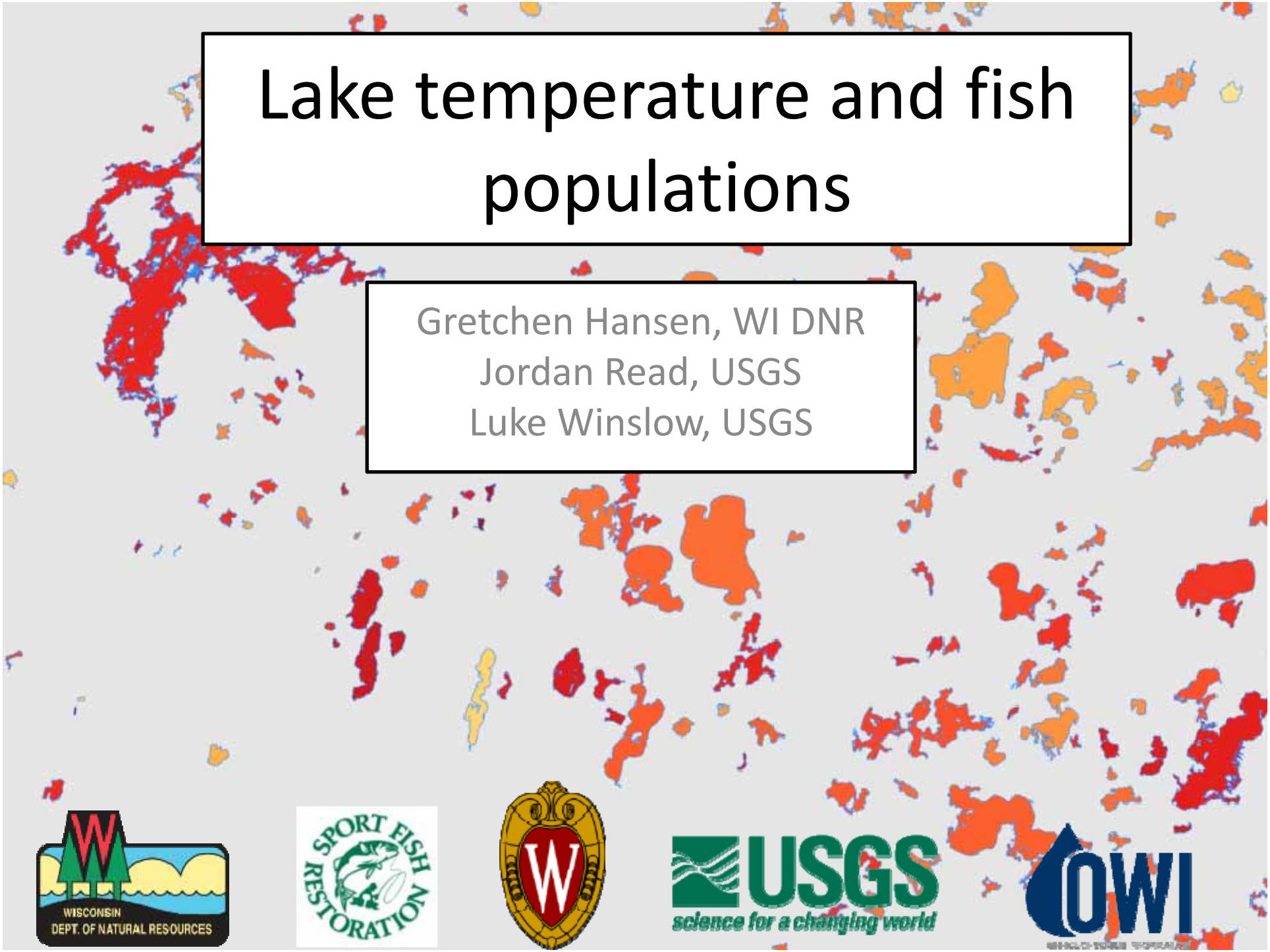
Lake temperature and fish populations

Gretchen Hansen, WI DNR
Jordan Read, USGS
Luke Winslow, USGS



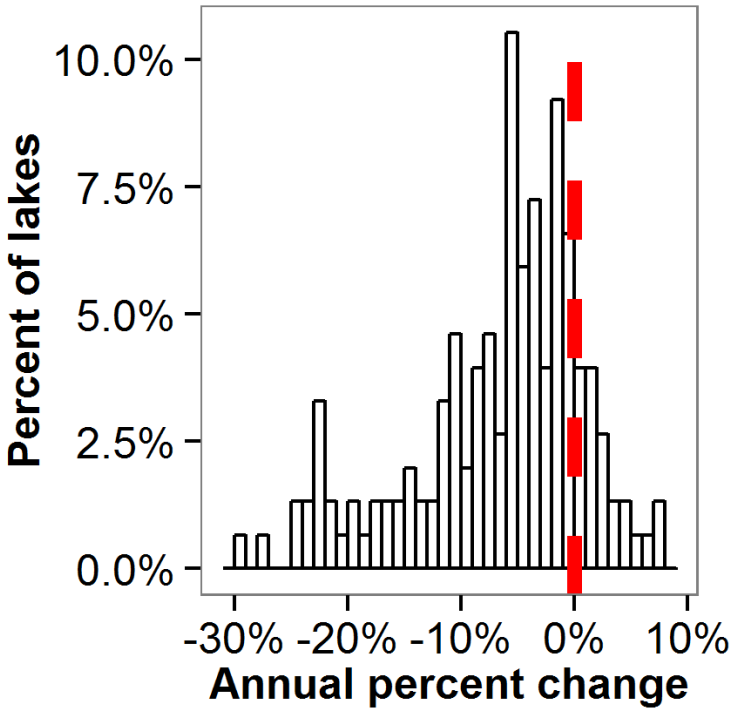
WISCONSIN STATE JOURNAL

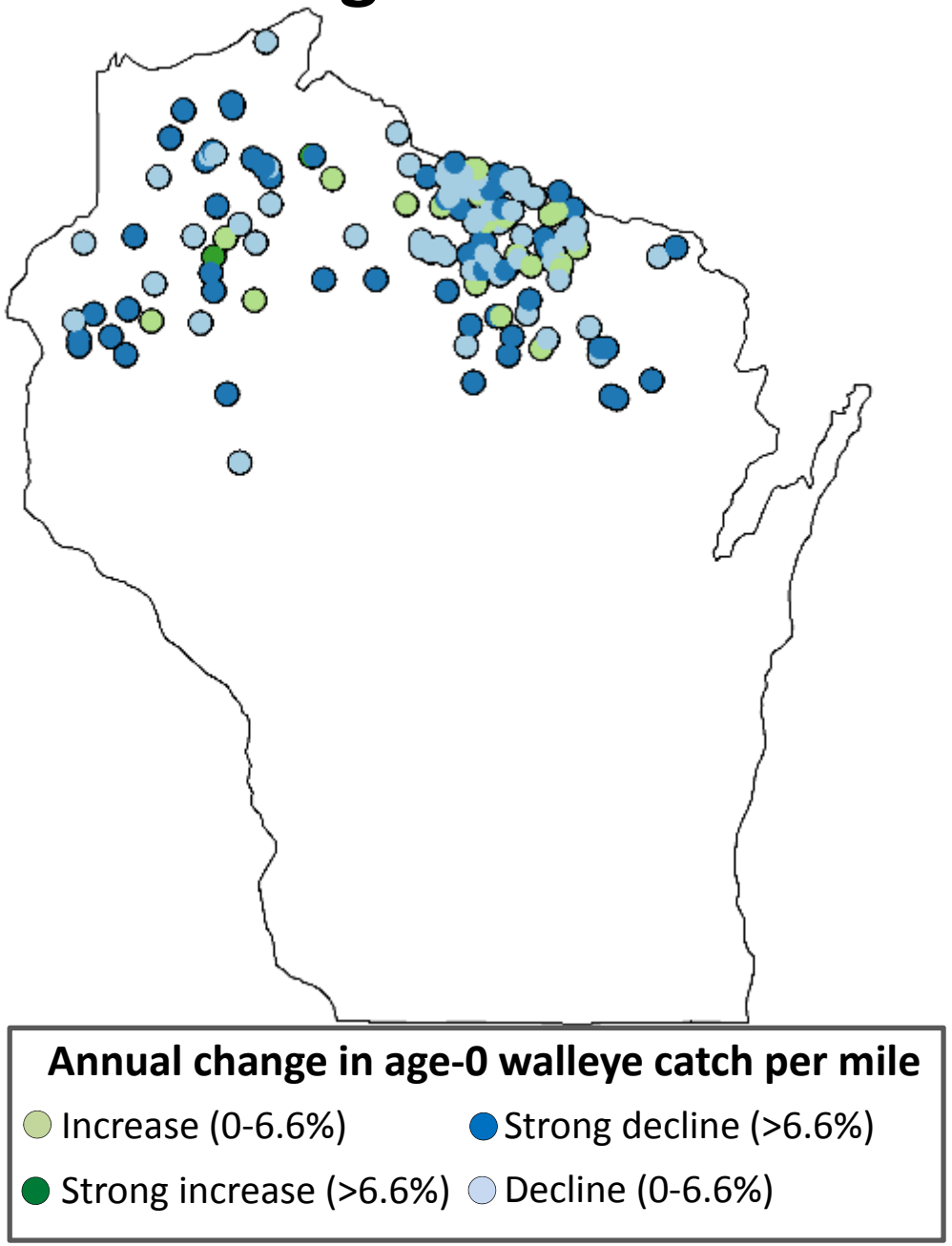
Fishing opener means no walleye dinners from the Minocqua Chain of Lakes

BARRY ADAMS badams@madison.com, 608-252-6148 Apr 26, 2015 0

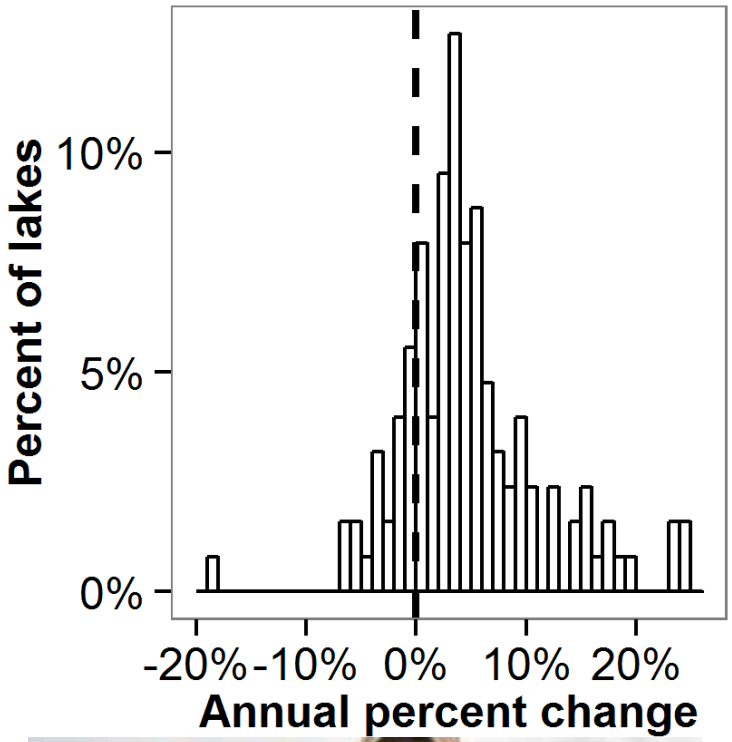
RHINELANDER (WITI) — The number of Wisconsin lakes stocked with larger walleye will skyrocket in the next two years as the state harnesses a $12 million funding plan to boost walleye populations statewide, state fisheries officials say.

