

Using DNA to track golden algae across Oklahoma

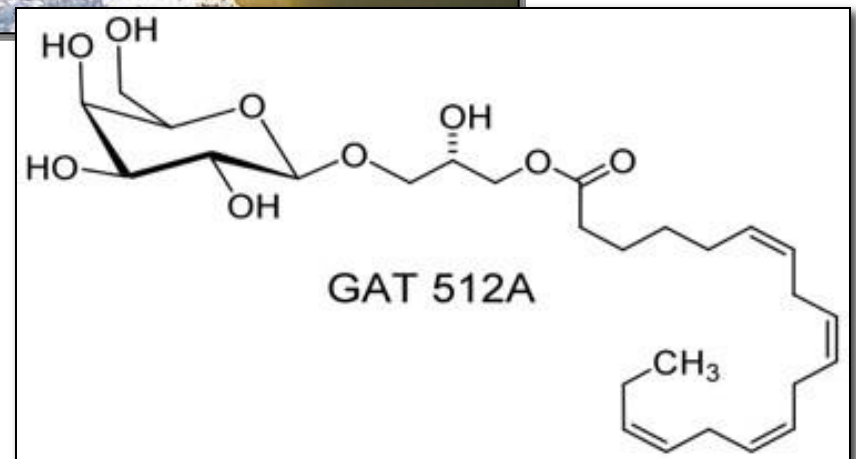
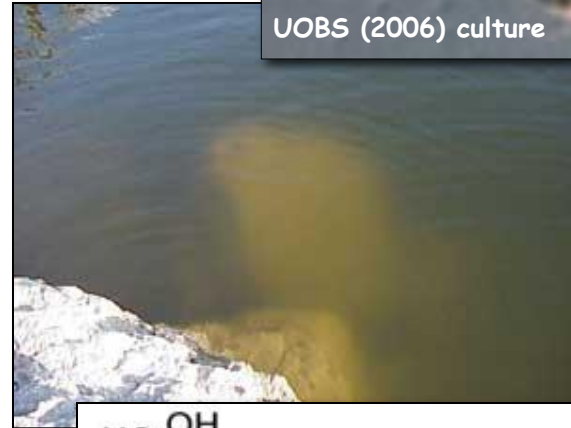


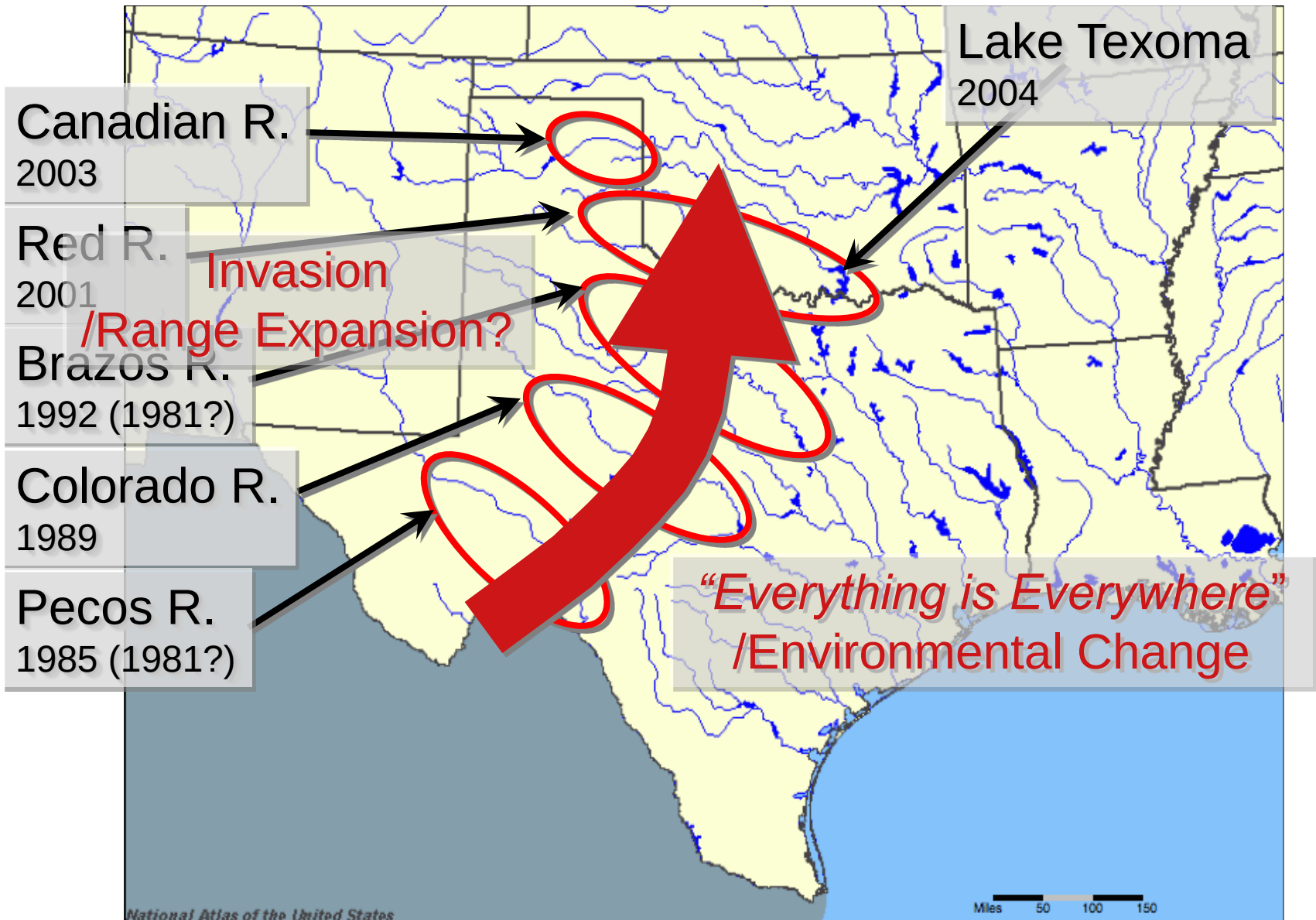
Rich Zamor

Univ. of Oklahoma & Biological Station, Dept. of Zoology, EEB

Introduction to *Prymnesium parvum*

- Single celled protist, class Prymnesiophyceae
- Originally classified from brackish/marine systems
- Blooms primarily in late winter through early spring in North America
- Mixotrophic
- Releases extracellular toxins







Working hypothesis:

Prymnesium parvum is
predictably distributed in
the landscape.

