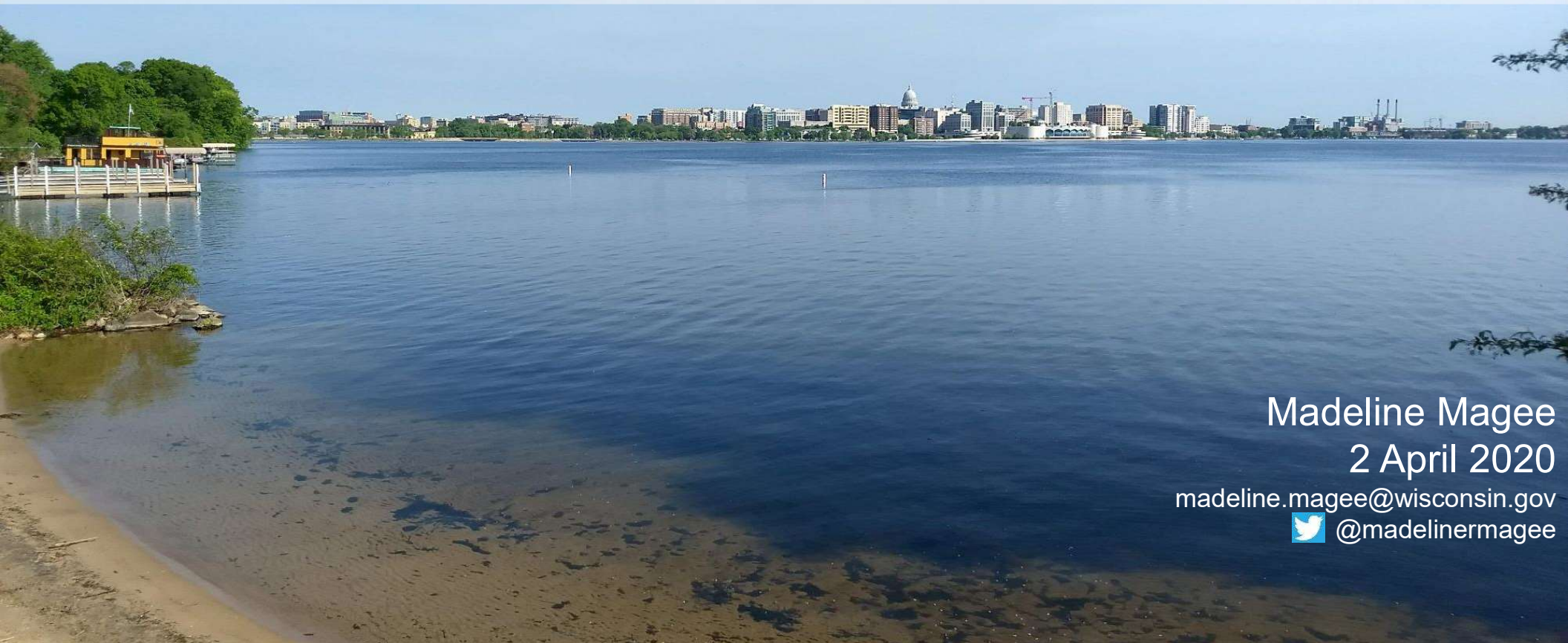



Lake-specific climate adaptation solutions for preserving cold-water fish habitat in Wisconsin lakes

