

# WHITE LAKE

## “What the pH happened?”

Division of Water Resources

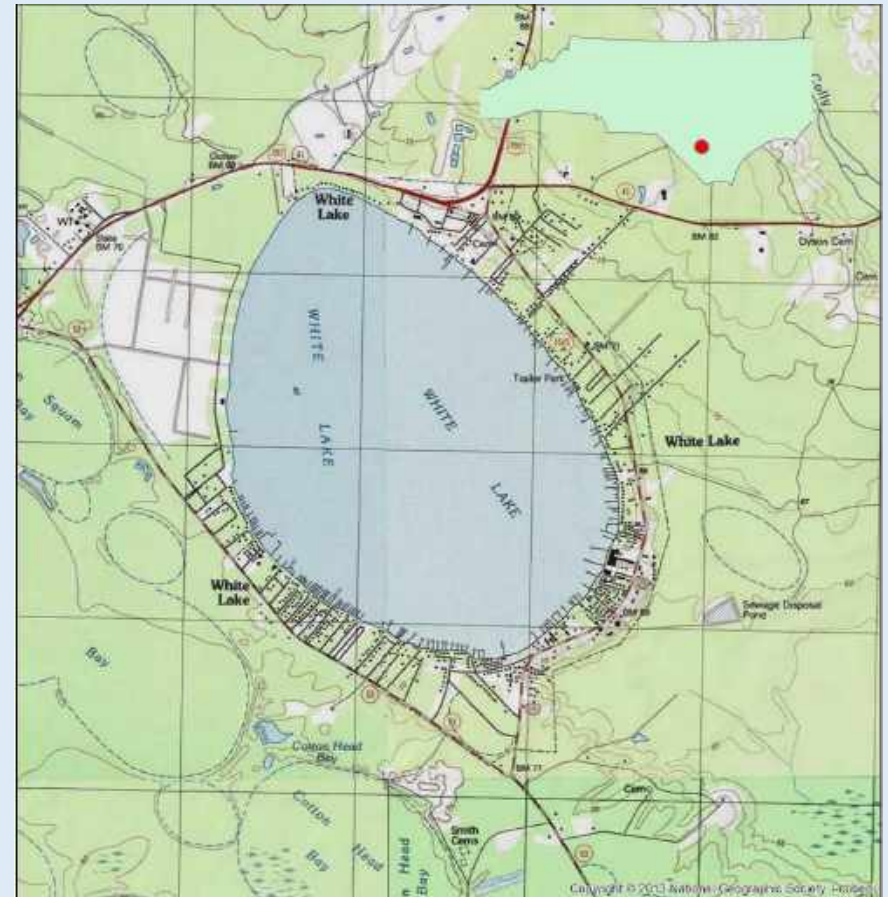
Fayetteville Regional Office

Water Sciences Section

Special Study 2015

# White Lake: Background

- Carolina Bay Lake, Bladen County
- State Park
  - Shoreline privately owned
  - Limited public access
- Springs Feed Lake
- White Sandy Bottom and Beaches
- Depth:  $\pm$  2.5 M
- Monitored Since 1981
  - Clean Lakes Program
  - Basin-wide Monitoring Program
- Most Recent 2015



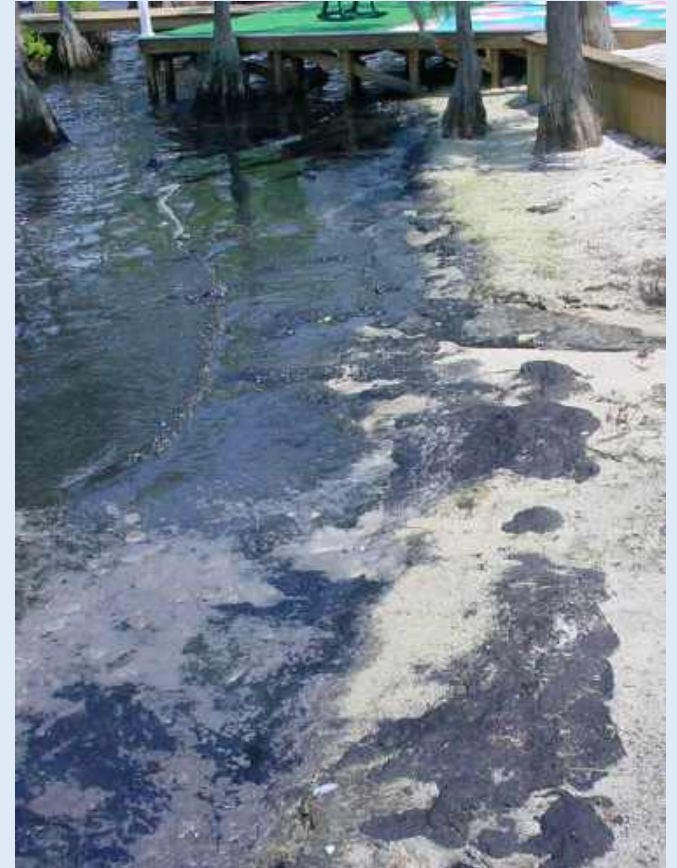
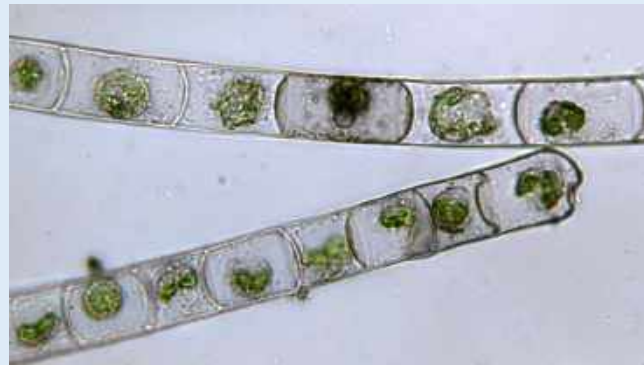
# White Lake: Water Quality (the past)

