

Changes in water quality across a longitudinal gradient in Lake Lemon, Indiana: A 20-year perspective.

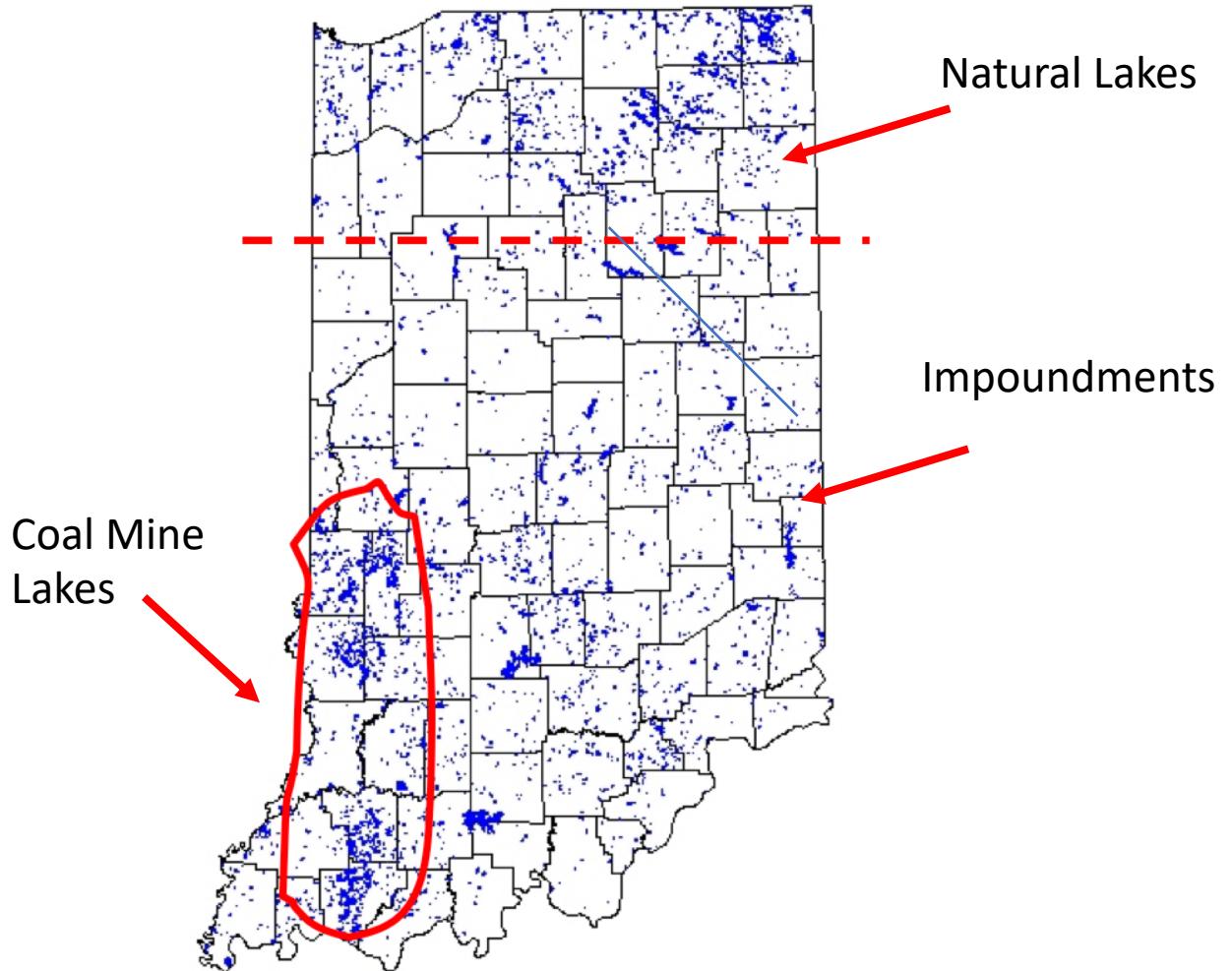
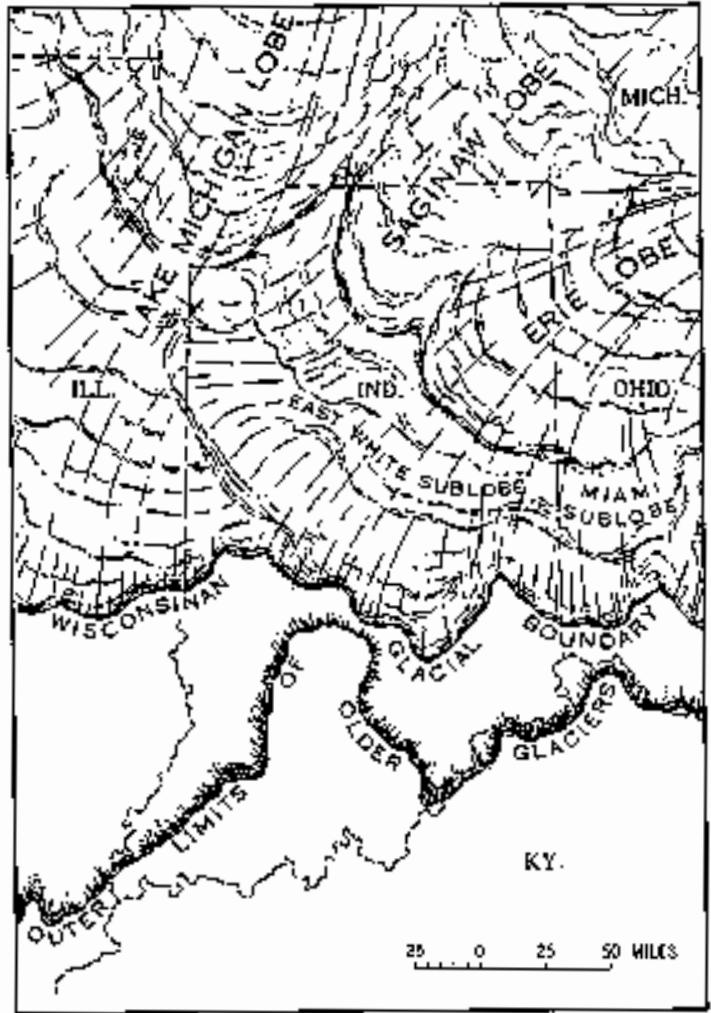
Cory Sauve

