Lake Gaston Weed Control Council Meeting
NCSU Update
July 14th , 2022

Jessica R. Baumann

Extension Associate, Lake Gaston

Aquatic Plant Management Program

Outline

1. Lyngbya Management

1.1 LYNGBYA LITERATURE REVIEW
1.2 ENVIRONMENTAL FACTORS INFLUENCING LYNGBYA GROWTH - PREDICTIVE MODELING
1.3 LYNGBYA TREATMENTS – LAB STUDY
1.4 LYNGBYA TREATMENT PROGRAM – OVERVIEW
1.5 EFFICACY OF LYGNBYA TREATMENT PROGRAM
1.6 POTENTIAL ENVIRONMENTAL IMPACTS OF TREATMENTS
1.7 LYNGBYA TOXIN POTENTIAL

2. Water Quality

2.1 WATER CHEMISTRY AND NUTRIENT LEVELS
2.2 BACTERIA MONITORING
2.3 HYDROSOIL CHARATERISTICS

3. Improved Surveys

3.1 ENVIRONMENTAL FACTORS INFLUENCING NATIVE VEGETATION DISTRIBUTION

4. Improved Revegetation

4.1 NOVEL REVEGETATION DESIGN

5. Hydrilla Management

5.1 EVALUATION OF NEW HYDRILLA HERBICIDE

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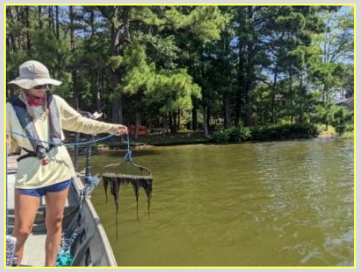

5. Hydrilla Management

5.1 EVALUATION OF NEW HYDRILLA HERBICIDE

Outline

Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

Lyngbya Management

- Environmental Factors Influencing Lyngbya Growth

- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

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Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

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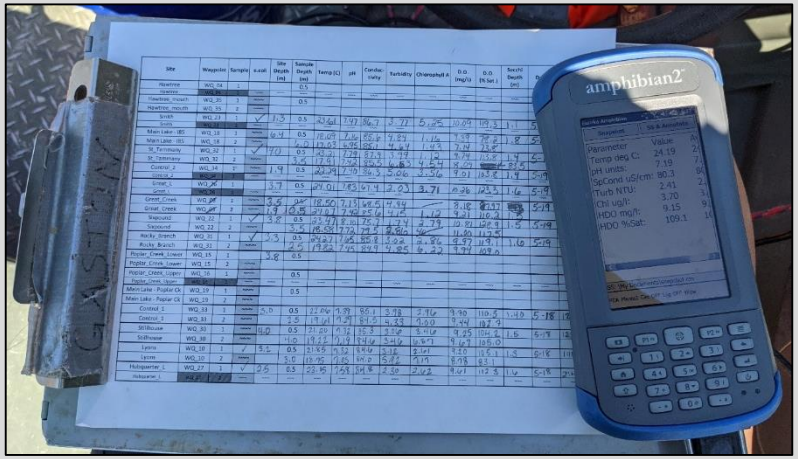
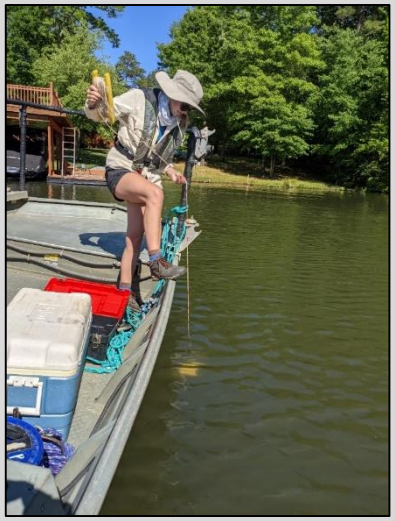
  - Lab Trials

Water Quality

Water Quality Report

1. Nutrients
2. Water Chemistry
3. Bacterial Community
4. Hydrosoil Characteristics



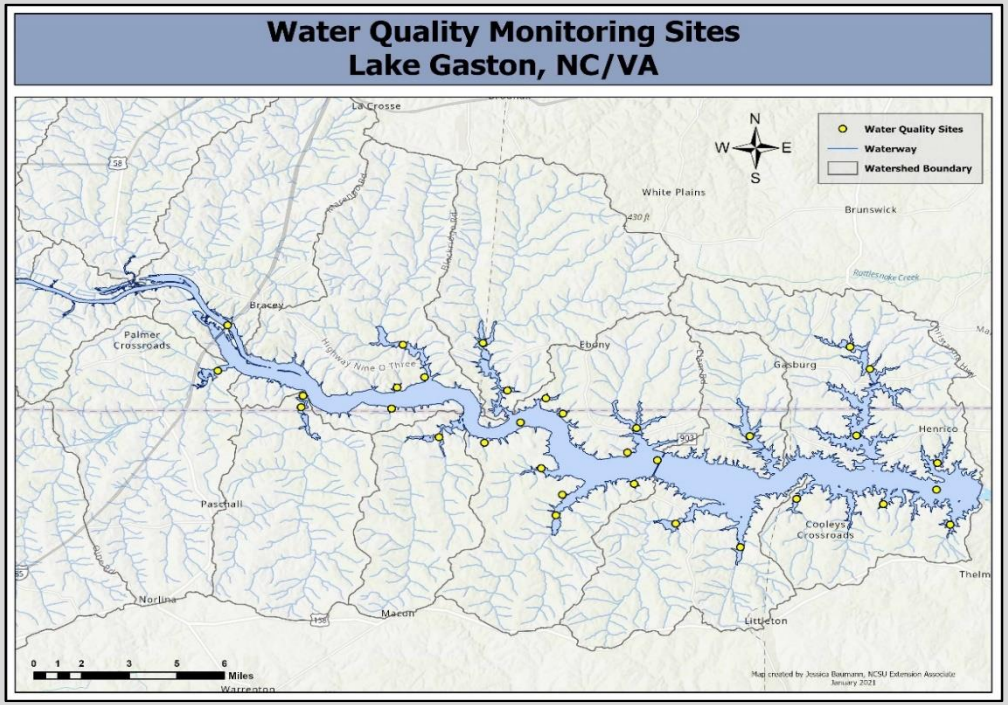


Water Quality

Water Quality Sampling

- 35 Total Sites
  - 18 E.coli sites

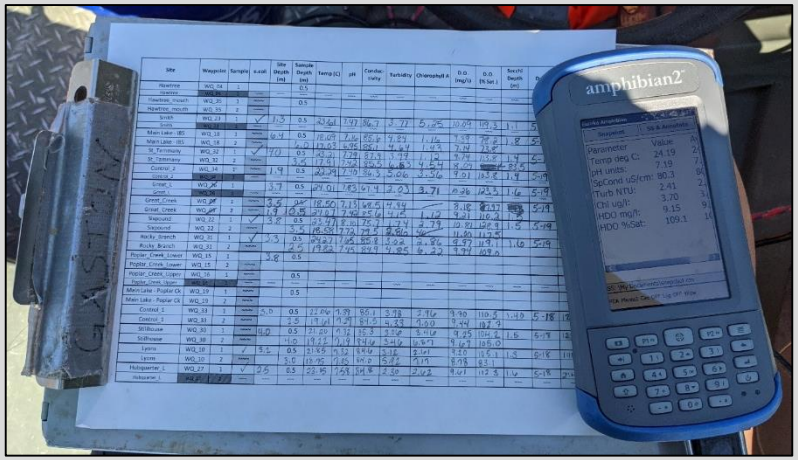
- All associated watershed are represented

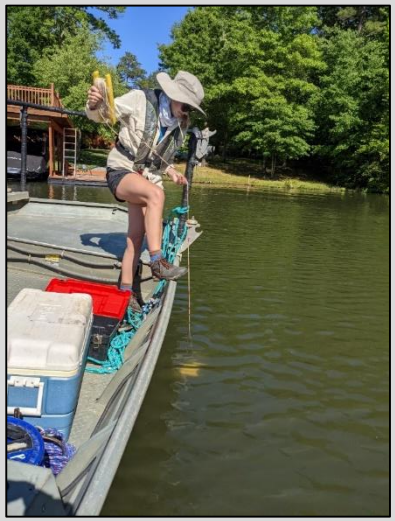


Water Quality

Goals

1. Characterize basic water quality parameters for future monitoring efforts
2. Identify any potential negative impacts to water quality
3. Correlate water quality parameter to lyngbya growth patterns



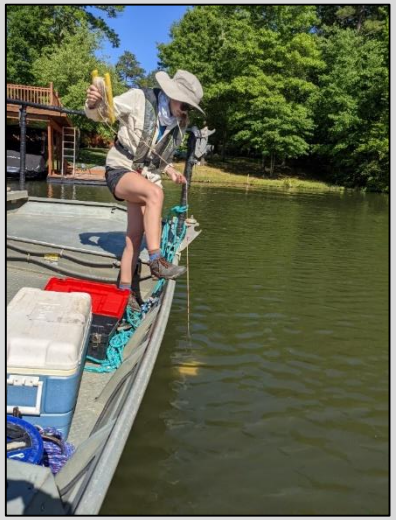


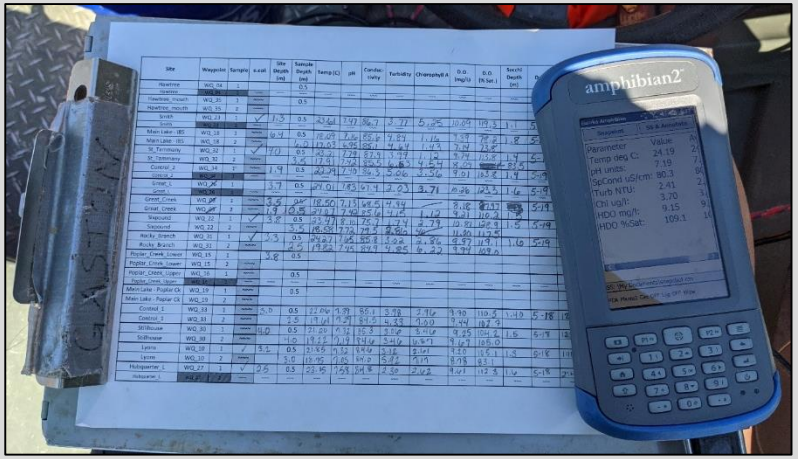
Water Quality

Nutrients

1. Nitrogen
2. Phosphorus
3. Chlorophyll-a
4. Secchi Depths

- Everything within EPA standards



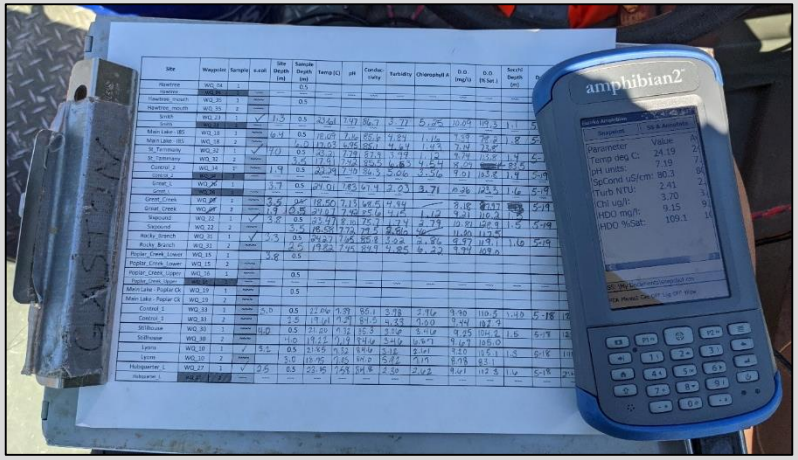


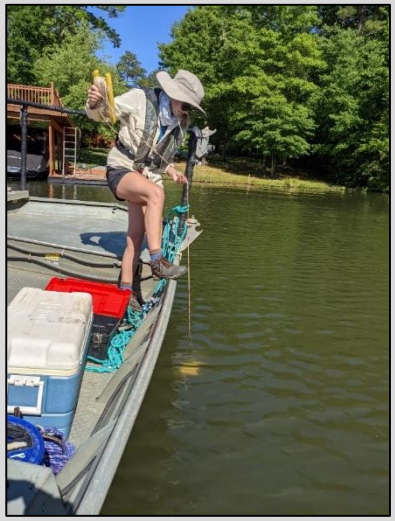
Water Quality

Nutrients

1. Nitrogen
   - Naturally occurring
   - Nitrogen-cycles

2. Phosphorus
   - Not Readily available in aquatic system – limiting nutrient
     - Biomass Aquatic Organisms
     - Bound to Soil Particles – Run off

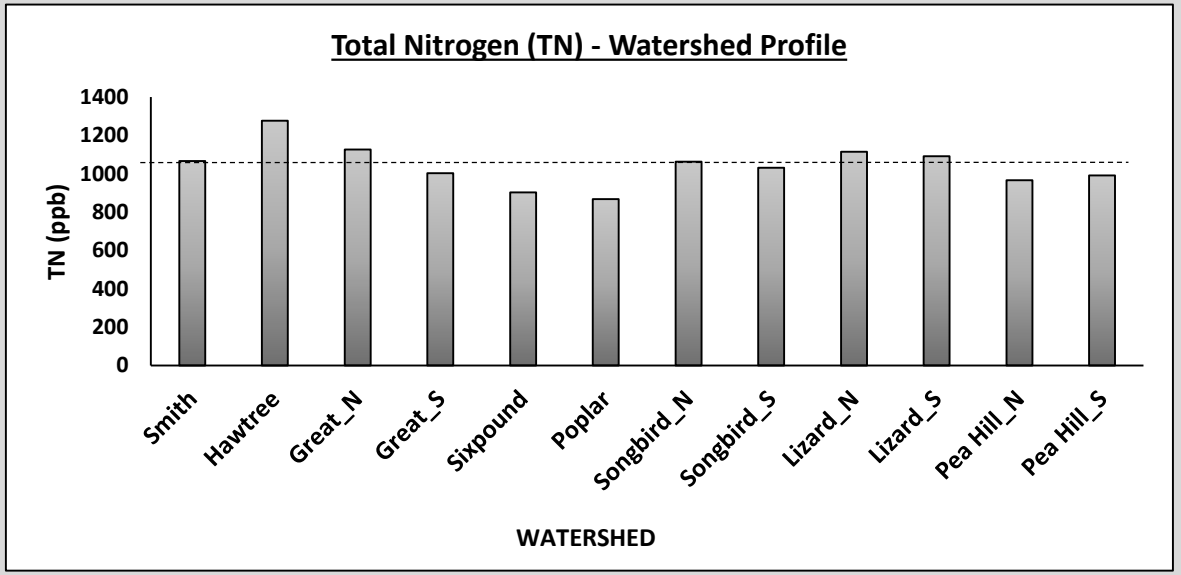


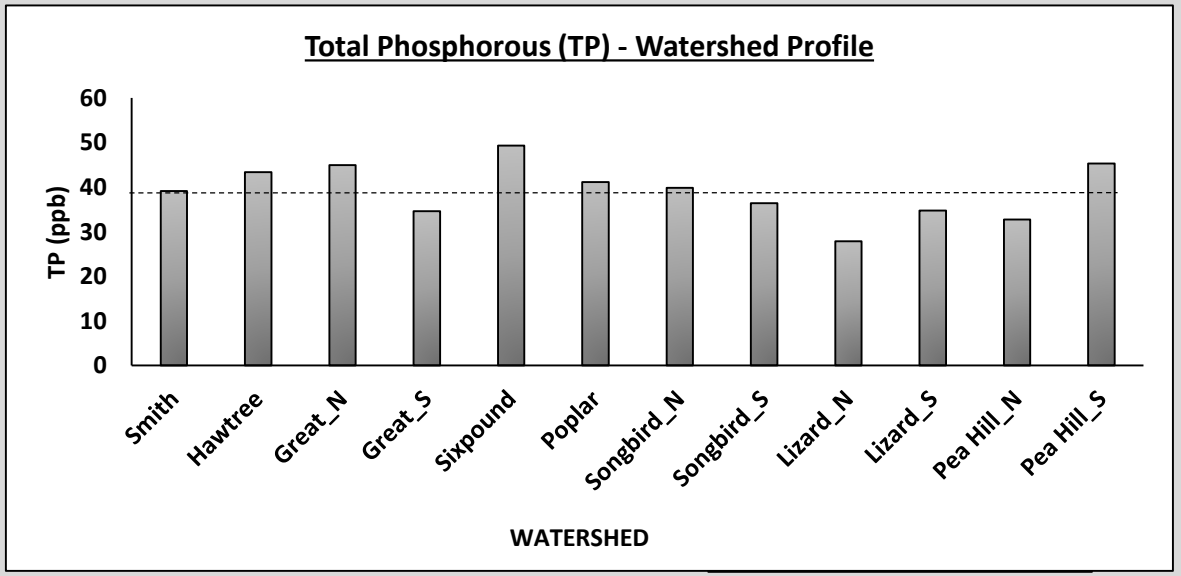


Water Quality

Nutrients

1. Nitrogen
2. Phosphorus

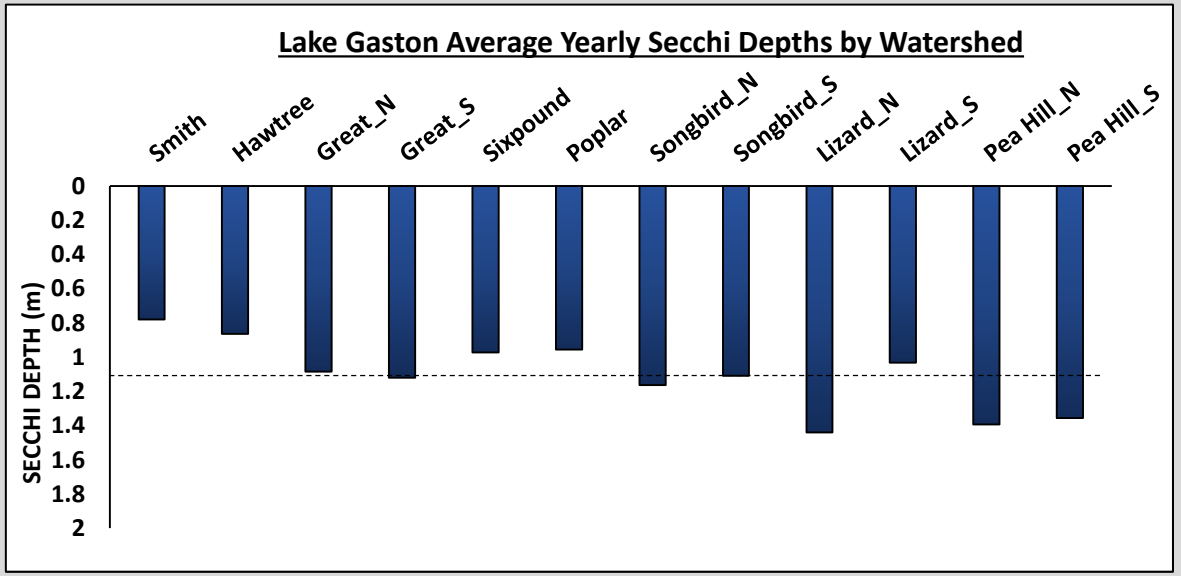


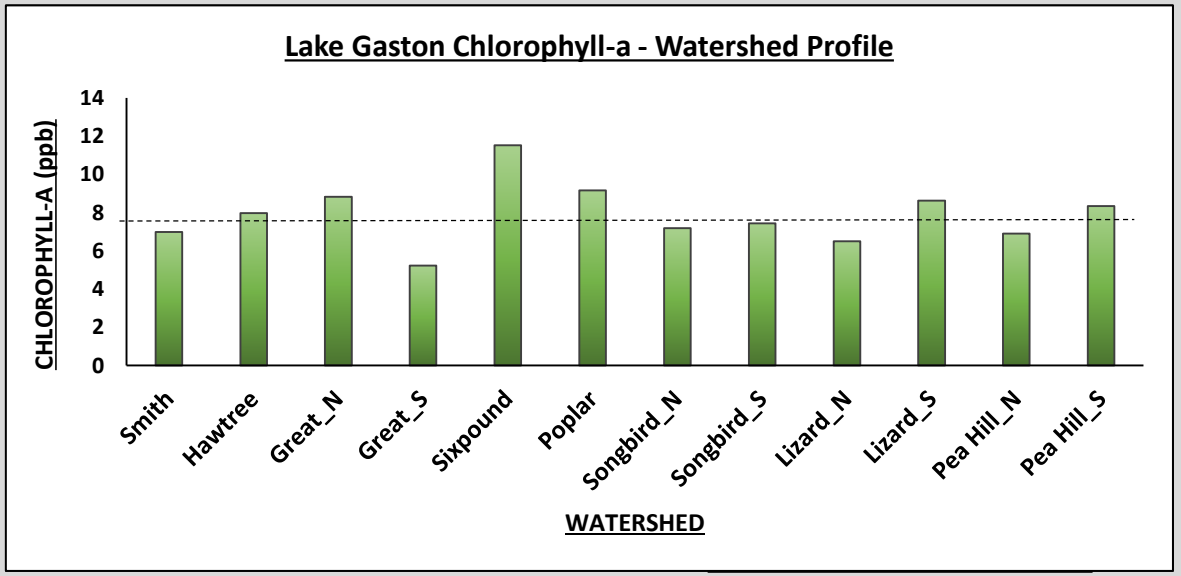


Water Quality

Nutrients

1. Secchi Depth
2. Chlorophyll-a





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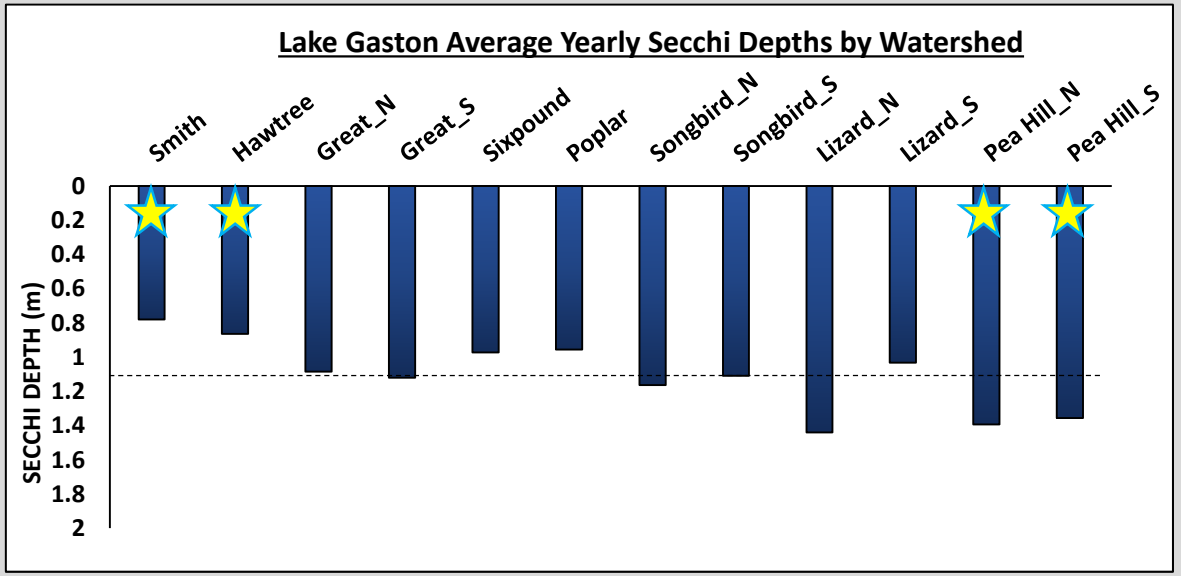

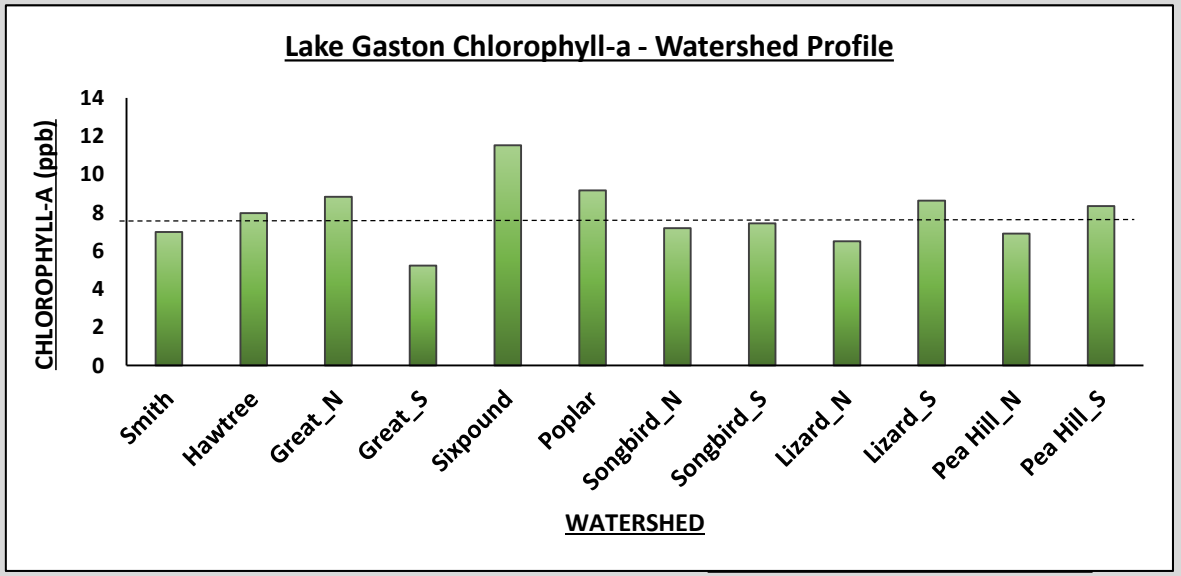

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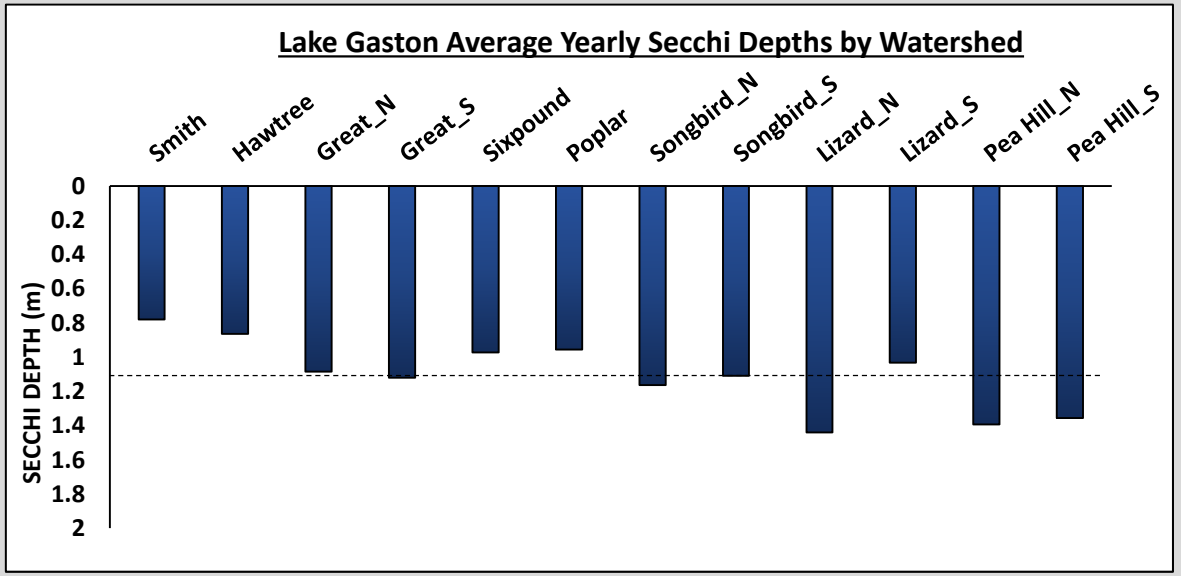

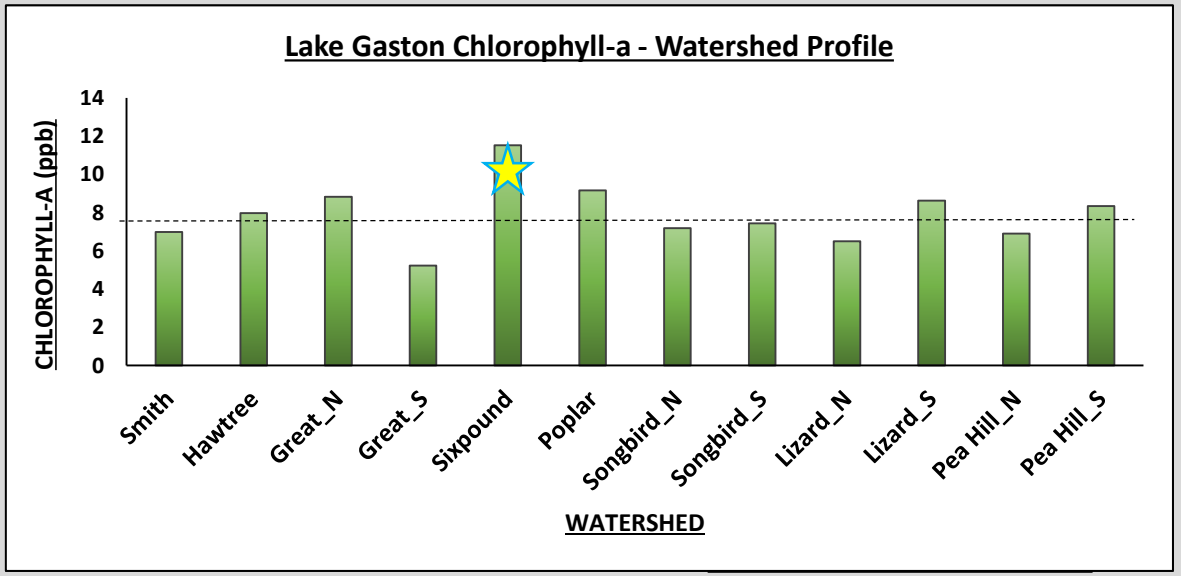

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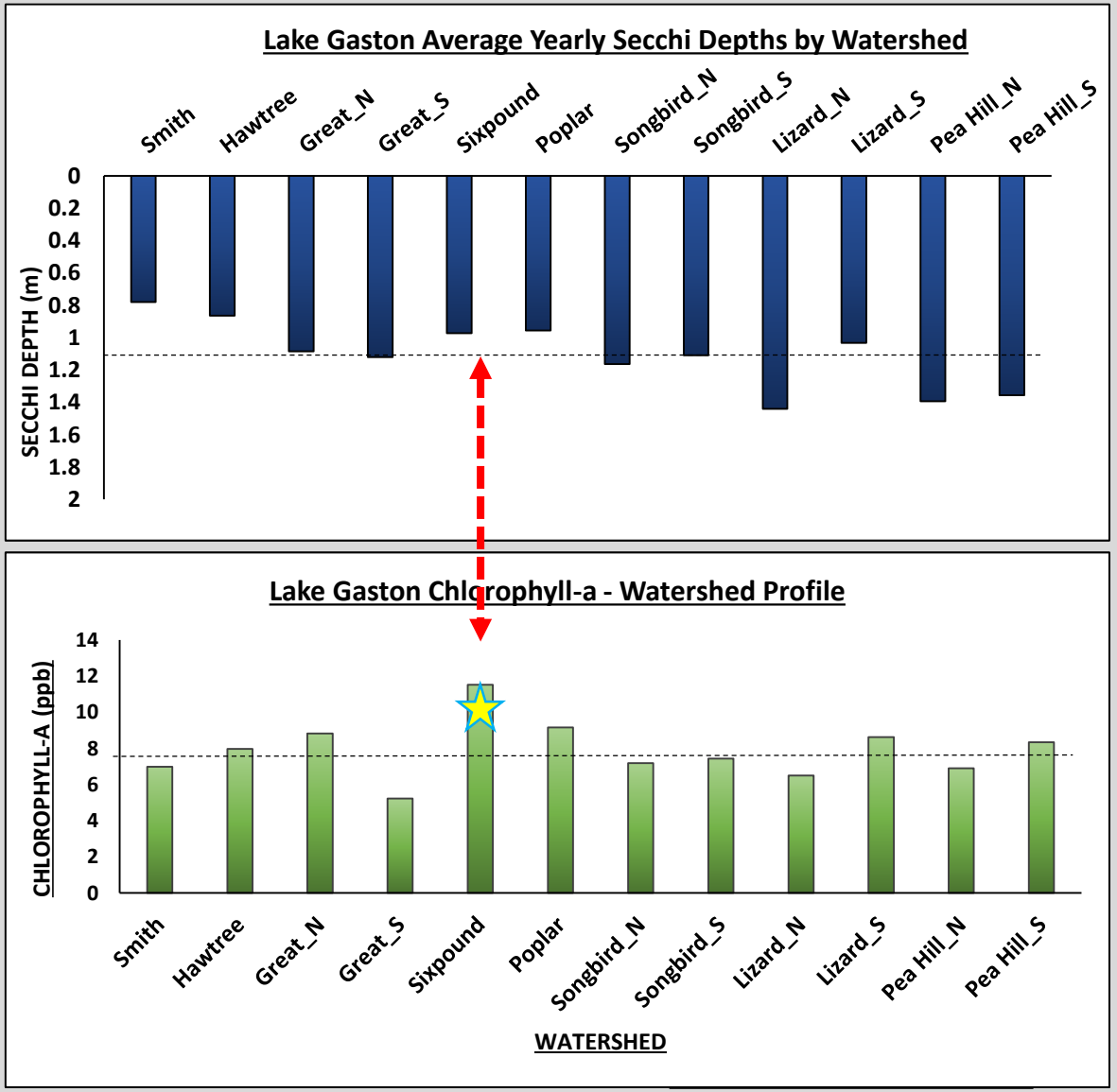

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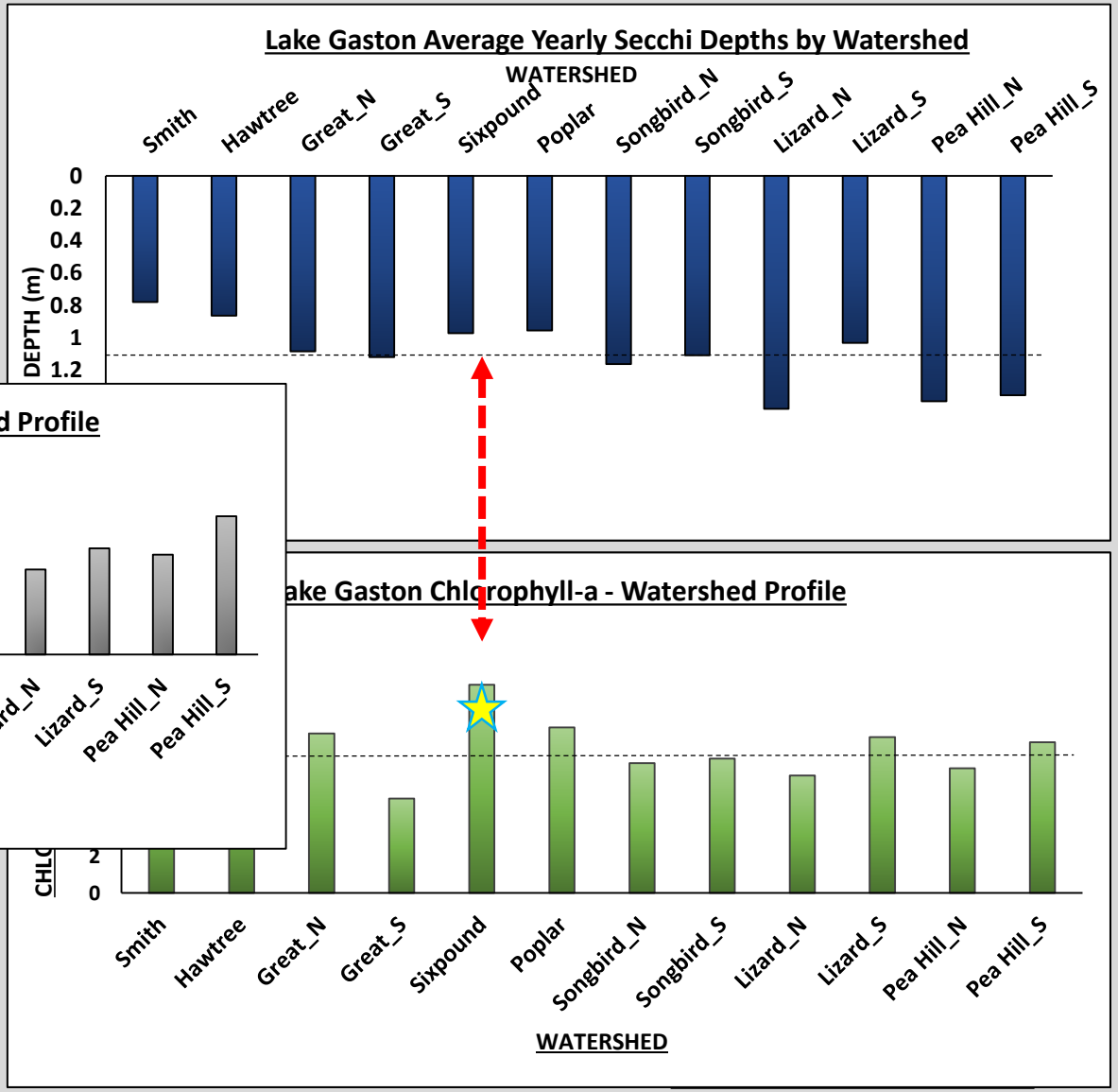

