Recovery of Copake Lake's Water Quality and Control of Nuisance Aquatic Vegetation

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Talk Overview

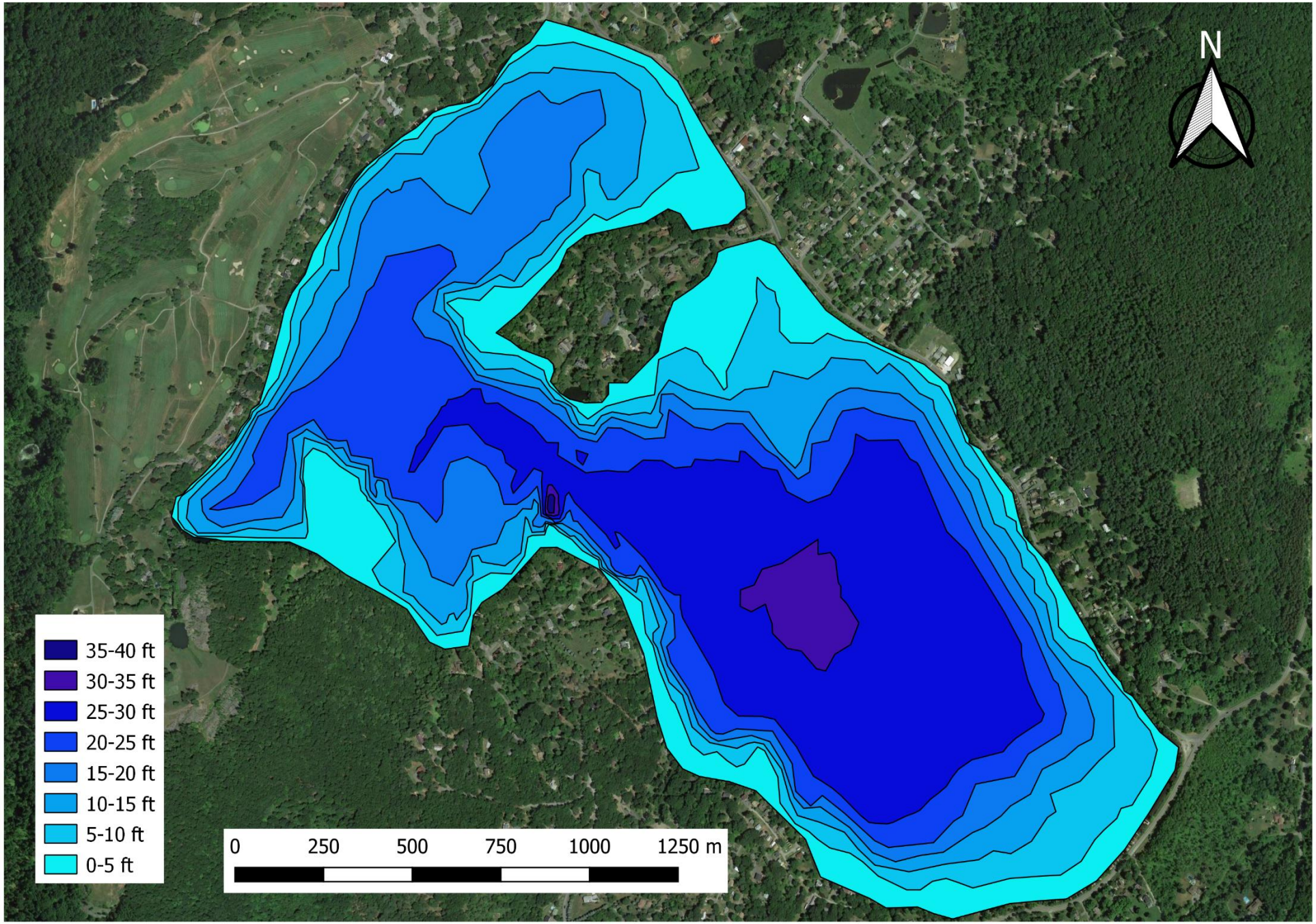
- Short History of Copake Lake
- Eurasian watermilfoil and Curly Leaf Pondweed Management
- Water Clarity and Internal Loading Dynamics
- Macrophytes and Water Quality
- Conclusions

Copake Lake

Lake Acres: 410

Watershed Acres: 1337

Watershed to Lake Ratio: 3.2:1



Identification of Lake Problems

- 1973 NY DEC investigated sanitation conditions around the lake
- 1974 Assemblyman Lawrence Lane declared the lake was suffering from eutrophication
- 1976 First Copper sulfate application made

