Lake Munson

Past, Present, and Future

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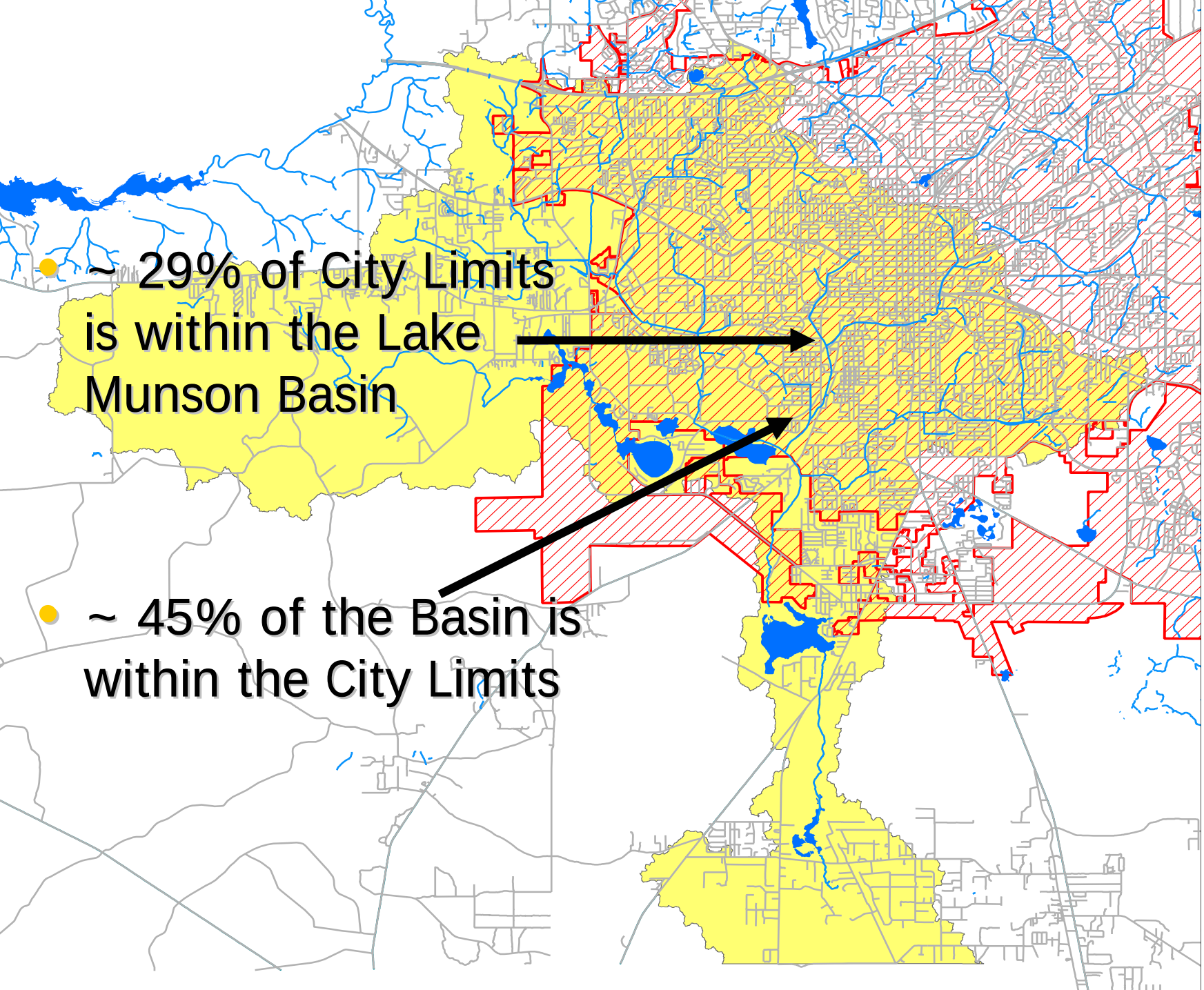
Water Quality Scientist

Description

- Shallow, 255 acre, cypress ringed lake that is impounded at the outflow
- Munson Slough is the lake’s primary inflow and outflow stream
- 42,529 acres in Lake Munson Basin


~ 29% of City Limits is within the Lake Munson Basin
~ 45% of the Basin is within the City Limits

History

1954 Game and Fish considered the lake a good waterfowl hunting area and cracker fishing lake

- many people didn't fish the lake because of algal blooms

1930's wastewater discharged into Lake Munson

1954 – early seventies, data was limited

History

1982 study classified Lake Munson as hypereutrophic and the 7th most degraded lake in the state

1978-79 WWTPs contribute at least 66% BOD, 88% of P, and 91% of the N loads going into Lake Munson

Wastewater effluent discharges were eliminated in 1984, and lake experienced water quality improvements

History

1992 Diagnostic Feasibility Report for Lake Munson was released

Recommended ways to improve the water quality of Lake Munson

-"In-lake restoration efforts should address the removal of bottom sediments from Lake Munson."

2005 County Park and Boat Ramp

1991 Adoption of Leon County Environmental Management Act Provides for local enforcement of sediment and erosion control

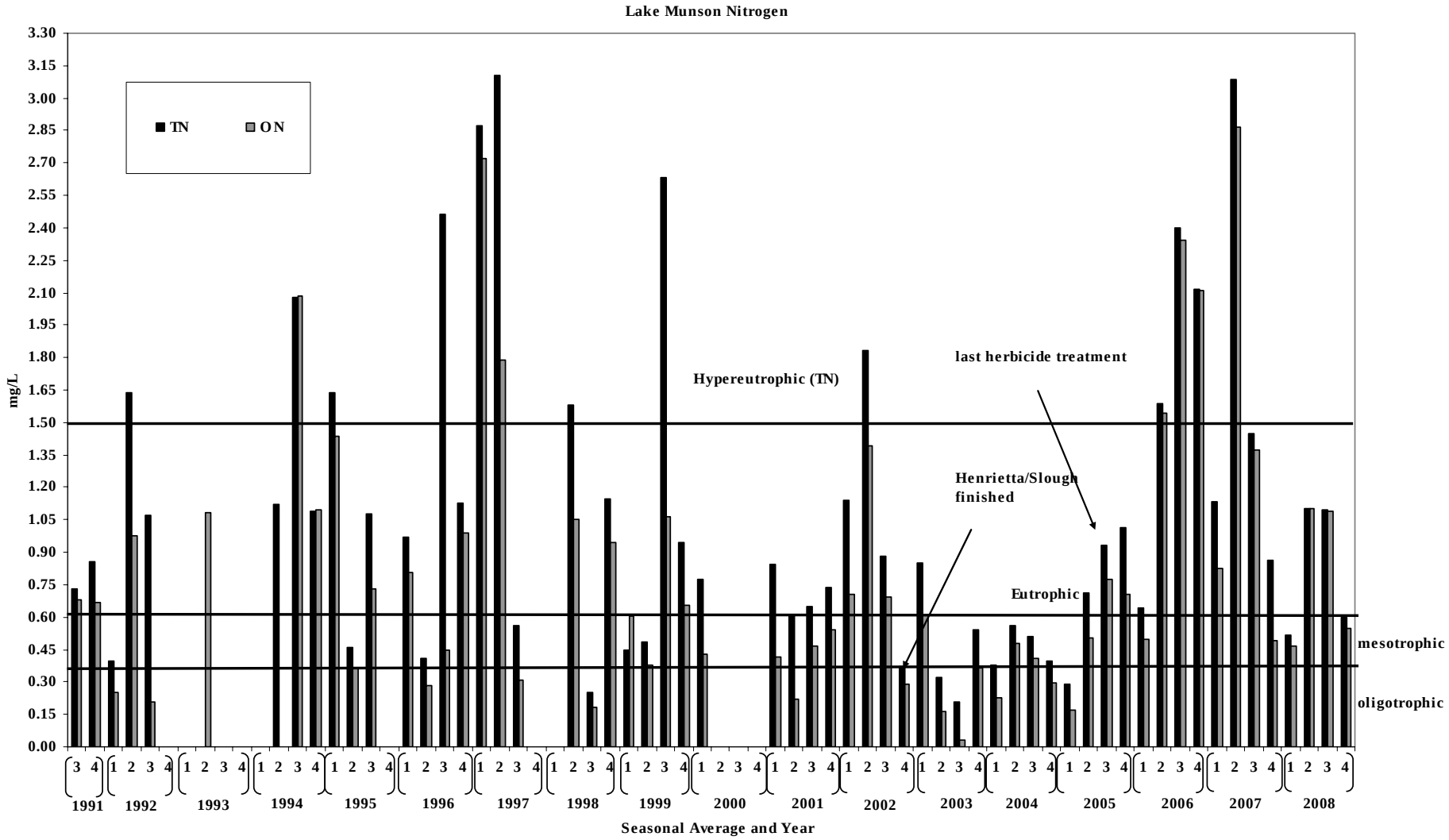
1994 Lake Munson Action Plan was released