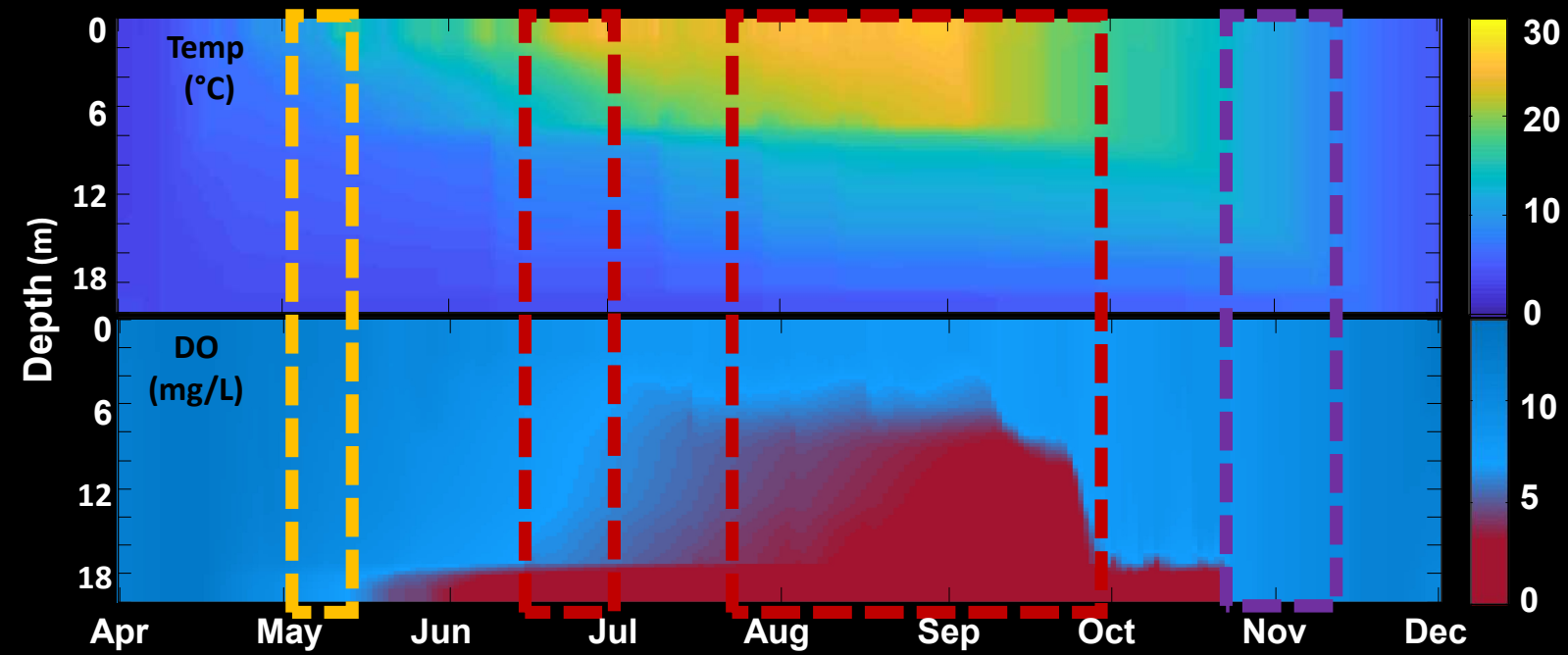


Madeline Magee
2 April 2020

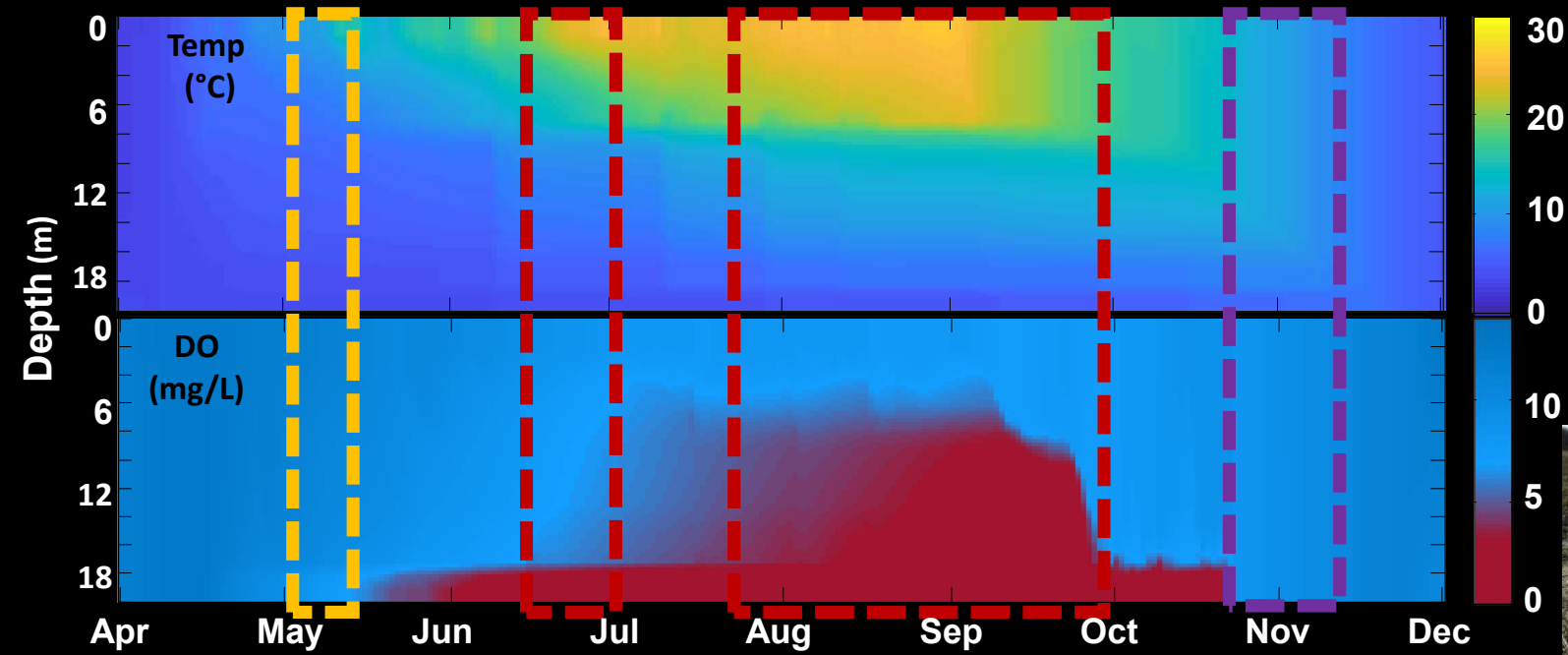
madeline.magee@wisconsin.gov

 [@madelinermagee](https://twitter.com/madelinermagee)

Oxythermal Niche



Oxythermal Stress



Cisco!