Early Lake Management

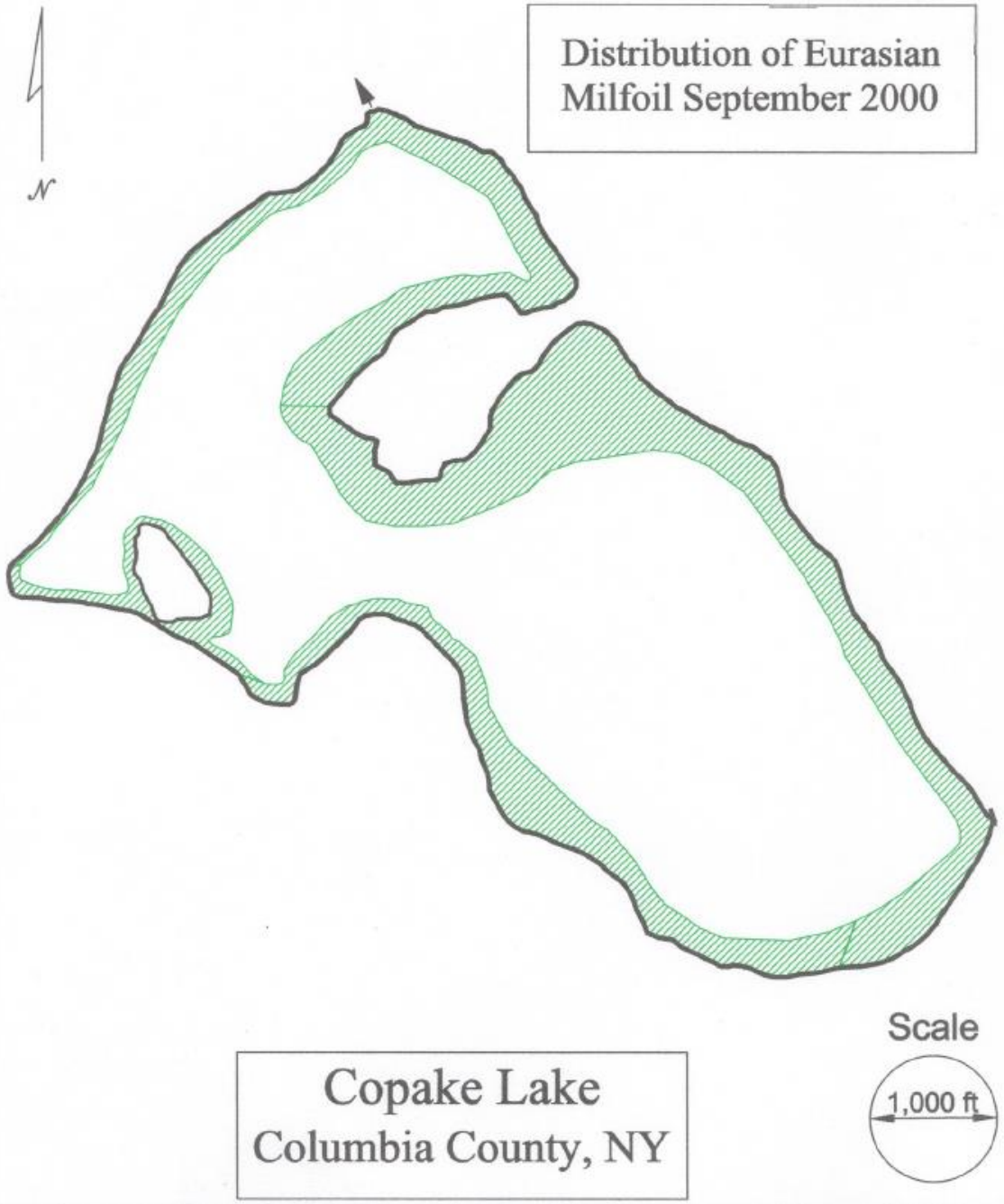
- 1979 Syracuse university reported that lake was unsafe for swimming, Columbia county health depth disputed.
- Weed harvesting was suggested by DEC, copper sulfate deemed cosmetic.
- Weed harvesting began in 1980, operations continued until 2002.
- 1986 Continuous CuSO4 application twice per season.

Lake Monitoring

- 1986 to 1990, 1996 to 2000 CSLAP Sampling was done
- In 2000, NEAR contracted to conduct a diagnostic study of lake
- Results:
  - Plant nutrients were significantly high
  - Lake devoid of oxygen below 20ft
  - Two invasive weeds covered ~130 acres of lake surface, topped out plants.