Reliable method for detection and quantification of a large number of samples

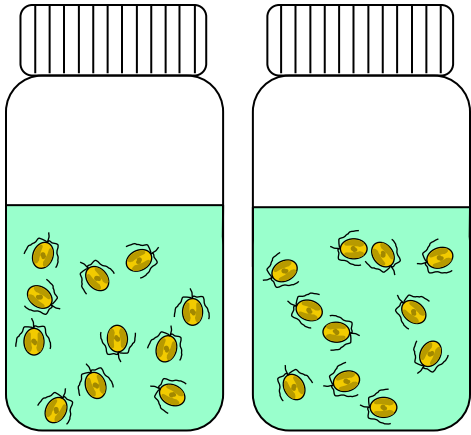
Microscopy

- 🪲 Time intensive
- 🪲 Difficult identification
- 🪲 Uncertainty

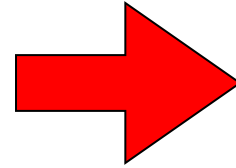
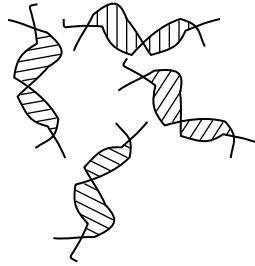
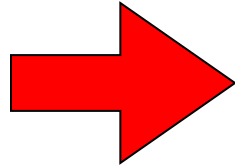
Real-time quantitative PCR

- 🪲 Galluzzi et al. 2008 -
Letters in Applied Microbiology
- 🪲 Time efficient
- 🪲 Specific DNA sequences
- 🪲 Low uncertainty

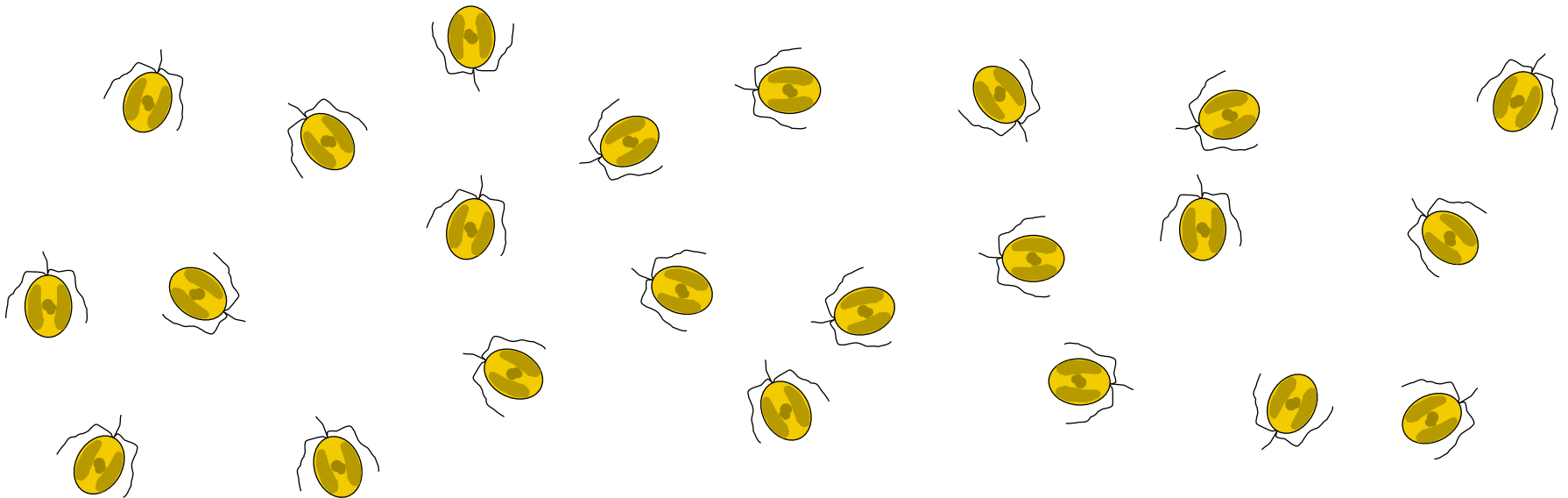




Water Samples



**Thermocycler &
Detection Camera**



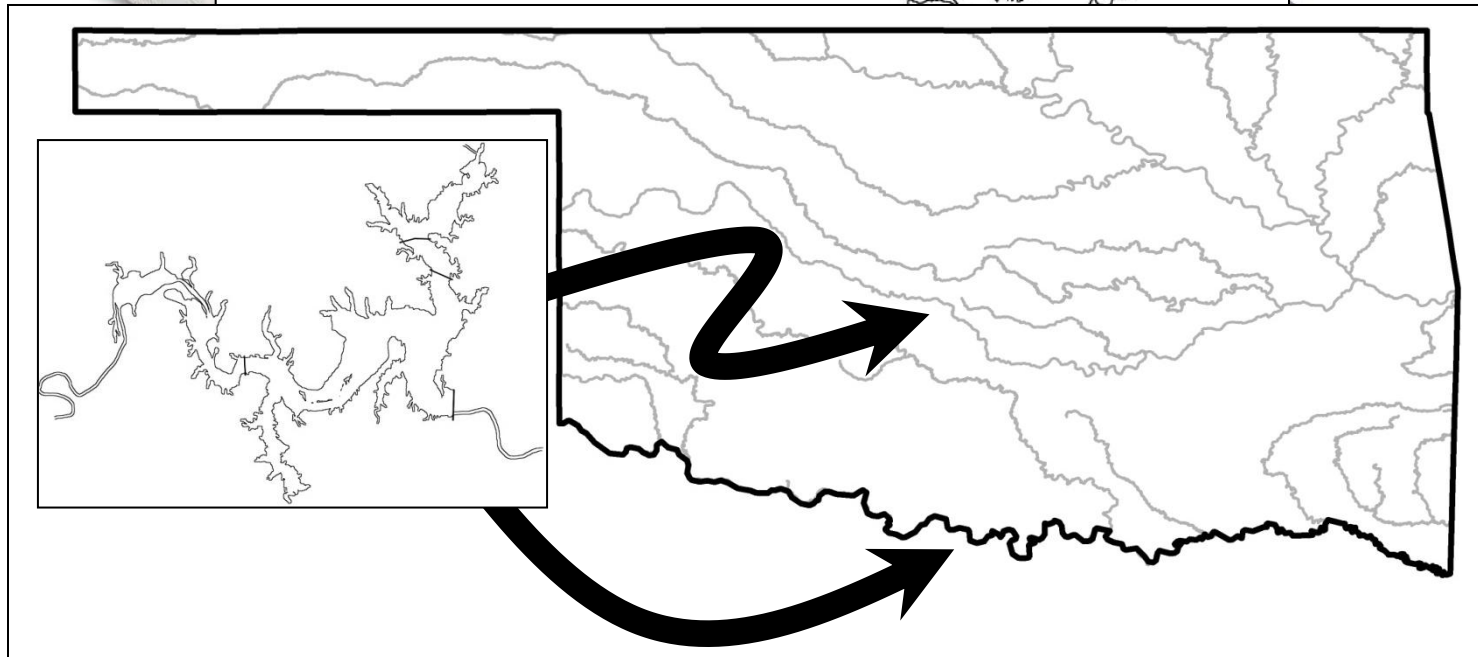
of Golden Algae!