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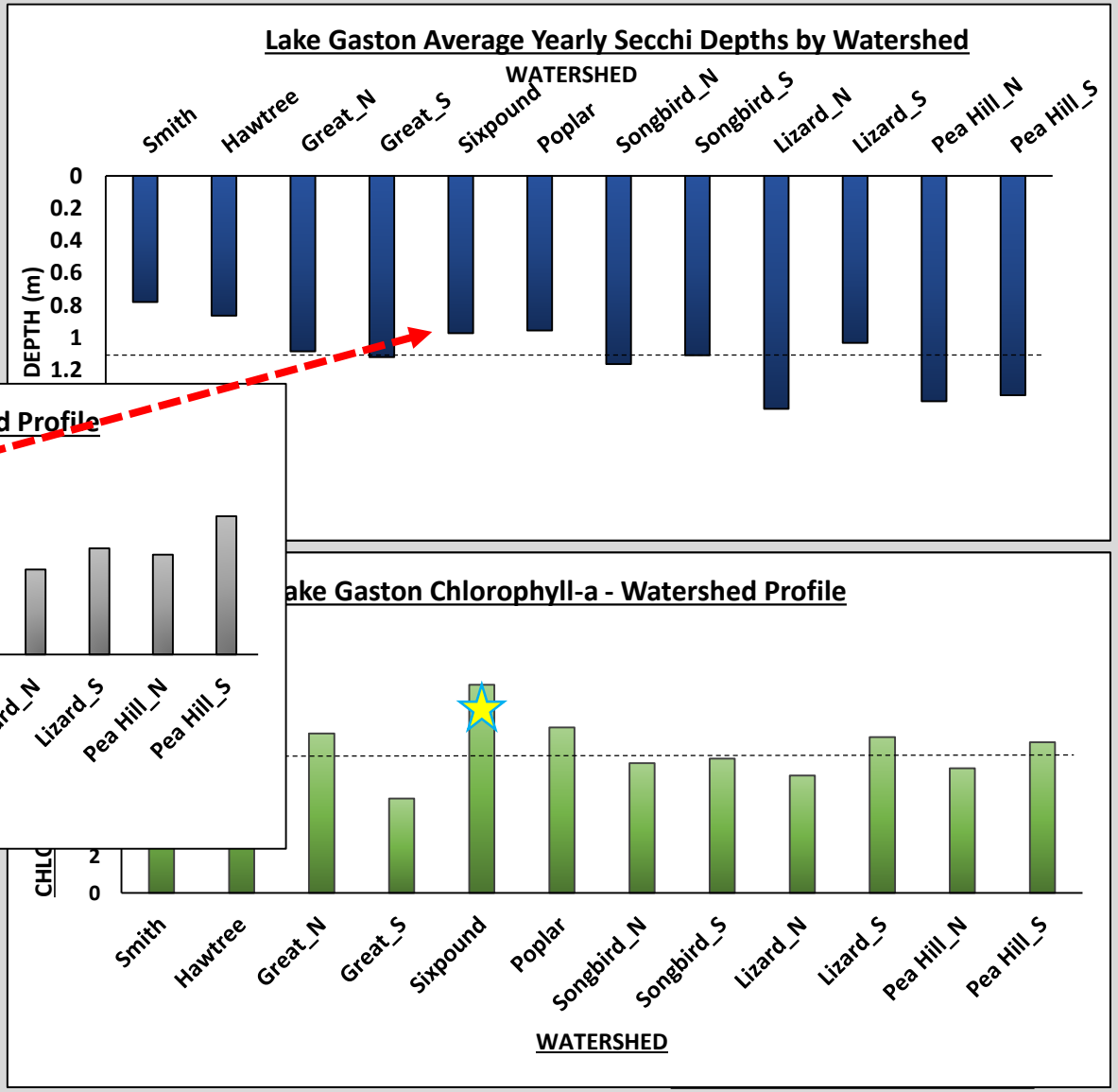
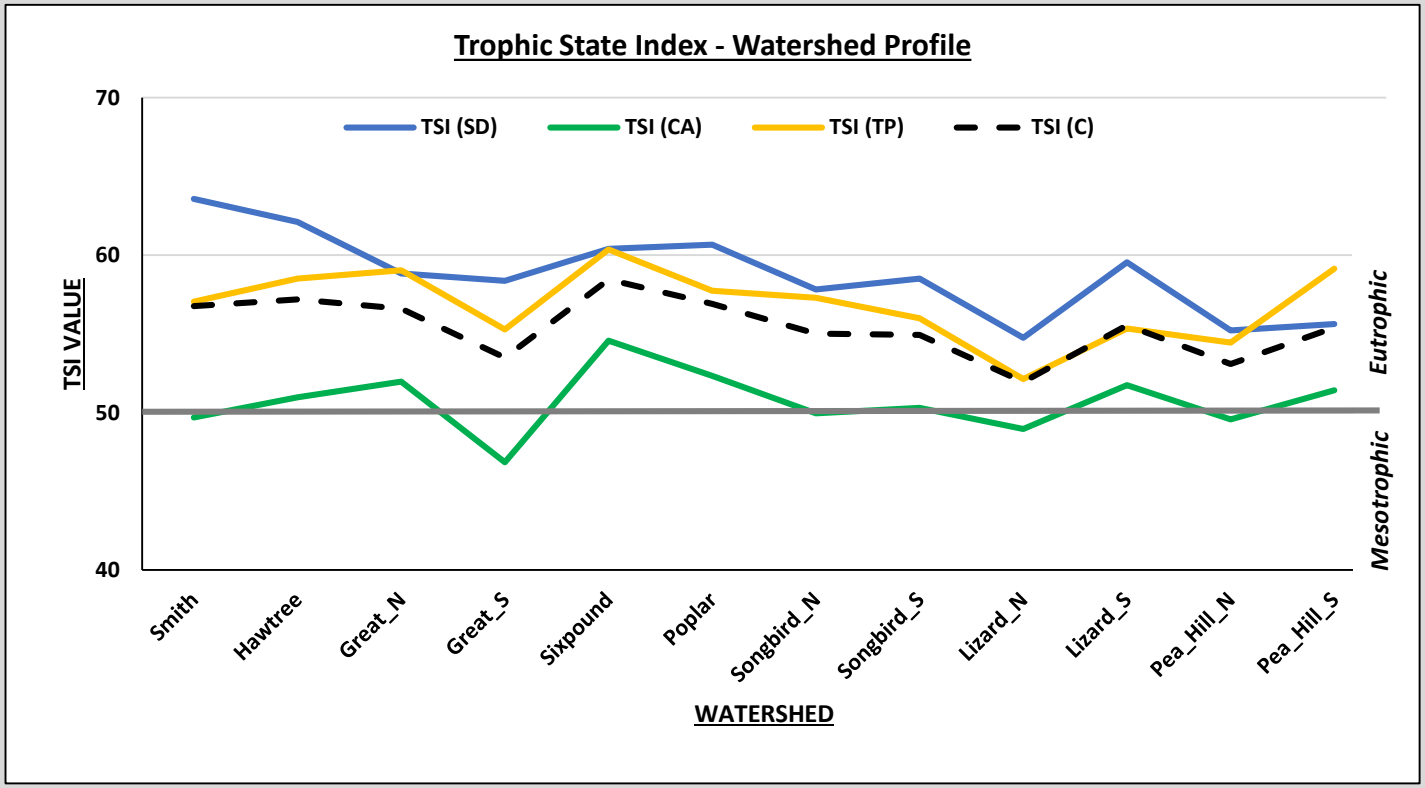


Water Quality

Trophic State Index

1. Uses chlorophyll-a, secchi depth, and total phosphorous to classify the productivity level of aquatic systems and identify limiting factors within a system



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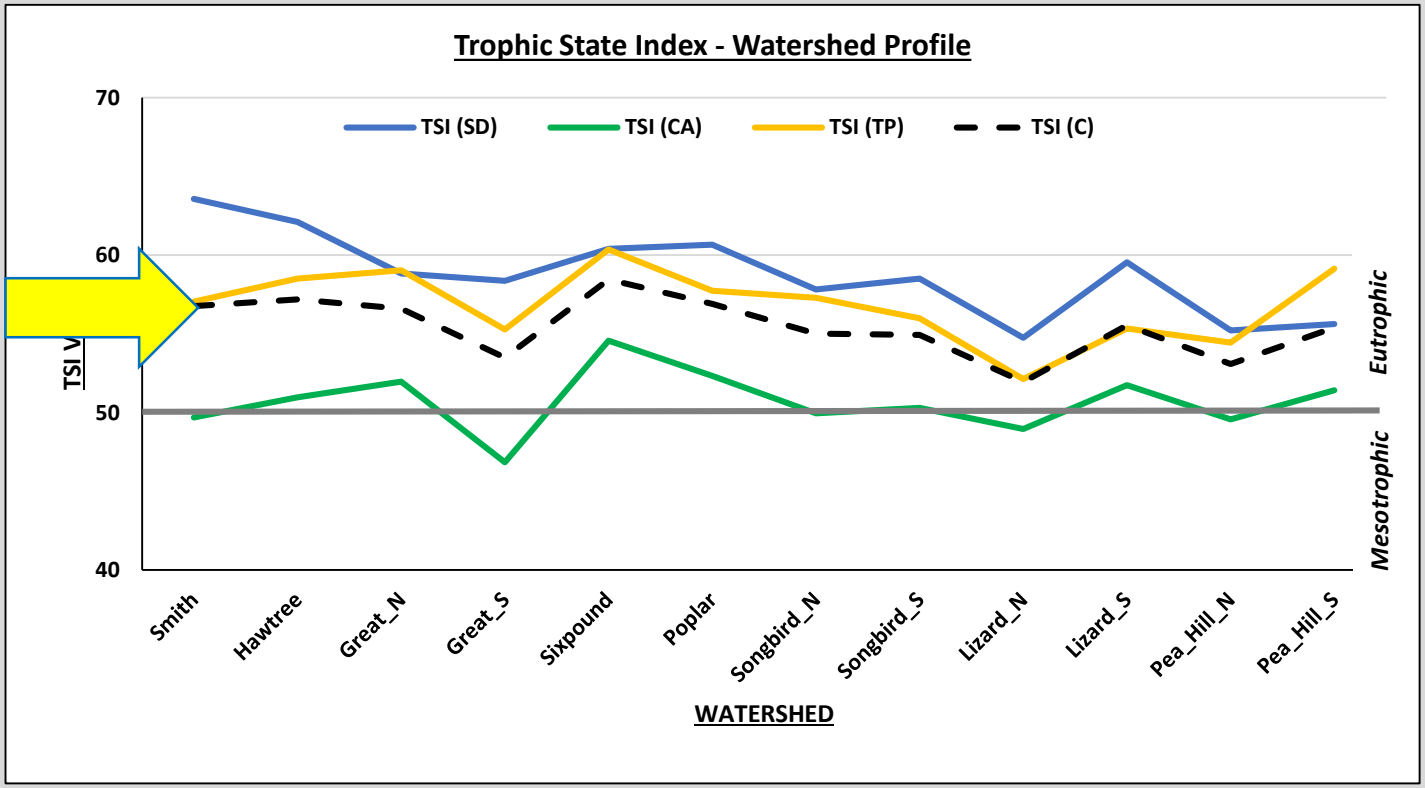

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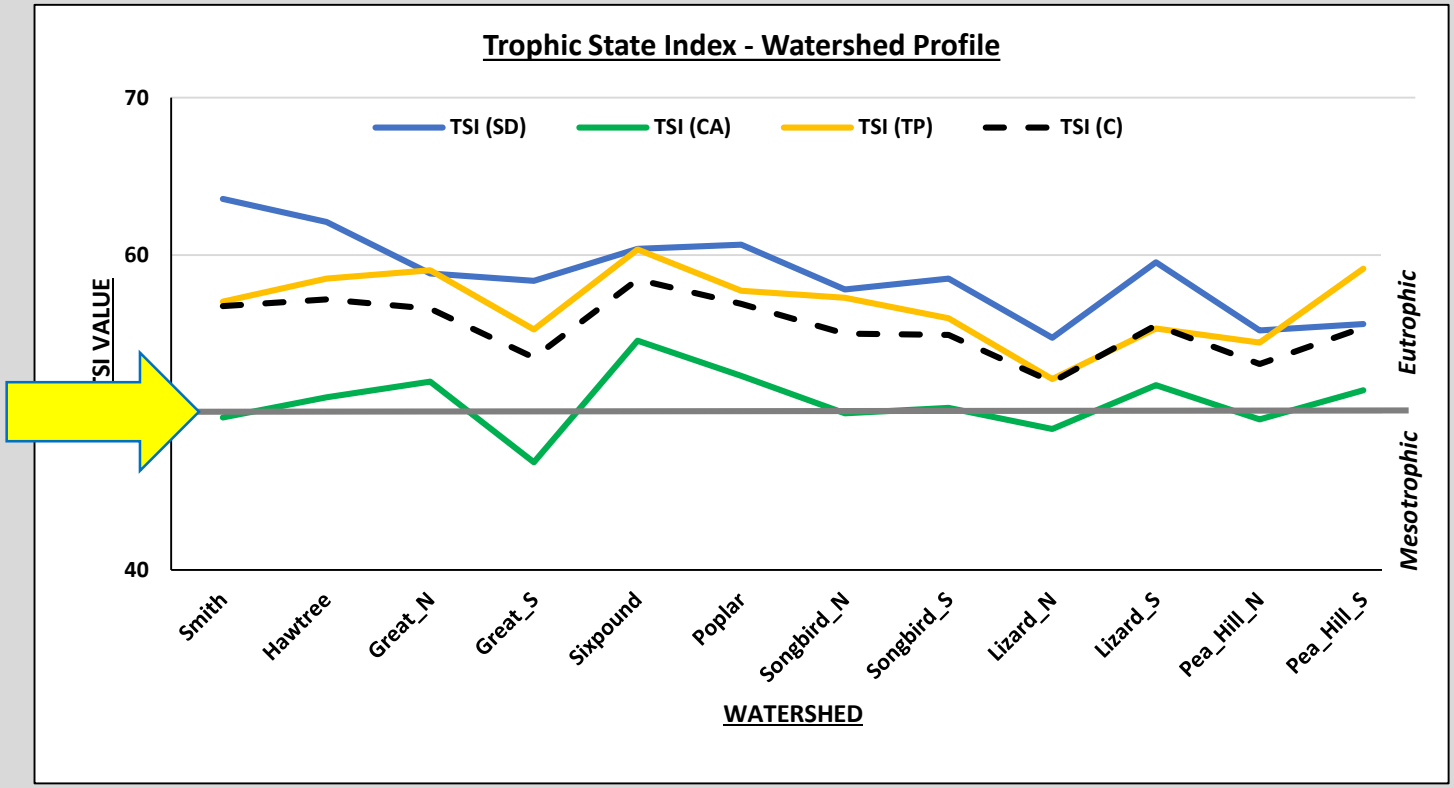
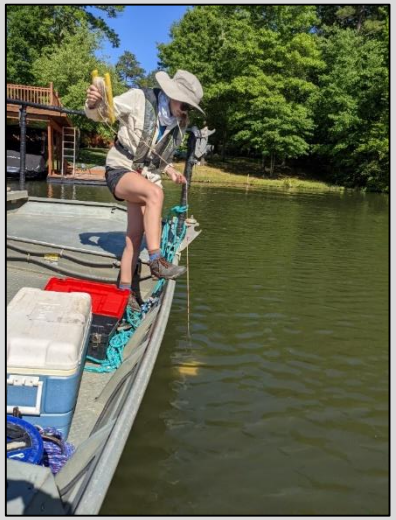


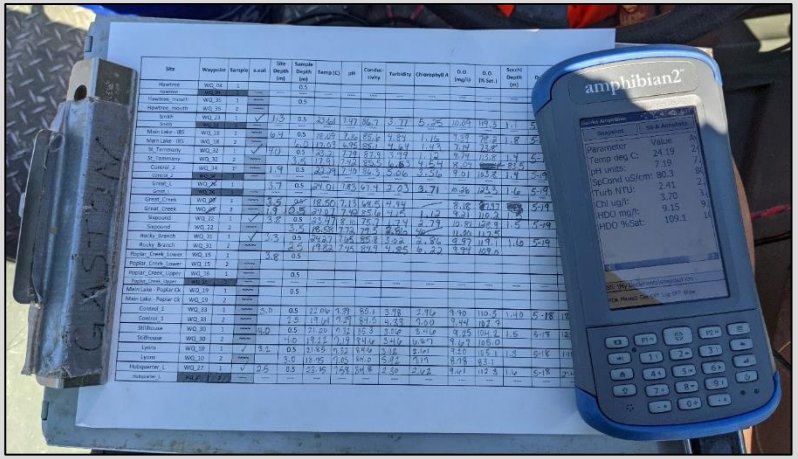
Water Quality

Water Chemistry

1. Temperature
2. Dissolved Oxygen
3. pH
4. Alkalinity
5. Conductivity

- Everything within EPA standards
- Within ranges to support healthy aquatic ecosystem





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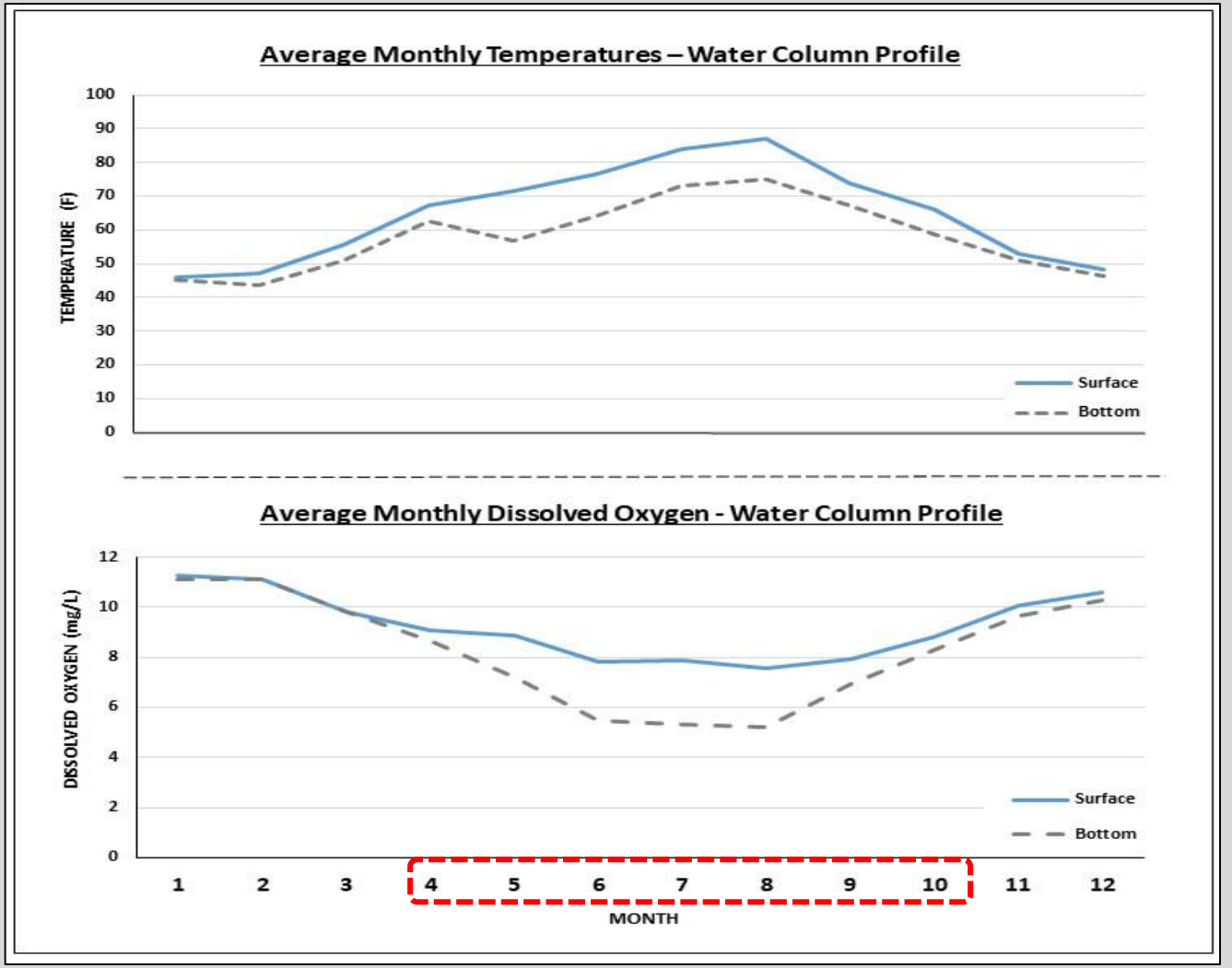


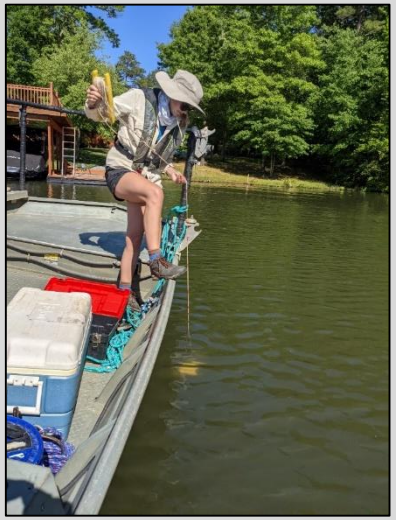
Water Quality

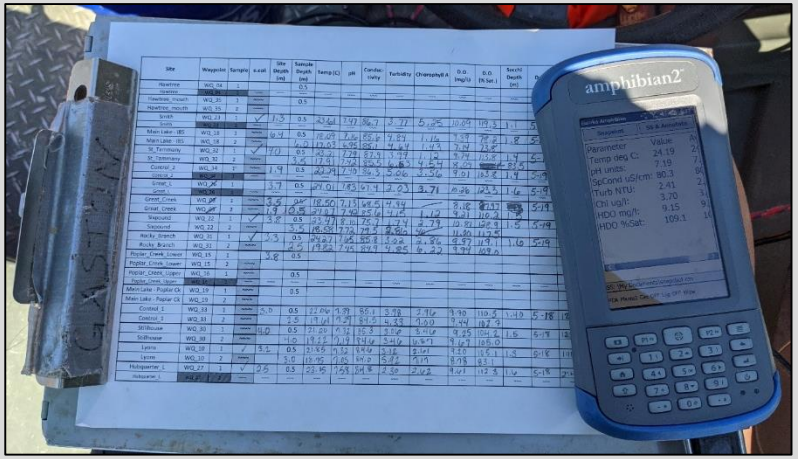
Water Chemistry

1. Temperature
2. Dissolved Oxygen
3. pH
4. Alkalinity
5. Conductivity
6. Turbidity

- Everything within EPA standards
- Expected Seasonal variations

- Neutral pH of 7





Water Quality

Hydrosoils

- Sample taken from WQ site in all associated watersheds
  - Carbon (% weight)
  - Nitrogen (% weight)
  - Nitrate (mg/L)
  - Ammonia (mg/L)
  - Phosphorous (mg/kg)
  - Copper (mg/kg)
  - Iron (mg/kg)

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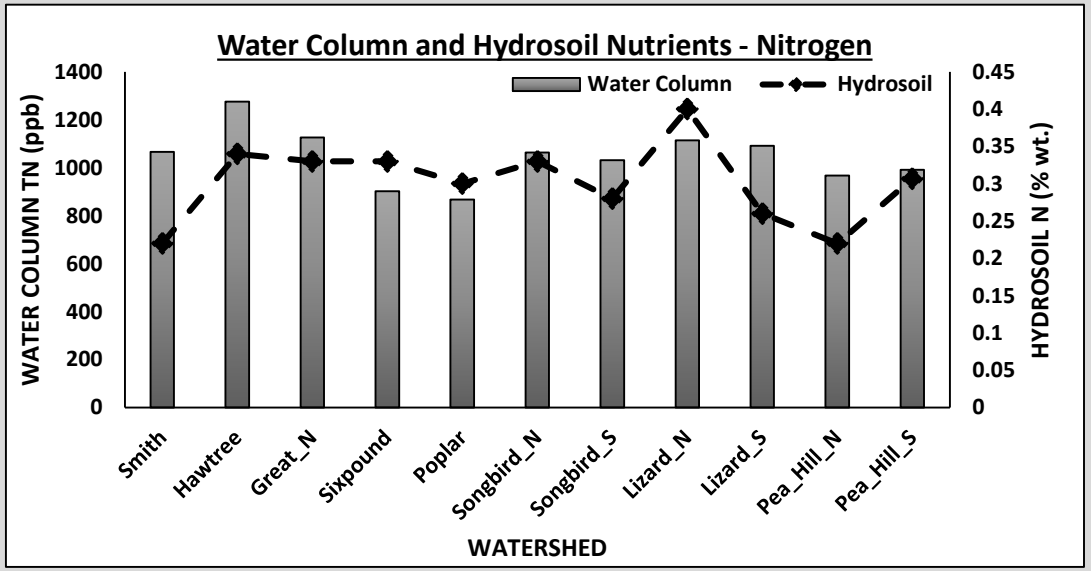

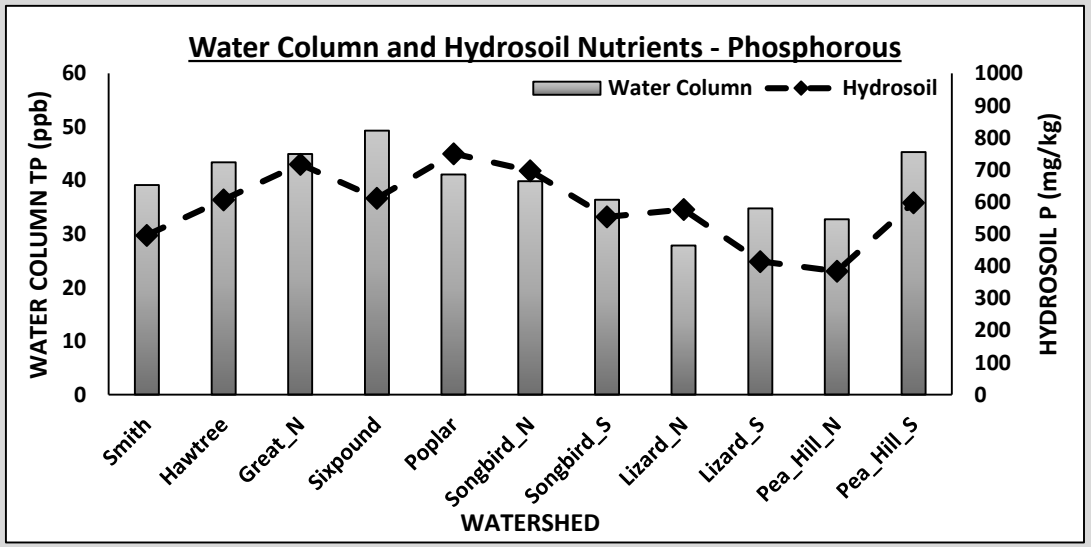

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- Water Chemistry and Nutrients
- Hydrosoil Characteristics

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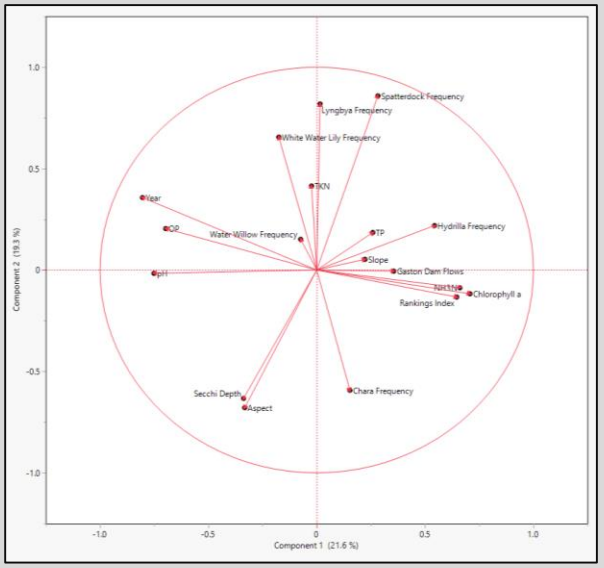
- Environmental Factors Influencing Lyngbya Growth

- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

Environmental Factors - Lyngbya

Principle Components Analyses (PCA)

- Model that helps explain the relationship that environmental variables have on each other.
- Ecosystem view and multidimensional
- BUT, only explains when all factors are present!



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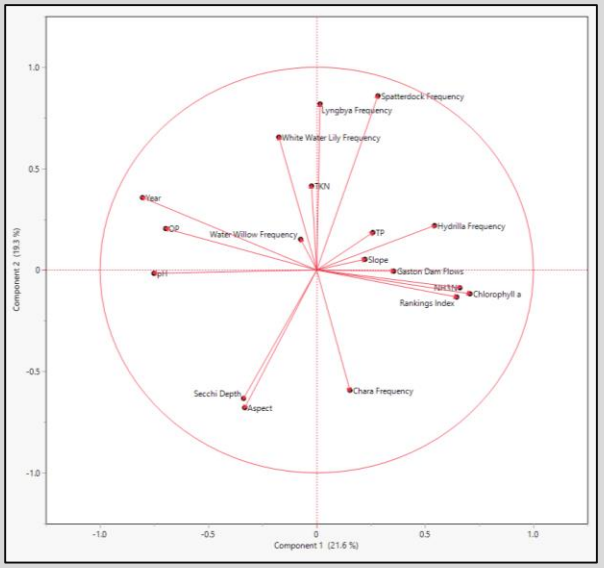
Lyngbya

- Distribution (frequency)
- Density (rankings index)



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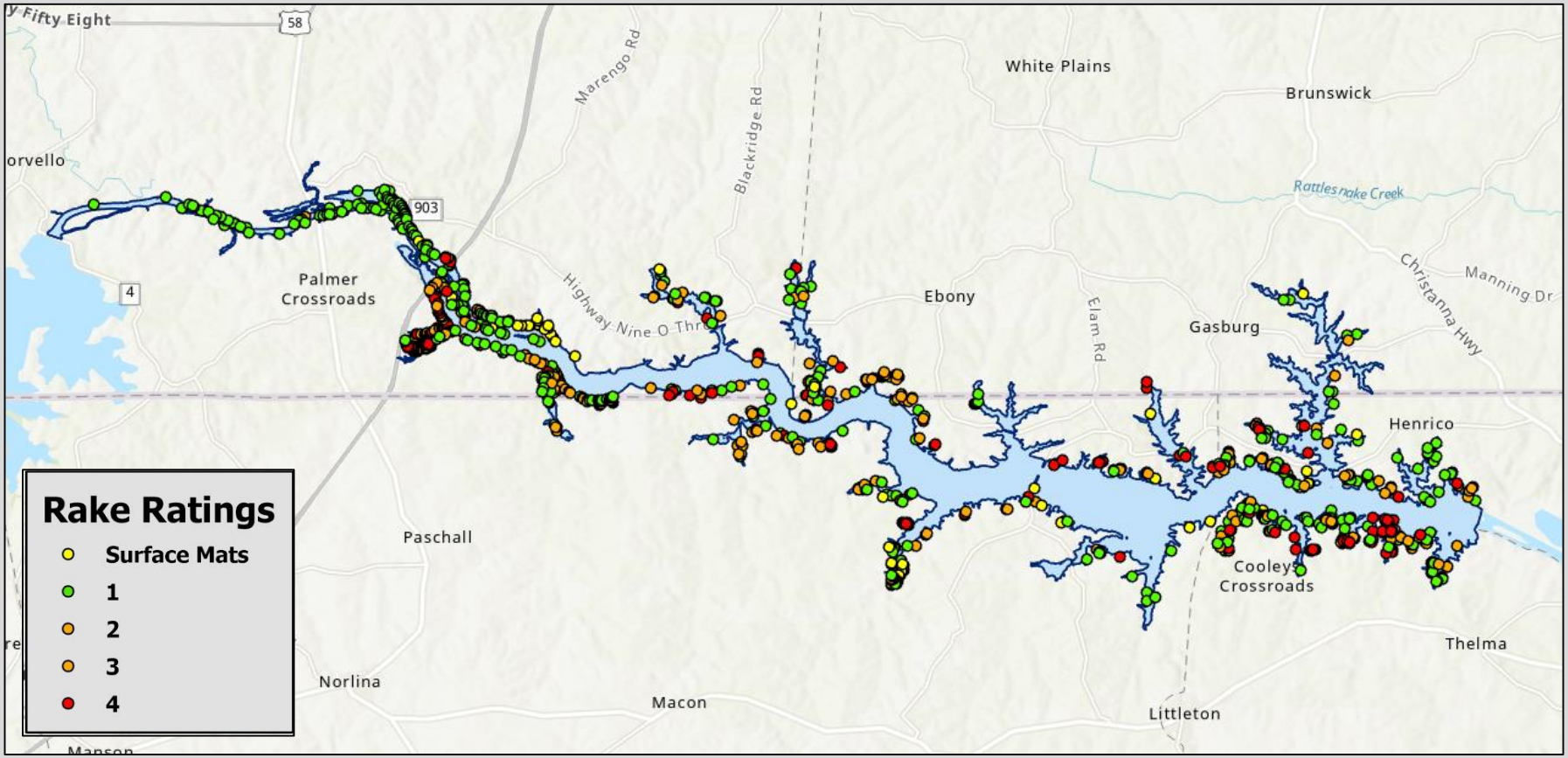


Environmental Factors - Lyngbya

Principle Components Analyses (PCA)

Lyngbya
- Distribution (frequency)
- Density (rankings index)

Native Vegetation
- Hydrilla
- Spatterdock
- White Water Lily
- Chara

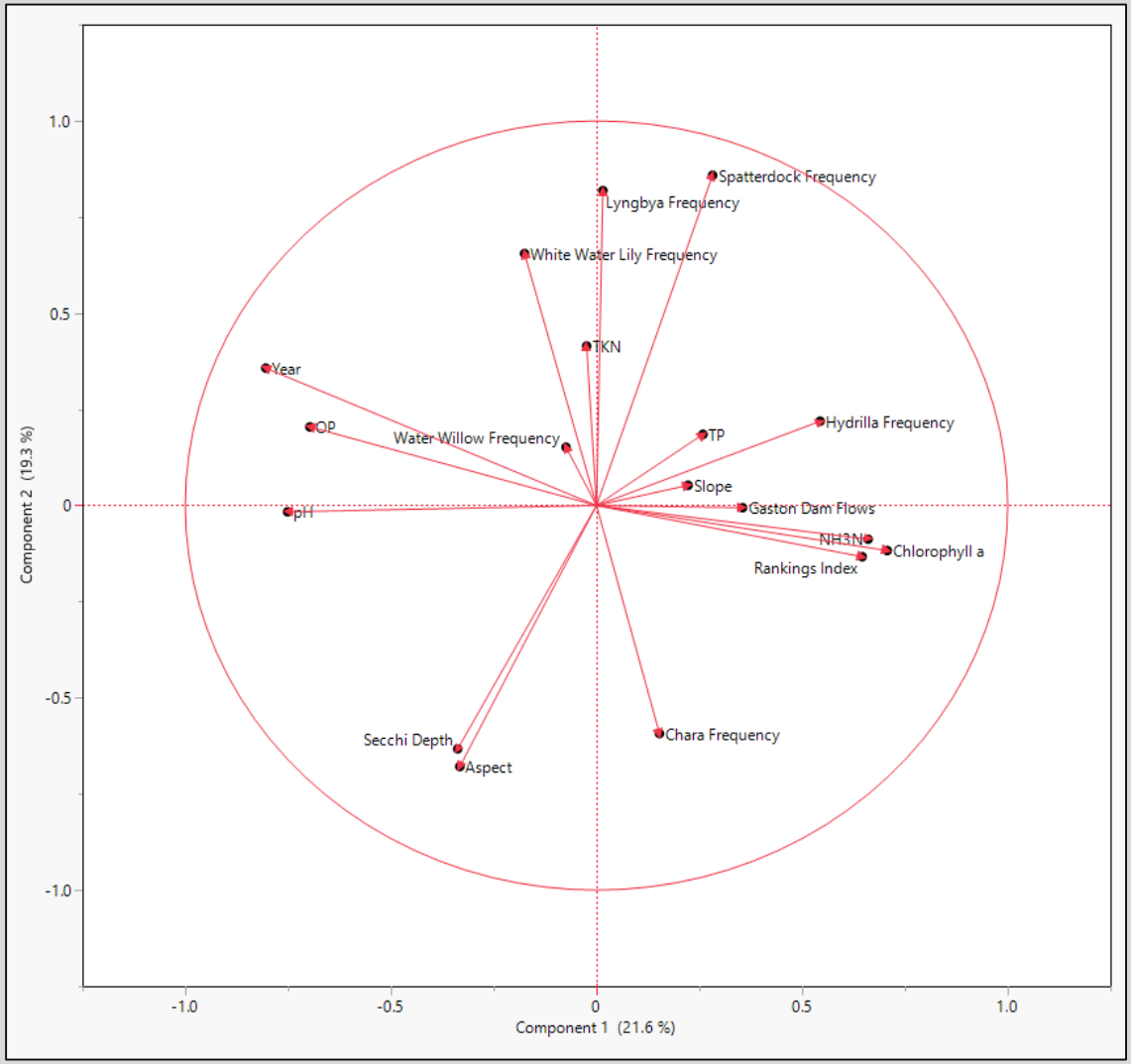
- Year

Benthic Characteristics
- Shoreline Slope
- Shoreline Direction

Water Quality
- Nitrogen
- Phosphorous
- Clarity
- Chlorophyll a
- Ammonia
- Flow

Environmental Factors - Lyngbya

Principle Components Analyses (PCA)



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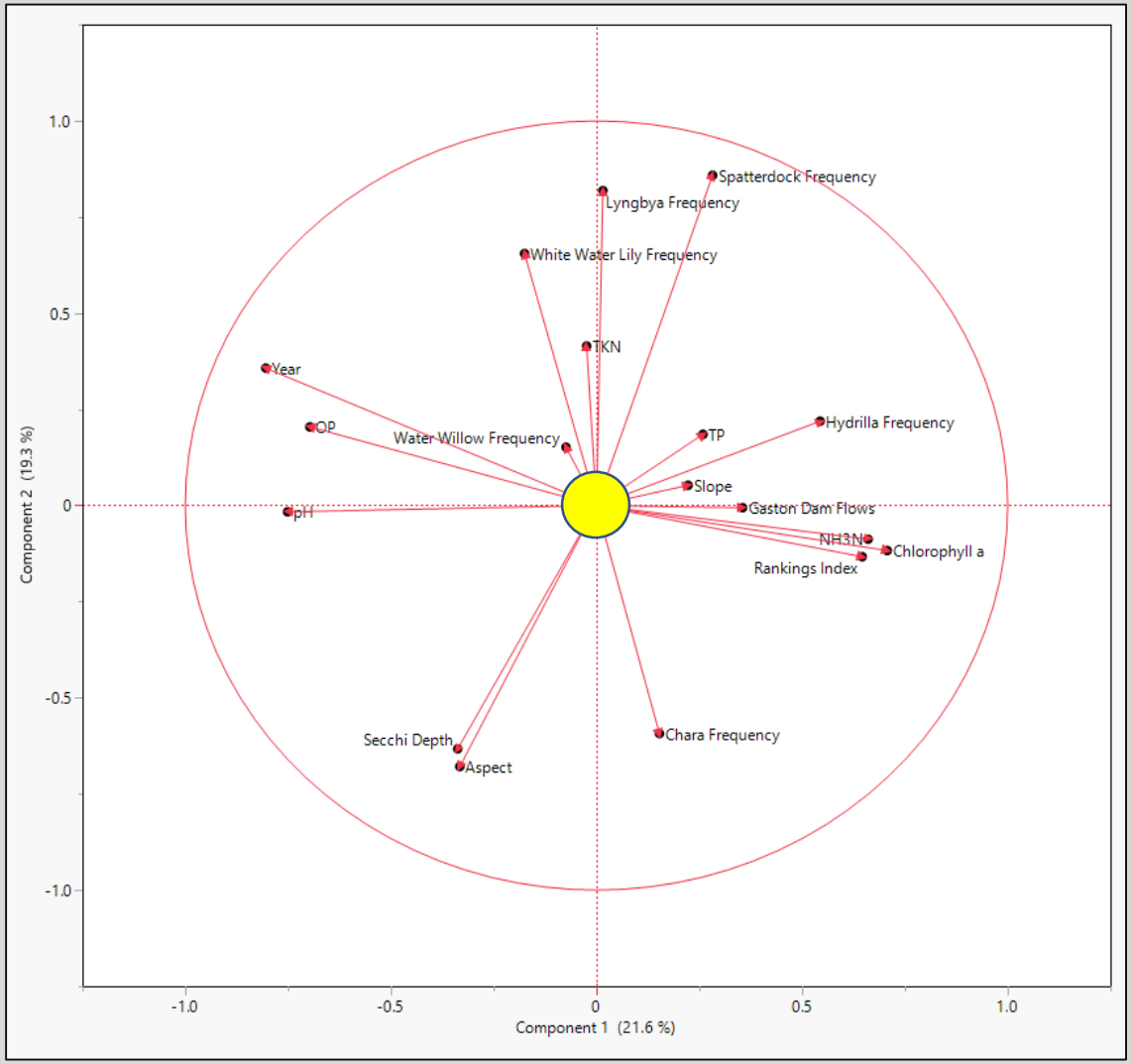

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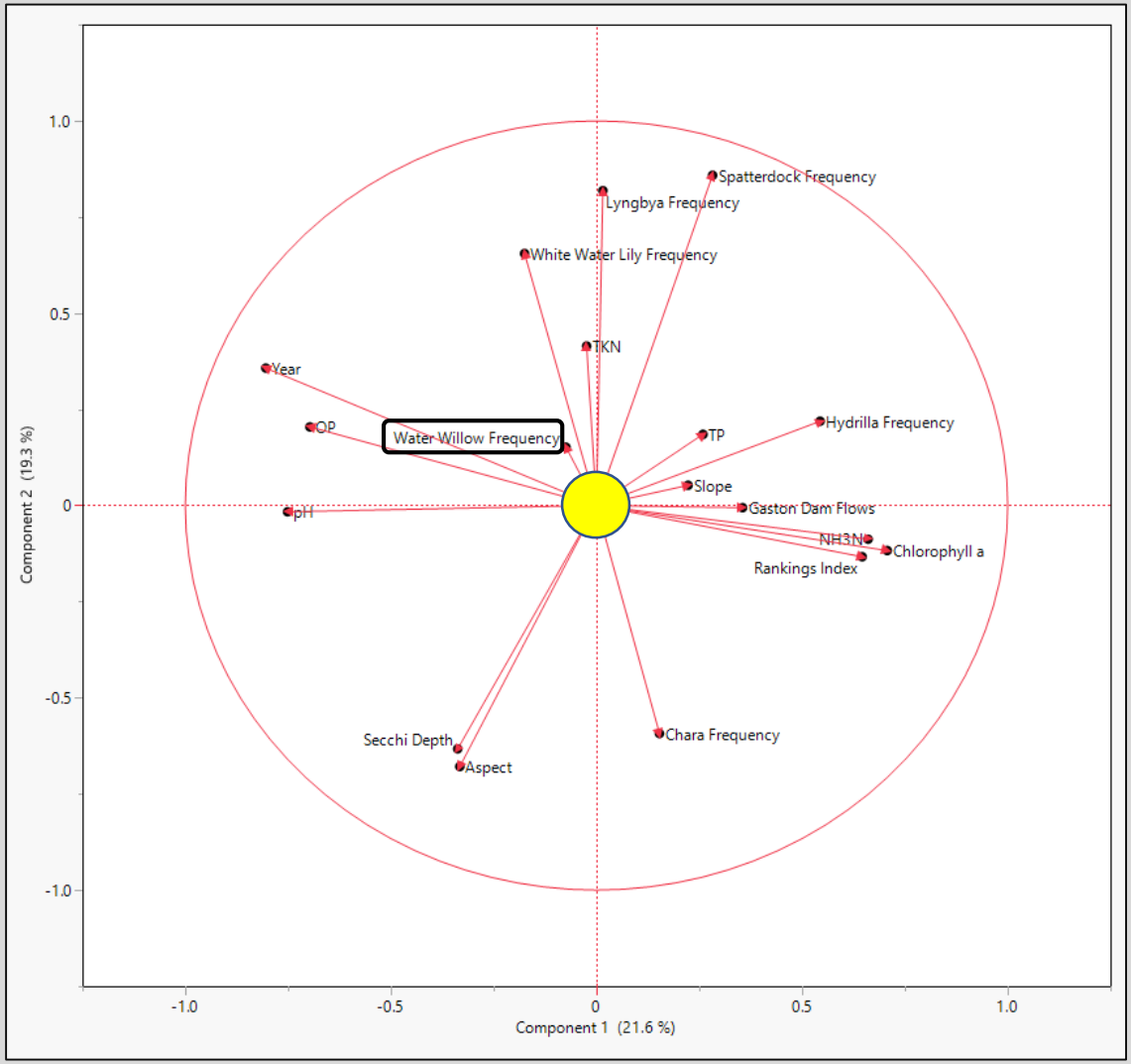