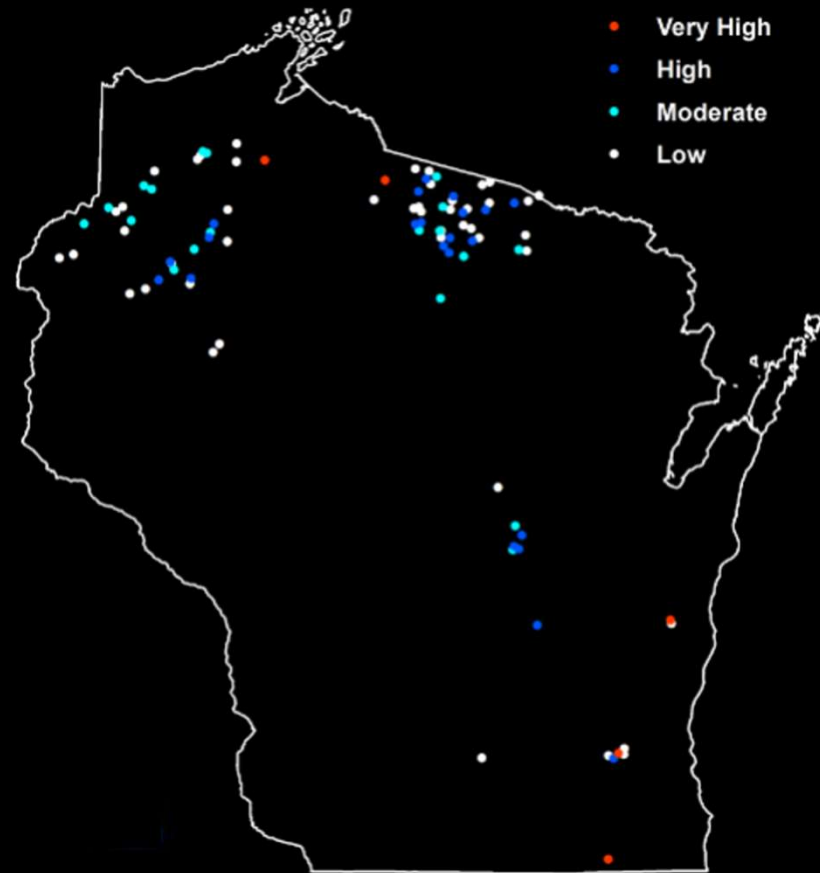
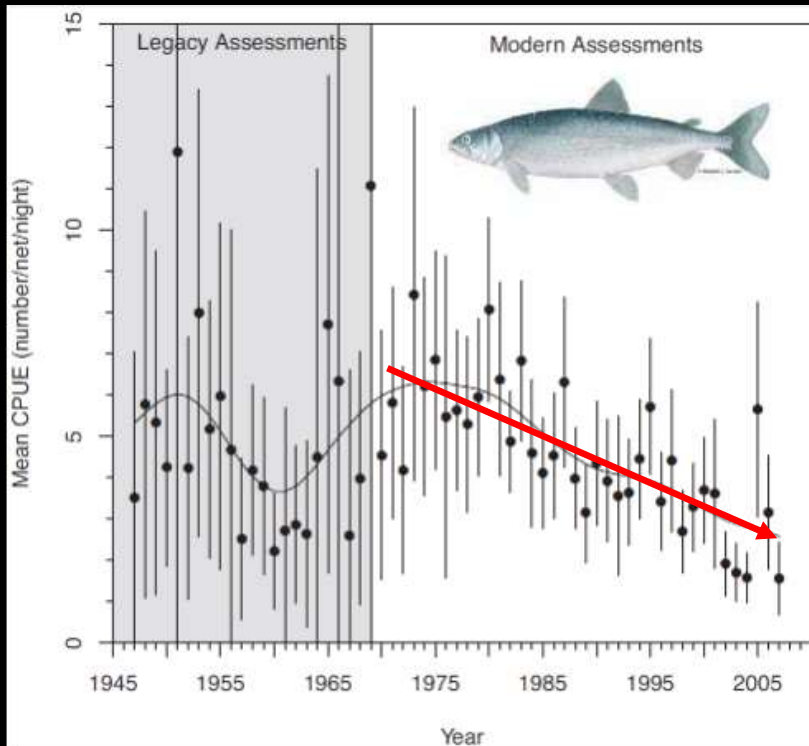
Native forage base



