Understanding Cisco Decline in Wisconsin's Inland Lakes

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WISCONSIN
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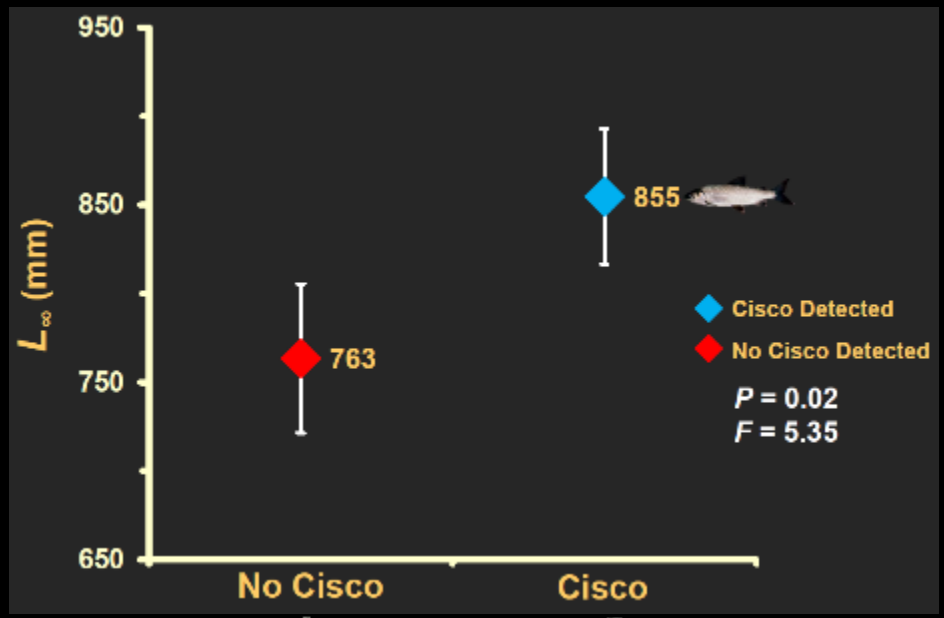
SPORT FISH RESTORATION

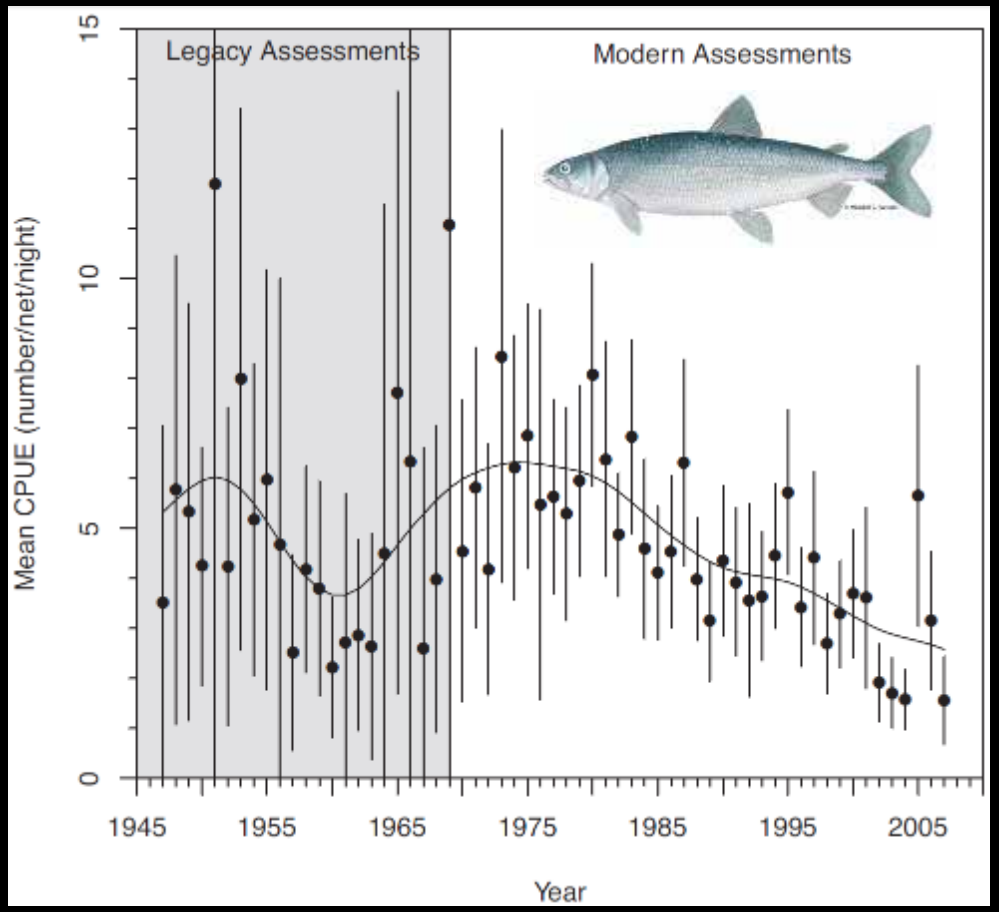
Cisco, a Sentinel Species

- Cisco *Coregonus artedi*
  - Coldwater fish found in deepest lakes with best water quality
    - Indicator of lake health
  - Keystone species
    - High quality forage for gamefish
- Cisco lakes are a special aquatic resource