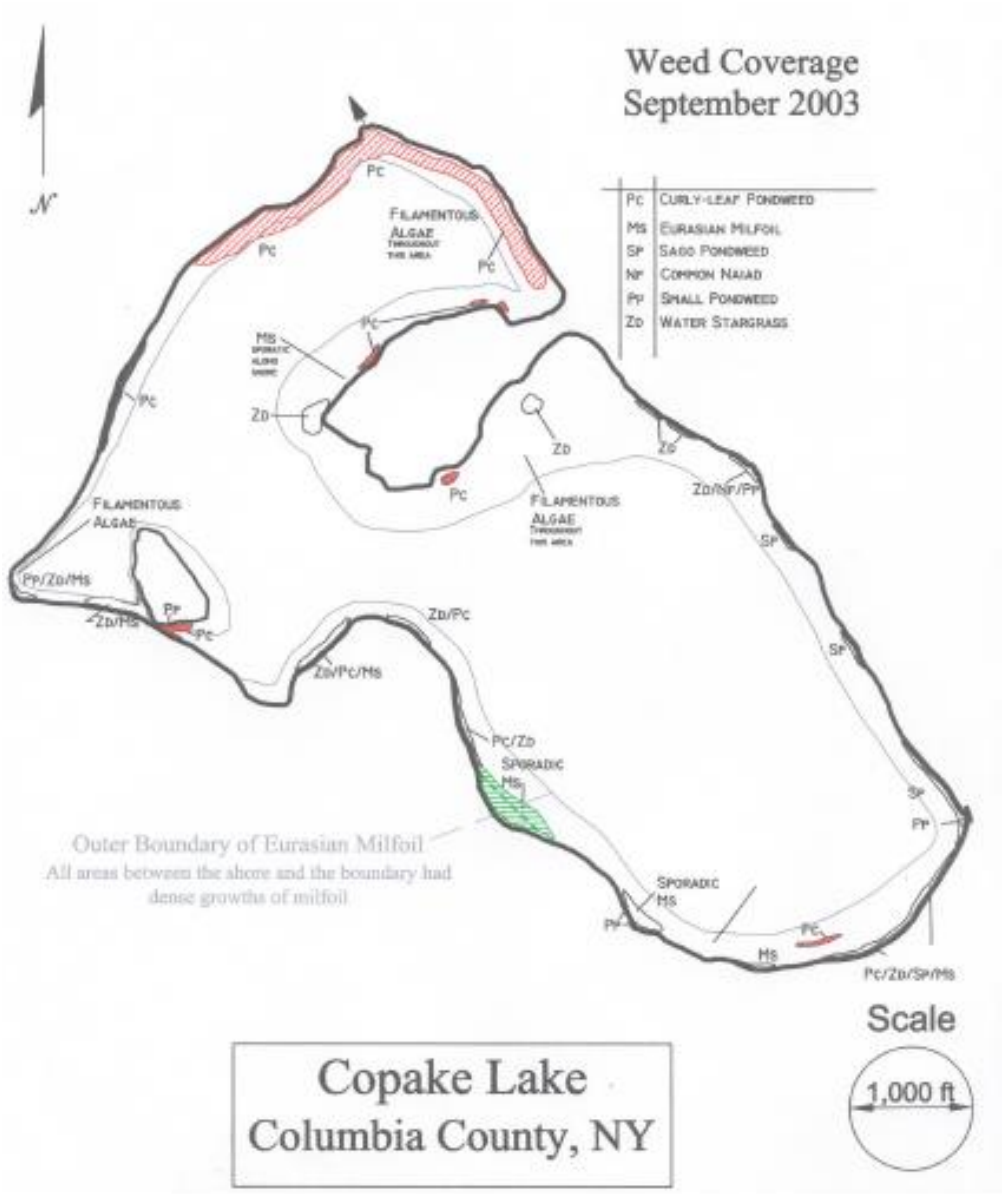
First Herbicide Treatment

- Whole lake fluridone treatment in 2002
- 30% of entire surface area was covered with Eurasian Watermilfoil.