Fishery

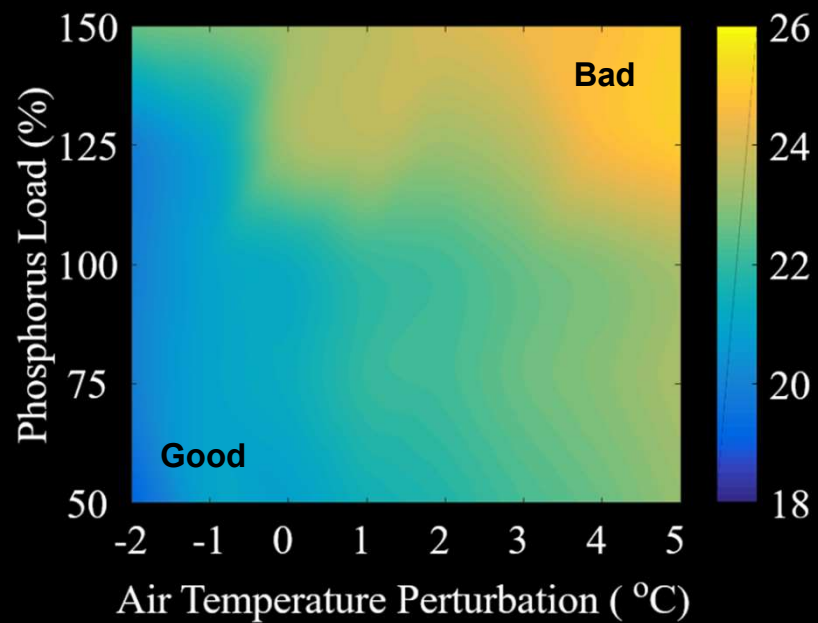
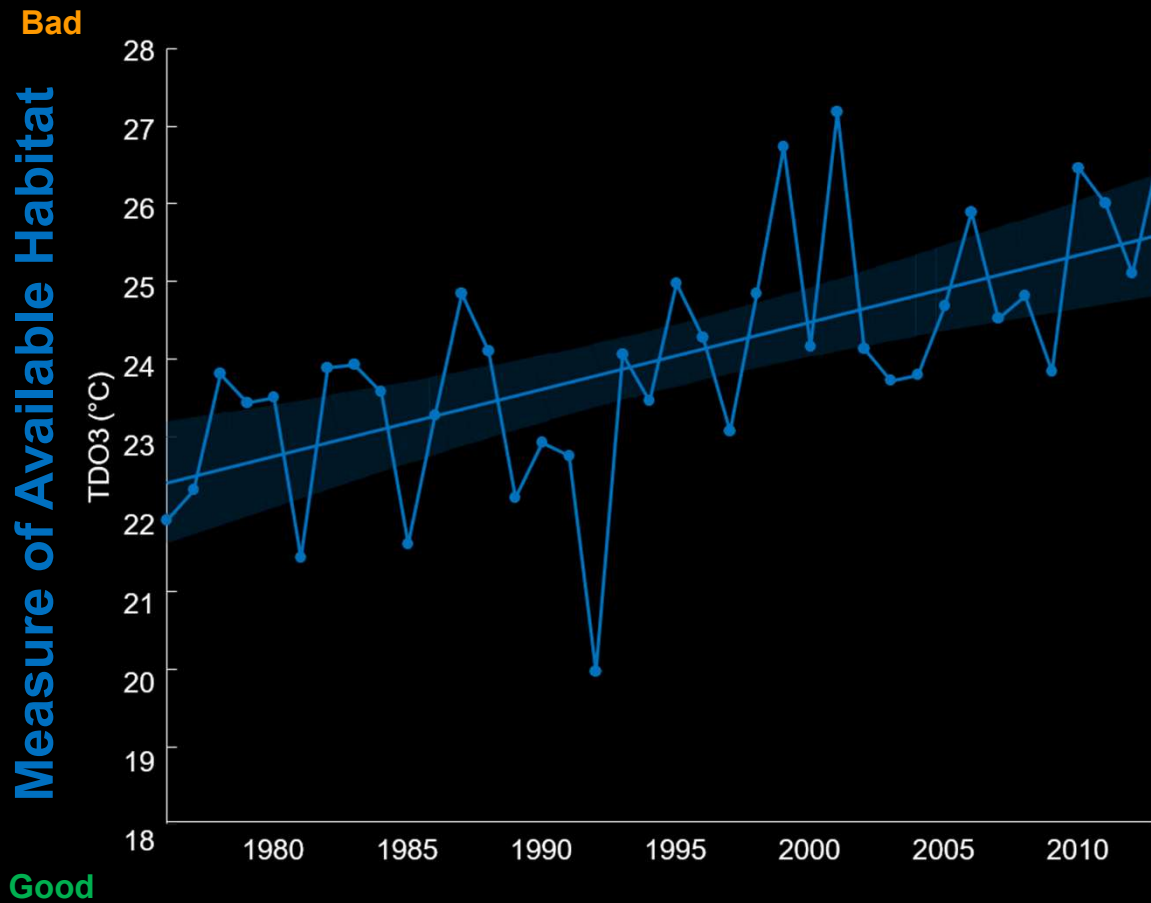