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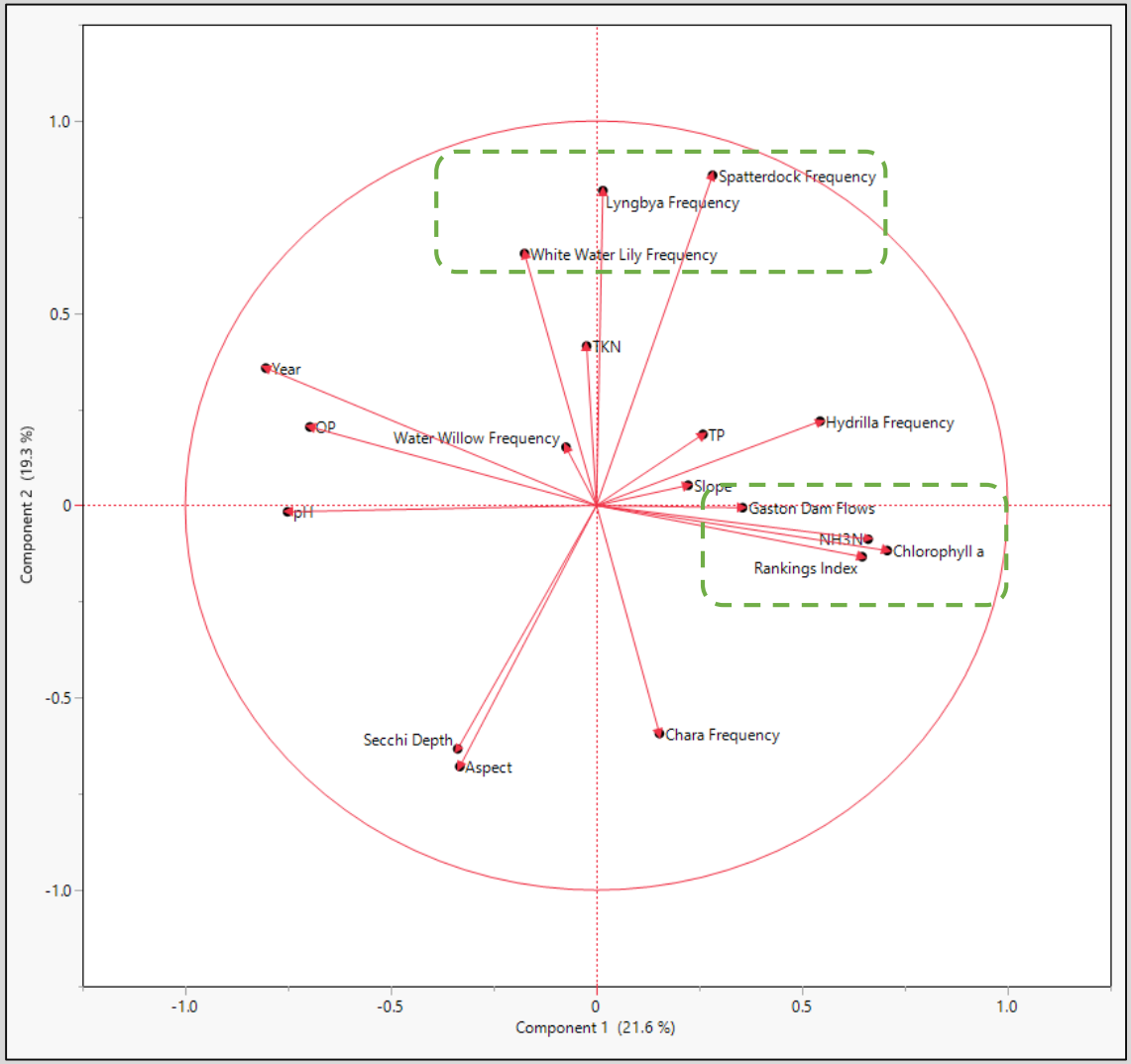

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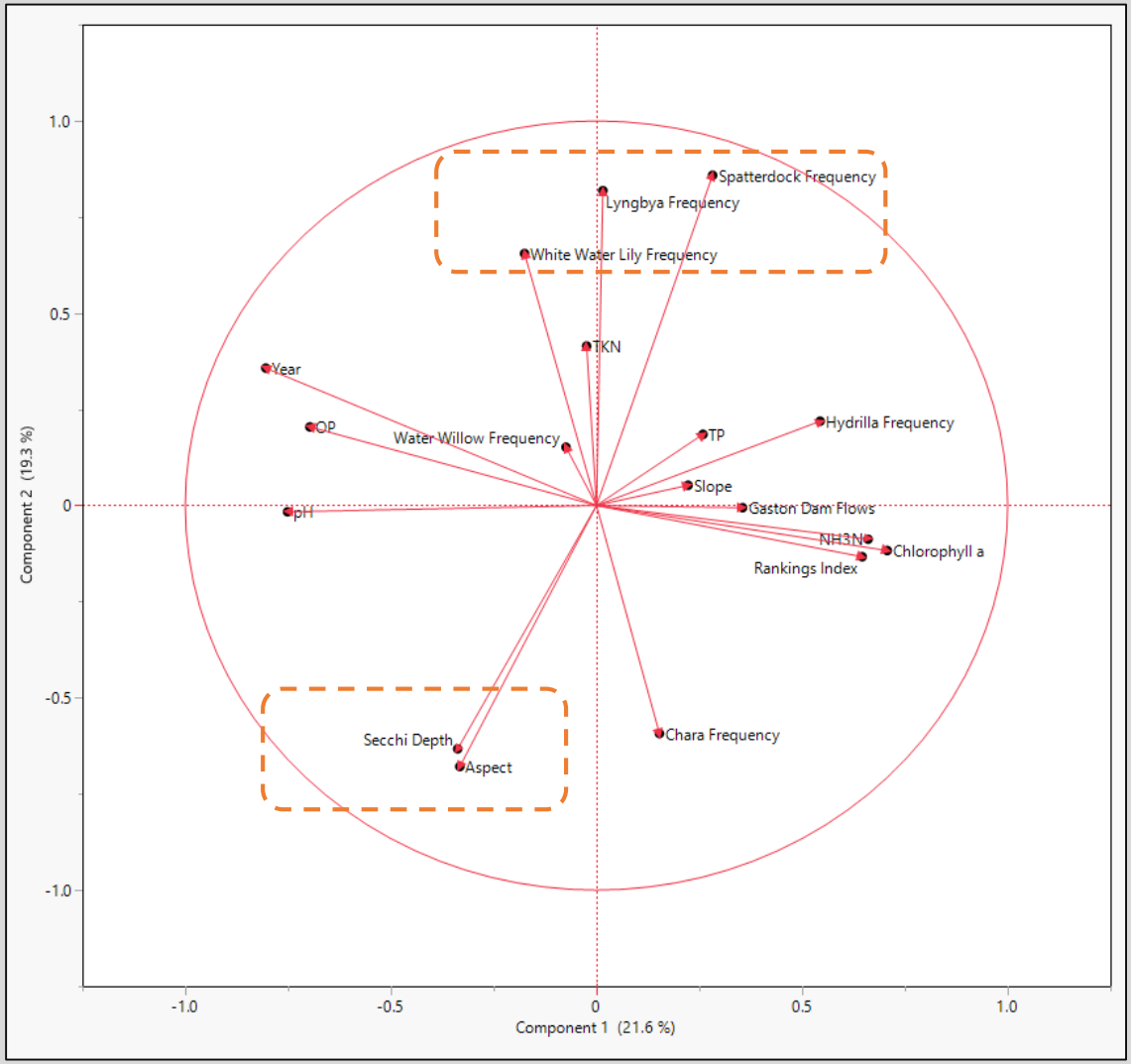

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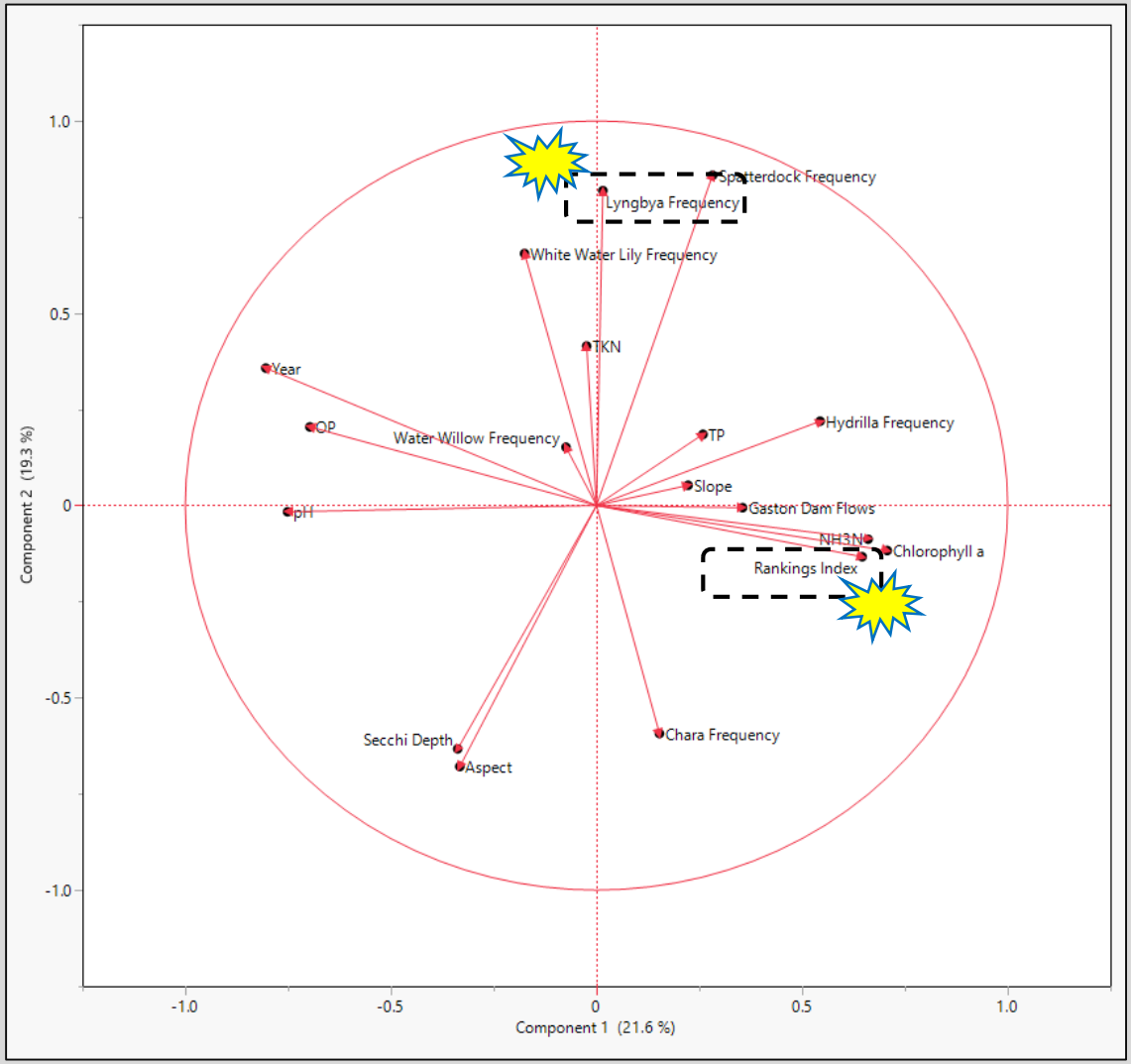

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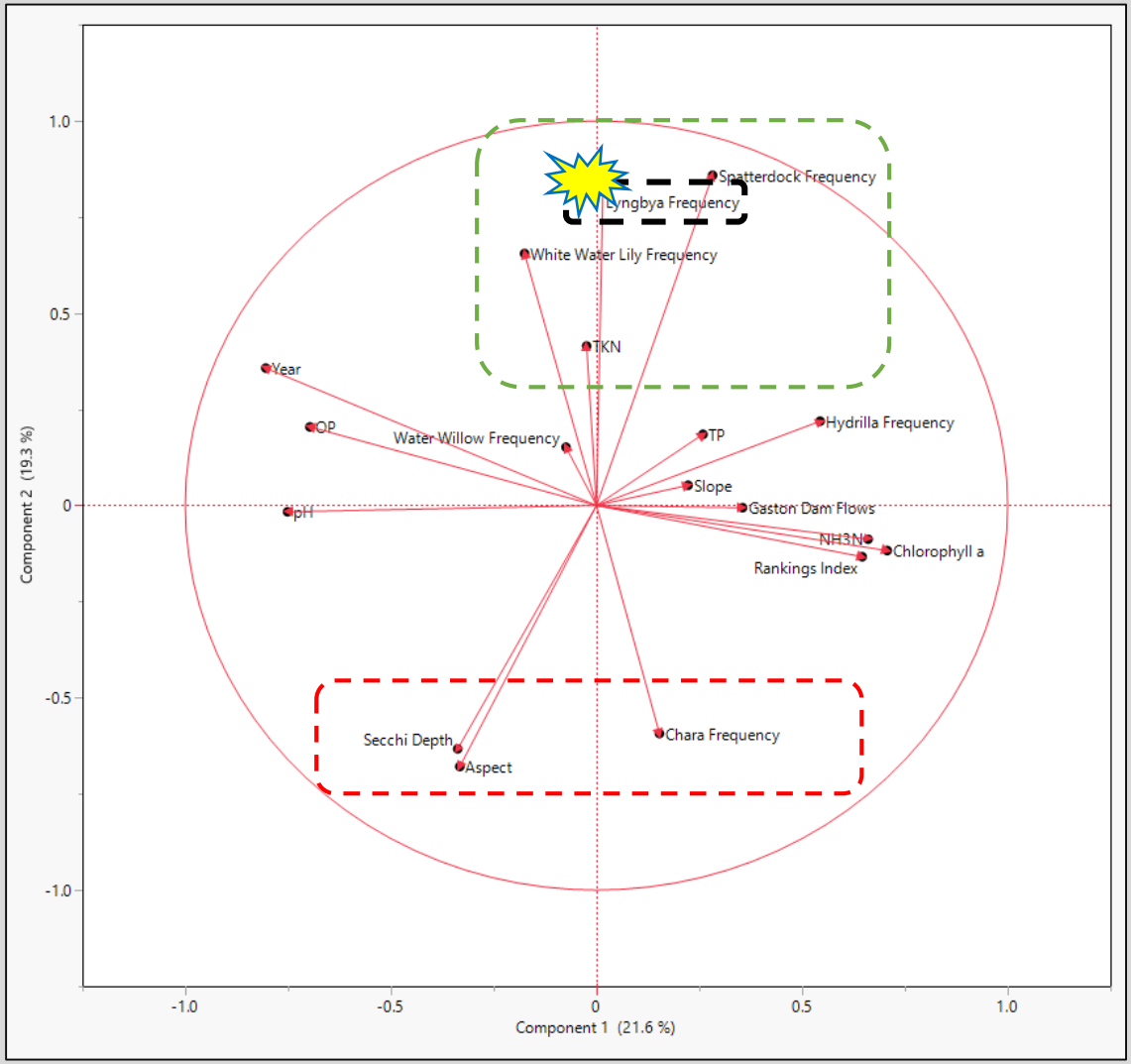

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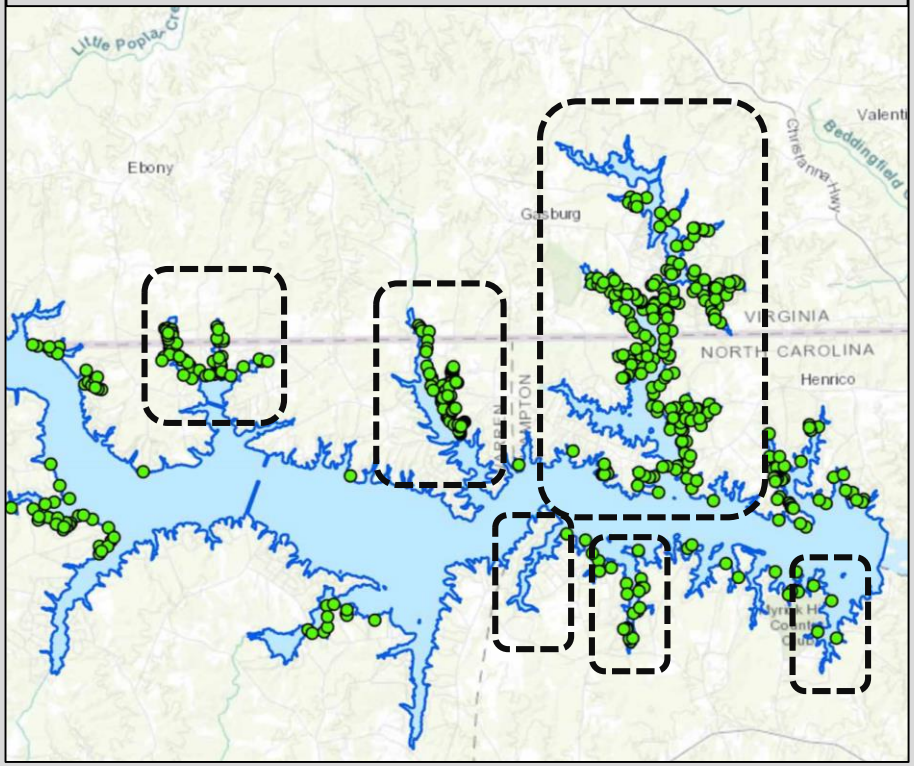
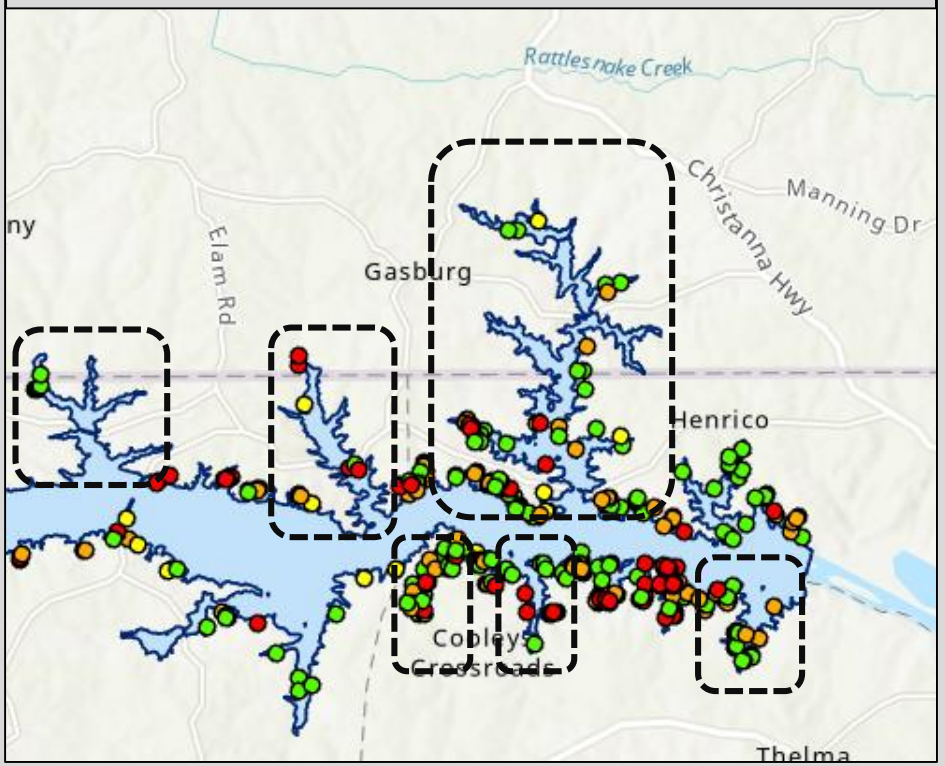
Environmental Factors - Lyngbya

Chara Distribution



Lyngbya Distribution



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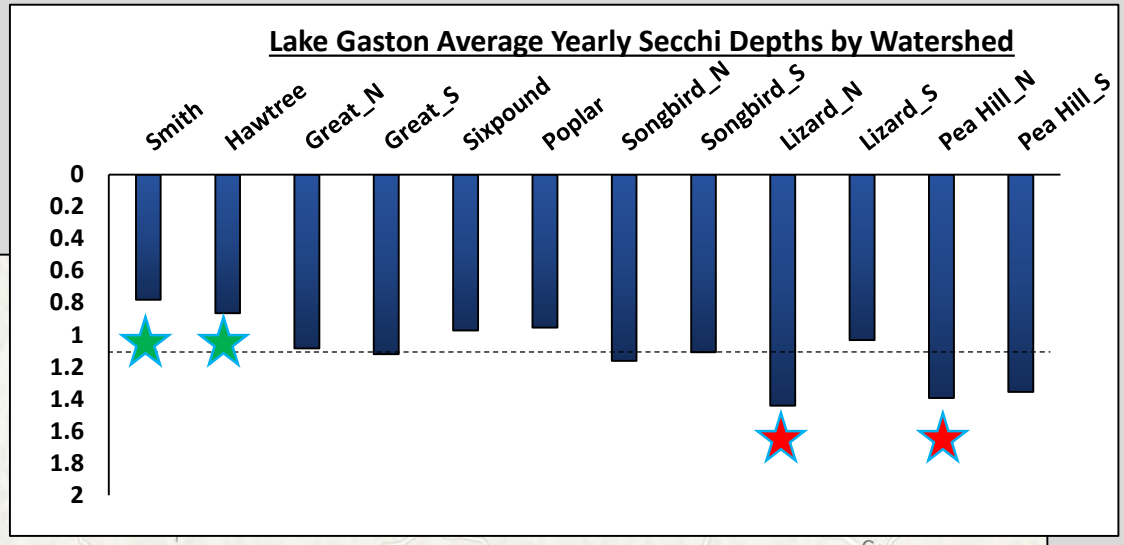
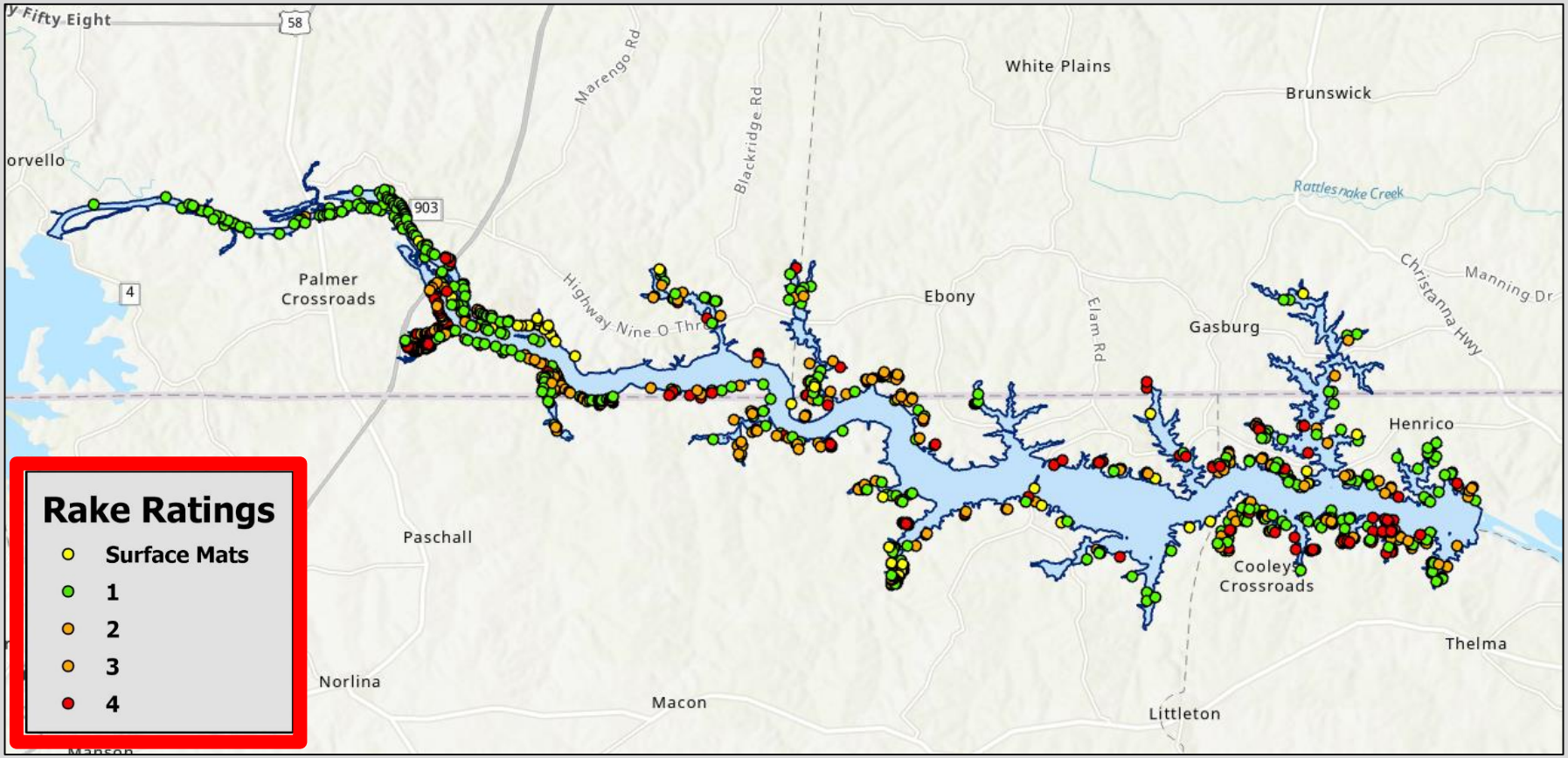
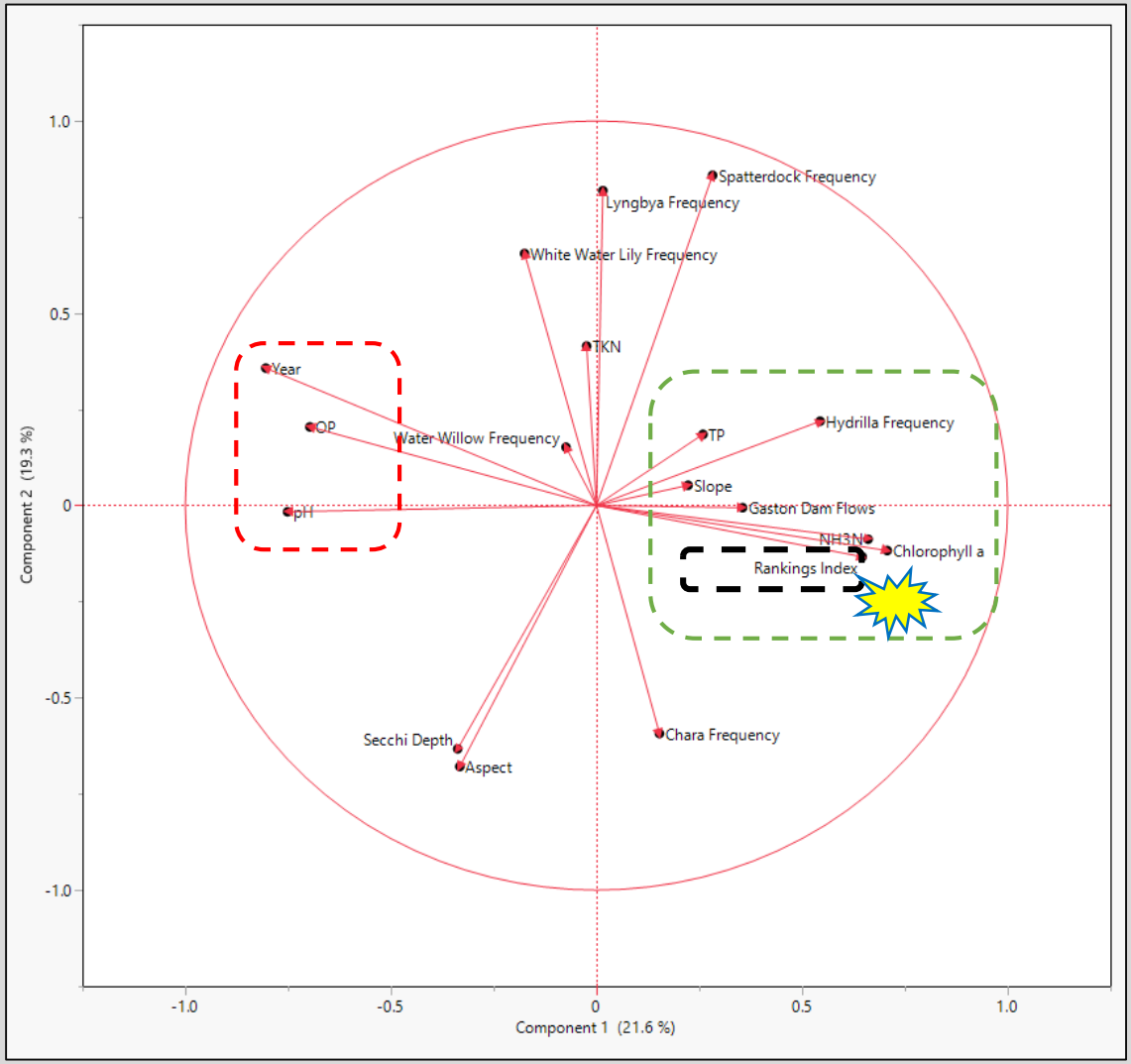


Environmental Factors - Lyngbya



Environmental Factors - Lyngbya

Principle Components Analyses (PCA)



Environmental Factors - Lyngbya

Principle Components Analyses (PCA)

Lyngbya
- Density (ranking index)

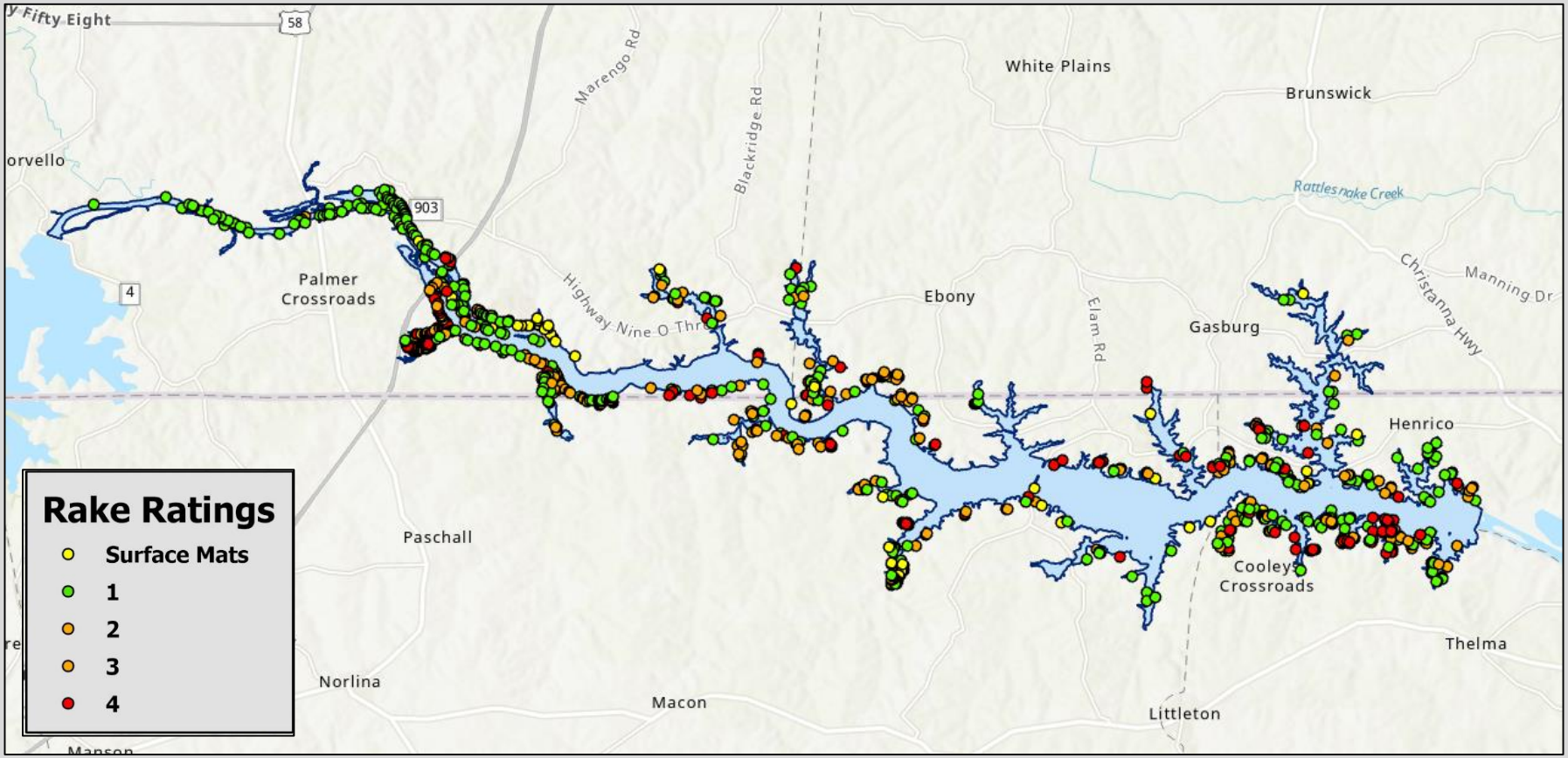
Native Vegetation
- Hydrilla
- Spatterdock
- White Water Lily
- Chara

- Year

Benthic Characteristics
- Shoreline Slope
- Shoreline Direction

Water Quality
- Nitrogen
- Phosphorous
- Clarity
- Chlorophyll a
- Ammonia
- Flow

2021 Survey Results - Lyngbya



Outline

Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

Lyngbya Management

- Environmental Factors Influencing Lyngbya Growth

- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

Environmental Impacts

Chelated Copper Algaecides

- Known toxicity to aquatic organisms
- Mode of toxicity: Impairs respiration function
- Application methods create an egress for mobile species to escape treated areas
- Mussels are confined to impacted sediment

Compounding Effects

- Naturally encountered environmental stressor
  - Increased temperature
  - Increased ammonia

Environmental Impacts

Tidewater Mucket

- Native to Roanoke River Drainage
- Impaired due to rising sea levels impacts on coastal populations
- Gaston Reservoir provides a unique refugee
  - Gaston population used in study to test how coastal populations will respond to negative impacts
  - Virginia Department of Wildlife Resources uses Gaston population as brood stock for propagation efforts
- Unusual to have highly sensitive species in reservoir
- Not much known on Gaston population
  - Abundance or Distribution Data

Environmental Impacts

aqua services, inc.