Objectives:

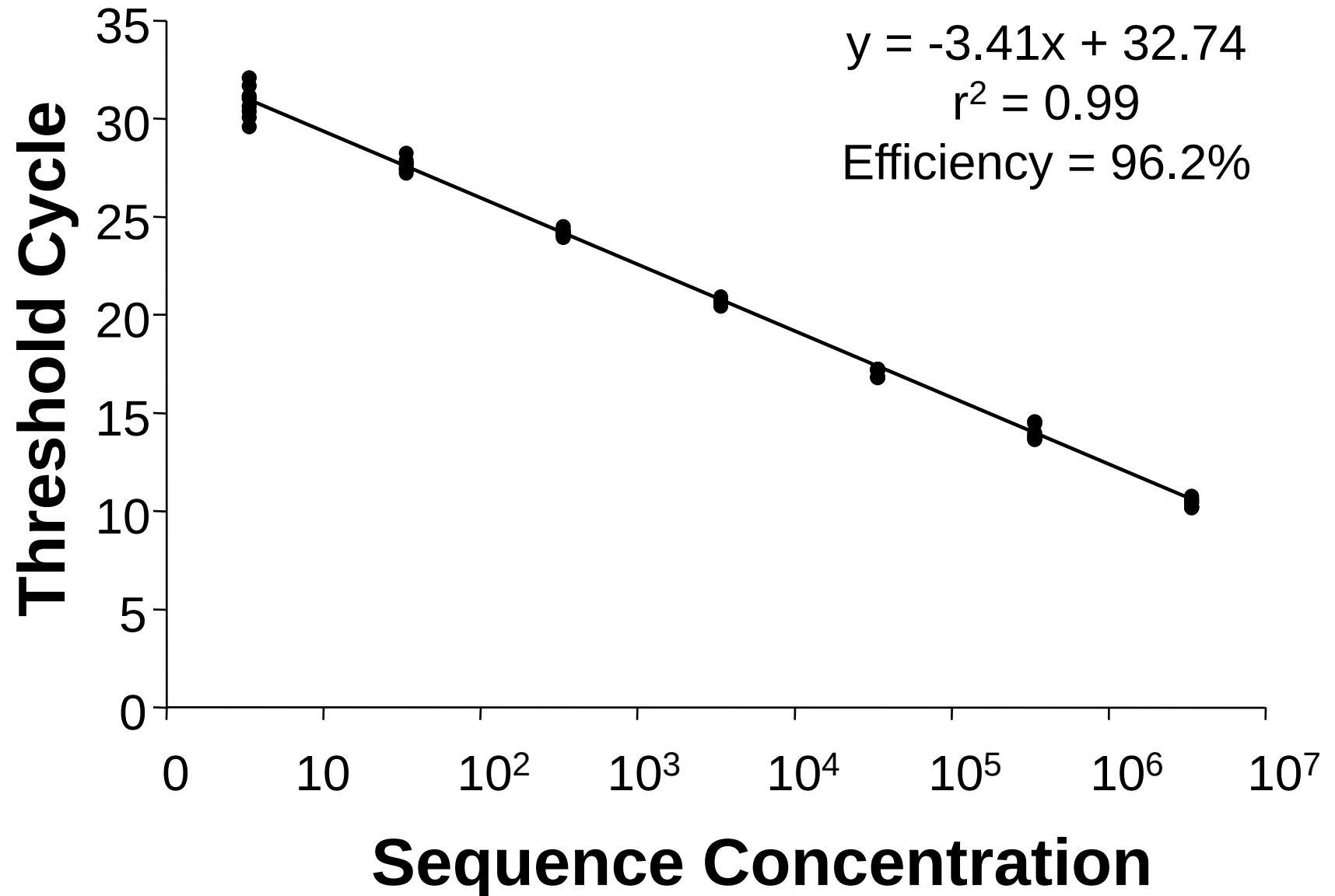
🐛 Verify qPCR

🐛 Construct predictive model

🐛 Appl

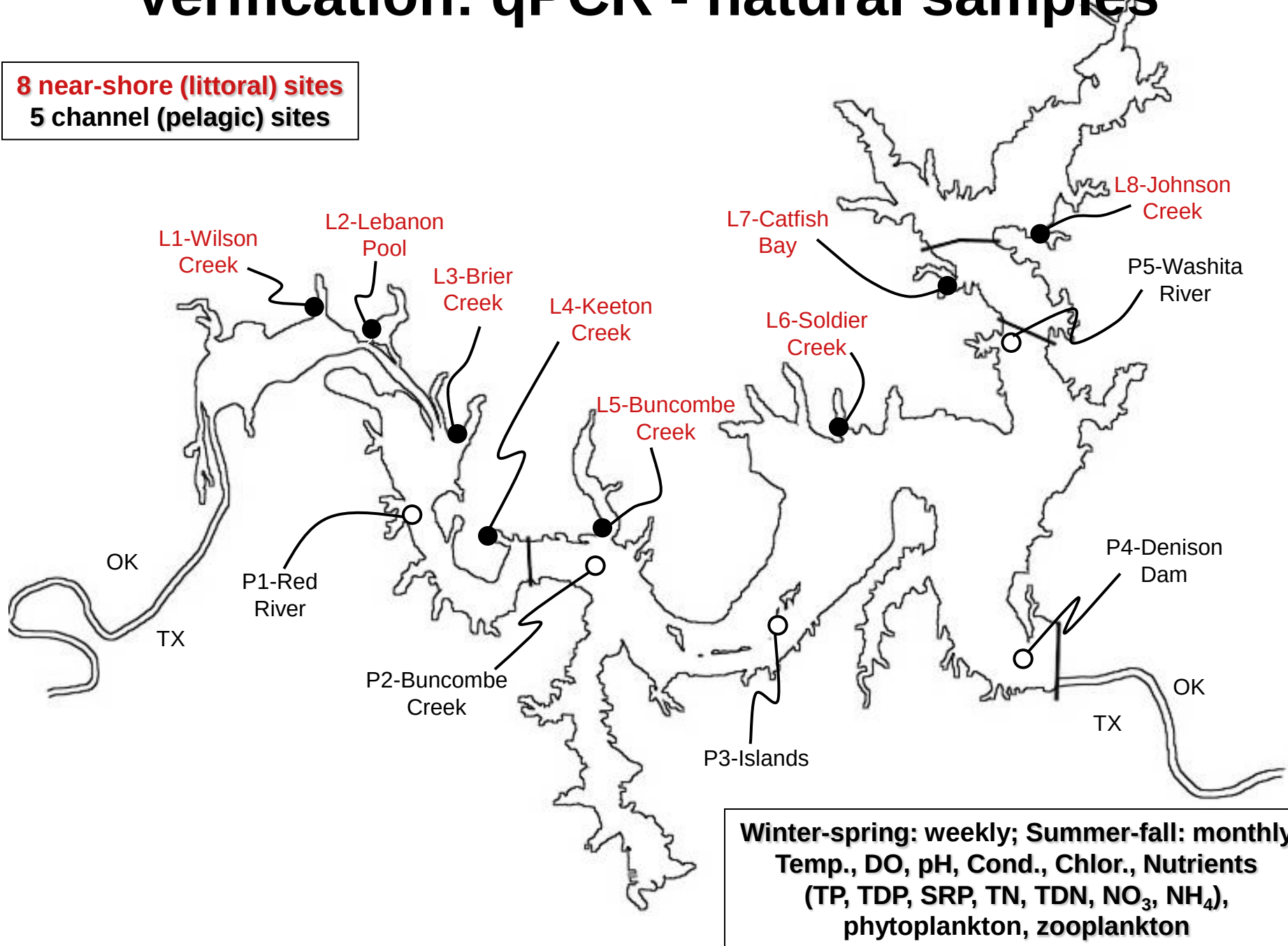