Cisco in Wisconsin



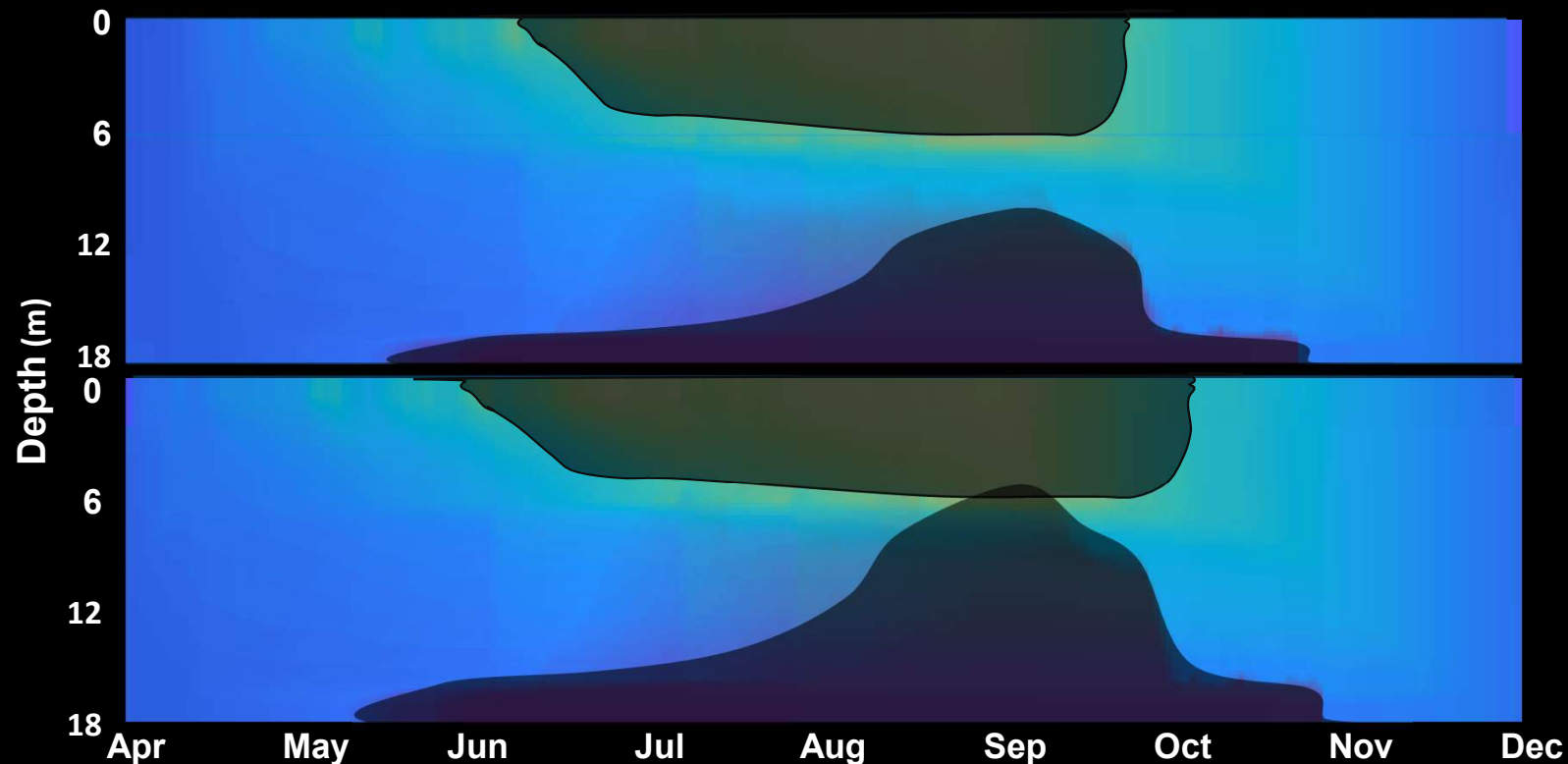
Timothy Parks, WDNR

Climate change and fish habitat



Magee et al. *Environmental Management*. 2019

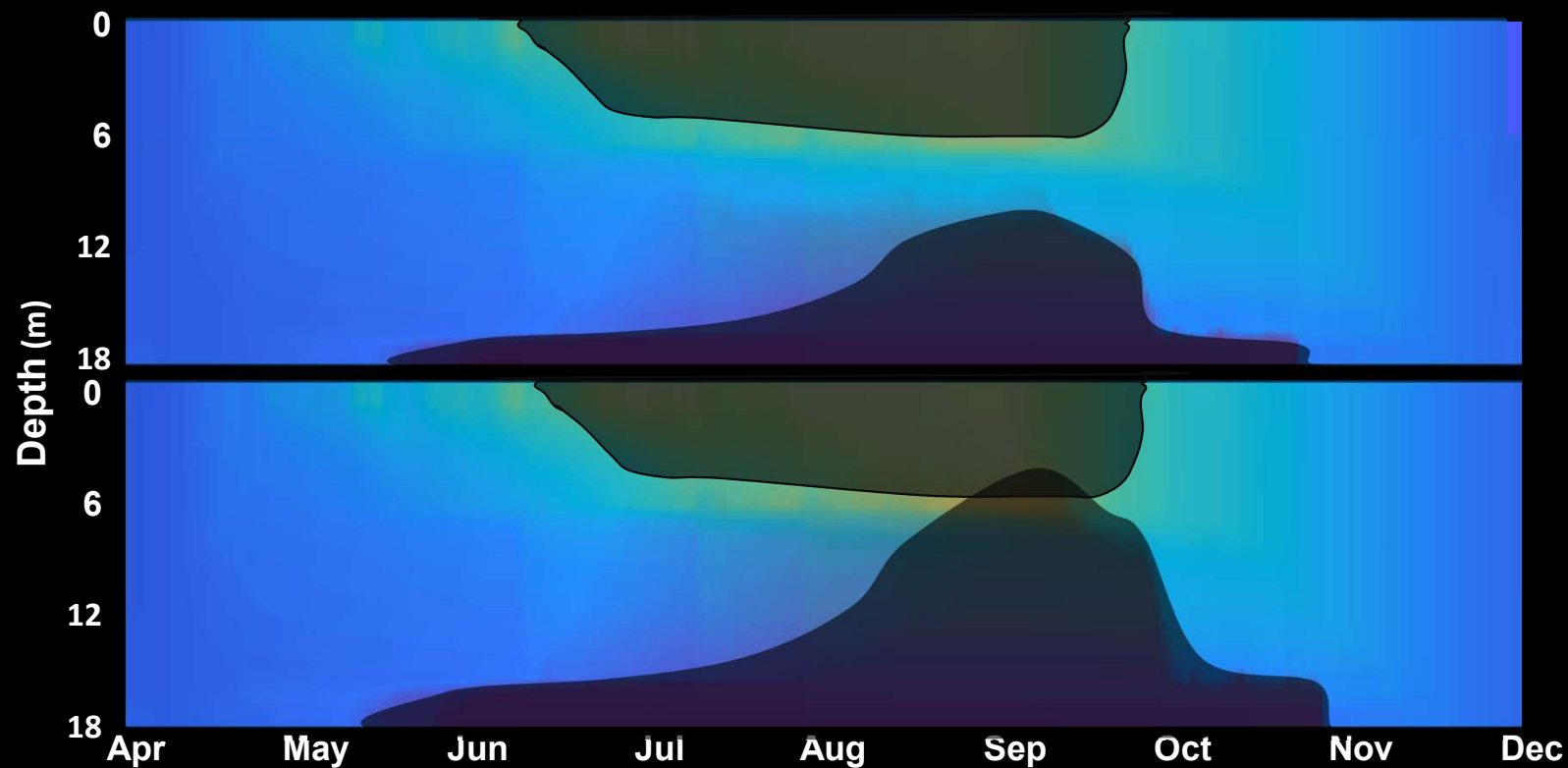
Climate change and fish habitat



Longer stratification duration (**AT**↑ **WS**↓) decreases habitat

**Possible Actions: add oxygen to the hypolimnion OR
reduce stratification duration through artificial mixing**

Climate change and fish habitat