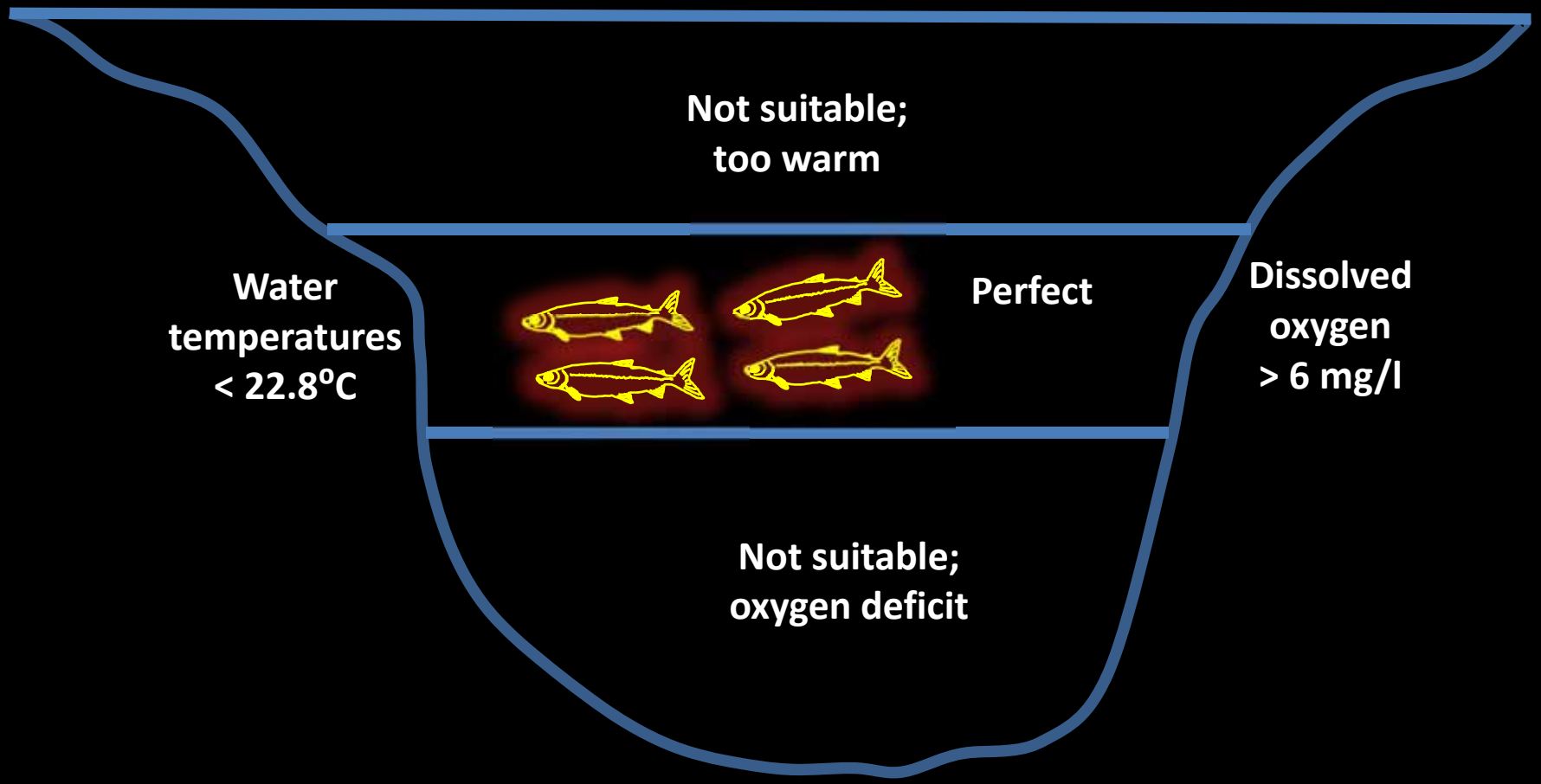


Recent Concerns about Cisco Populations

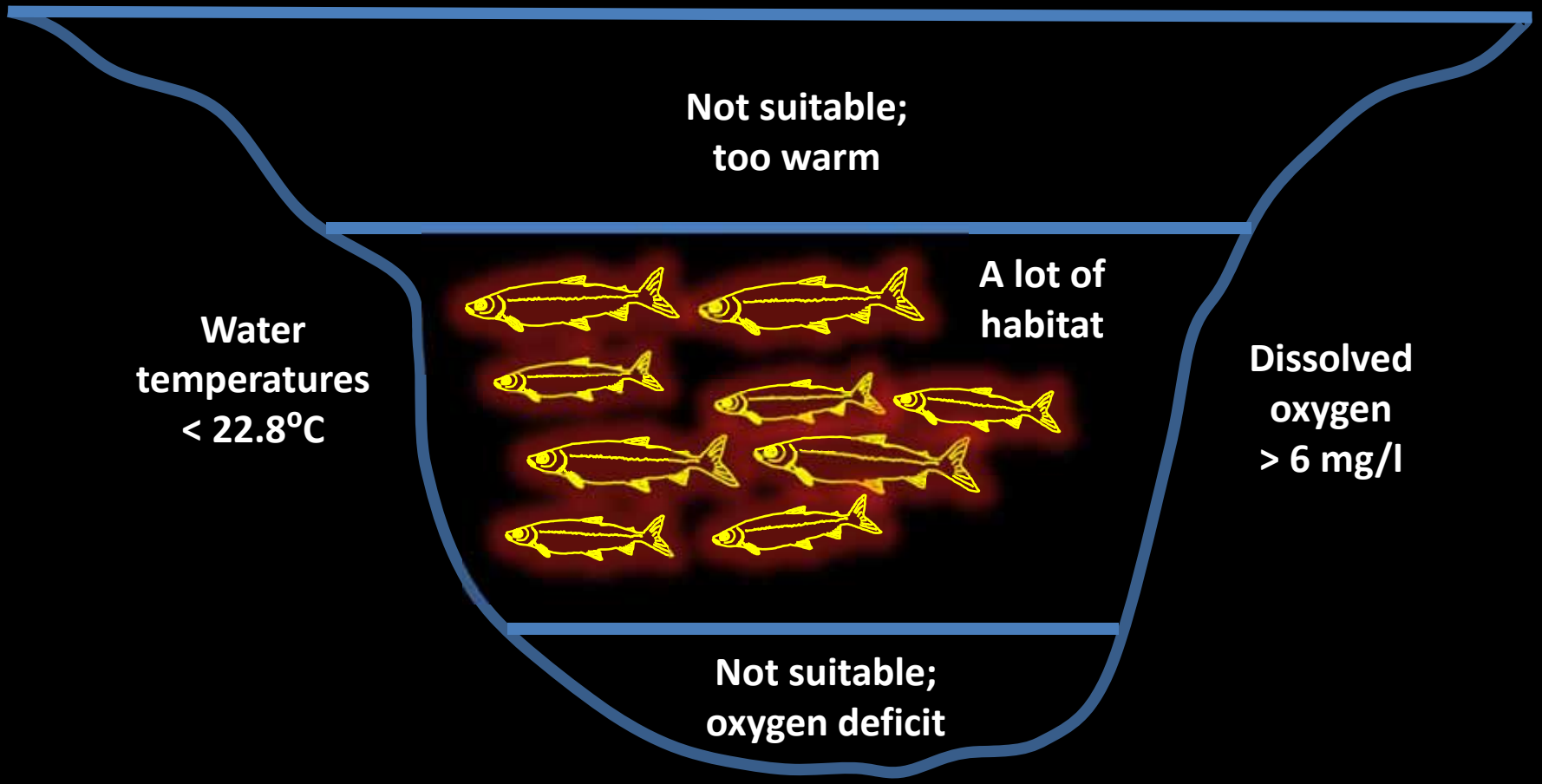
- Decline of cisco in Midwest
  - Lakes near Southern extent of range (IN) experienced considerable extirpations
  - Decline in gillnet catch rates in MN lakes since 1975.
  - Oxythermal habitat loss
    - Land use change & eutrophication
    - Climatic variation
  - Biotic interactions
    - Invasive smelt



