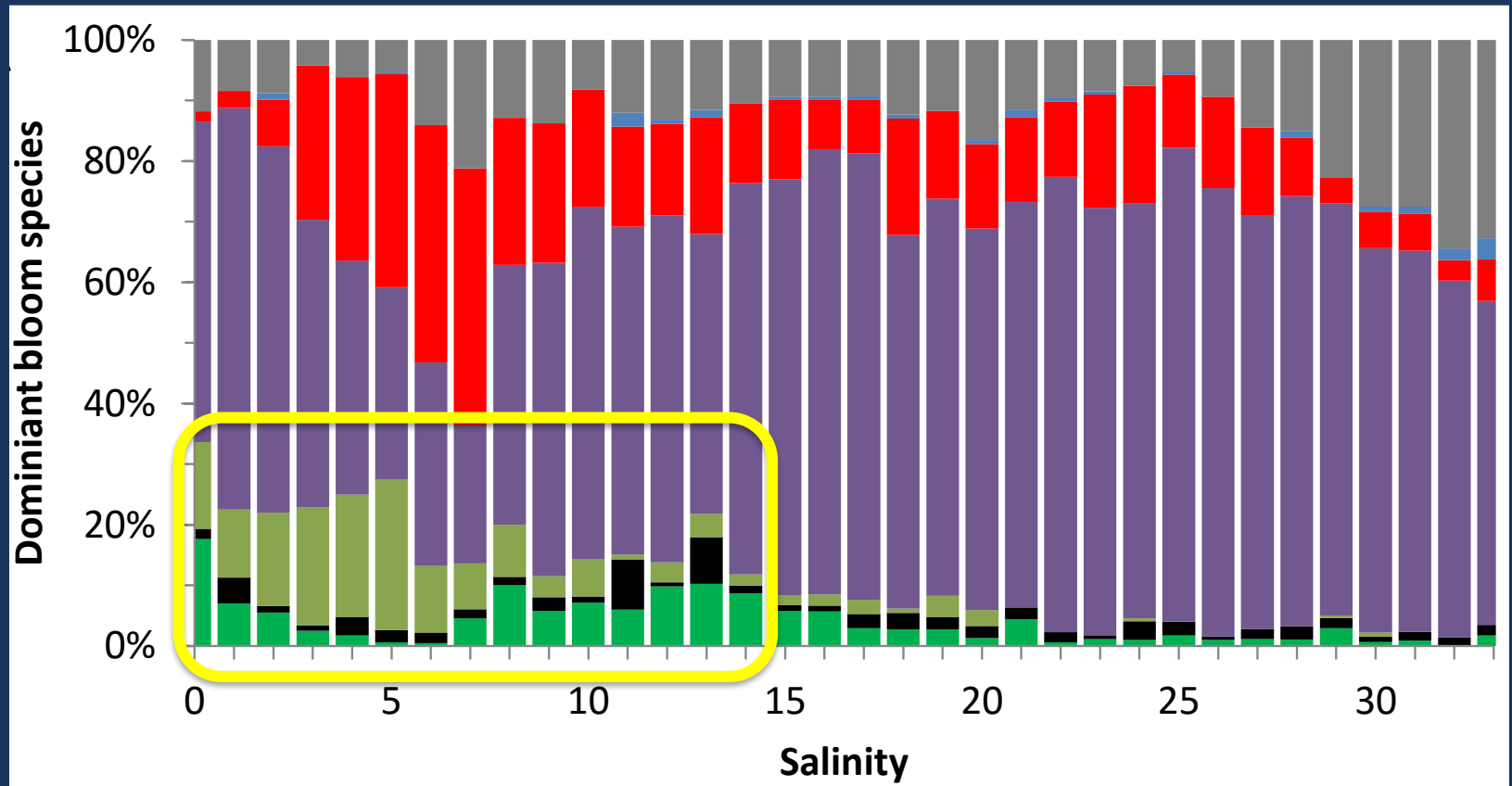
Average FQI for each Region 1992- 2016



bars = +/- 1 standard error of FQI mean

Global study of dominant phytoplankton groups

86 estuarine-coastal sites (> 30,000 samples)