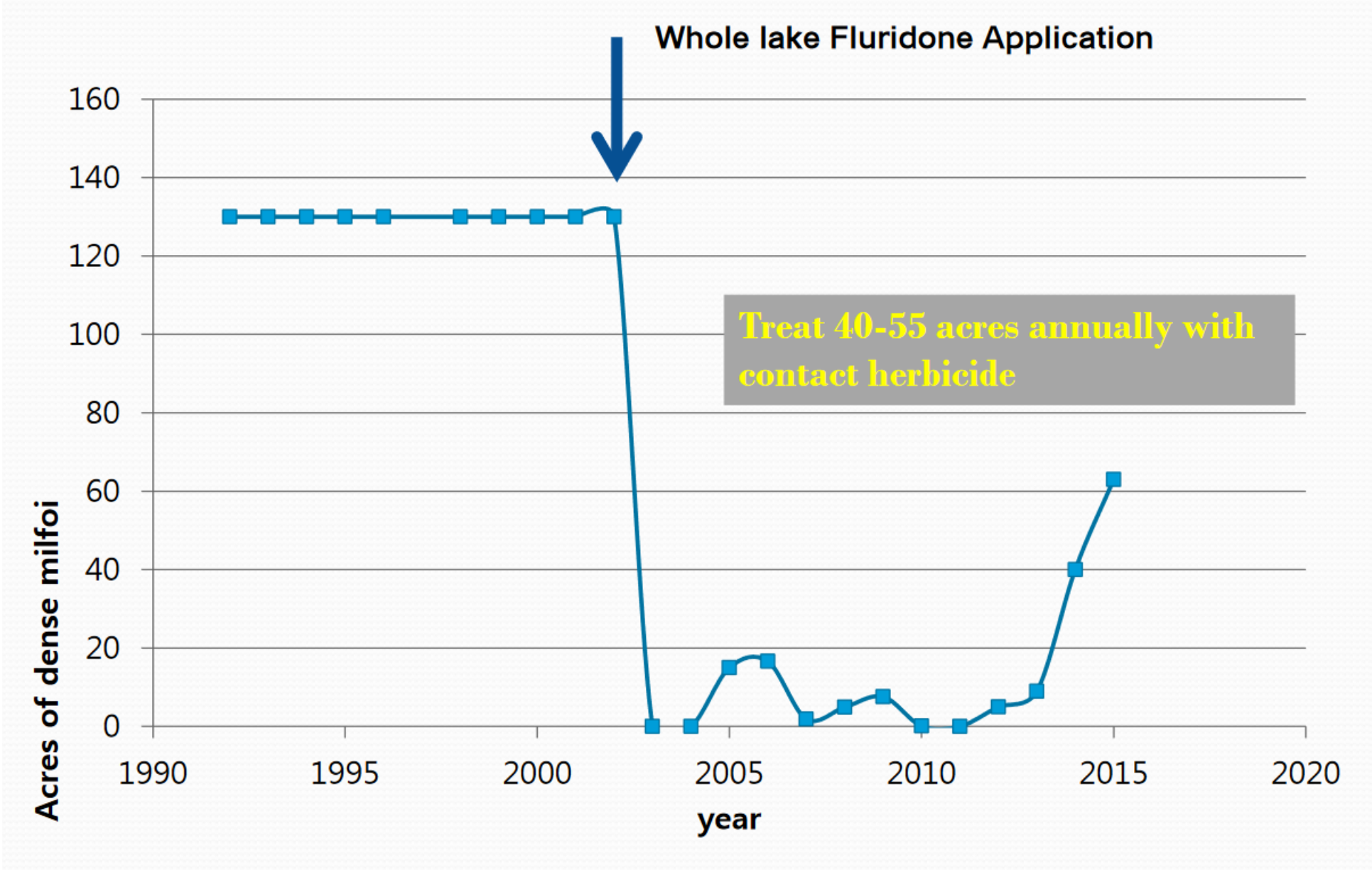
Post Fluridone Application

- Curly Leaf Pondweed returned in late season, with about 10 acres of coverage

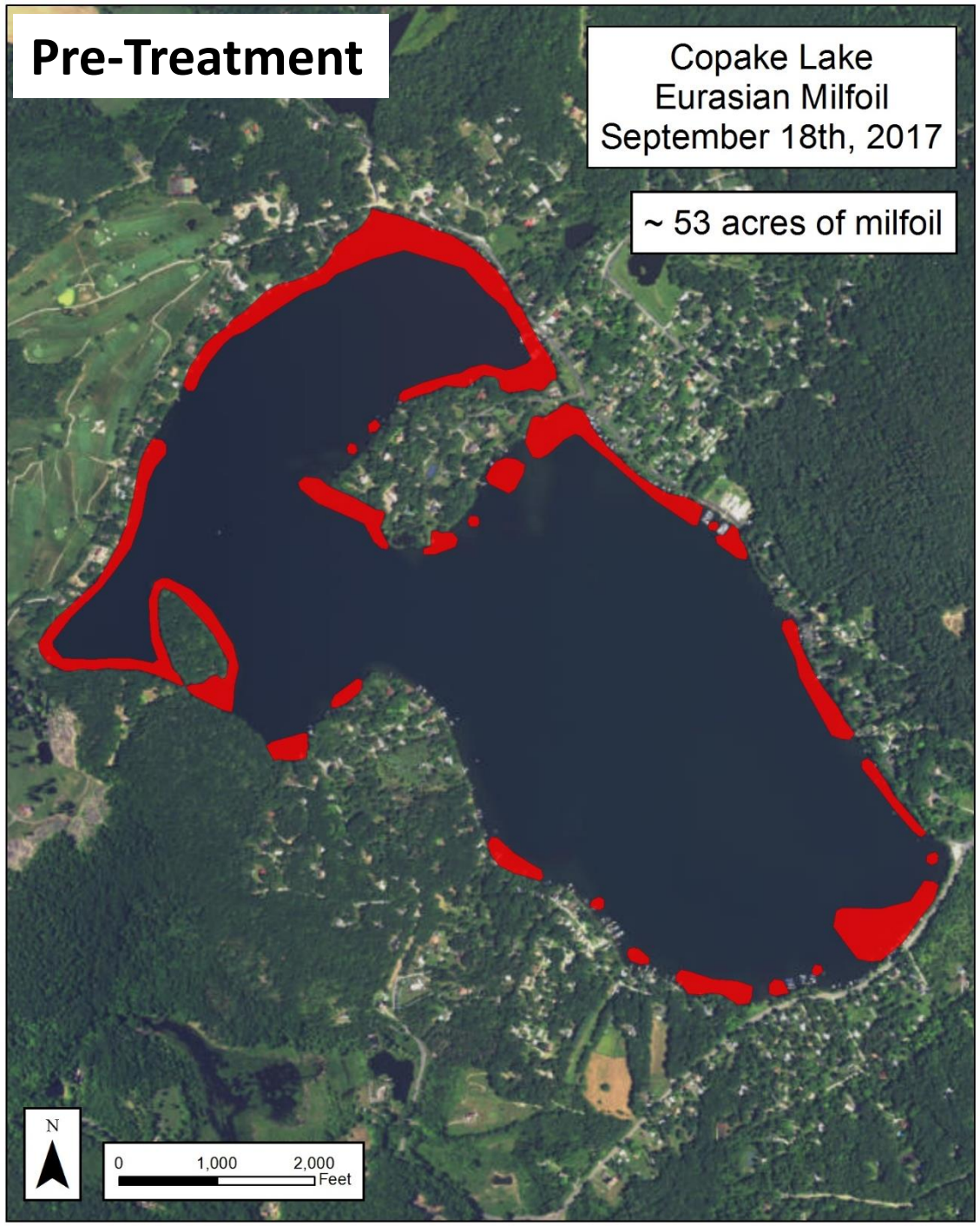


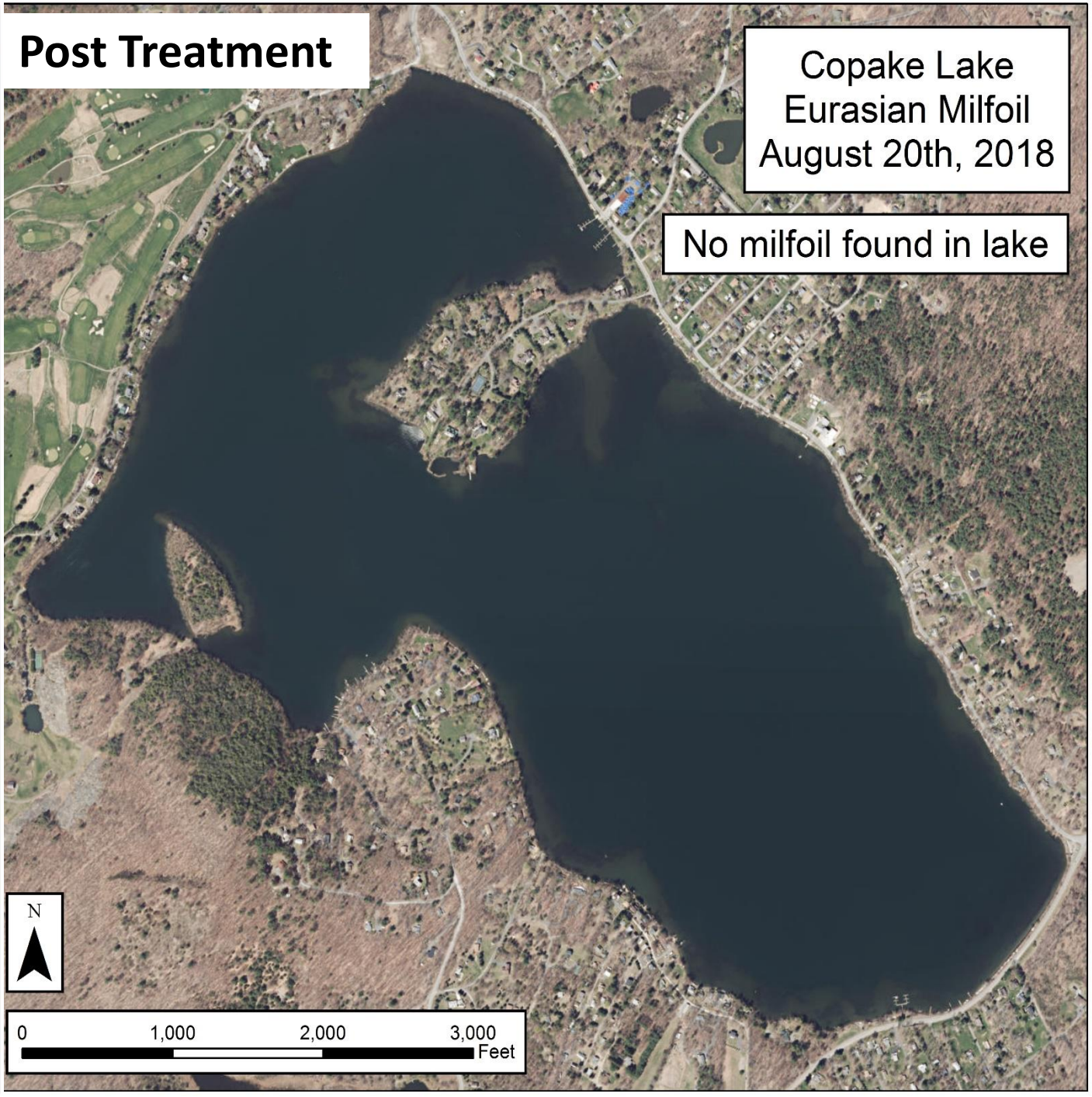
2004 to 2016

- Milfoil and curly leaf populations waxed and waned, but did not reach pre-2002 treatment levels
- Various strategies used to keep plants in check