Verification: qPCR Example Standard Curve

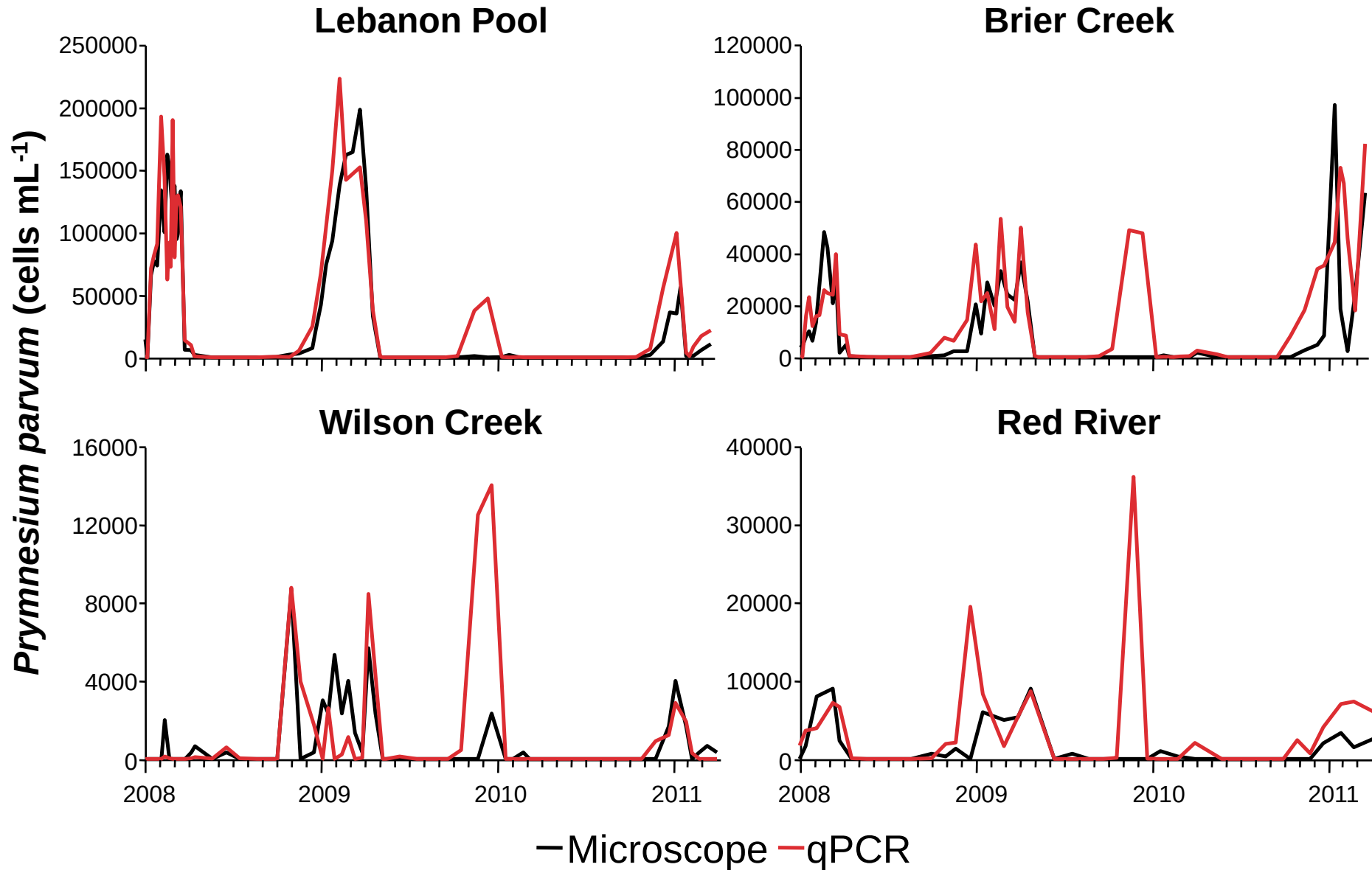


Verification: qPCR - natural samples

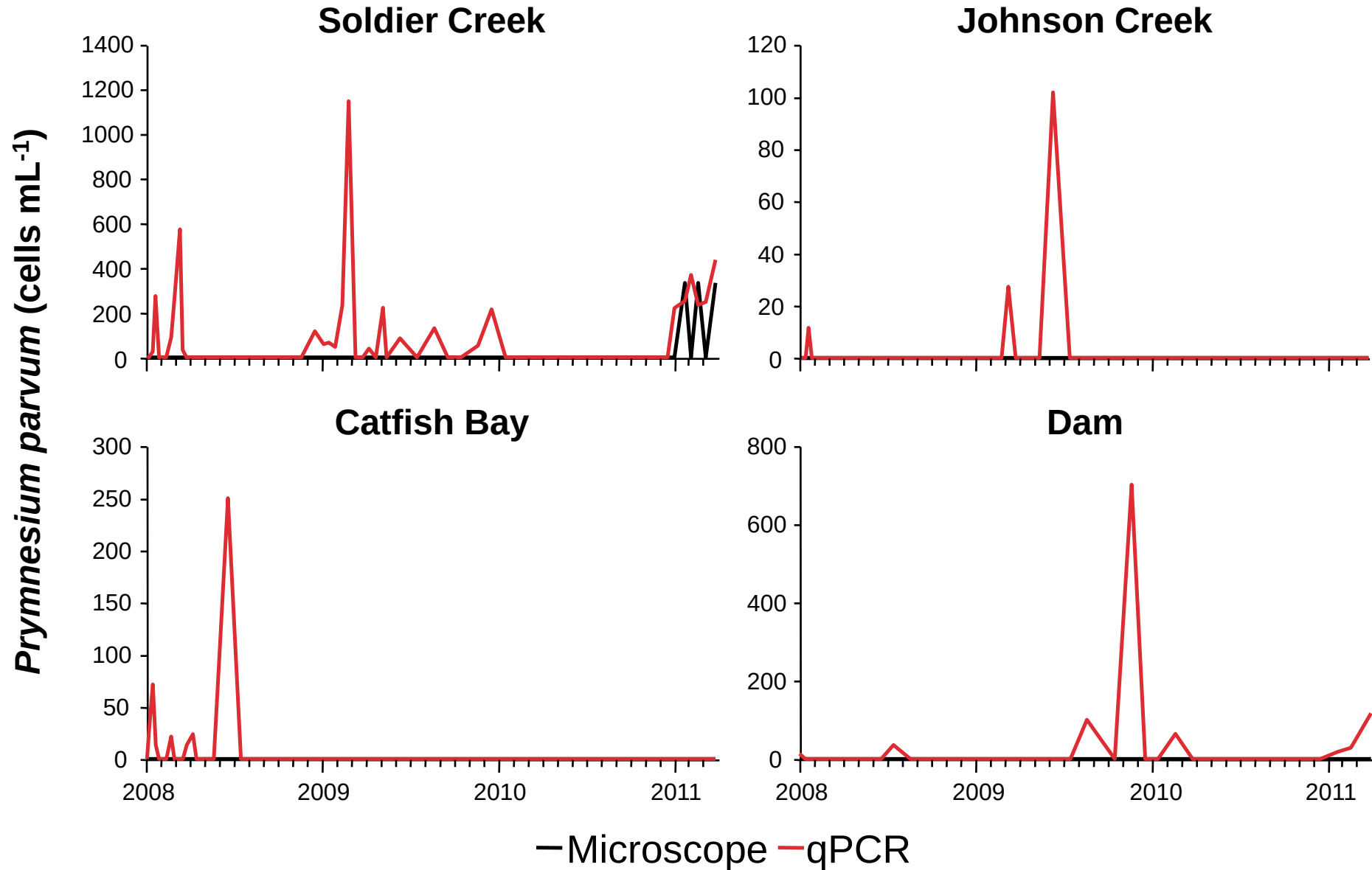
