Growth of *Lyngbya* (*Microseira*) in the freshwater tidal Potomac

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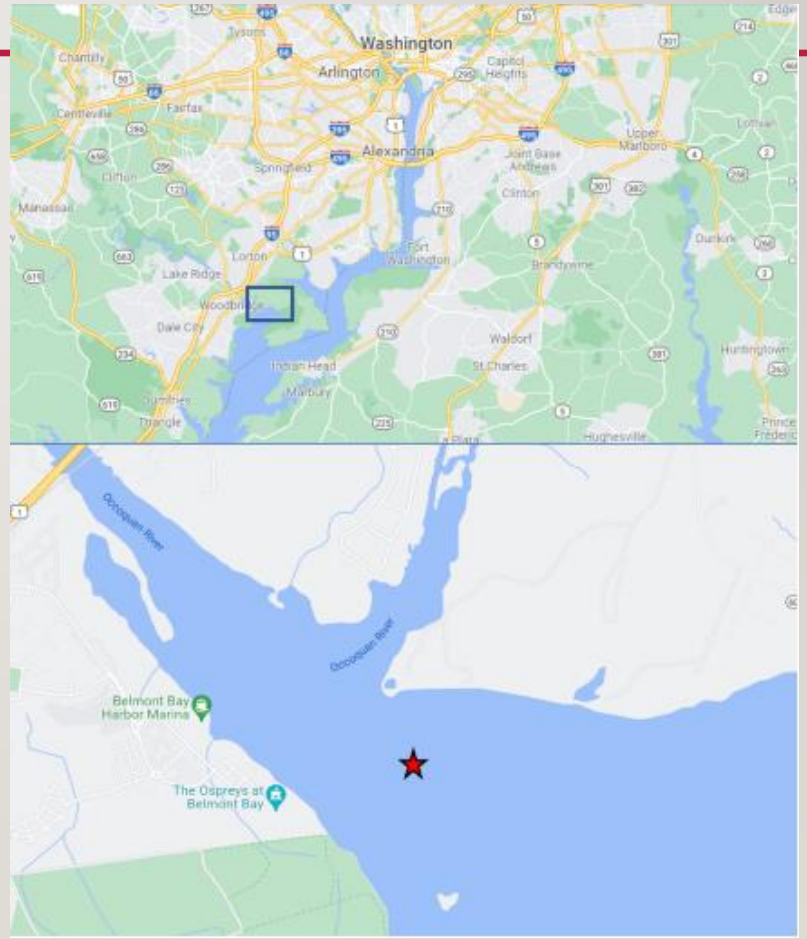
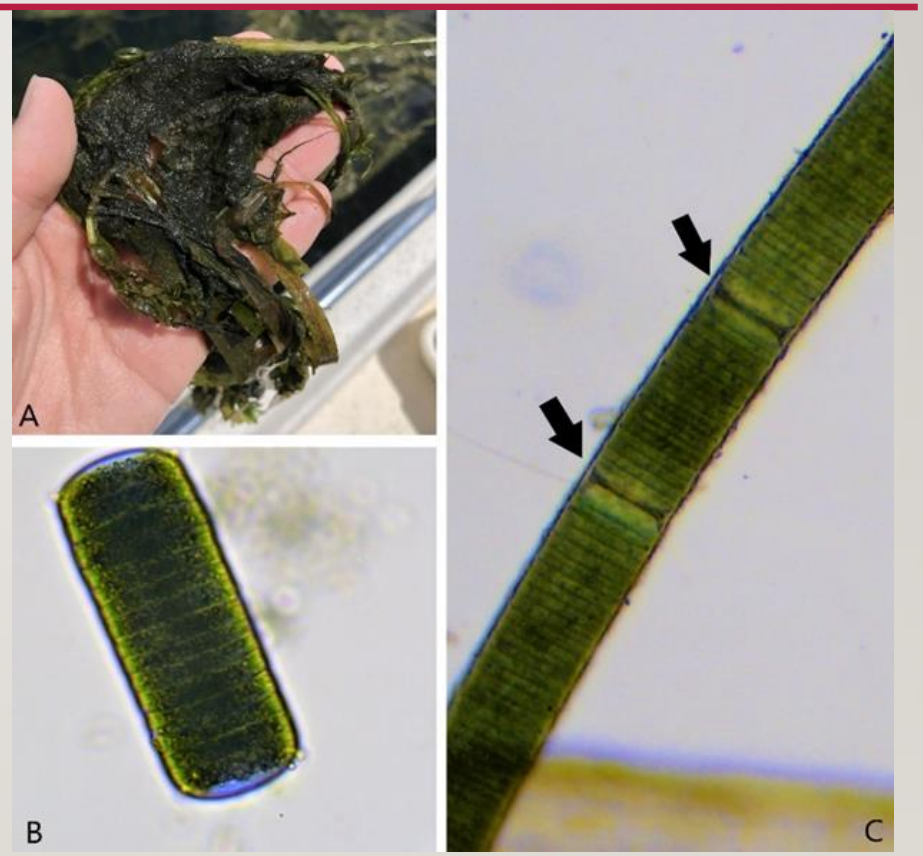
Lyngbya grows in the littoral zone in several locations in the tidal freshwater Potomac