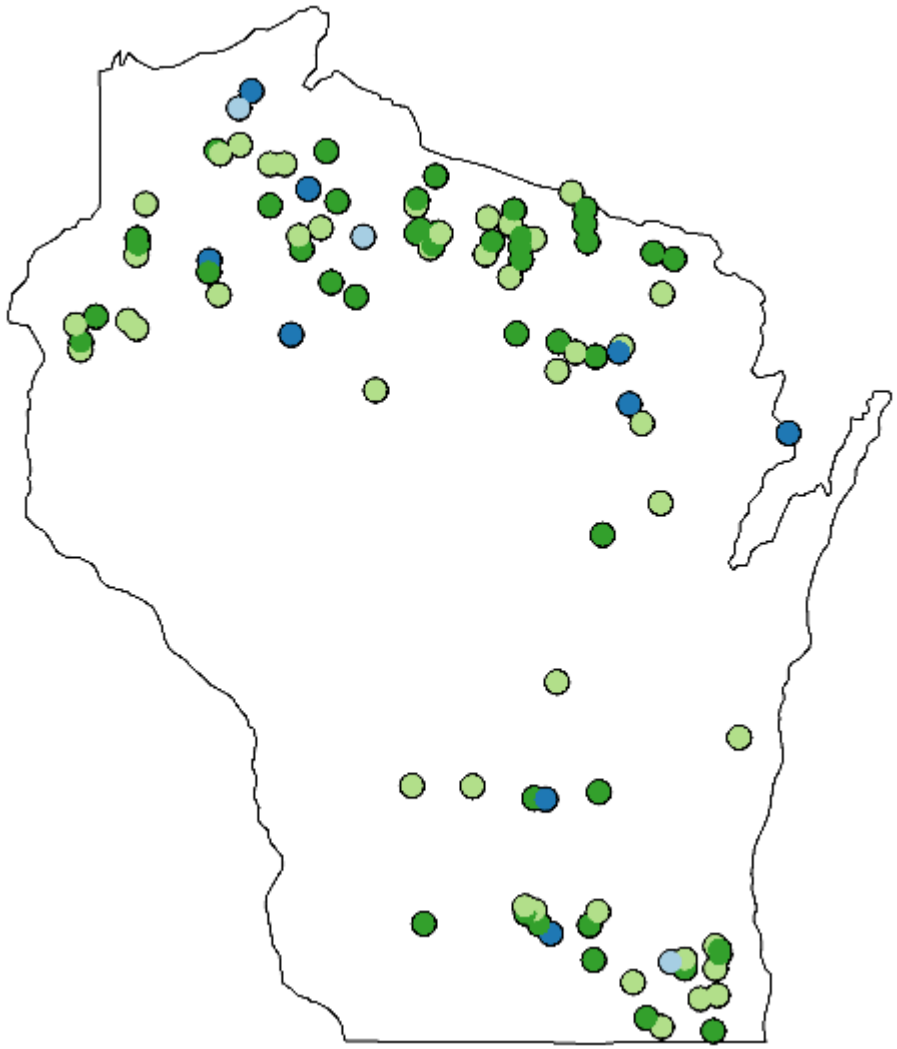
Walleye recruitment is declining in Wisconsin





Largemouth bass density is increasing

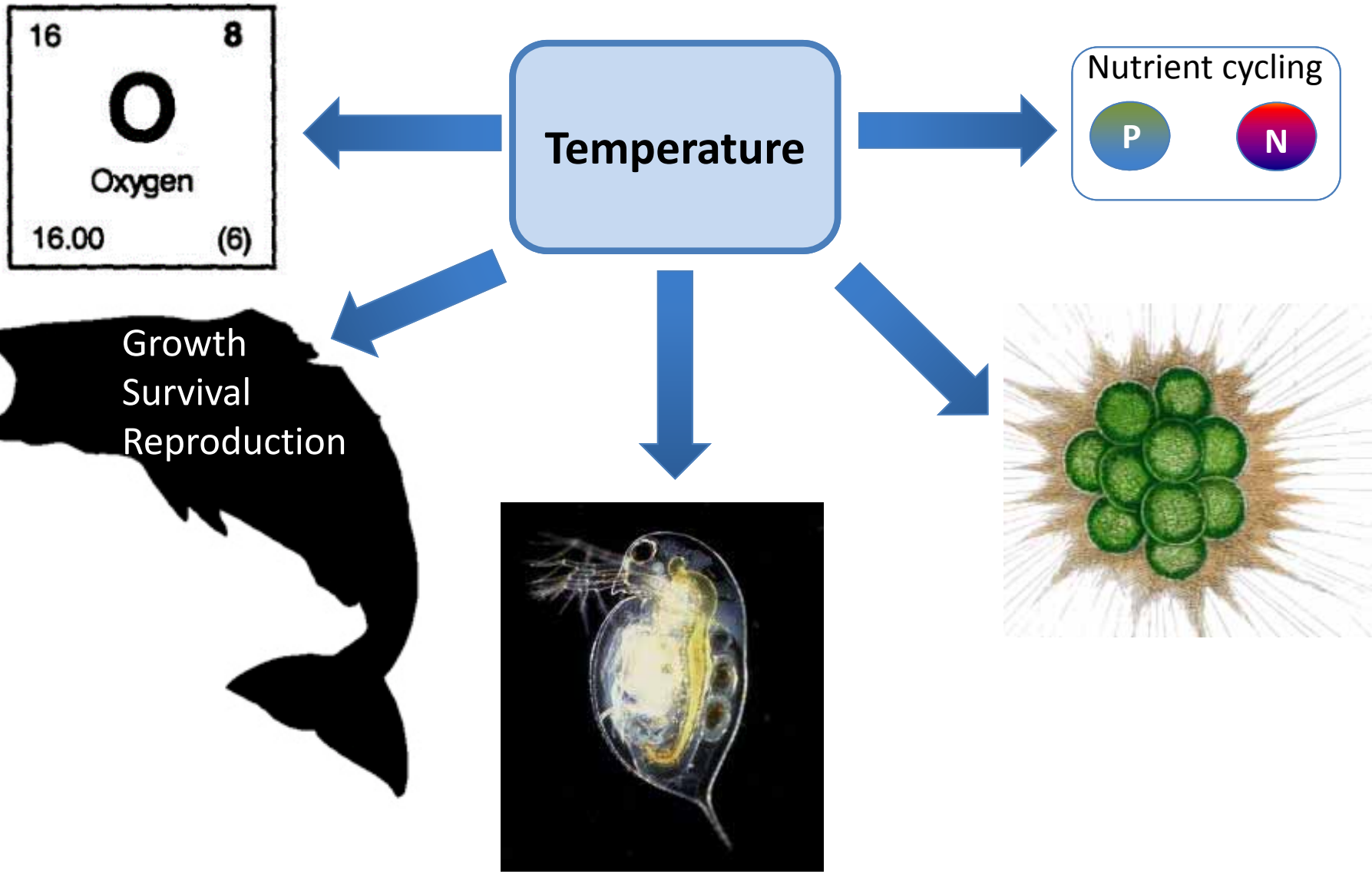




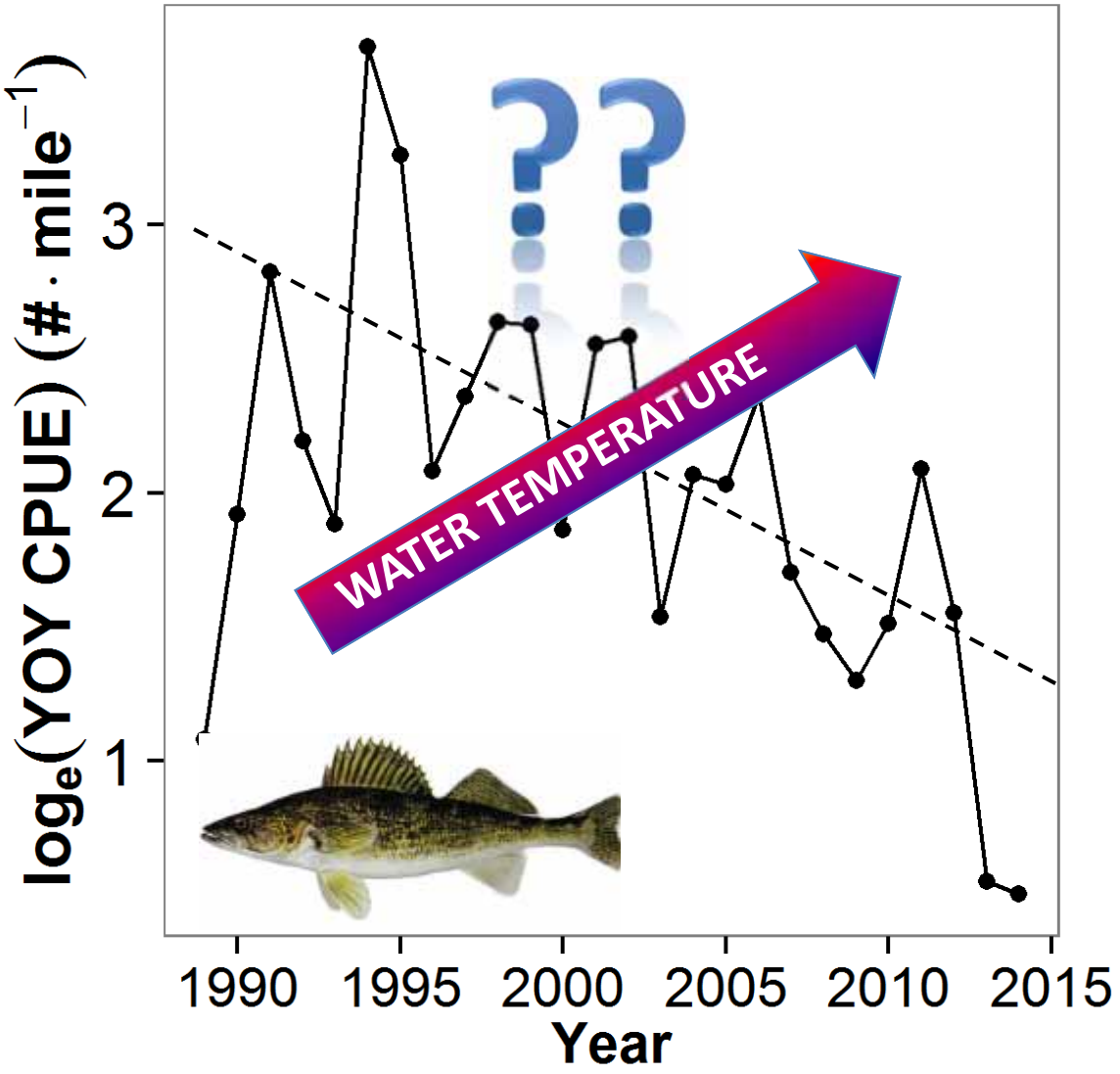
Annual change in LMB >8in spring catch per mile

- Increase (0-4%)
- Strong decline (>4%)
- Strong increase (>4%)
- Decline (0-4%)