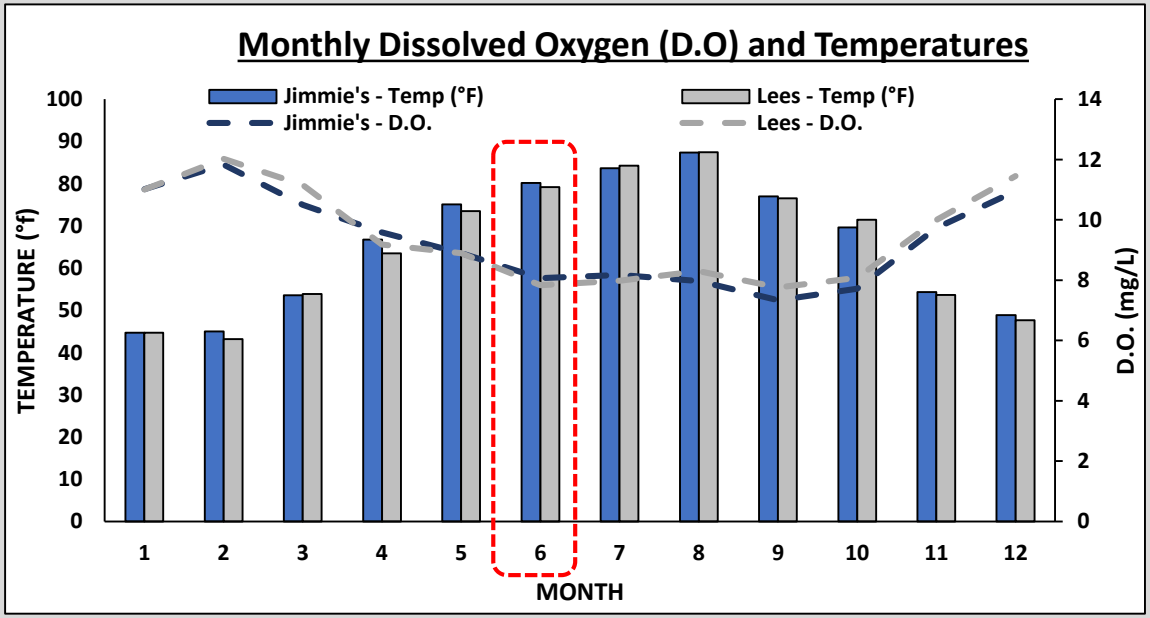
Lyngbya Treatment Application Method

- Airboats
- New patented application system
  - Targets the mats along the bottom

Environmental Impacts

Mussel Mortality Event – June 2021

- June Treatment Factors
  - Same protocol as April / May treatments
  - Followed week of 90 degree temperatures
  - Kerr dam releasing hypo limnetic water (<4.0 mg/L)



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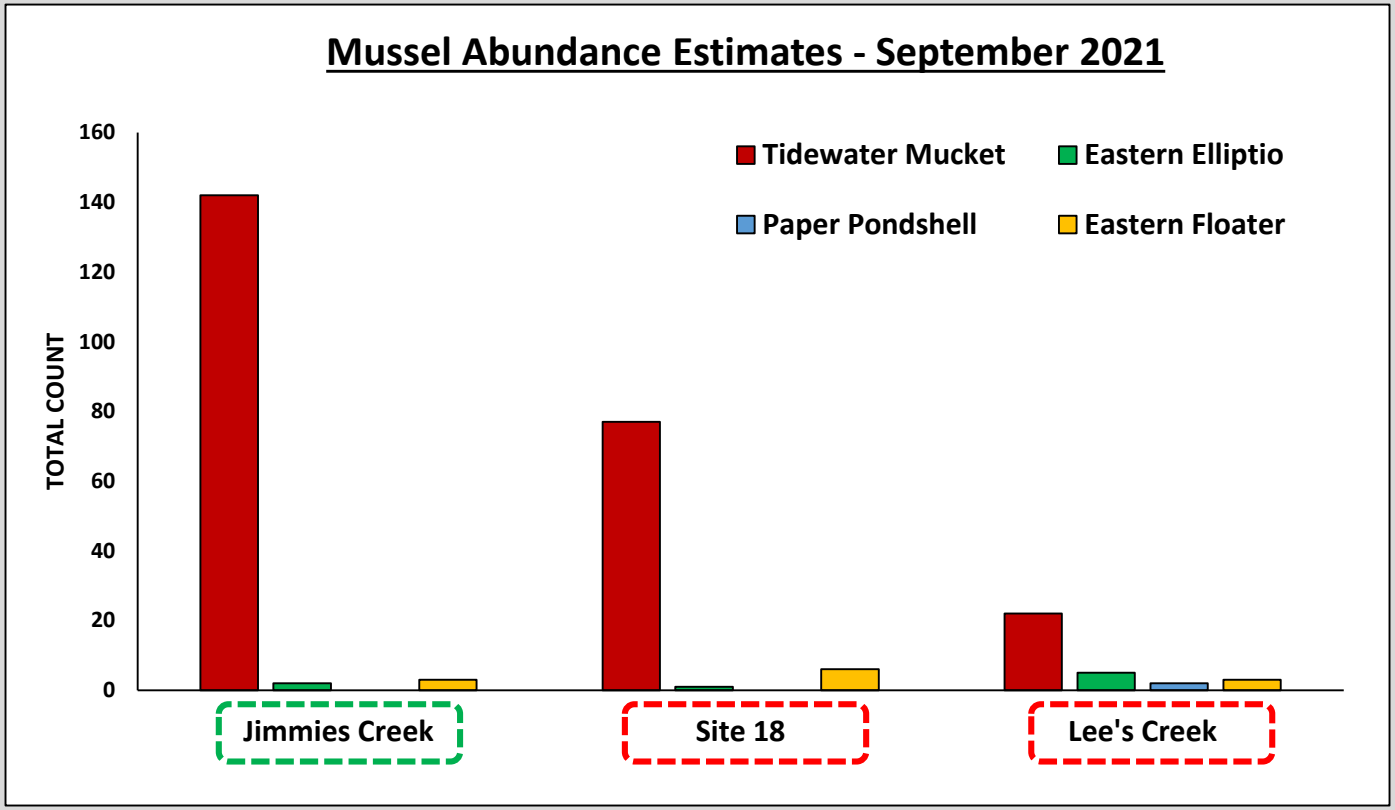
  - **Mussel beds were located in sandy, shallow habitat**
  - **Lyngbya mats were located in deeper water**
  - **Algaecide will not be applied in water < 4 feet to avoid mussel habitat**

- **Follow-up survey – September 2021**
  - **Snorkeling and Scuba**

Environmental Impacts

September 2021 Follow-up Survey

- NCSU and NCWRC
- Surveyed two impacted sites and one reference site



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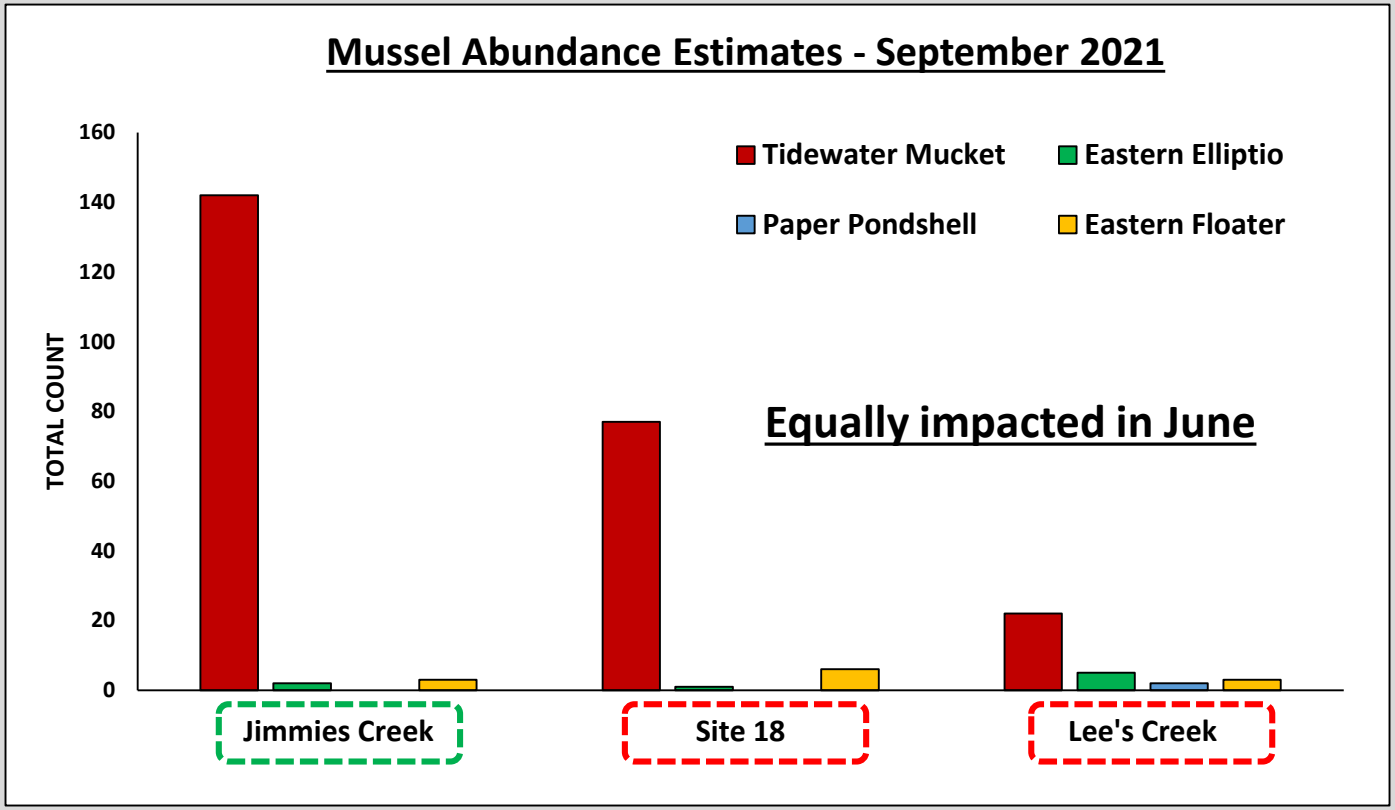

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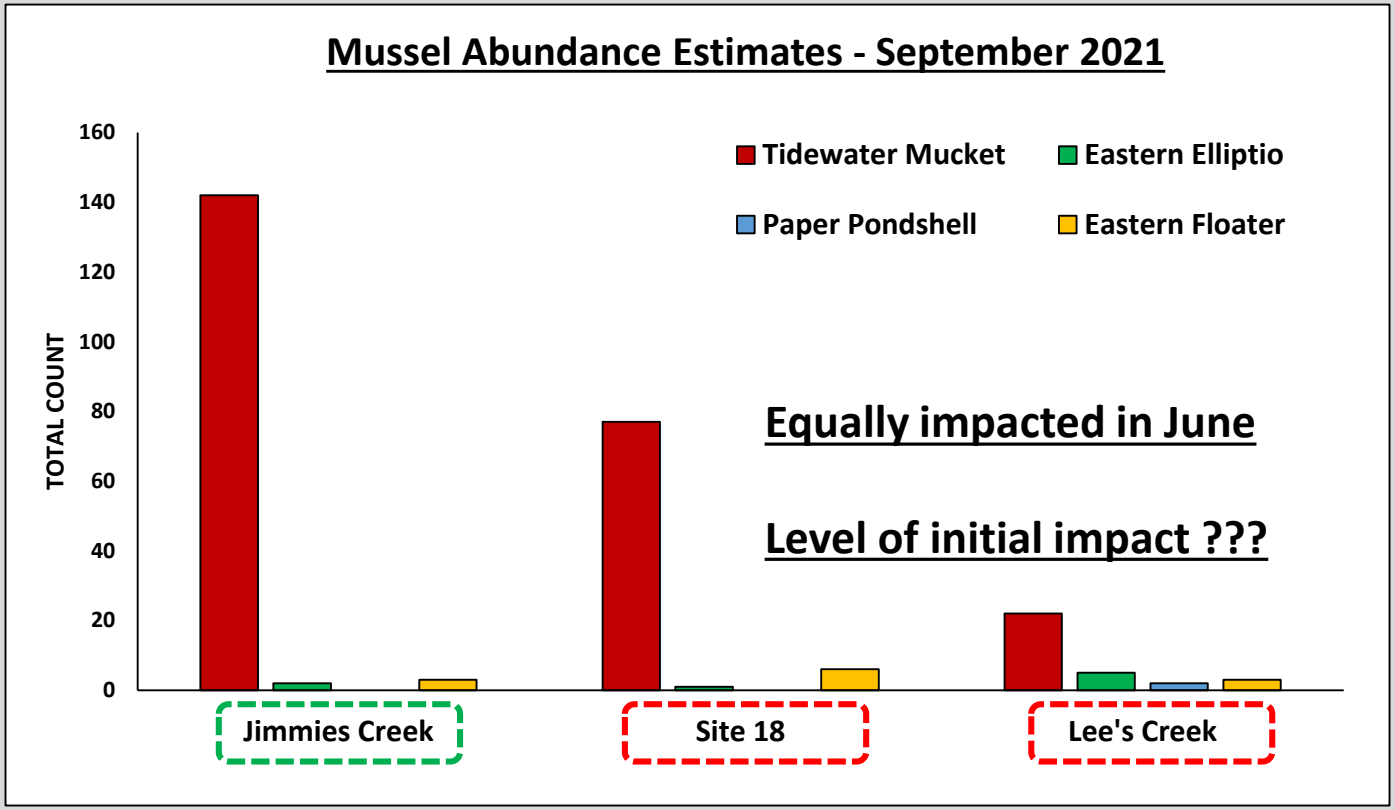

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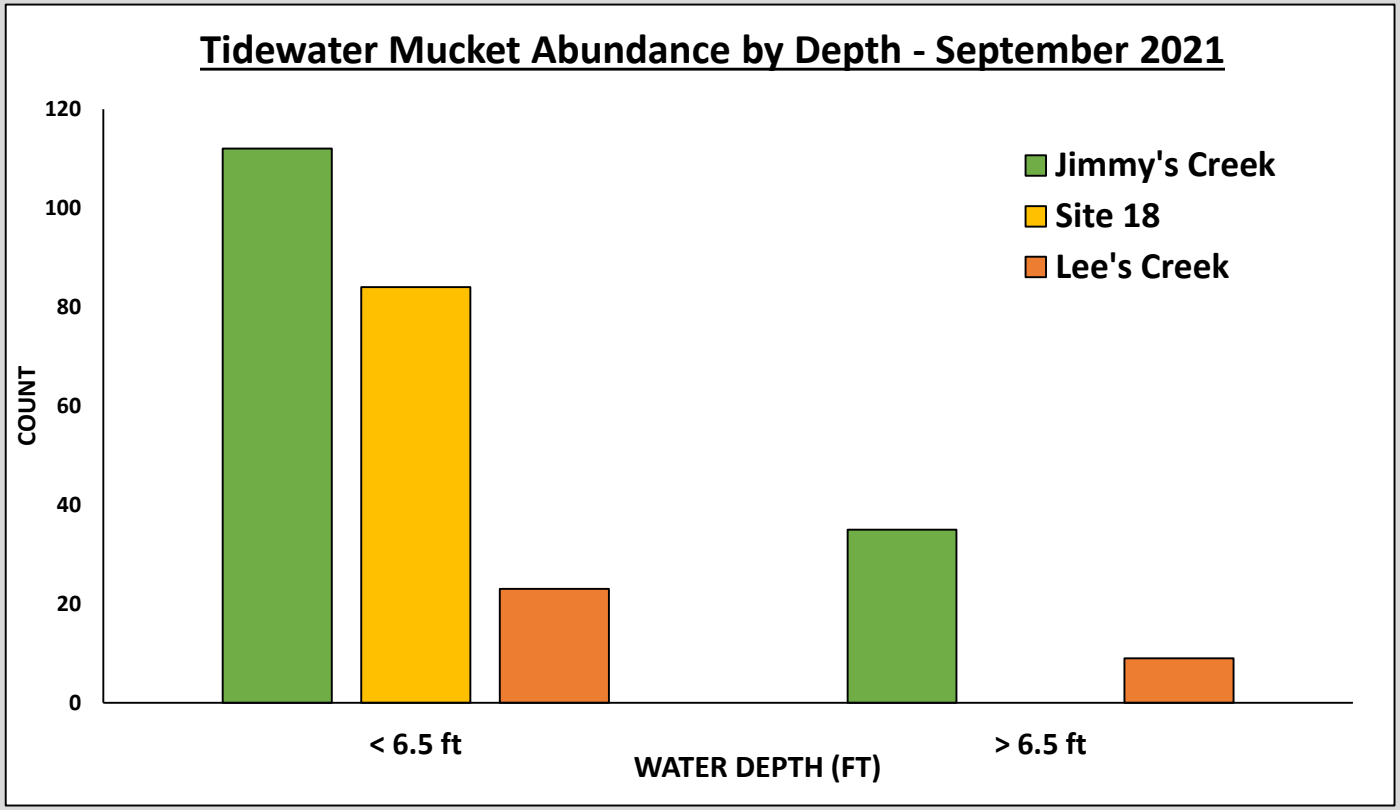

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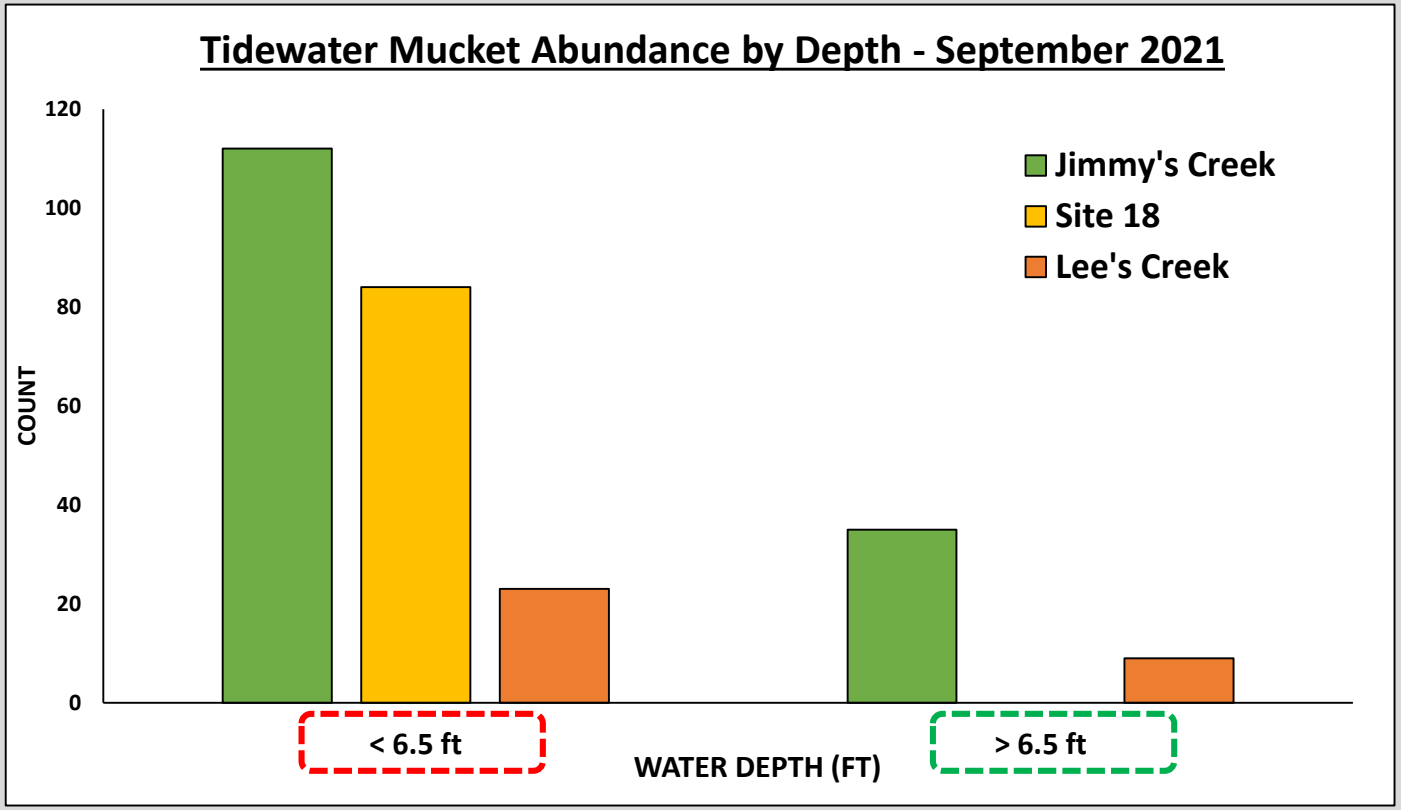

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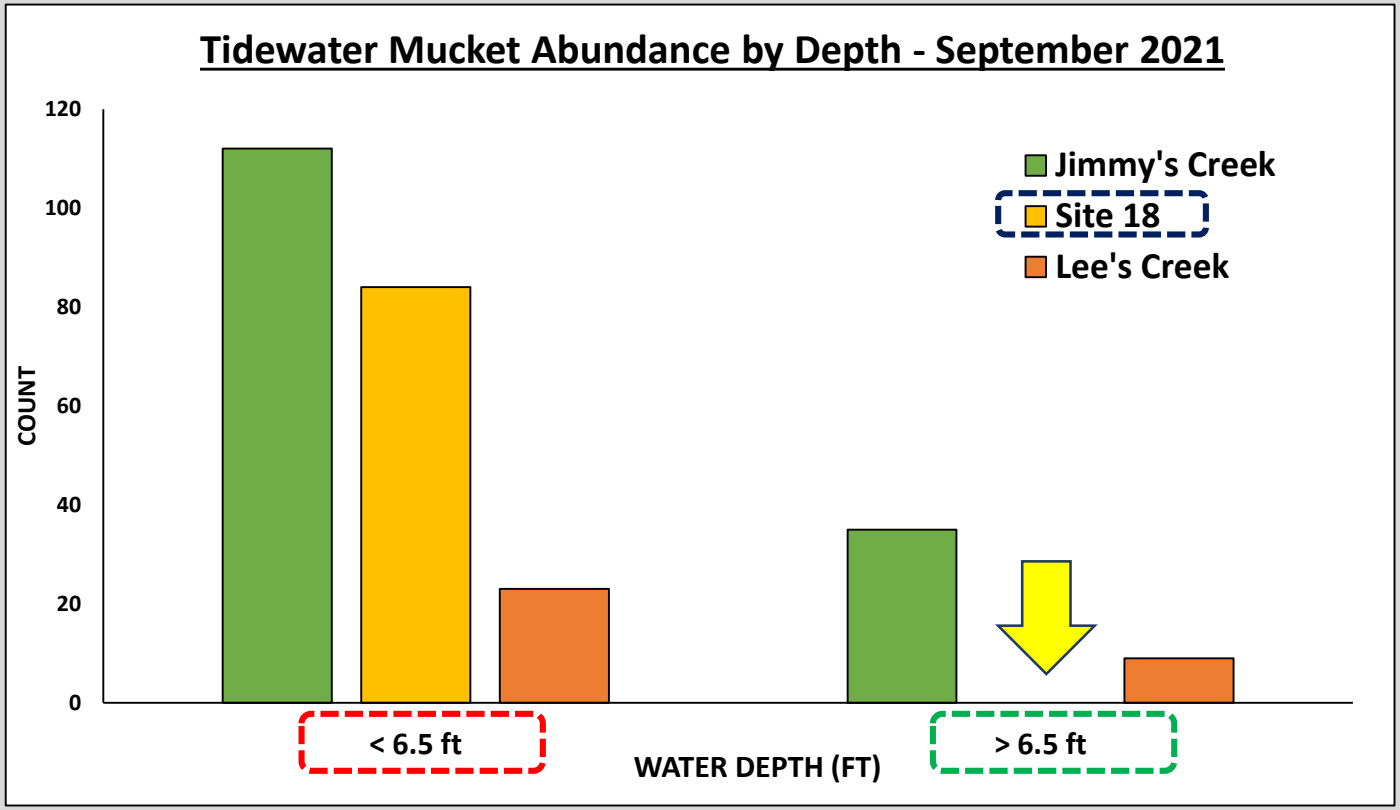

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- **No Additional Reported Tidewater Mucket Mussel Mortality Reported!**

Environmental Impacts

Future Treatment Protocols

- Current protocol allows for unregulated growth of lyngbya benthic mats that are found in shallow water and in the backs of coves, potentially decreasing the overall efficacy of the treatments.

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- **The impacts of freshwater mussels co-occurring with a benthic mat forming and potentially toxin producing cyanobacteria is unknown.**

Current protocol is protective, but not solution

Environmental Impacts

Proposed Research – Tidewater Muckets

Objective

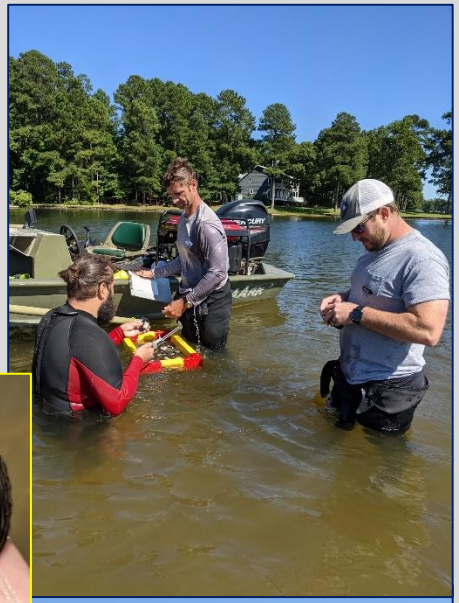
- To increase the understanding of Tidewater Mucket distribution, abundance, and habitat preference in Lake Gaston
- Use that knowledge to develop a more effective lyngbya treatment protocol that will minimize negative impacts to native mussel species while increasing the efficacy of the treatment design.

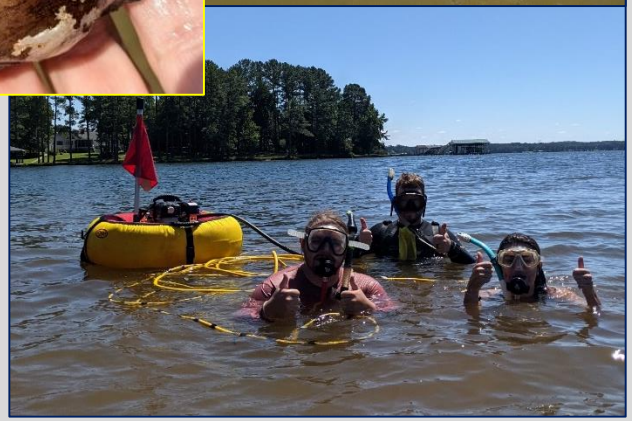
Environmental Impacts

Proposed Research – Tidewater Muckets

Challenges

- Extensive Shoreline (350 miles)
- Survey Logistics
  - Snorkel / Scuba
  - Hand grubbing
  - Time Consuming!
- Treatment Areas = Lyngbya Infestations



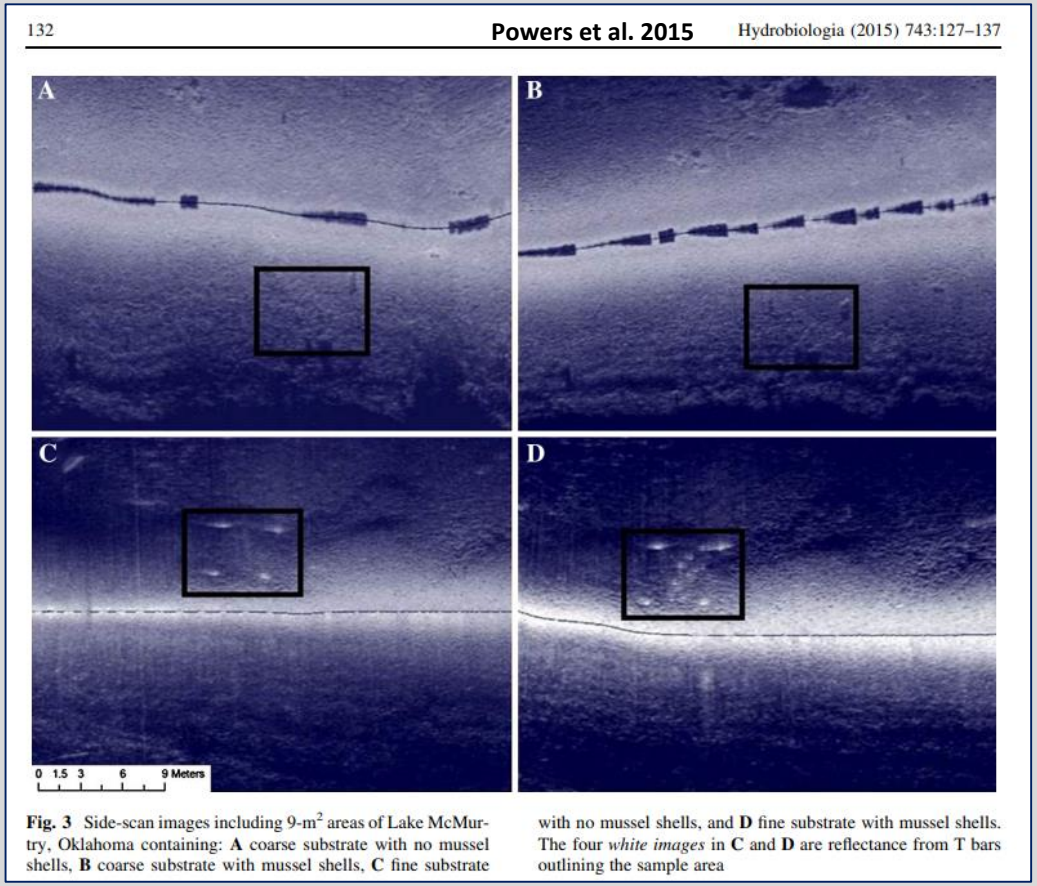


Environmental Impacts

Proposed Research – Tidewater Muckets

Powers et al. 2015

- Utilized side-scan sonar to map mussel beds in Oklahoma
  - Riverine
  - Reservoir
- Successful in locating previously unknown mussel beds located in sandy / clay substrates



Environmental Impacts

Proposed Research – Tidewater Muckets

1) **Determine if side-scan sonar can be utilized for locating freshwater mussel beds in Lake Gaston.**

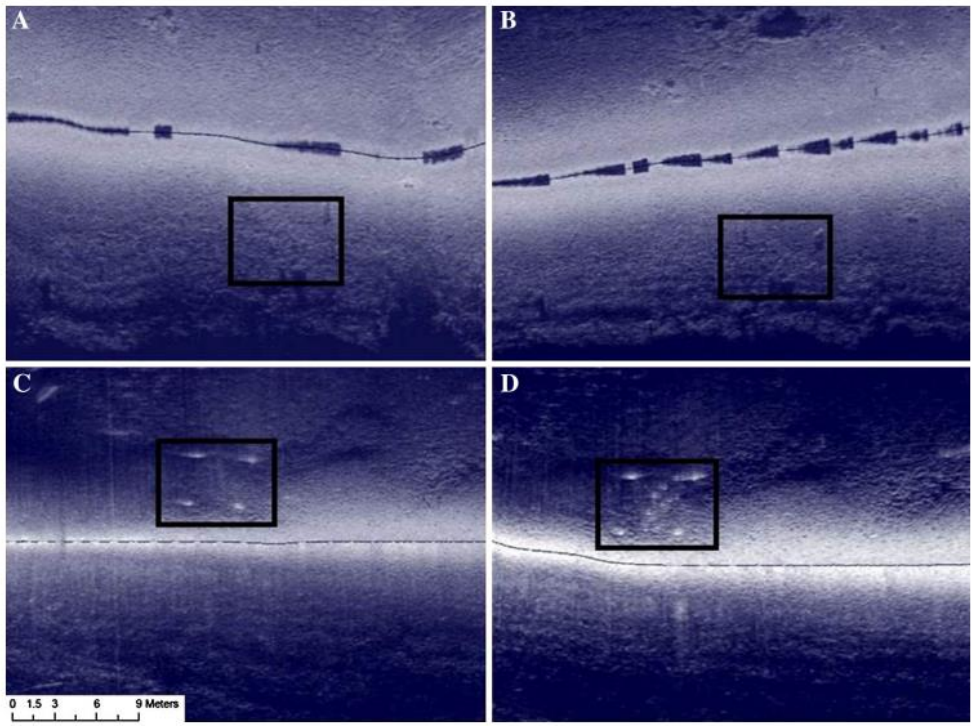


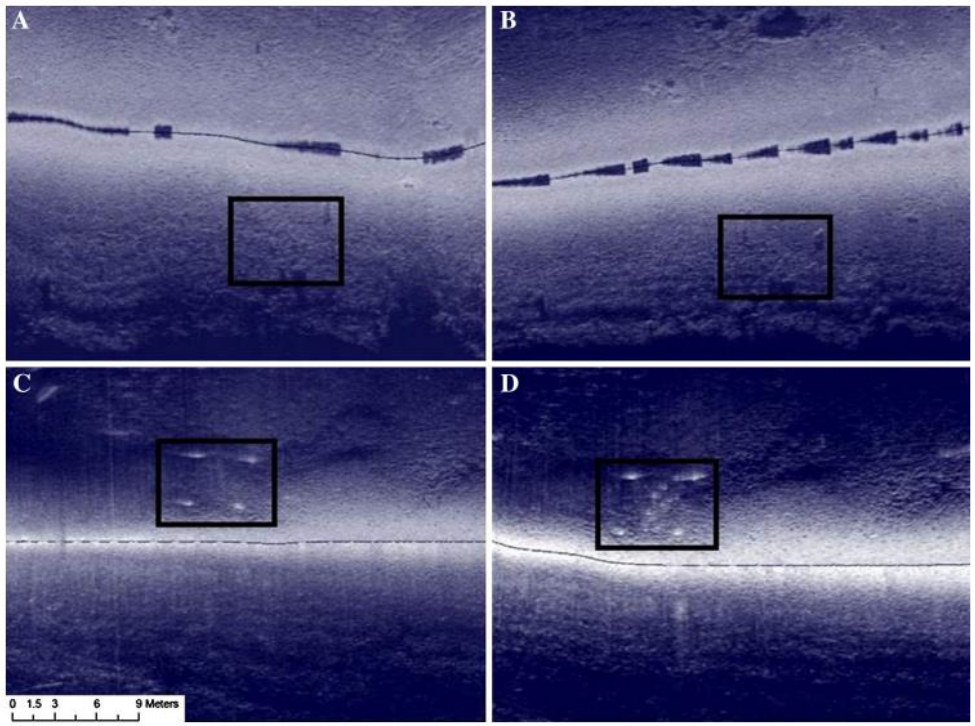
Fig. 3 Side-scan images including 9-m^2 areas of Lake McMurtry, Oklahoma containing: **A** coarse substrate with no mussel shells, **B** coarse substrate with mussel shells, **C** fine substrate with no mussel shells, and **D** fine substrate with mussel shells. The four *white images* in **C** and **D** are reflectance from T bars outlining the sample area

Environmental Impacts

Proposed Research – Tidewater Muckets

1) Determine if side-scan sonar can be utilized for locating freshwater mussel beds in Lake Gaston.

2) Determine if mussel beds can be properly identified and mapped within lyngbya treatment zones.



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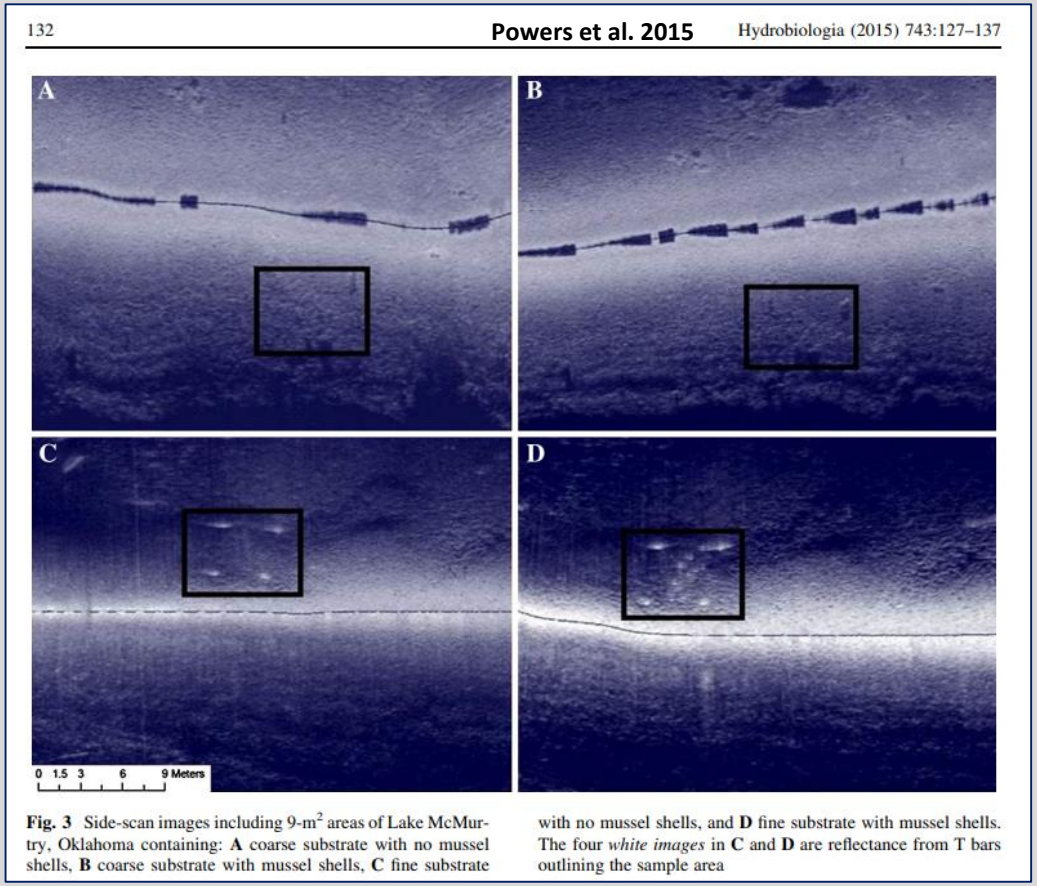
Proposed Research – Tidewater Muckets

1) Determine if side-scan sonar can be utilized for locating freshwater mussel beds in Lake Gaston.

2) Determine if mussel beds can be properly identified and mapped within lyngbya treatment zones.

3) Use distribution data to modify lyngbya treatment protocols to maximum the efficacy of treatments while ensuring minimal contact with mussel beds!



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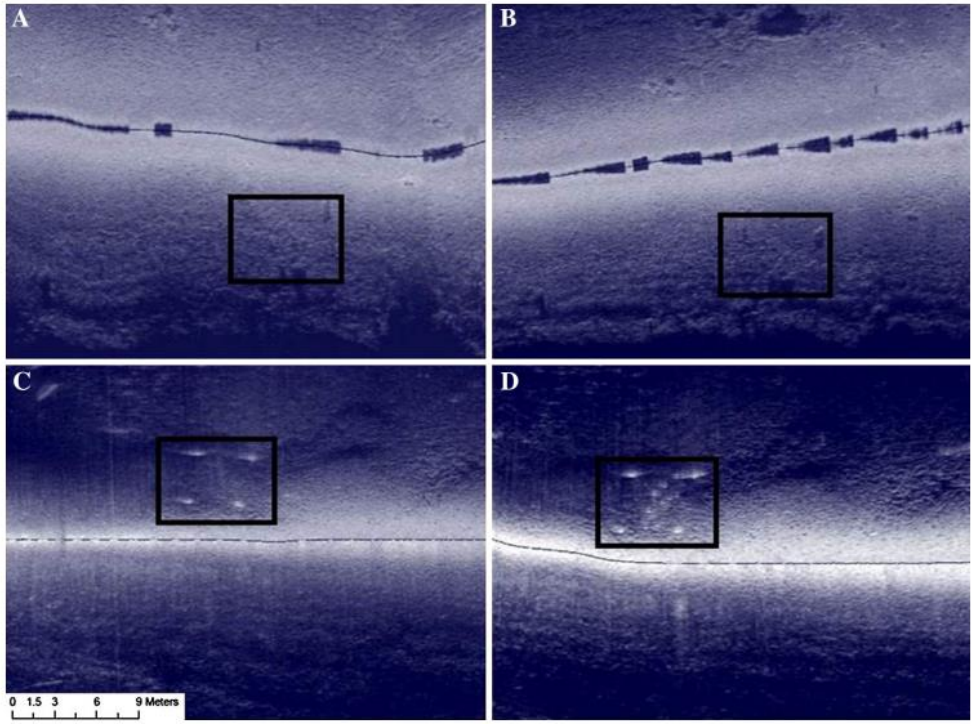
Environmental Impacts

Proposed Research – Tidewater Muckets

4) **Expand use of technology and determine overall distribution patterns and habitat preferences of Tidewater Mucket populations within Lake Gaston.**

Future treatments:

- **ID areas of lyngbya encroachment to Tidewater Mucket beds**
- **ID areas for exclusion due to extensive mussel beds.**



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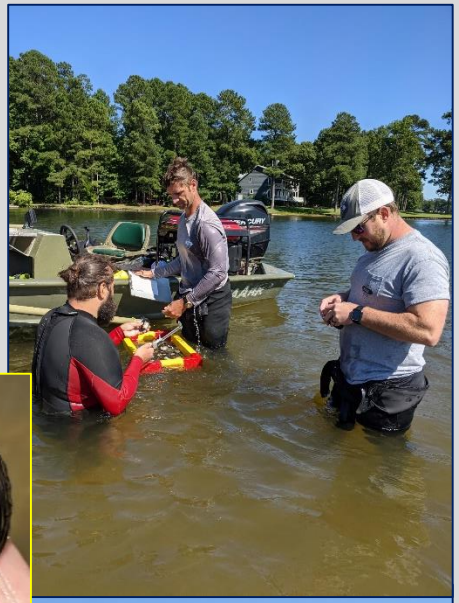
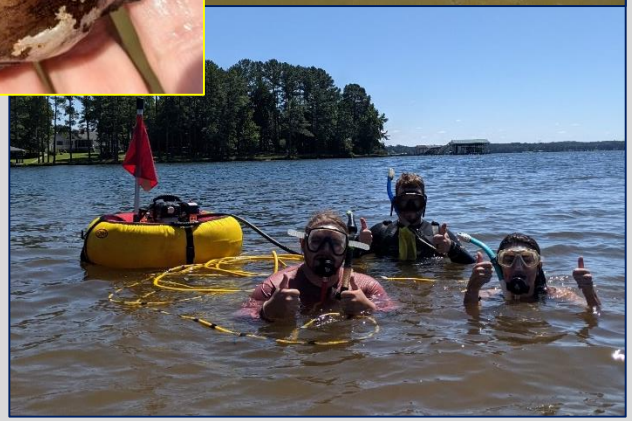
Environmental Impacts

Proposed Research – Tidewater Muckets

5) Collaborate with the North Carolina Wildlife Resources Commission (NCWRC) to expand the scope of this research to include data on overall abundance estimates.





Outline

Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

Lyngbya Management

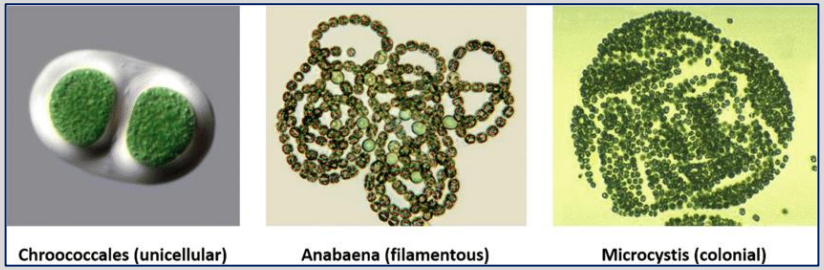
- Environmental Factors Influencing Lyngbya Growth

- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

Human Health Impacts

Cyanobacteria Toxin Production

- Multiple types impacting skin, liver, and nervous system
- EPA drinking and shellfish production restriction criteria
- Governmental HAB response focus on planktonic forms of cyanobacteria due to their high toxicity potential
- Even if toxin-producing cyanobacteria are present within a system, it does not mean they are producing toxins.
  - Environmental and physiological factors that drive toxin production are still not well understood



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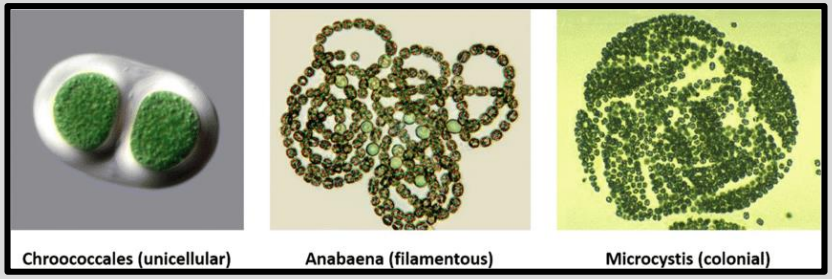

Human Health Impacts

Lyngbya Toxin Production

- Earliest studies from 1990's – Guntersville Reservoir, AL
  - Paralytic Shellfish Poison (PSP) neurotoxins
- Recent studies detected an analogue to the PSP neurotoxin, saxitoxin (neurotoxin)
  - St. Lawrence River, Canada
  - Butterfield Lake, NY
  - Lake Wateree, SC
- The saxitoxin derivatives associated with lyngbya is less potent than other PSP-producing cyanobacteria
  - Direct contact presents a relatively low risk to humans and animals

Human Health Impacts

Lyngbya Toxin Production

Concerns

- Chronic exposure through drinking water and long-term public health
- Changing environmental factors related to climate change could impact lyngbya toxin production
- Compounding effects of multiple lyngbya toxins release simultaneously.
  - Toxin standards for lyngbya toxins unavailable.

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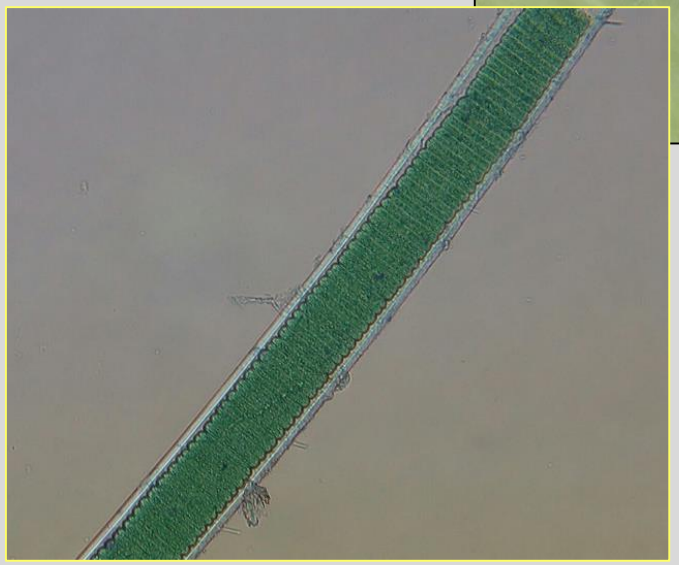
- Chronic exposure through drinking water and long-term public health
- Changing environmental factors related to climate change could impact lyngbya toxin production
- Compounding effects of multiple lyngbya toxins release simultaneously.
  - Toxin standards for lyngbya toxins unavailable.
- Is lyngbya in Lake Gaston producing toxins??