Indiana University

School of Public and Environmental Affairs

Indiana Lake Distribution

Coverage of last
glacial episode
~ 10,000 years
before present

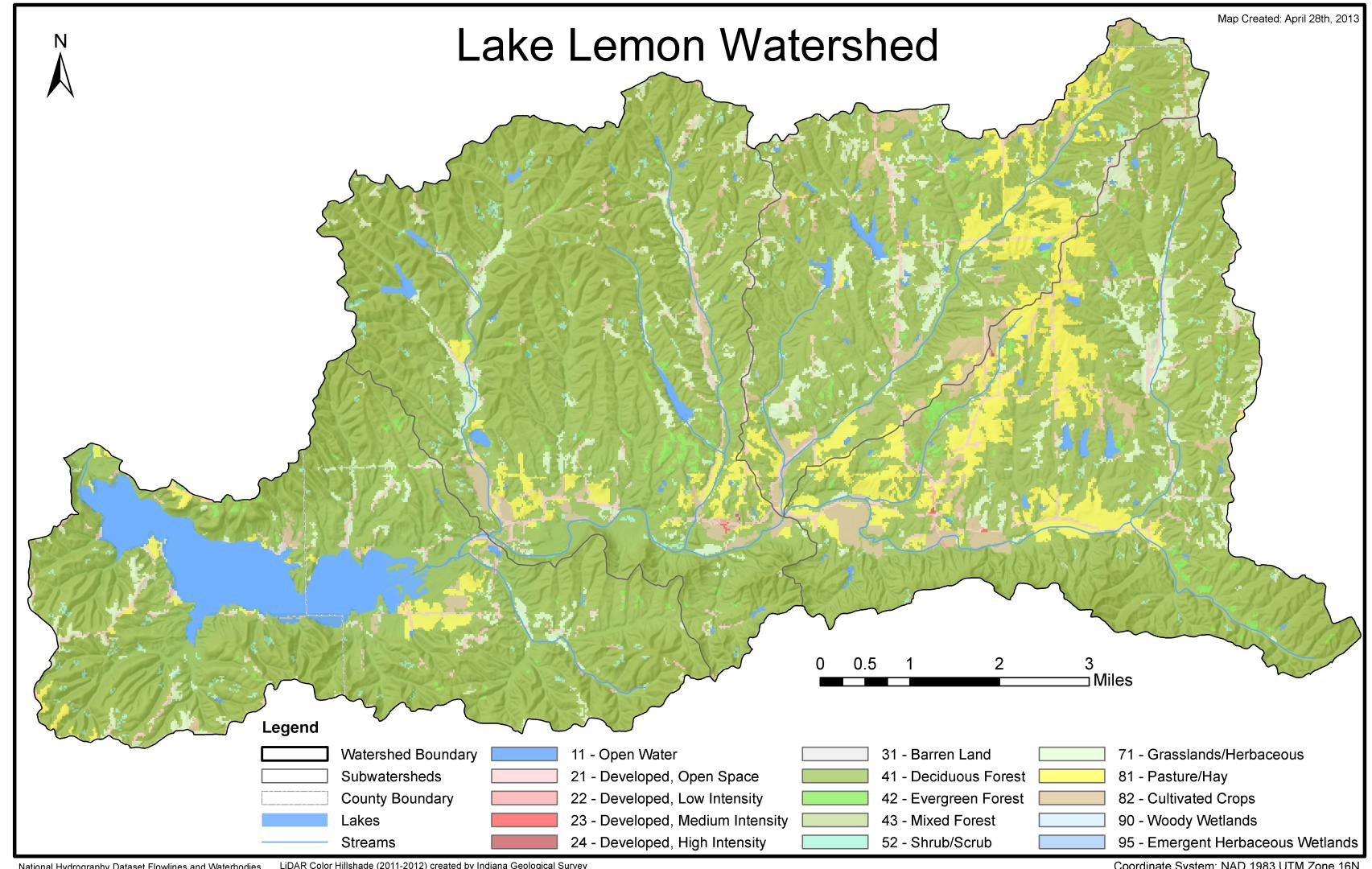


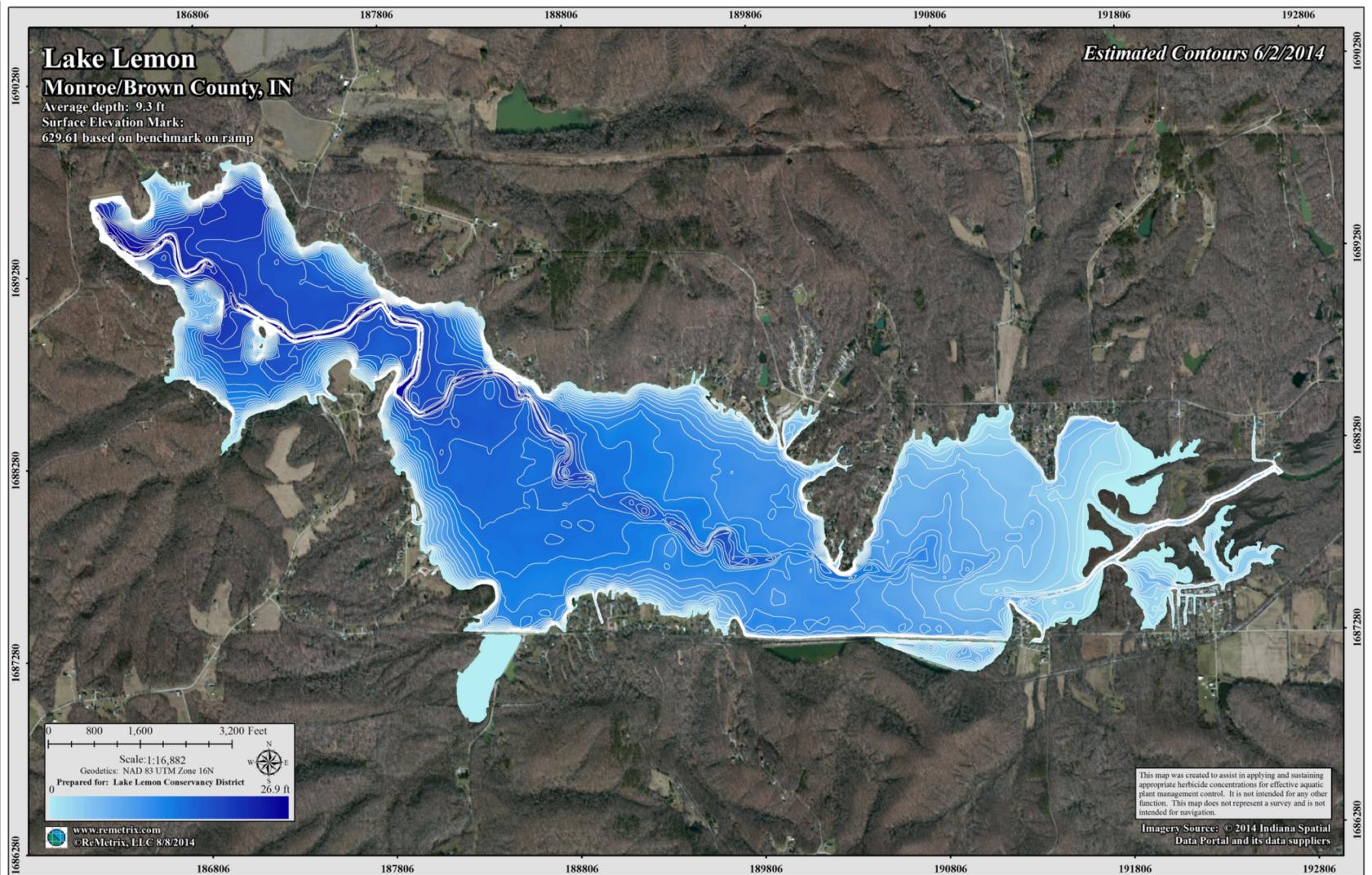
Lake Lemon

- Located in southcentral Indiana
- Built in 1955 → drinking water reservoir
- Conservancy District established in 1995
 - 50 year lease through City of Bloomington



- Area = 46,080 acres
- Forest = 77.78%
- Agriculture = 8.96%