Temperature as ecological “master factor”

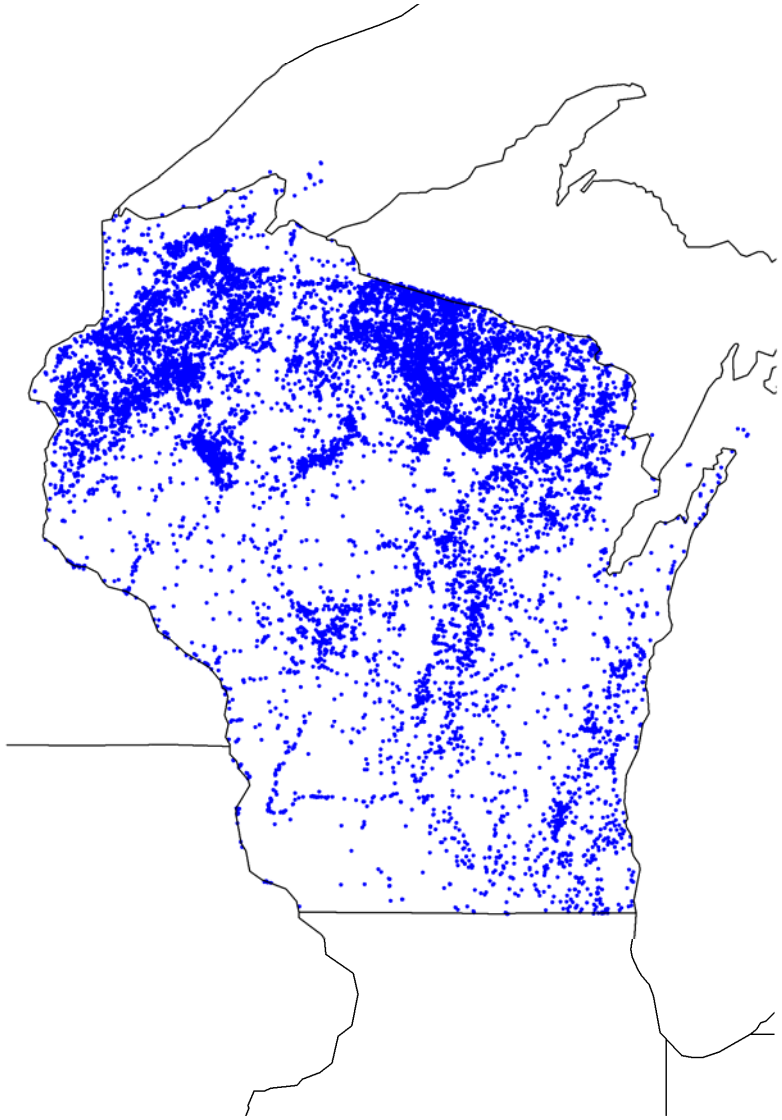


Is water temperature related to fish community change?

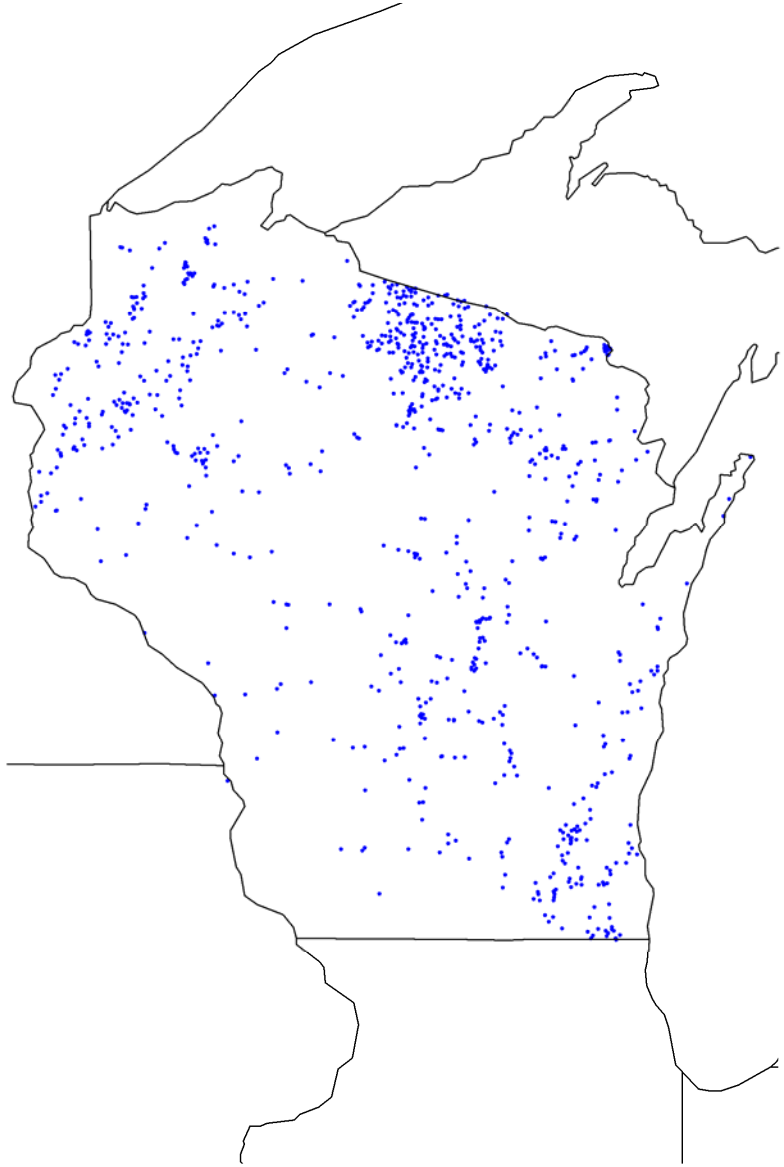


Long-term temperature records are rare

All Wisconsin Lakes

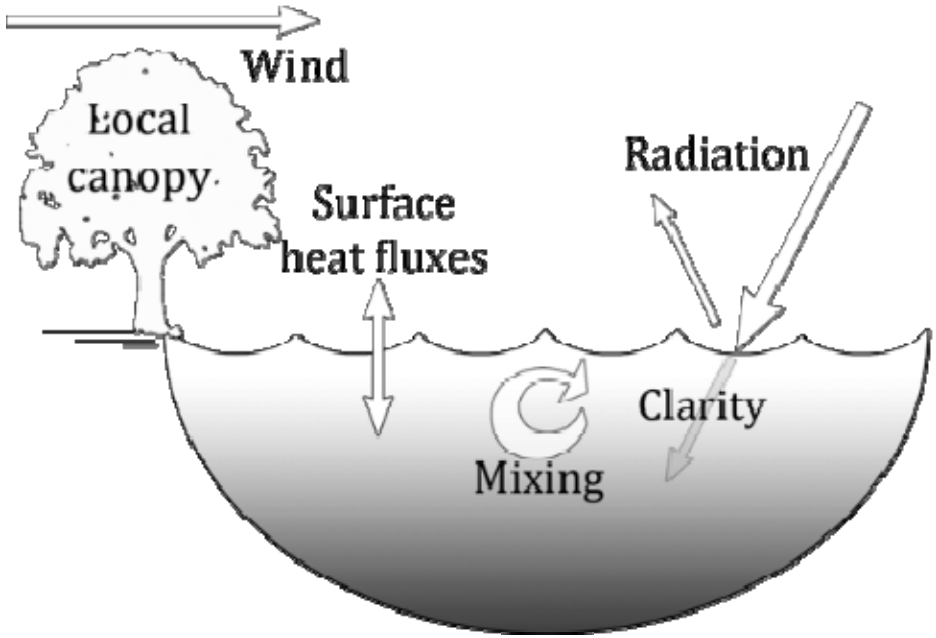


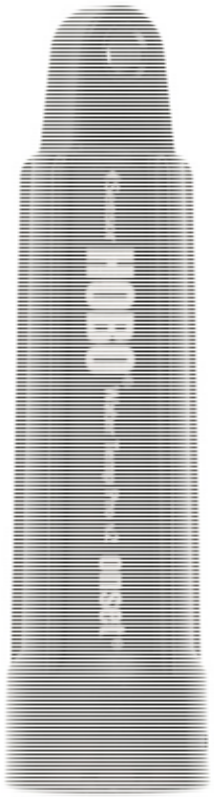
Lakes with > 1 in-situ observation



Multi-faceted approach to increase availability of lake temperature data

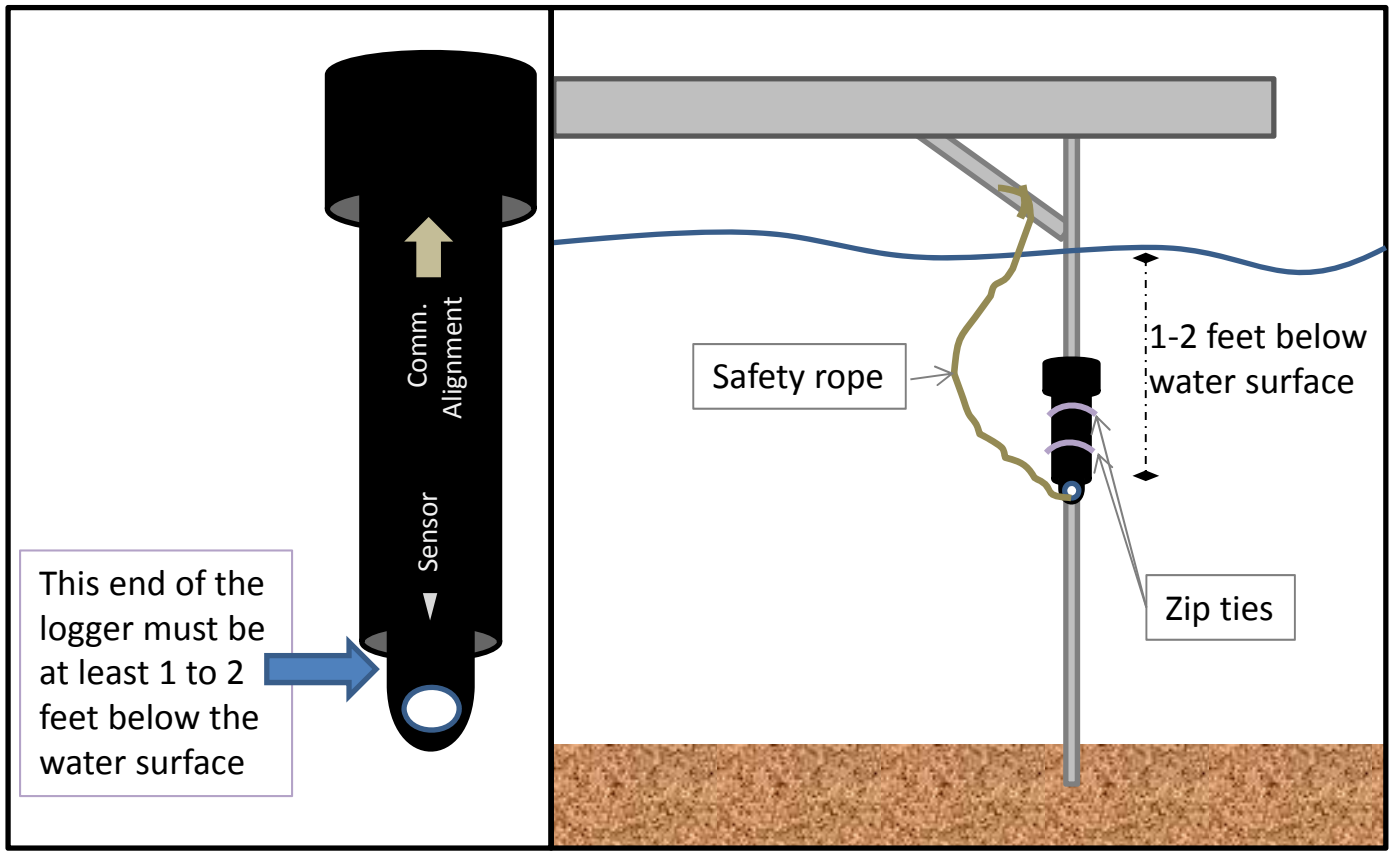
- Citizen monitoring pilot program
- Model to hindcast and forecast temperatures for thousands of WI Lakes