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

- Old Dominion University's (ODU) Phytoplankton Analysis Laboratory
- Pilot study so scope was small
- NCSU designed, deployed, and collected the SPATTS, and provided the needed ELISA kits
- ODU extracted and provided analysis of the cyanotoxin concentrations

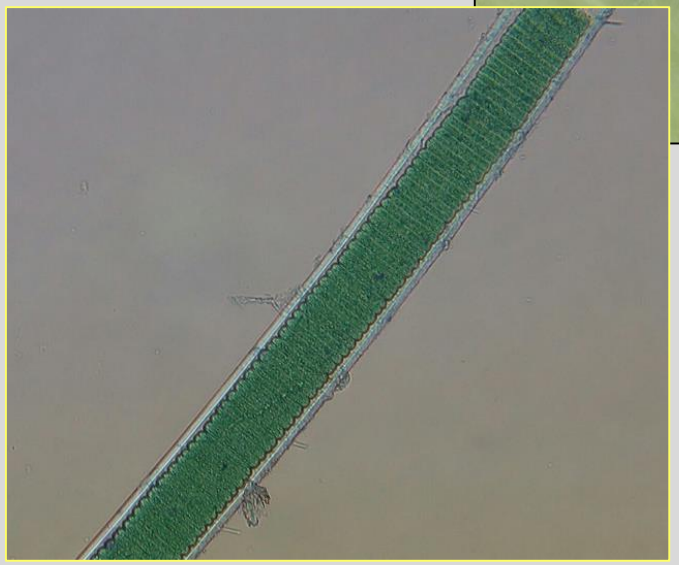


Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

- April 2021
  - Collection of mat material
  - Run for toxins
    - Saxitoxin-a
    - Cylindrospermopsin
  - Positive detections for both



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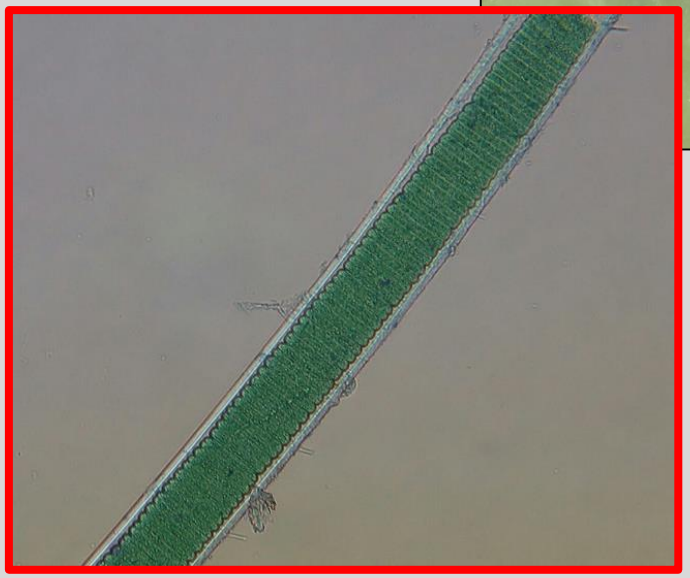
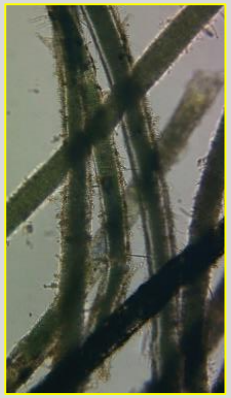
    - Mat material is ground up
    - Intercellular toxins





Human Health Impacts

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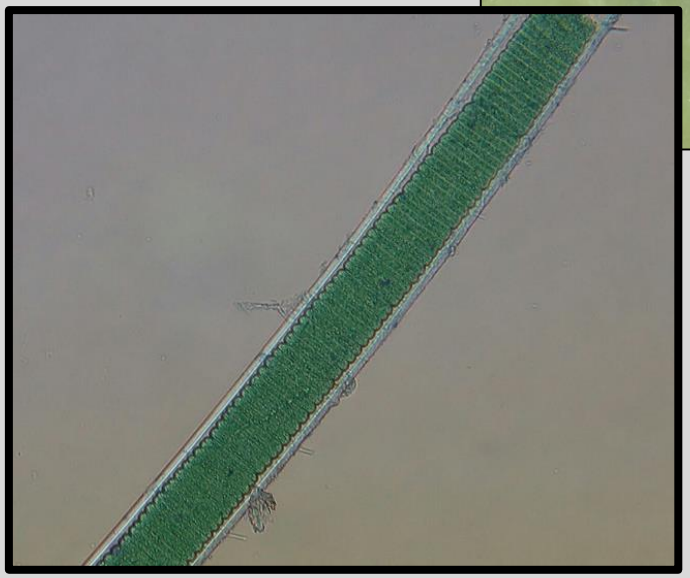
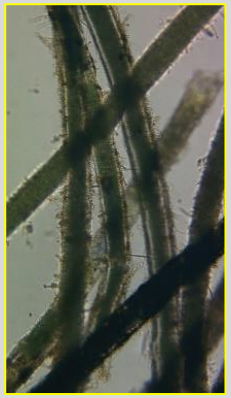




Human Health Impacts

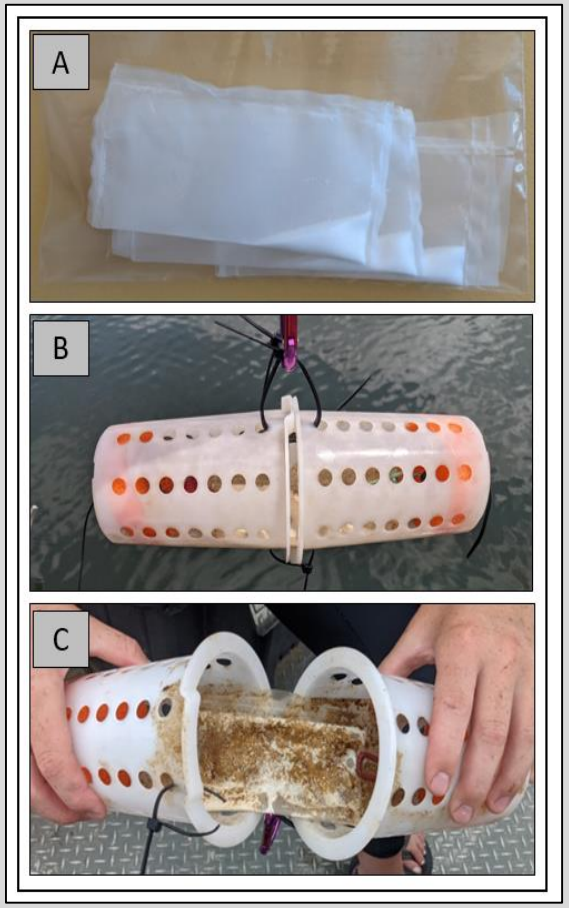
Lyngbya Toxin Production

NCSU / ODU Pilot Study

- June 2021
  - Deployment of SPATTS
    - Solid Phase Adsorption Toxin Tracking

  SPATTS

  - Developed as a cost-effective way to monitor toxic algal blooms in New Zealand
  - Deploys a synthetic resin with the ability to adsorb toxins directly from the water column
  - Shown to be useful in detection of a wide range of phycotoxins
  - Sampling design that can increase the understanding of toxin release both spatially and temporally



Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

- June 2021
  - Deployment of SPATTS in conjunction with lyngbya treatment application
    - Stress release?
  - Deployment sites included
    - Two treatment sites
    - One untreated site
    - One reference site (void of lyngbya)
  - SPATTS for each site were vertically suspended from each other

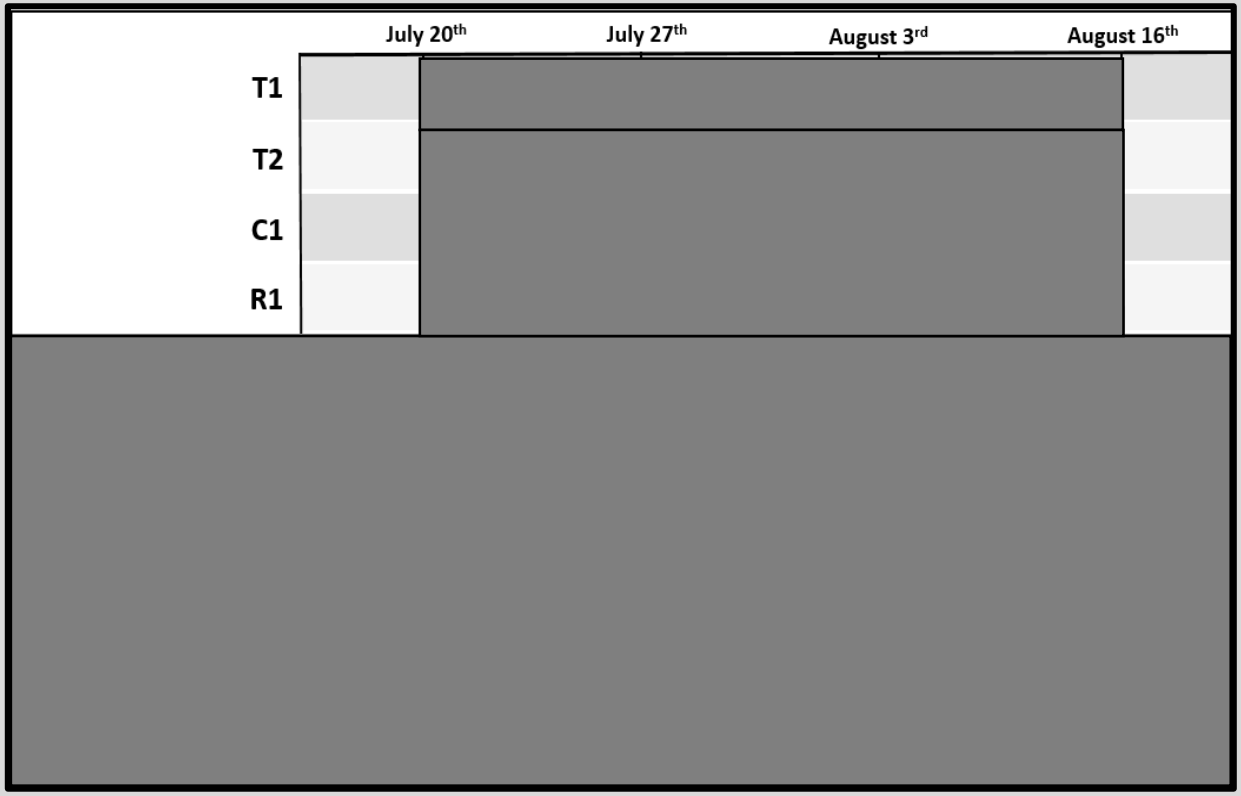
Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results

Treatment / Deployment



Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

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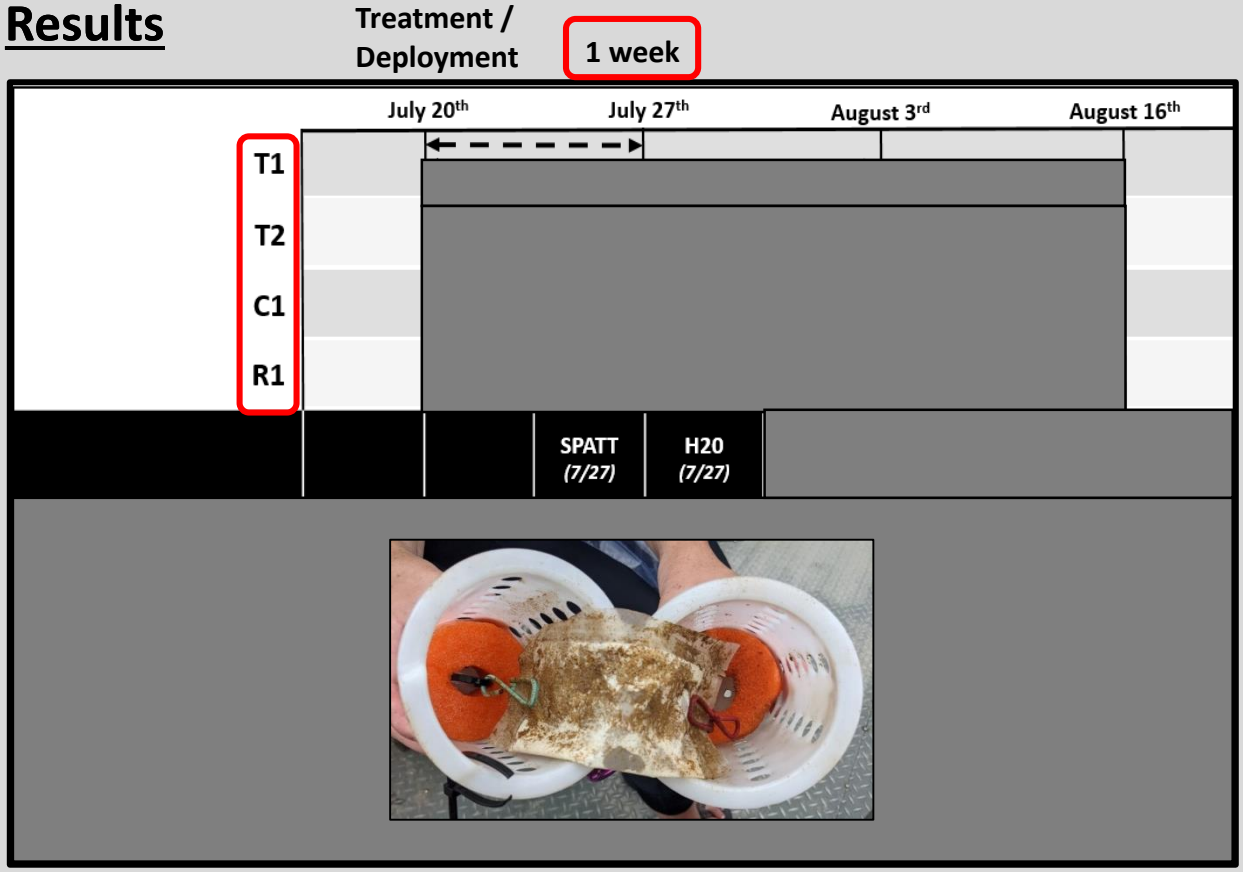

Human Health Impacts

Lyngbya Toxin Production

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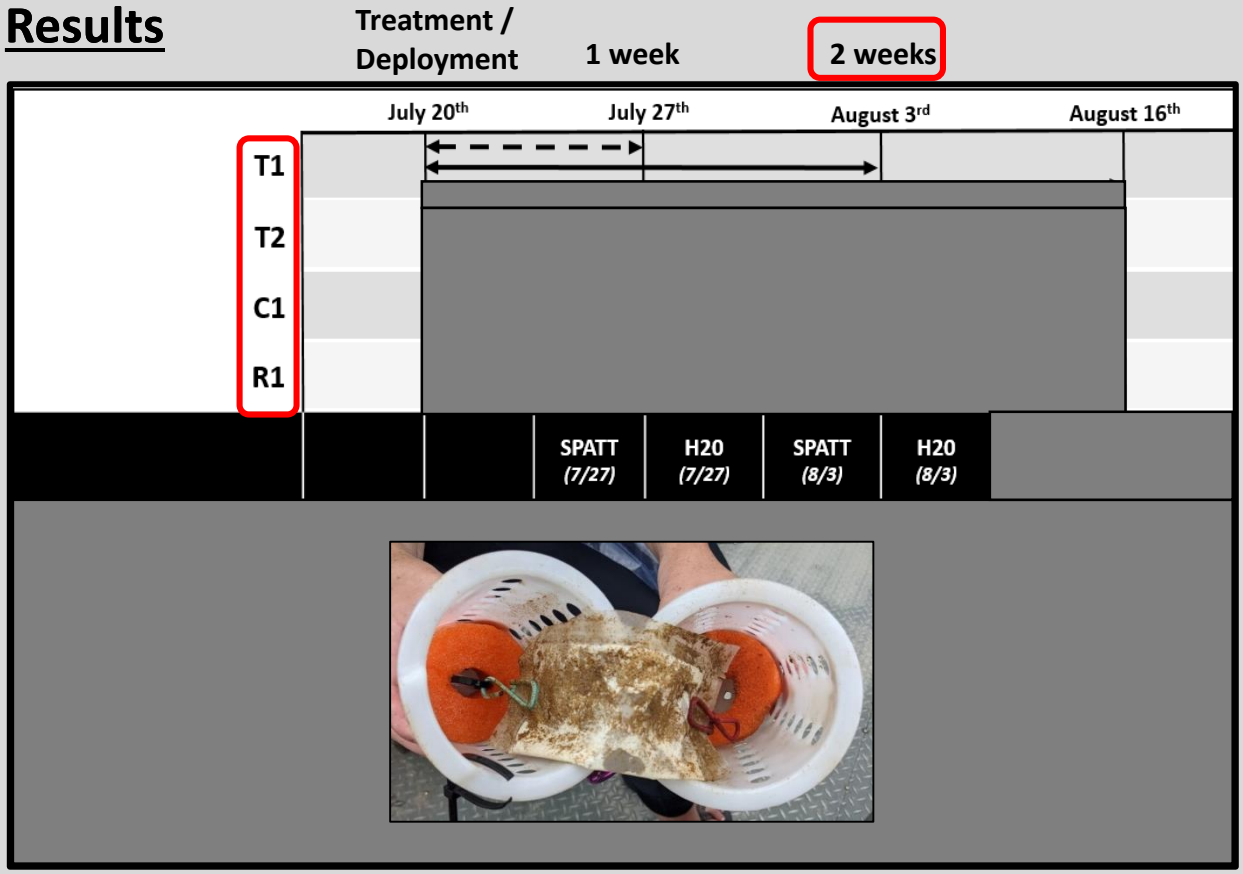
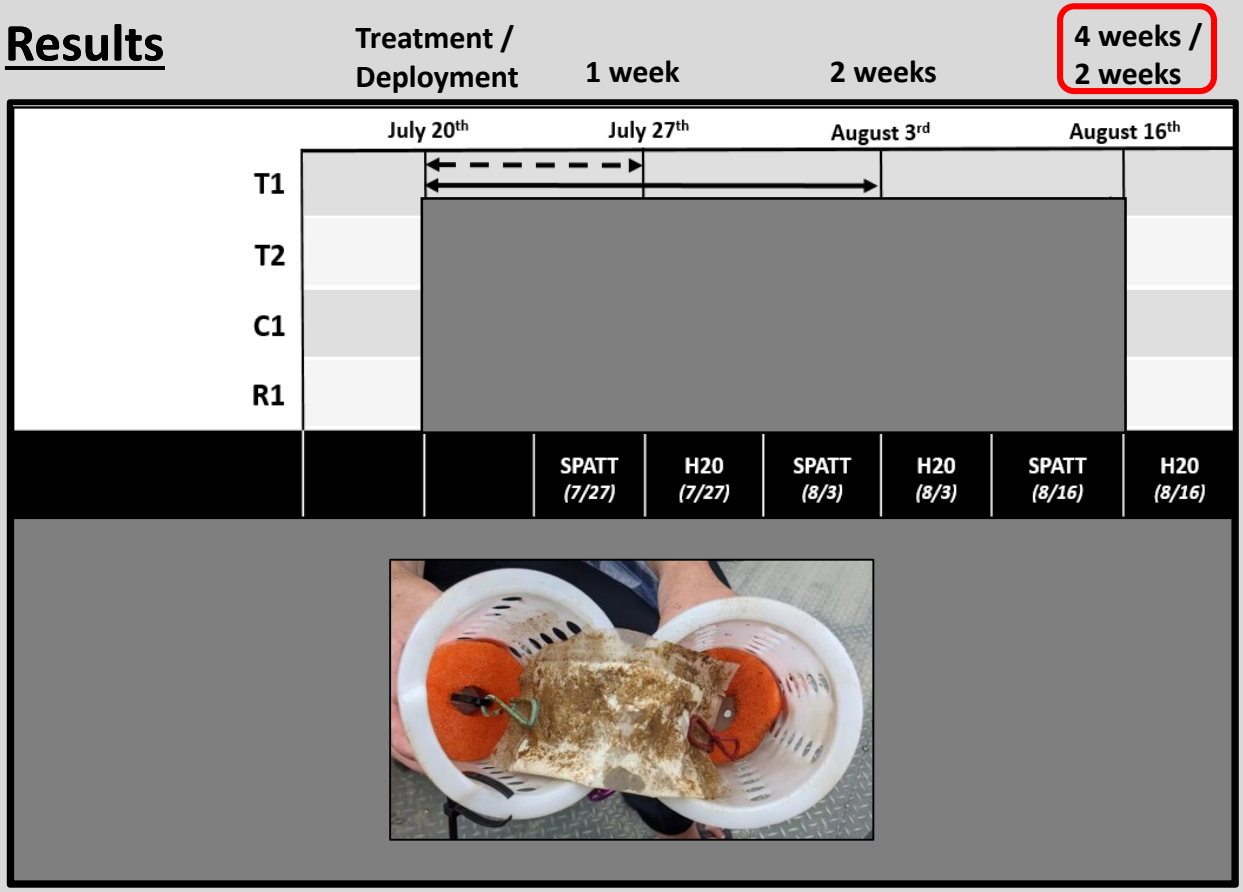


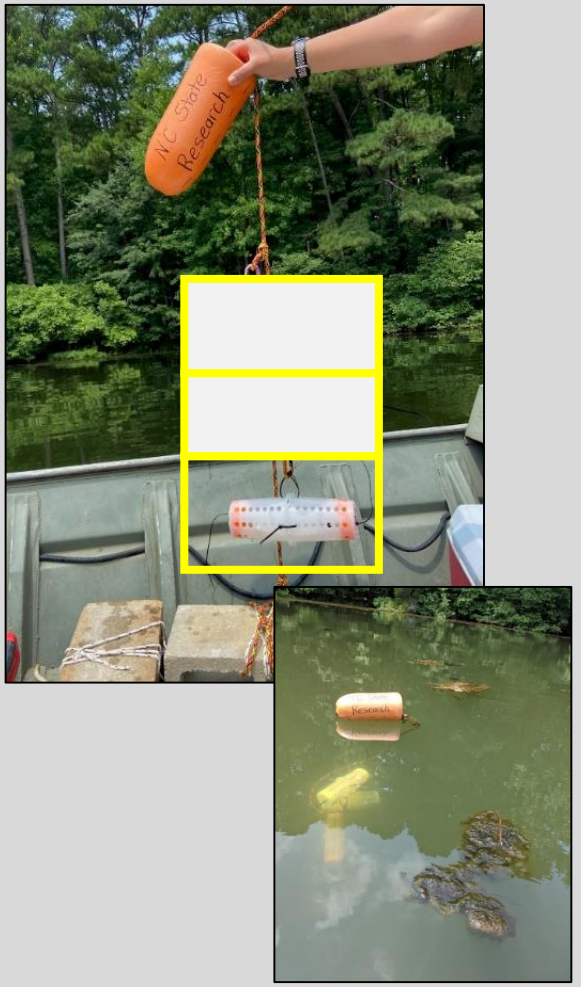
Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results





Human Health Impacts

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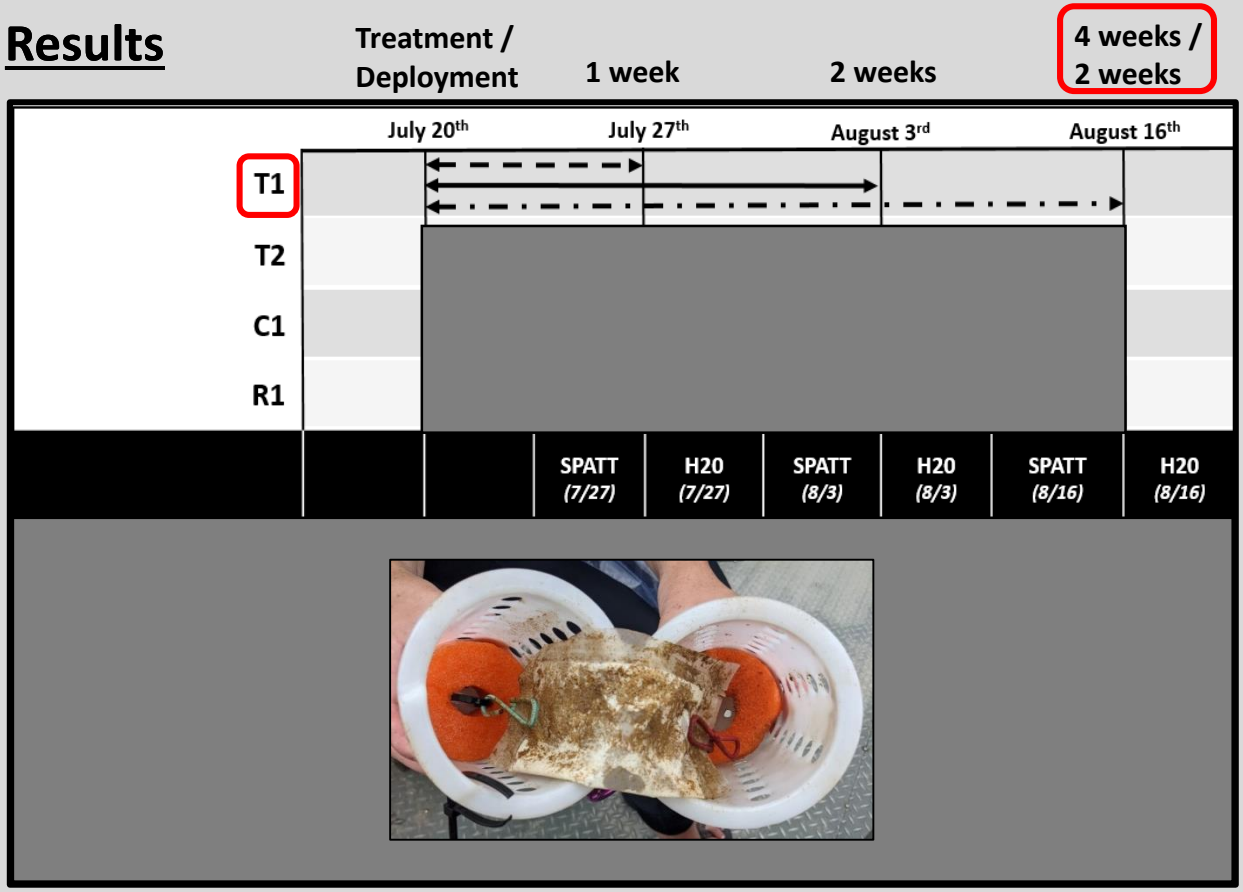

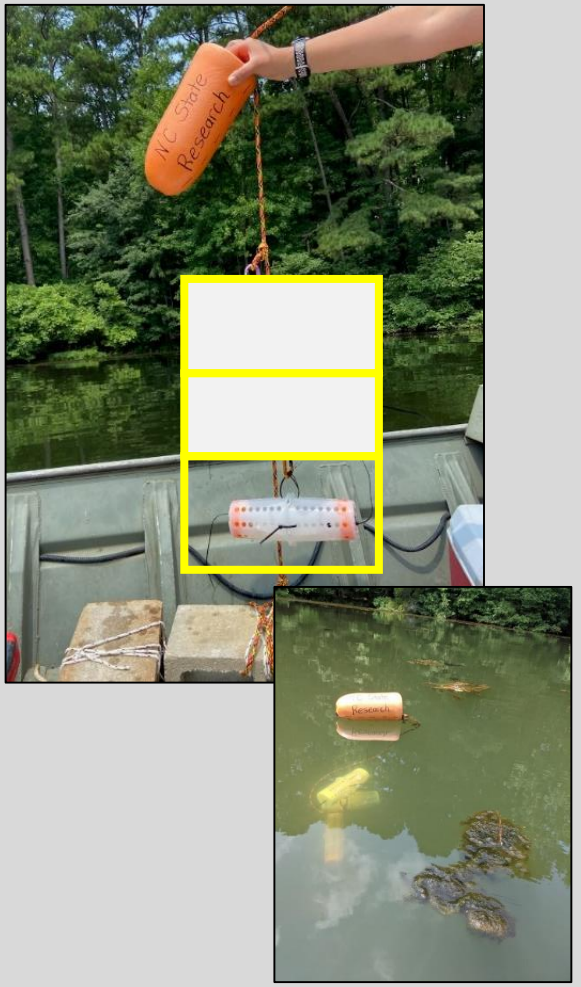

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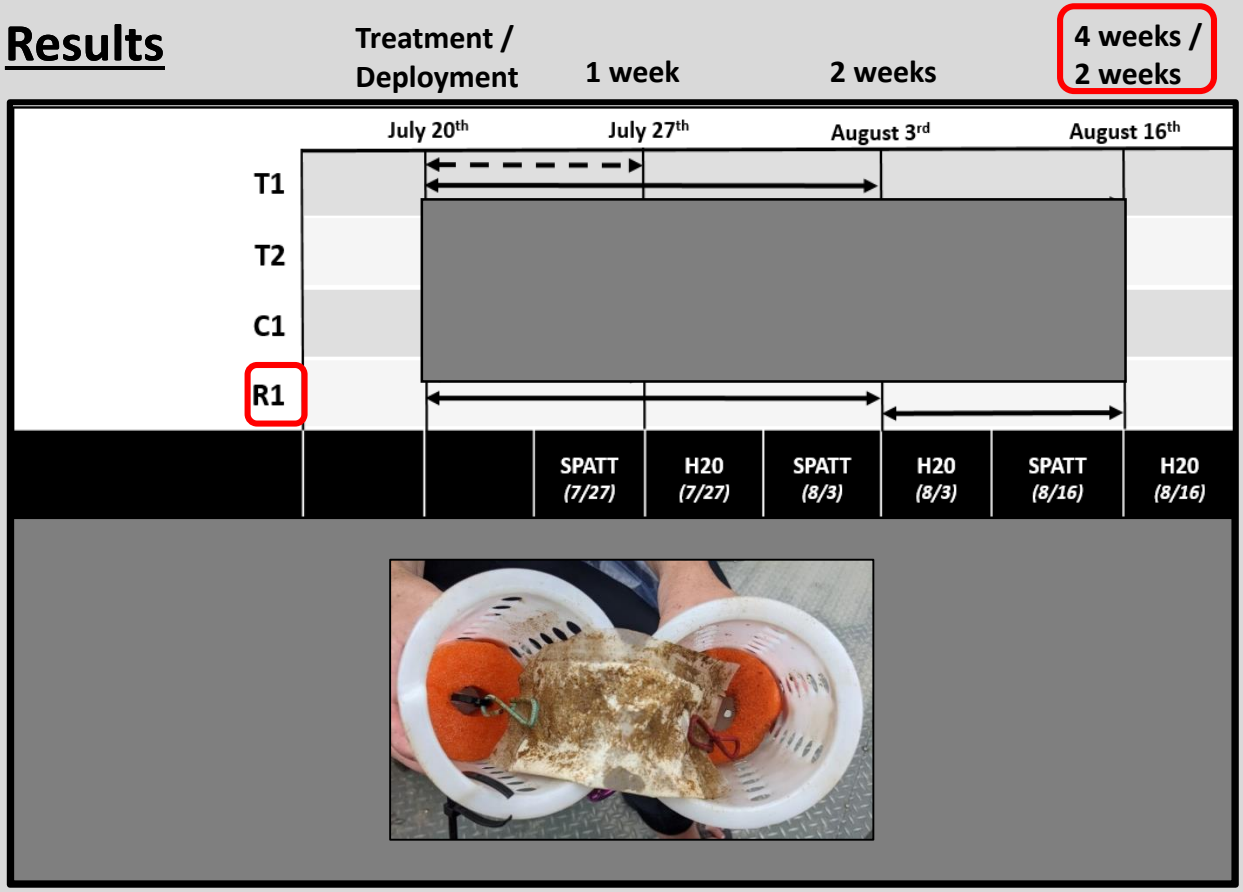

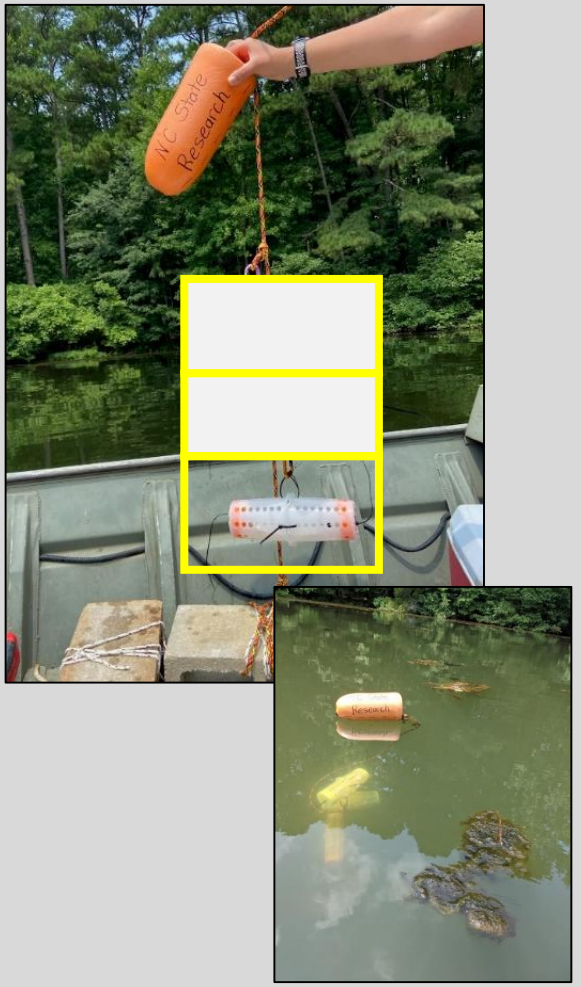

Human Health Impacts

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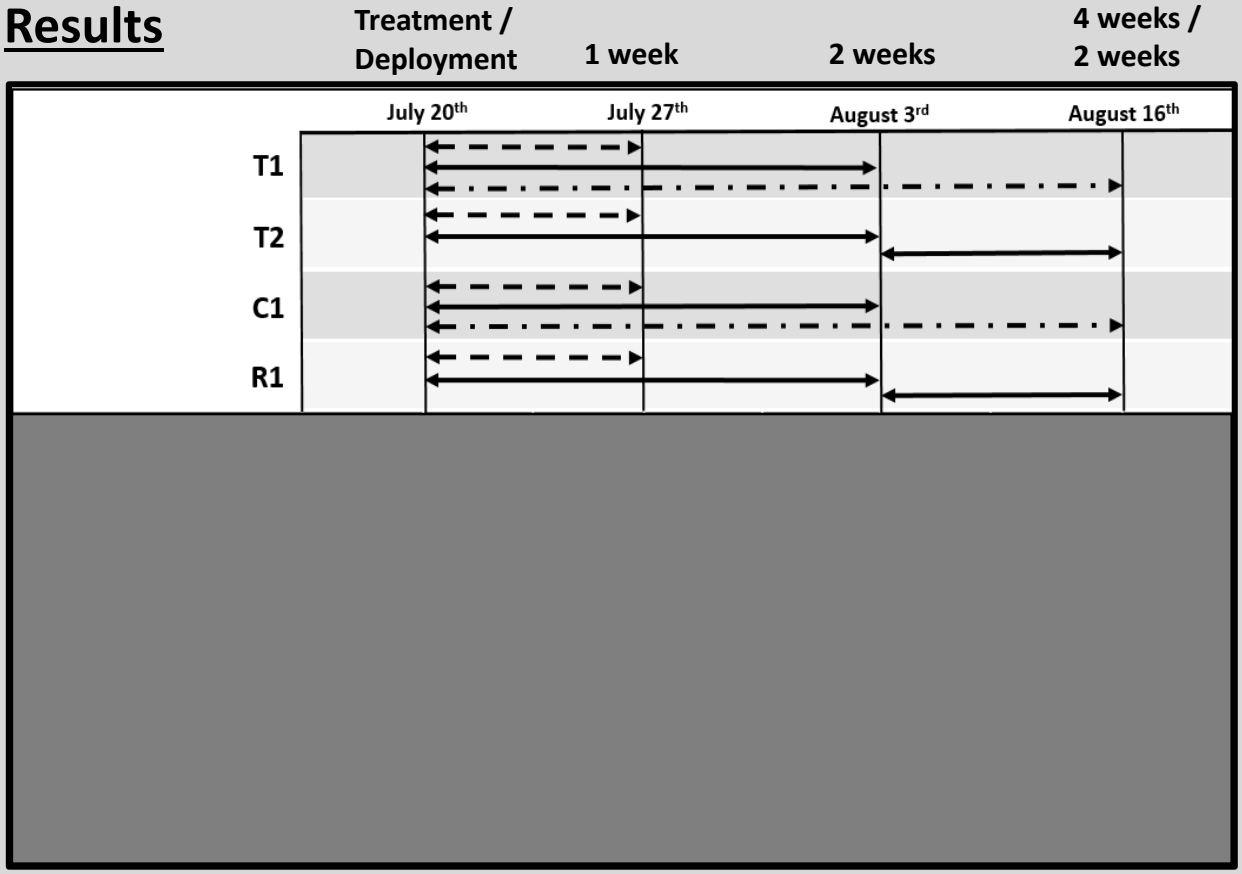

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

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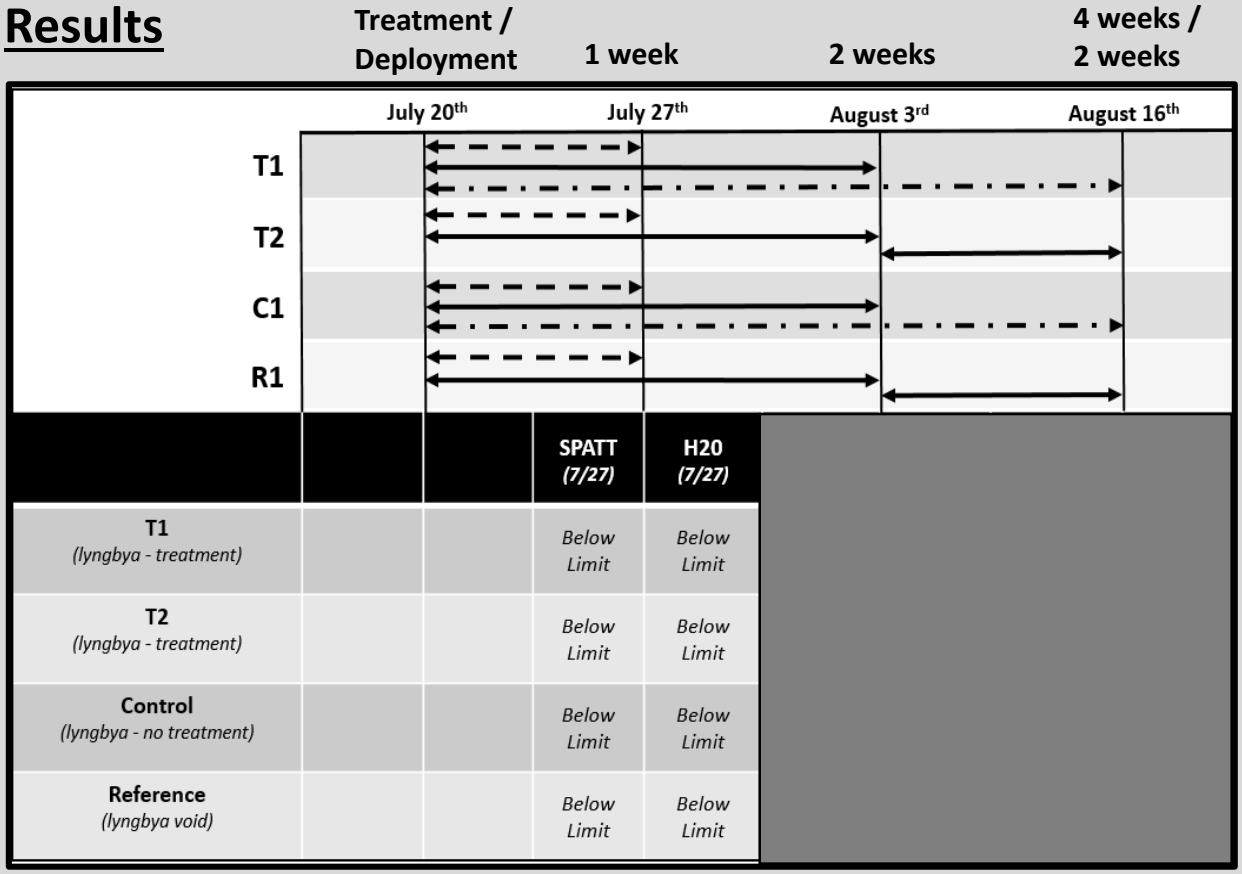


