Microcystis in the Delta 2004 through 2008

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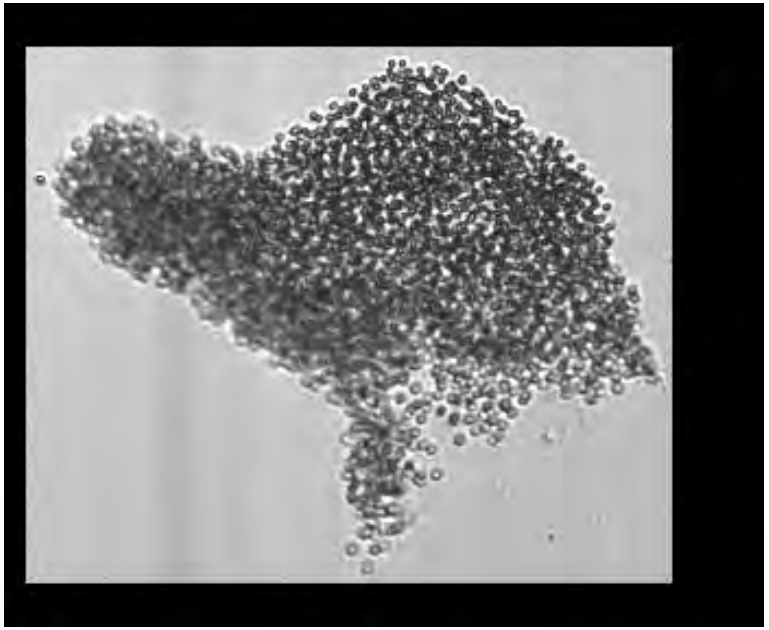
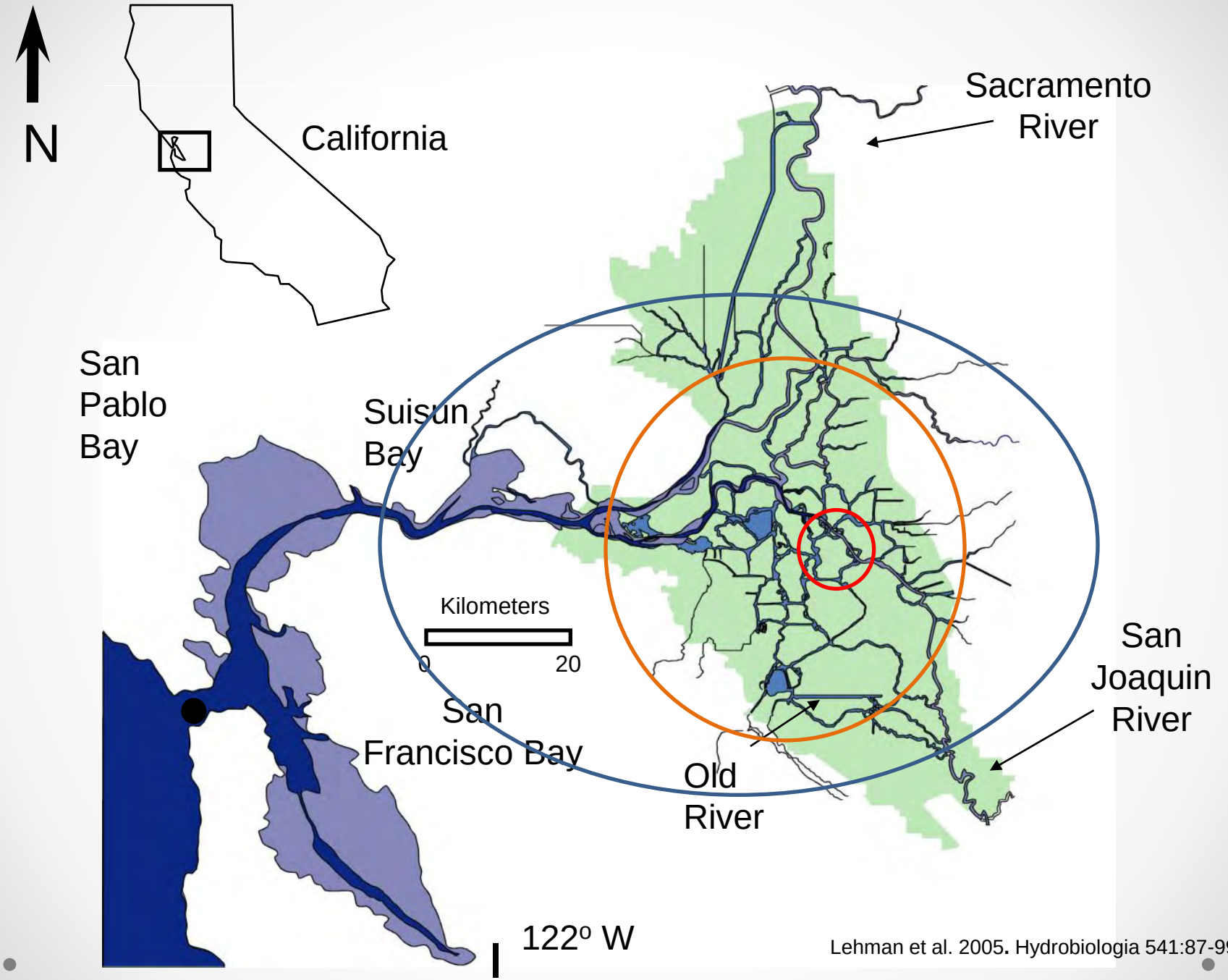
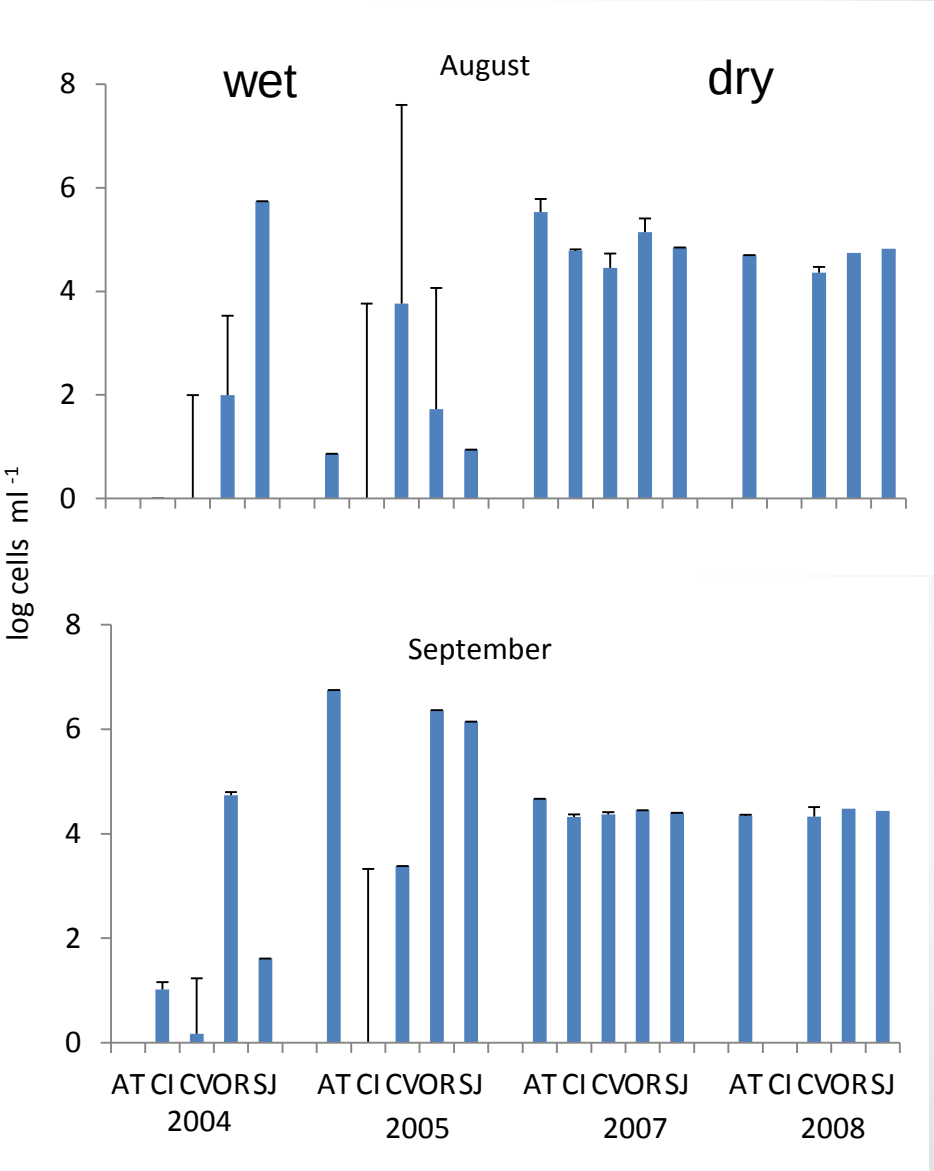
Distribution and abundance