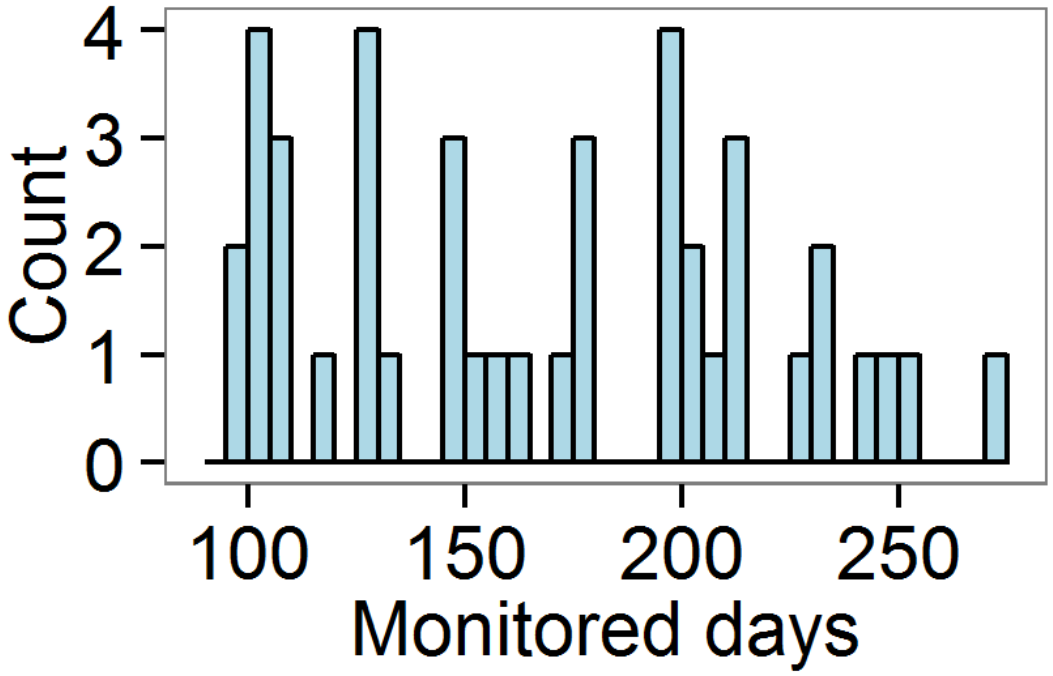




Citizen monitoring

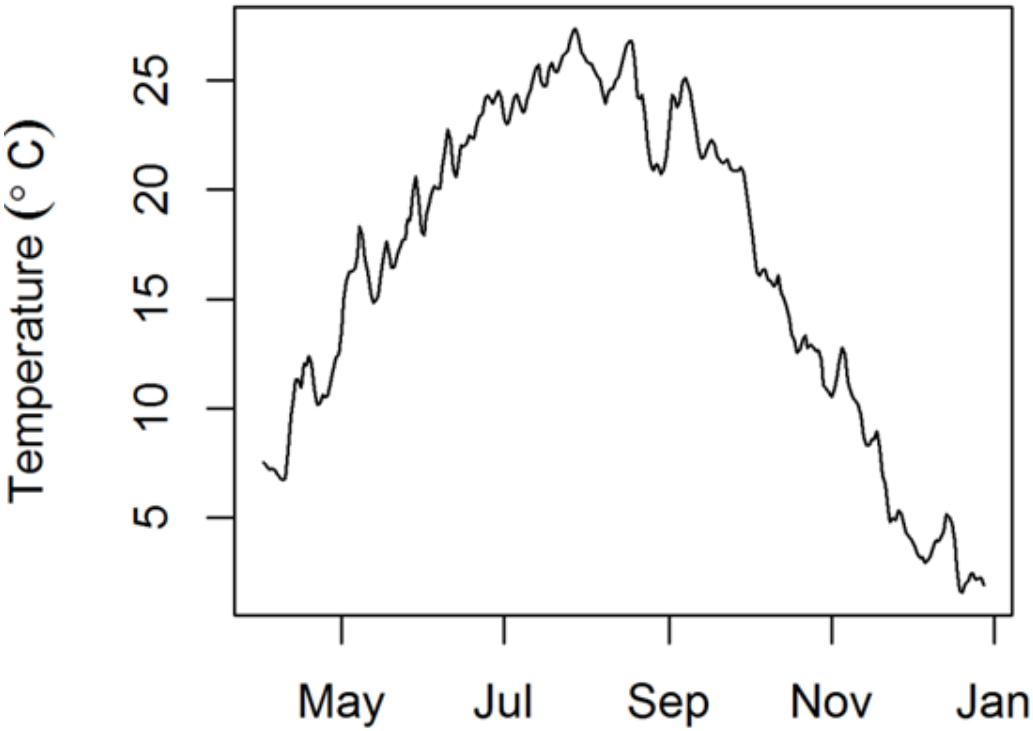
- 48 lakes spanning gradients of size, clarity, location
- Hourly monitoring of surface water temperature
- Deployed ASAP post-ice-out, retrieved as late as possible before ice-on