- Great H<sub>2</sub>O Quality
- Crystal Clear Water
- Low Nutrient
- Low pH
- Good Fishing
- **North Carolina Trophic State Index (NCTSI): Oligotrophic**



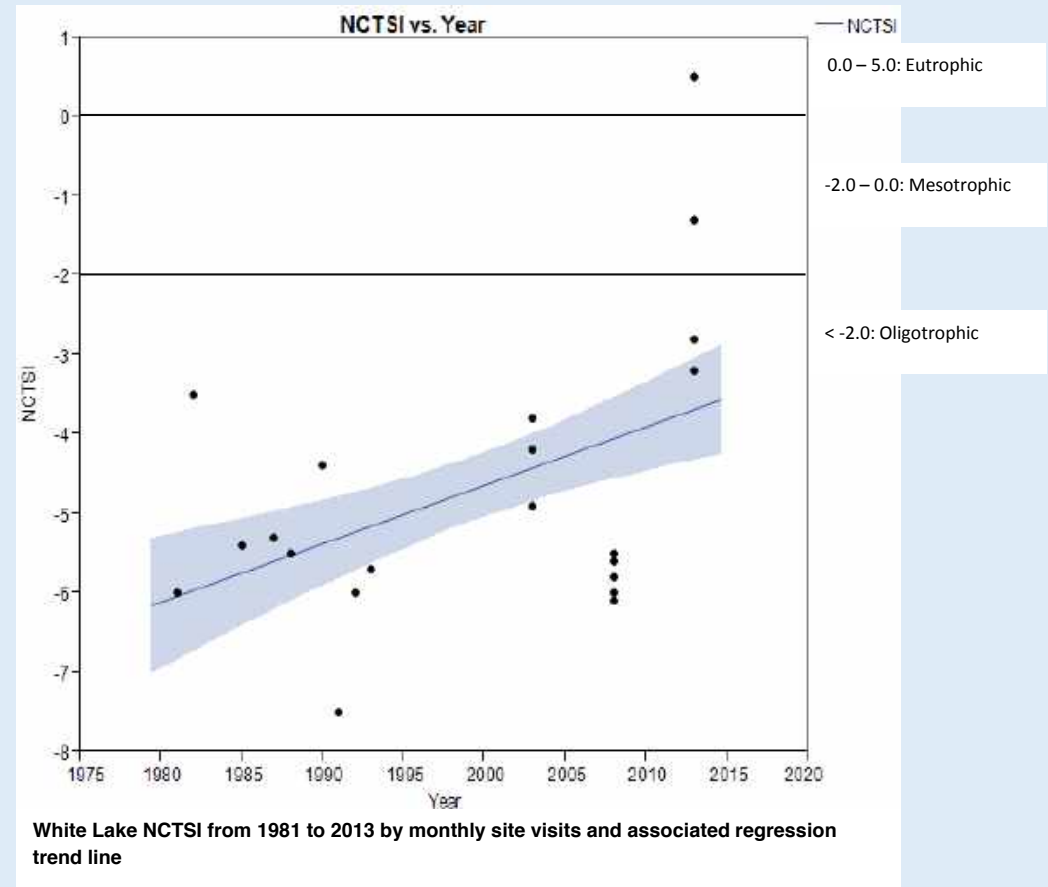
# White Lake: Historic Water Quality Issues

- Summer Algae Die-off
- Benthic Filamentous Green Mats
  - *Spirogyra*, *Oedogonium* & *Ulothrix*
- Black, Smelly & Stains



# White Lake: Basin-wide Monitoring 2013

- Major H2O Quality Changes
  - Chemistries
  - Clarity
- NCTSI: **Mesotrophic to Eutrophic**
- Odd Weather Year
  - May = Abnormally dry
  - June = 2<sup>nd</sup> Wettest since 1895
  - July = 3<sup>rd</sup> Wettest since 1895
    - (Rain = 10- 15 inches)
- Trend Analysis On Historic Data Highlight Changes