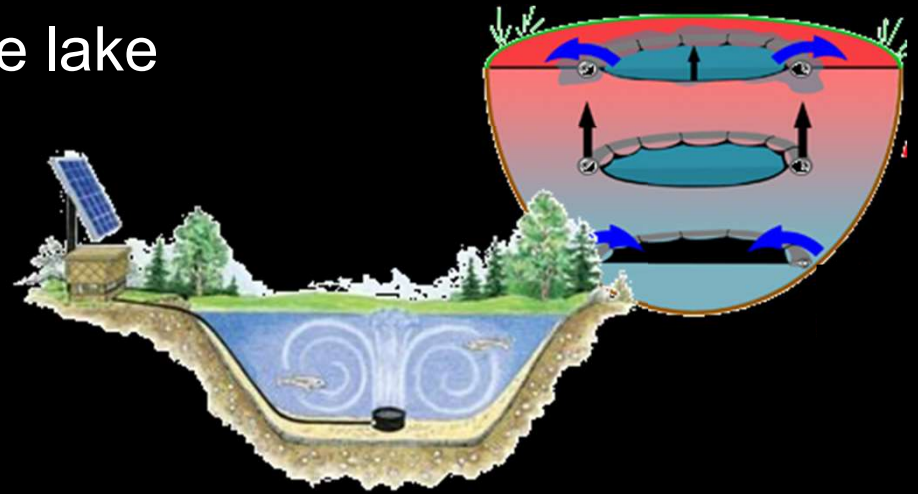


More phosphorus runoff ($P \uparrow$ $Precip \uparrow$) decreases habitat

Possible Action: reduce phosphorus runoff into the lake

Possible adaptation actions

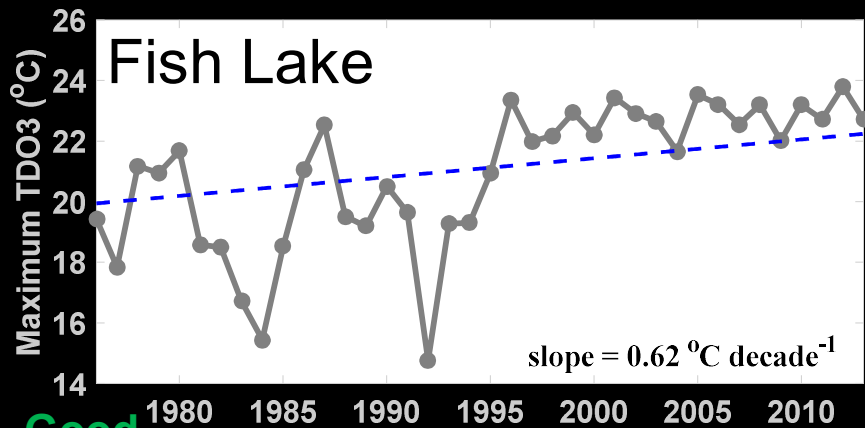
- reduce phosphorus runoff into the lake
- oxygenate the hypolimnion
- artificial destratification



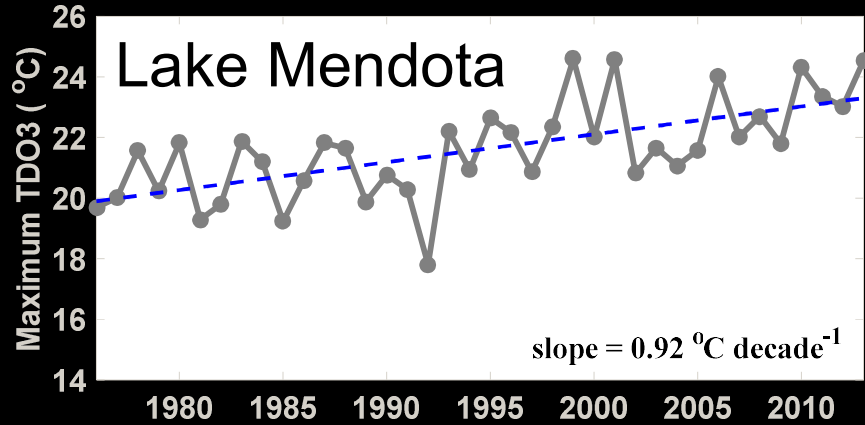
What adaptation strategies should we use?
(for a particular lake)