-"Without in-lake restoration, water quality will remain poor, even if the quality of stormwater is improved."

Currently,

County has historic and current water quality monitoring program

- Water and sediment chemistry
- Biological Surveys

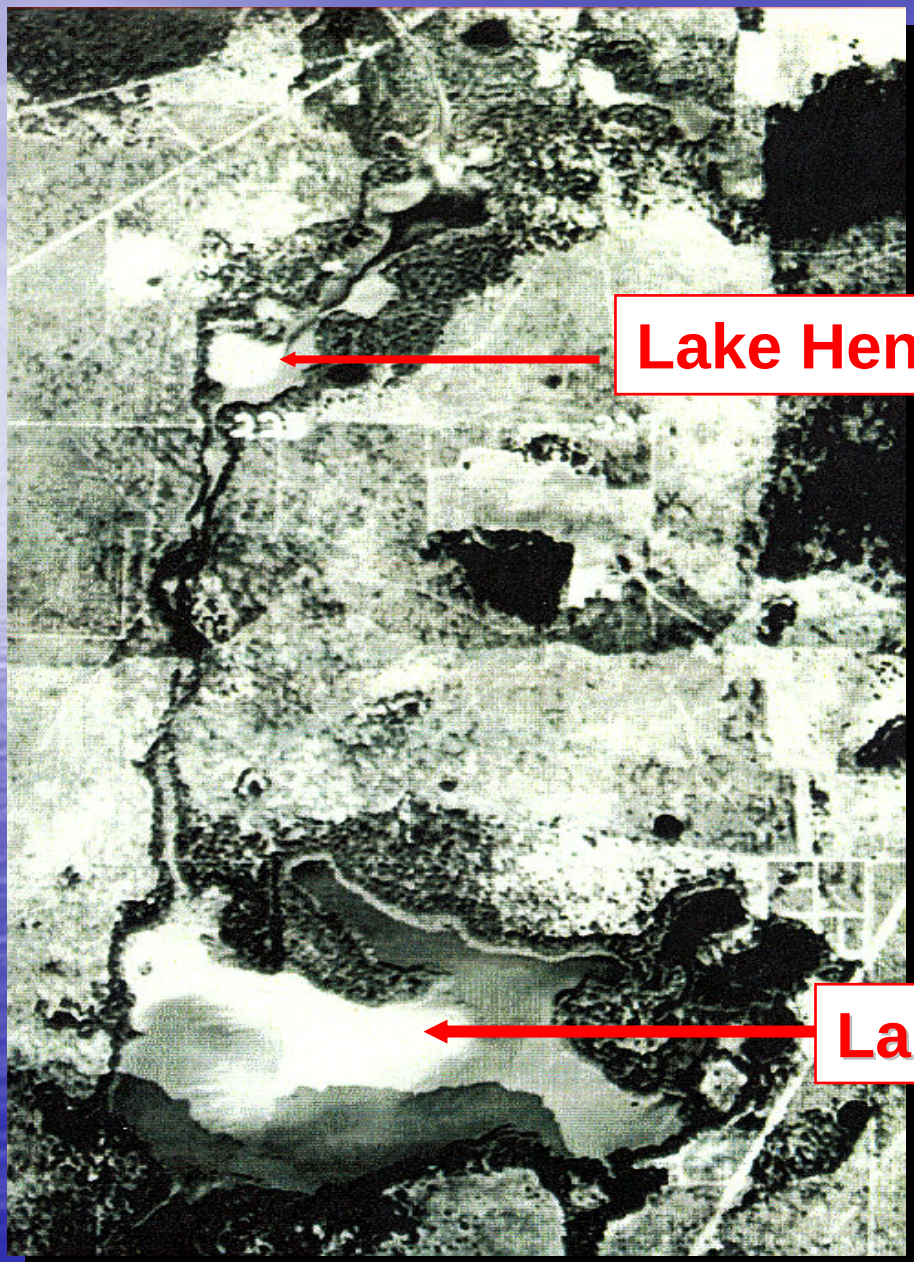

Lake Munson Nitrogen
TN
ON
mg/L
3.30
3.15
3.00
2.85
2.70
2.55
2.40
2.25
2.10
1.95
1.80
1.65
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
Hypereutrophic (TN)
last herbicide treatment
Henrietta/Slough finished
Eutrophic
mesotrophic
oligotrophic
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Seasonal Average and Year

Overall

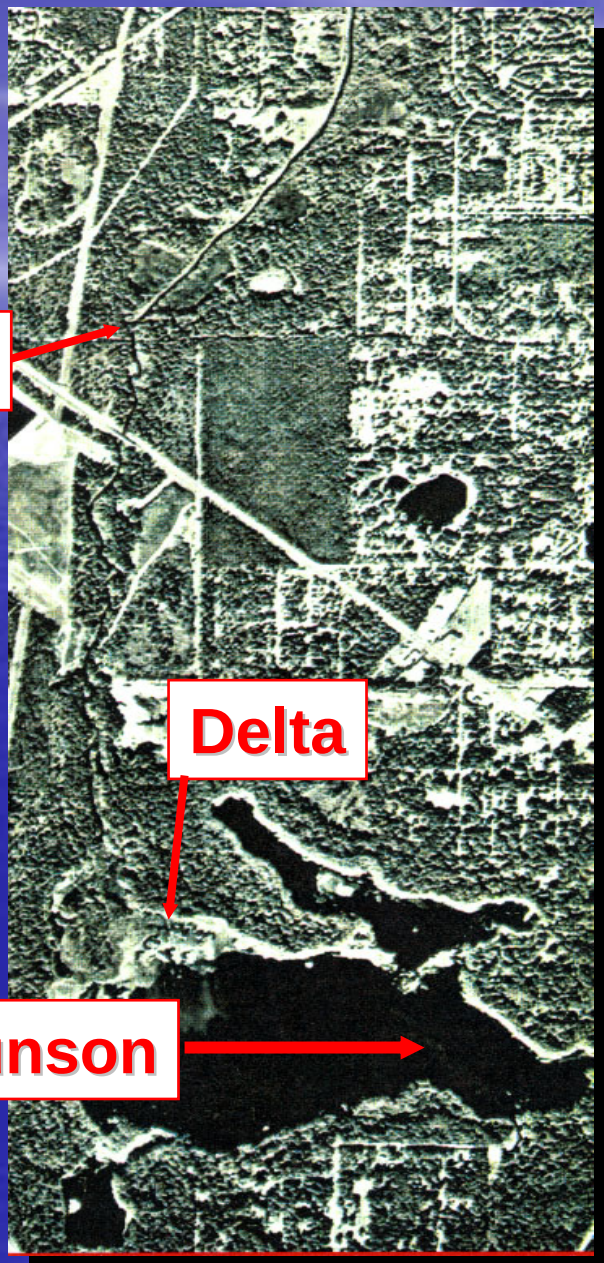
- Since the 1930's, the lake's esthetic condition has been quite variable
  - Poor water quality
  - Heavy algal blooms
  - Fish kills
  - Street debris
    - Paper products, cans, bottles, toys, dead animals, and yard trash were scattered throughout the lake's inflow delta and has been around since the 1970's
- But, over time there has been a gradual improvement in water quality