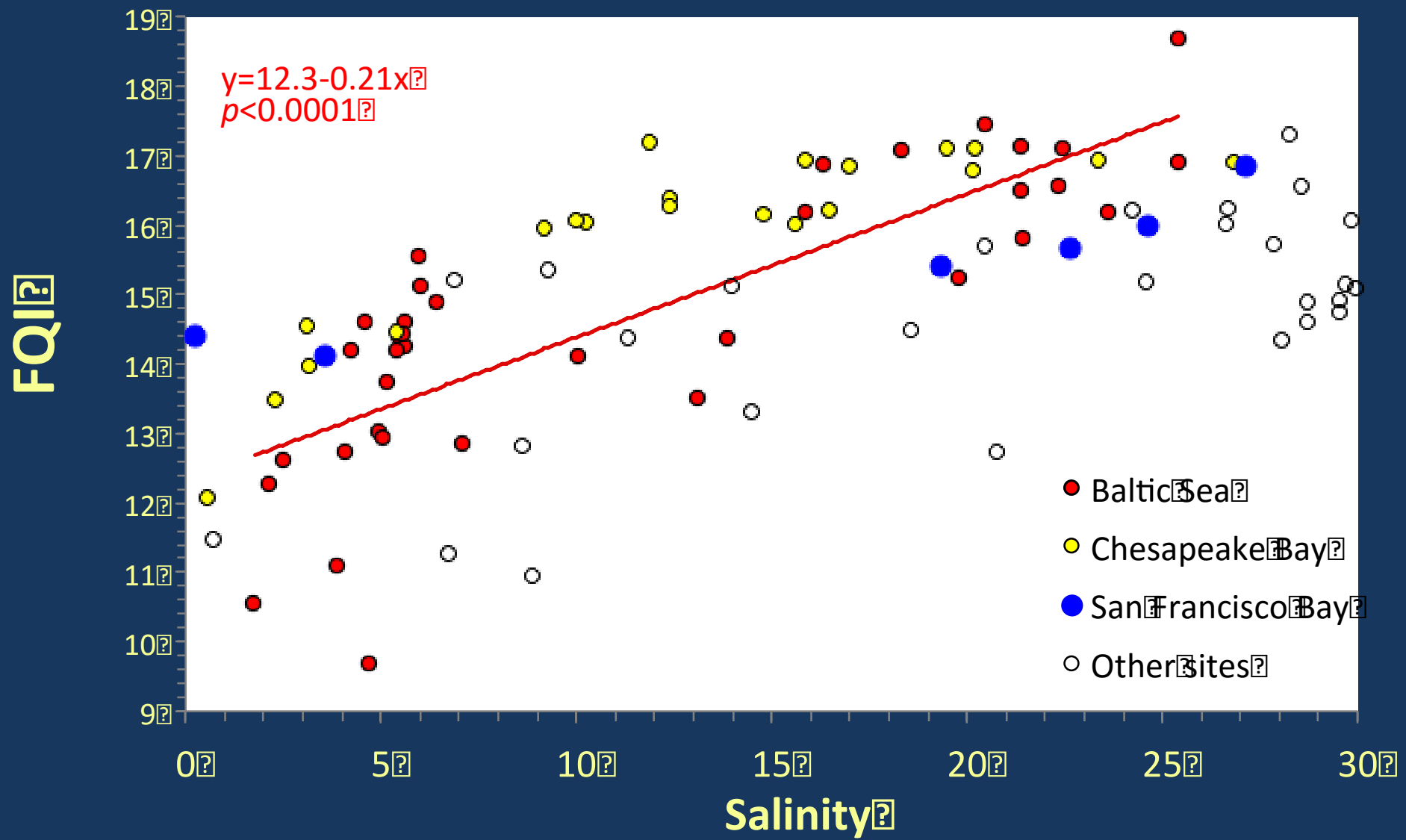


From Carstensen et al, 2015

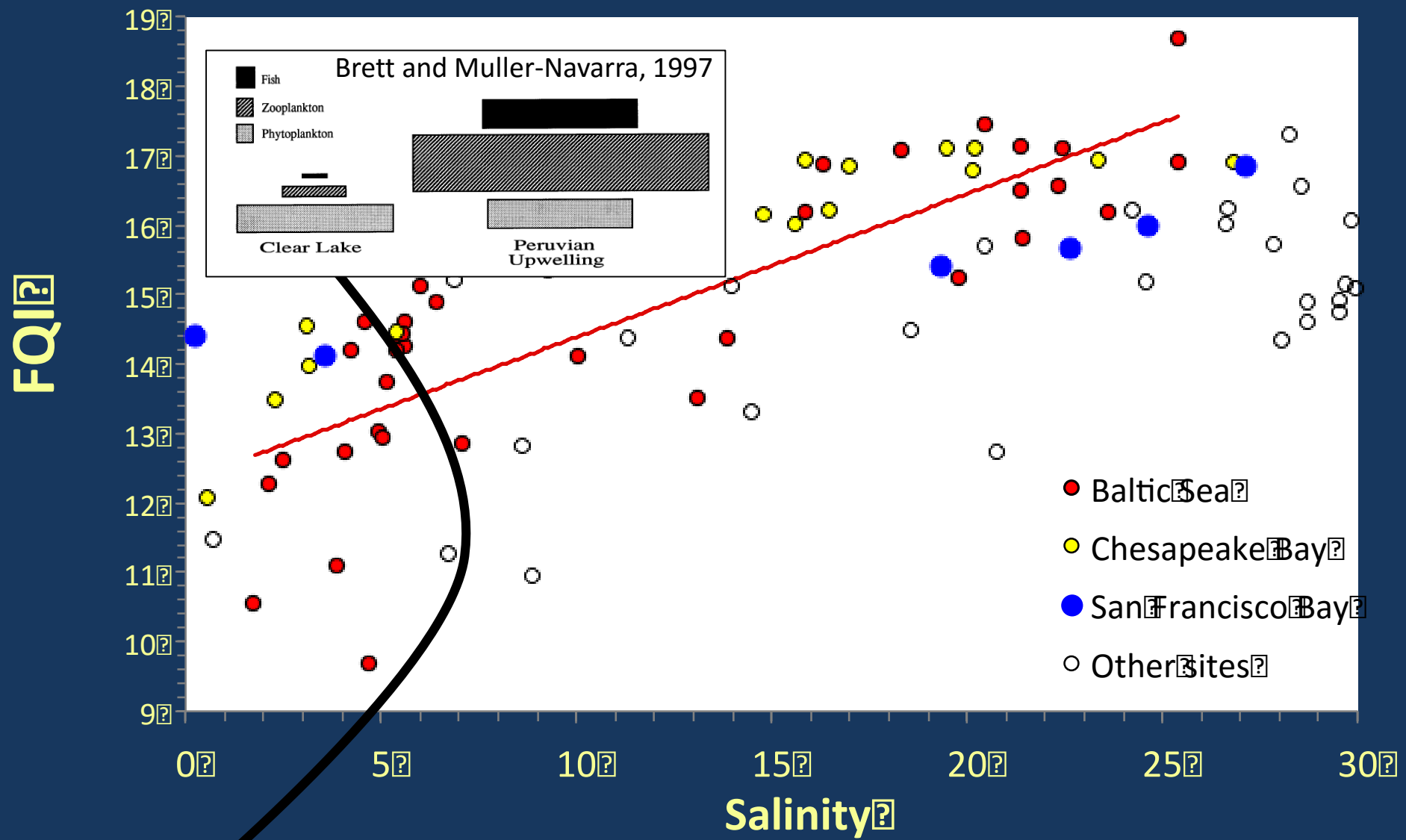
Carbon biomass proportion of dominant species



How does the SFBay FQI compare with other estuaries worldwide?



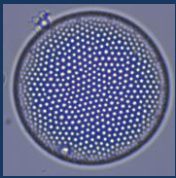
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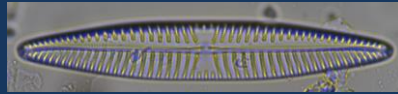
The San Francisco Bay phytoplankton community is
of good food quality for consumers



Big thanks to



Jacob Carstensen for his help and Monika Winder et al for sharing plots from their newly submitted ms

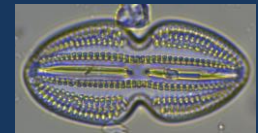


USGS Cloern project members Erica Kress and Charlie Martin who make data happen

All the USGS folks who collected the phytoplankton data over the past 24 years

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Regional Monitoring Program and Nutrient Program

Taxonomy by BSA Environmental Services, Inc and Dick Dufford



The phytoplankton