  - Spot herbicide treatments
  - Hand pulling
  - Drawdown

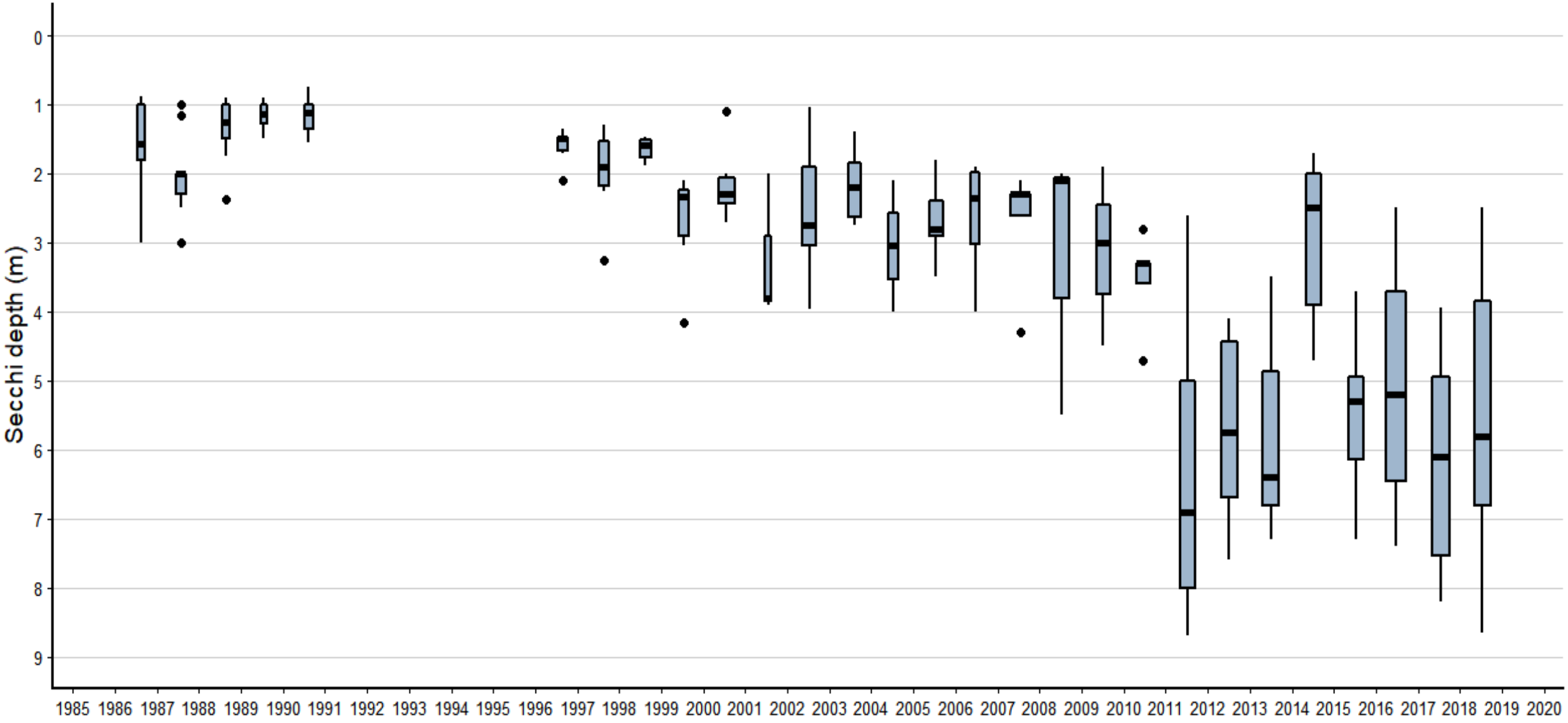

Whole lake Fluridone Application
160
140
120
100
80
60
40
20
0
Acres of dense milfoi
1990
1995
2000
2005
2010
2015
2020
year
Treat 40-55 acres annually with contact herbicide


Copake Lake
Mosquito Island
Copake Lake
© 2015 Google
Dense Milfoil Beds 2015-
62 acres
2261 ft