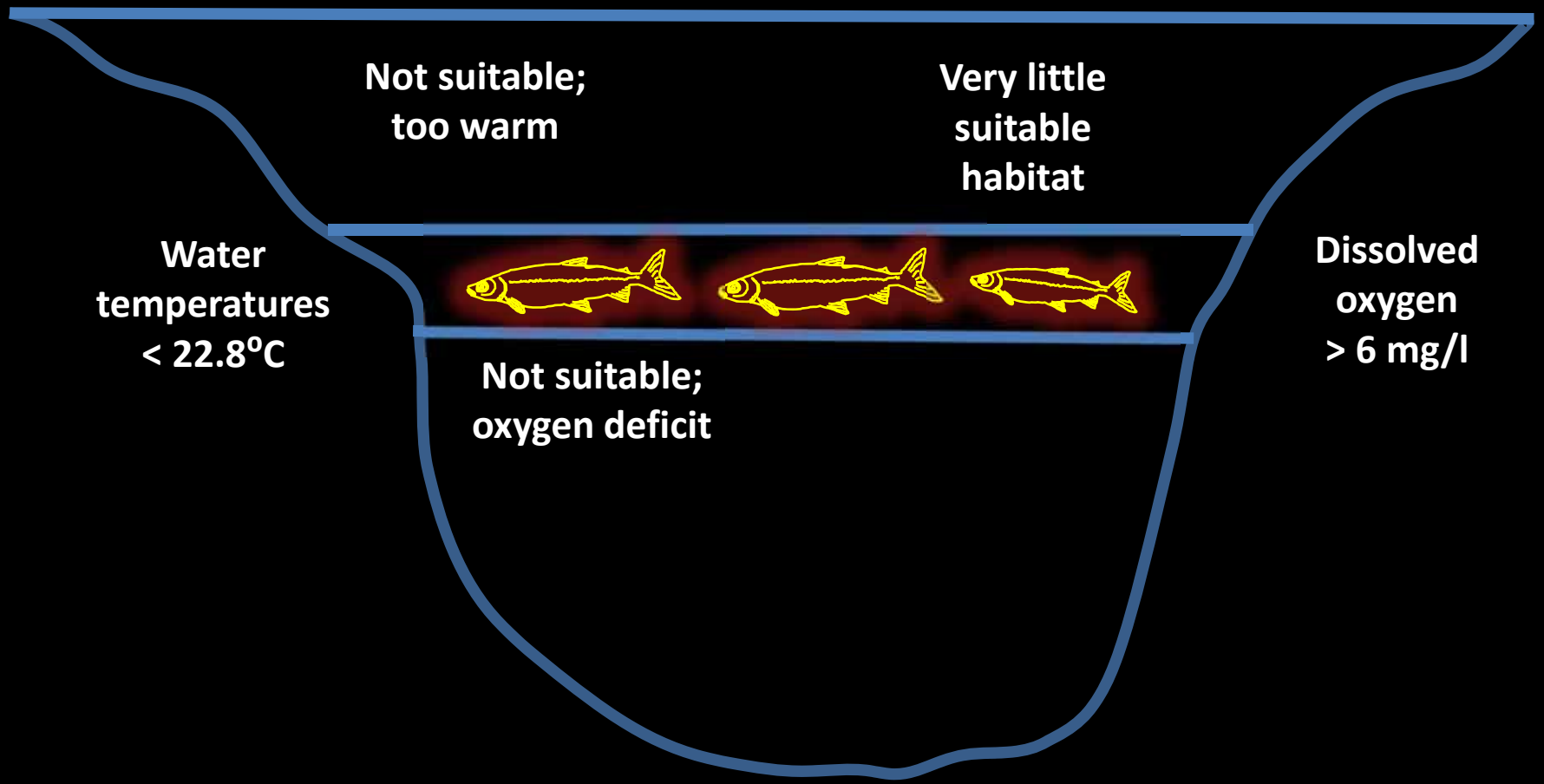
Hypothetical Cisco Habitat



Very Deep Oligotrophic Lakes in Late Summer

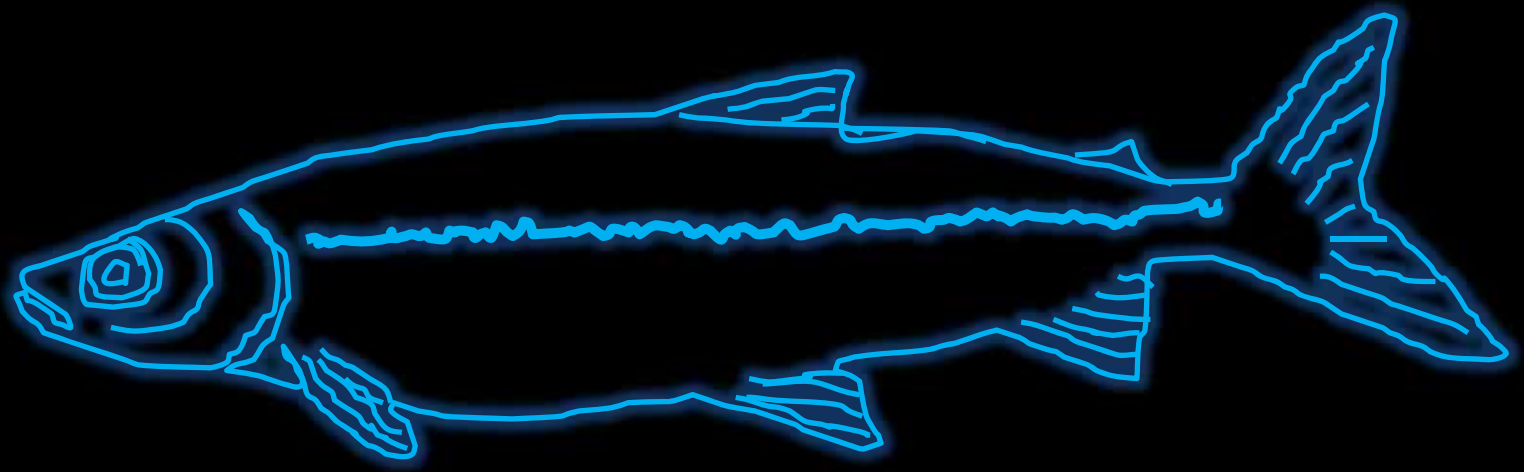


But for more Eutrophic Lakes In Late Summer



Our Study Objectives

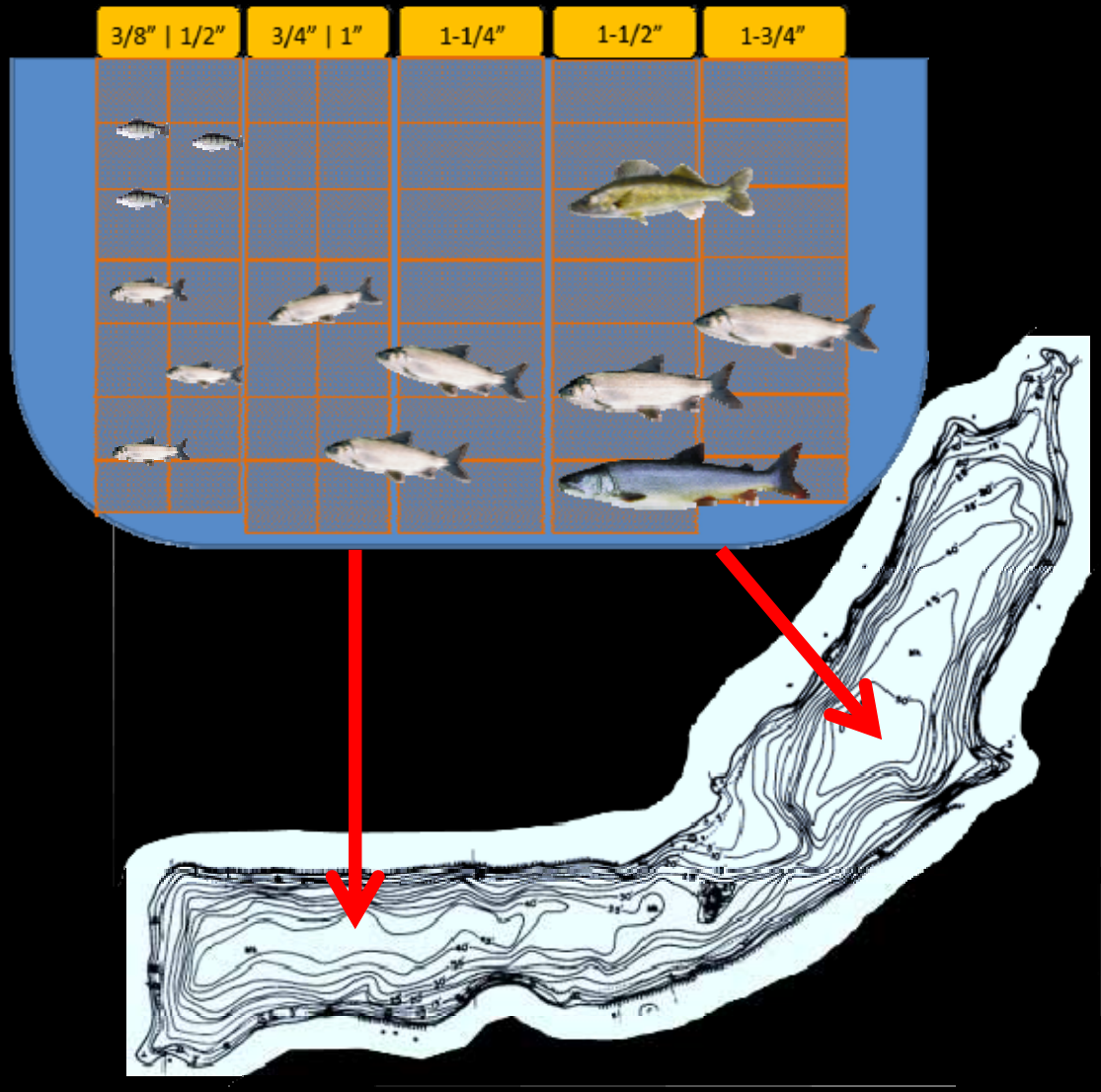
- Determine Current Status of Cisco Populations in WI
  - Describe what populations are intact
  - Determine what factors may be associated with persisting cisco populations



Methods: Study Area

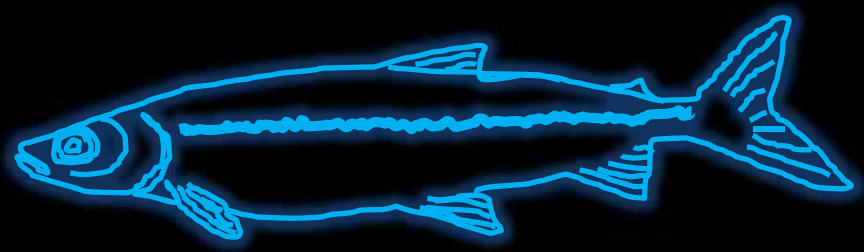
- Compiled historical cisco records
  - 188 lakes with valid records
  - 141 valid lake systems (pooled by chain)
- Historic distribution
  - Reflects glacial events
  - Surrounding driftless area
- Plan to systematically sample these lakes