8 near-shore (littoral) sites
5 channel (pelagic) sites



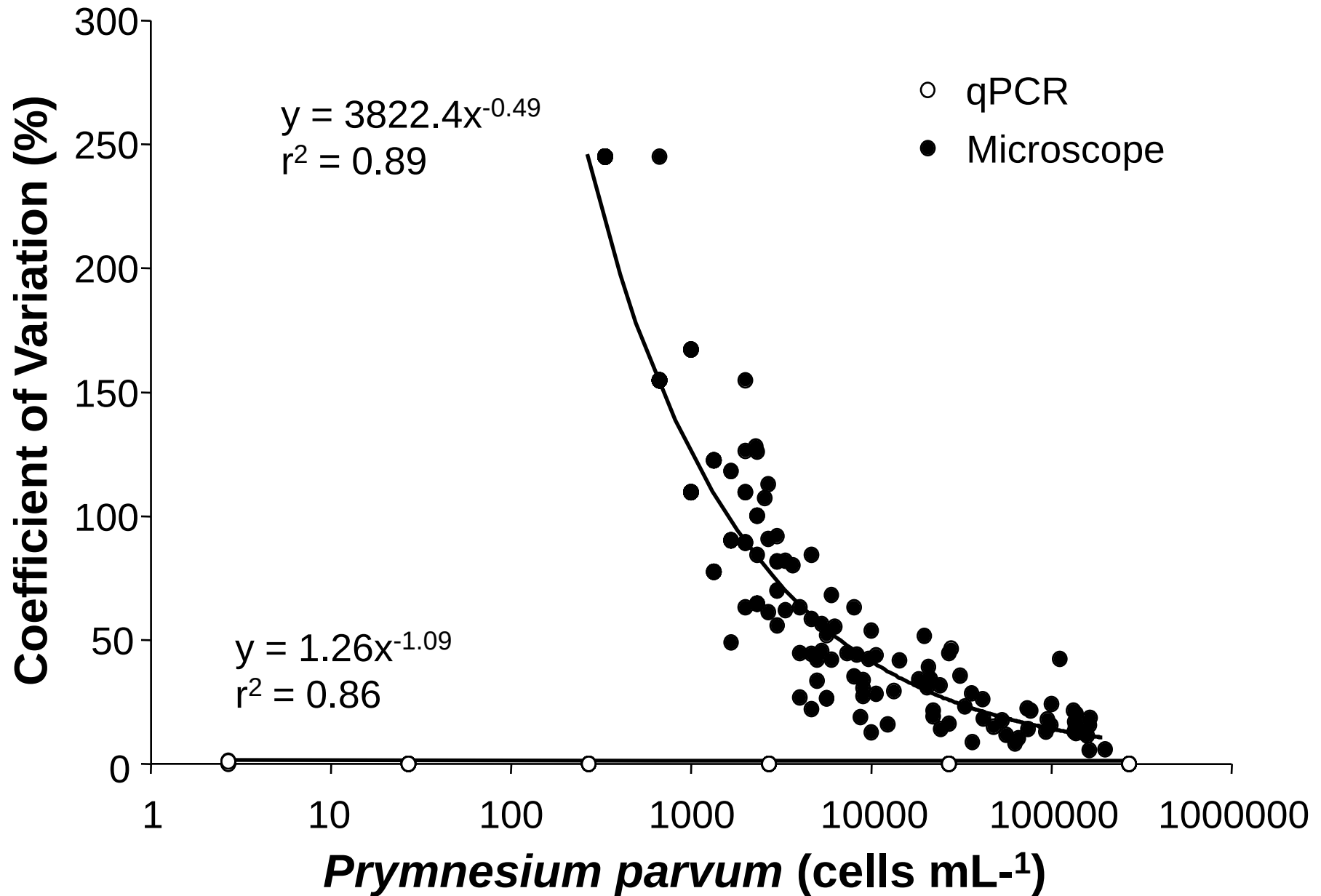
Verification: qPCR - natural samples



Bonus: Increased detection limit!