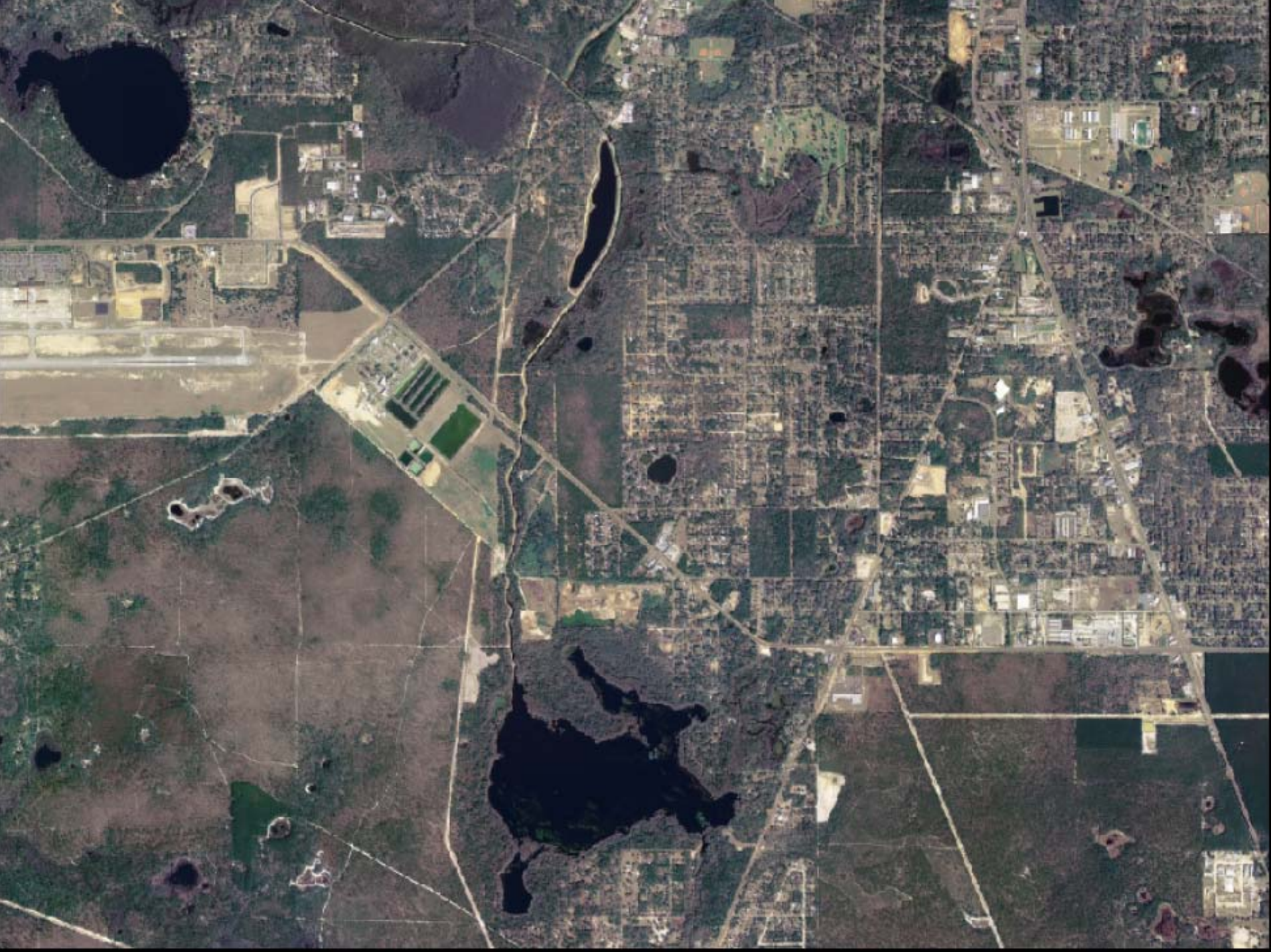
Lake Henrietta

1955



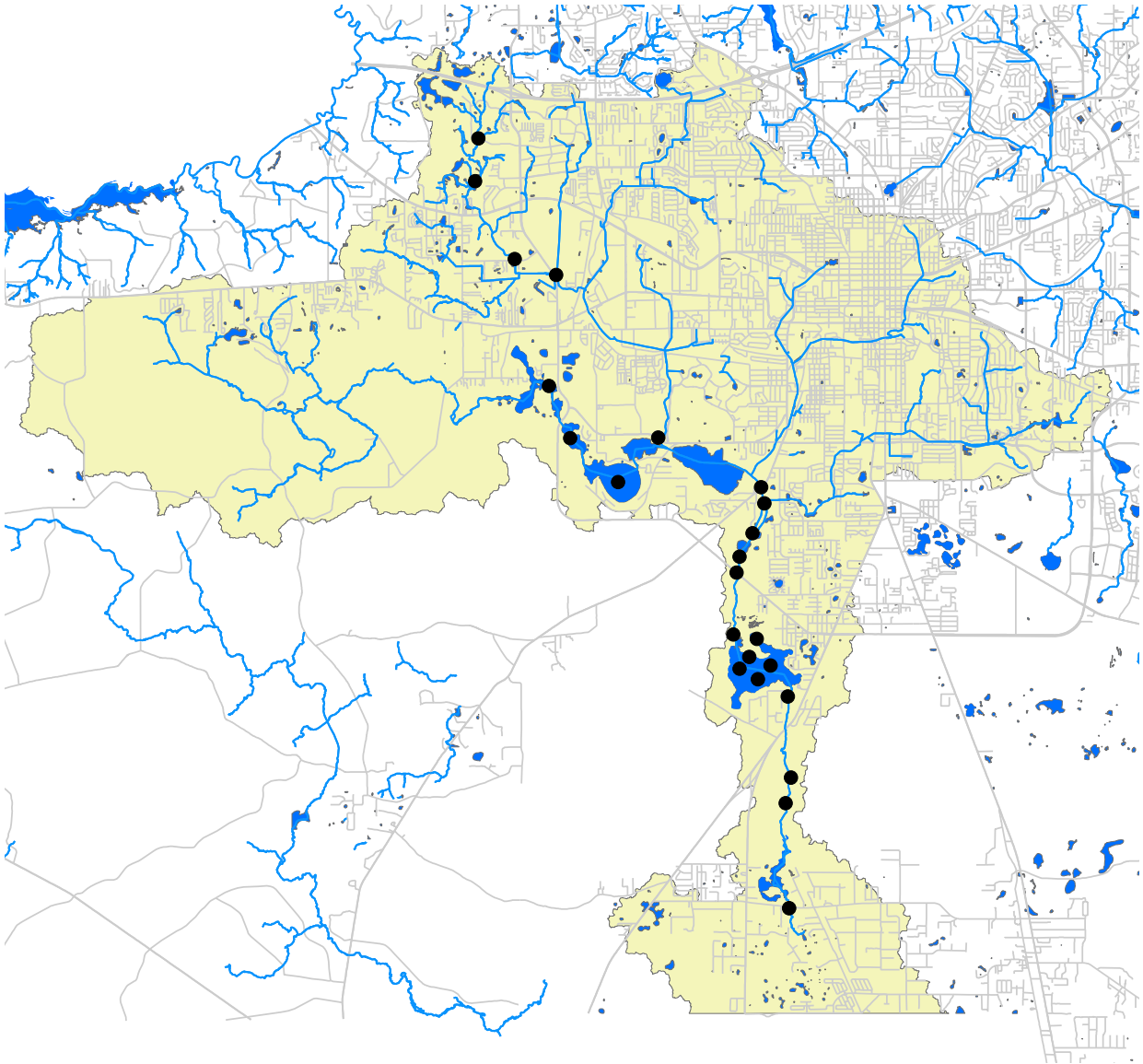
1990





So, what’s happening in Lake Munson?

- Selected Sampling Stations



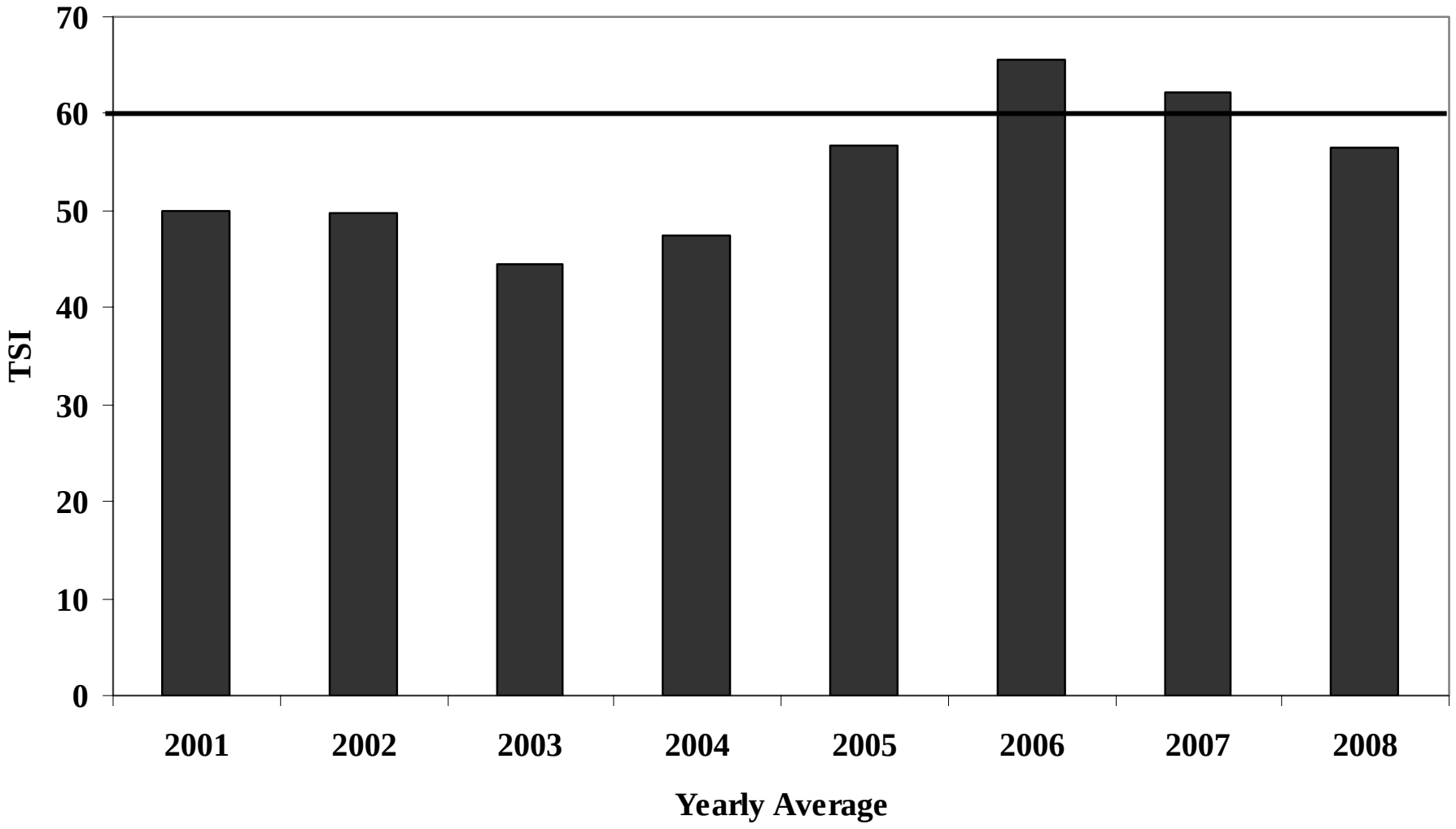
Trophic State Index (TSI)