- Topography - Hilly with steep slopes draining into ravines and narrow valleys
- Soils – Four major soils, relatively high to highly erodible





- 11th largest lake in IN
- 1,650 acres when built
- Max depth = 8 m
- Mean depth = 3m
- Residence time = 73 days

Current Conditions and Challenges

Cylindrospermopsis

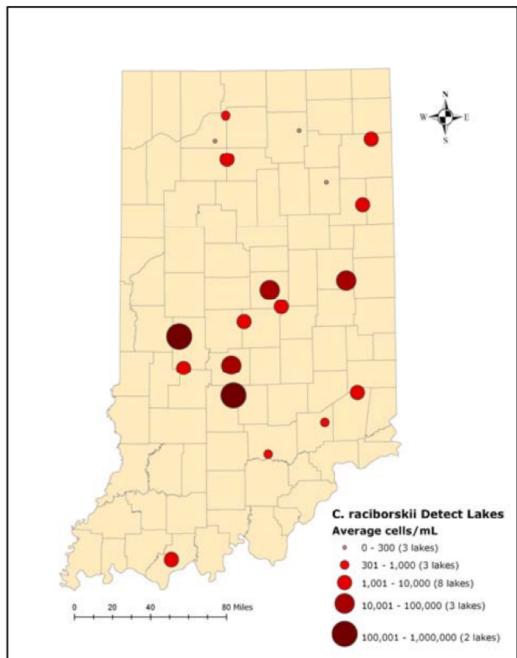
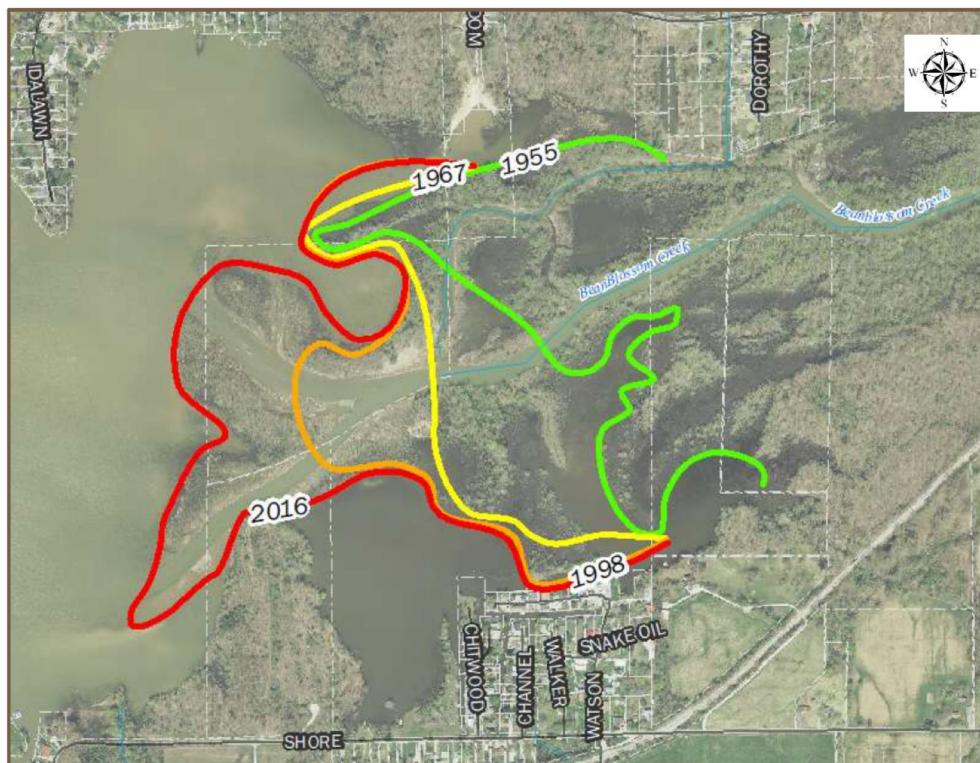


Figure 4-3. Distribution and abundance of *C. raciborskii* in Indiana.