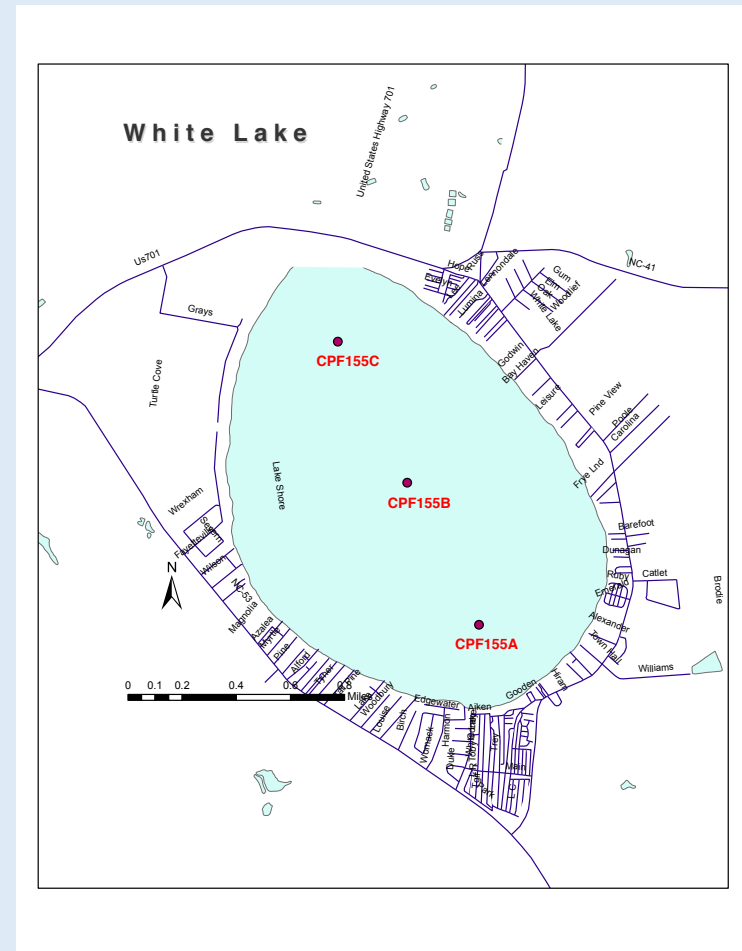
# White Lake: Special Study 2015

## Goal:

- Repeat 2013 assessment
  - Three stations
  - May through September
- Measure Physical Conditions
- Measure Water Chemistries