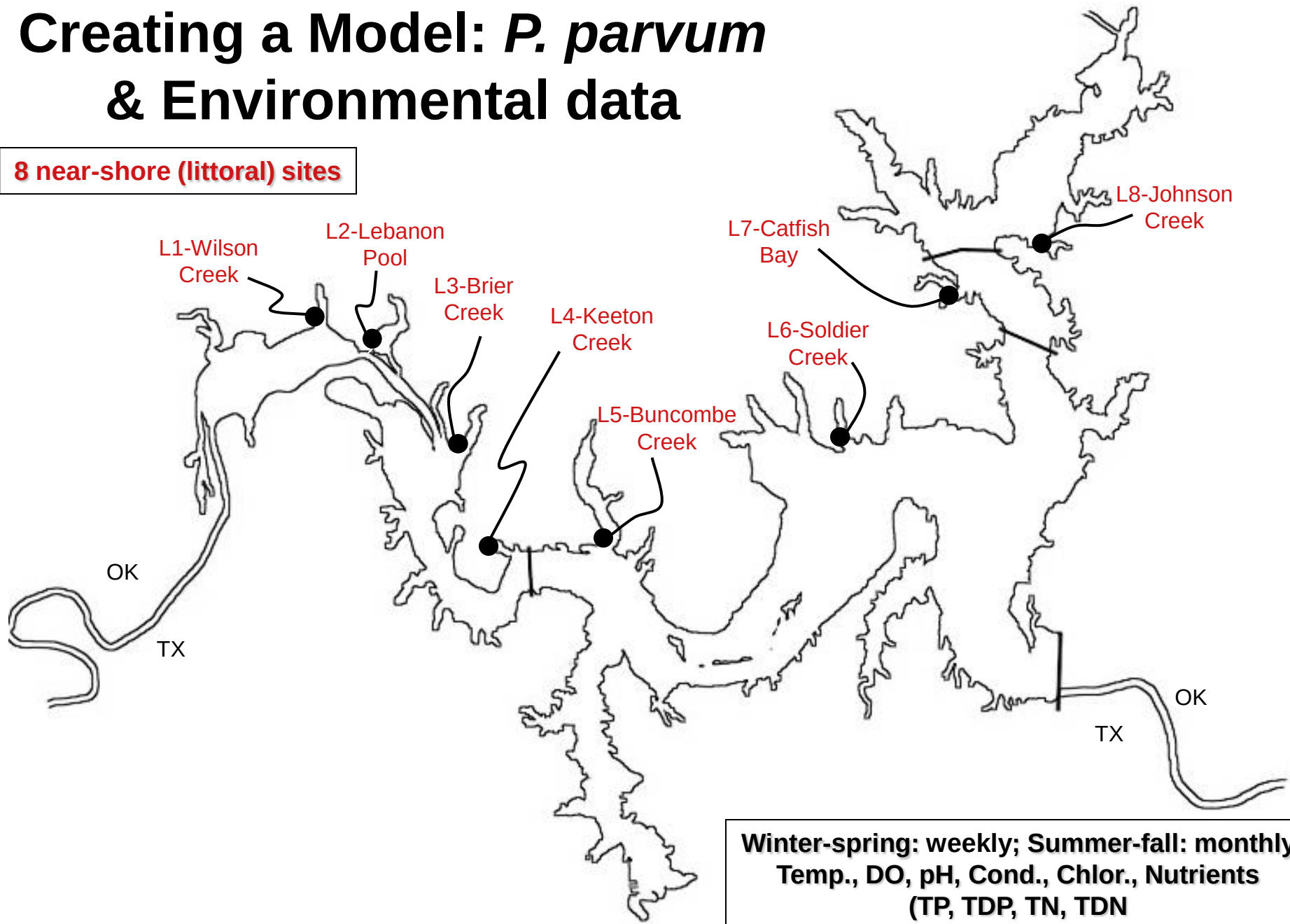


Error comparison qPCR vs. Microscope



Creating a Model: *P. parvum* & Environmental data

8 near-shore (littoral) sites



Creating a Model: *P. parvum* in Lake Texoma

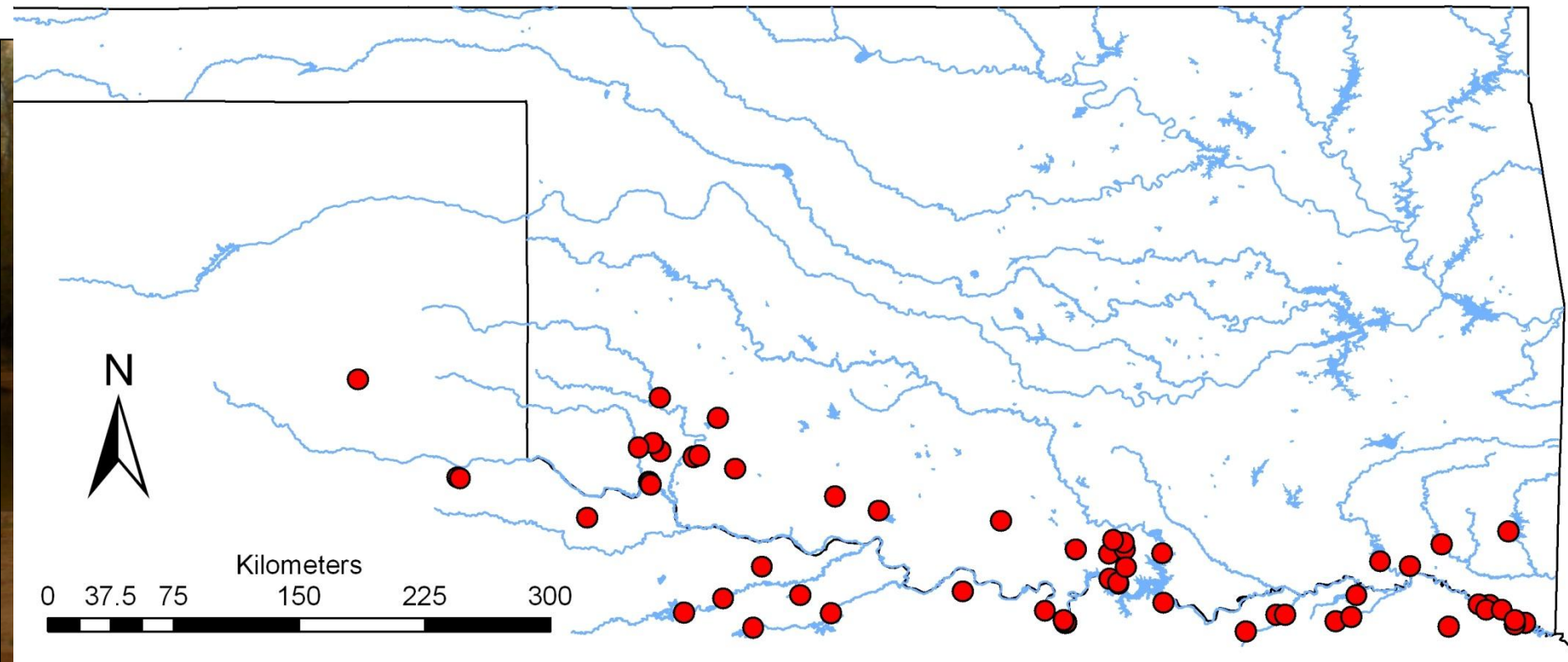
- 🐛 Stepwise Discriminant Function Analysis (DFA)
- 🐛 Jan 2008 - Jun 2010 (n=377)
- 🐛 Conductivity, TDP, and TN:TP correctly classifies 82% of sites