Sedimentation



E. Coli and Nutrients



Management Actions

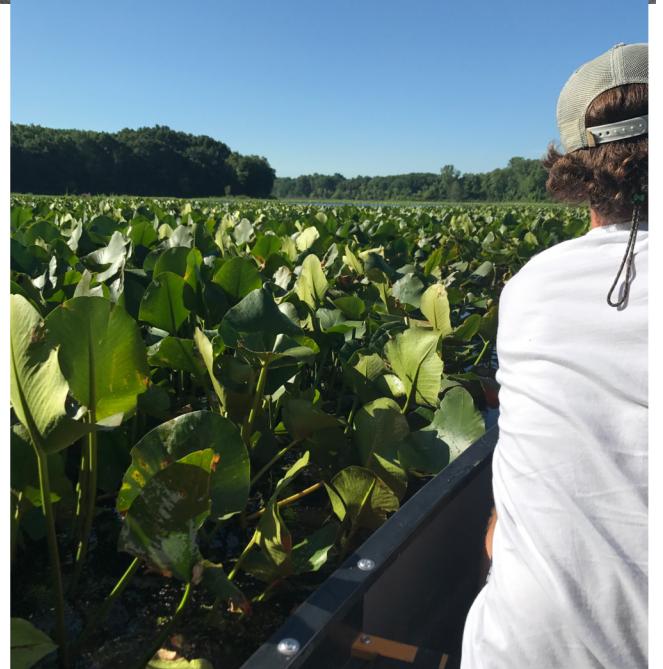
- Sedimentation Restoration Project
 - In-house dredging operation
 - Remove ~11,000 cubic yards per year
- Shoreline stabilization
 - 9,000 linear feet stabilized through 2017
- Vegetation control
 - 80 acres per year



Study Questions

- 1) Has Lake Lemon maintained water quality since 1996?
- 2) Is there a longitudinal gradient through the reservoir?

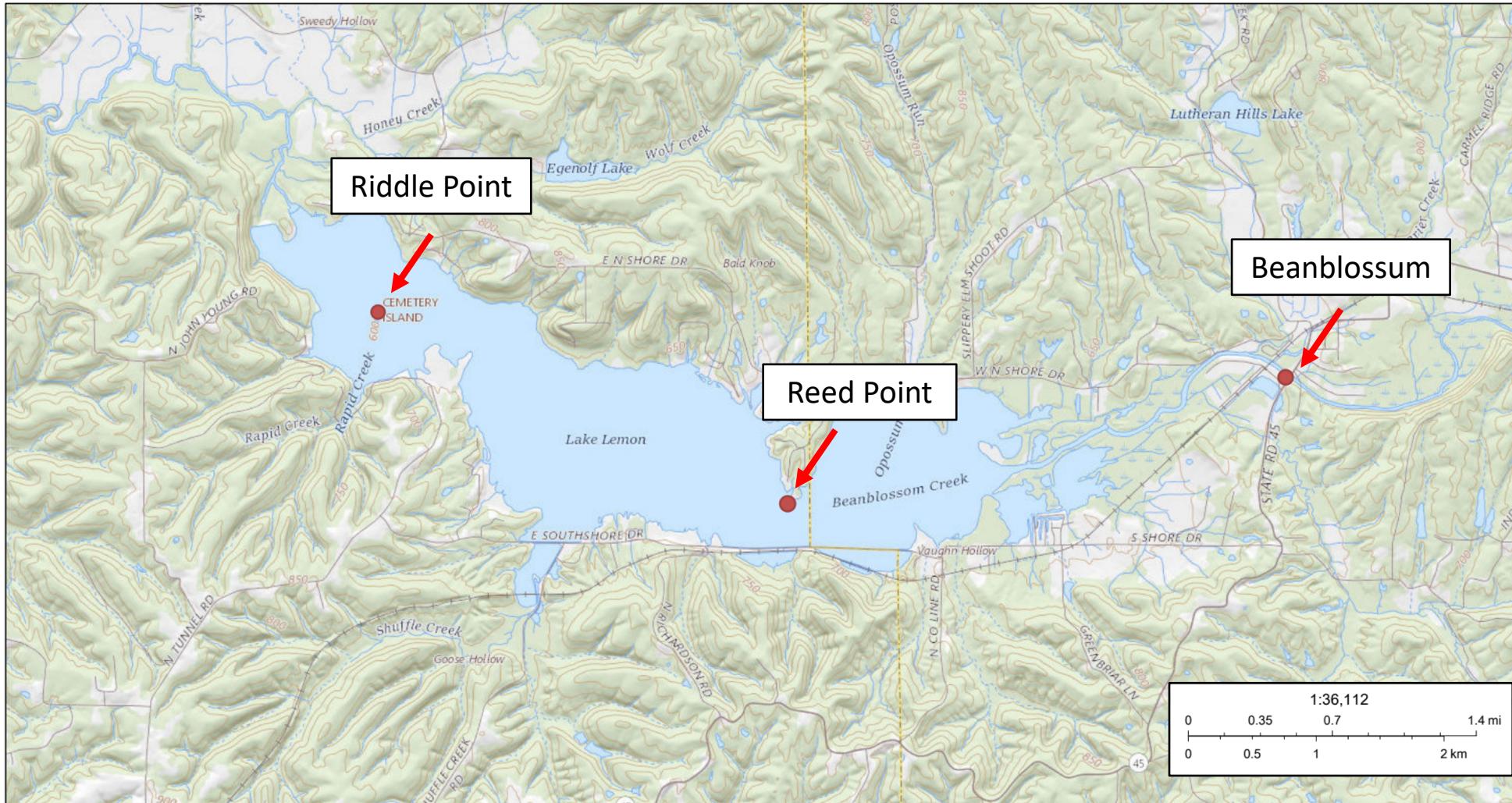
Methods – Sample Collection – Indiana Clean Lakes Program