## Purpose:

- Verify Chemistry Changes
- Verify Trophic Changes
- Investigate Water Color



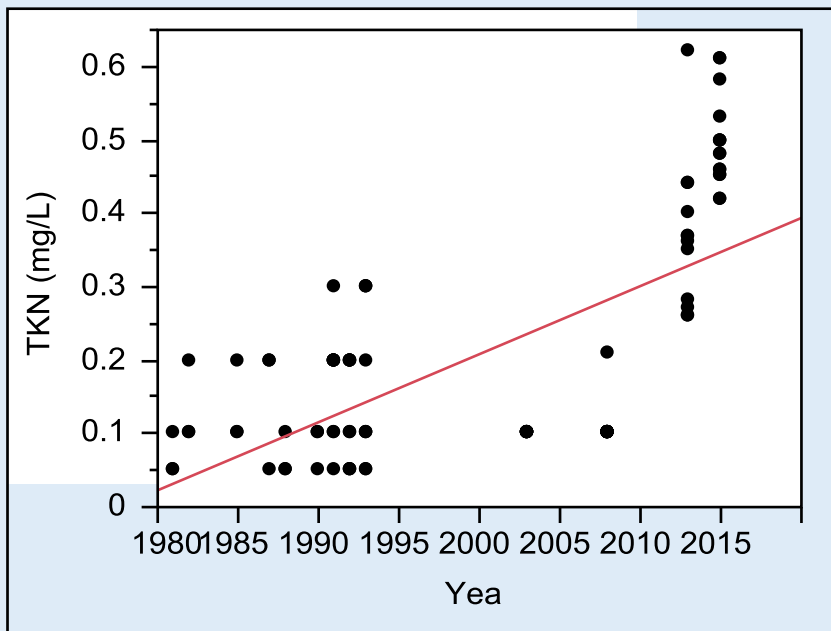
# Special Study: Water Chemistries

## Total Kjeldahl Nitrogen

Historic = 0.05 to 0.30 mg/L

2013 = 0.26 to 0.62 mg/L

2015 = 0.42 to 0.61 mg/L

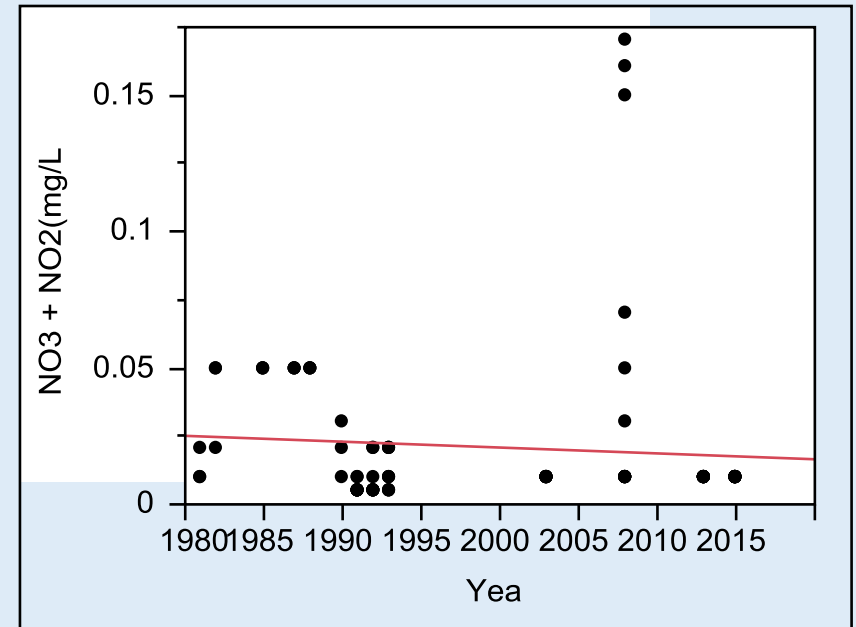


## Nitrate + Nitrite

Historic = 0.1 to 0.17 mg/L

2013 = 0.01 mg/L

2015 = 0.01 mg/L



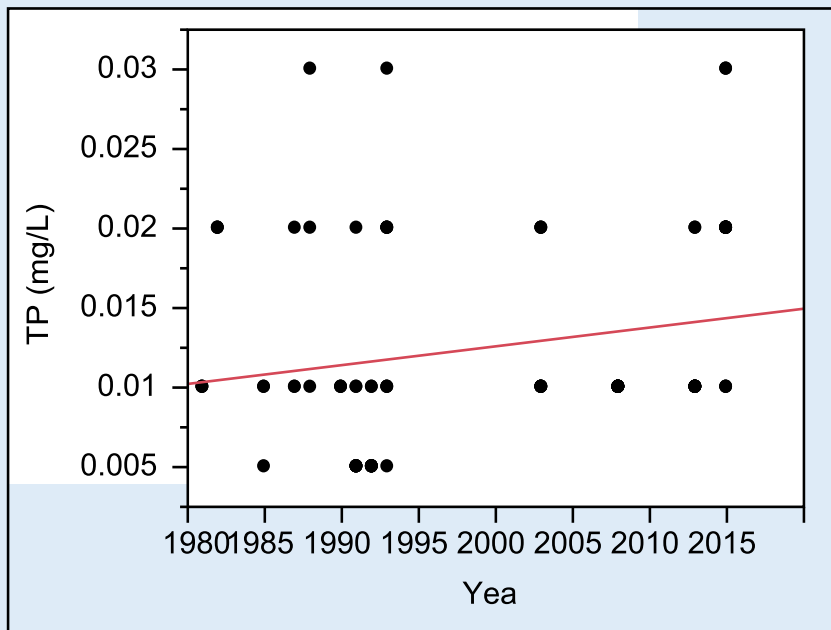
# Special Study: Water Chemistries

## Total Phosphorus

Historic = 0.005 to 0.03 mg/L

2013 = 0.01 to 0.02 mg/L

2015 = 0.01 to 0.03 mg/L

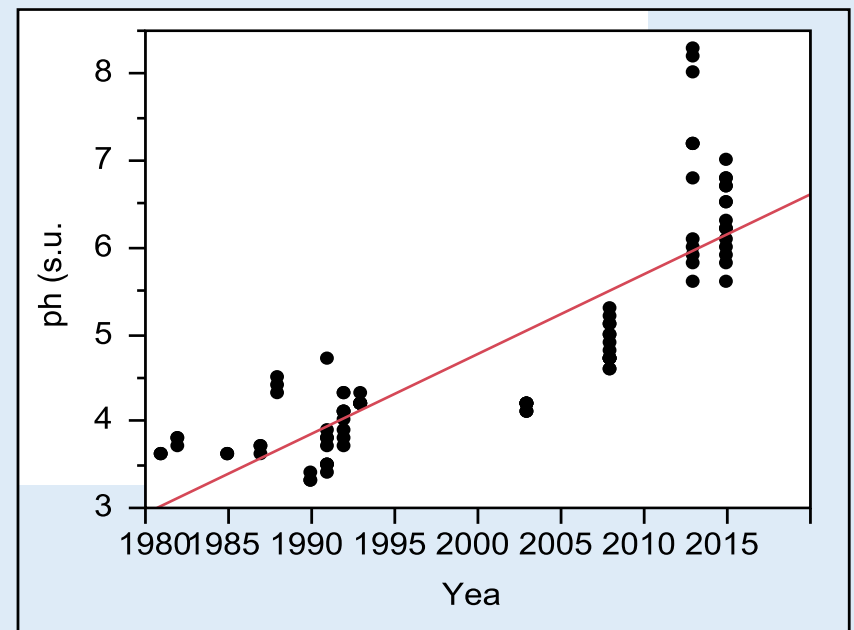


## pH

Historic = 3.3 to 5.3 s.u.

2013 = 5.6 to 8.3 s.u.

2015 = 5.6 to 7.1 s.u.