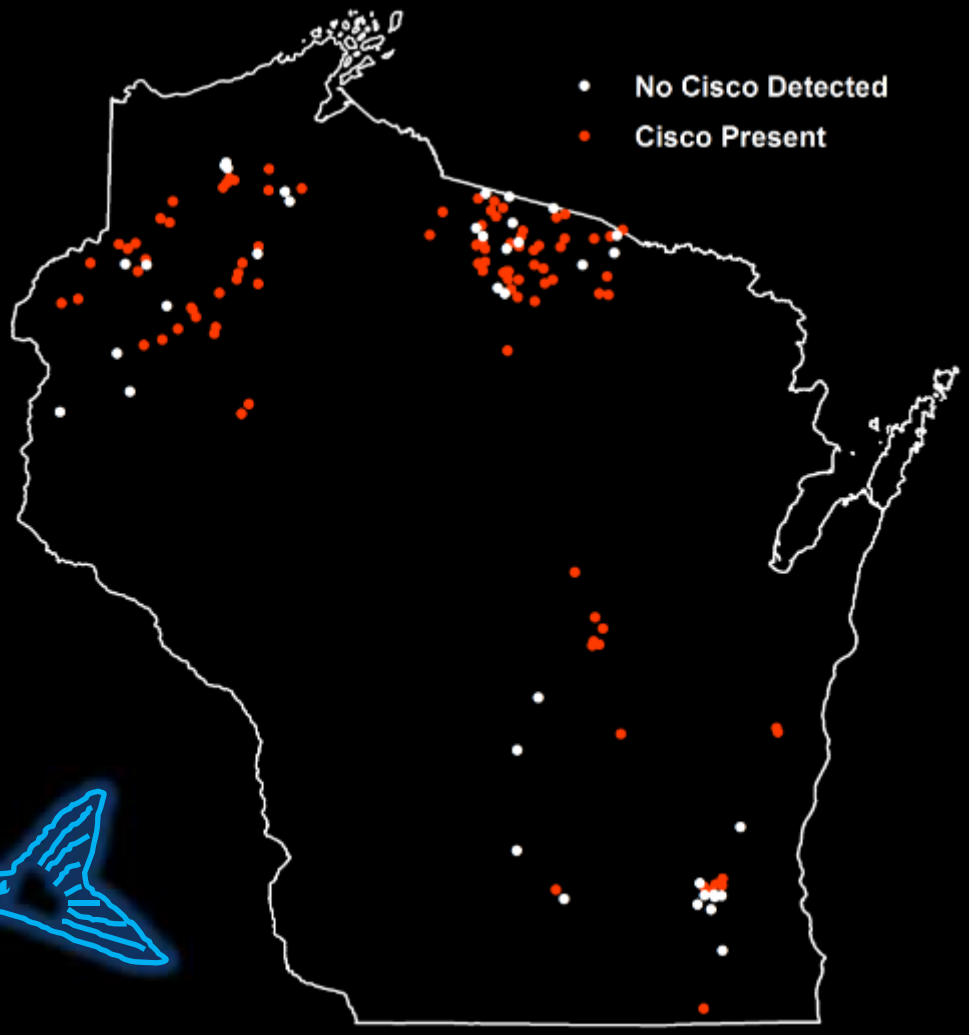
Fish Sampling: Vertical Gill Nets



Current Cisco Distribution

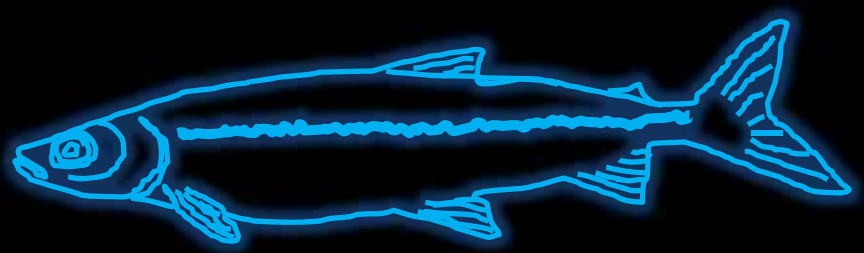
- 133 lake systems assessed
  - Detected
    - 95 (71%)
  - No detection
    - 38 (29%)