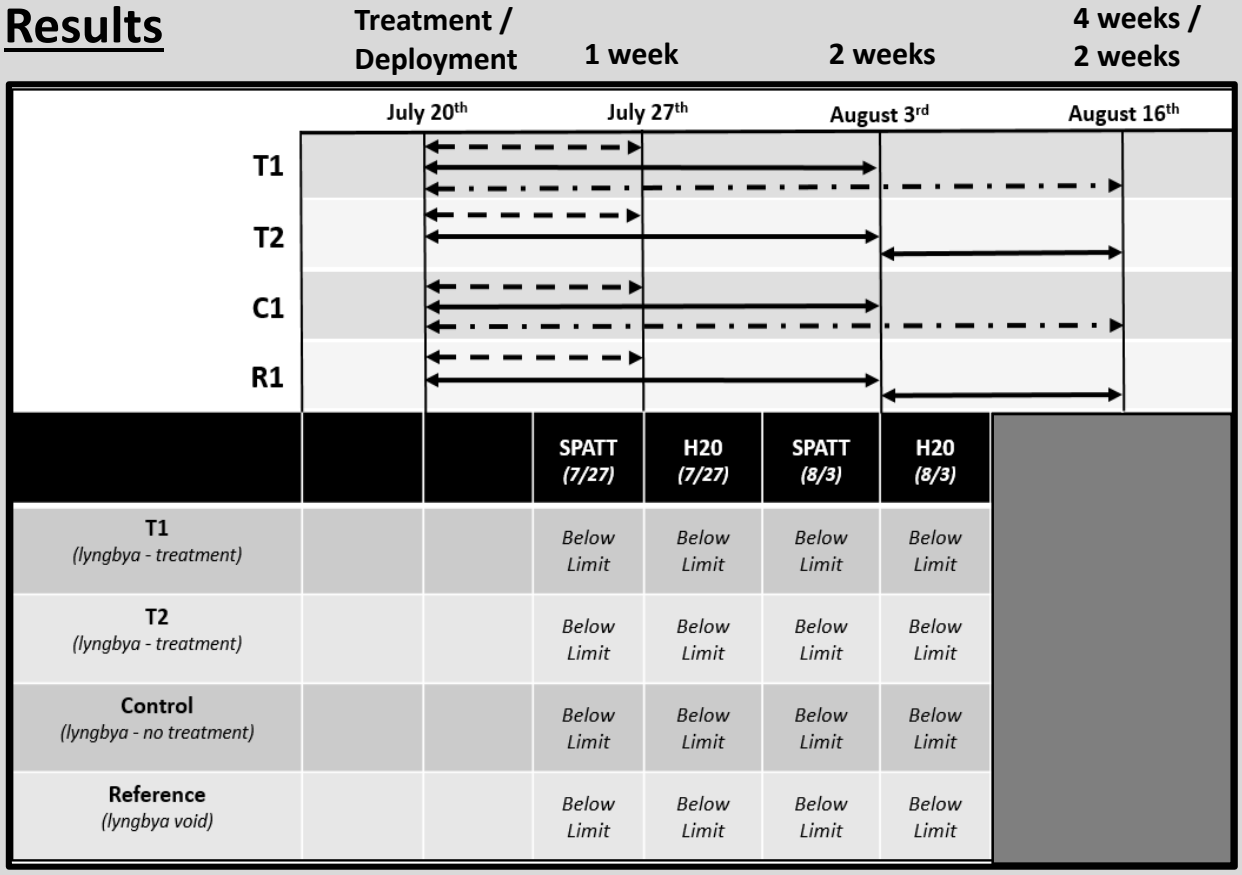
			SPATT (7/27)	H20 (7/27)
T1 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*
T2 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*
Control *(lyngbya - no treatment)*			*Below Limit*	*Below Limit*
Reference *(lyngbya void)*			*Below Limit*	*Below Limit*

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results



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T1 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*
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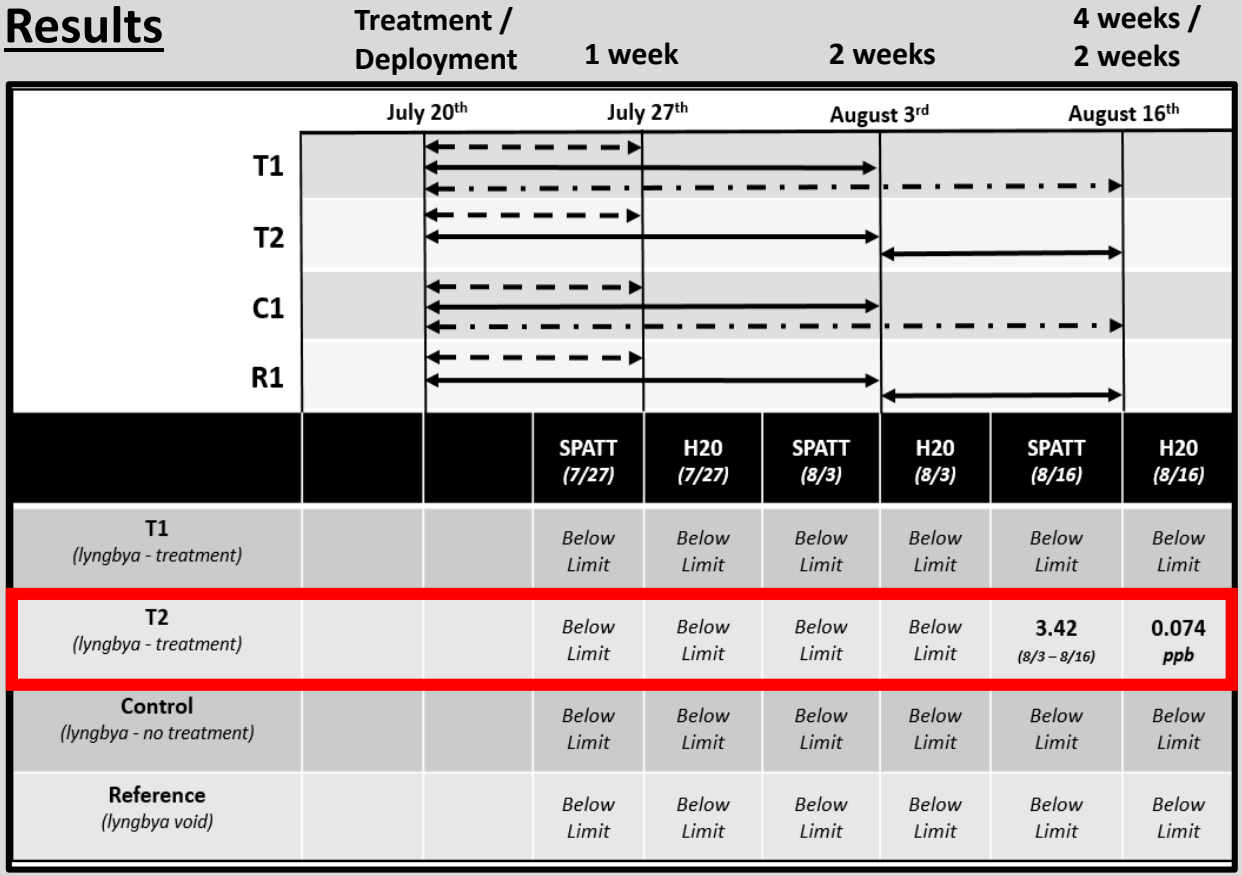
Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results



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T1 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*
T2 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	**3.42** *(8/3 – 8/16)*	**0.074** ***ppb***
Control *(lyngbya - no treatment)*			*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*
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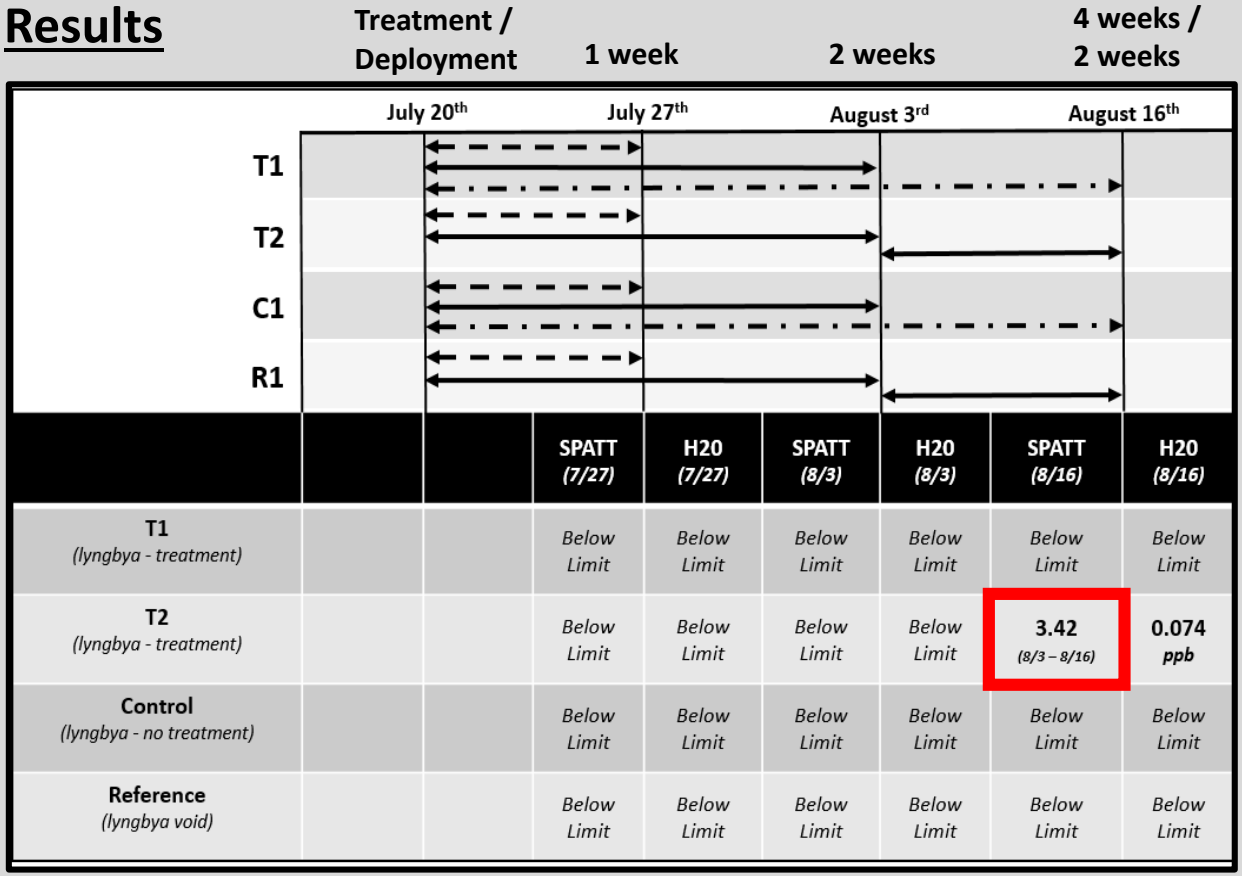
Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results



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Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

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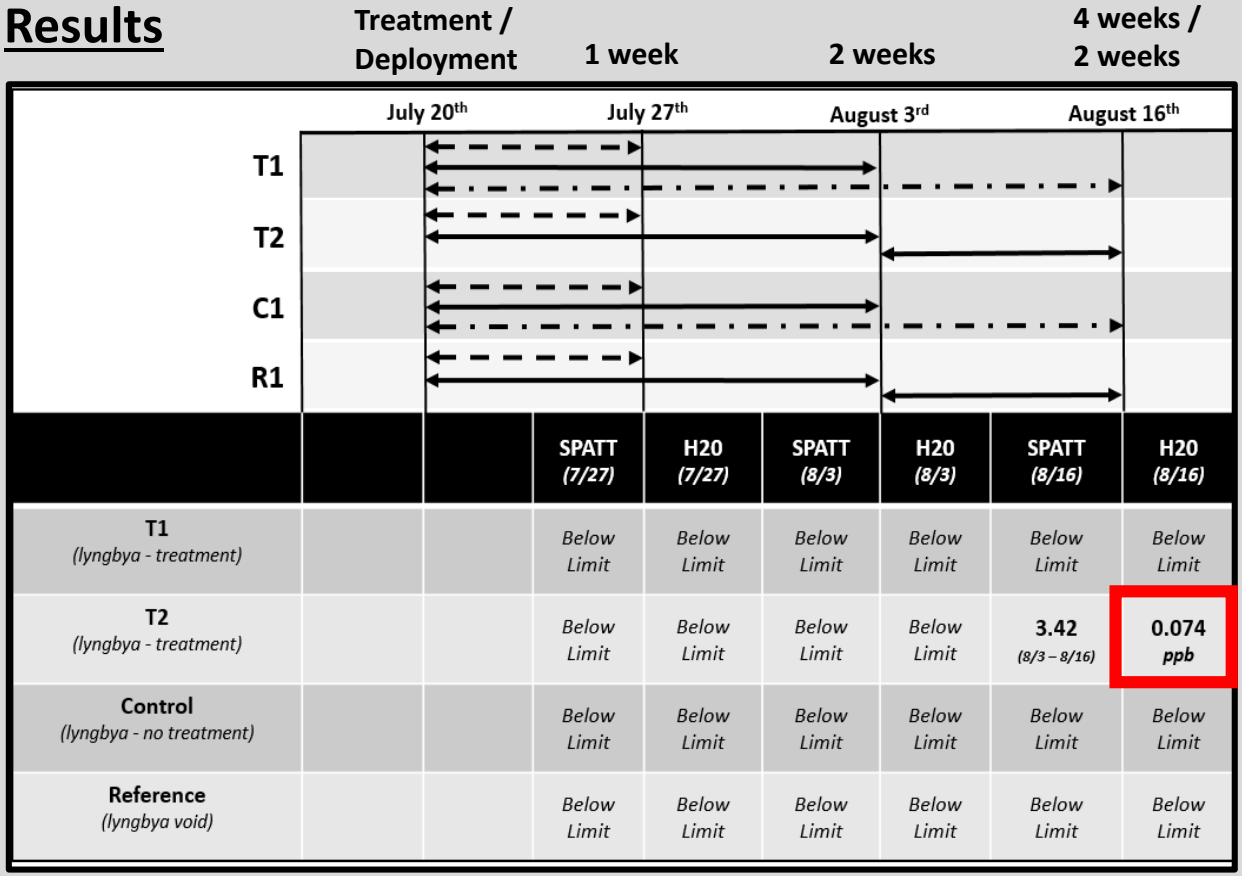

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Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

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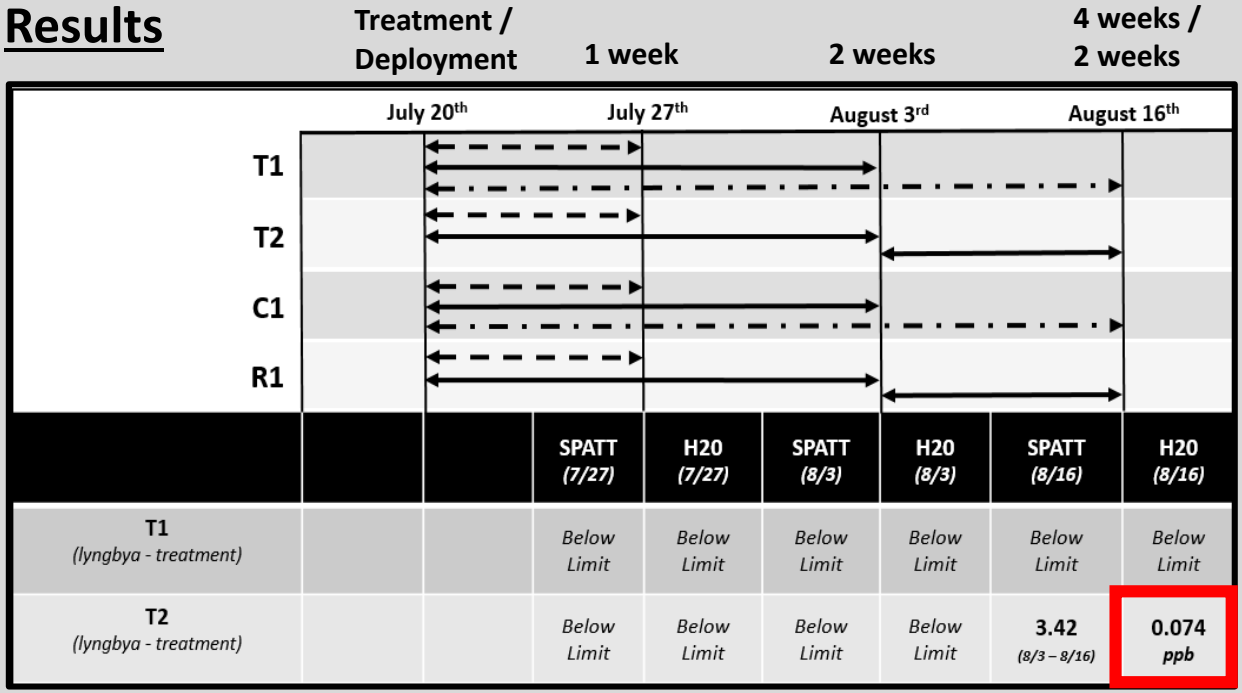

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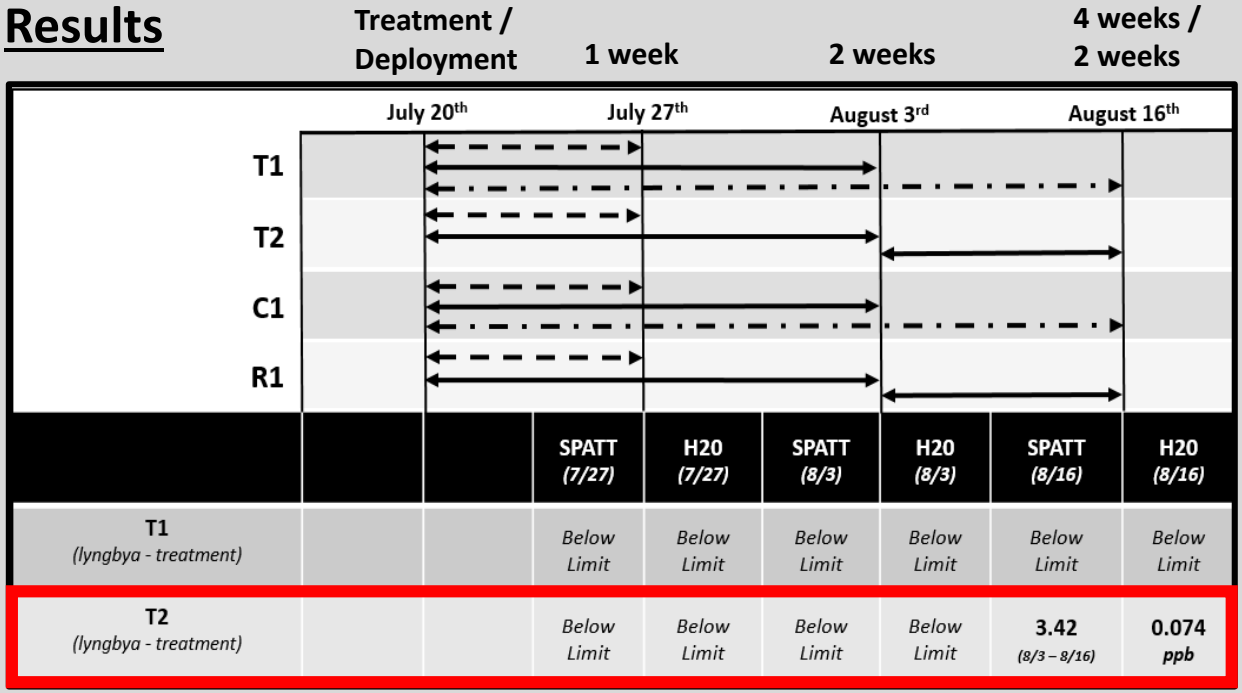
VA Recreational Advisory: 4 ppb

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results



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T2 (lyngbya - treatment)			Below Limit	Below Limit	Below Limit	Below Limit	3.42 (8/3 – 8/16)	0.074 ppb

- Lyngbya Treatment Area
- Adjacent to a site of new construction
  - Boat Dock

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results

	Treatment / Deployment	1 week	2 weeks	4 weeks / 2 weeks
	July 20th	July 27th	August 3rd	August 16th
T1				
T2				
C1				
R1				

			SPATT (7/27)	H20 (7/27)	SPATT (8/3)	H20 (8/3)	SPATT (8/16)	H20 (8/16)
T1 *(lyngbya - treatment)*			*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*	*Below Limit*
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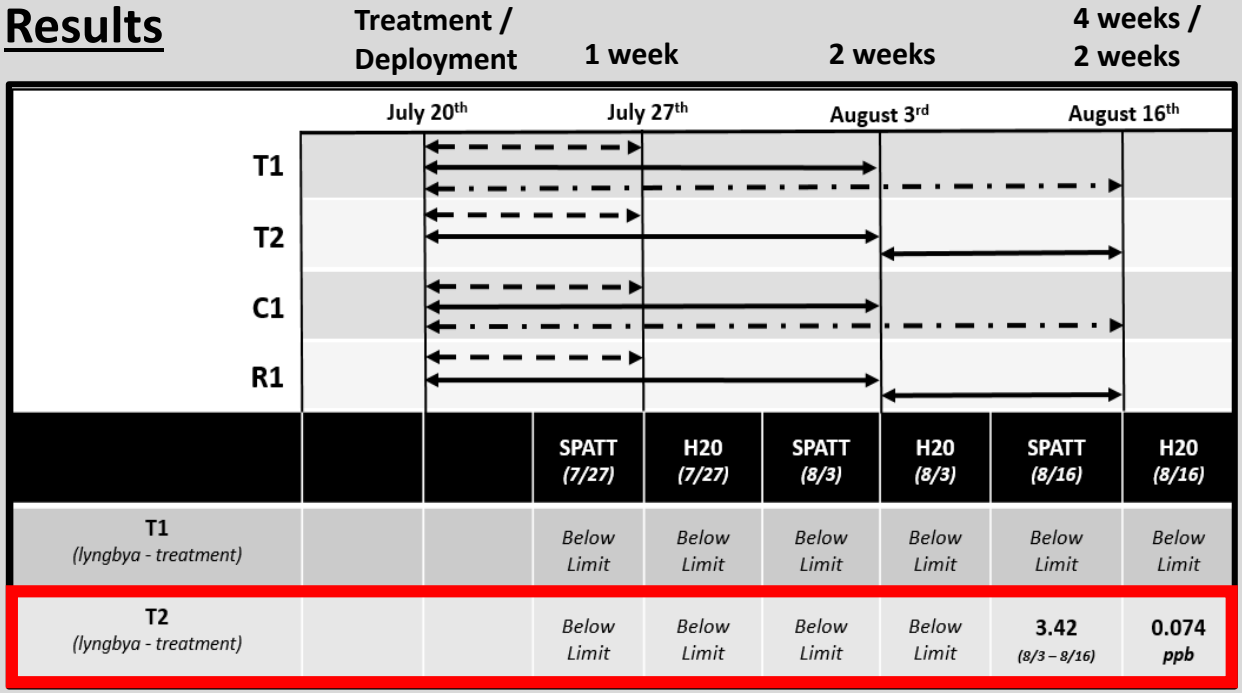
- **Take Away:** determine proof of concept for using SPATTs to detect lyngbya cyanotoxins within a freshwater environment

Human Health Impacts

Lyngbya Toxin Production

NCSU / ODU Pilot Study

Results



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- **Take Away:** determine proof of concept for using SPATTs to detect lyngbya cyanotoxins within a freshwater environment
- **First Study To Do This!**

Human Health Impacts

Proposed Research – Lyngbya Cyanotoxin Production

Need

- Better understand the environmental and human health risks posed by lyngbya in freshwater environments

Human Health Impacts

Proposed Research – Lyngbya Cyanotoxin Production

Need

- Better understand the environmental and human health risks posed by lyngbya in freshwater environments

Objective

- Address various factors that promote growth or increase stress for lyngbya could help increase our understanding of the environmental and physiological factors that drive toxin production and release for this species.



Human Health Impacts

Proposed Research – Lyngbya Cyanotoxin Production

- Deploy a series of SPATTs representing various environment conditions that could potentially influence growth conditions of lyngbya (temperature, light intensity, flow, etc.) and therefore toxin production.
- Deploy SPATTS at sites that could pose increased stress and drive toxin production (lyngbya treatment sites and high traffic areas).
- Conduct sampling efforts over a 12 month period to identify any temporal variations in toxin production that could be associated with active growth and/or the senescence of lyngbya.



Human Health Impacts

Proposed Research – Lyngbya Cyanotoxin Production

Goals

1) Characterizing spatial and temporal variation in potential toxin production within Lake Gaston.

2) Identify potential stress drivers for production and release of toxins from benthic lyngbya mats.

Outline

Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

Lyngbya Management

- Environmental Factors Influencing Lyngbya Growth

- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

Lyngbya Herbicide Efficacy Lab Trials

Objectives

Lyngbya Herbicide Efficacy Lab Trials

Objectives

- Determine efficacy of field based treatment protocols in a laboratory setting
  - Better address evaluations techniques
    - Assess all treated mat material

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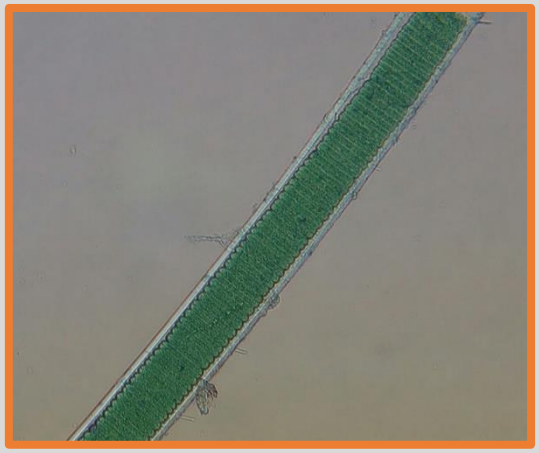

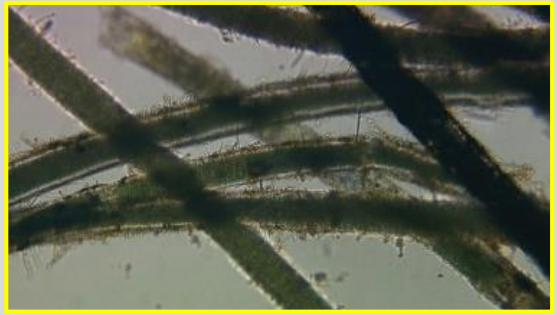

Lyngbya Herbicide Efficacy Lab Trials

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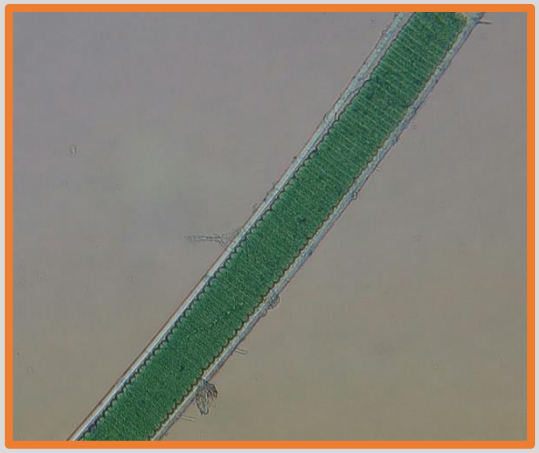
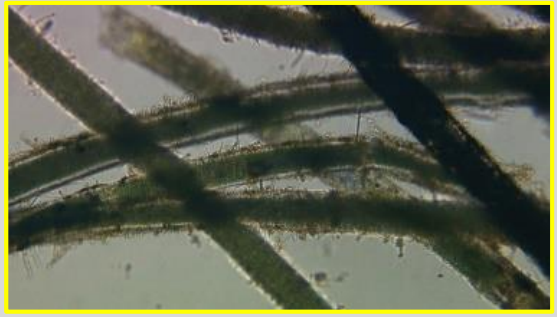




Lyngbya Herbicide Efficacy Lab Trials

Objectives

- Determine efficacy of field based treatment protocols in a laboratory setting
  - Better address evaluations techniques
    - Assess all treated mat material
- Determine if positive results shown in Lake Gaston treatment program translated to lyngbya infestations outside of Gaston system

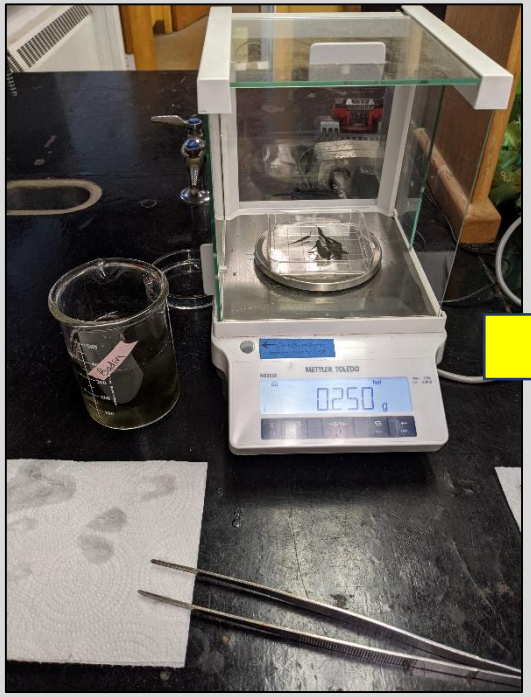
Lyngbya Herbicide Efficacy Lab Trials

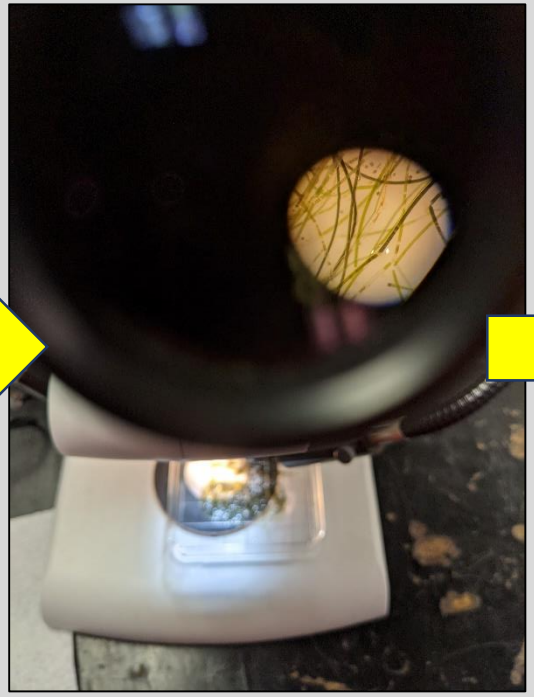
Objectives

- Treatment Combinations (4 reps each)
  - Captain XTR + AMP
  - Captain XTR + Diquat
  - Cutrine Ultra + AMP
  - Untreated Control

- Samples collected from:
  - Lake Gaston
  - Tuckertown Reservoir
  - Badin

Lyngbya Herbicide Efficacy Lab Trials





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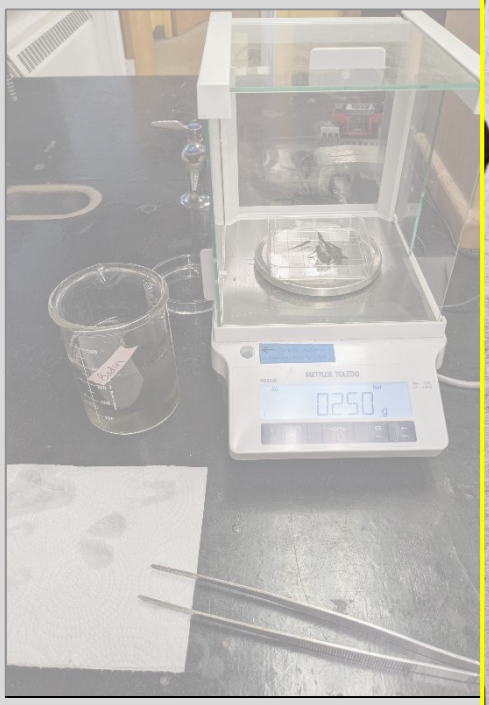
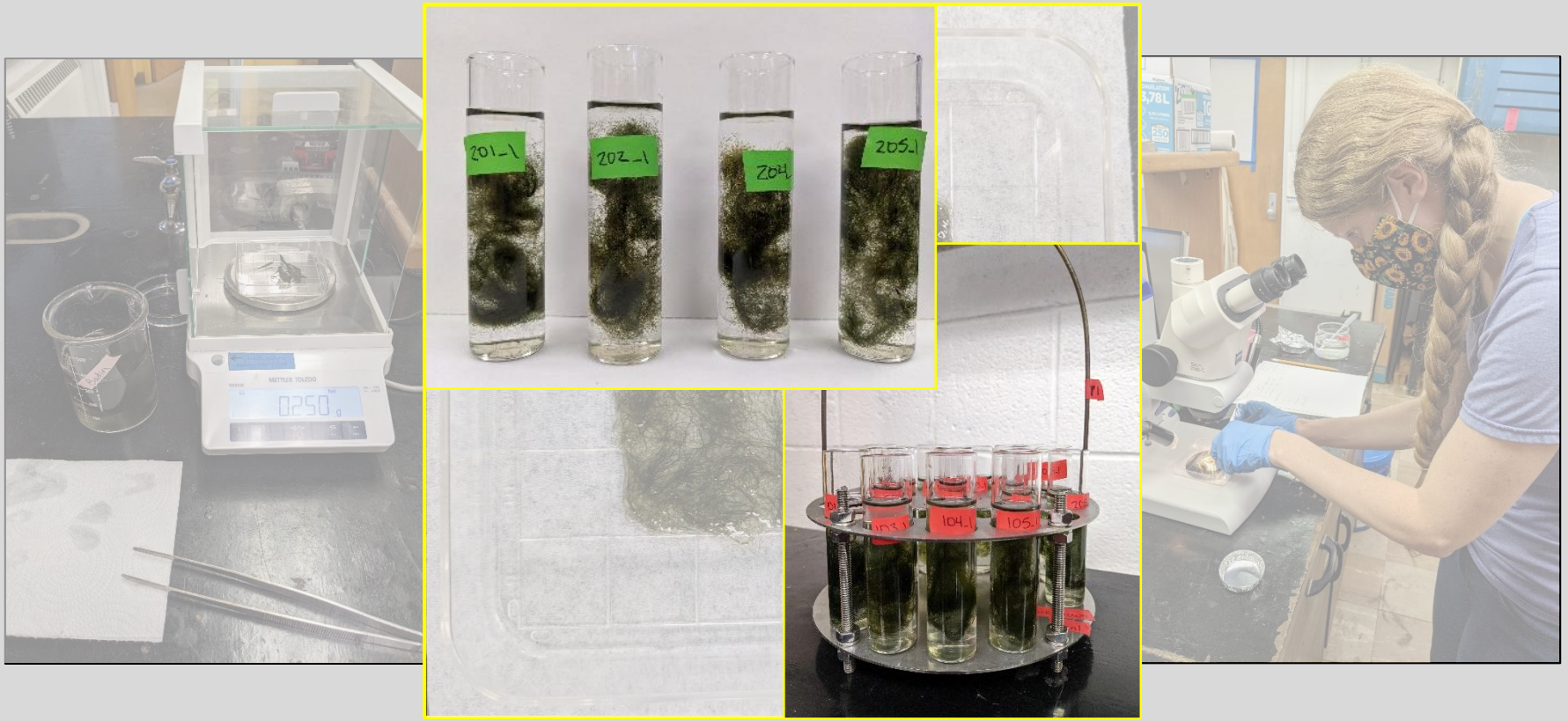


> 90 % Viability Level

Lyngbya Herbicide Efficacy Lab Trials

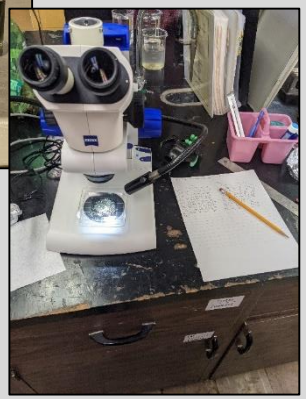


> 90 % Viability Level

Lyngbya Herbicide Efficacy Lab Trials

Methods

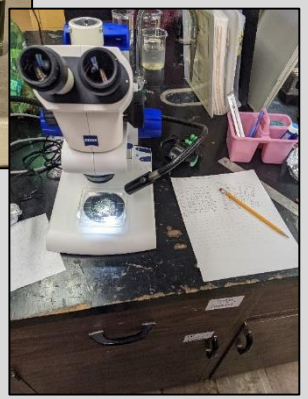
- Three Treatment Exposures
  - 48 hour exposure time
  - Viability was determined 10-days post exposure
  - Follow up treatments occurred every 14-days



Lyngbya Herbicide Efficacy Lab Trials

Methods

- Three Treatment Exposures
  - 48 hour exposure time
  - Viability was determined 10-days post exposure
  - Follow up treatments occurred every 14-days
- Started with Single Treatment…..