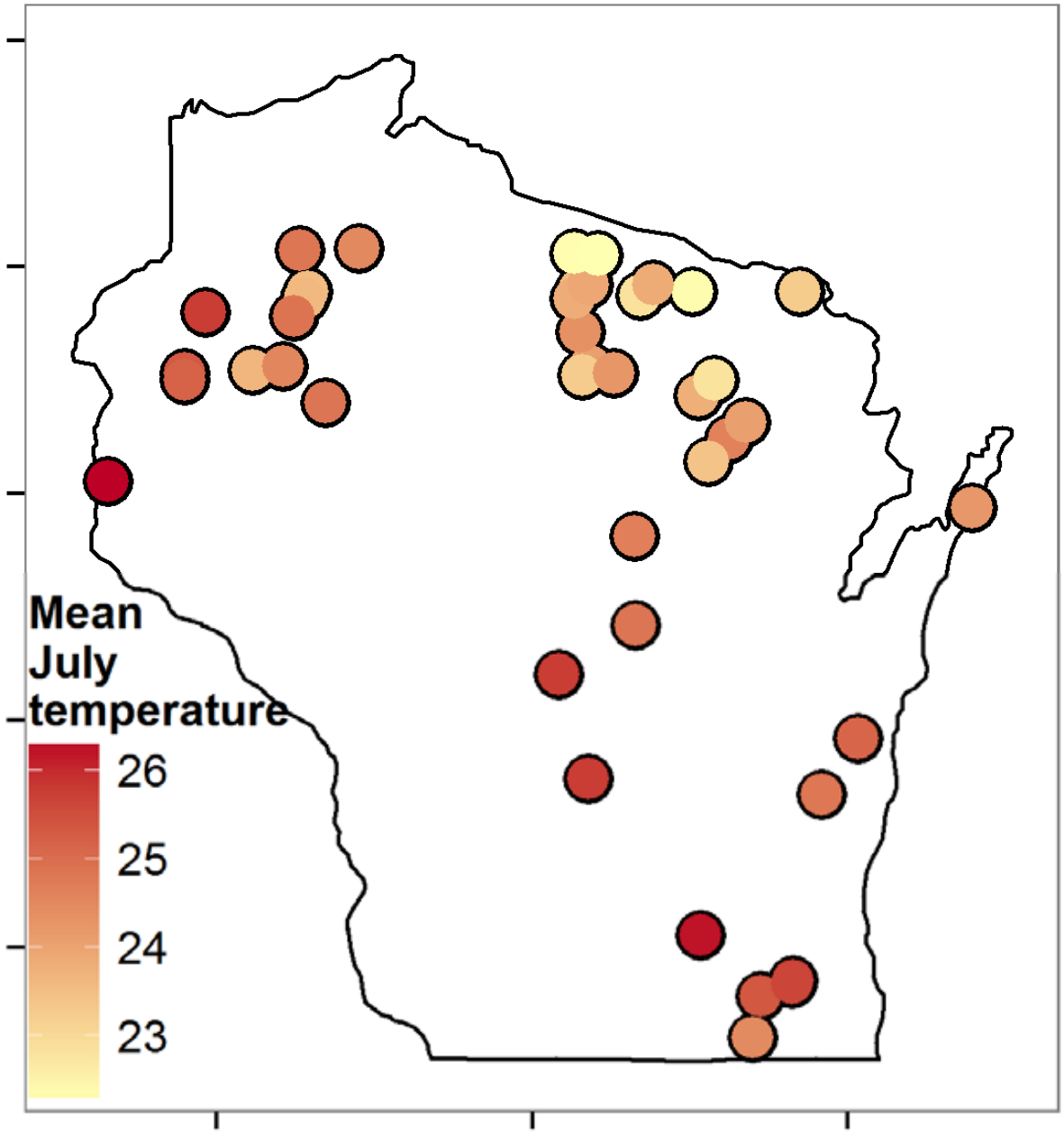




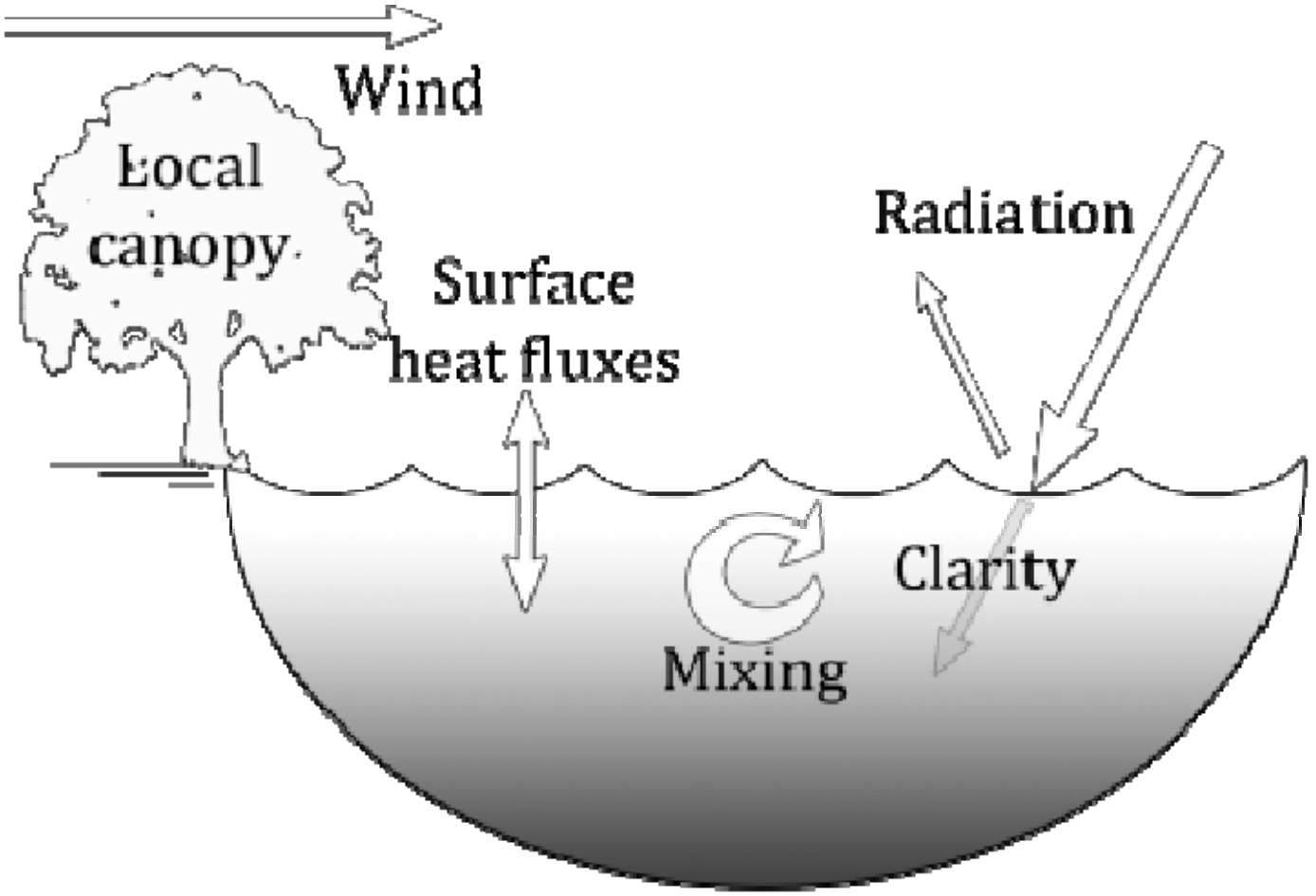
Citizen monitoring

42 of 48 loggers returned



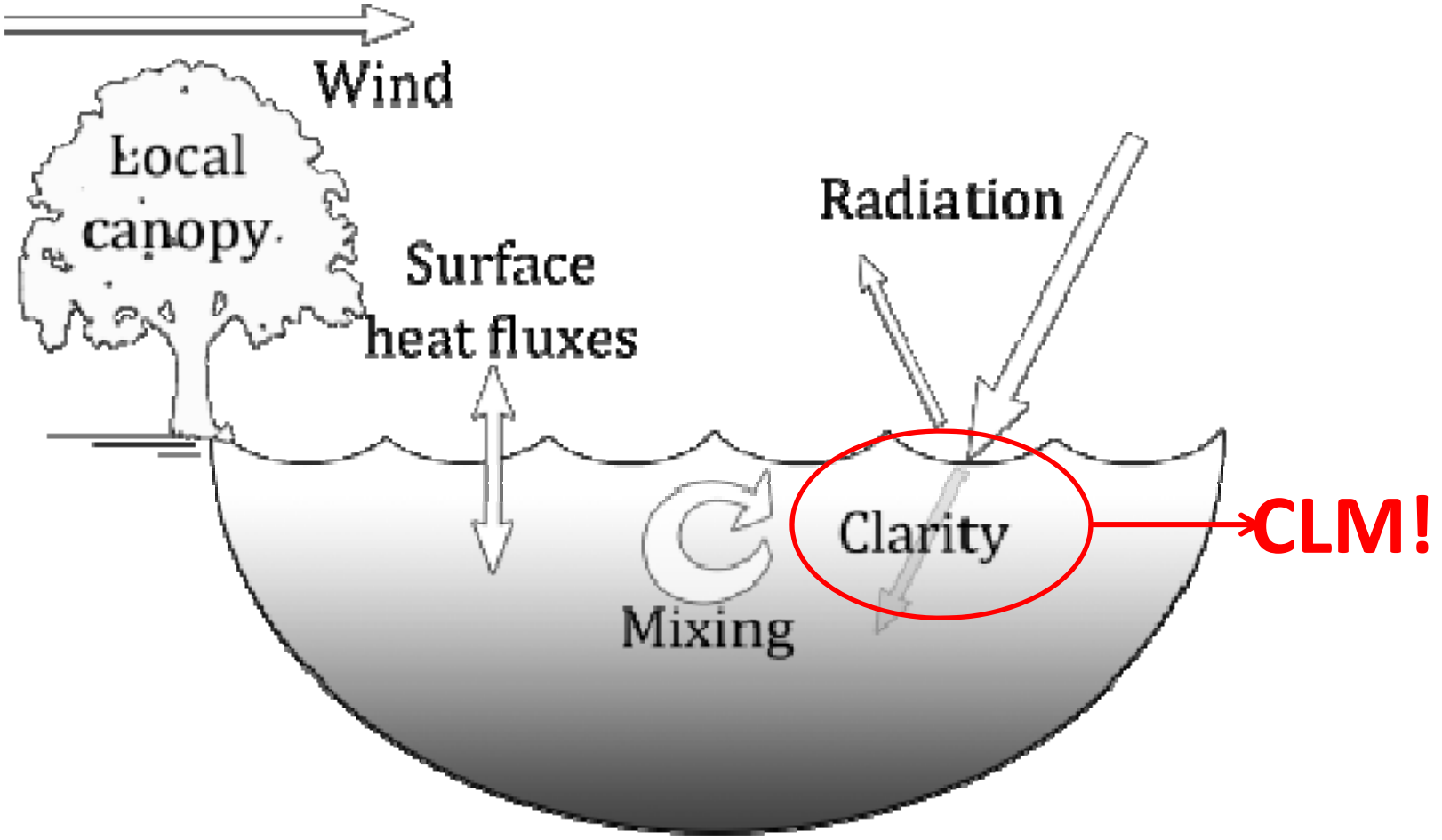

Mean
July
temperature
26
25
24
23

Hindcast and forecast lake temperatures



Read et al. 2014. Ecol. Model. 291C: 142-150

Hindcast and forecast lake temperatures



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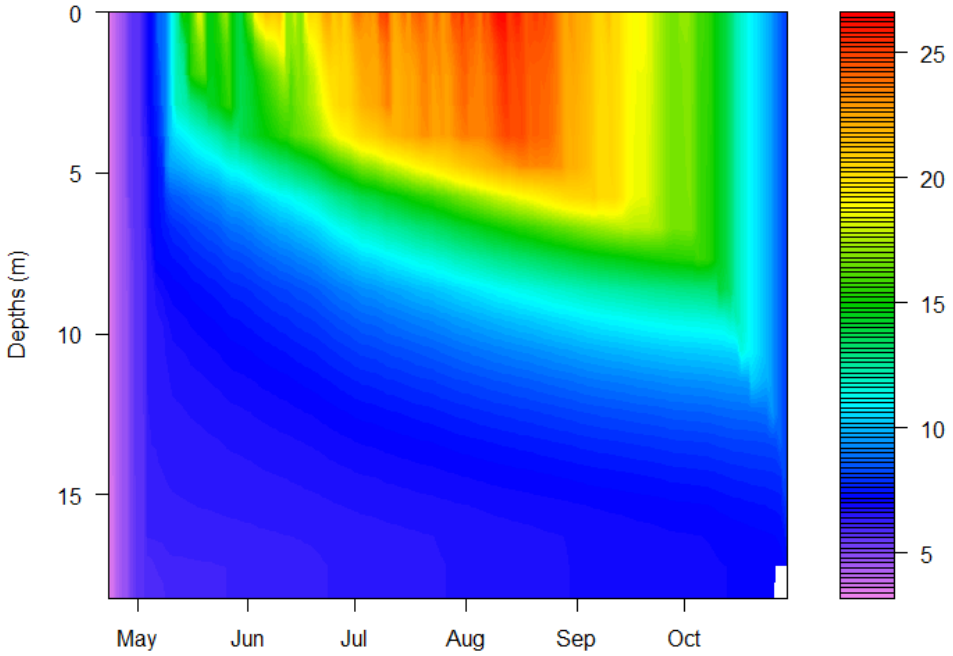
Model outputs



x 2300 lakes x 25 years x 3 periods

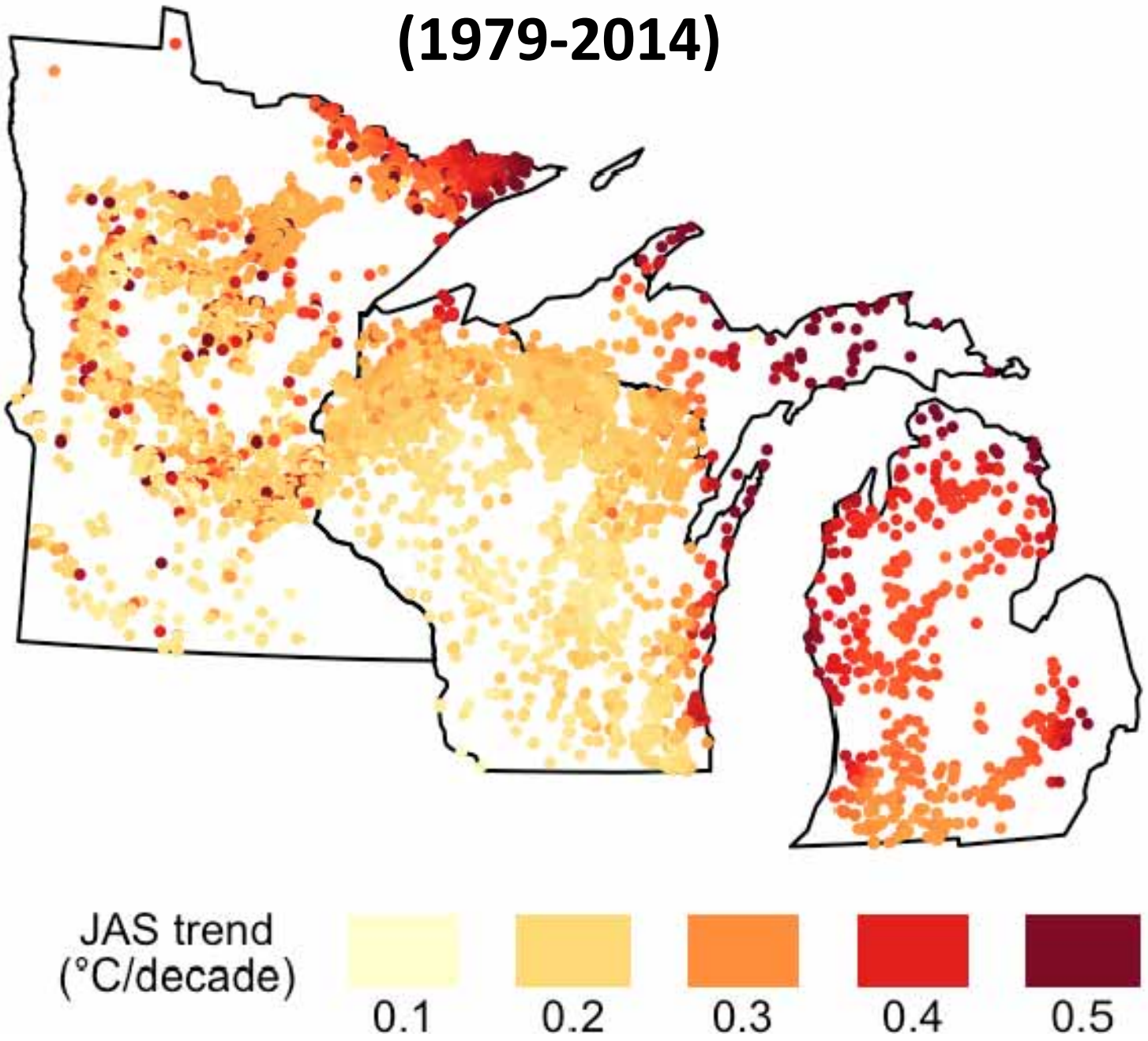
1989-2014
2040-2064
2065-2089

Derived temperature outputs

- Max. surface water temp
- Mean summer surface temp
- Growing degree days
- Duration of ice free season
- Duration of stratification

