

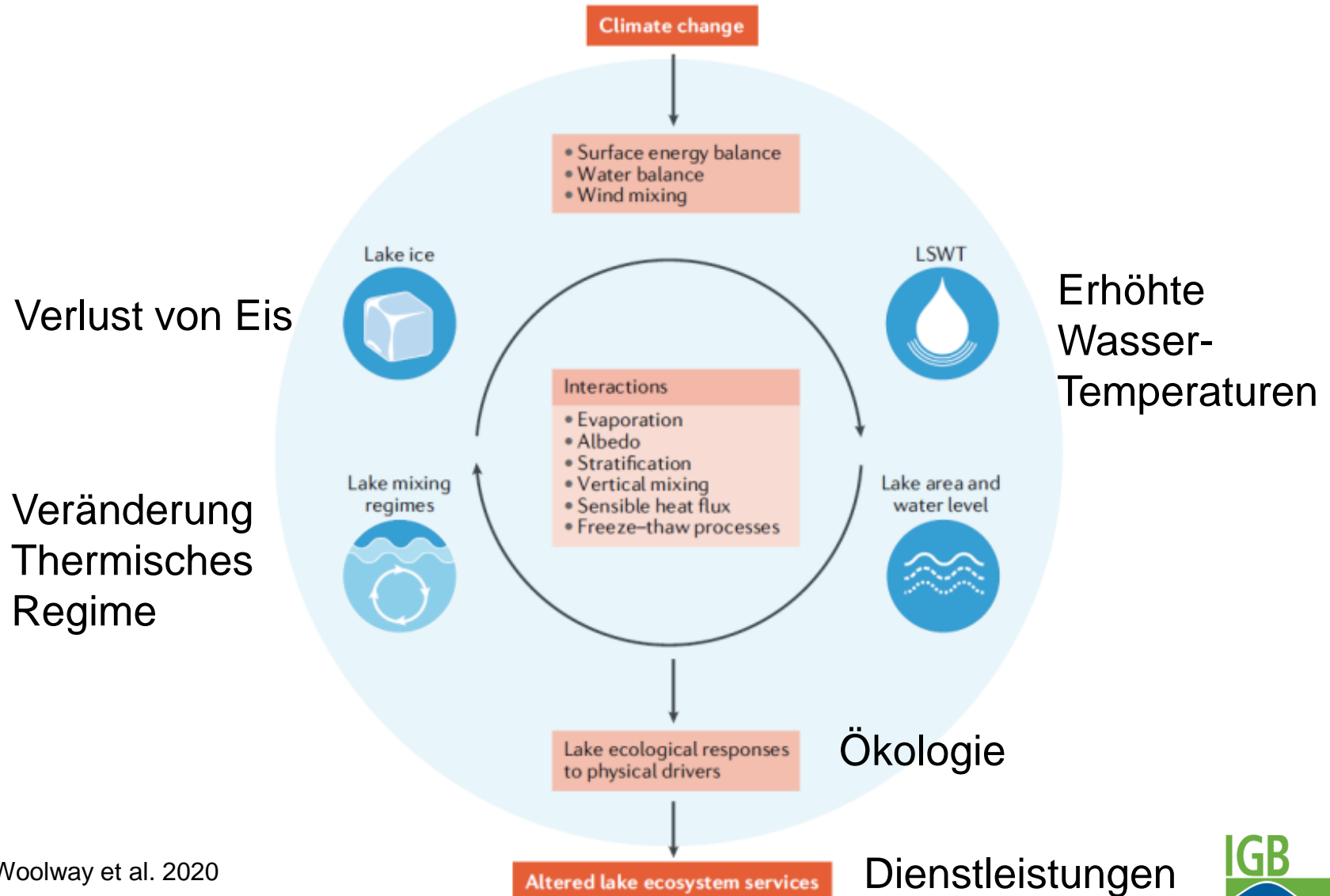


# Seen im Klimawandel

**Rita Adrian**

Department of Ecosystem Research

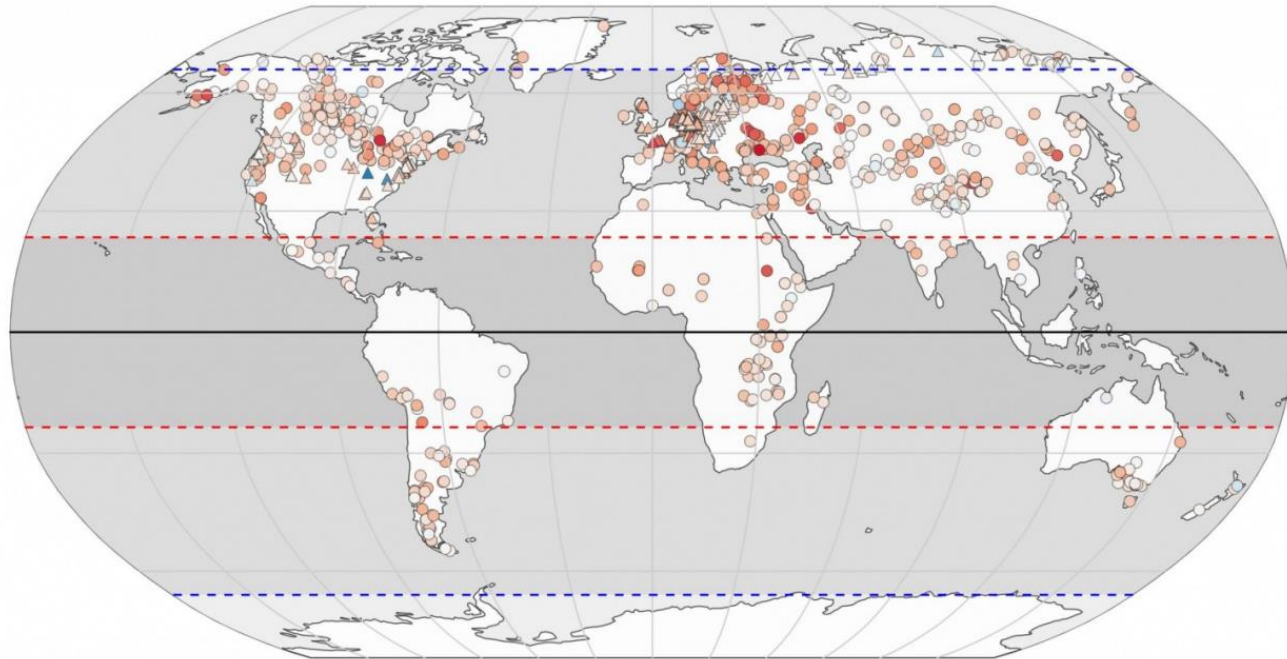
# Lakes in a changing climate



Woolway et al. 2020

# Global lake surface water temperature trends

0.34°C / Decade: 1985 - 2009



Type

- lake
- △ stream or river

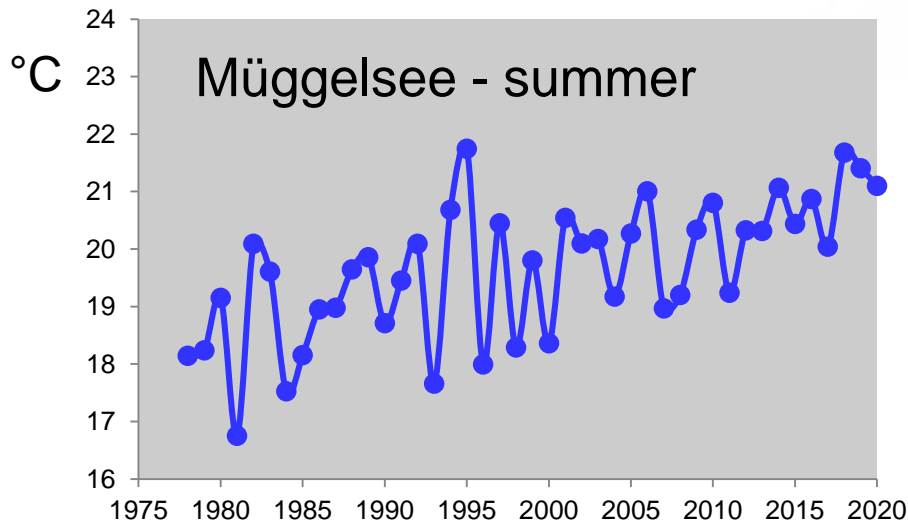