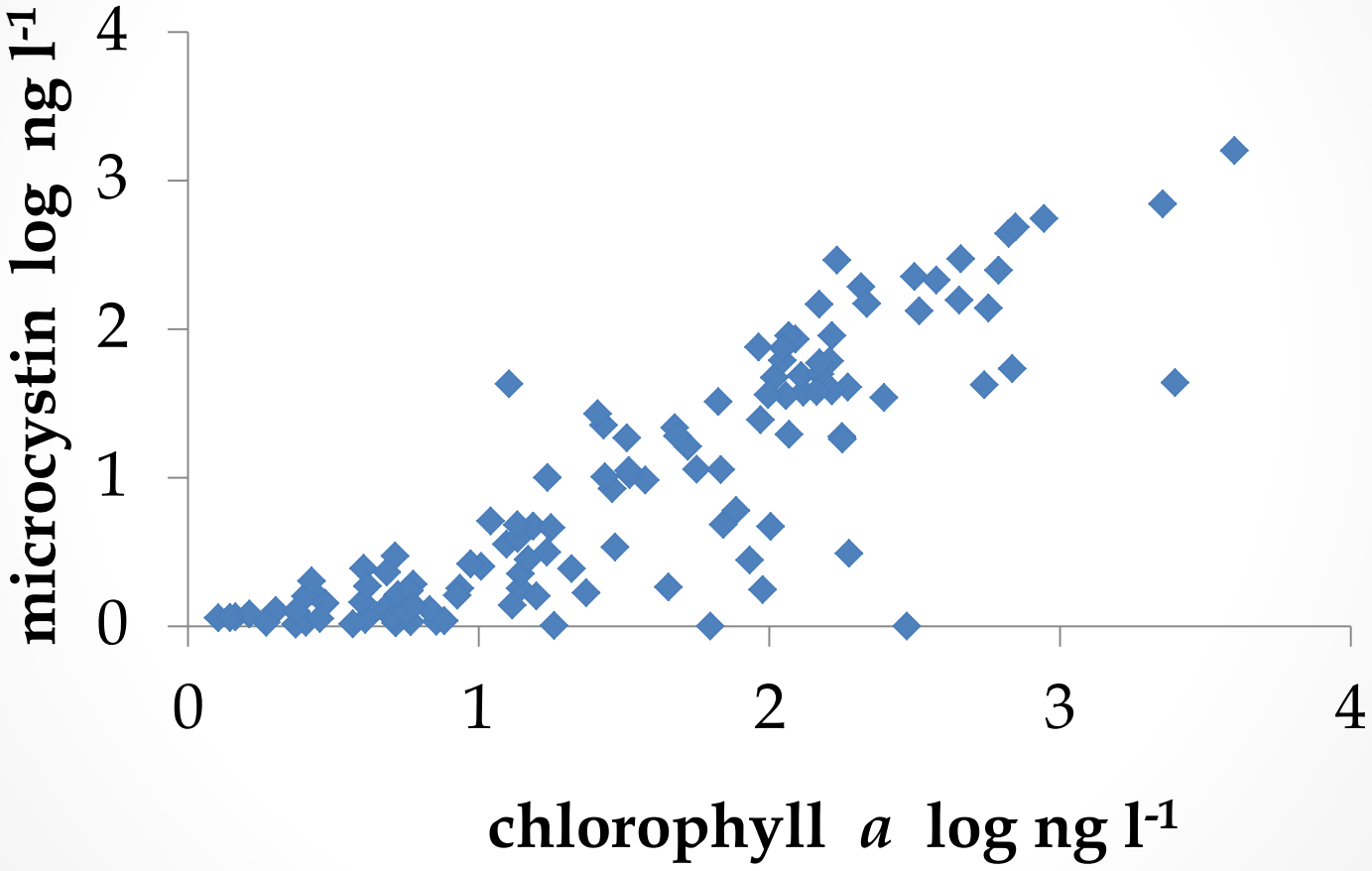


Lehman et al. 2005. Hydrobiologia 541:87-99.

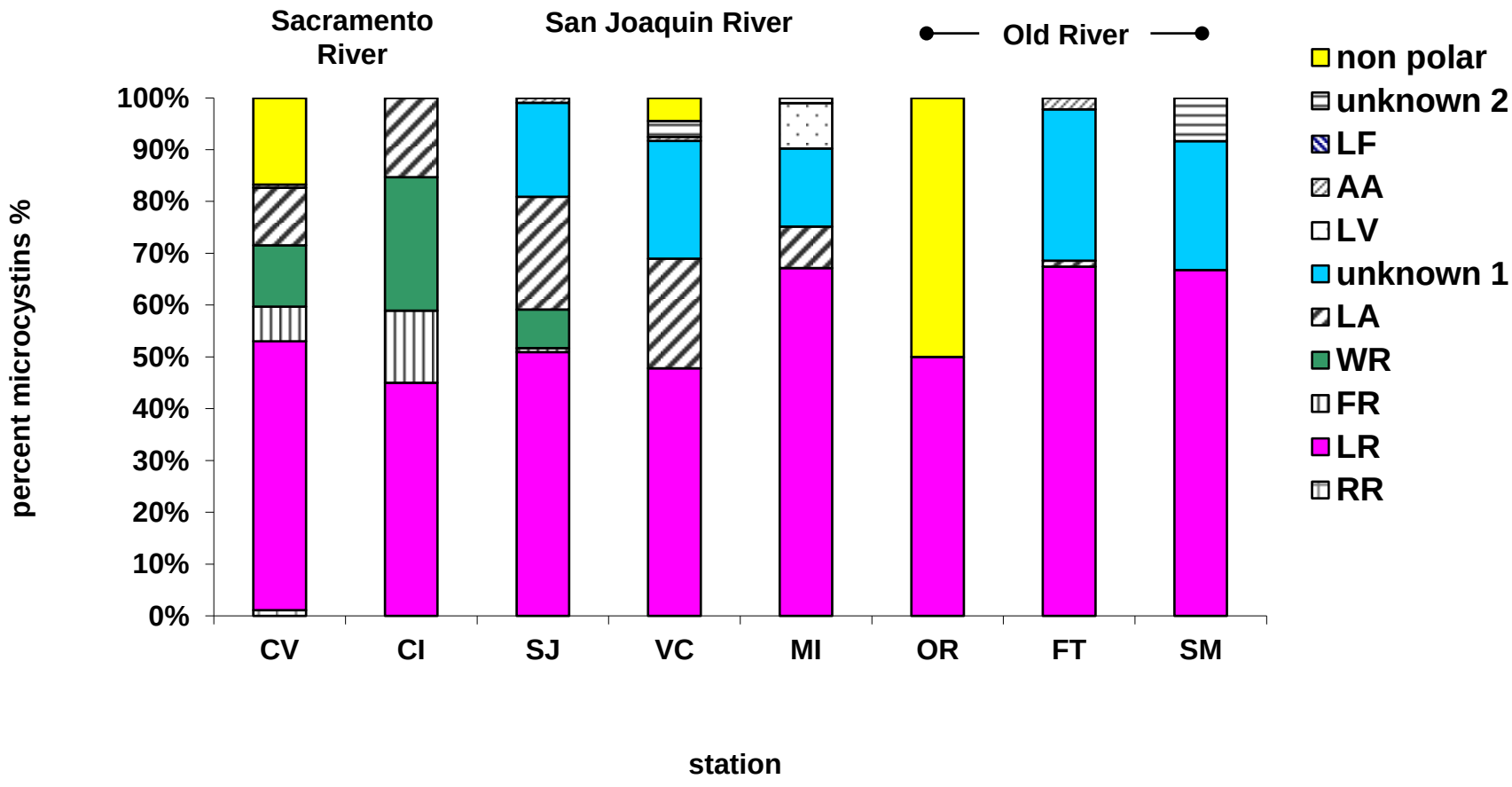
Abundance


wet
August
dry
8
6
4
2
0
log cells ml -1
September
AT CI CVOR SJ
2004
AT CI CVOR SJ
2005
AT CI CVOR SJ
2007
AT CI CVOR SJ
2008