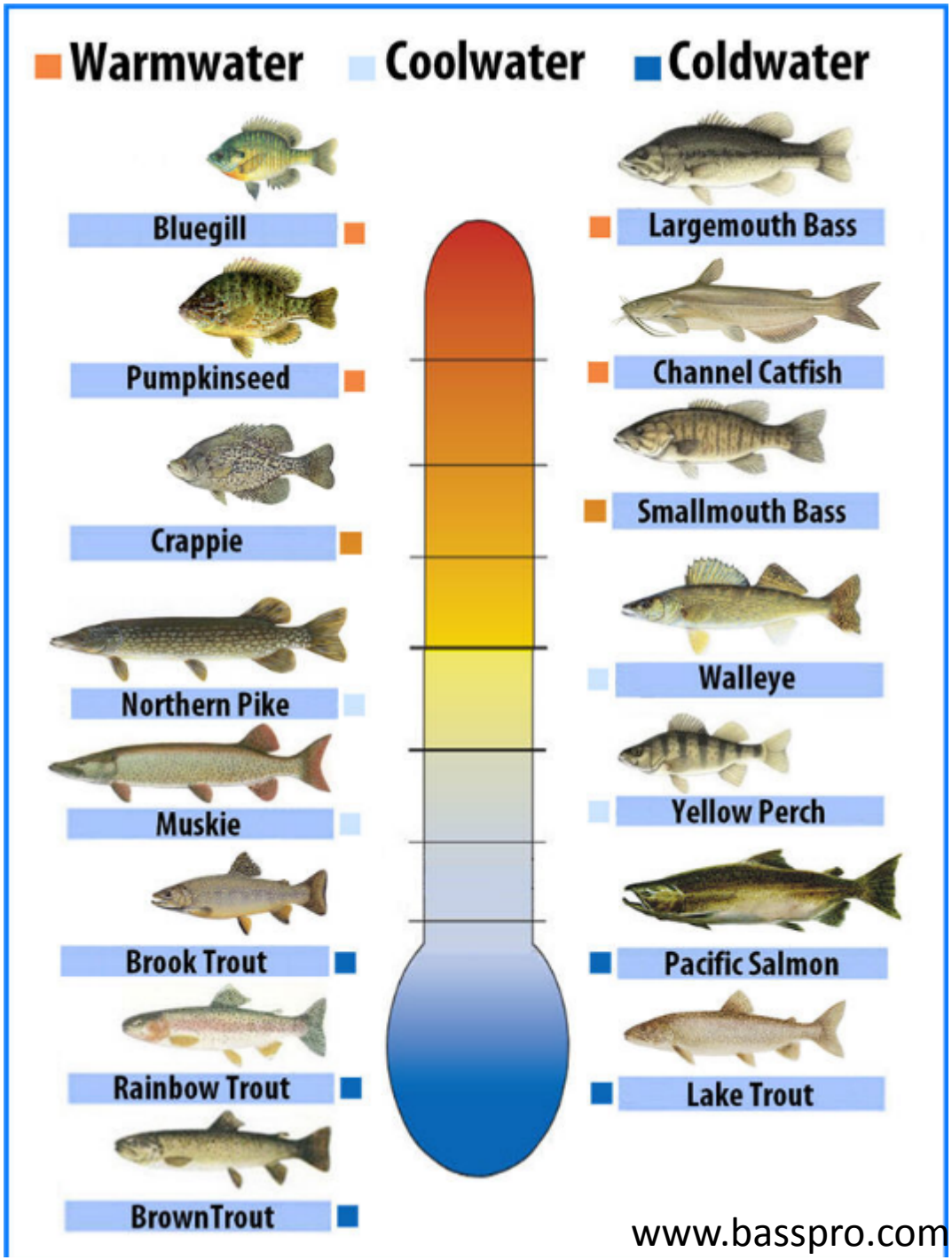
- CV in surface temp, 0-30 and 30-60 days post-ice off
- Height of water column and days between 19-23 ^{o}C
- Date at which surface temp$\geq$ 8.9 ^{o}C and 5 ^{o}C

Contemporary trends in water temperature (1979-2014)



GH1

What does this mean for fish?

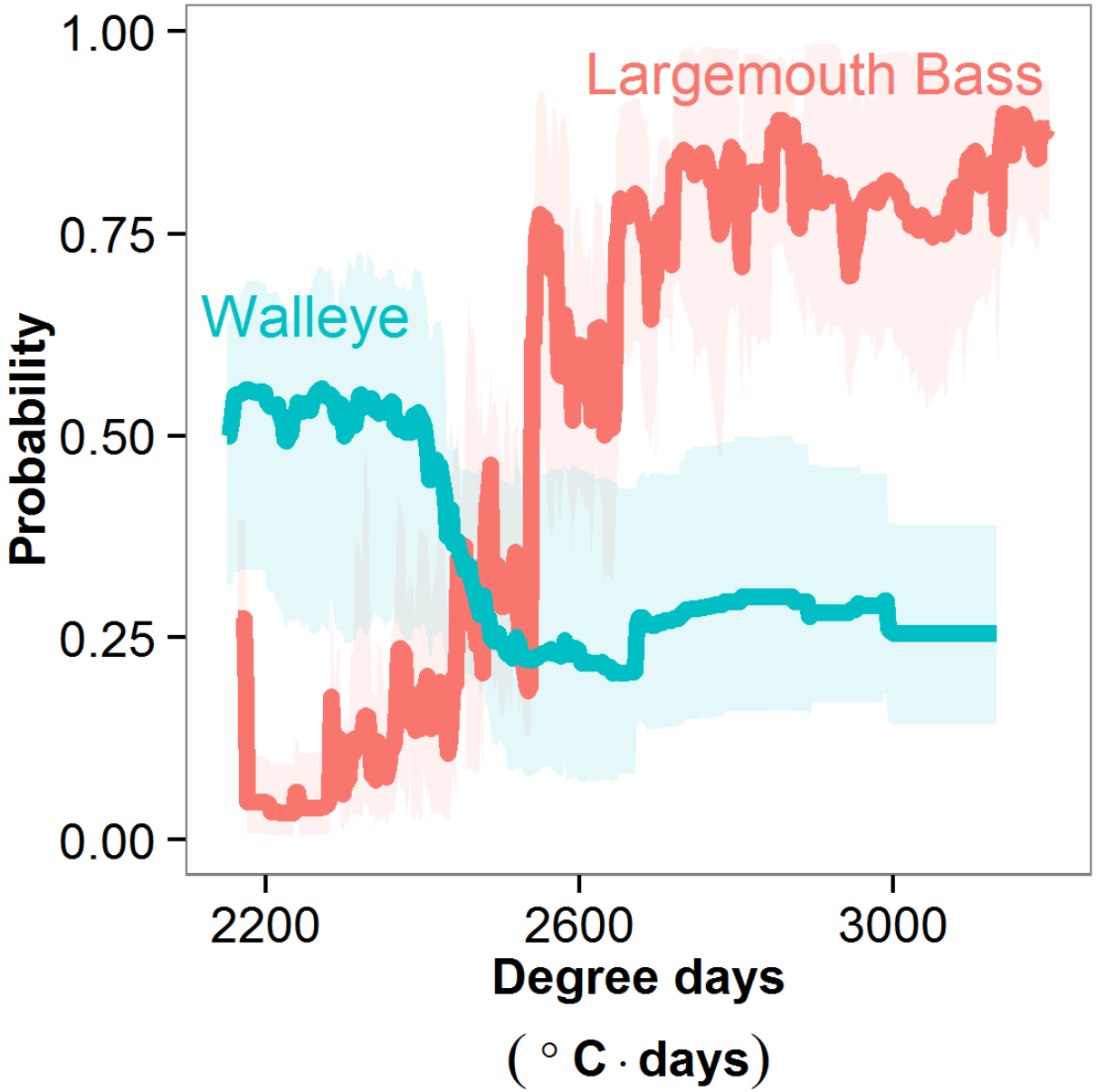


Slide 16

GH1 GH takes over here

Gretchen Hansen, 10/22/2015

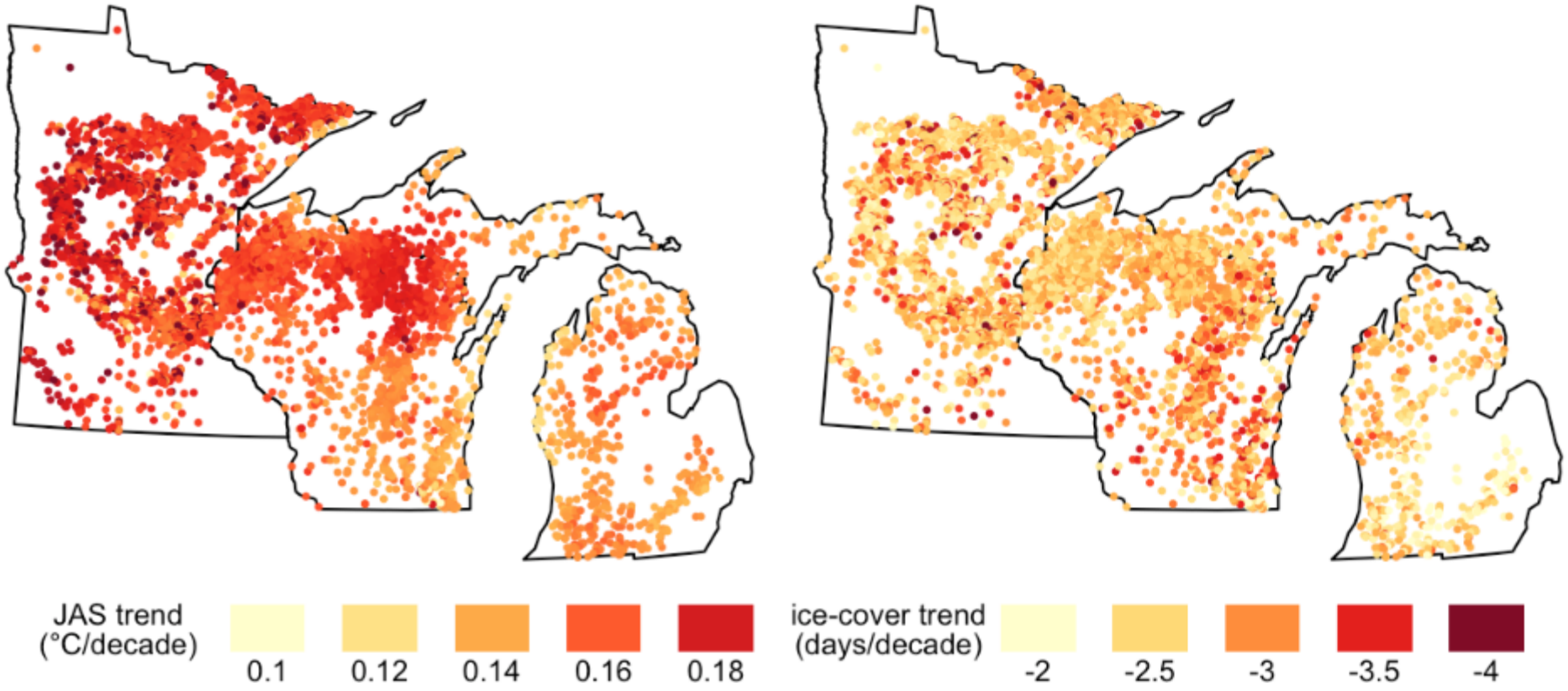
Water temperature influences fish



Projected future water temperatures

Surface water temperatures

Ice-cover duration



How do we expect lakes to change?