- Trophic state relates to biological productivity of a lake
- Uses total nitrogen, total phosphorus and chlorophyll *a*
- Numerical scale from 0 to 100
- The higher the score, the higher the productivity

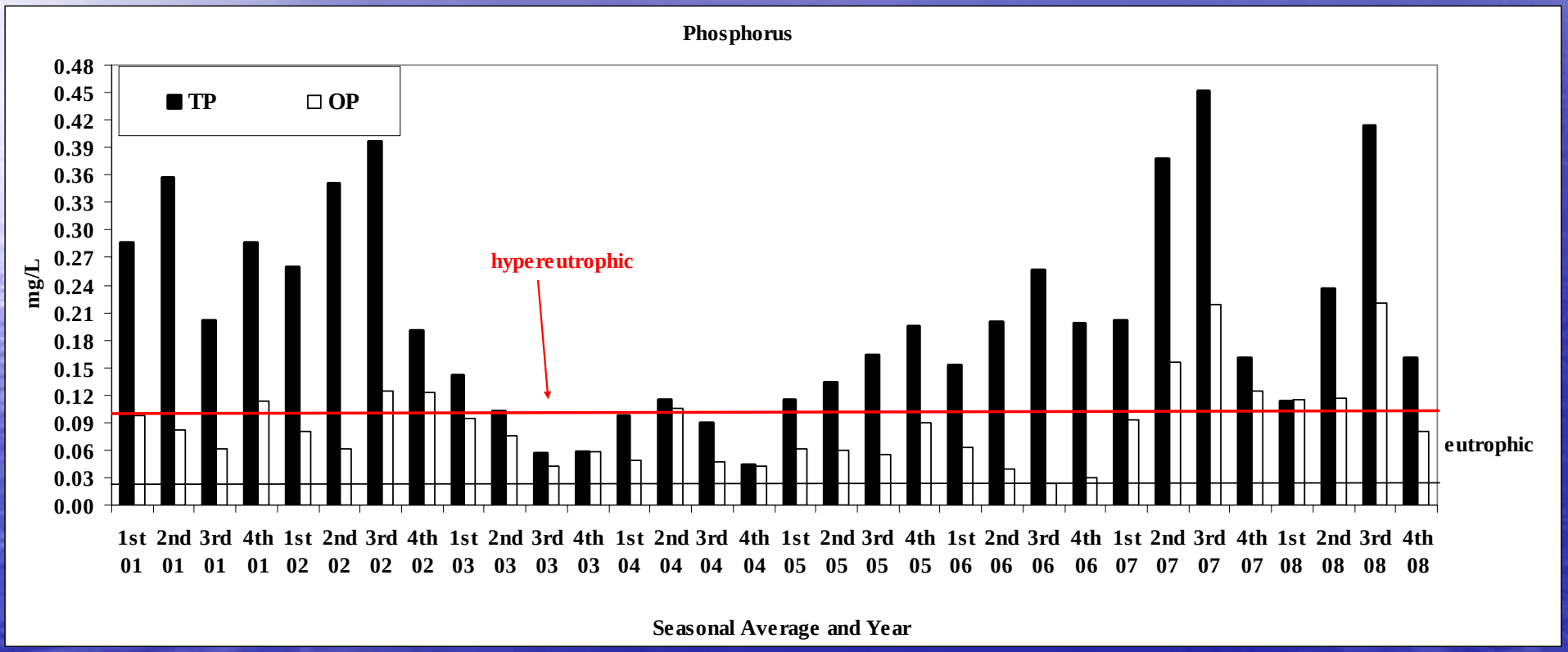
Considered impaired when:

- Because the lake’s mean color is 60 PCU, FDEP considers the lake impaired when the annual mean TSI exceeds 60.

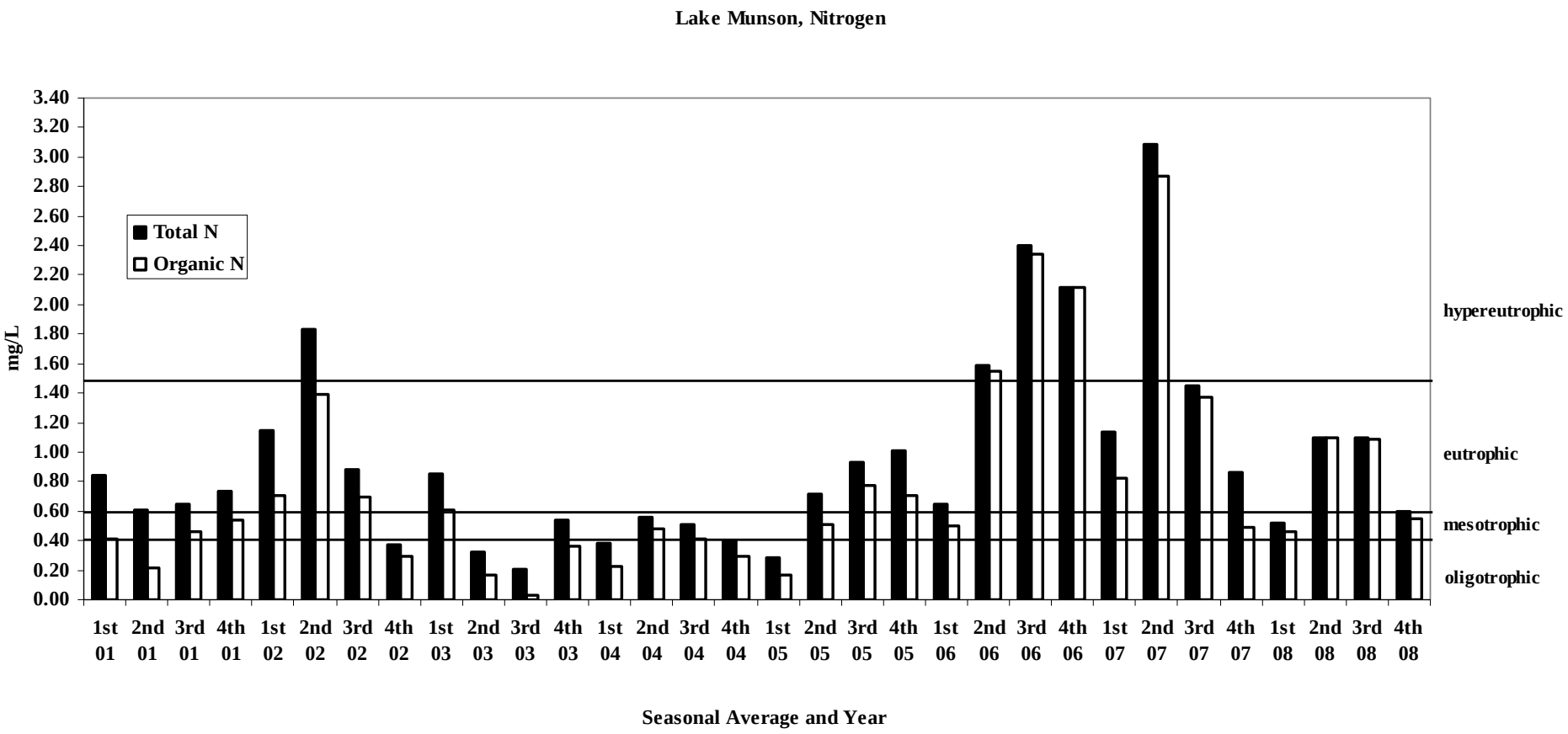
Trophic State Index



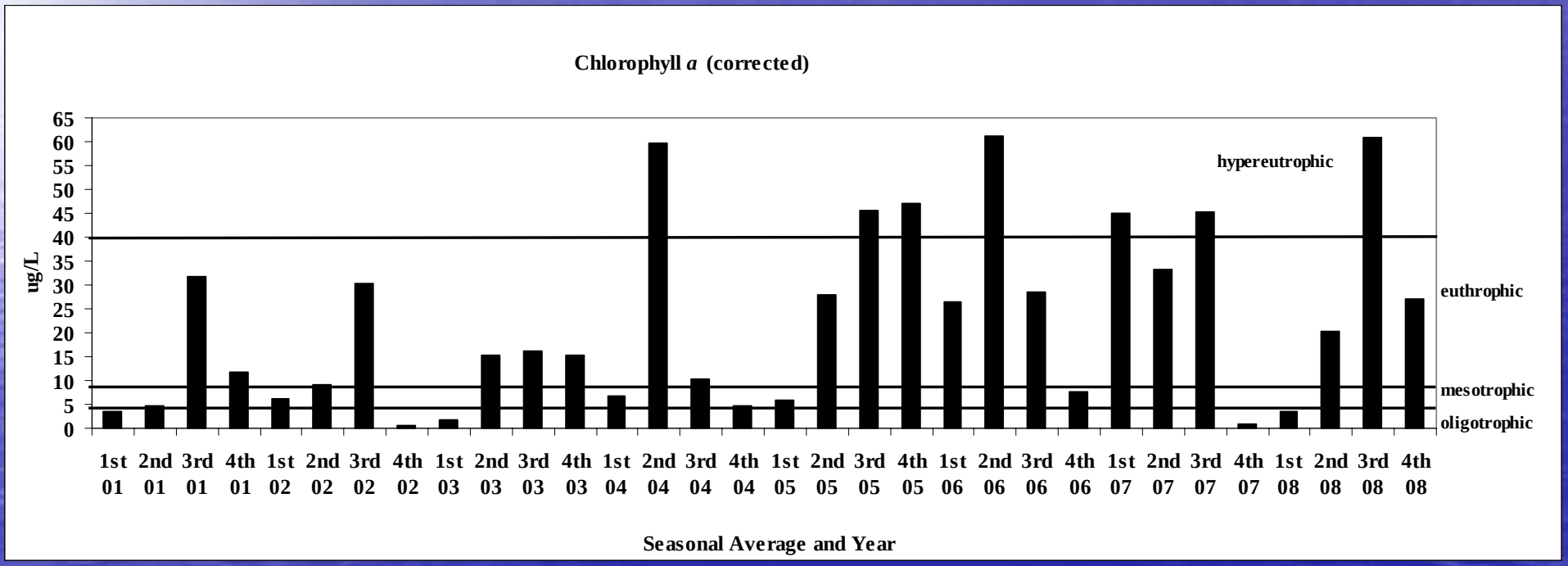
Phosphorus


Phosphorus
TP
OP
mg/L
0.48
0.45
0.42
0.39
0.36
0.33
0.30
0.27
0.24
0.21
0.18
0.15
0.12
0.09
0.06
0.03
0.00
hypereutrophic
eutrophic
1st 01
2nd 01
3rd 01
4th 01
1st 02
2nd 02
3rd 02
4th 02
1st 03
2nd 03
3rd 03
4th 03
1st 04
2nd 04
3rd 04
4th 04
1st 05
2nd 05
3rd 05
4th 05
1st 06
2nd 06
3rd 06
4th 06
1st 07
2nd 07
3rd 07
4th 07
1st 08
2nd 08
3rd 08
4th 08
Seasonal Average and Year

Nitrogen


Lake Munson, Nitrogen
mg/L
3.40
3.20
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Total N
Organic N
hypereutrophic
eutrophic
mesotrophic
oligotrophic
1st 01
2nd 01
3rd 01
4th 01
1st 02
2nd 02
3rd 02
4th 02
1st 03
2nd 03
3rd 03
4th 03
1st 04
2nd 04
3rd 04
4th 04
1st 05
2nd 05
3rd 05
4th 05