Toxic microcystins



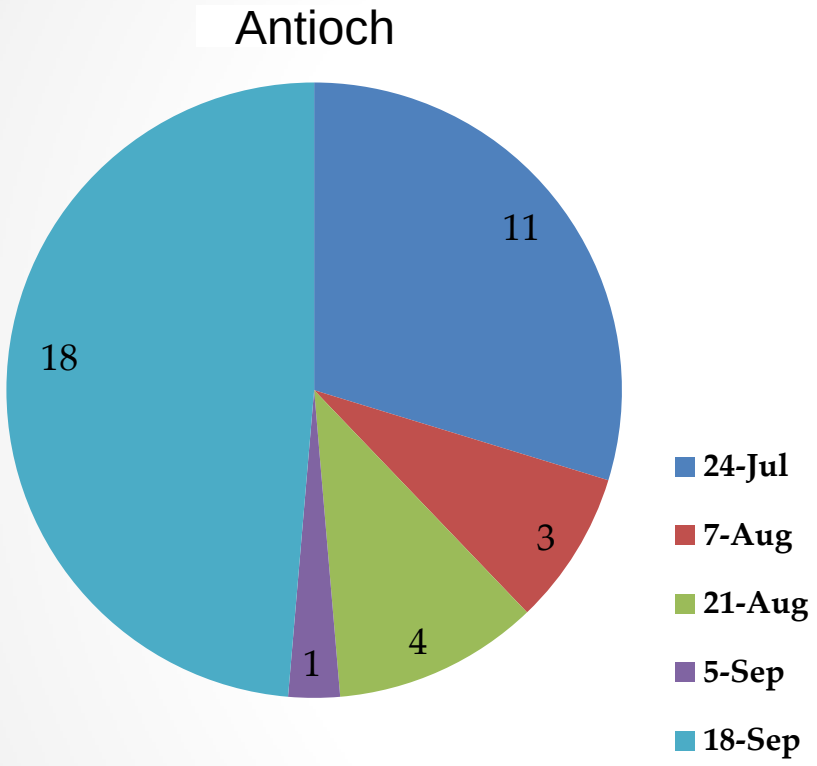
Microcystin congeners

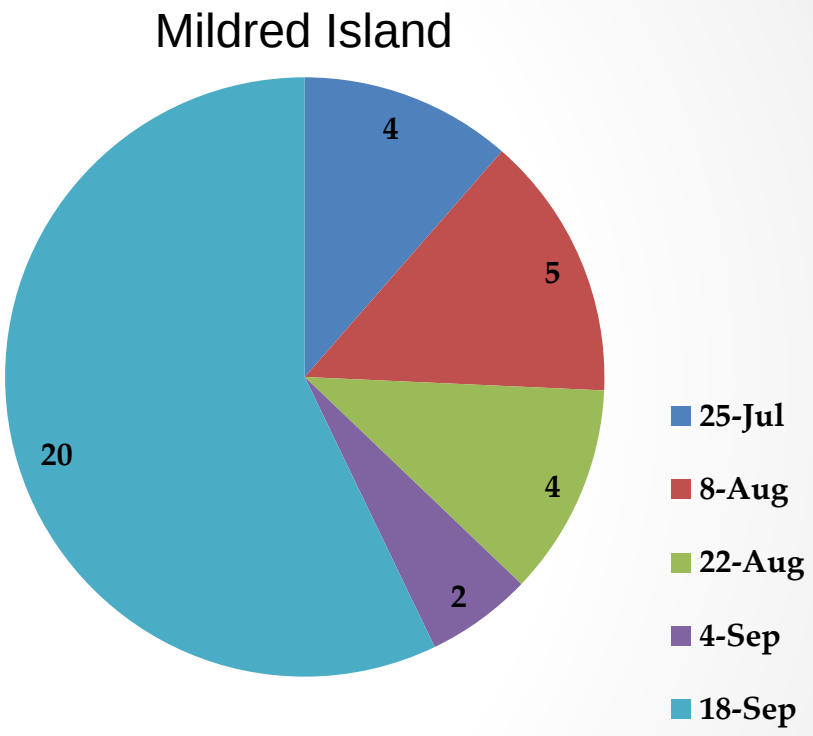


Lehman et al. 2008. Hydrobiologia 600:187-204

qPCR percent toxicity

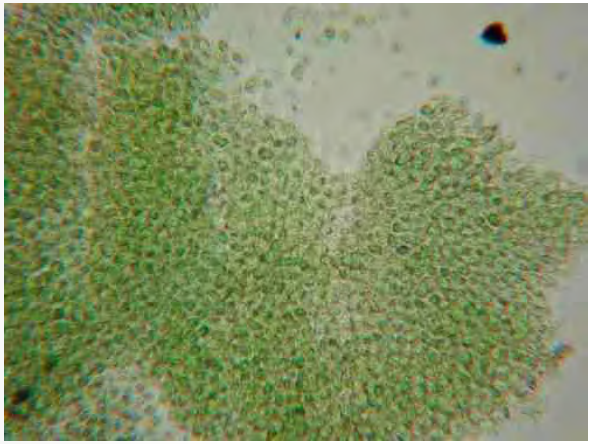
mcyD gene

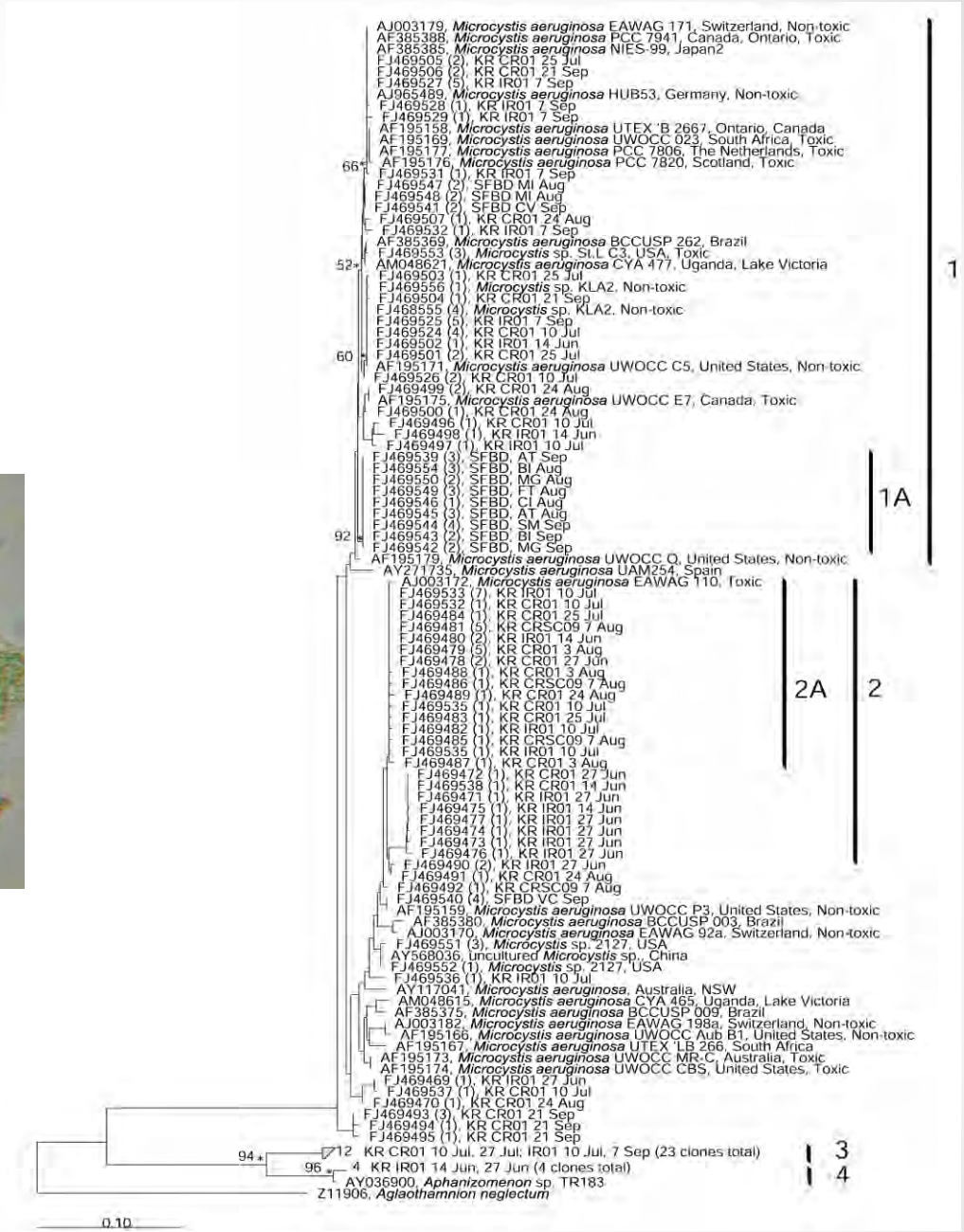




Baxa et al. 2010. Harmful Algae 9:342-349.

Genetic diversity

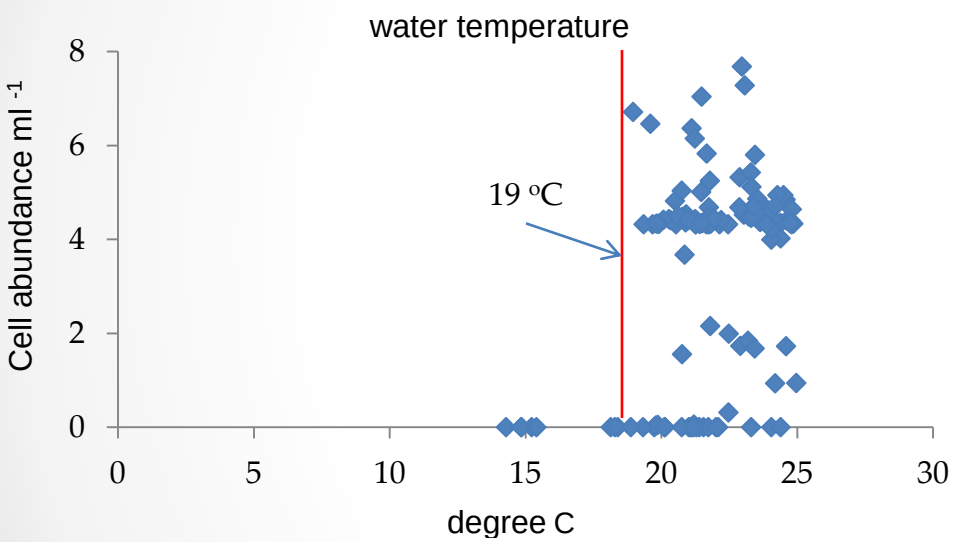


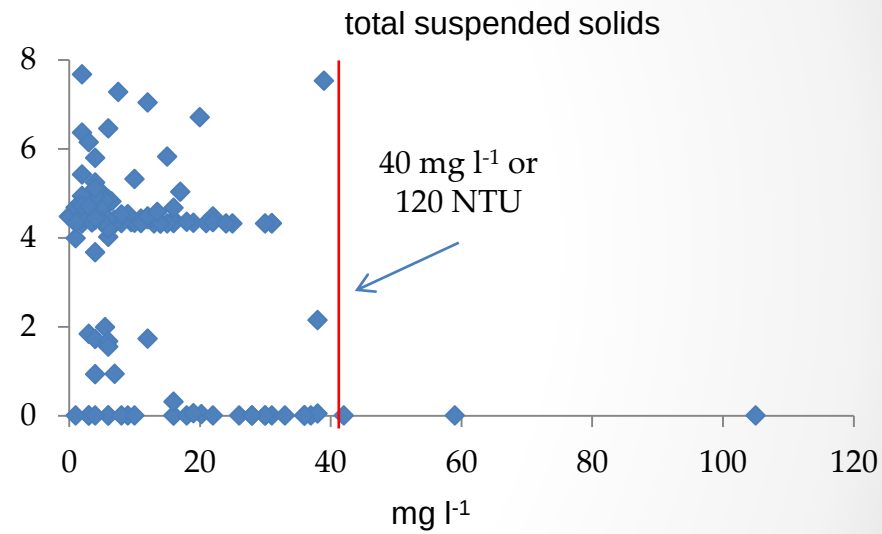


Moisander et al. 2009. Aquatic Microbial Ecology 57:19-31.