Identifying optimal actions

Bad

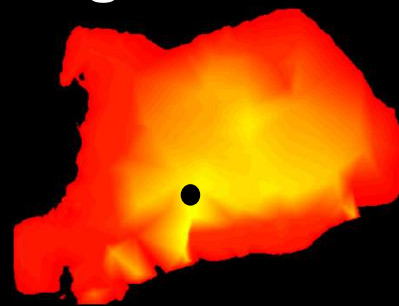


Good

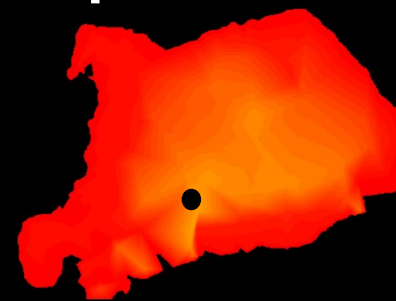


Magee et al, *in prep*

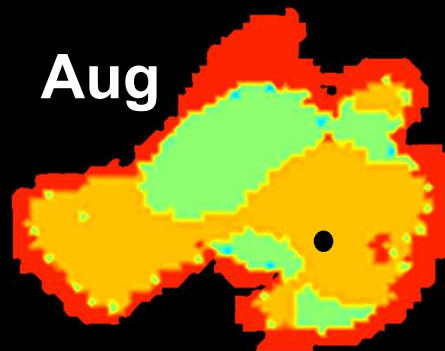
Aug



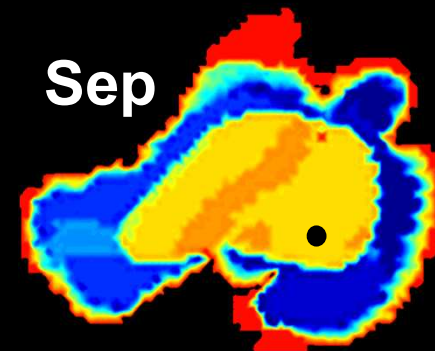
Sep



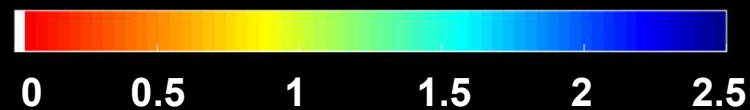
Aug



Sep

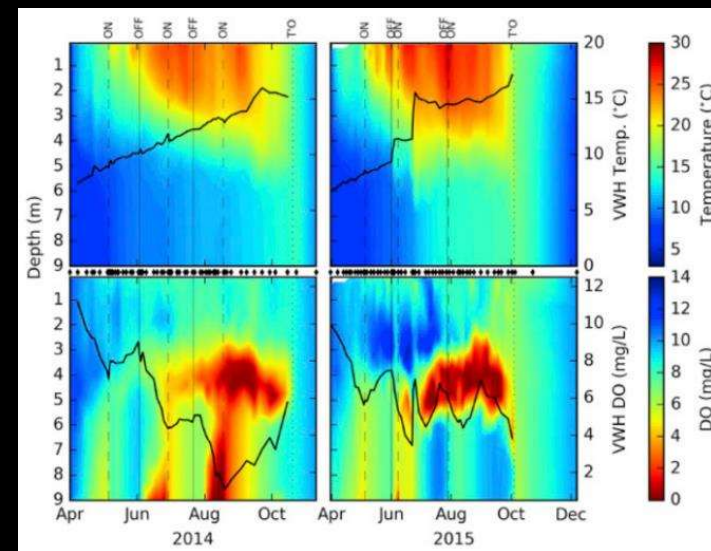


Available
vertical
habitat

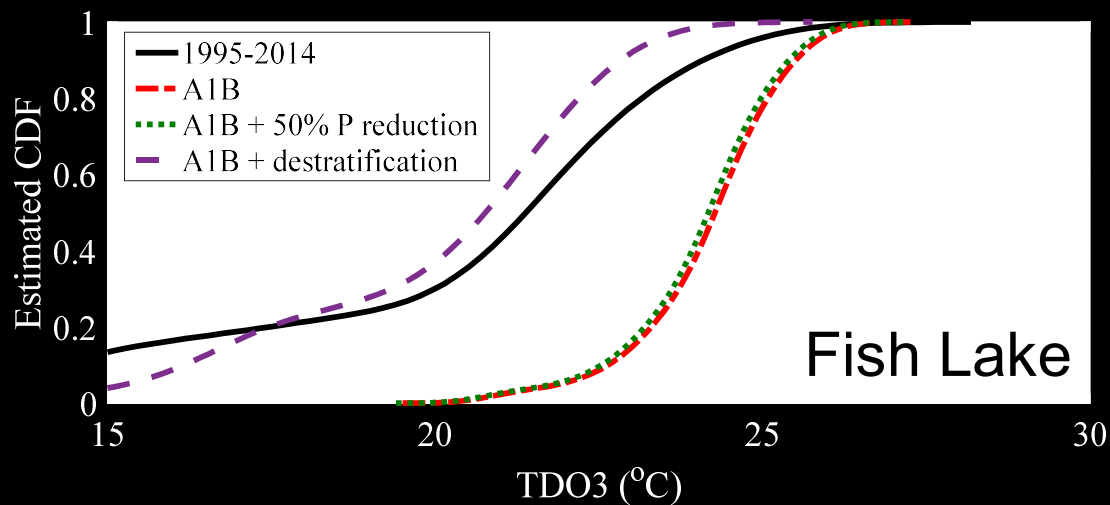


Identifying optimal actions

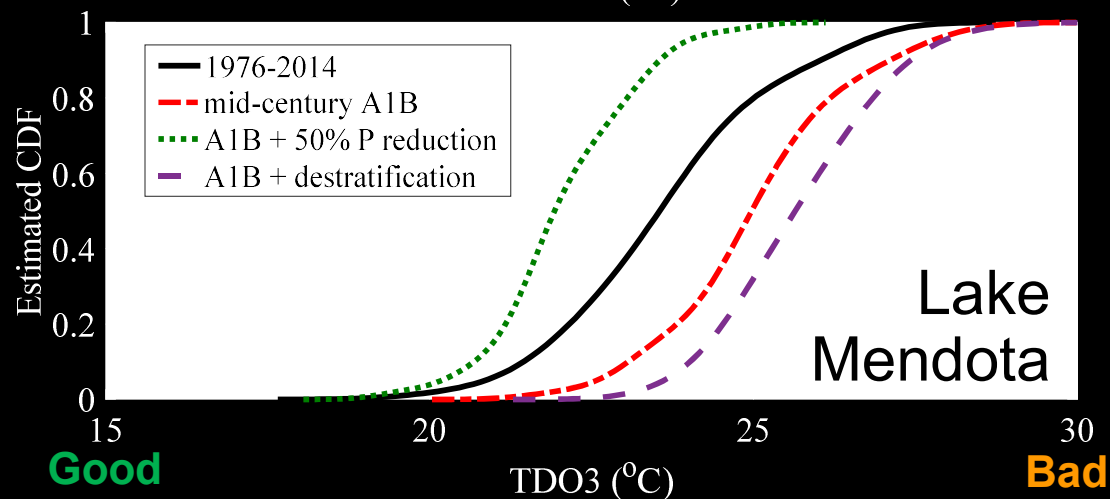
- reduce phosphorus runoff into the lake
- oxygenate the hypolimnion
- artificial destratification