1st 06
2nd 06
3rd 06
4th 06
1st 07
2nd 07
3rd 07
4th 07
1st 08
2nd 08
3rd 08
4th 08
Seasonal Average and Year

Chlorophyll *a*



So what's happening in Lake Munson?

There has been a shift from a vascular plant community to an algal community.

2000

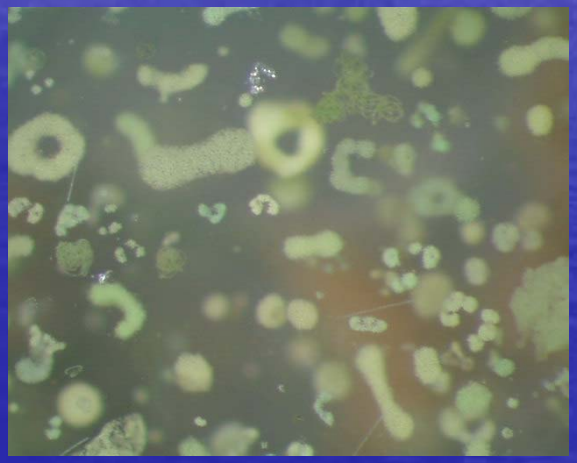
2007

Algal Blooms

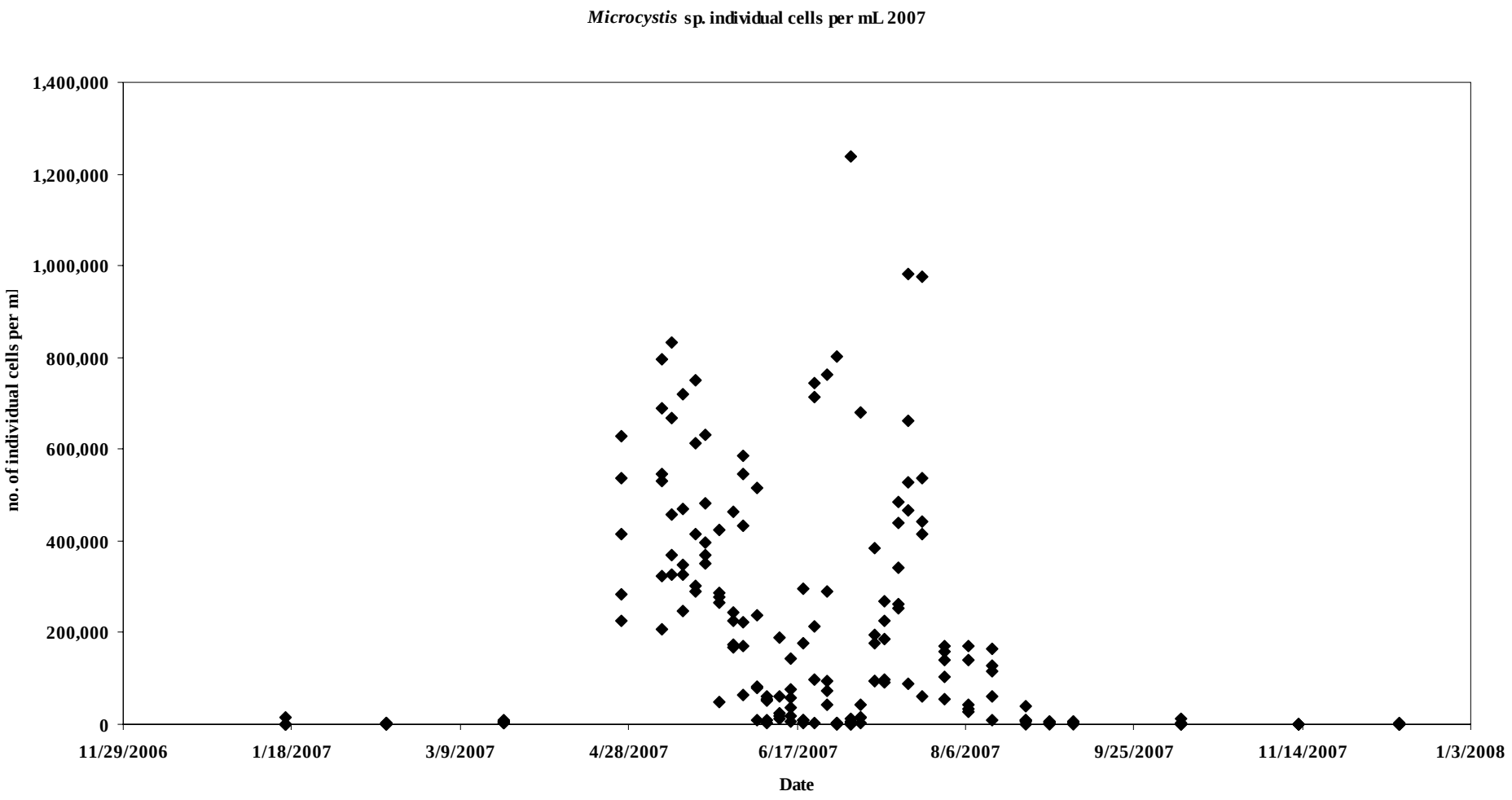
- An algal bloom is an overabundance of algae
  - Can block sunlight preventing light from reaching submersed plants
  - Can cause fish kills. In FL, this is most likely to occur after several days of hot weather with overcast skies or after a heavy rain.

Algal blooms cont.

- During the largest blooms the dominant species was
  - *Microcystis aeruginosa*
    - blue-green algae (cyanobacteria) that grows naturally in many surface waters. In most bodies of fresh water and most weather conditions it does not pose a hazard to wildlife or human beings.



- But . . . .