Environmental factors

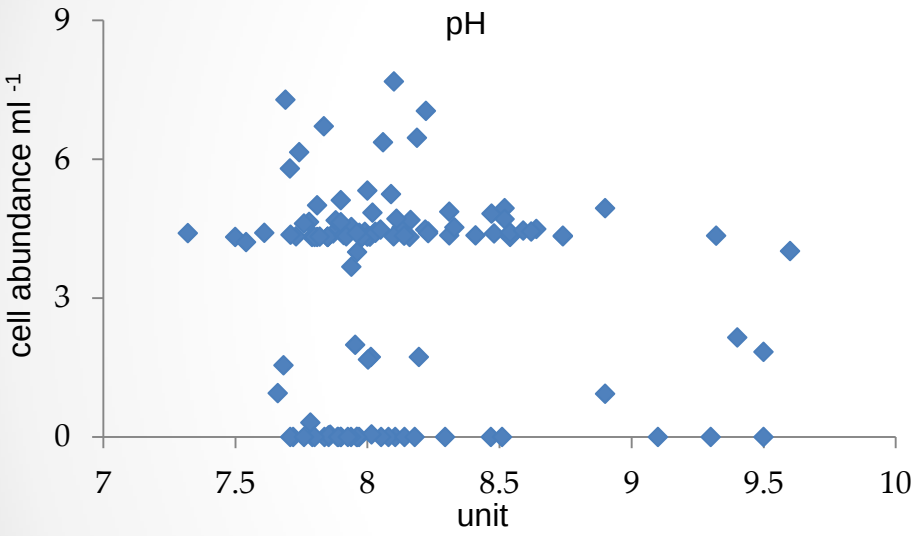
Threshold response

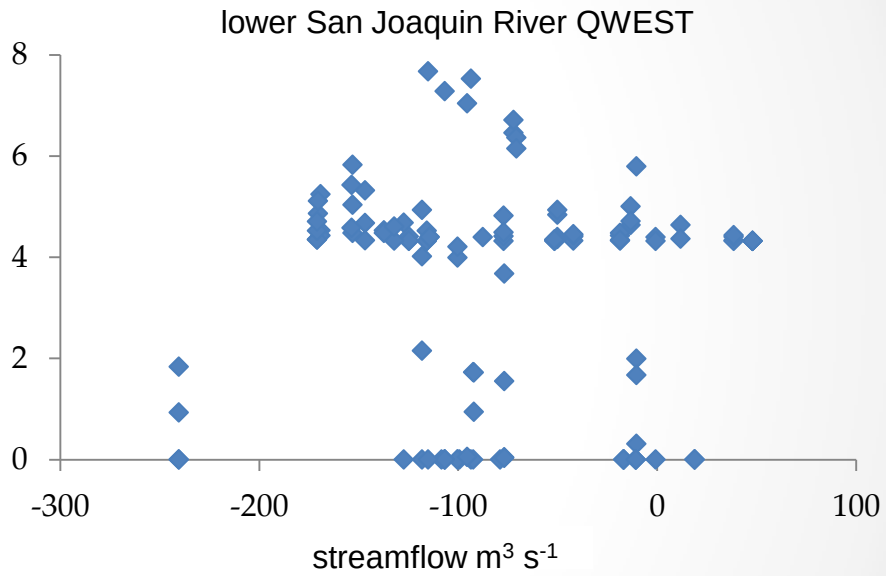




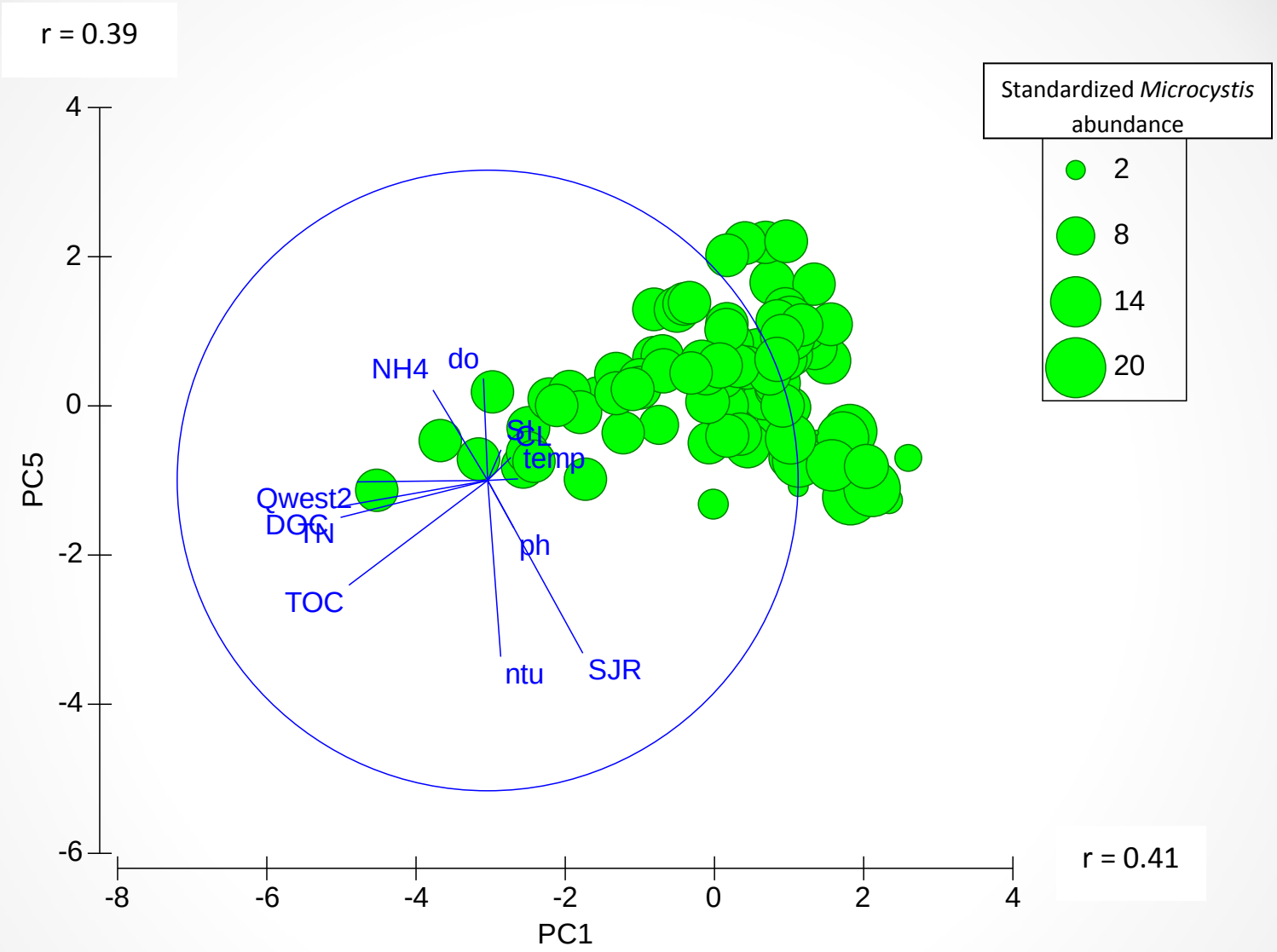
Lehman et al. in review.

Wide range



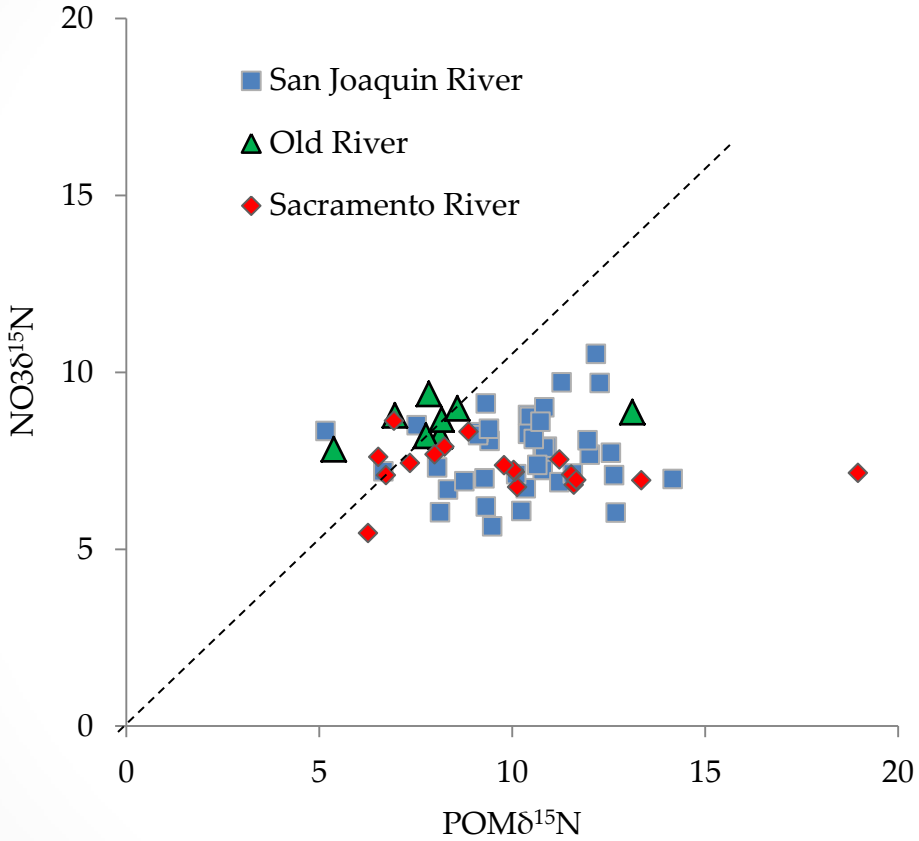


Lehman et al. in review.