- *Lyngbya* is a filamentous cyanobacterium which grows on the sediment surface under an SAV canopy
- We have found it to be particularly abundant below *Vallisneria americana*
- There has been only limited research on this species, particularly in tidal freshwater ecosystems
- MS student Sam Mohney studied an area of the tidal Occoquan across from GMU's Potomac Science Center, home of Potomac Environmental Research and Education Center where *Lyngbya* mats have been observed consistently for several years.



Lyngbya grows in the littoral zone in several locations in the tidal freshwater Potomac

- I had observed the growths of a thick black mat in the *Vallisneria* beds across the river from our labs at Potomac Science Center on the tidal Occoquan for several years
- Our work started in 2020 when MS student Samantha Mohney adopted this project for her thesis
- We had planned to start in spring of 2020, but the work was delayed due to COVID and the project began in July 2020. By that time the obvious *Lyngbya* carpet had established itself.



Benthic cyanobacteria production and abundance in the tidal Occoquan River. S. Mohney. 2002. MS thesis. GMU.
http://hdl.handle.net/1920/12998

- Sam studied *Lyngbya* biomass and growth at site on the tidal Occoquan near Potomac Science Center
- She used a petite ponar grab (232 cm^2) to capture samples of the sediment which included the *Lyngbya* mats and any SAV
- The samples were preliminarilly processed in the field to remove fine sediments and any SAV material
- This sampling technique resulted in globs of *Lyngbya* and included CPOM and plant fragments