Microcystis sp. individual cells per mL 2007
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
no. of individual cells per ml
11/29/2006
1/18/2007
3/9/2007
4/28/2007
6/17/2007
8/6/2007
9/25/2007
11/14/2007
1/3/2008
Date

Microcystis aeruginosa

- Can produce natural toxins (called microcystins)
- Toxic effects to zooplankton, fish, other wildlife and humans.
- Possibly inhibit vascular plant growth

Algal blooms contribute to fish kills

Large fish kill reported 11/28/06, other minor fish kills reported since

- How does algal blooms kill fish?
  - Dissolved oxygen levels
    - Too high or too low

Water Chemistry Changes

- Algal blooms causes pH to increase during daylight hours and decrease at night

So,

- The lake has gone from a vascular plant community to an algal community
- Fish Kills
- Why has this happened? And how do we fix it?

One suspect

Channeled Apple Snail

- ***Pomacea canaliculata* complex**

Pomacea sp.

- Family Ampullariidae (= Pilidae)
  - Complex of five species (*insularum* and possibly *canaliculata* in Leon County)
- shells globular, as much as 5 inches long (much larger than native *Pomacea*)
- brown, greenish, or yellowish in color, sometimes with longitudinal stripes
- introduced into FL from S. America as early as 1978; spread to many parts of the world
- serious agricultural pest of rice, taro, and other crops
- adaptable: tolerant of dessication, low DO, some salinity (to 8 ppt), eutrophication, etc.

Environmental impacts to Lake Munson

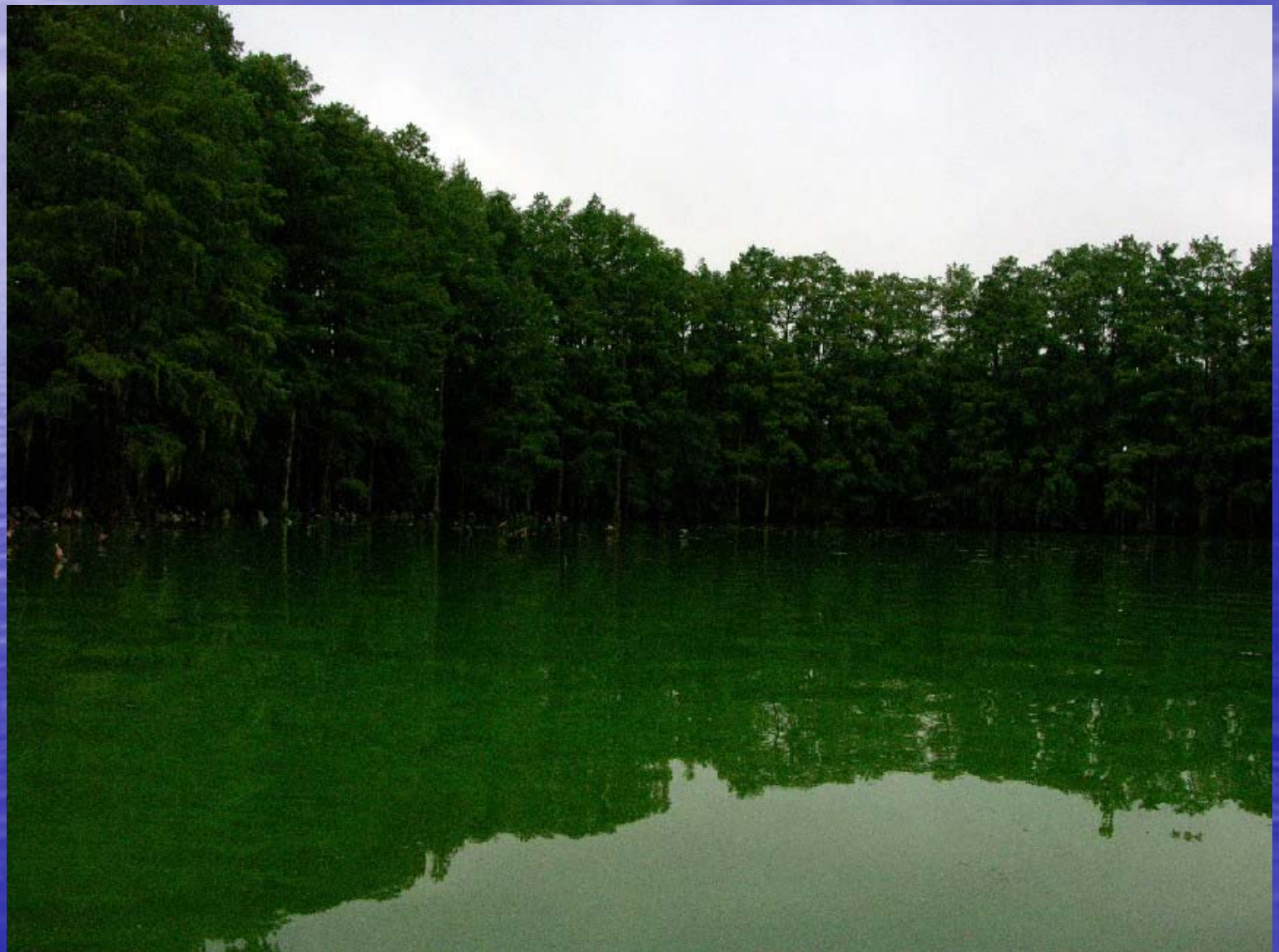
- reduction in macrophyte diversity
- habitat loss → reduced overall biodiversity
- outcompeting native species
- potential water quality deterioration
  - ✓ extensive macrophyte grazing
  - ✓ nutrient uptake by phytoplankton
  - ✓ proliferation of phytoplankton
  - ✓ oxygen sags
  - ✓ fish and invertebrate kills