Methods – Lake Lemon Sampling

- Indiana Clean Lakes Program has been monitoring Lake Lemon since 1997
- Three sampling locations
 - Beanblossum Creek
 - Reed Point
 - Riddle Point
- Water quality parameters collected at all sites

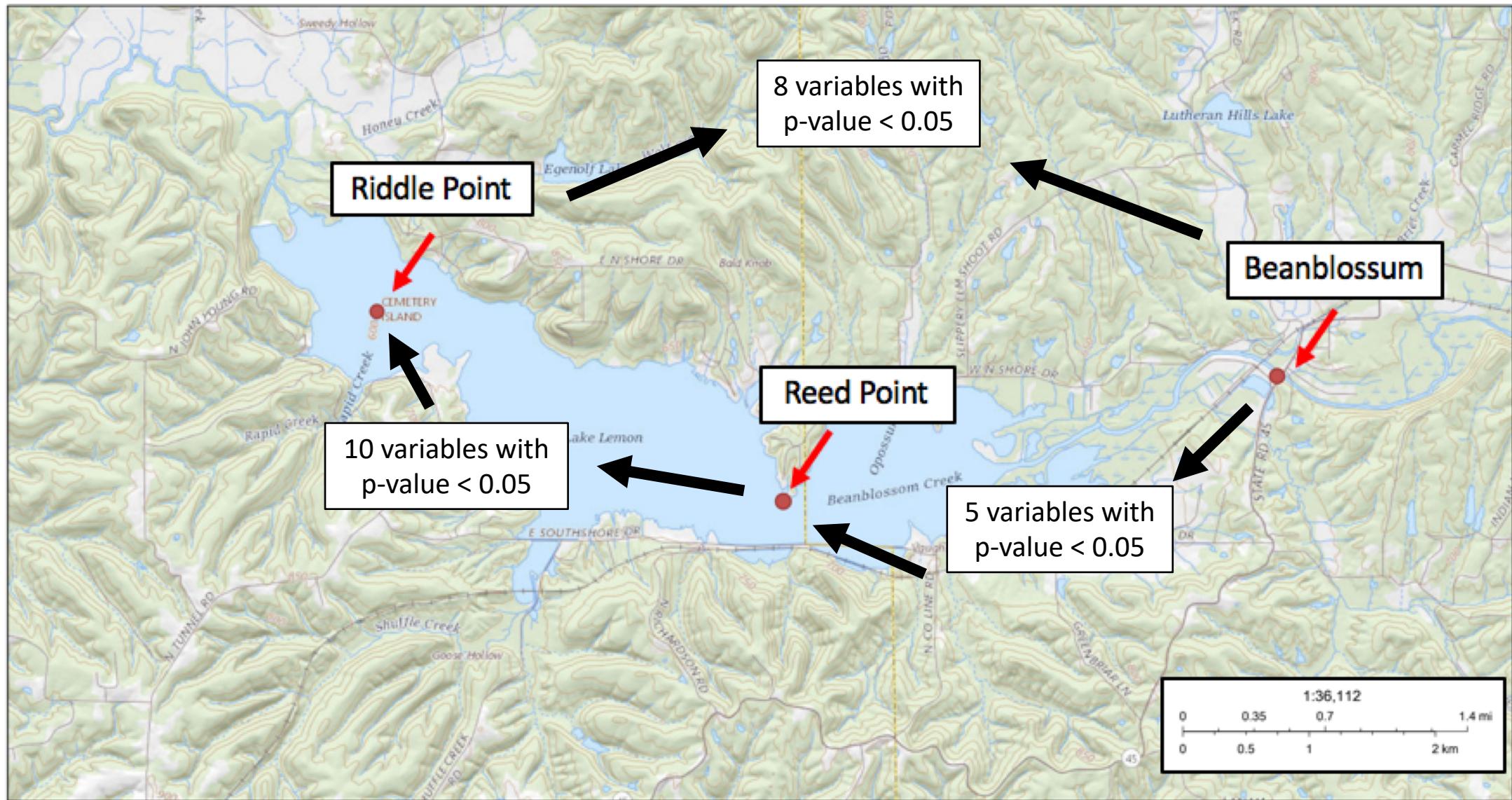
Methods - Sampling Locations



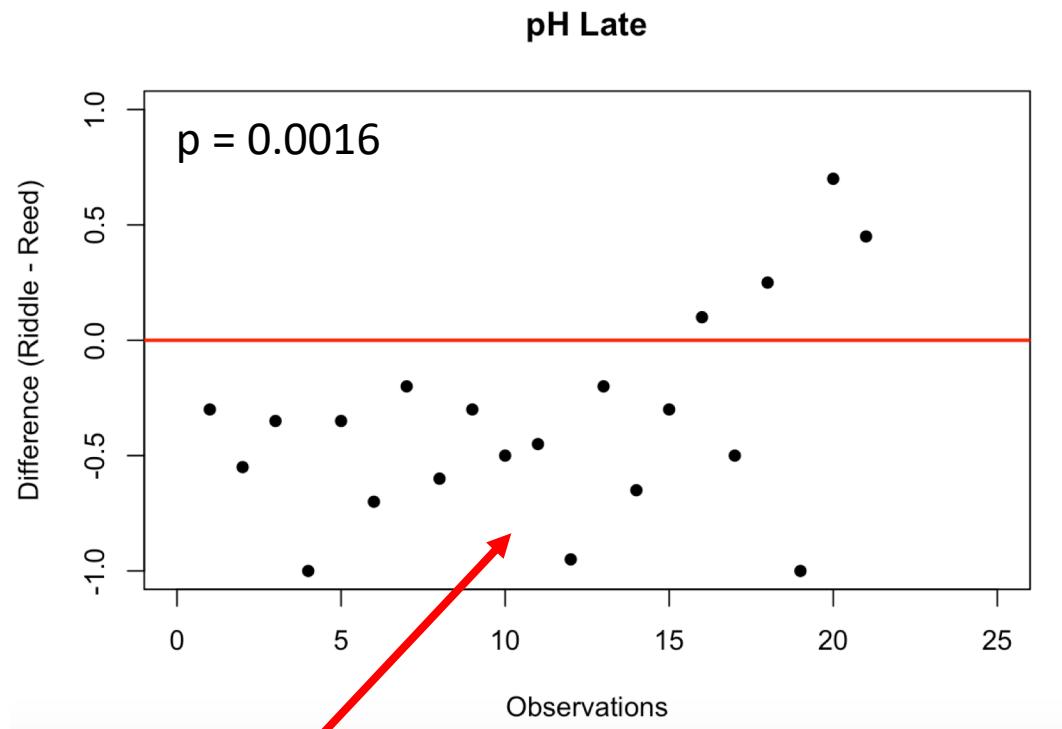
Methods – Analysis

- Beanblossum to Reed & Riddle
 - 9 variables
- Reed to Riddle
 - 14 variables
- Early, mid, late periods in growing season
- Paired t-test per variable per site comparison
- Variables
 - pH
 - Conductivity
 - Alkalinity
 - TSS
 - NH₃
 - NO₃
 - Org-N
 - SRP
 - TP
 - Secchi depth
 - Chl-a
 - TSI SD
 - TSI Chl-a
 - TSI TP