Benthic cyanobacteria production and abundance in the tidal Occoquan River. S. Mohney. 2002. MS thesis. GMU.
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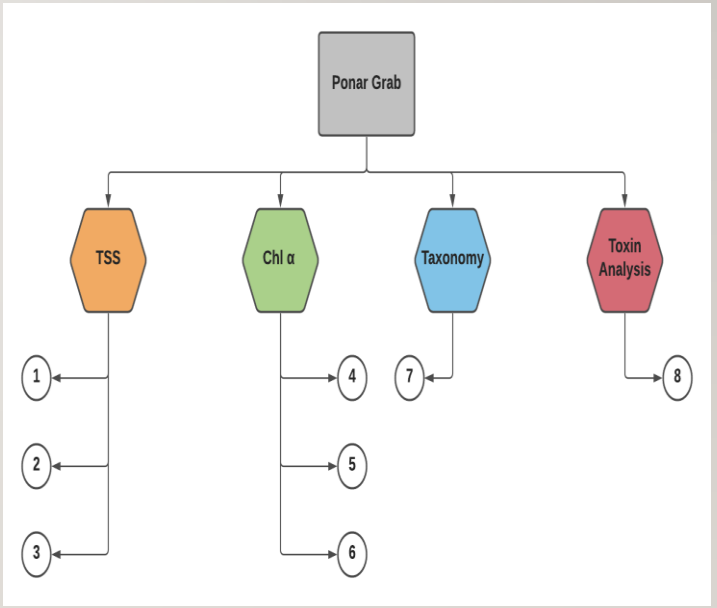
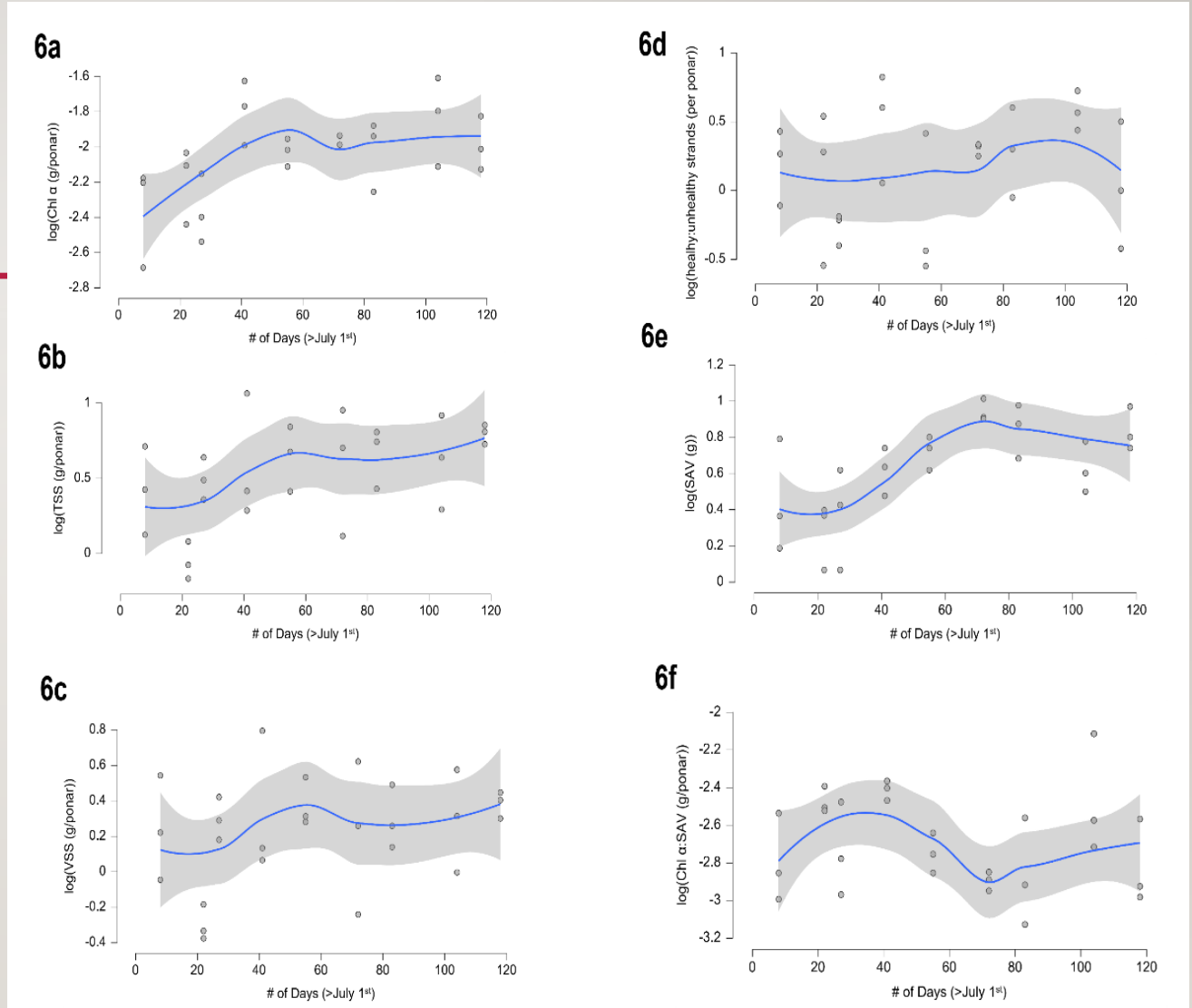
- In the lab these samples were further cleaned on a 0.5 mm sieve and obvious SAV material was removed
- The sample was then divided into 8 "equal" portions which went to measuring different parameters
- She reported on TSS, Chla, and microscopy in her thesis