WALLEYE

(% of lakes)

Mid-century (2040-2059)		
Lose	**Maintain**	**Gain**
27.2	63.2	9.6

How do we expect lakes to change?

WALLEYE

(% of lakes)

Mid-century (2040-2059)			Late century (2070-2089)		
Lose	**Maintain**	**Gain**	**Lose**	**Maintain**	**Gain**
27.2	63.2	9.6	62.3	30.3	7.4

How do we expect lakes to change?

WALLEYE (% of lakes)

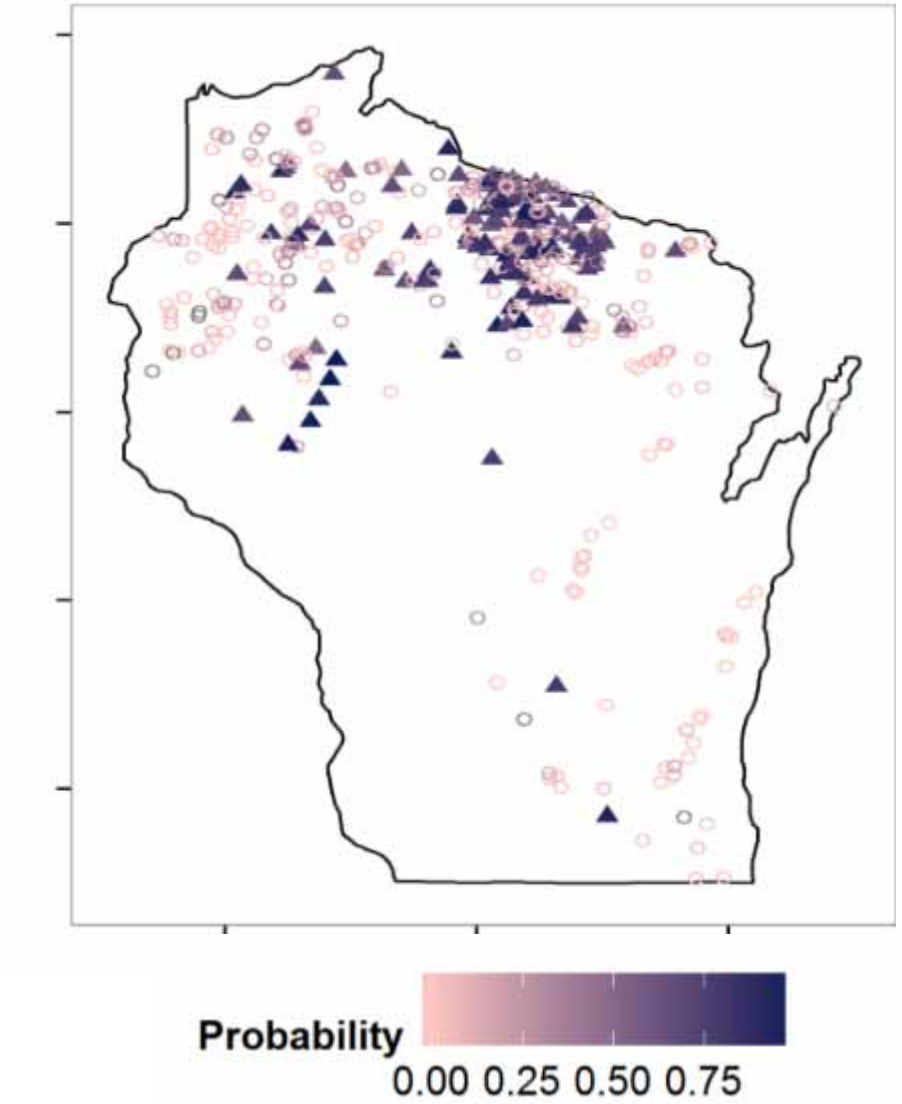
Mid-century (2040-2059)			Late century (2070-2089)		
Lose	Maintain	Gain	Lose	Maintain	Gain
27.2	63.2	9.6	62.3	30.3	7.4

LARGEMOUTH BASS (% of lakes)

Mid-century (2040-2059)			Late century (2070-2089)		
Lose	Maintain	Gain	Lose	Maintain	Gain
7.4	78.2	14.3	2.6	66.2	31.2

From models to management

- Prioritize management actions
  - Protect resilient lakes
  - Guide stocking
- Bound realistic expectations
  - Lake-specific
  - Classify lakes



Acknowledgements

- Citizen volunteers, past and present!
- CLM coordinators and WDNR biologists
- Dan Isermann and Andrea Musch, UWSP
- Kevin Wehrly (MI), Pete Jacobson (MN)
- Midwest Glacial Lakes partnership
- Funding from CLMN, Sportfish restoration funds, USGS NWCCWSC, NECSC

Questions/Discussion

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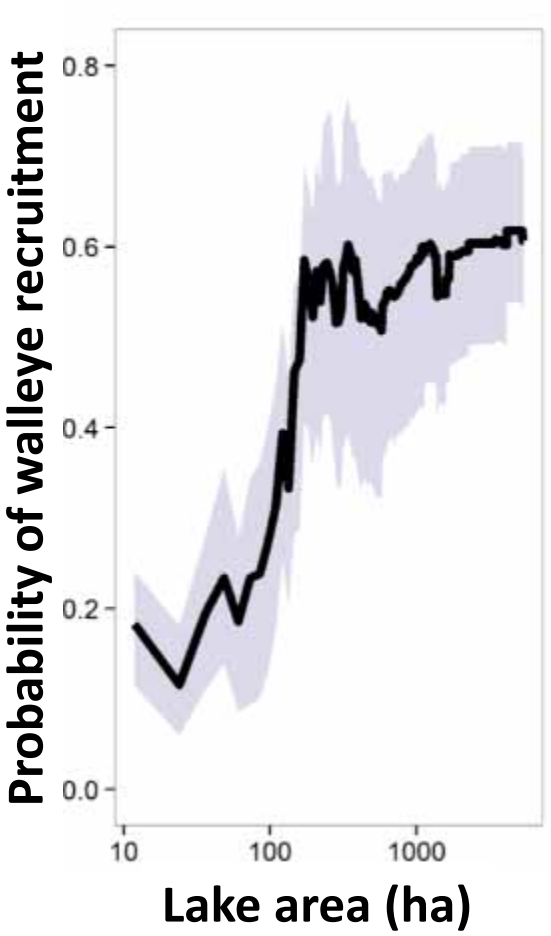
Walleye recruitment predicted by lake morphometry and water temperature