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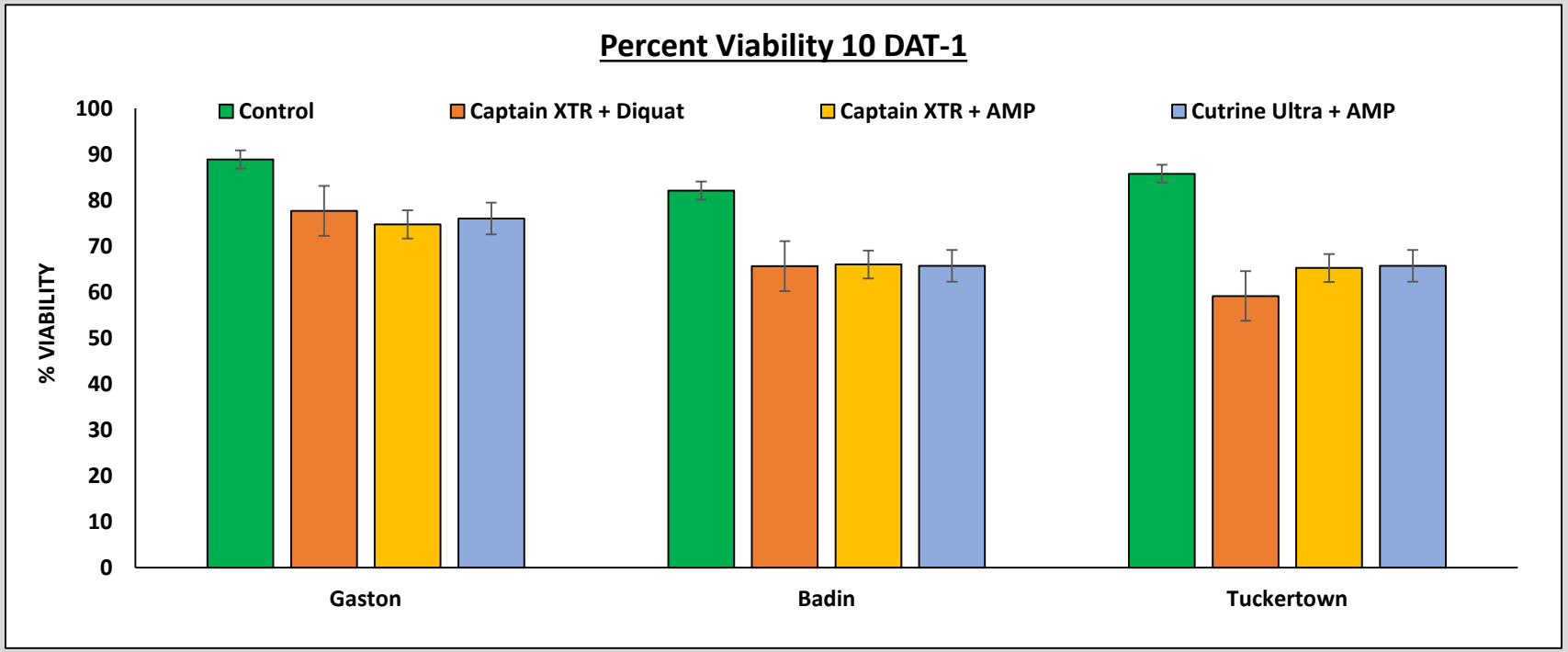

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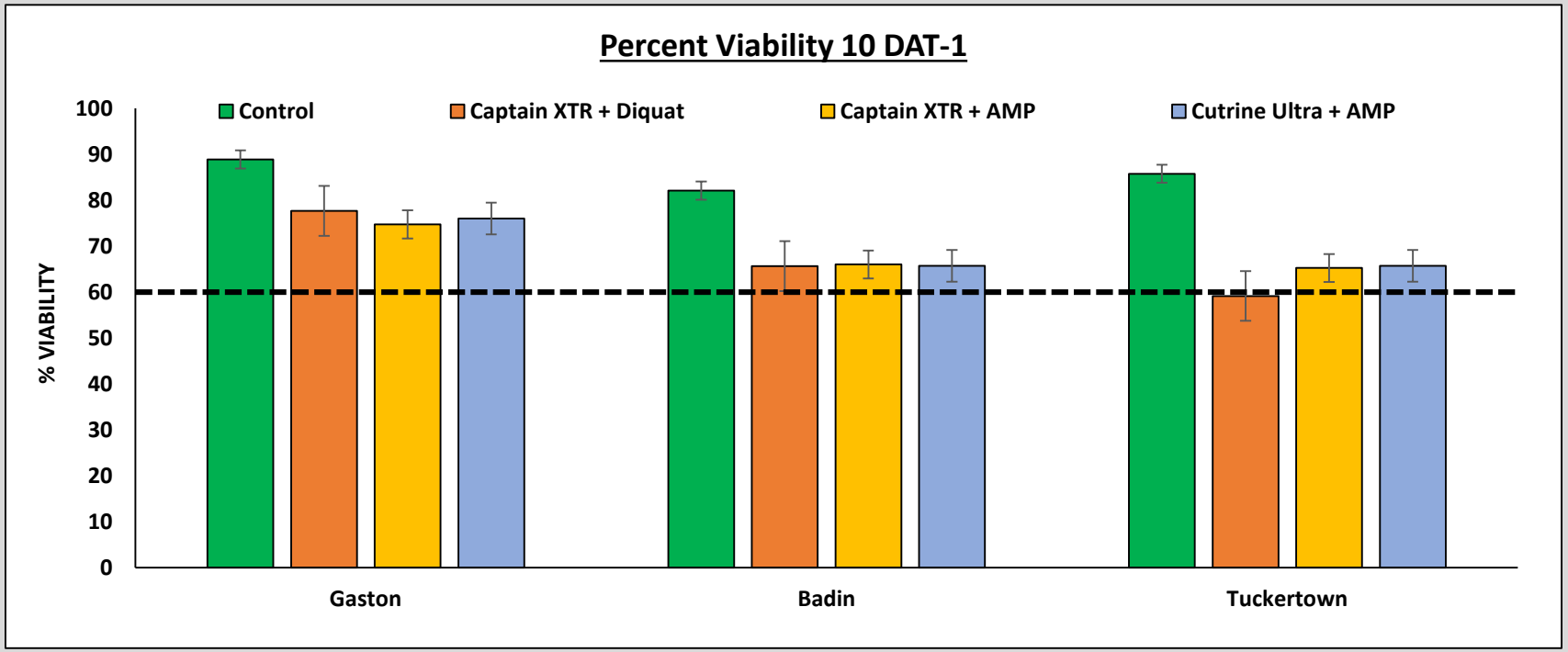

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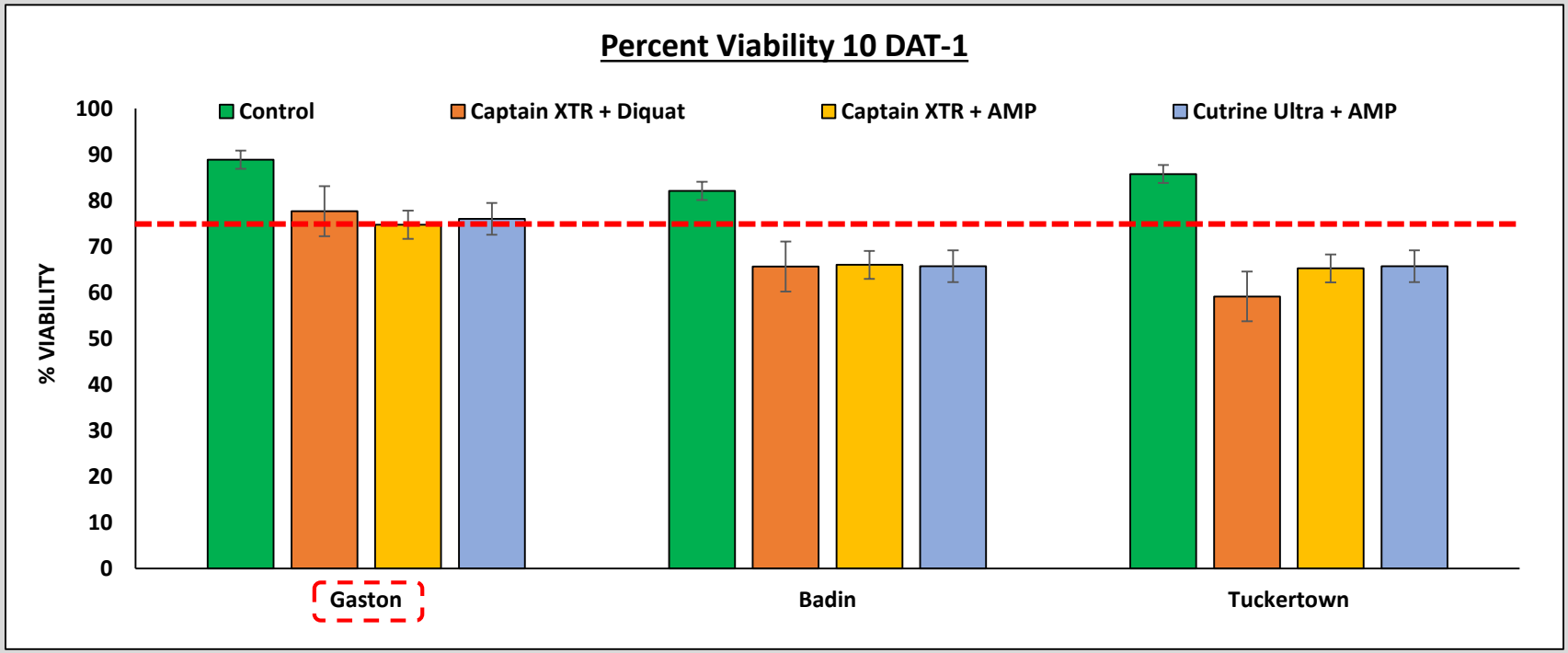

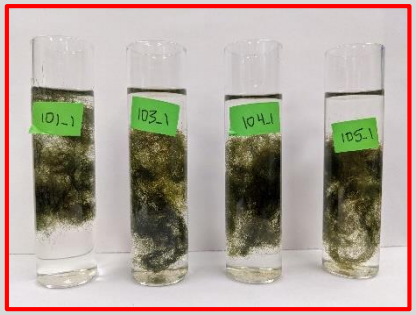

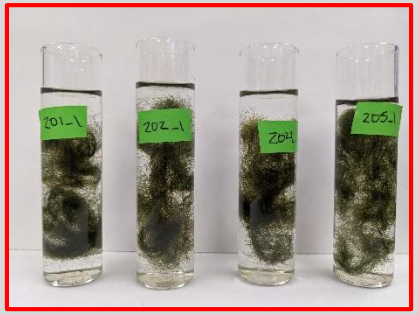

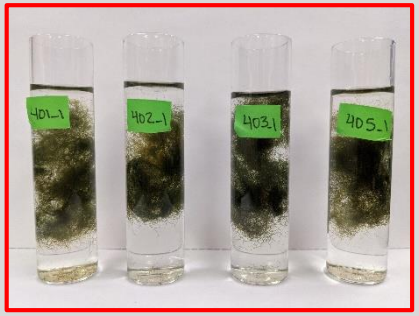

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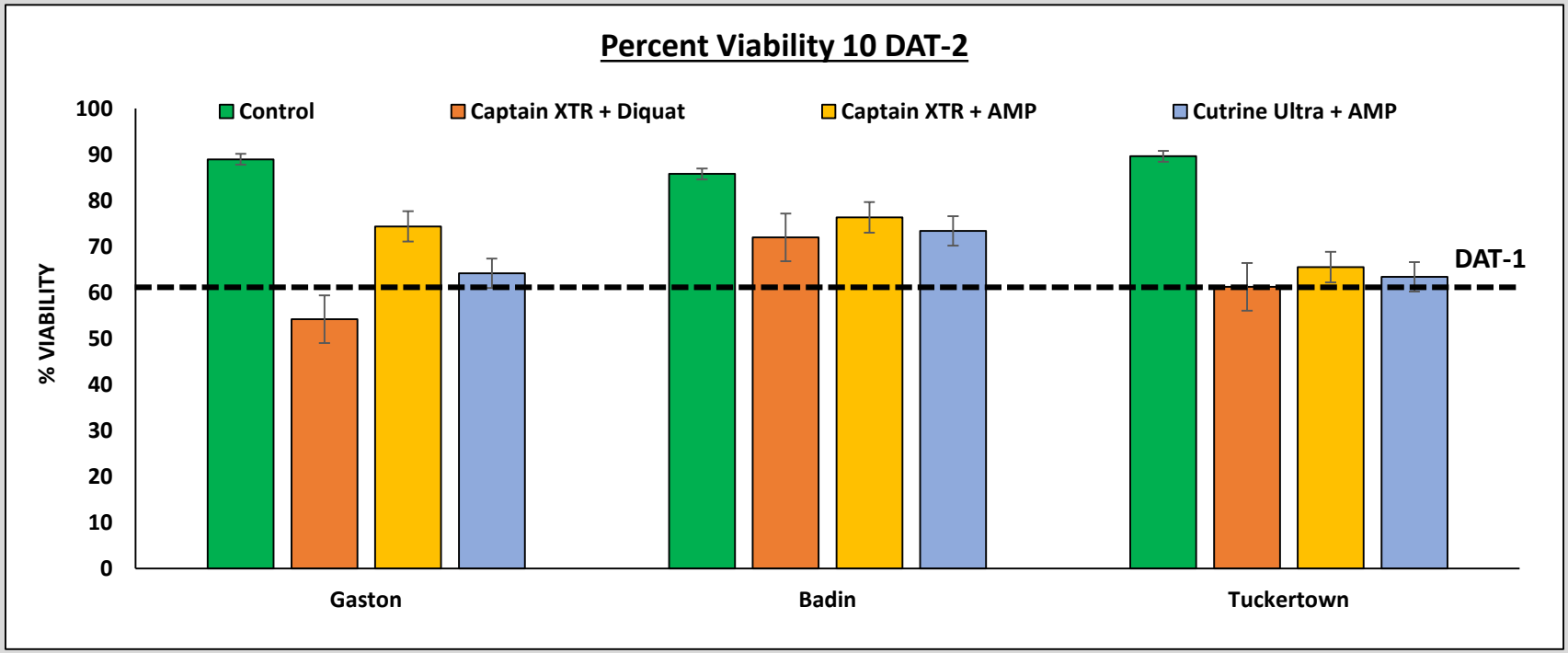

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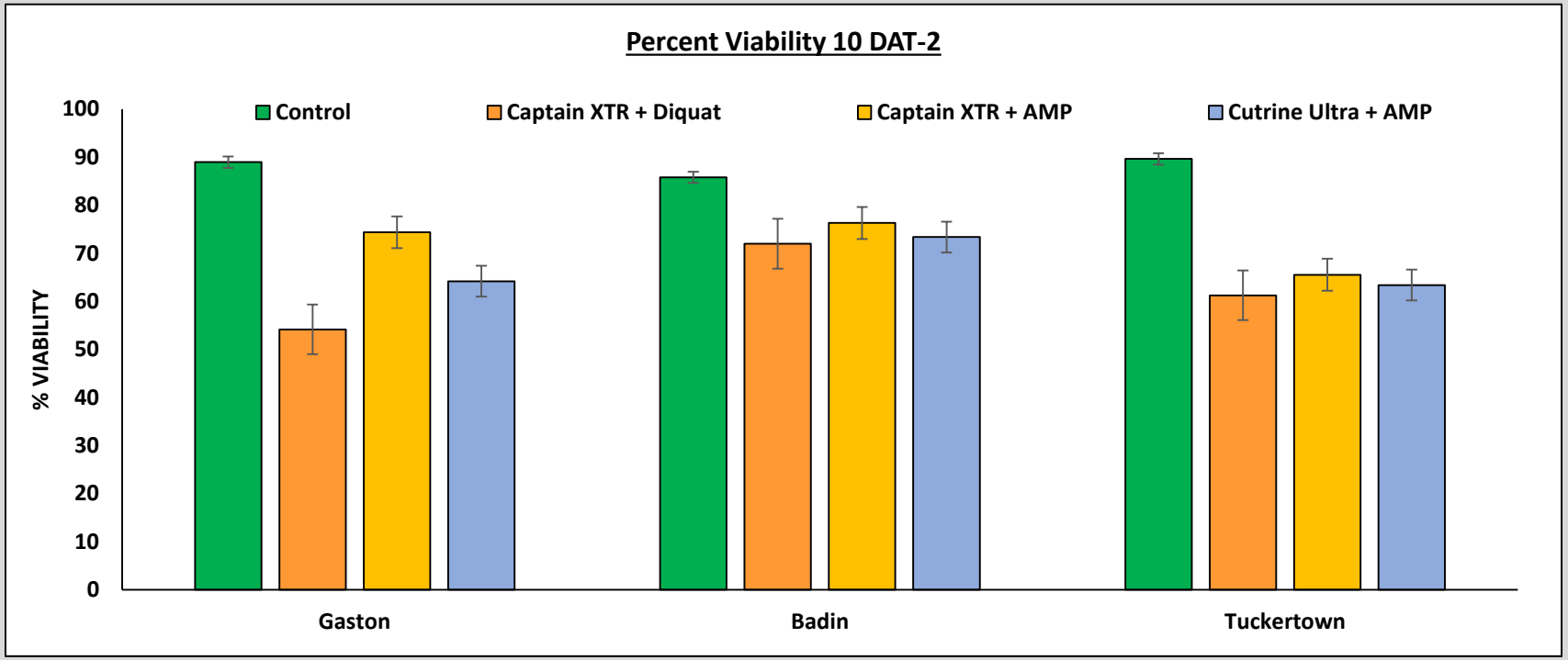

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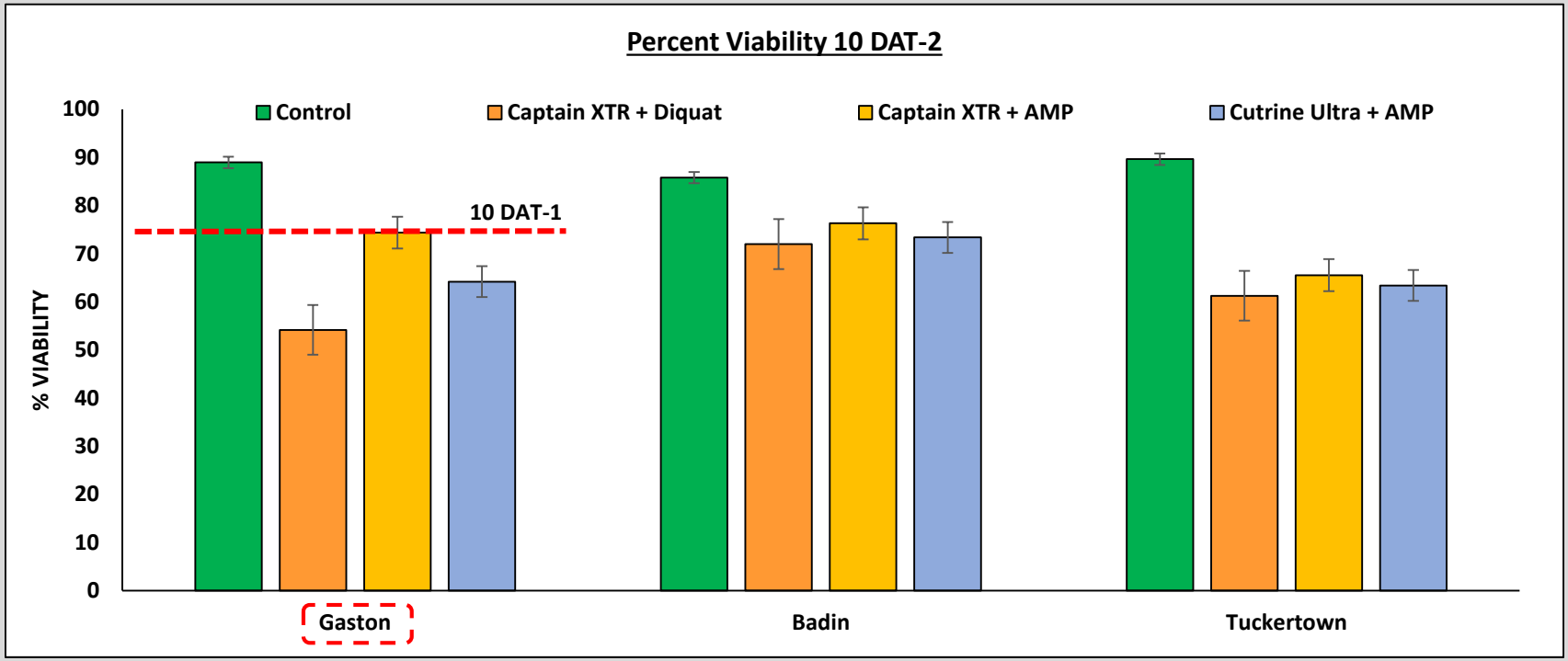

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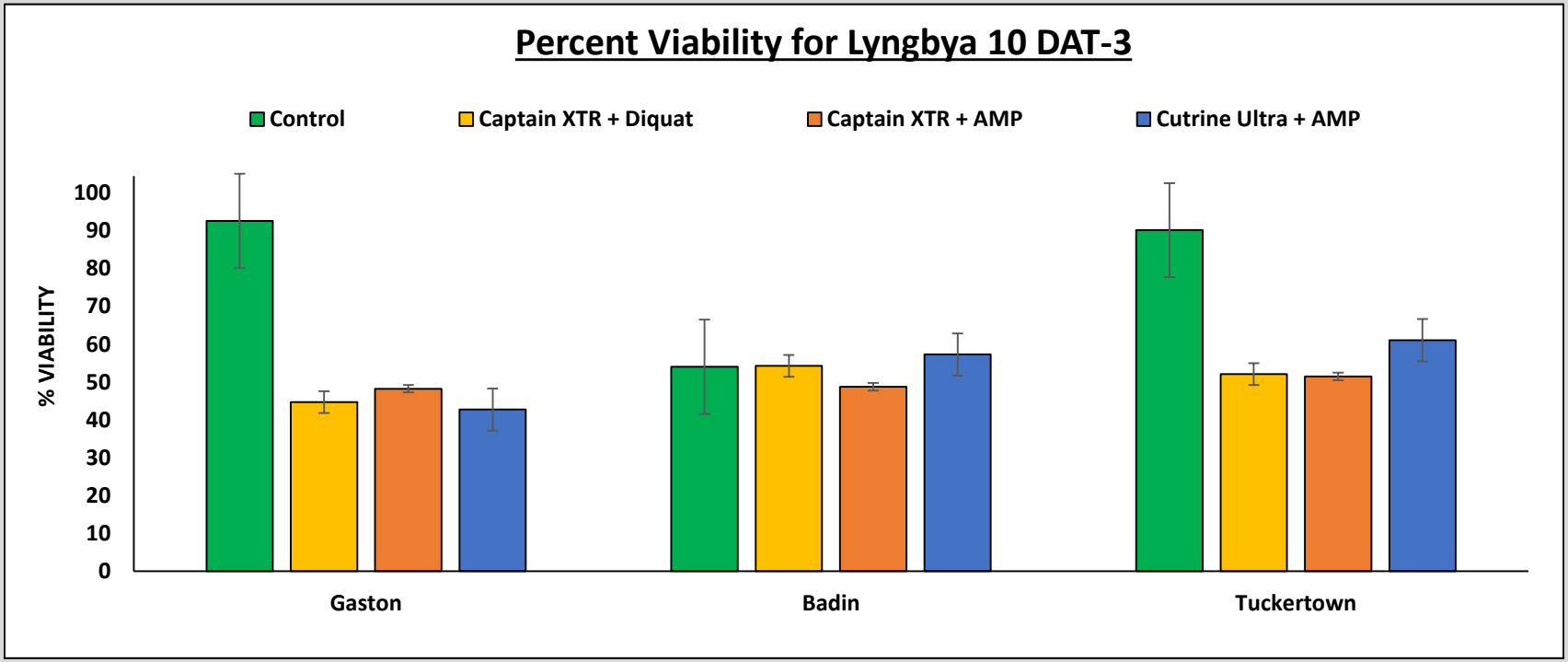

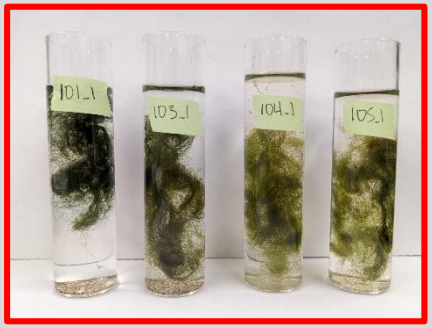

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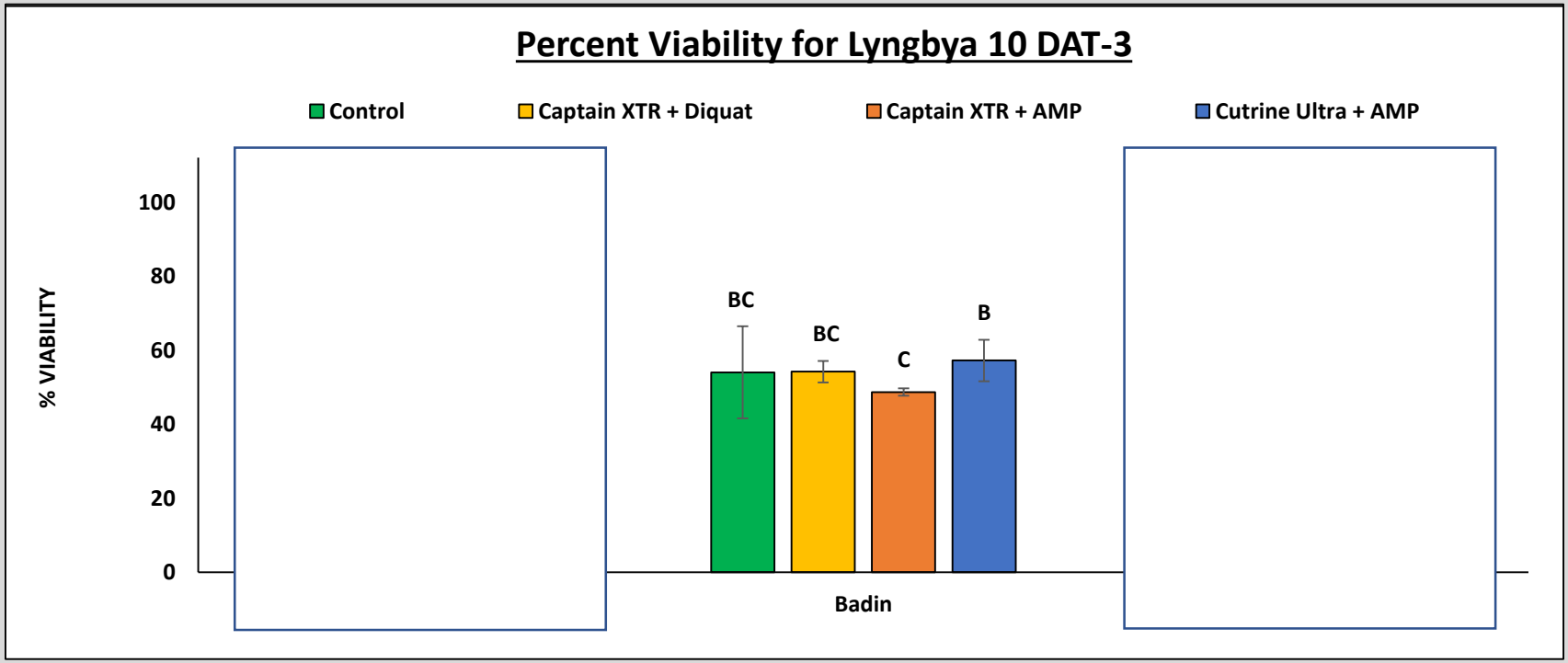

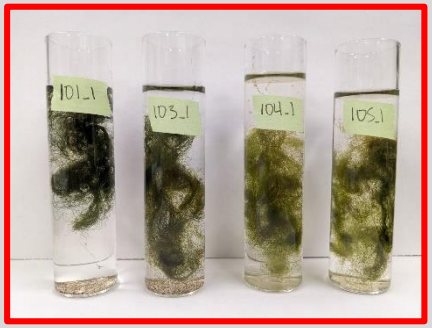

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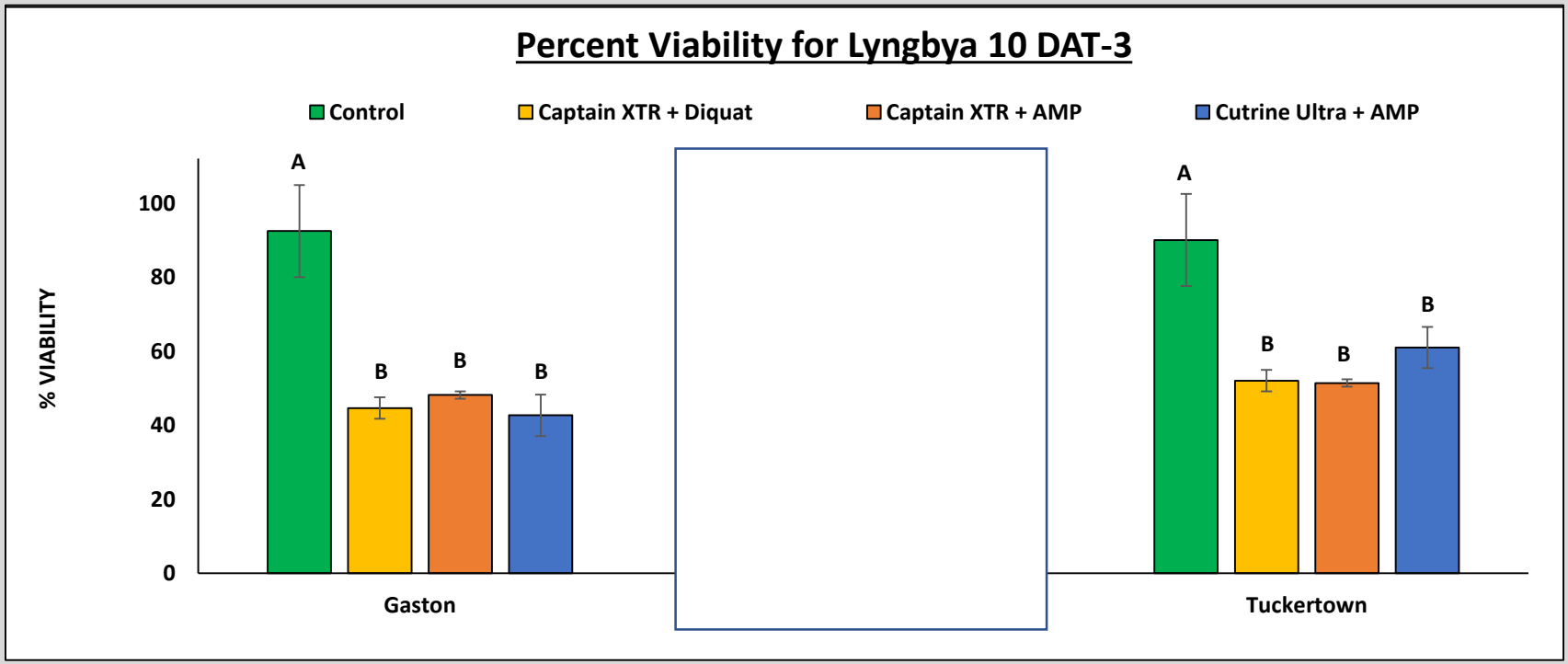
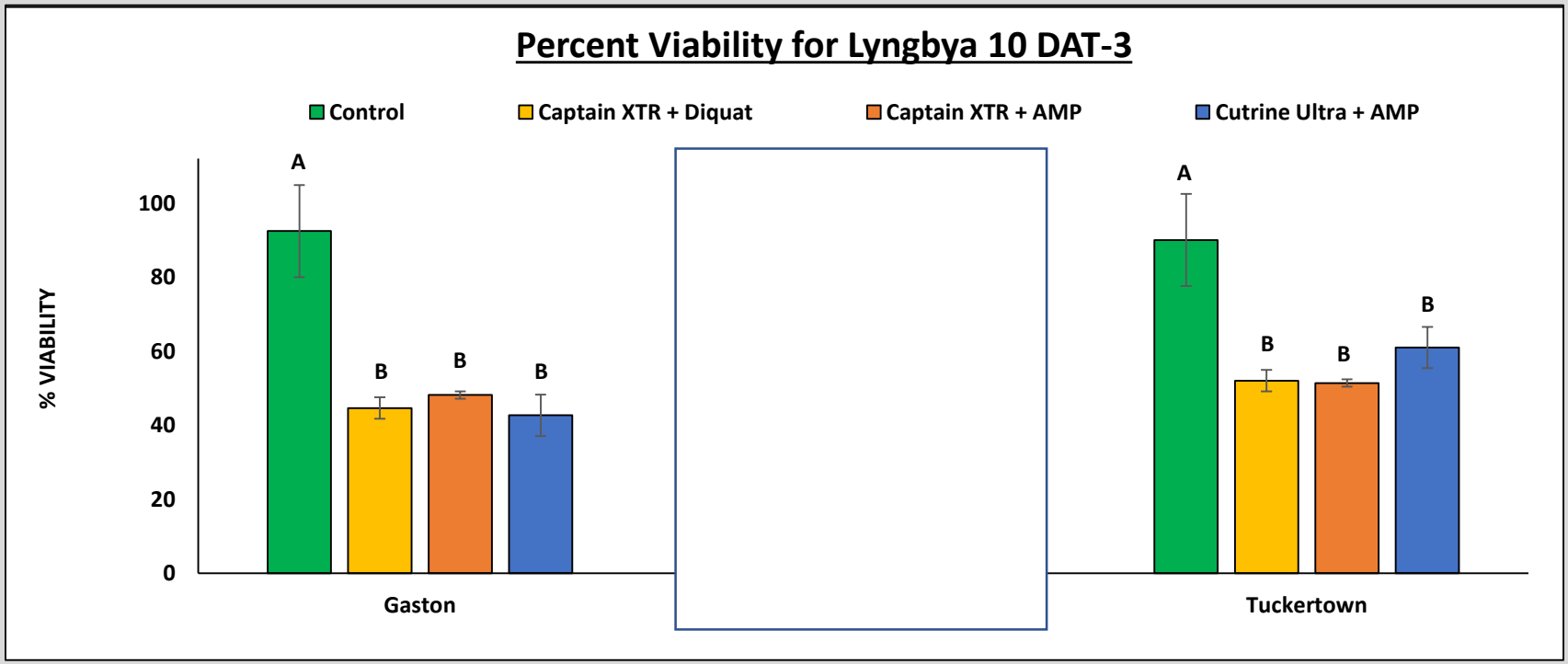
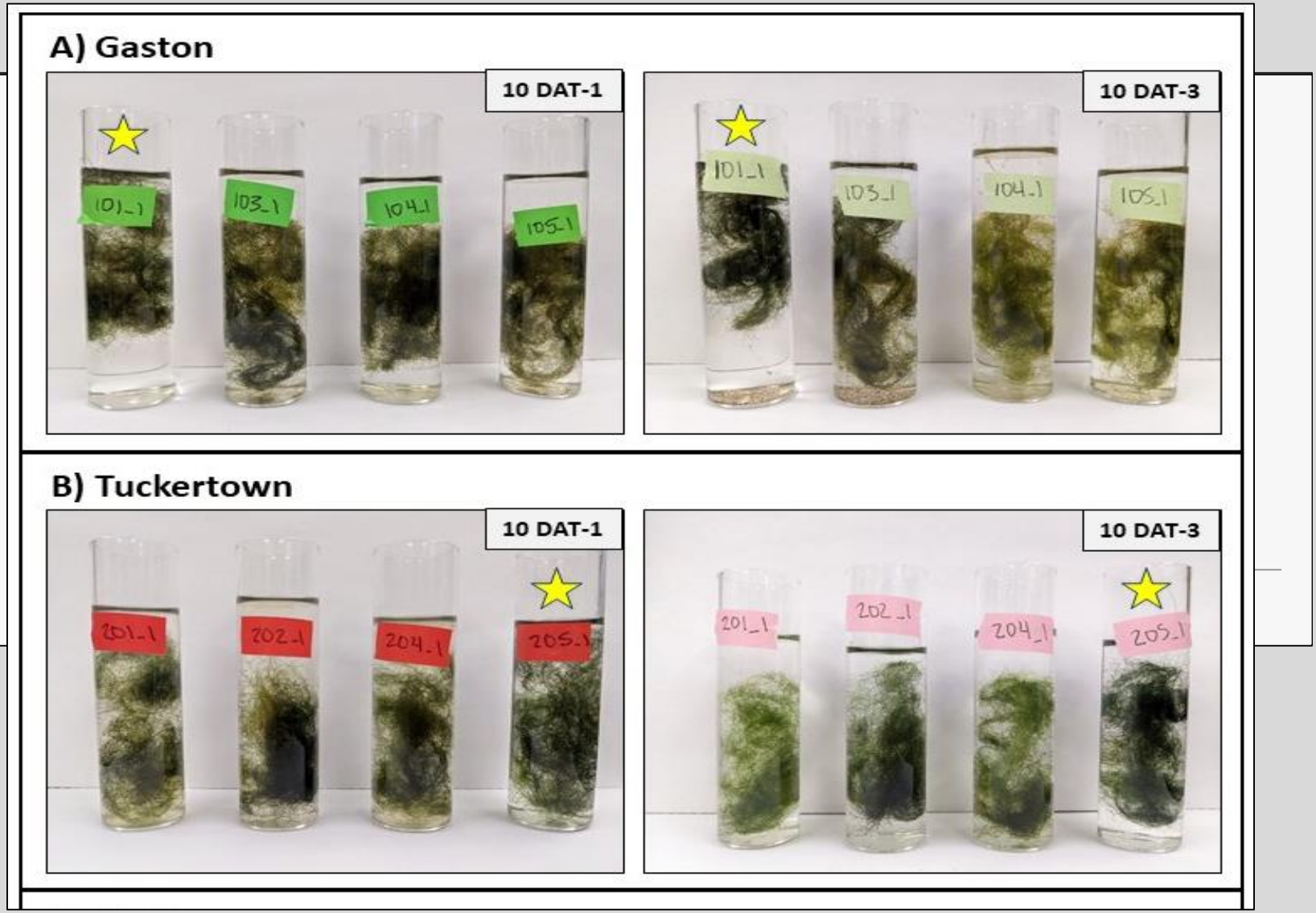