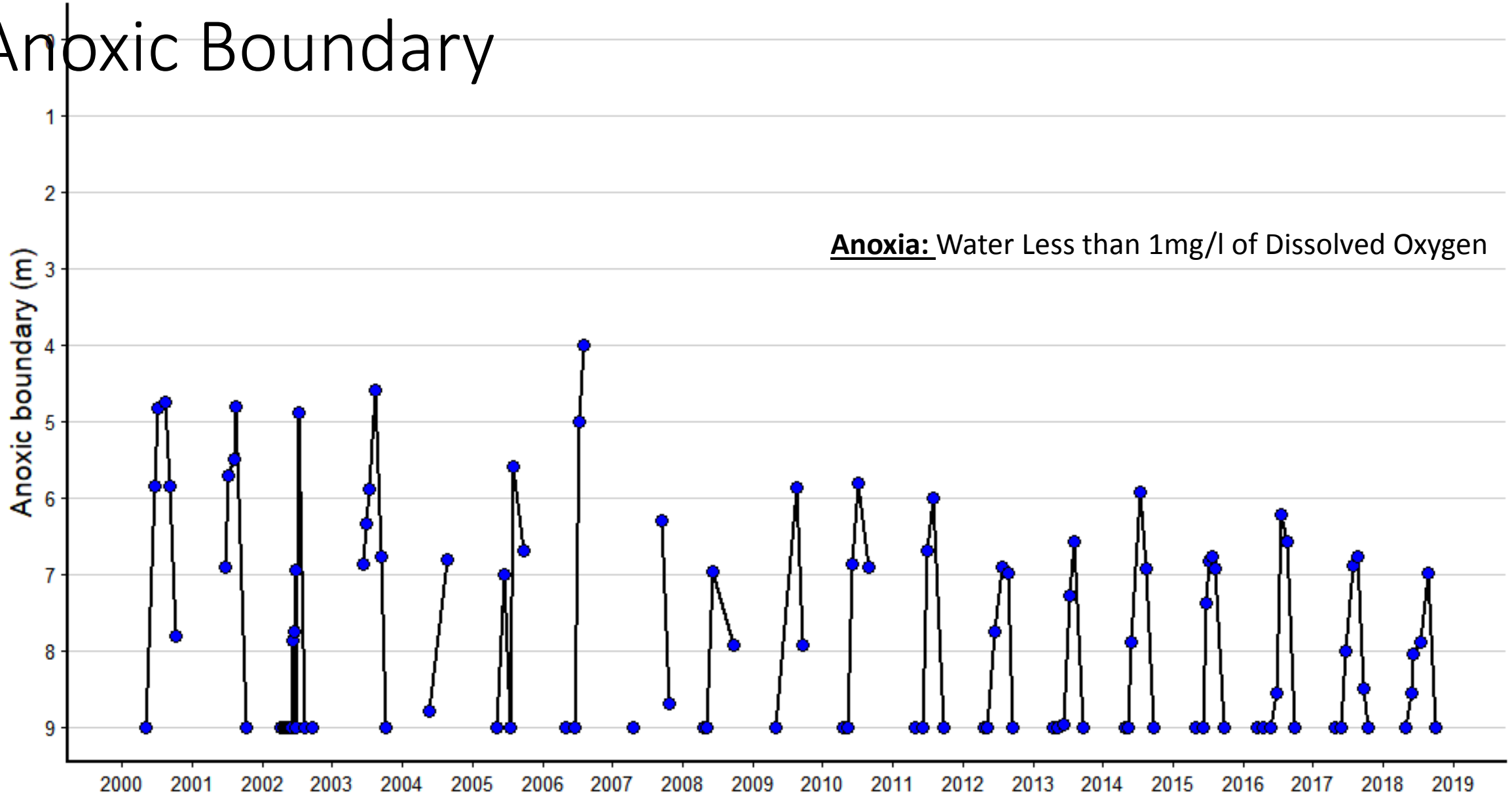

Pre-Treatment
Copake Lake
Eurasian Milfoil
September 18th, 2017
~ 53 acres of milfoil
N
0
1,000
2,000
Feet


Post Treatment
Copake Lake
Eurasian Milfoil
August 20th, 2018
No milfoil found in lake
N
0
1,000
2,000
3,000
Feet