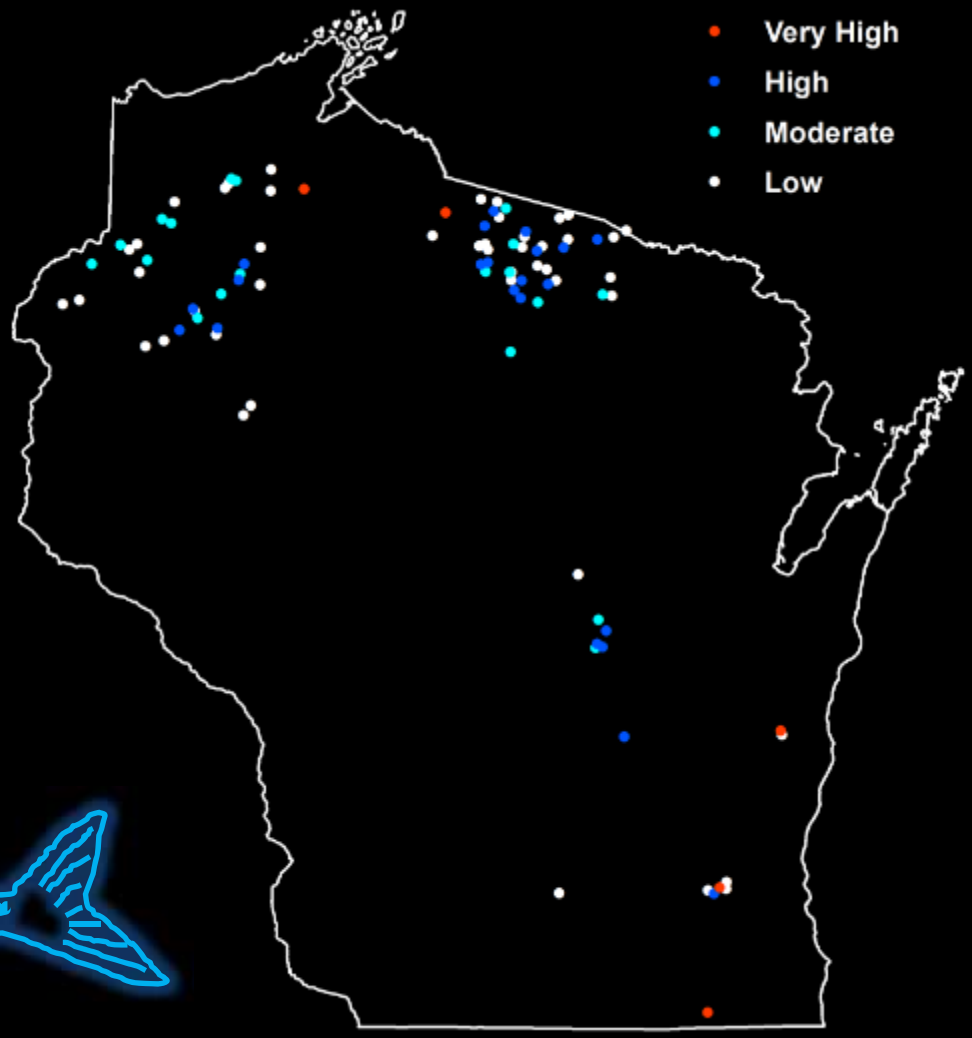




Cisco Relative Abundance

- Cisco catch rates
  - 5 lakes (4%)
    - > 50 fish/night-gang
  - 23 lakes (17%)
    - 25-50 fish/night-gang
  - 20 lakes (15%)
    - 10-25 fish/night-gang
  - 46 lakes (35%)
    - < 10 fish/night gang





What Drives Cisco Persistence?

- Environmental conditions influencing cisco are correlated
  - Ex: Latitude with agriculture, conductivity, & degree days
  - This limited our modelling
- Best model
  - 67% overall accuracy
  - Used 4 of 10 potential predictors