Golden Algae		Predicted (DFA)	
		Present	Absent
Observed (qPCR)	Present	73%	27%
	Absent	15%	85%

Blue Circles: predicted ≠ observed

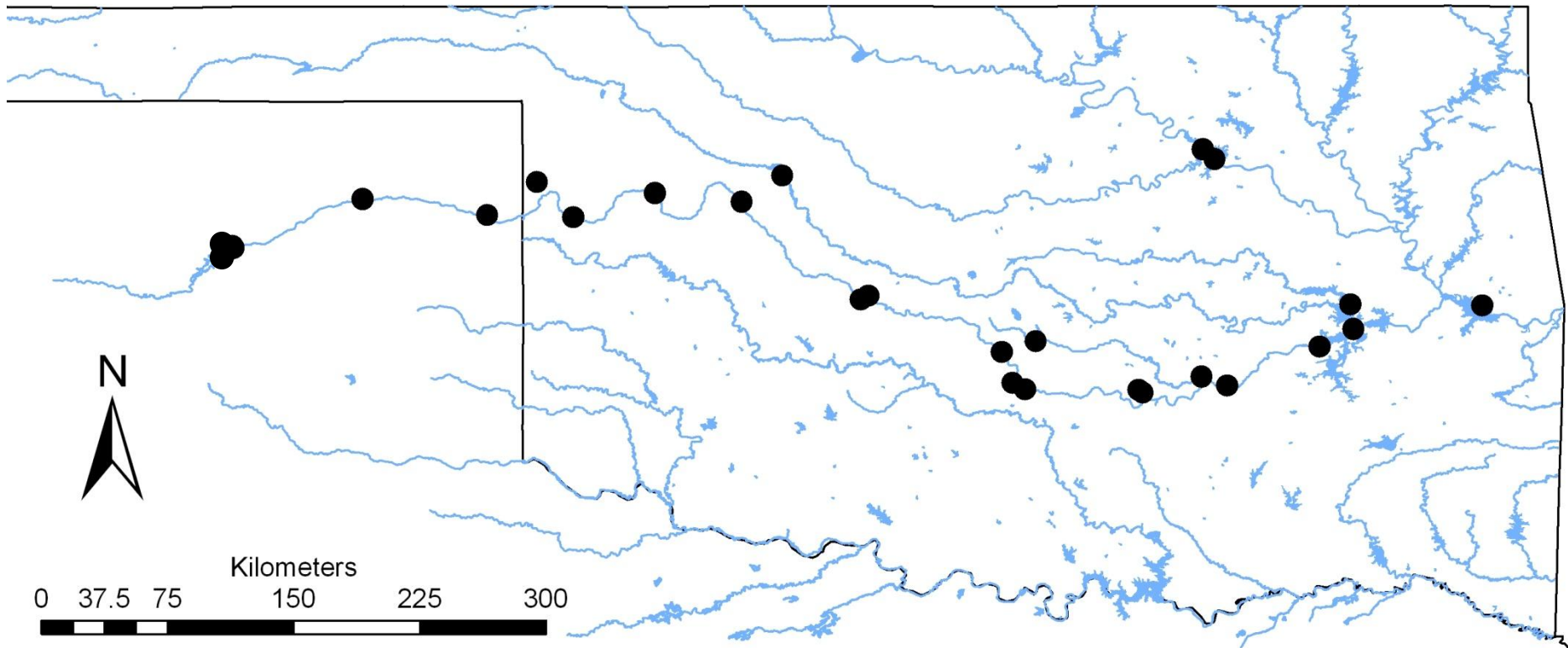
Model Application: *P. parvum* in Red River

- 🪲 Red River Basin (n=62) from 25Jan - 1Mar2008
- 🪲 qPCR (200-250mL filters)
- 🪲 Hydrolab (Temp, pH, Chl-a, Conductivity)
- 🪲 Nutrients: N & P (total and dissolved)

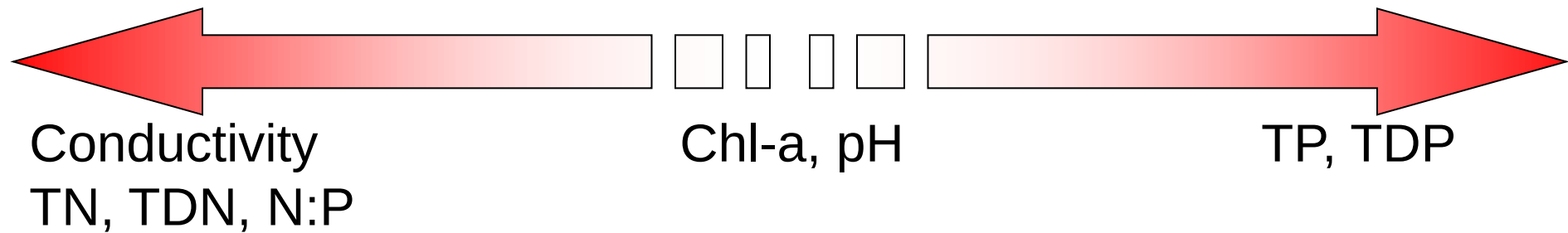
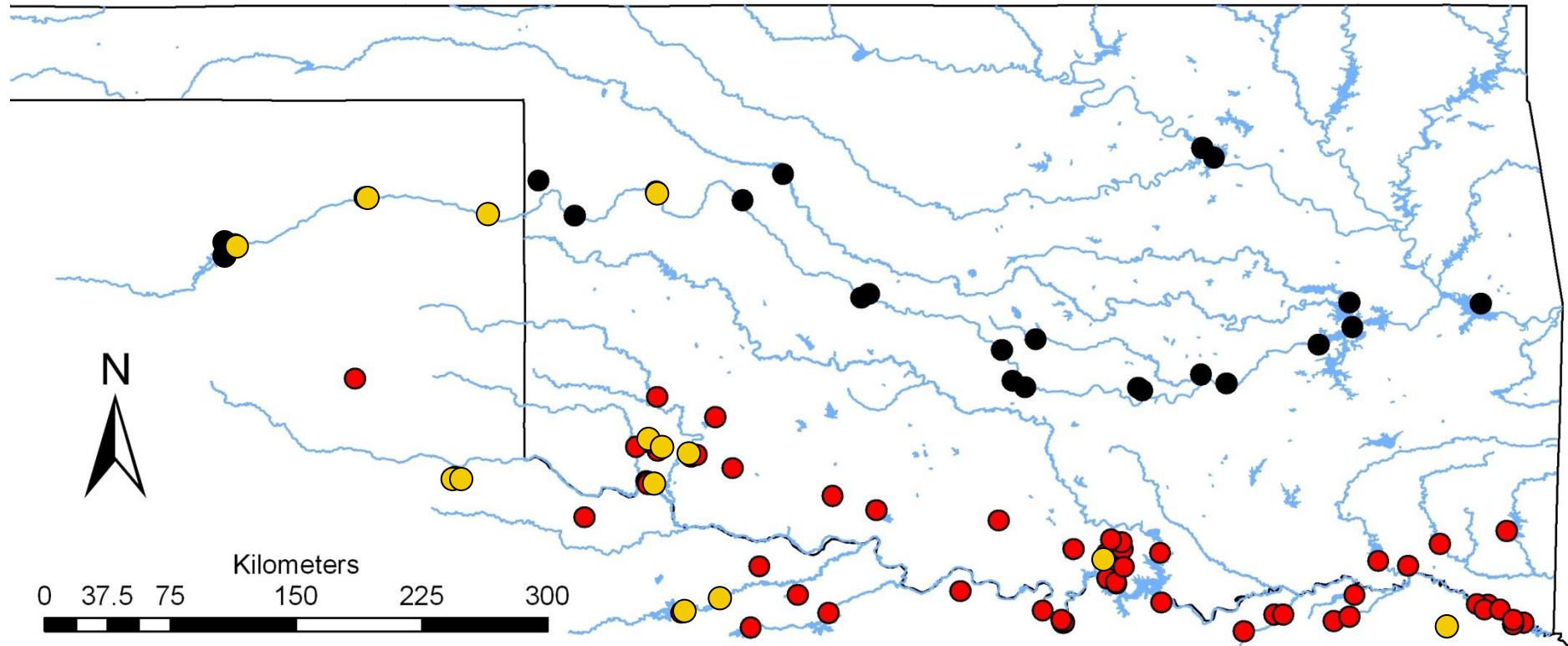