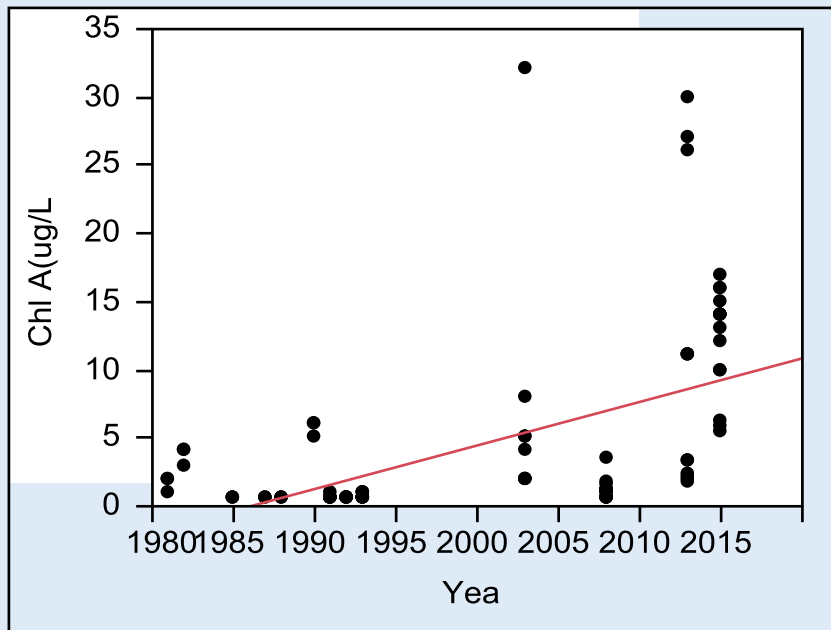
# Special Study: Water Clarity

## Chlorophyll-a

Historic = 1.6 to 6.0  $\mu\text{g/L}$

2013 = 6.0 to 30.0  $\mu\text{g/L}$

2015 = 5.8 to 17.0  $\mu\text{g/L}$

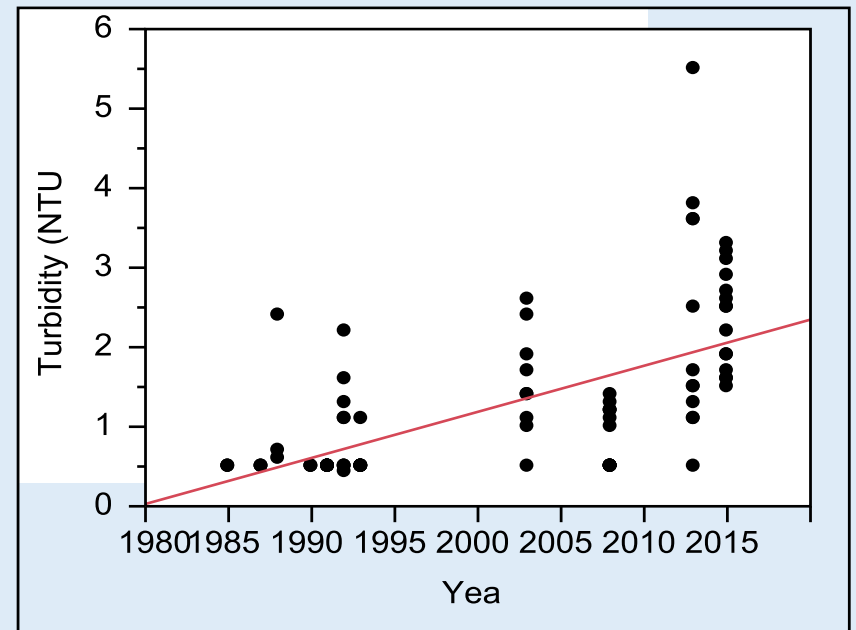


## Turbidity

Historic = 0.4 to 2.6 NTU

2013 = 1.0 to 5.5 NTU

2015 = 1.5 to 3.3 NTU



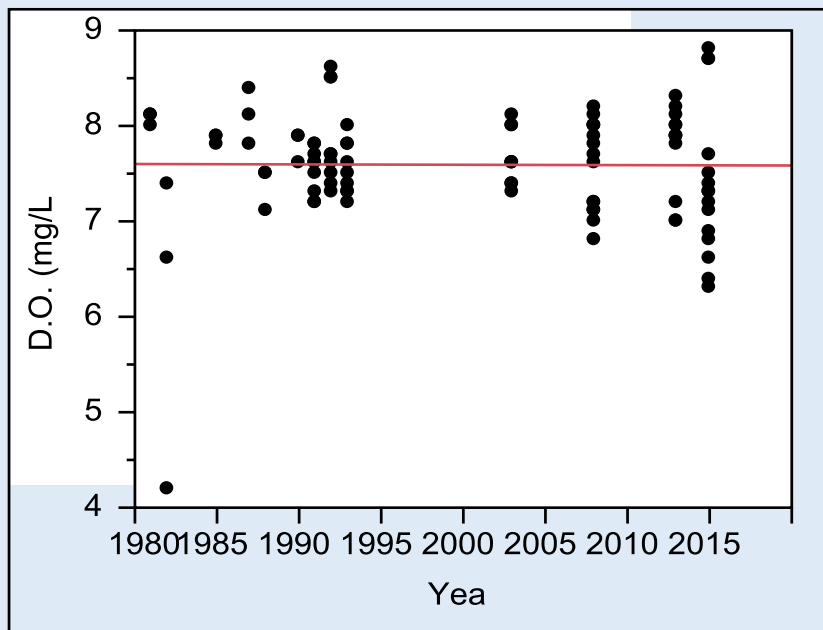
# Special Study: Physical Conditions

## Dissolved Oxygen

Historic = 4.2 to 8.7 mg/L

2013 = 6.8 to 8.4 mg/L