Identifying optimal actions

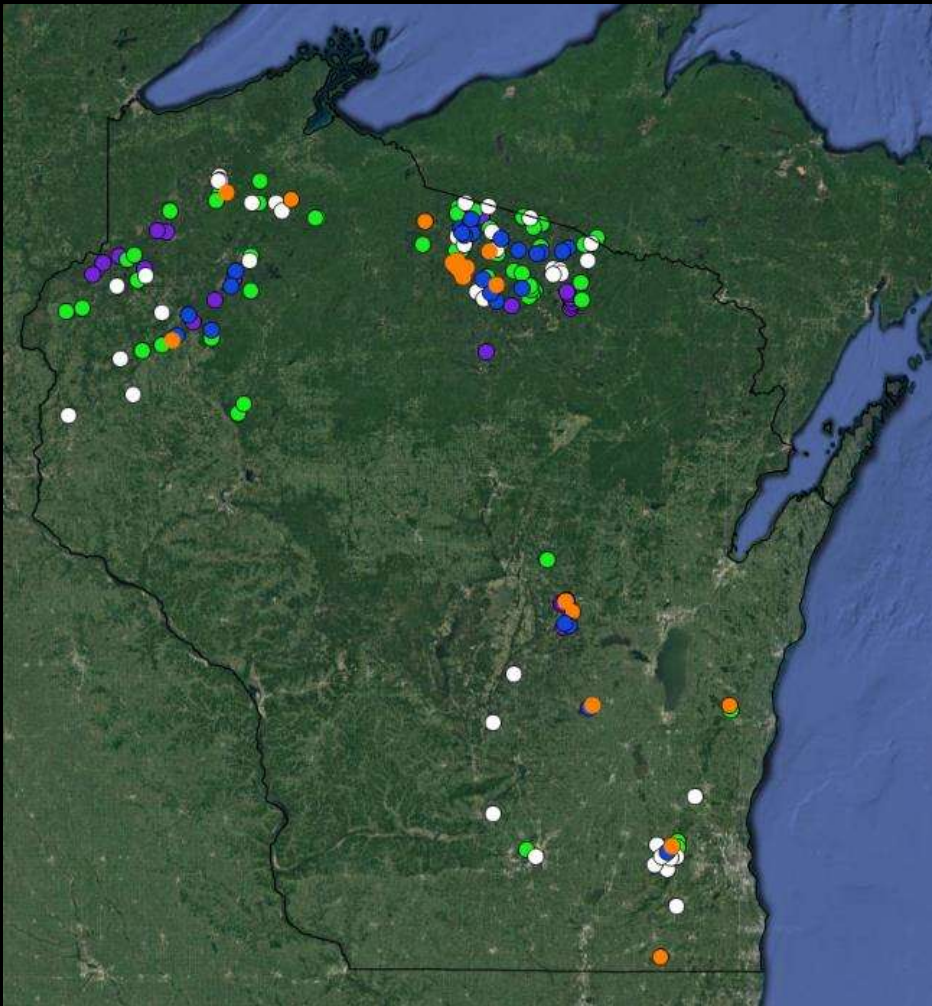


In small, isolated lakes P loading reductions DO NOT improve habitat



In large lakes artificial destratification DOES NOT improve fish habitat

Next Steps



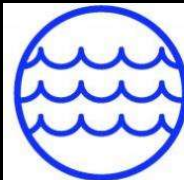
- Resilient
- Extirpation
- P reduction
- Land cover
- Engineered Solution

Acknowledgements



WR

University of Wisconsin Water Resources Institute



Center for Limnology
University of Wisconsin–Madison



Questions?



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 @madelinermagee