Model Application: *P. parvum* in OK-TX

- 🪲 Canadian River Basin (n=26) from Apr 2009
- 🪲 Similar sampling methodology



Environmental Data: *P. parvum* in OK-TX



Model Application: *P. parvum* in OK-TX

- 🪳 Red River Basin (n=62)
- 🪳 Conductivity, TDP, and TN:TP correctly classifies 88% of sites .

Golden Algae		Predicted (DFA)	
		Present	Absent
Observed (qPCR)	Present	77%	23%
	Absent	10%	90%

Blue Circles: predicted = observed
Red Circles: predicted ≠ observed

Predictive Model: *P. parvum* in Canadian River

- 🪲 Canadian River Basin (n=26)
- 🪲 Conductivity, TDP, and TN:TP correctly classifies 81% of sites.

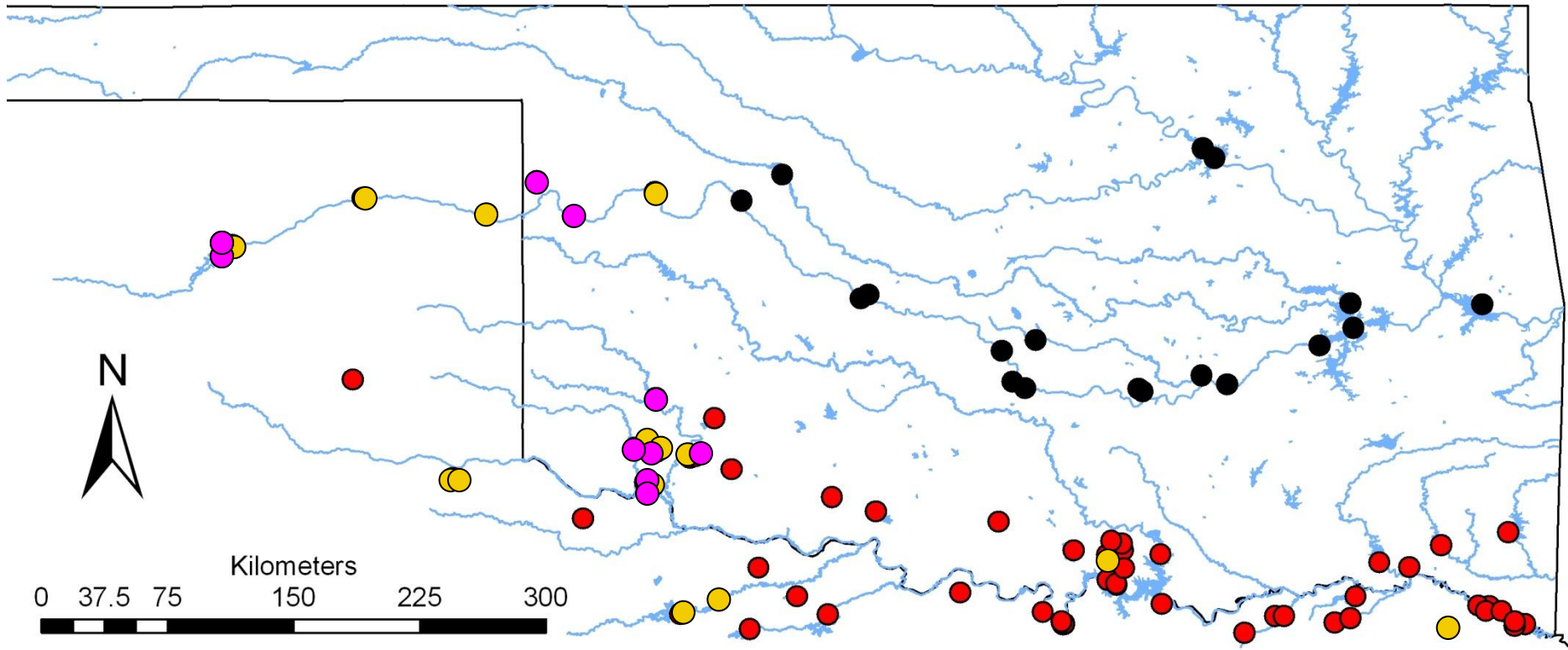
Golden Algae		Predicted (DFA)	
		Present	Absent
Observed (qPCR)	Present	75%	25%
	Absent	18%	82%

Blue Circles: predicted ≠ observed

Conclusions



qPCR offers major advantages over the microscope



Possibly suggests range expansion
(microscopic invasive species!!)

Acknowledgments



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