2015 = 6.3 to 8.9 mg/L

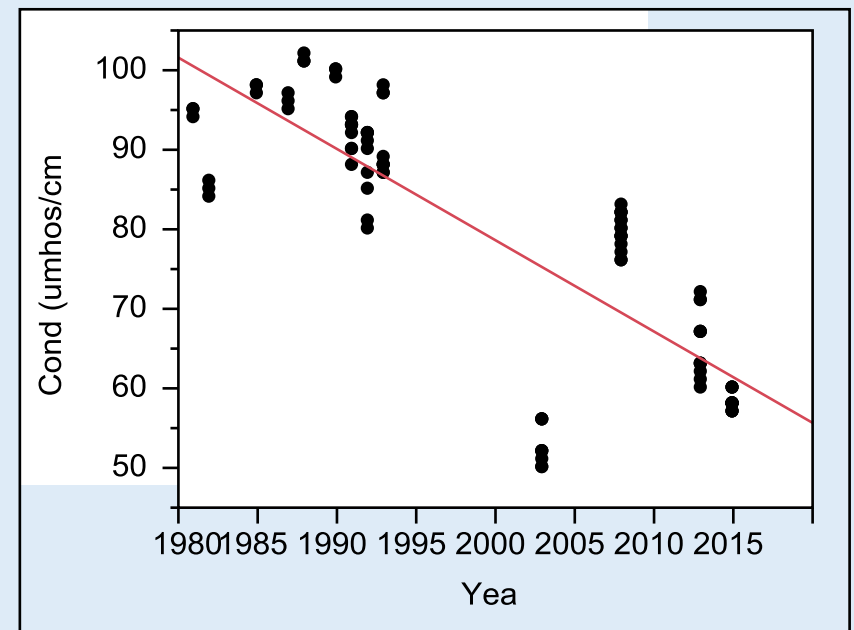


## Conductivity

Historic = 50 to 105  $\mu$ mhos/cm

2013 = 60 to 75  $\mu$ mhos/cm

2015 = 57 to 60  $\mu$ mhos/cm

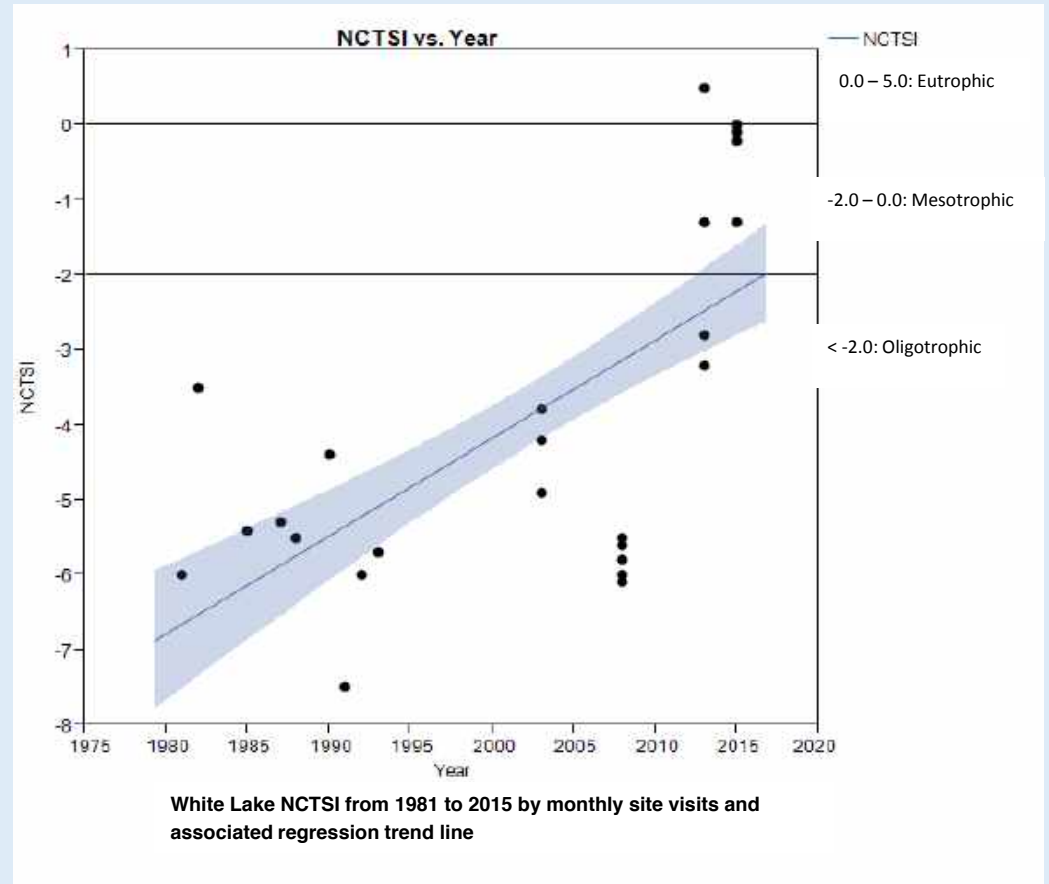


# Special Study: White Lake 2015

## Results:

- NCTSI = **Mesotrophic**
- Chemistries have changed
- pH has changed
- Physical conditions stable

Trend continues toward eutrophication



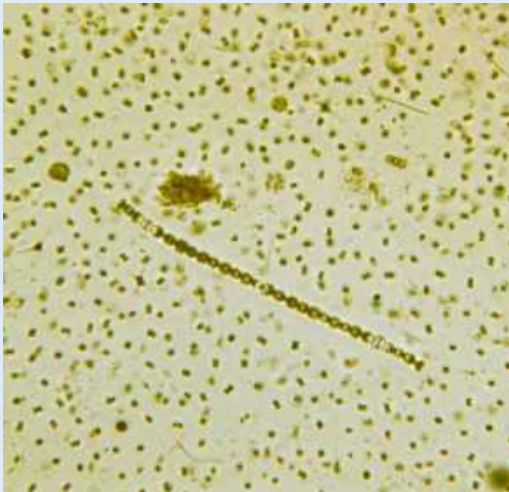
# Eutrophication? What Does That Mean?