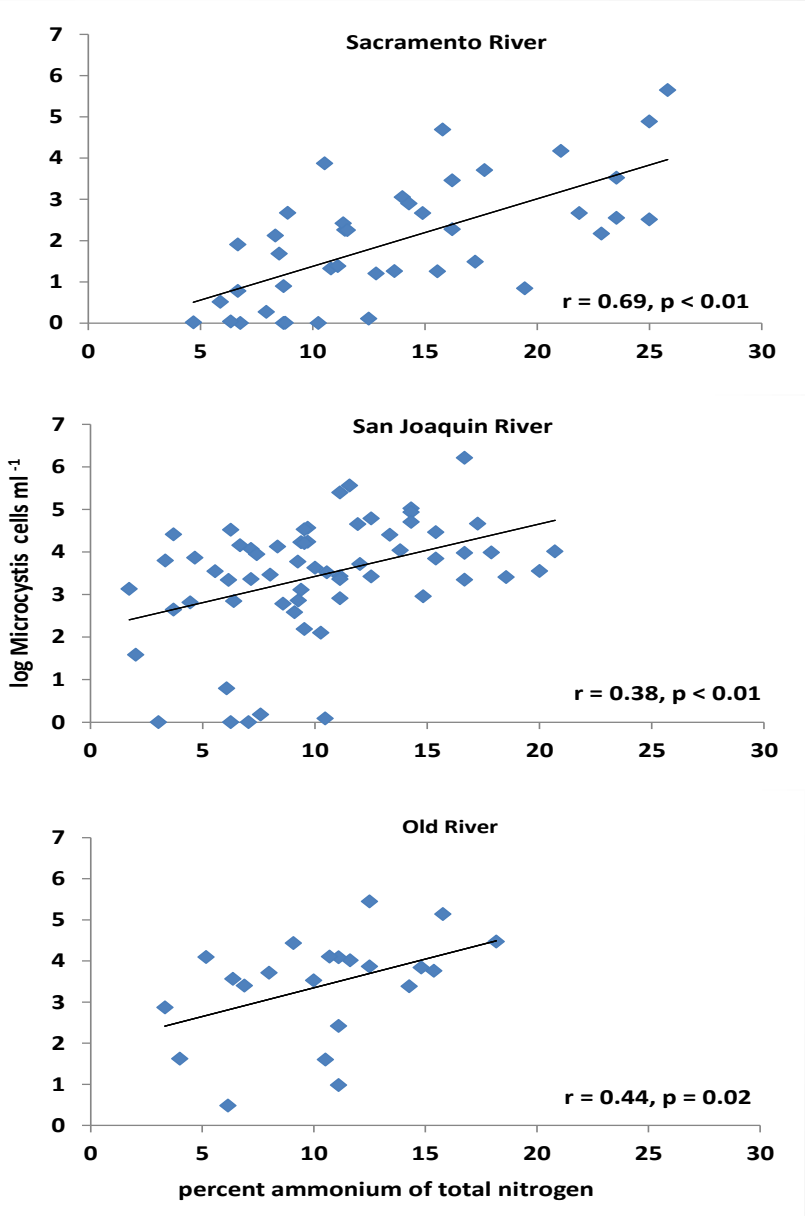
Lehman et al. in revision

Ammonium uptake



Lehman et al. in review

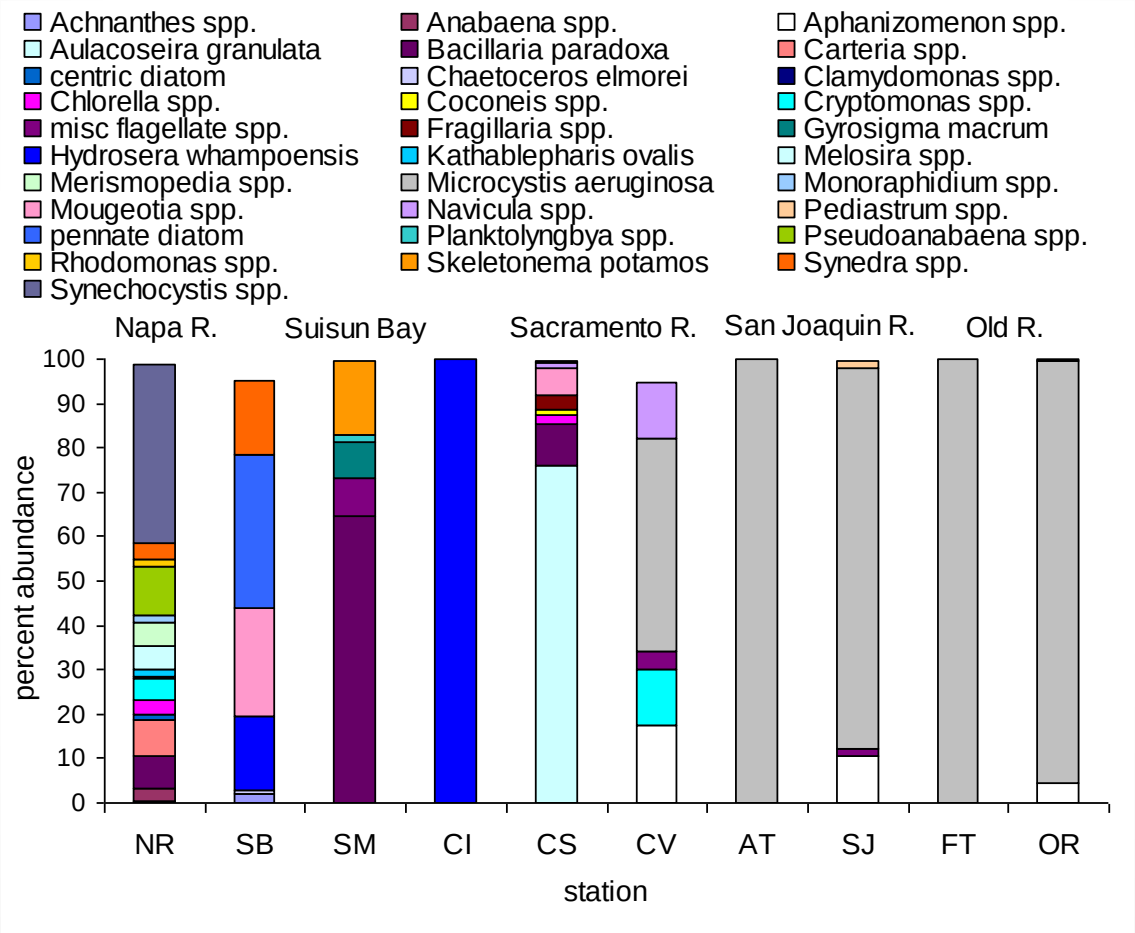
percent ammonium



Lehman et al. in review

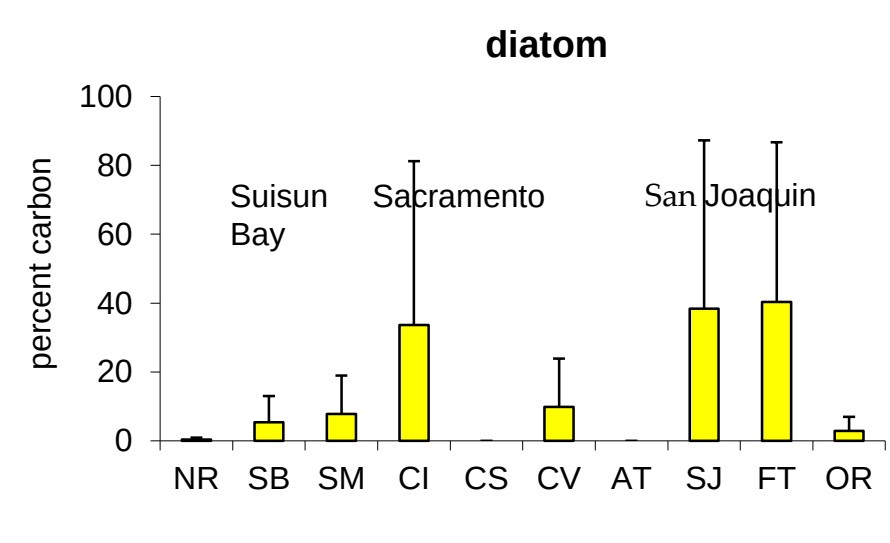
Biological Impacts

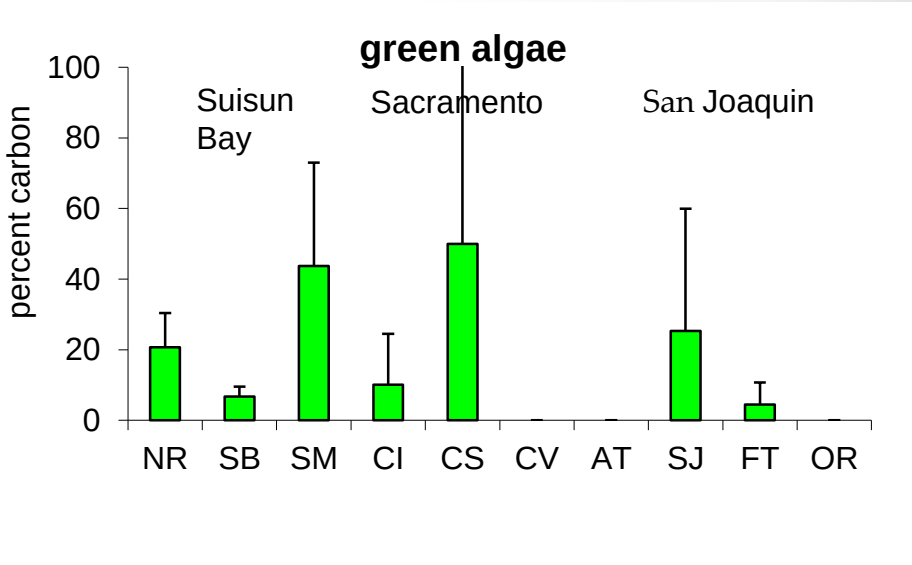
Phytoplankton abundance