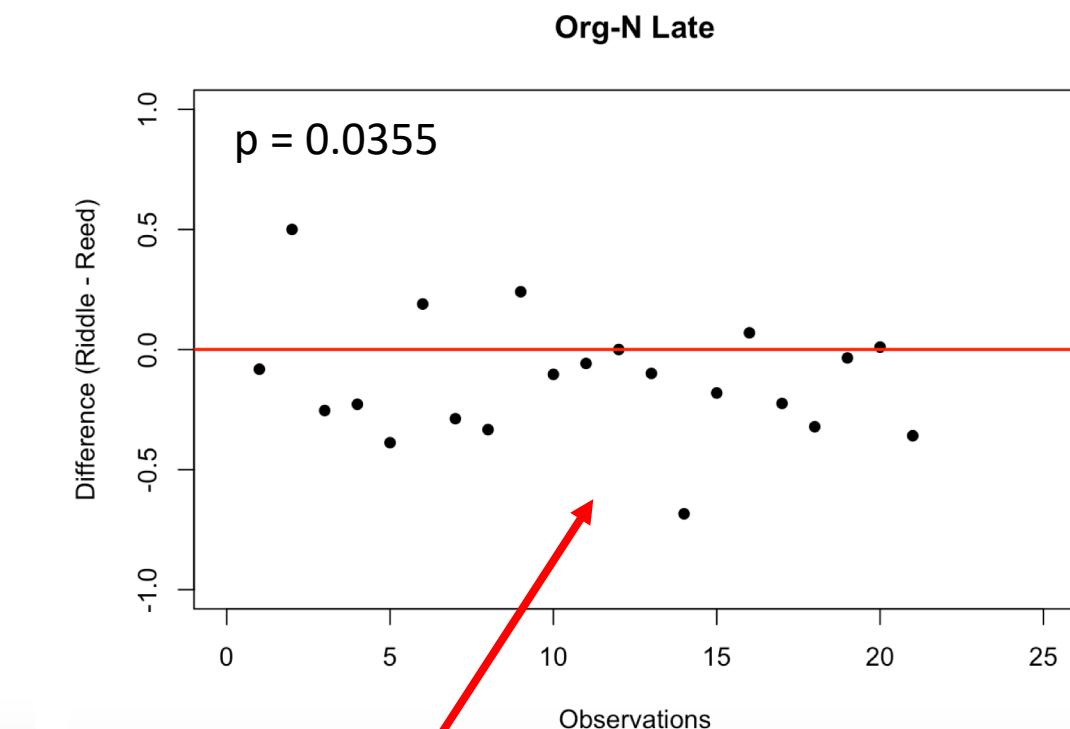
Results – Longitudinal Change



Results – Longitudinal Change

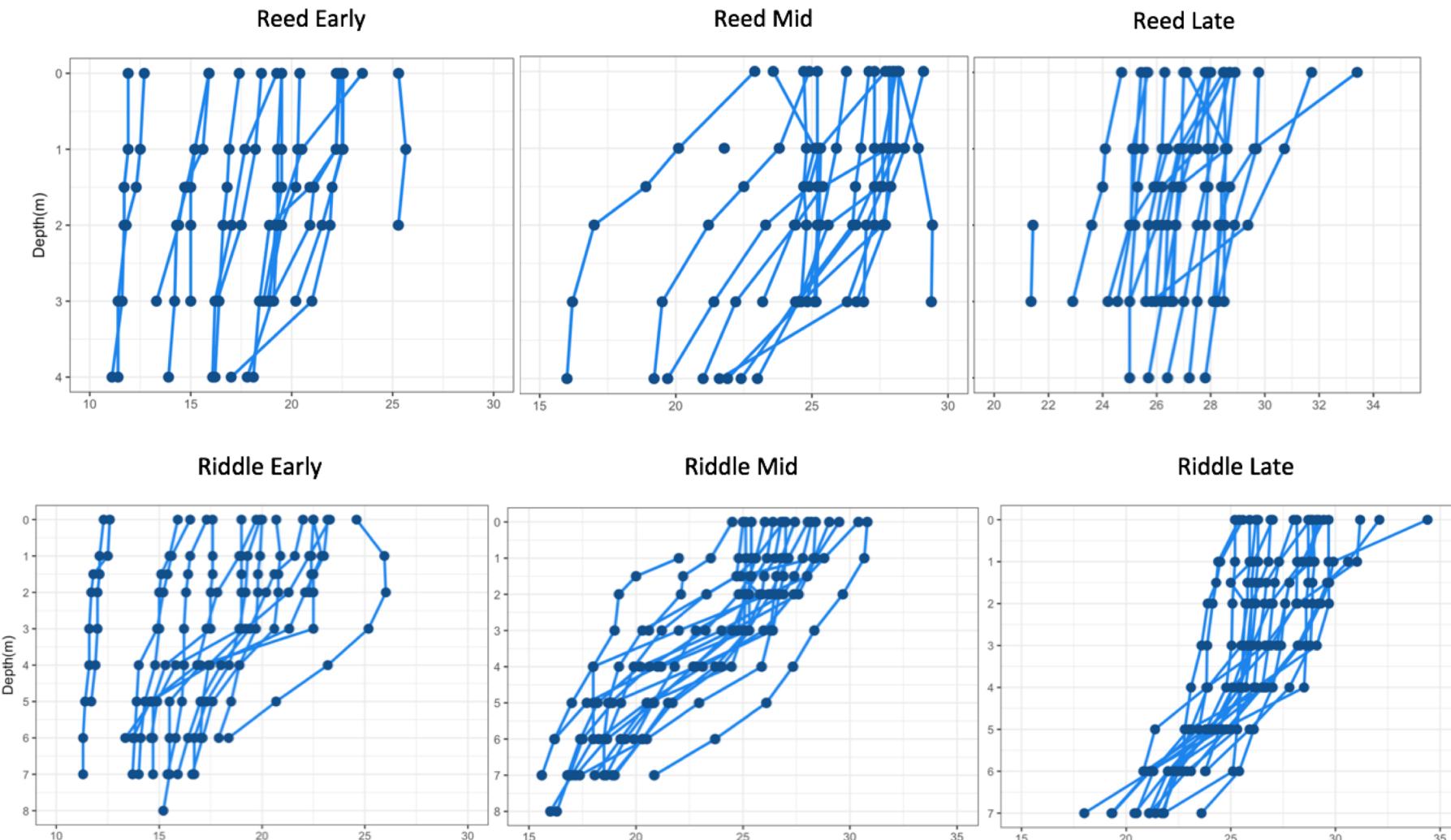


80% of Reed samples > Riddle samples

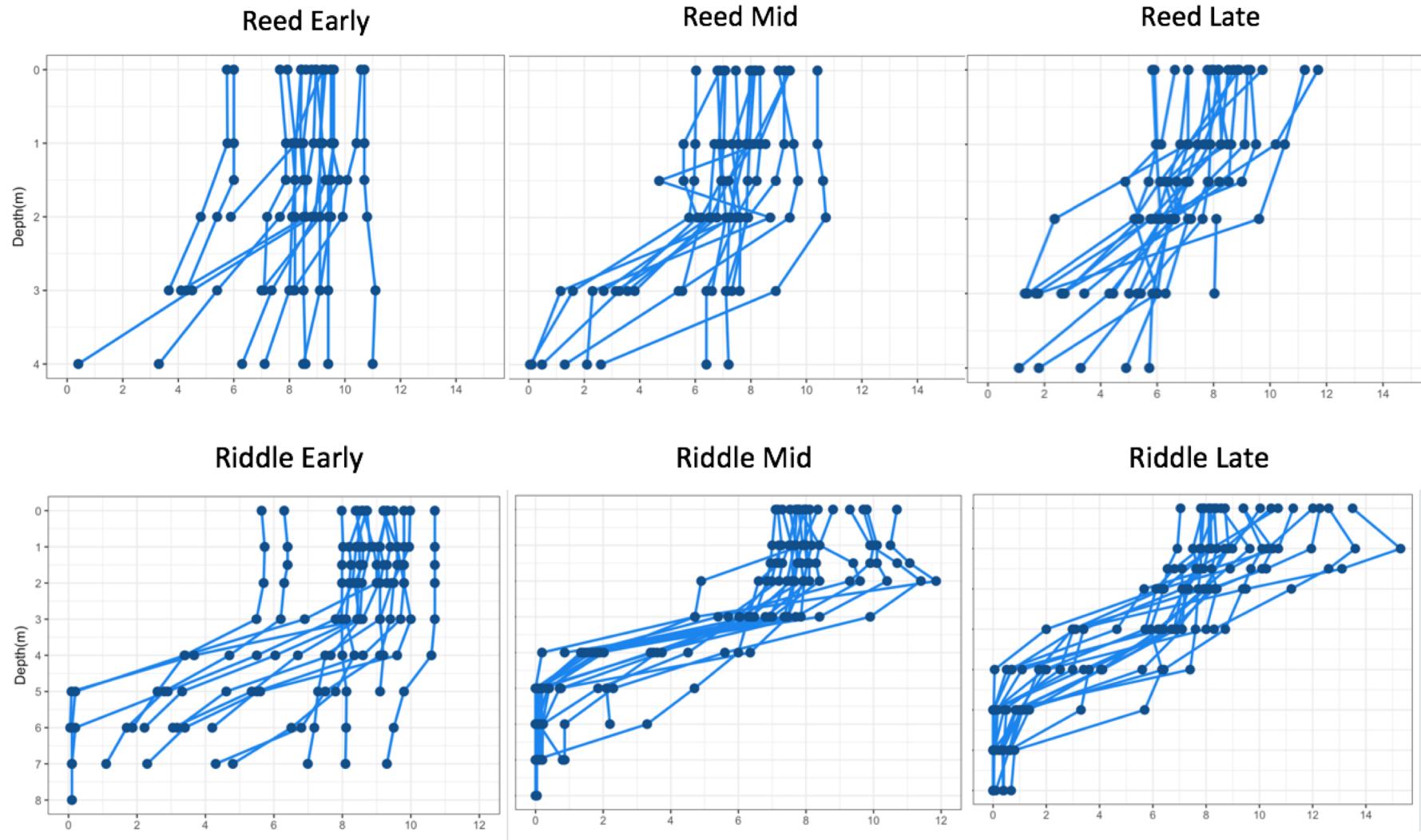


71% of Reed samples > Riddle samples

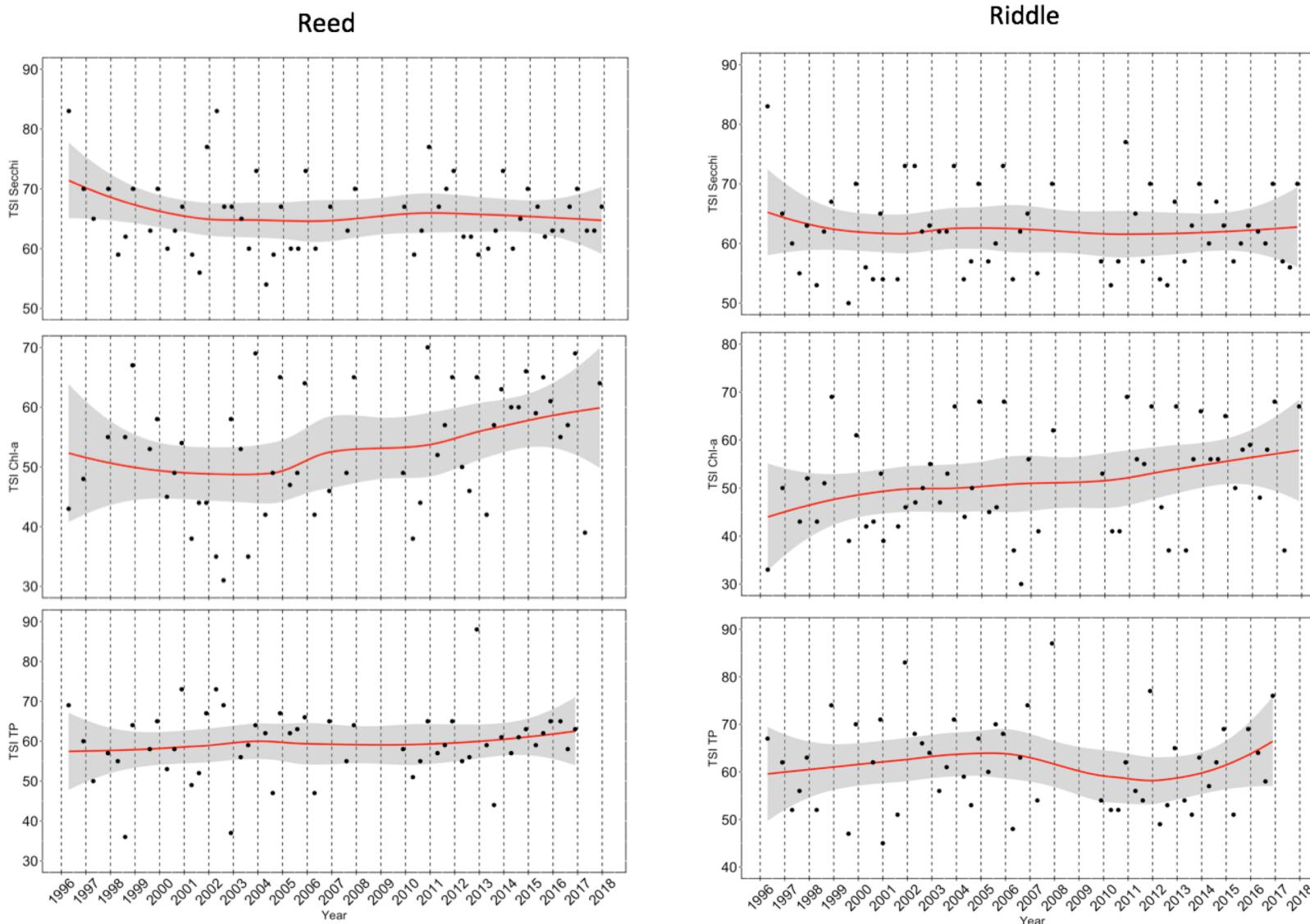
Results – Thermal Stability



Results – Dissolved Oxygen