- Trophic Status = Productivity = Nutrients (i.e., plant food)
  - Oligo = Few
    - Low nutrients, low productivity, low diversity
  - Meso = Middle
    - Some nutrients, more productivity, more diversity
  - Eu = Well/Good
    - Rich in nutrients, a lot of productivity, a lot of diversity
  - Hyper Eu = Above/Over
    - Over enriched in nutrients, excessive productivity, very diverse
    - Likely impaired for chlorophyll-a, dissolved oxygen and/or pH

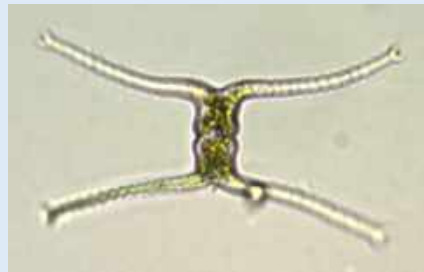
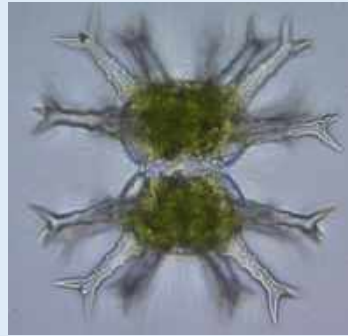
# Changes in Algae

## • Historically Dominant

- Greens
  - Desmids
- Dinoflagellates



- Benthic filaments
- Low pH tolerant



## • Dominant 2015 Study

- Greens
  - Desmids
- Dinoflagellates
- Bluegreens
  - *Planktolyngbya*



- Phytoplankton
- Neutral pH

# Changes in Fish Community

## NC Wildlife Resources Commission Fish Community Assessment 2015

- Historically Dominant

- Yellow Bullhead
- Yellow Perch
- Bluespotted Sunfish
- Warmouth



- All Low pH Tolerant

- Dominant 2015 Survey

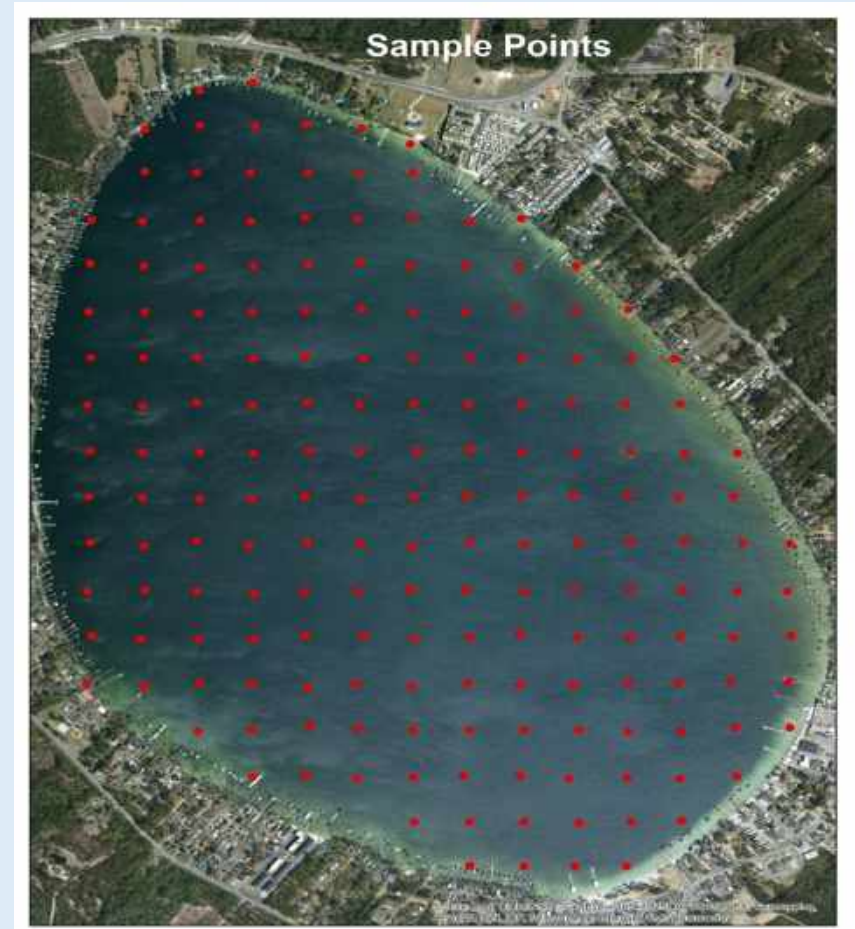
- Largemouth Bass
- Yellow Perch
- Bluegill