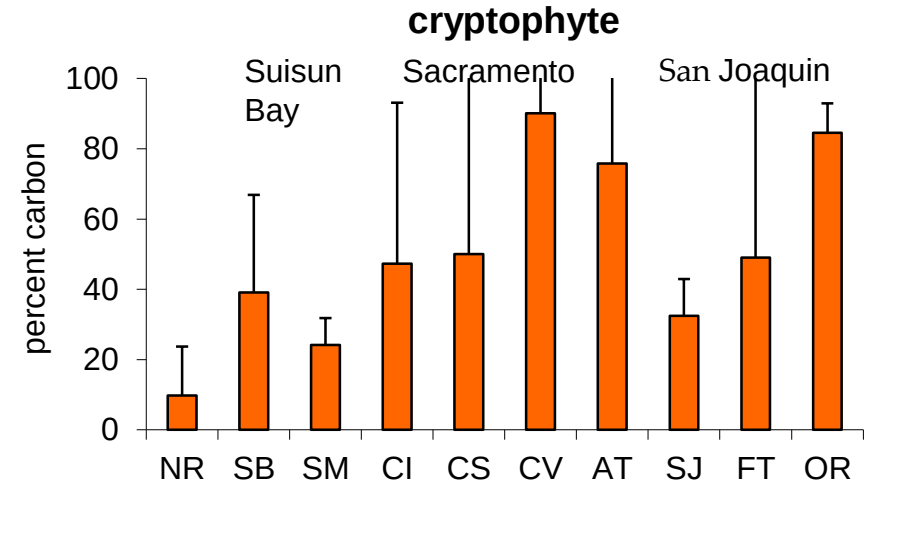


Lehman et al. 2010. Hydrobiologia 637:229-248

Phytoplankton carbon

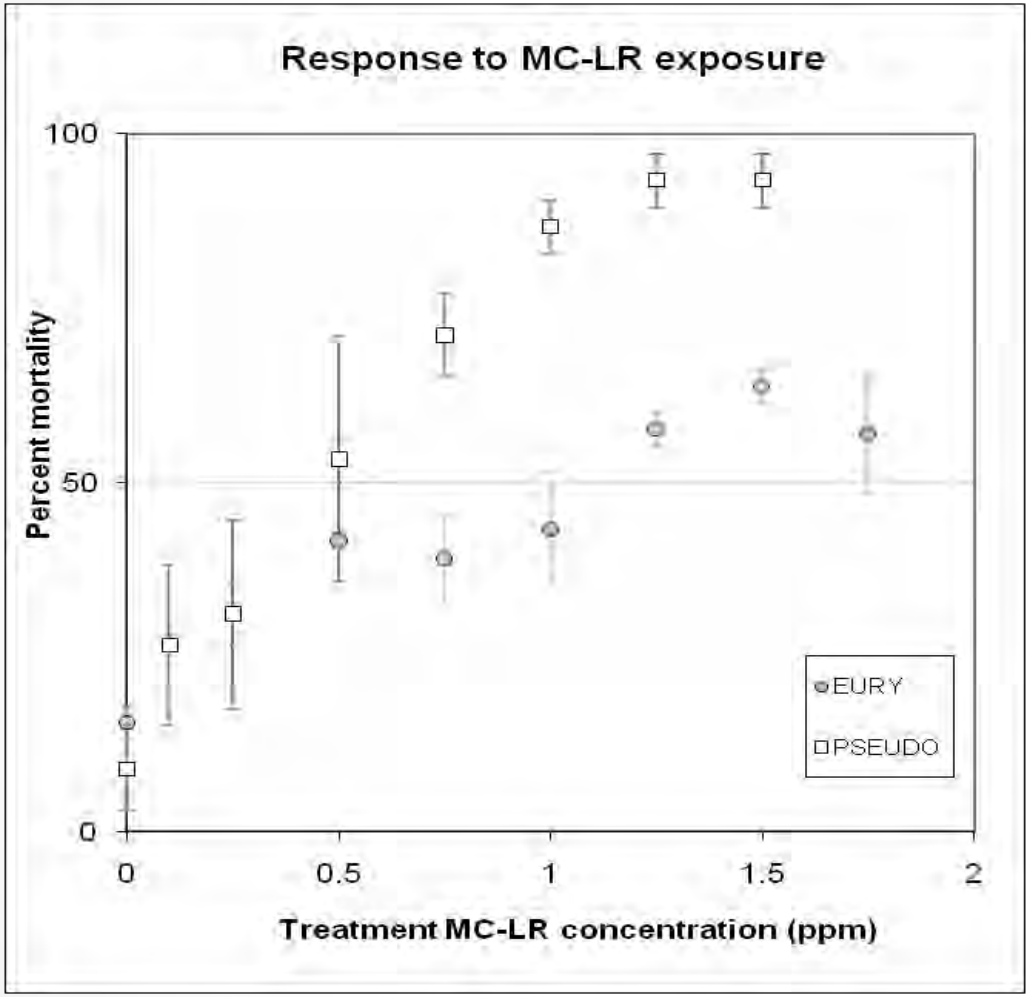






Lehman et al. 2010.
Hydrobiologia 637:229-248

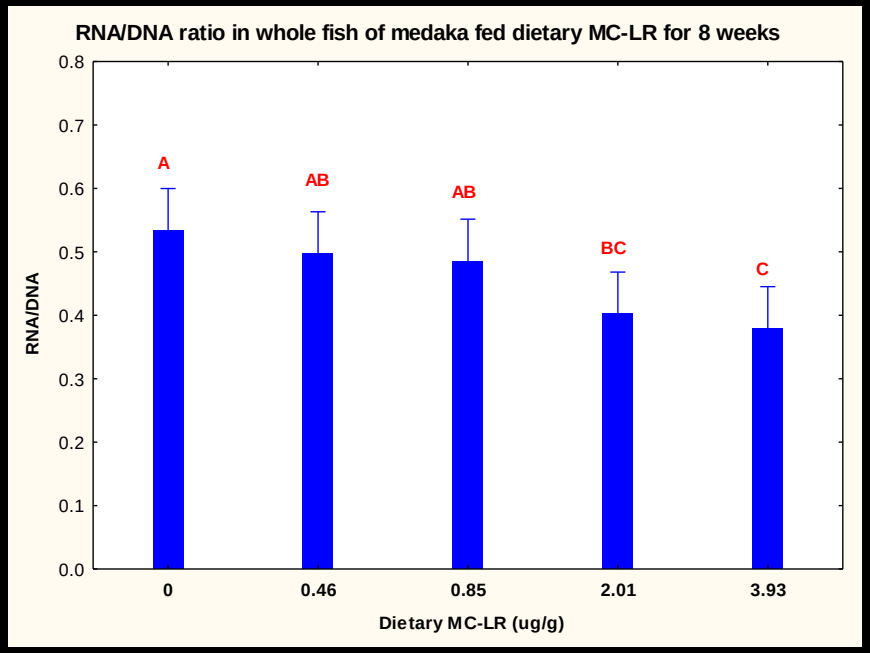
Zooplankton



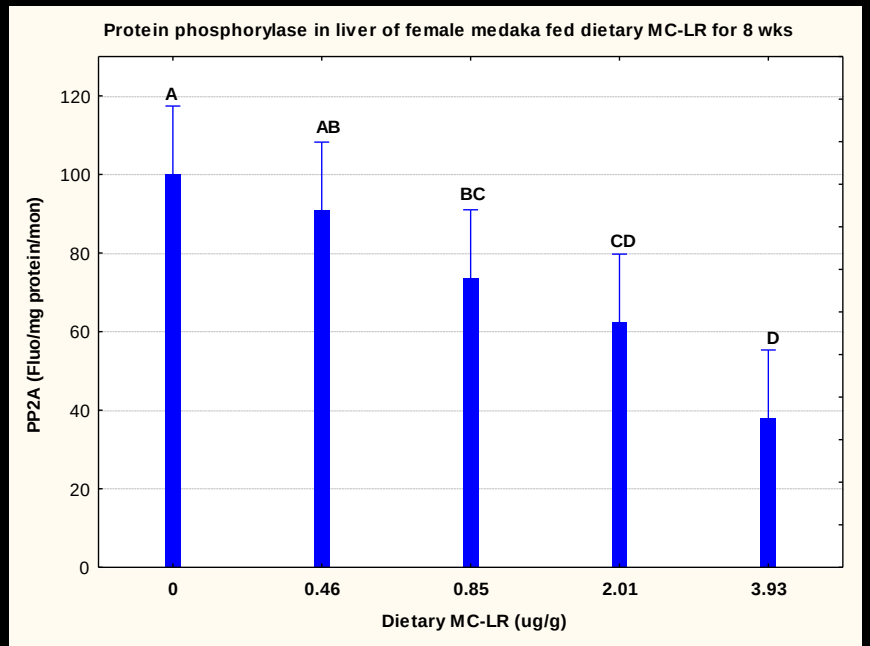
Ger et al. 2010. Freshwater Biology 55:1548-1559

