Title
AQU 1: Characterization of the Phytoplankton Community in Lake Fulmor, CA, Using Embedded Sensor Networks

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Characterization of the phytoplankton community in Lake Fulmor, CA, using embedded sensor networks

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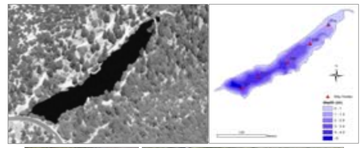
Introduction: Phytoplankton communities in aquatic & marine ecosystems

Highly variable phytoplankton communities

- **Chemical & physical forcing of phytoplankton communities**
  Phytoplankton populations can be limited by chemical nutrients such as nitrate, phosphate, and silicate. They are also strongly impacted by changes in physical parameters, including wind speed & direction (which directly affects mixing depth & water column stratification), light regime, & water flow
- **Harmful algal & cyanobacterial blooms in aquatic environments**
  Previous & current NAMOS work has focused on the Brown Tide organism, *Aureococcus anophagefferens*, & a Red Tide dinoflagellate, *Lingulodinium polyedrum.* In addition, some cyanobacteria produce hepatotoxins & neurotoxins that can have deleterious effects on animal & human health

Study Site: Lake Fulmor, San Jacinto Mountains, CA

• Altitude: ~ 5000 feet
• Maximum depth: 6m
• Low flow but relatively strong discrete wind events
• Observed surface scum formation during wind events



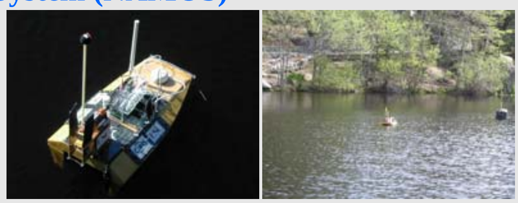
Clockwise, from top left: Aerial photograph of Lake Fulmor (LF); Bathymetric map of LF (depths in meters); NAMOS buoys deployed in LF; Surface scum along shore.

Problem Description: Sensor networks provide *in situ* presence at high resolution

Networked Aquatic Microbial Observing System (NAMOS)

Network of 10 buoys provides chlorophyll & temperature data from several locations with high temporal resolution

Components
•Turner Designs Cyclops 7 chlorophyll fluorometer at 0.5m depth
• Thermistor array to 2.5 m depth
• 6-port surface water sampler (on boat)



Robotic boat fills in gaps spatially & can collect samples for further analysis

Proposed Solution: Phytoplankton community in Lake Fulmor, CA

NAMOS deployments in 2005 & 2006

Seasonal changes in water column stratification & chlorophyll concentration

• Relative chlorophyll in LF increased from a daily mean of 12 to 158 μg/L from May to October, 2005 (Figure 1a).
•Water column temperature stratification in LF decreased over the year
  • Increasing the accessibility of nutrients to phytoplankton?
  • Also increasing the amount of time spent outside of the euphotic zone (and thus promoting vertical migration)?

Diel variations in chlorophyll concentration at single stations in lake (vertical migration)

• Maximum fluorescence measurements were observed at 1m depth from dusk → dawn (18:00-06:00) on a diel cycle.
• Additional sensing & sampling is underway in 2006 season to investigate the constituency & dynamics of migration

Phytoplankton community composition

• LF was heavily dominated by cyanobacteria in July 2005, including species in the genera *Microcystis* (3b), *Anabaena* (3c,d), & *Spirulina* (3e). The dinoflagellate *Ceratium* was also abundant (3a).
• In October 2005 *Anabaena* (3i,j) was dominant in the surface scum, while the cyanobacterium *Aphanizomenon* (3g,h) was abundant in water collected from 0.5m depth. Diatoms of the genus *Amphipleura* (3f) were also present in the surface sample.
• Preliminary analyses of samples from the May 2006 deployment show dominance by diatoms (likely *Asterionella*) & cladocerans (mainly Daphnids).

Results & Figures

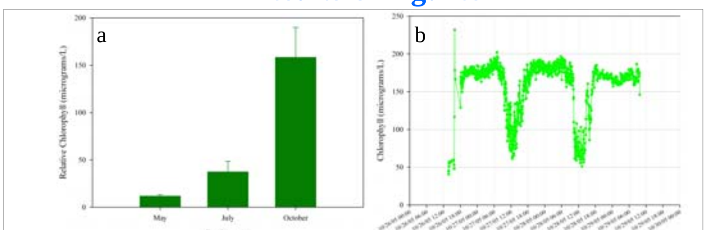
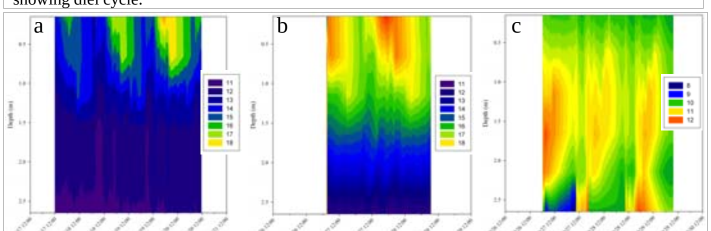


Figure 1: Mean daily relative chlorophyll (& standard deviation) at Node 107 during 2005 deployments (a). Relative chlorophyll concentration at Node 107 during the October deployment (b), showing diel cycle.



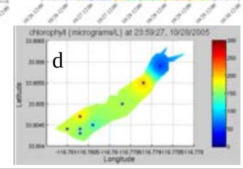


Figure 2: Temperature stratification in LF (a-c) in May, July, & October 2005, respectively. Visualization display of surface chlorophyll concentrations along LF during October deployment (d).

Figure 3: Dominant LF phytoplankton in July (a-e) & October (f-j) 2005