June 2006

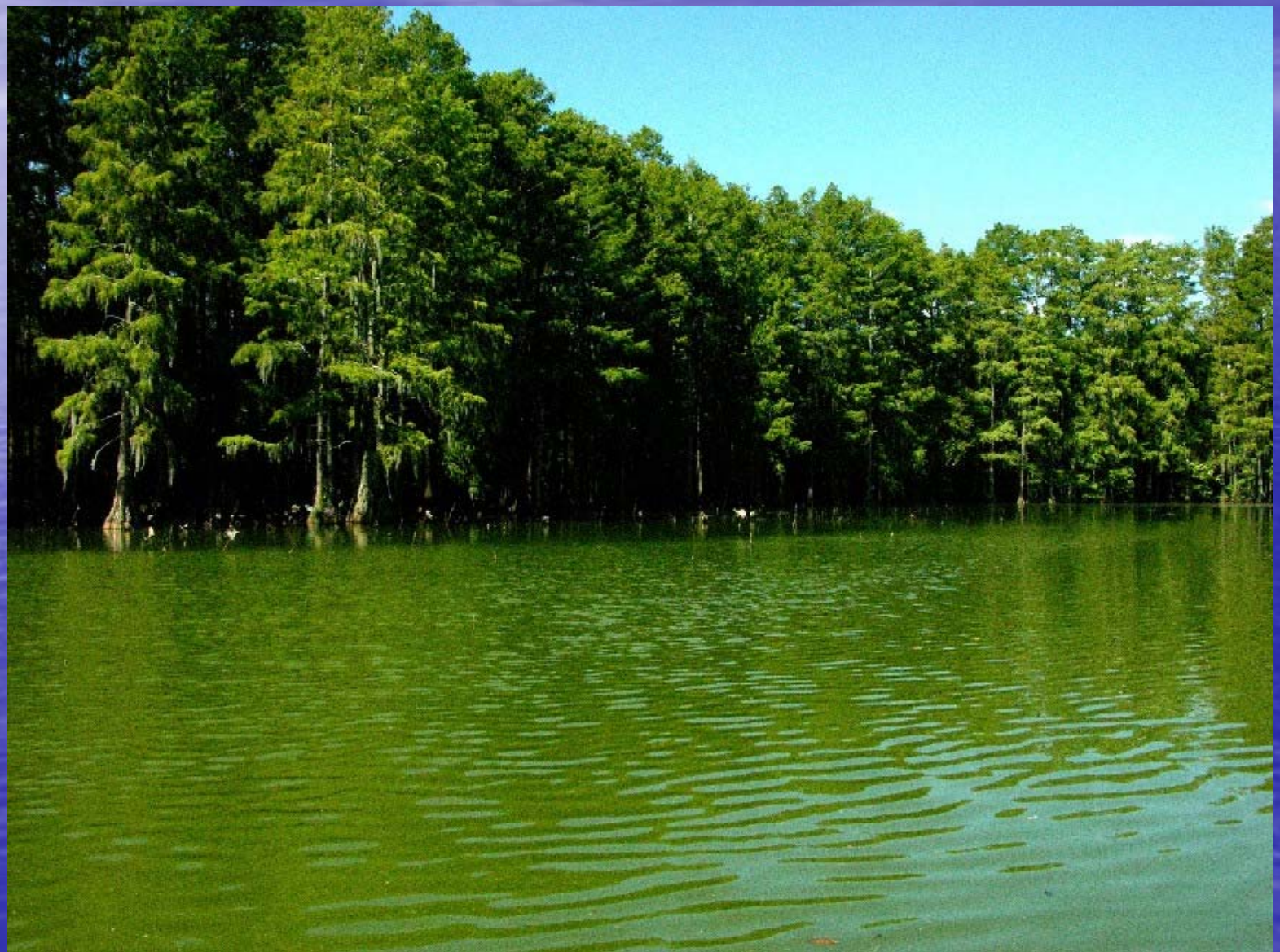
July 2006

August 2006

September 2006



October 2006



Channeled apple snails are BIGGER

Their eggs are different

- Channeled apple snail eggs very small, numerous, bright pink
- Native apple snail eggs larger, fewer, and white or light pink

How can we get rid of them?

-- We probably can't. --

- **molluscicides** – high cost and non-target mortality
- **predators** – some present, but not enough to substantially effect snail populations
- **physical removal** – will help somewhat (esp. eggs), but probably of limited effectiveness

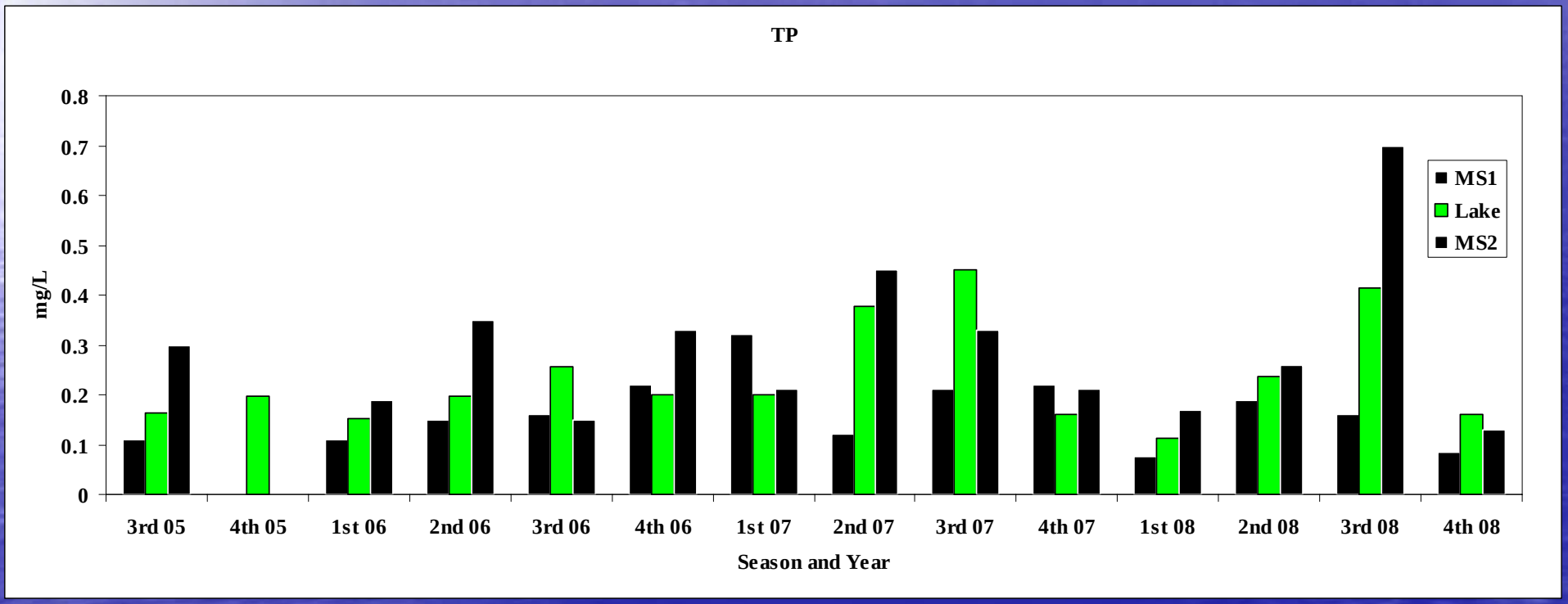
Runoff (or lack thereof)

- Drought (concentration of nutrients)
- Too much rain in a short period of time
  - Heavy rains tend to wash large amounts of organic material into lakes, streams, etc.
  - Bacteria decompose the new material using oxygen much faster than normal
  - Can also cause water turnover

Sediments

- Net burial of nutrient laden sediments has occurred for over 50 years
- Estimated 900 tons of phosphorus in the first foot of sediment (NWFWMD, 1992)
- May contribute up to 40% of the phosphorus concentration of the lake (NWFWMD, 1992)

Munson Slough and Lake Munson



Sediments, cont.

- The bottom sediments are also poor substrate for
  - Plants
    - Stable Substrate for growth
  - Animals
    - Lack of spawning sites
    - Fluctuating dissolved oxygen levels
    - Limited plant community

By removing the sediments

- Regain lost lake volume and depth
- Improve water quality by the control of internally released nutrients
- Improve lake substrate
- Remove toxic substances

Further reduction of upstream nutrient loadings

- County projects (Martha Wellman pond, Lake Henrietta and Munson Slough), but bulk of development in the Munson Basin is in the City limits
- TMDLs

Further Research

- Apple Snails - eradication efforts
- *Microcystis aeruginosa* – nitrogen fixation? Vascular plant toxicity?
- Microbial function in Lake Munson
- Continued sampling of Munson Slough and Lake Munson
- Addition of Lake Vegetation Index (LVI) survey

Why we care

Birding is good

- Anhinga
- Bald Eagle (Removed from the endangered species list in 2007)
- Barred Owl
- Belted Kingfisher
- Canada Goose
- Common moorhen
- Cormorant
- Great Blue Heron
- Great Egret
- Hooded Merganser

Birds cont.

- Limpkin
- Little Blue Heron
- Mallard
- Night Heron
- Osprey
- Red Shouldered and Red Tailed Hawk
- Snowy Egret
- Turkey
- White Ibis
- Wood Stork (Endangered Species)

Fishing is good

Recreational opportunities also include

- Hiking and observing nature
- Waterfowl hunting
- Boating
- Picnics
- Photography

Information

- Water Quality Data is now accessible on the Tallahassee/Leon County Water Atlas

http://www.tlc.wateratlas.usf.edu/

Contact

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