Medaka

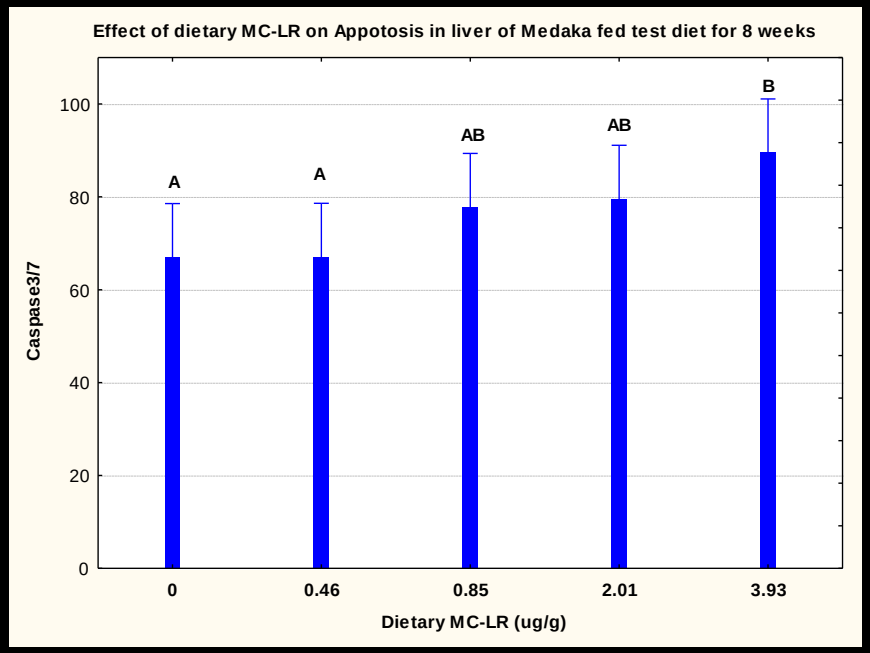
RNA/DNA ratio



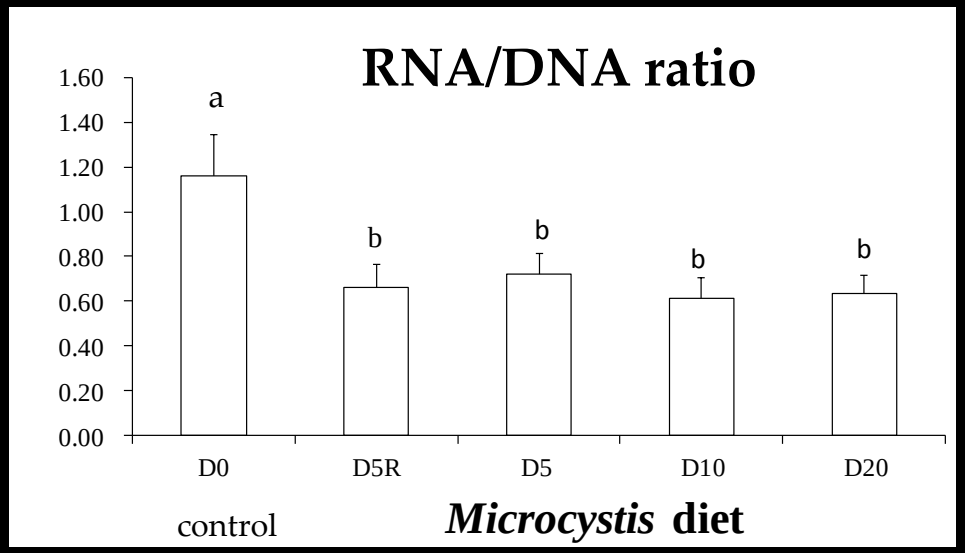
Protein Phosphotase 2A activity



Caspase activity

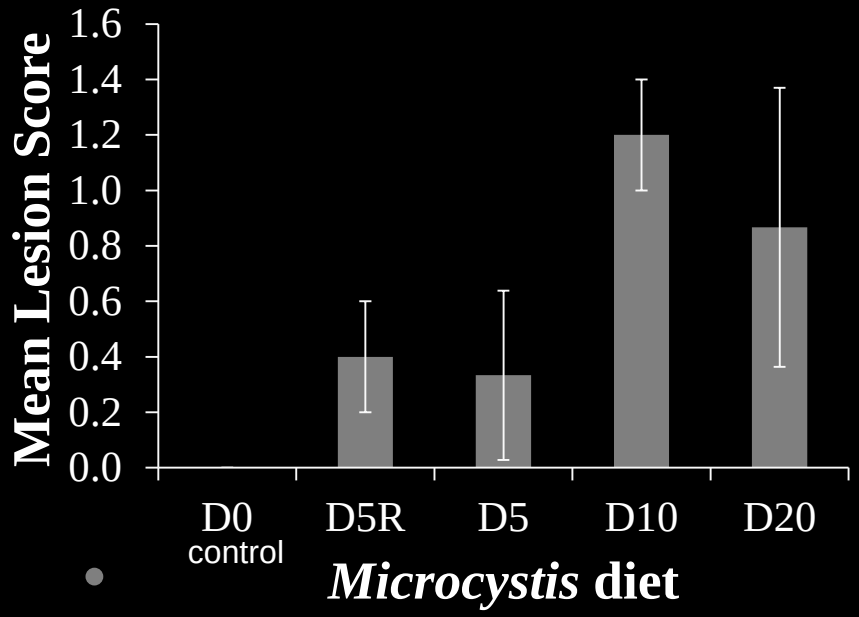


Deng et al. Toxicon 55:787-794.