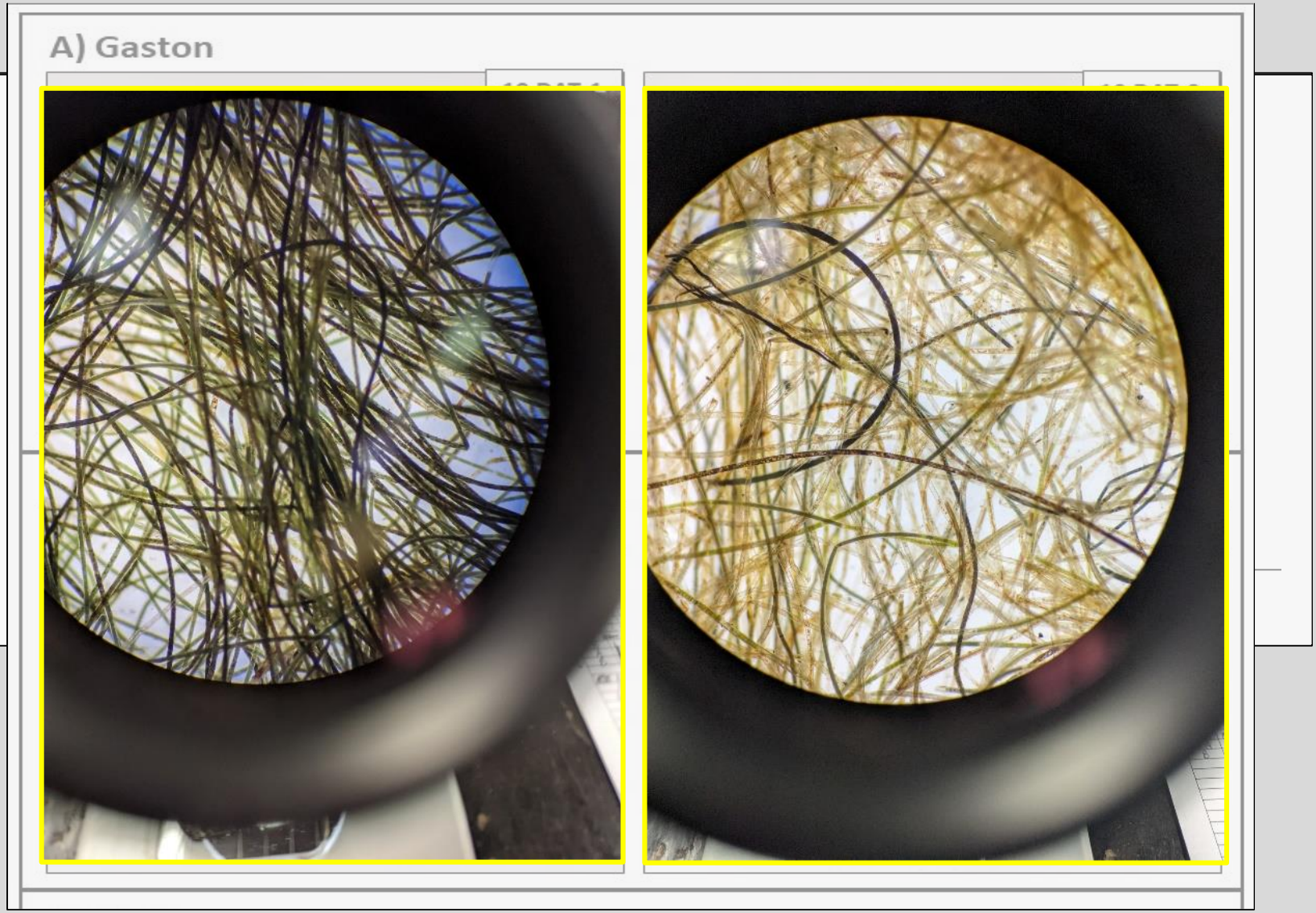
Lyngbya Herbicide Efficacy Lab Trials



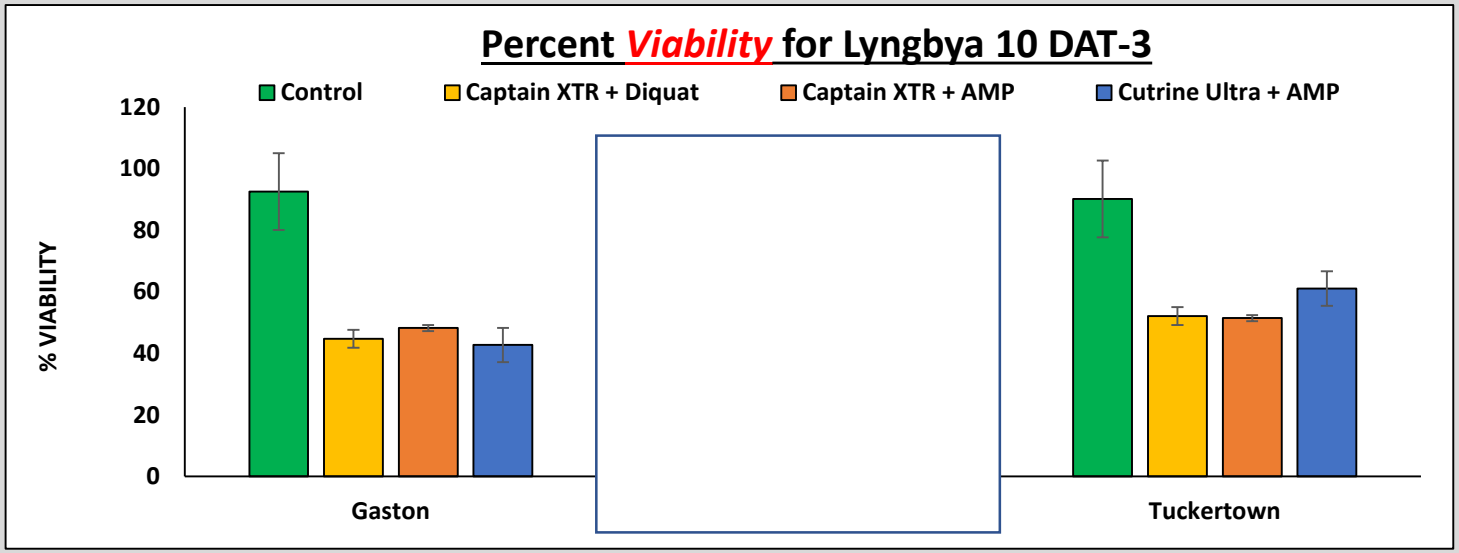
Lyngbya Herbicide Efficacy Lab Trials

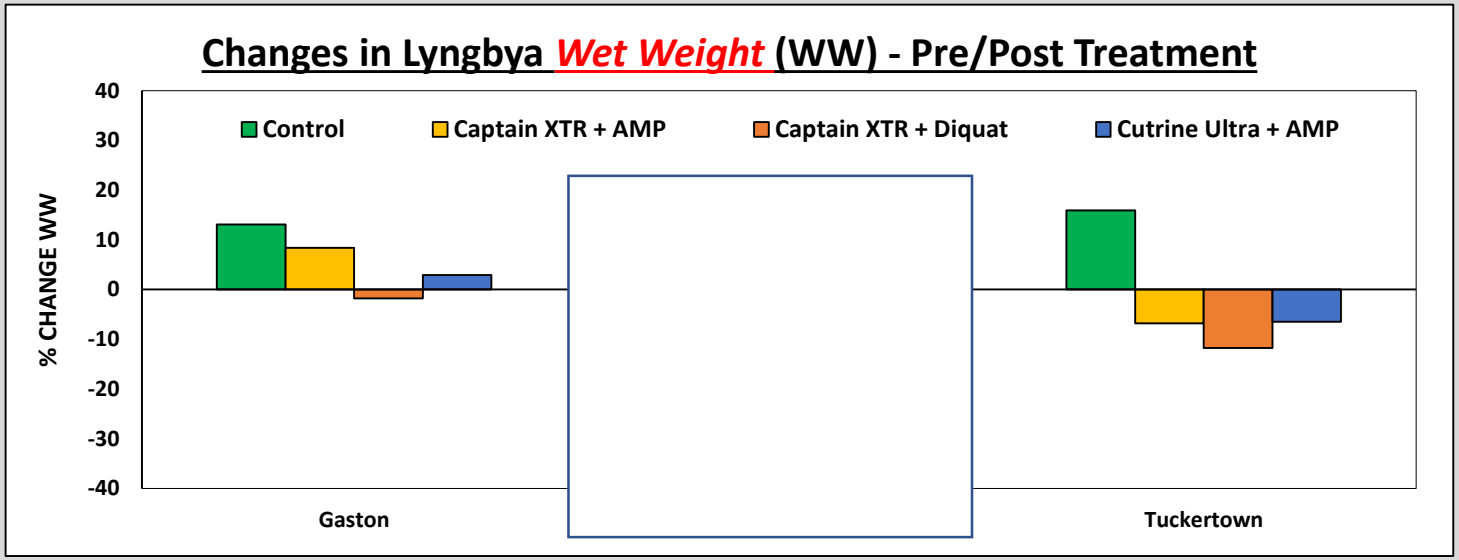


Lyngbya Herbicide Efficacy Lab Trials

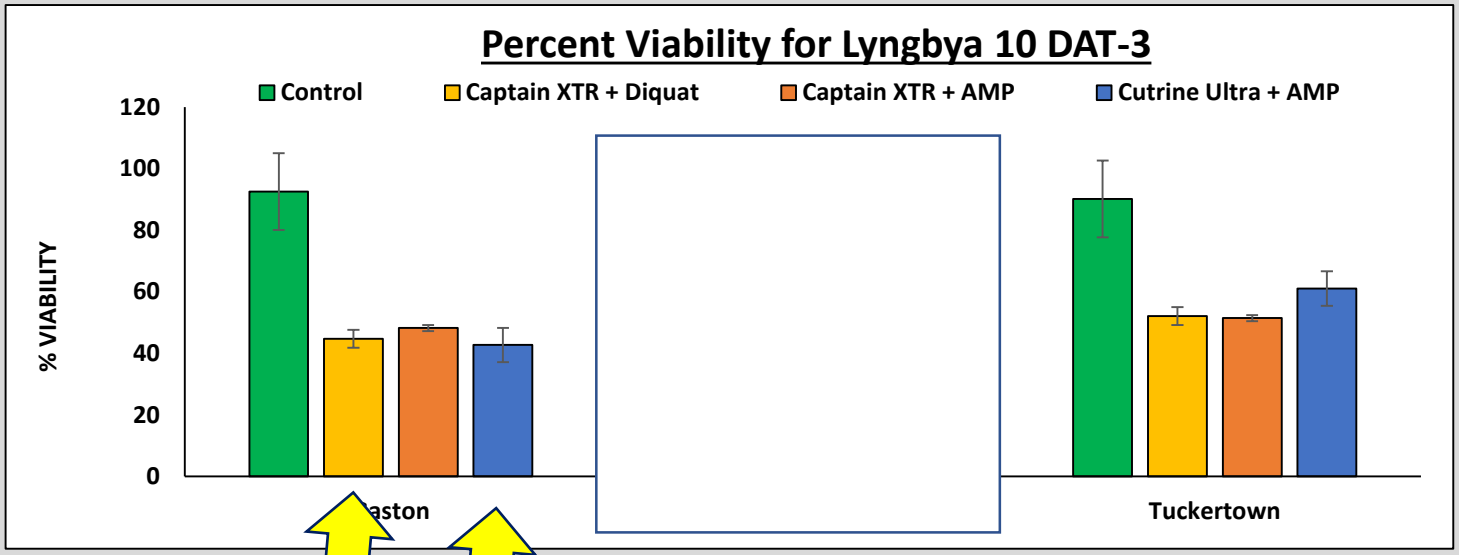


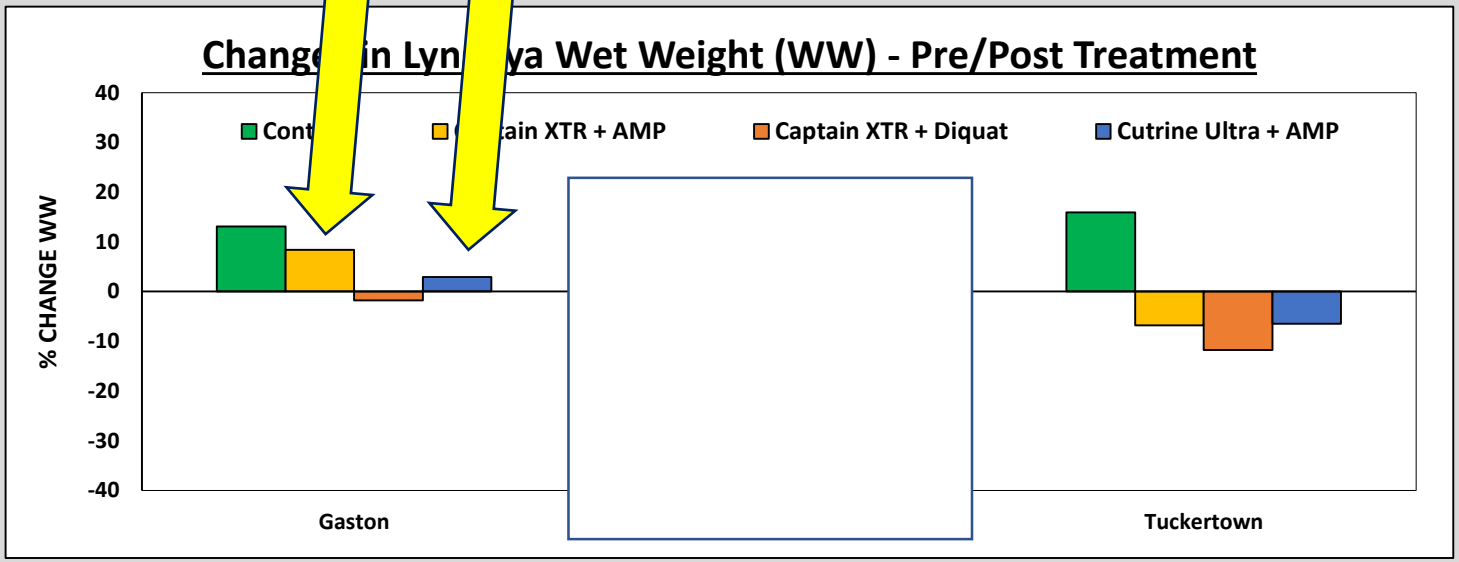
Lyngbya Herbicide Efficacy Lab Trials



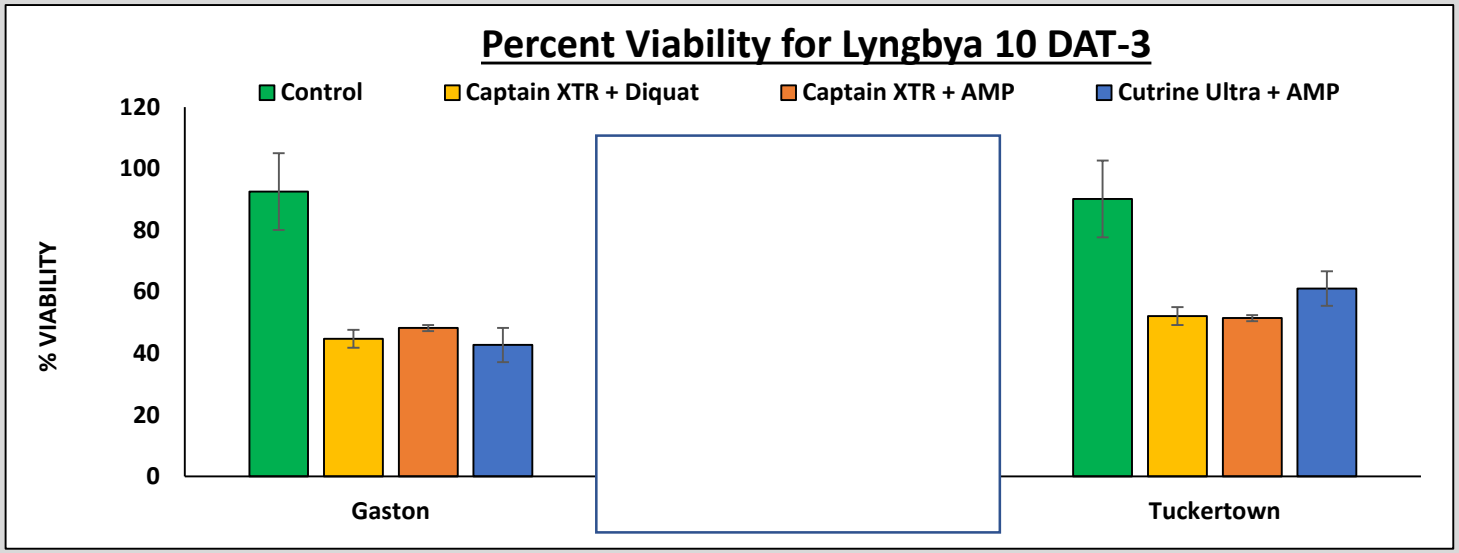


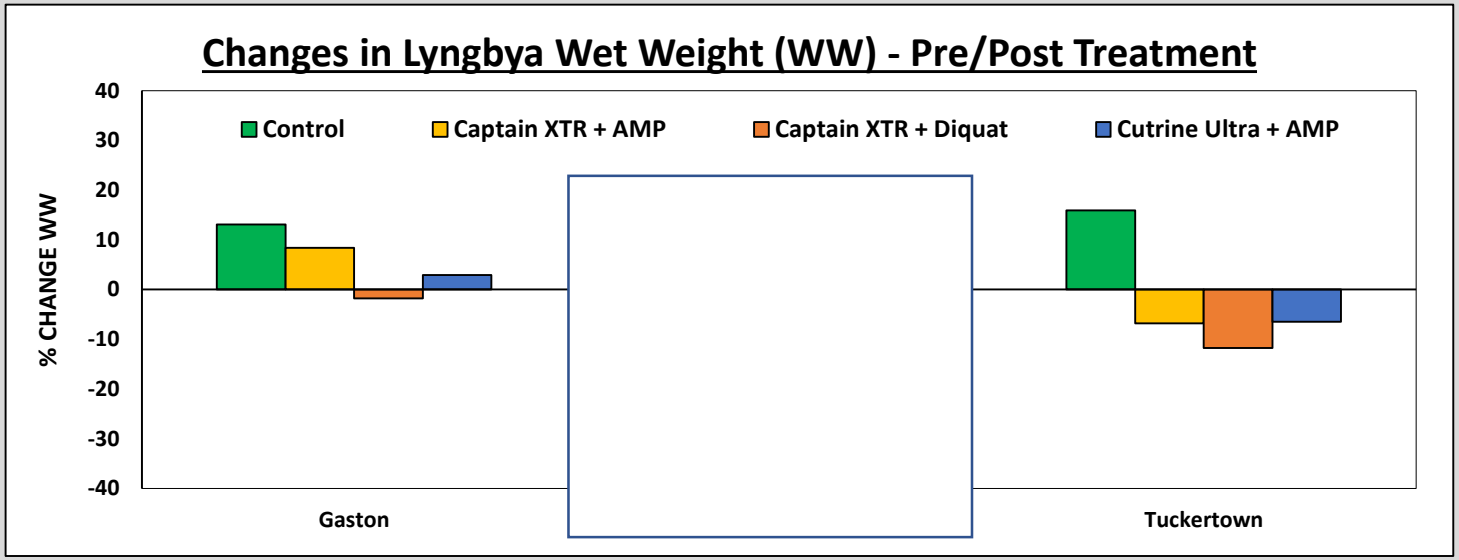
Lyngbya Herbicide Efficacy Lab Trials

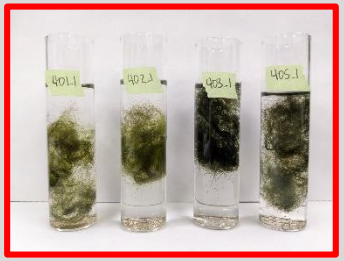




Lyngbya Herbicide Efficacy Lab Trials

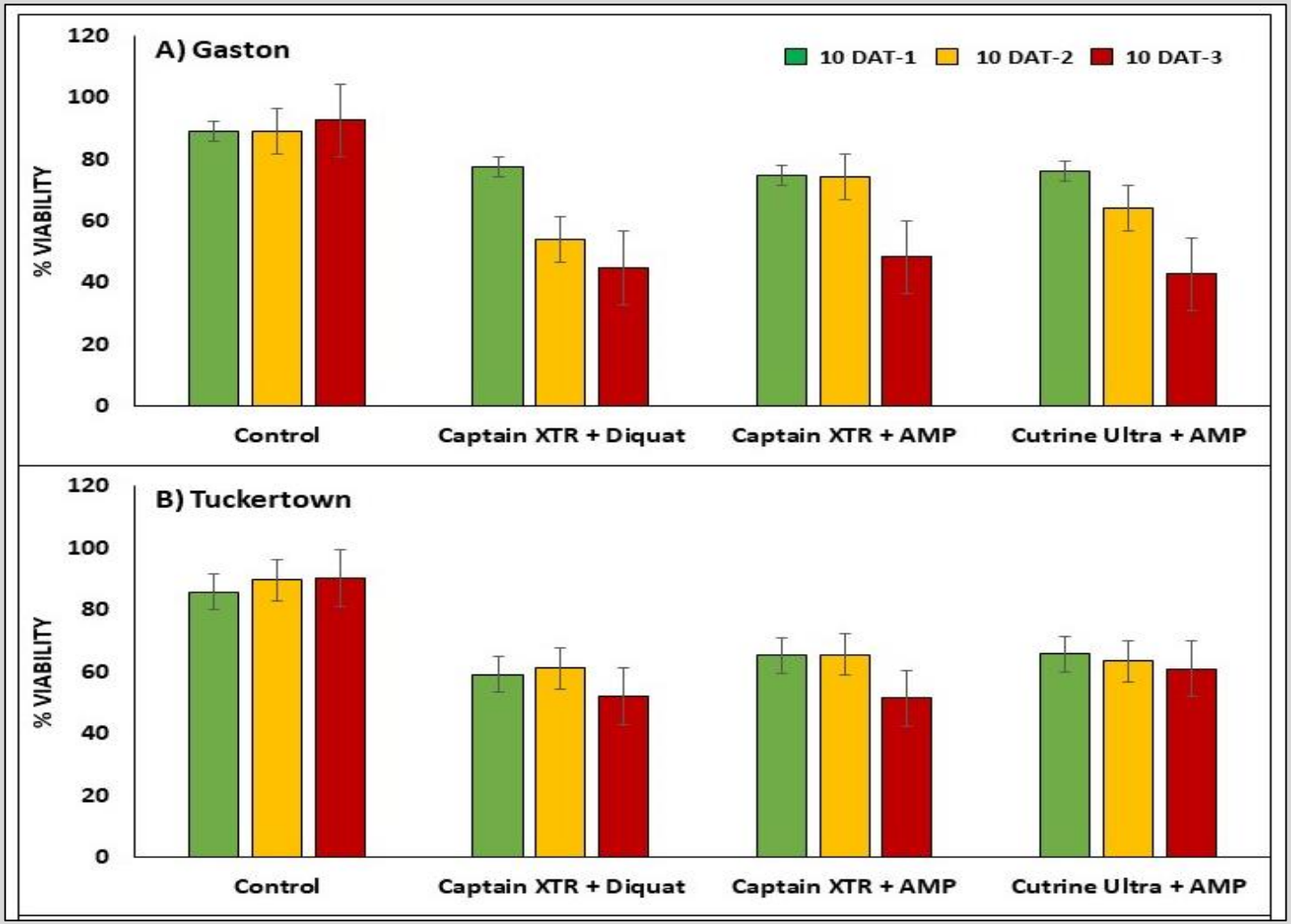




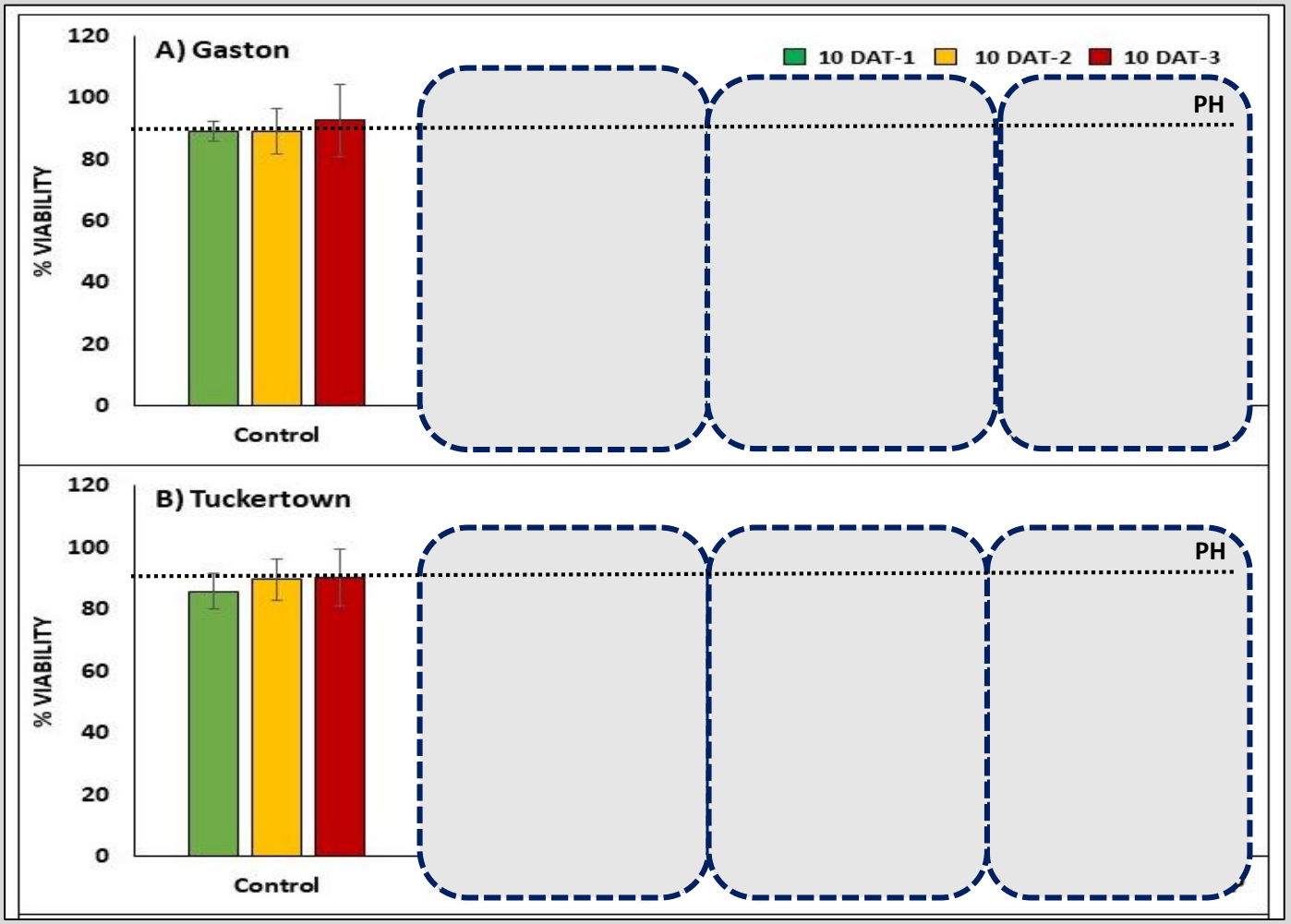


Lyngbya Herbicide Efficacy Lab Trials

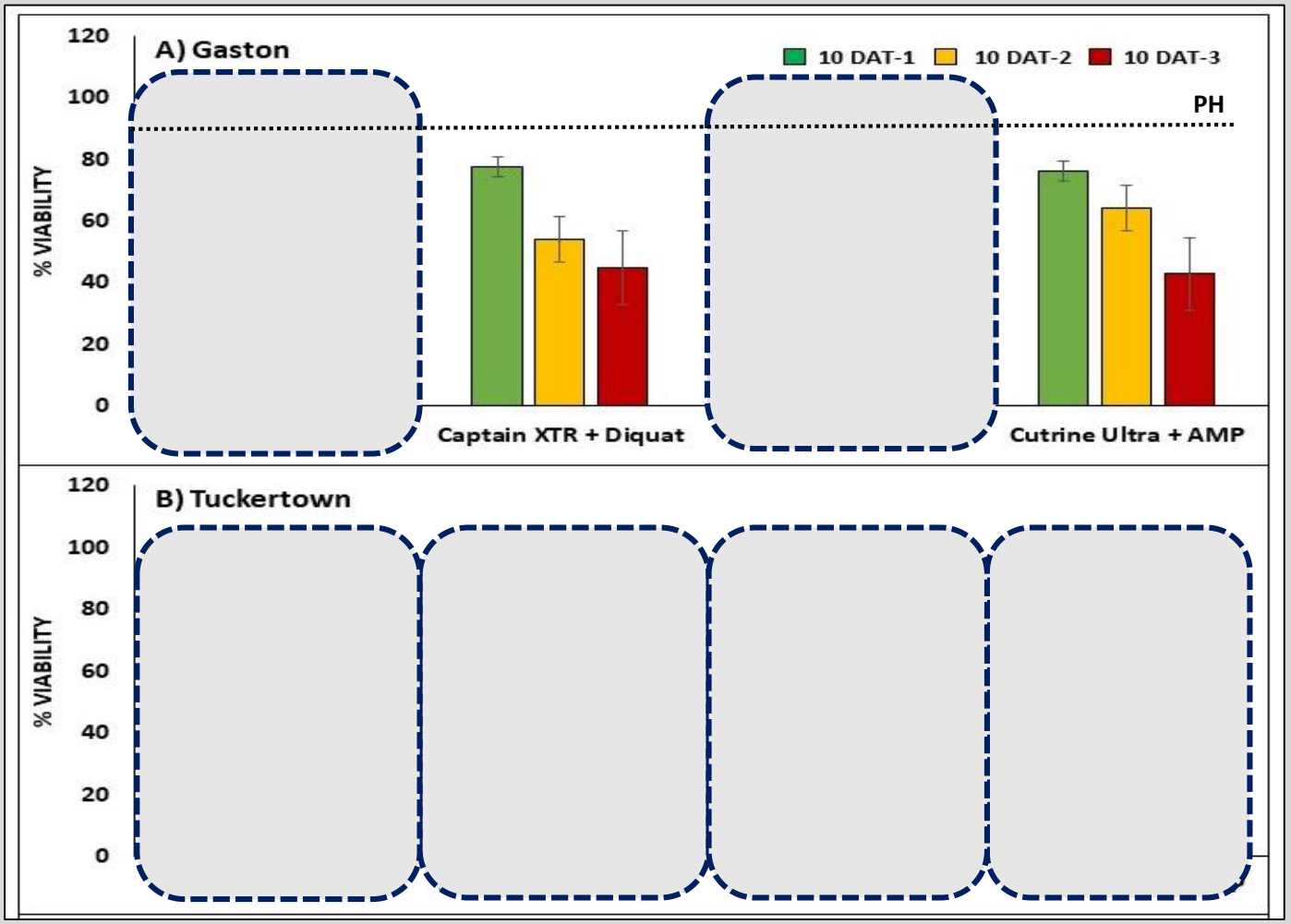
Temporal (Over Time) Reponses to Treatments



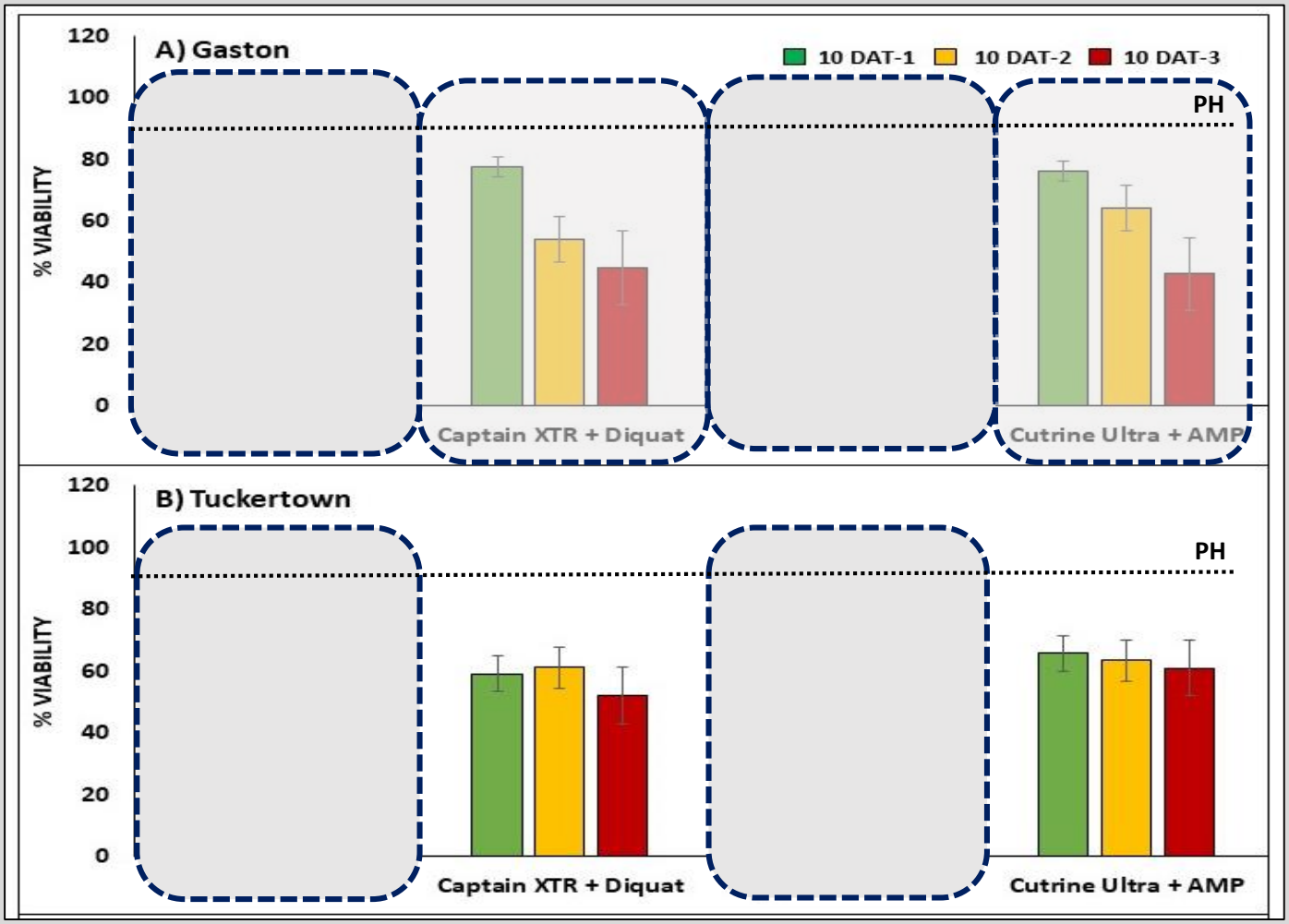
Lyngbya Herbicide Efficacy Lab Trials



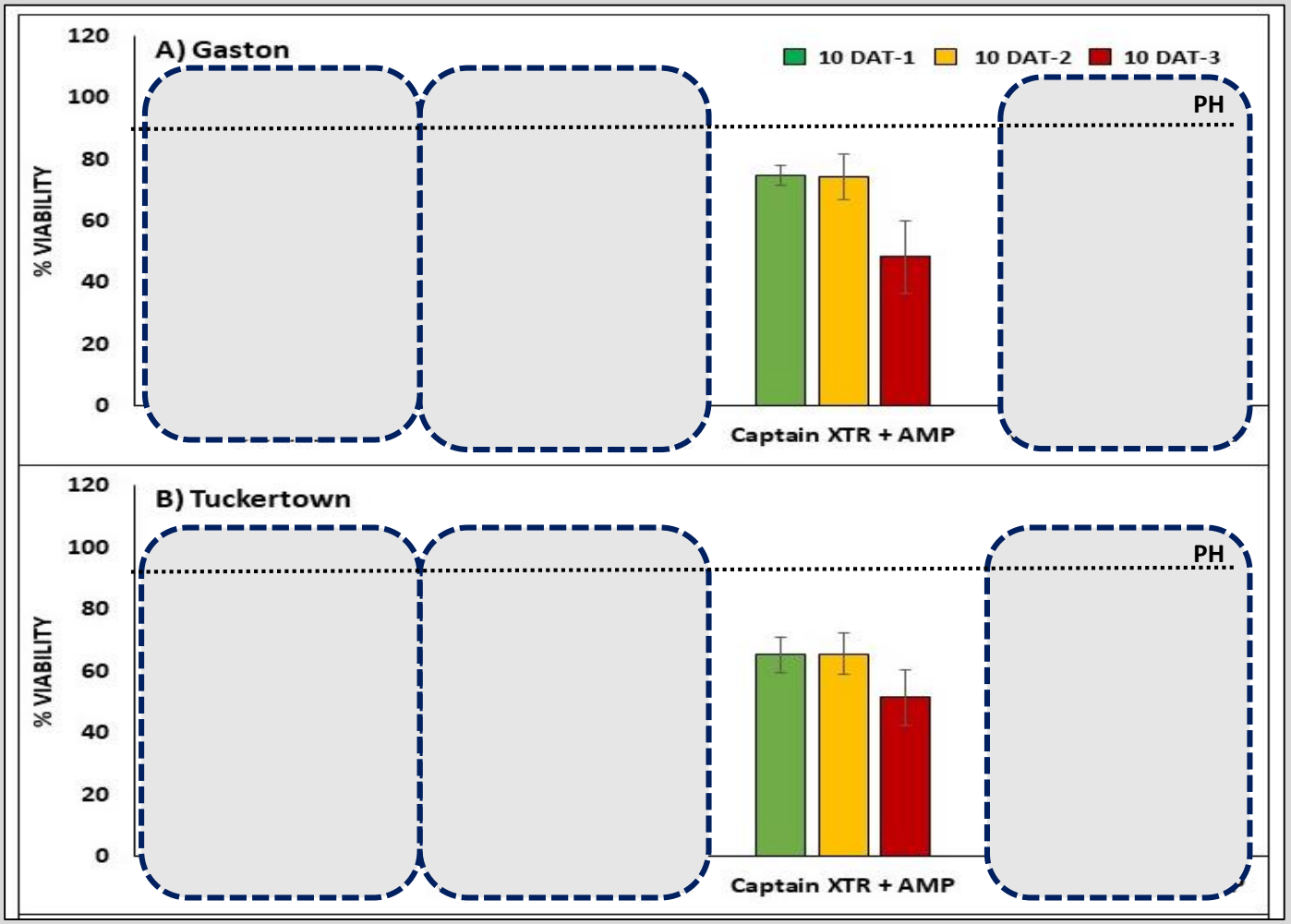
Lyngbya Herbicide Efficacy Lab Trials



Lyngbya Herbicide Efficacy Lab Trials



Lyngbya Herbicide Efficacy Lab Trials



Lyngbya Herbicide Efficacy Lab Trials

Future Research – Lab Trials

1) Determine how consecutive treatment exposures impacts lyngbya viability
   a. Acute exposure (single treatments)

2) Determine how timing of consecutive treatment exposures impacts lyngbya viability

Lyngbya Herbicide Efficacy Lab Trials

Lab Trial – Run 2

1) Second run of experiment was set-up the exact same way

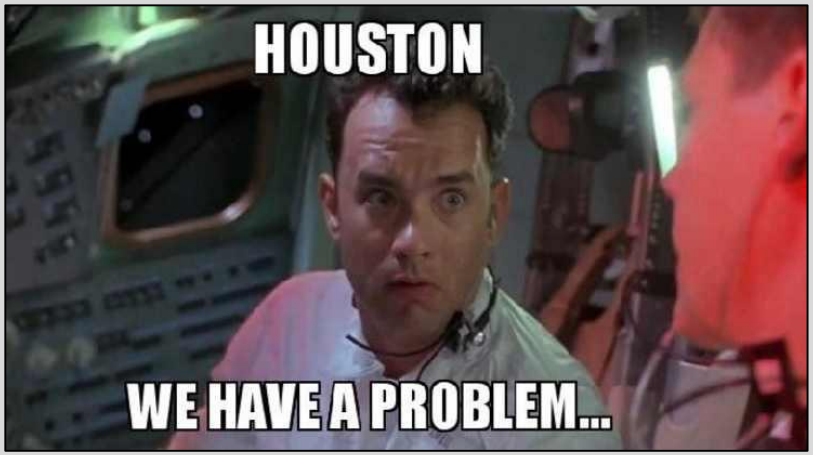
2) Evaluation after third treatment exposure

3) And…..

Lyngbya Herbicide Efficacy Lab Trials

Lab Trial – Run 2

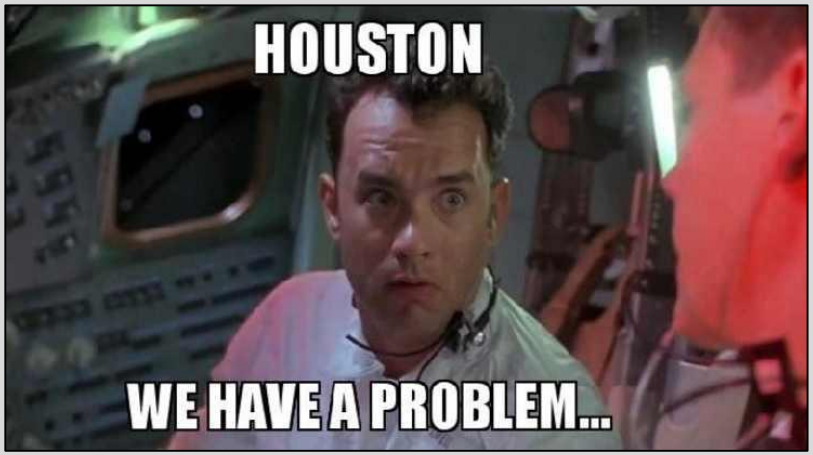
- **Incubator thermostat unit malfunctioned**



Lyngbya Herbicide Efficacy Lab Trials

Lab Trial – Run 2

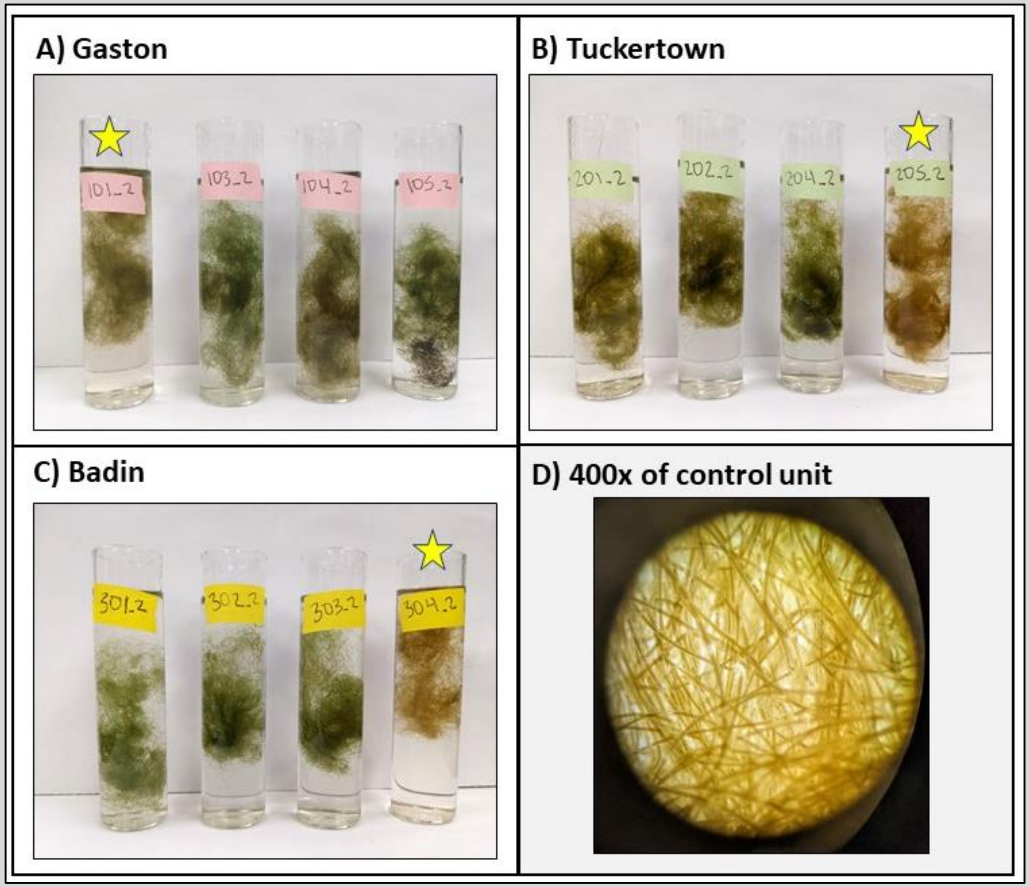
- Incubator thermostat unit malfunctioned
- Lyngbya units were exposed to air temperatures up to 55°C (131 °F) for an unknown amount of time (< 48h)



Lyngbya Herbicide Efficacy Lab Trials

Lab Trial – Run 2

- **Control units from each rep experienced a greater negative impact of the extreme temperatures than the treated unites**
- **Protective response to treatments??**



Lyngbya Herbicide Efficacy Lab Trials

Future Research – Lab Trials

1) Determine how consecutive treatment exposures impacts lyngbya viability
   a. Acute exposure (single treatments)

2) Determine how timing of consecutive treatment exposures impacts lyngbya viability

Lyngbya Herbicide Efficacy Lab Trials

Future Research – Lab Trials

1) **Determine how consecutive treatment exposures impacts lyngbya viability**
   a. Acute exposure (single treatments)
   b. **Chronic exposure (years)**
2) Determine how timing of consecutive treatment exposures impacts lyngbya viability
3) **Determine how varying water temperatures impacts the efficacy of lyngbya treatments**

Lyngbya Herbicide Efficacy Lab Trials

Future Research – Lab Trials

1) **Determine how consecutive treatment exposures impacts lyngbya viability**
   a. Acute exposure (single treatments)
   b. **Chronic exposure (years)**
2) Determine how timing of consecutive treatment exposures impacts lyngbya viability
3) **Determine how varying water temperatures impacts the efficacy of lyngbya treatments**
4) **Continue exploring the efficacy of different algaecide combinations.**

Lyngbya Herbicide Efficacy Lab Trials

Proposed Research – Lab Trials

1) Determine how consecutive treatment exposures impacts lyngbya viability
   a. Acute exposure (single treatments)
   b. Chronic exposure (years)
2) Determine how timing of consecutive treatment exposures impacts lyngbya viability
3) Determine how varying water temperatures impacts the efficacy of lyngbya treatments
4) Continue exploring the efficacy of different algaecide combinations.

Outline

Water Quality

- Water Chemistry and Nutrients
- Hydrosoil Characteristics

Lyngbya Management

- Environmental Factors Influencing Lyngbya Growth

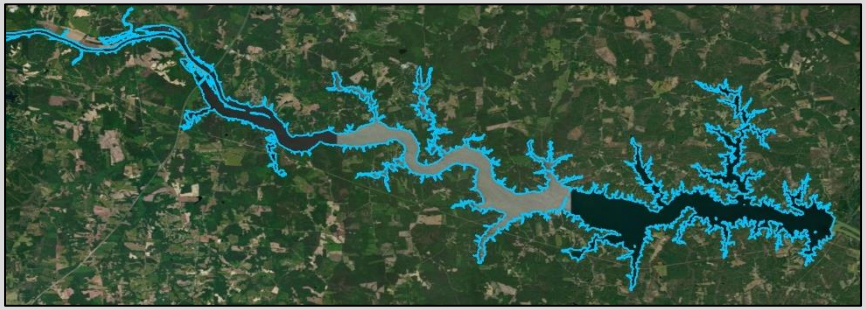
- Environmental - Impacts
- Human Health - Lyngbya Toxin Potential
- Management - Lyngbya Treatments
  - Lab Trials

Future Research Needed!

Questions?

Lake Gaston Weed Control Council

NC STATE UNIVERSITY



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