Results – Change over time



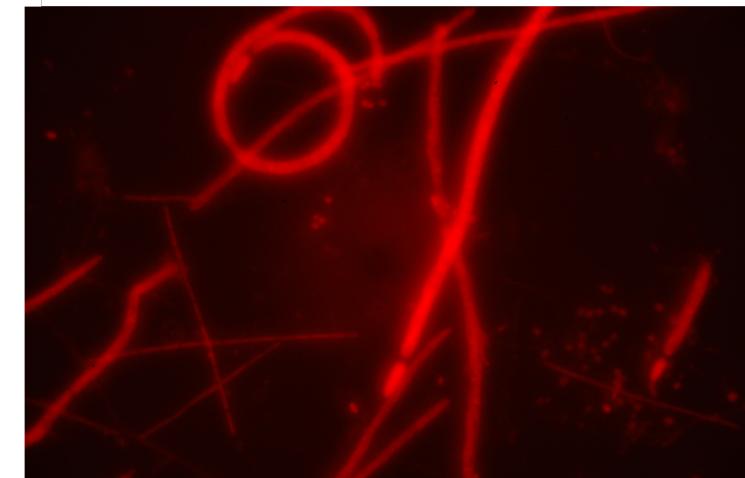
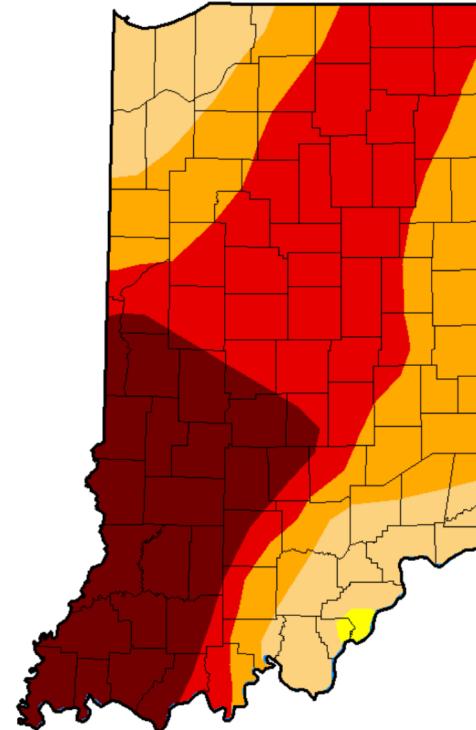
Discussion

- Yearly water quality appears to be relatively consistent since 1996
 - Conditions during growing season indicative of a shallow, eutrophic reservoir
- Apparent longitudinal gradient through reservoir
 - Clearer in model as growing season progresses

Further Research

- Climate factors relating to dataset – drought years
- Water quality across vertical gradient
- Harmonize plankton data to understand dynamics in Lake Lemon

U.S. Drought Monitor - 2012



Acknowledgements

- Indiana Clean Lakes Program
- Adam Casey – Lake Lemon Conservancy District
- Indiana University - School of Public and Environmental Affairs



Questions?