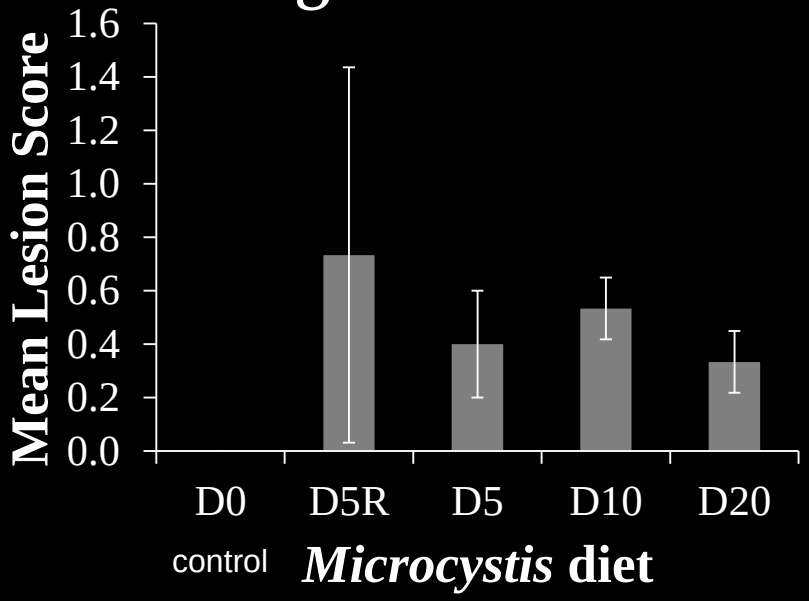


Splittail

Cytoplasmic Inclusion Bodies

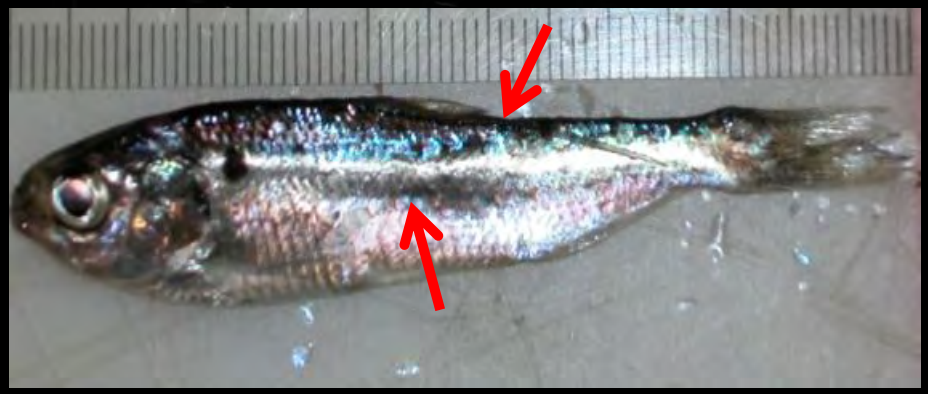


Single Cell Necrosis



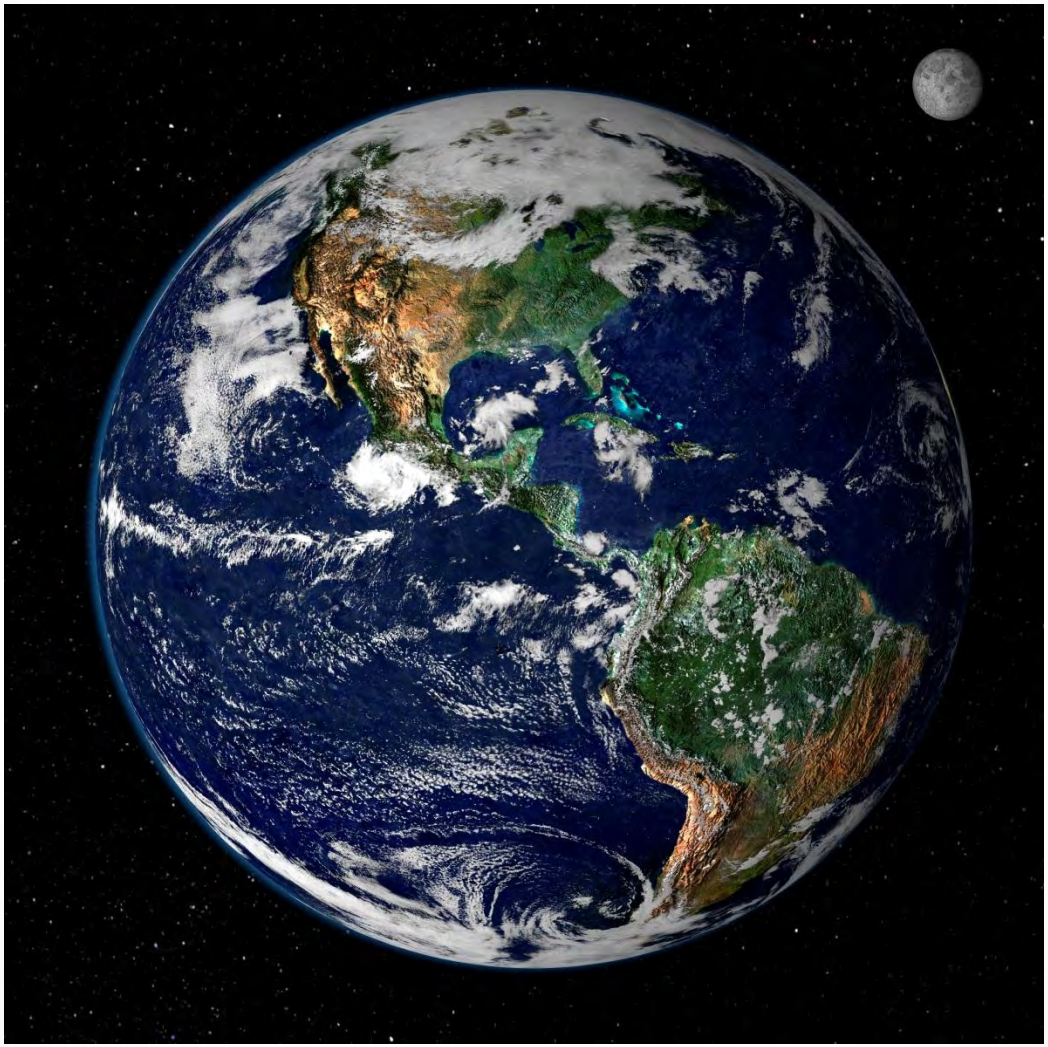
Acuña et al. 2012. Aquatic Toxicology 110-111:1-8.

Threadfin shad

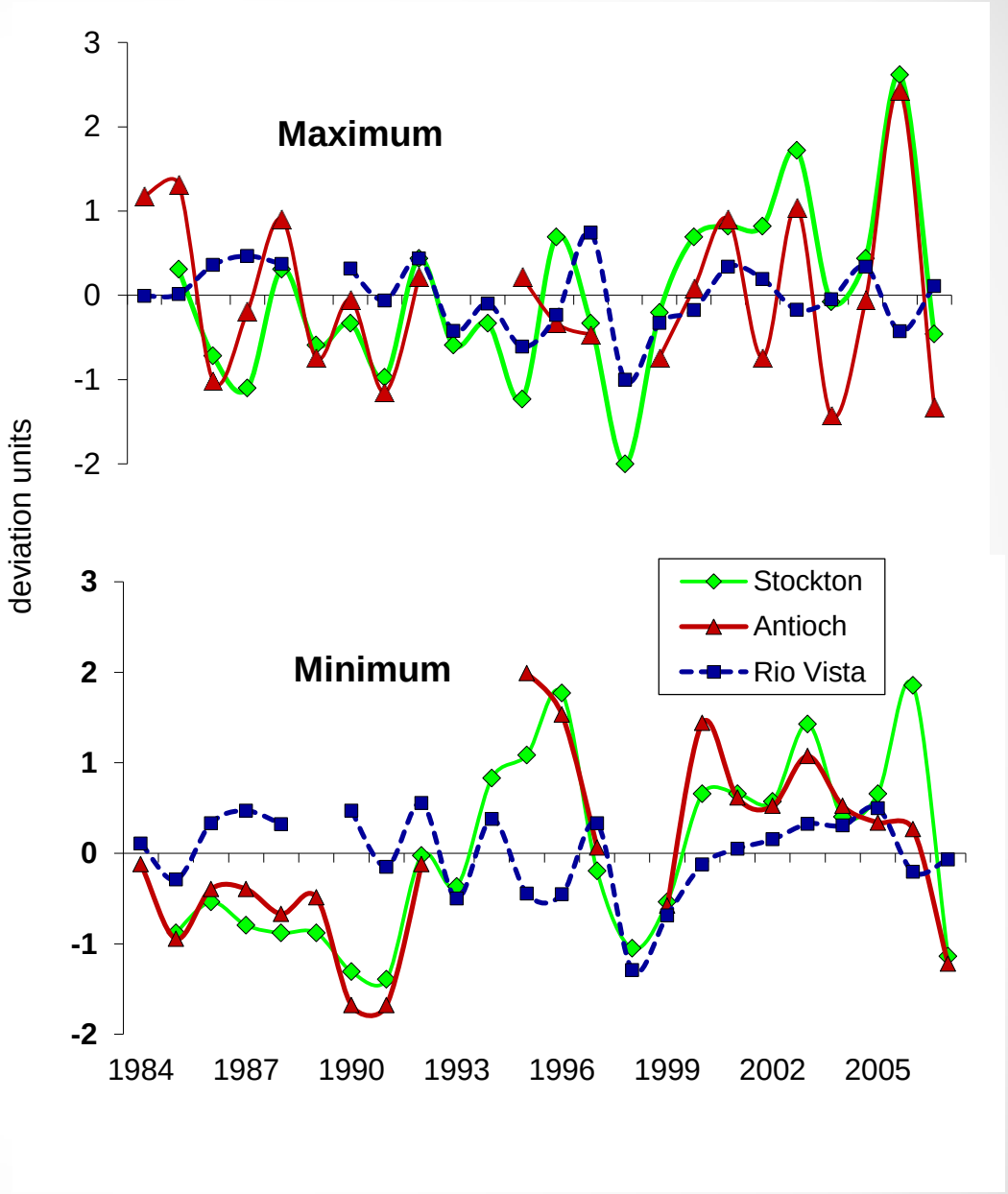


Acuña et al. 2012. Toxicon 60:1191-1202.

Climate change

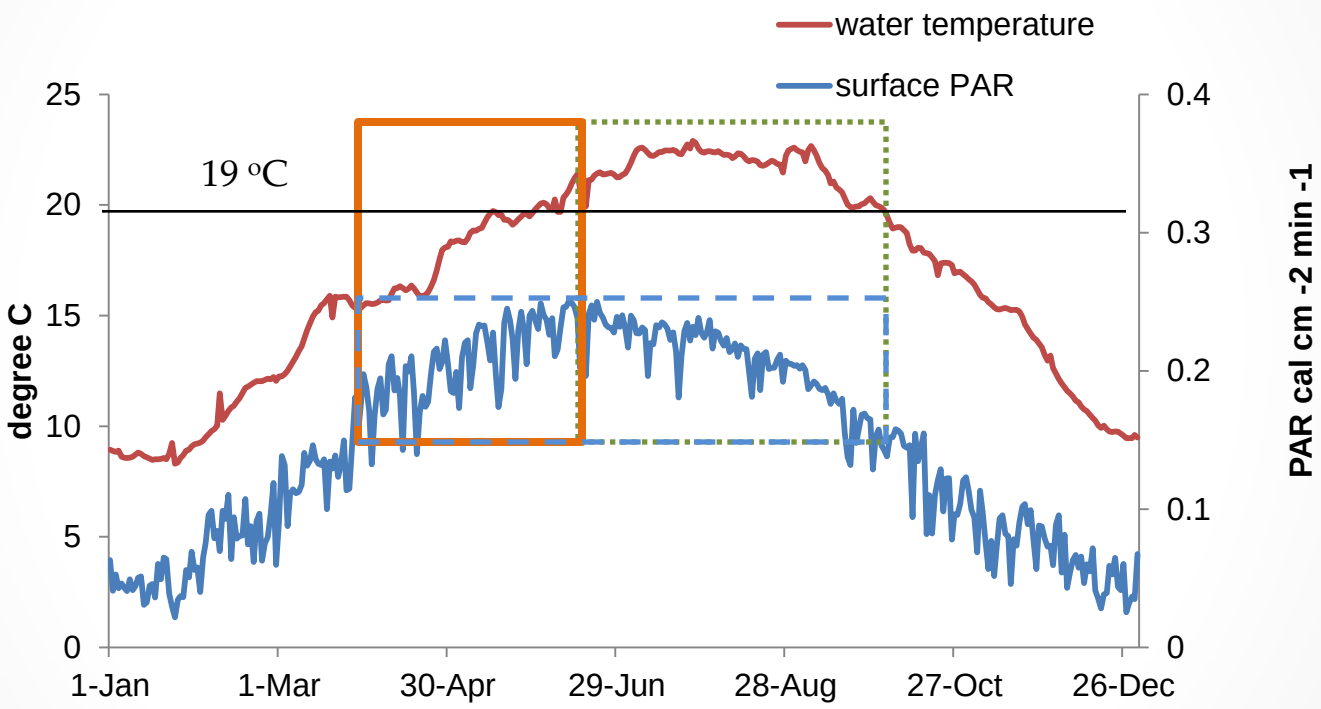


Increased amplitude

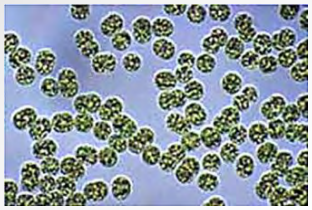


Brooks. et al. 2012. Estuaries and Coasts 35:603-621.

Increased bloom duration



Lehman et al. in revision



Summary

- **Distribution & abundance**
  - greater in the San Joaquin and Old River
  - increases in dry years
- **Toxins**
  - toxin concentration increases with biomass
  - Toxicity varies spatially and temporally
- **Controlling factors**
  - threshold factors: water temperature and light
  - multiple environmental factors
  - ammonium is the preferred nitrogen source
- **Biological impacts**
  - phytoplankton, cyanobacteria, zooplankton and fish
- **Climate change**
  - Increased amplitude and duration of blooms