- Bass and Bluegill Not Low pH Tolerant

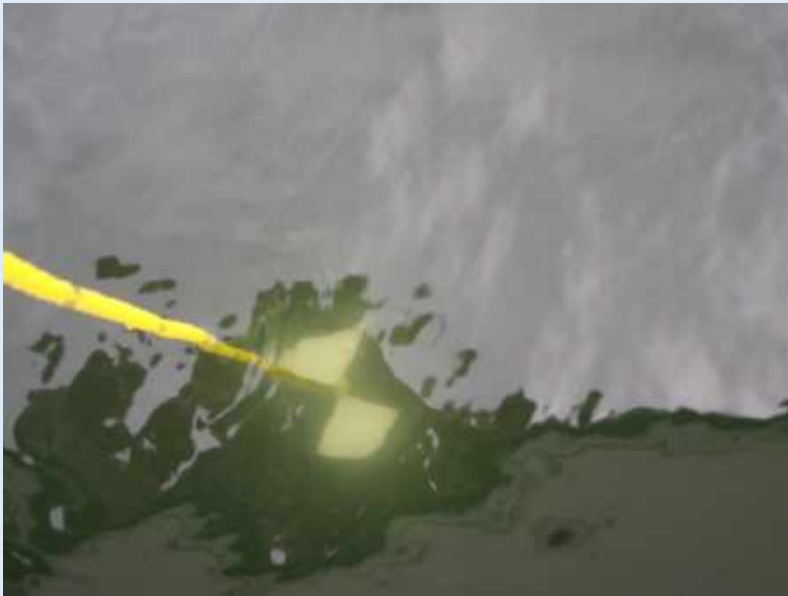
# Changes in Aquatic Plants

- Better *Hydrilla* Survey
- NCSU 2014 study
  - 182 sample points
  - 162 had aquatic plants present
    - 89%!
- Most common
  - *Myriophyllum humile* (54%)
- Also abundant
  - Sphagnum moss (43%)  
& *Eleocharis* (40%)
- All native
  - NO *HYDRILLA*
- Plant Community Good
  - “Healthy and Vigorous”



# White Lake: Discolored Water

- Obvious Discoloration Throughout Lake



August 2013 Mid-lake



June 2015 North End



July 2015 South End



# Water Color Study

- Goal: Document Water Color
- Determine: Apparent or True?
- Method:
  - Photograph secchi disk
    - surface, mid-depth (1m) and bottom (2m)
  - Collect water
    - surface, mid-depth (1m) and bottom (2m)
  - Document color of collected water
    - Visual assessment
    - Photograph



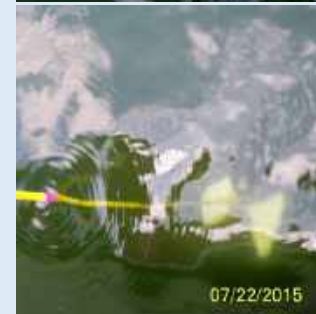
# Water Color: In the Lake

- Secchi Disk
  - determines transparency and light attenuation
- Visible Green Tint
- Secchi Disk Visible to Bottom (hard to photo)

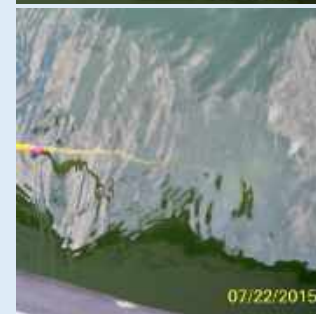
Surface



Mid-depth



Bottom



# Water Color: In the Glass Jars

- Water Collected at 3 Depths
  - Poured into Glass Jars
  - Shipped on ice
- Visual Analyses
  - Crystal Clear
- Jars with Background Color
- Water Reflects Color

Results:

Water Color Reflection of Benthic Plants



# White Lake: Conclusions

- Water Quality Trends Continue To Shift Toward Eutrophication
  - More productivity, more diversity
- pH = Neutral
  - Flora and fauna changes
- Water Color Crystal Clear
  - Color reflection off benthic plants
- Important next steps!
  - Ground Water
  - Drainage Ditches
  - Local Involvement
    - Stormwater runoff/Nutrient control
    - Brunswick Community College study
- What about you?



White Lake Water vs Jordan Lake Water  
(Mesotrophic) (Hyper Eutrophic)

# Many Thanks!!

- White Lake Marina
- State Parks and Recreation
  - Kristen Woodruff
- DWR Water Sciences Section
  - Intensive Survey Branch
    - Debra Owen & Katharine DeVilbiss
- North Carolina State University Aquatic Plant Survey
  - Rob Richardson & Justin Nawrocki
- North Carolina Wildlife Commission
  - Michael Fisk



# White Lake: Contact Information

Division of Water Resources

Fayetteville Regional Office (910) 433-3300

Water Sciences Section (919) 743-8400



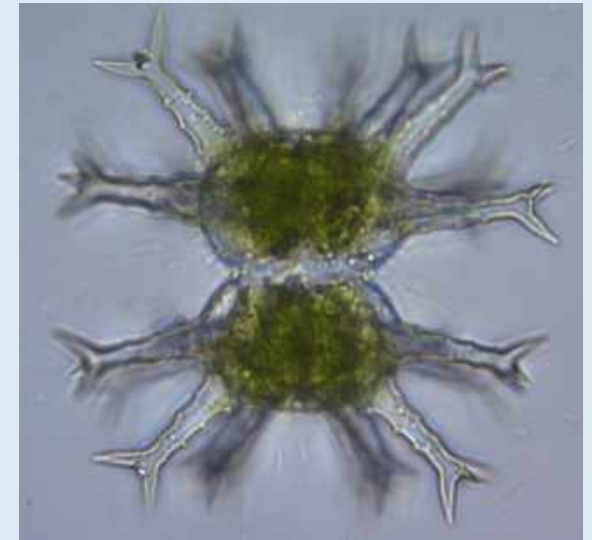
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