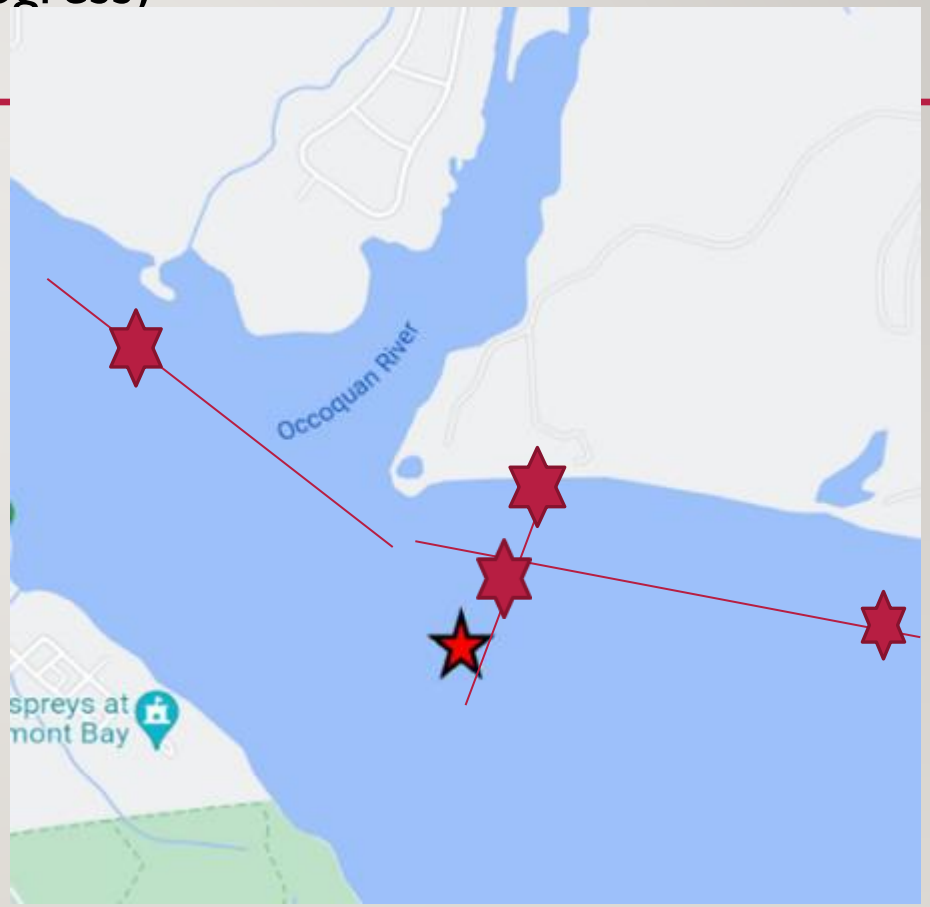


- Her results are summarized in this figure with all parameter values converted to mass per ponar
- Day 1 in these graphs is July 1 so the mat was already well established by this time
- Chlorophyll a in these samples continued to increase through the end of August and then leveled out as did Dry Wet and Organic Weight
- The ratio of healthy to unhealth filaments did not change noticeable during the period
- However the biomass of SAV (mostly Vallisneria) followed a similar pattern leading to a high correlation between this variable and measures of *Lyngbya* biomass
- *Lyngbya* biomass per unit SAV biomass showed some covariabilty with the other variables but did not vary in an obvious seasonal pattern



Growth and development of Lyngbya populations in the tidal Occoquan – a complete annual period. R. C. Jones (in progress)

- Sam's work provided a nice overview of Lyngbya mat variability and seasonal progression beginning in July at one site
- I wanted to follow up with a study which would:
  - begin earlier in the year and capture the full development of the mat
  - develop a better way to capture small scale variability and to achieve better separation of Lyngbya filaments from contaminating material such as plant framents
  - look at the aerial extent of these mats and their extent both parallel to shore as well as from shore out to the edge of the SAV bed
- So I have adopted the spatial sampling layout shown here
- Every two weeks I have sampled *Lyngbya* alternating between the along shore transect and the perpendicular transect. One site is sampled on bot transects so it is sampled every two weeks
- Sampling began on May 10 and continued through June 5.