Water Clarity via Secchi Disk

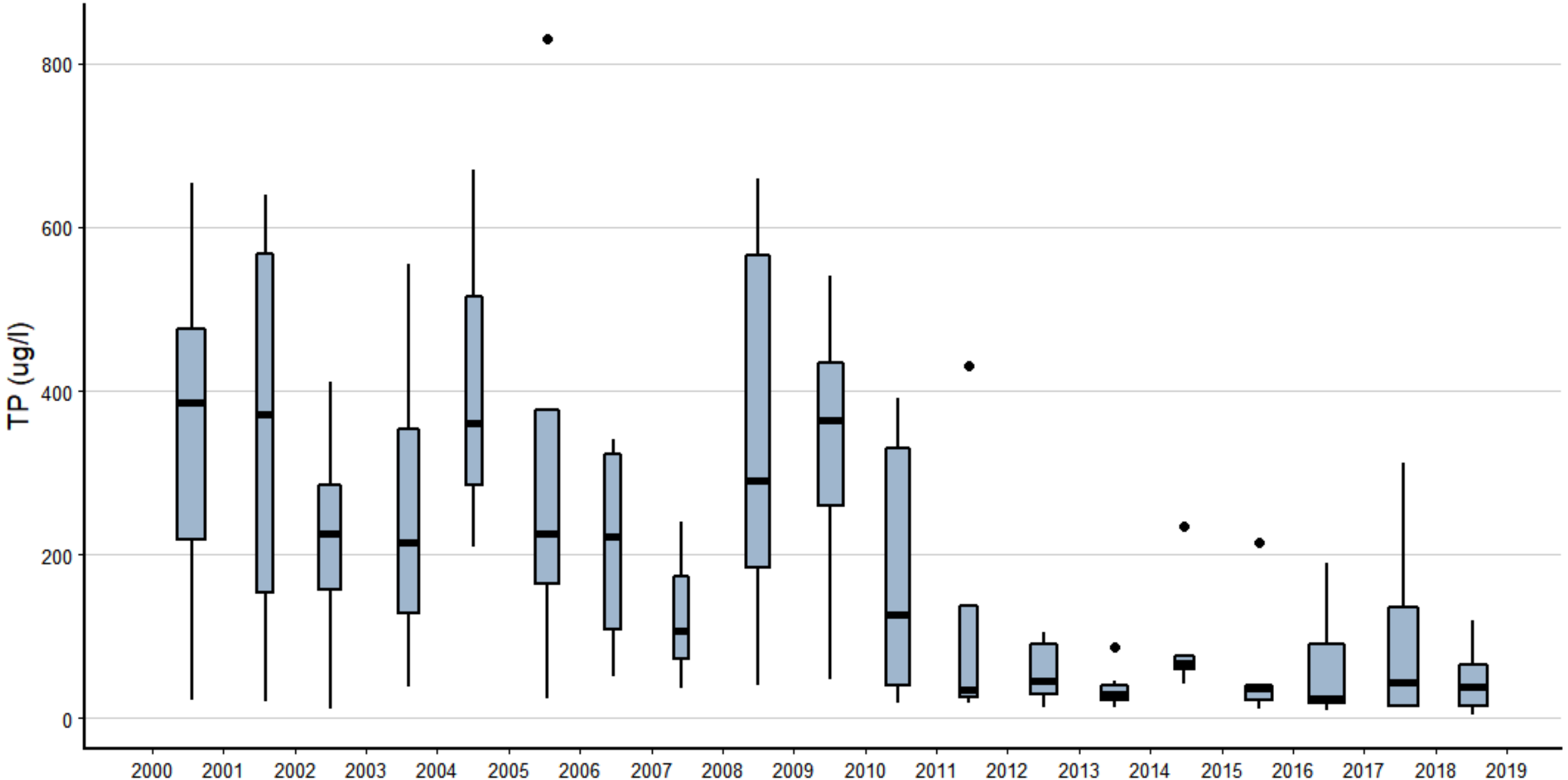


Anoxic Boundary

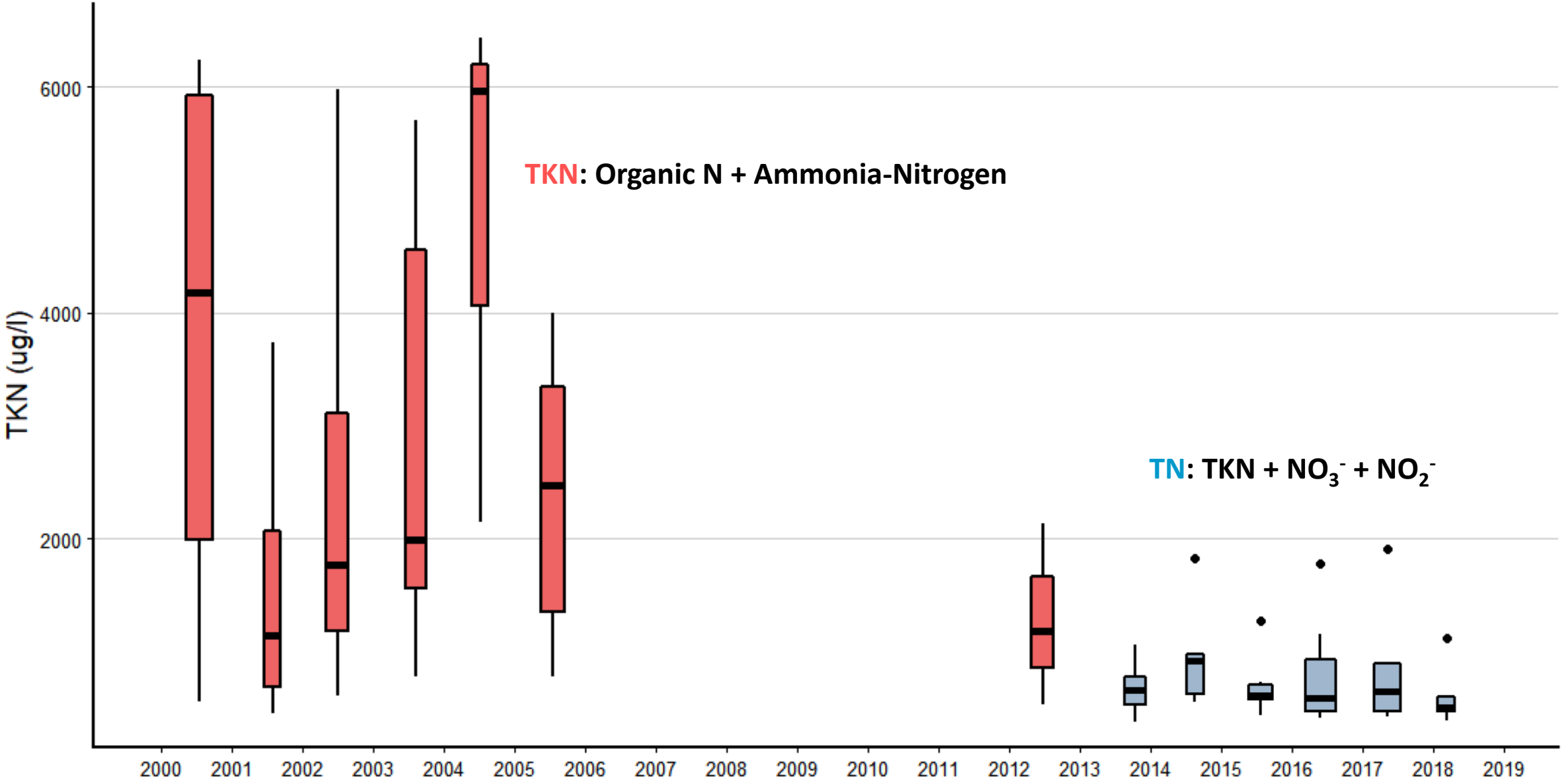


Anoxia: Water Less than 1mg/l of Dissolved Oxygen

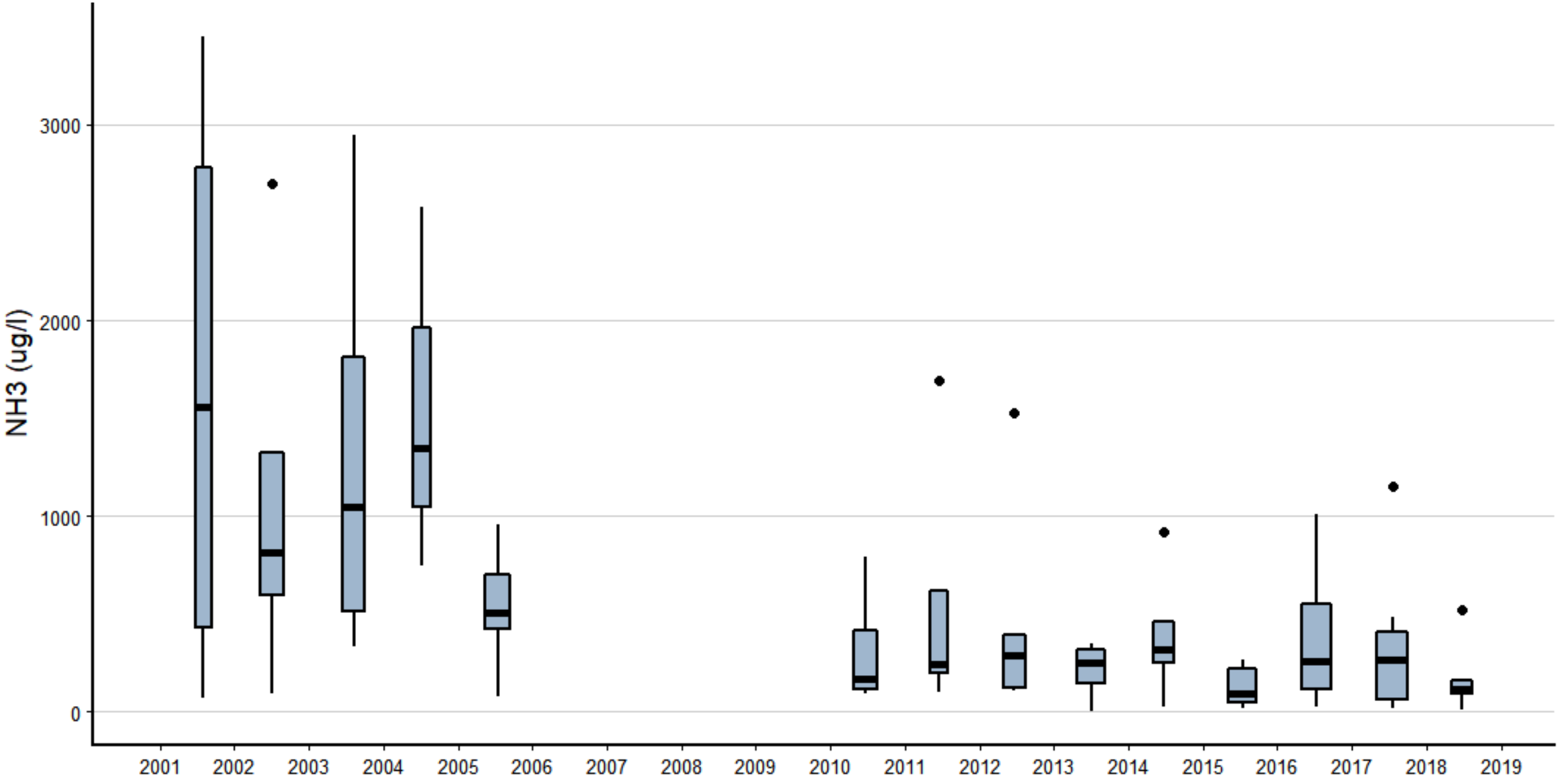
Bottom Total Phosphorus



Bottom Total Kjeldahl Nitrogen and Total Nitrogen



Bottom Ammonia-Nitrogen



Macrophyte impacts on lake ecosystems

- Large stands of macrophytes have significant impacts on ecosystems
  - Habitat for ephyphitic algae
    - Can add ~7 to 36% to biomass of eurasian watermilfoil (Balci and Kennedy 2003).
  - Enhance deposition of fine sediments (Carpenter and Lodge 1986)
  - Enhanced movement of nutrients from sediment to water column during the year and during senescence.

Reduction of Eurasian Watermilfoil

Decreased fine sediment deposition

Increased near-shore sediment erosion

Near shore sediments become coarser, less habitable for nuisance plant growth

Decreased plant senescence at end of year

Decreased organic matter and nutrient load from plants

Reduced internal loading

Improved oxygen conditions

Increased Water Clarity

Conclusions

- Use of EPA registered herbicides effectively knocked back aquatic plant coverage.
  - Not all formulations worked as intended though.
- Changes in aquatic plant coverage likely played a major role in increased water quality conditions
- Not the only source of nutrients though
  - Septic systems
  - Stormwater runoff

Looking forward….

- Copake Lake has the best clarity in years
  - 7.6m this spring!
- Still some issues remain…