Updated from Hansen et al. 2015 CJFAS 72(5): 661-672

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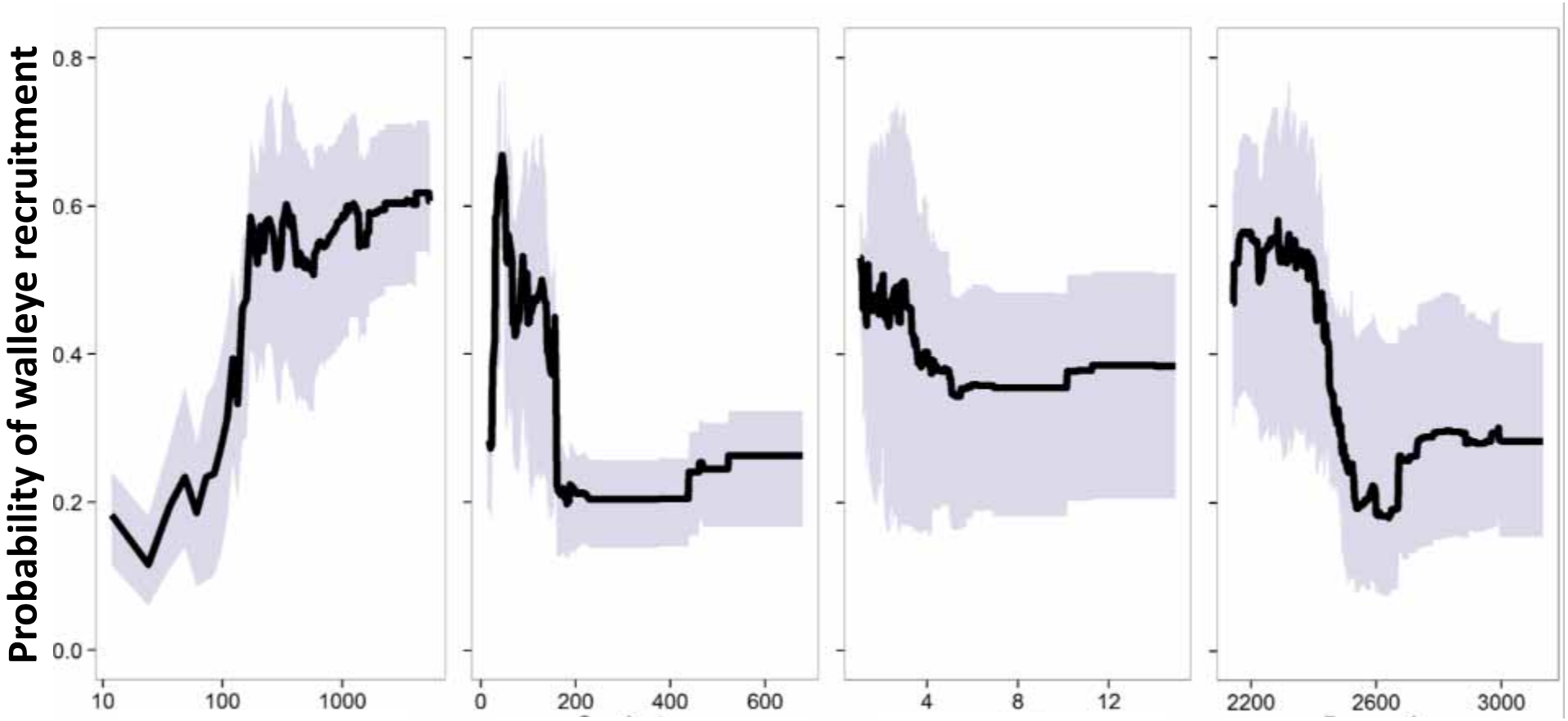
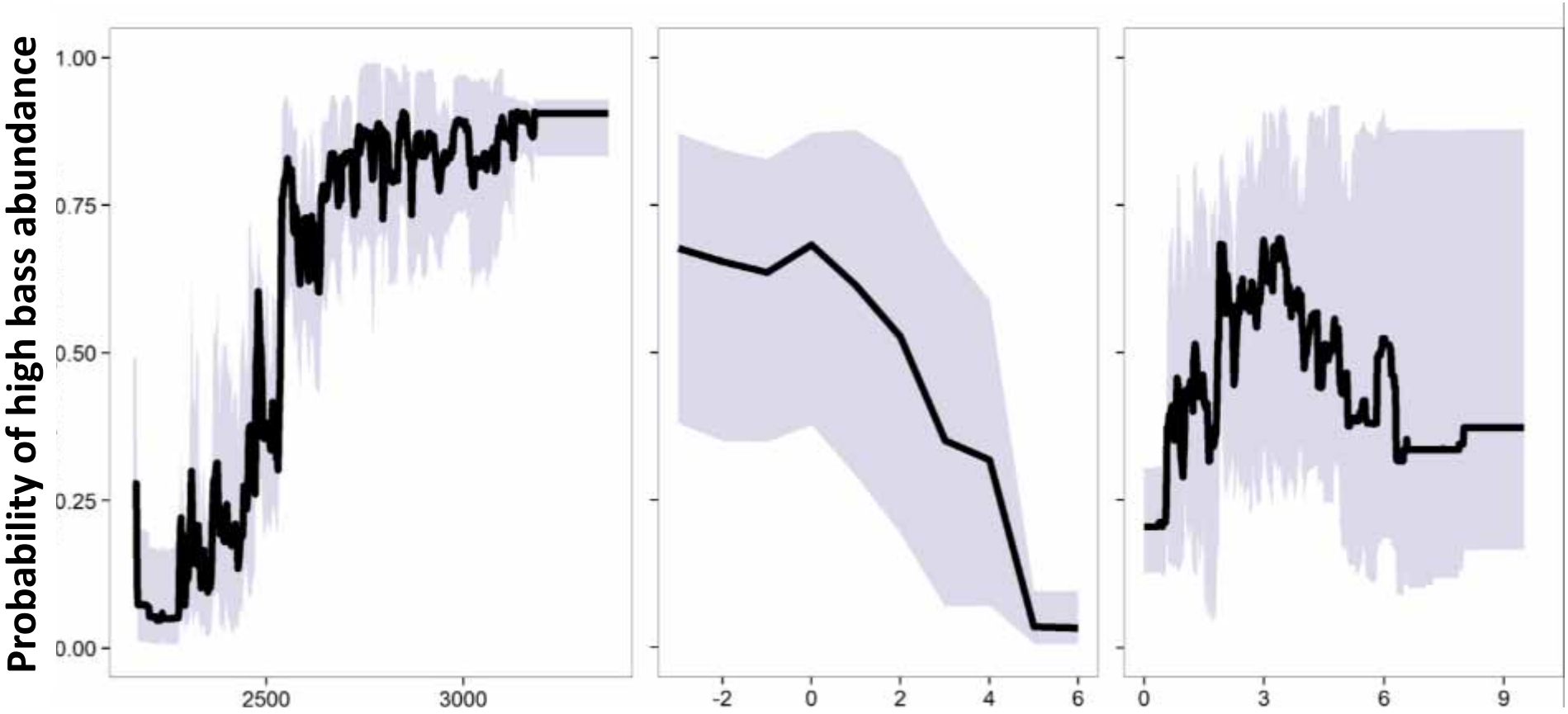
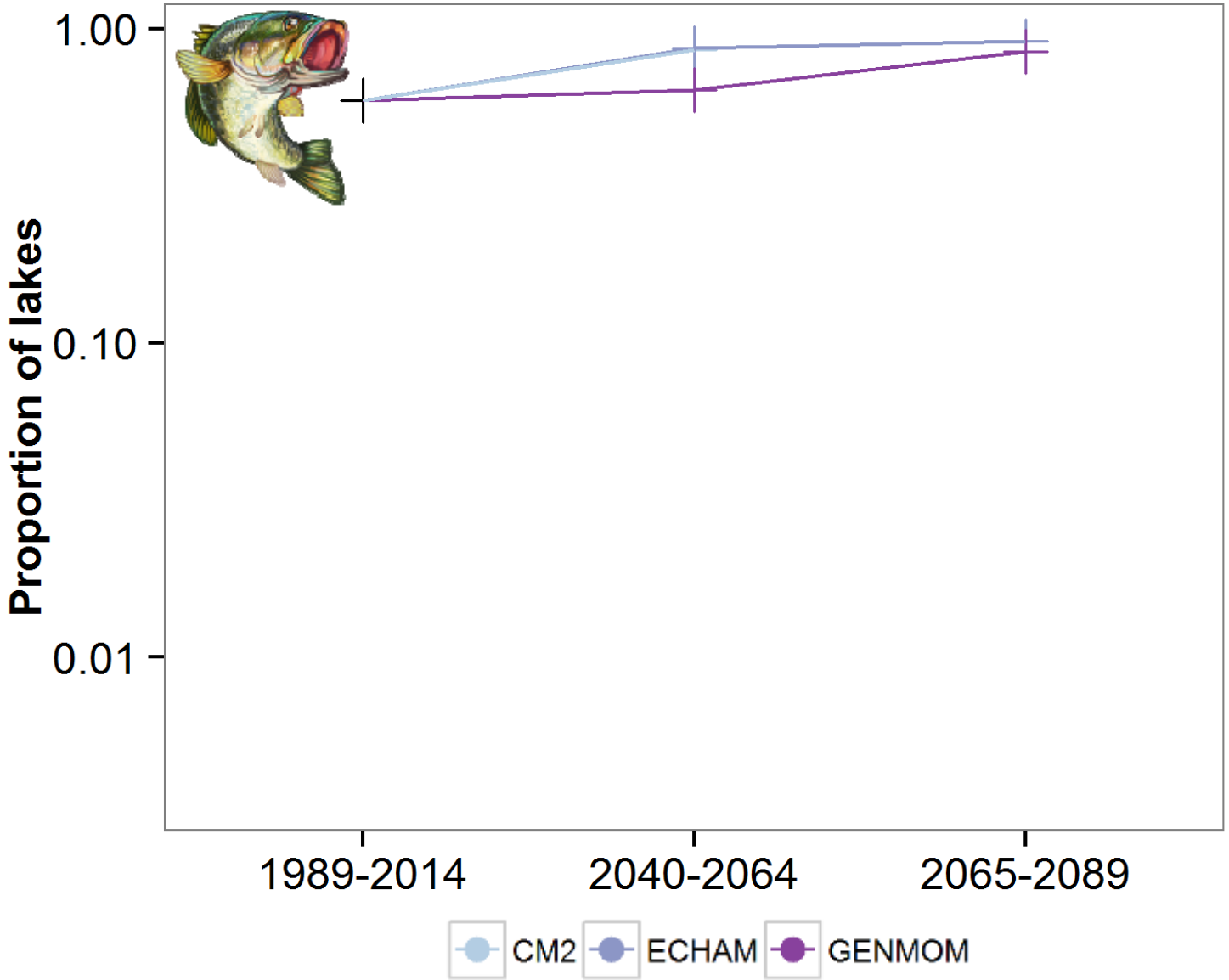


Updated from Hansen et al. 2015 CJFAS 72(5): 661-672

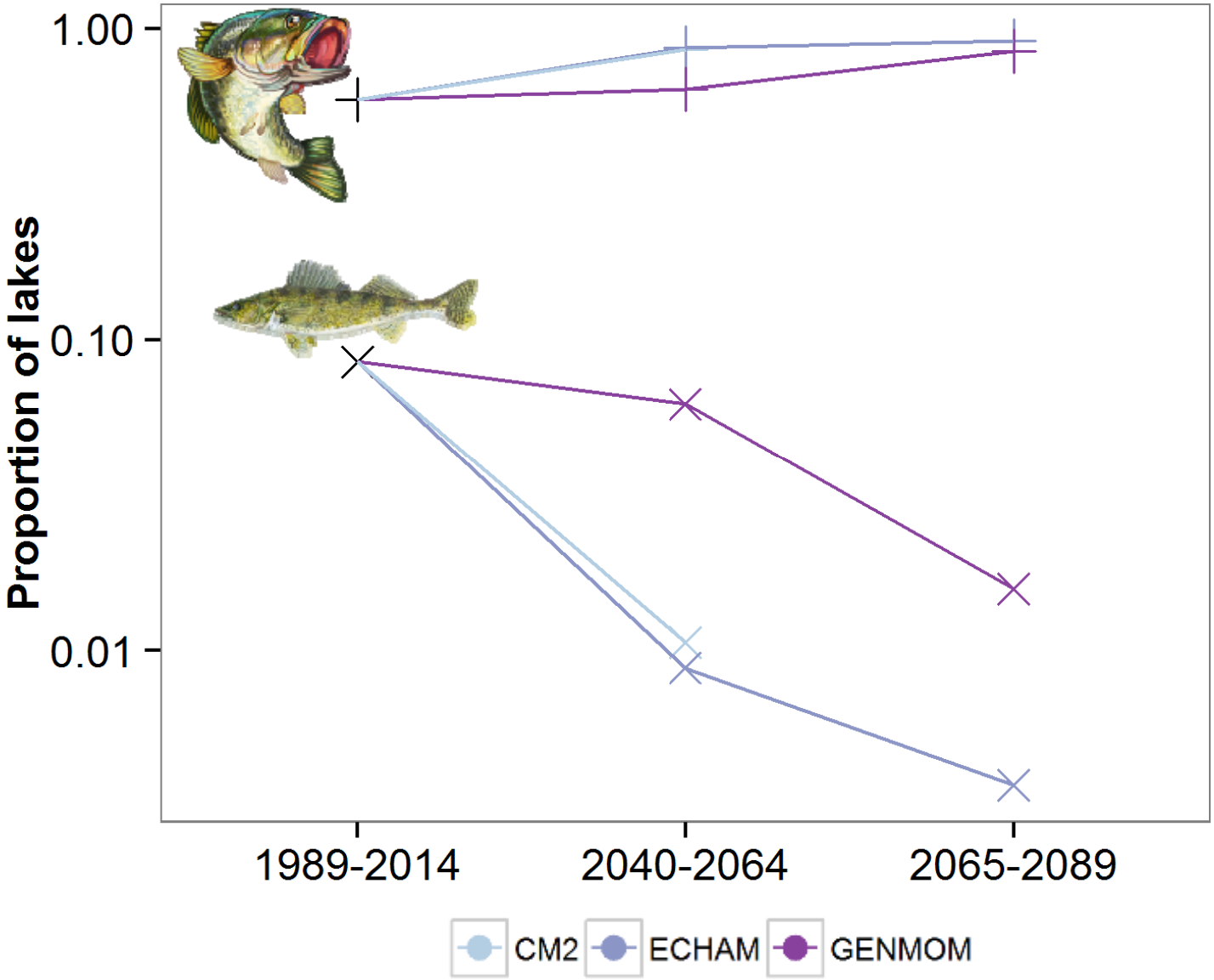
Largemouth bass abundance predicted by water temperature, lake order, and Secchi



Long-term fish community changes



Long-term fish community changes



Long-term fish community changes