- Sampling again included sediment capture using ponar, but this year I am then collecting individual cores within the sediment using a cork borer (approx. dia 3/8”)
- I collect 5 cores per ponar with three individual ponars collected per site
- The cores are placed in individual centrifuge tubes and returned to the lab
- Lyngbya is separated from the rest of the sediment using a 0.5 mm mesh
- The material on the core is flushed out of the centrifuge tube with a rinse bottle onto the 0.5 mm sieve
- The fine material is flushed through the sieve

- The fine material is flushed through the sieve. The material on the sieve is back flushed into a pan, sloshed around to suspend the finer organic material including the Lyngbya filaments
- The supernatant is then decanted through the 0.5 mm sieve
- The material on the sieve is collected in the centrifuge tube for filtering though GN-6 membrane filters for chlorophyll analysis
- The materials in both the fine sediment washings and the coarse sediment leavings have been scanned for filaments and not have been observed
- While the study has been implemented as planned, new *Lyngbya* growth has failed to appear in the study area.

ADDITIONAL STUDIES

- Since we have not seen *Lyngbya* in our restricted study area we have begun looking more broadly and we have located some floating mats and balls nearby
- We have used these to continue to develop our sampling methods and to developing our capacity to measure phycocyanin in the mats

Microseira wollei in Occoquan River produces neurotoxins and VOC

Microseira fresh samples from Occoquan River sent overnight on May 2nd, 2023 to Dr. Rosalina Christova at CSUSM for microscope observations and toxin measurements. Composite mixed sample of *Microseira* fresh filaments was sent to Dr. Greg Boyer for toxin measurements.

ESF State University of New York College of Environmental Science and Forestry

Dr. Gregory Boyer

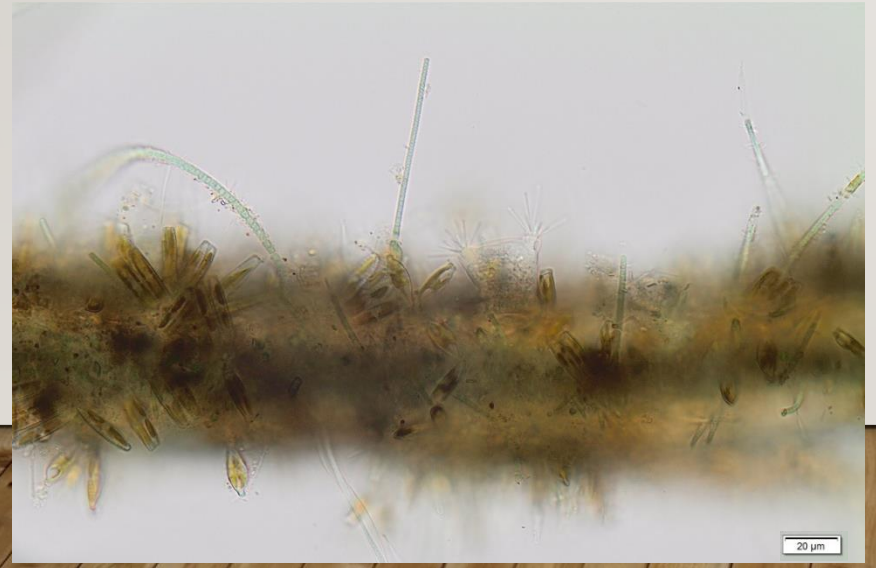
PSP positive (ELISA)
VOC positive (not measured)
Microcystins negative (LC-MS)
Anatoxins negative (LC-MS)

Follow up analysis by LC-MS found 21.42 ug/g of PSP

Microseira wollei in Occoquan River creates micro-scale ecosystems

- *Microseira* mats create micro-scale ecosystems
- *Microseira* filaments provide solid substrate for attachment of diverse epiphytic cyanobacteria, diatoms , green algae, bacteria, ciliates and other protozoa

Diatoms and cyanobacterial epiphytes



Diatoms and ciliates

FUTURE WORK

- Need to map our study area and map outbreaks of active *Lyngbya* growth
- Explore alternative ways of collecting replicate samples to allow various measures of *Lyngbya* biomass and growth to be measured. This includes sampling of the benthic surface as well of mats themselves.
- Use C14 uptake to measure the photosynthetic activity of the mats
- Determine the significance of epiphytes to *Lyngbya* development
- Continue to assess the toxins in Potomac River *Lyngbya*