↑ cisco persistence =

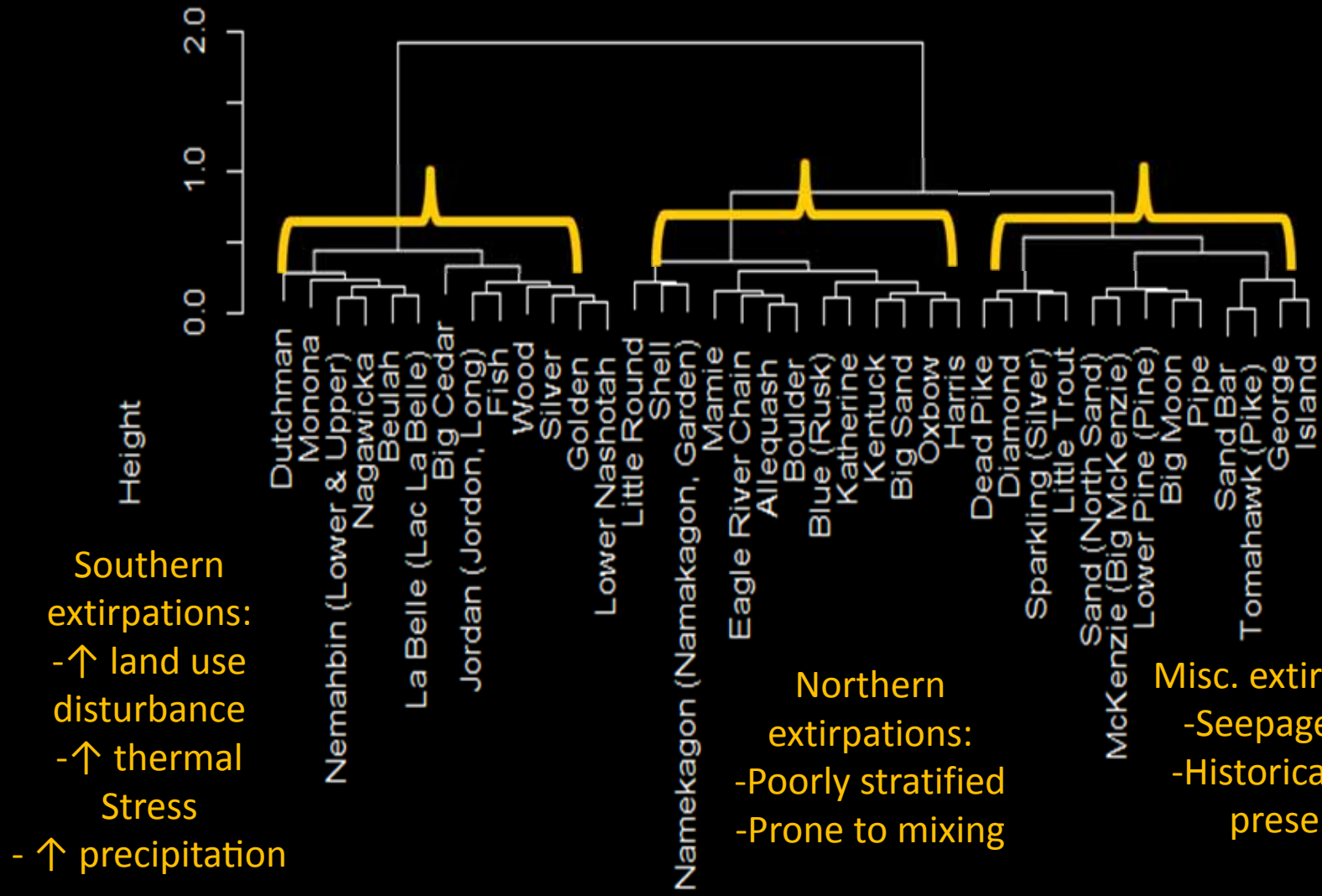
↓ degree days

↓ annual precipitation

↑ forest in watershed

↓ watershed to lake ratios

No Clear Explanation of Cisco Persistence/Extirpation



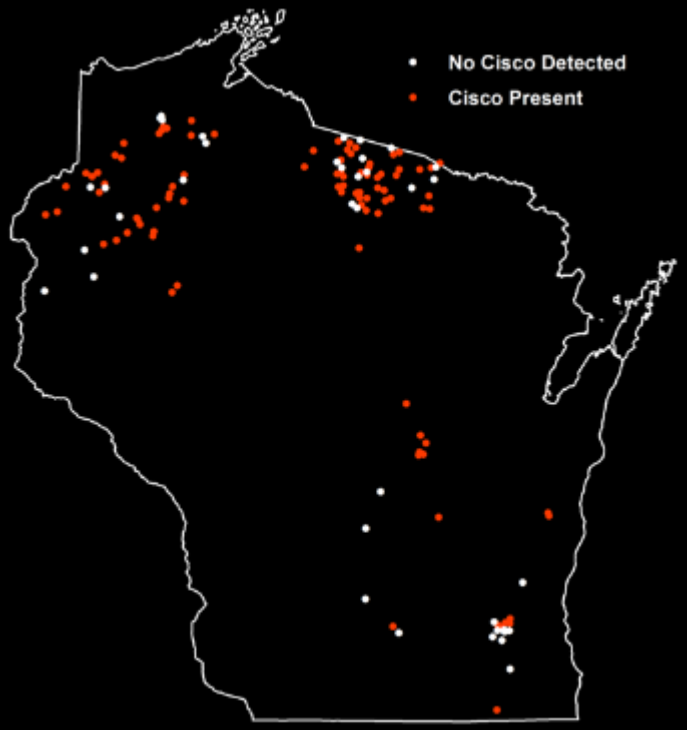
Southern extirpations:
-↑ land use disturbance
-↑ thermal Stress
- ↑ precipitation

Northern extirpations:
-Poorly stratified
-Prone to mixing

Misc. extirpations:
-Seepage lakes
-Historical smelt presence

Conclusions

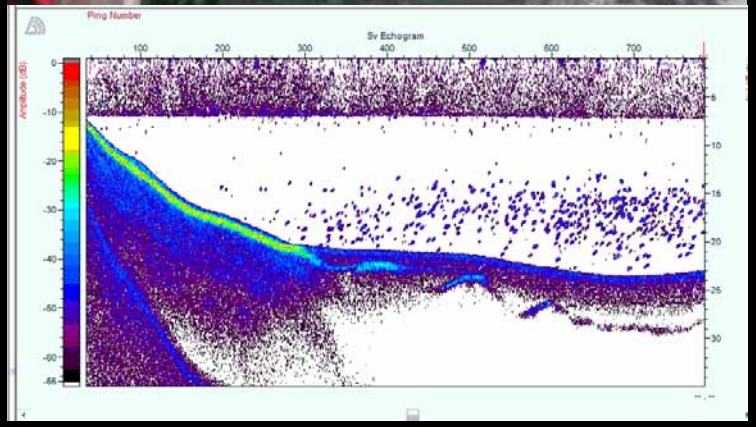
- 29% reduction in cisco distribution
  - Greater proportion of absences in Southern lakes
- Decline seems to be driven by climate and watershed characteristics
  - Cannot manage climate
  - Realistic management should focus on land use change
- Difficult to model cisco persistence/extirpation
  - Regional environmental similarities in extirpations
  - One-time acute extirpation events may mask what long-term environmental conditions suggest
    - Ex: Big Cedar Lake 2003 summer-kill



Monitoring Cisco in the Future

- Cisco are an excellent sentinel species, but occurrence probably not best for monitoring cisco lakes

- Better to monitor more responsive cisco metrics:
  - Hydroacoustic estimates of biomass and production rates
  - Oxythermal habitat measures (TDO6)
  - Cisco body morphology



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