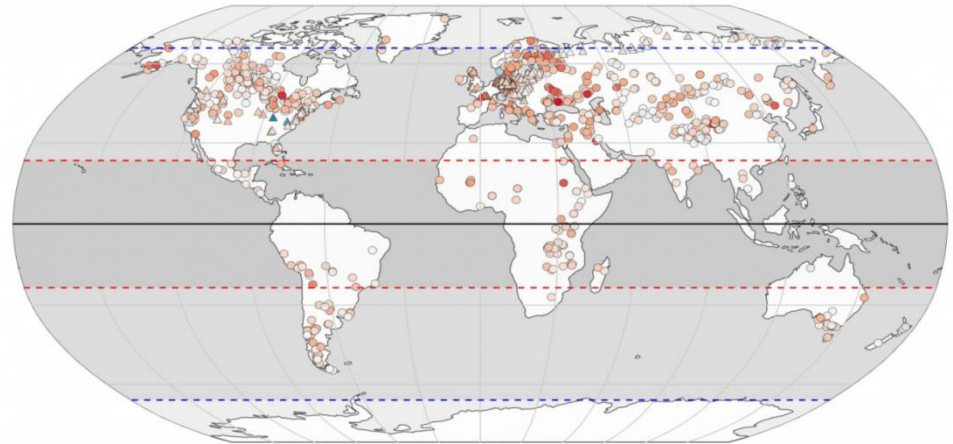
Geographical zones

- light gray polar
- medium gray temperate
- dark gray tropic

- - - Arctic/Antarctic Circle
- - - Tropic of Cancer/Capricorn
- Equator

# Global versus local lake surface water temperature trends

Global:  
0.34°C / decade  
(1985 – 2009)



Type  
○ lake  
△ stream or river

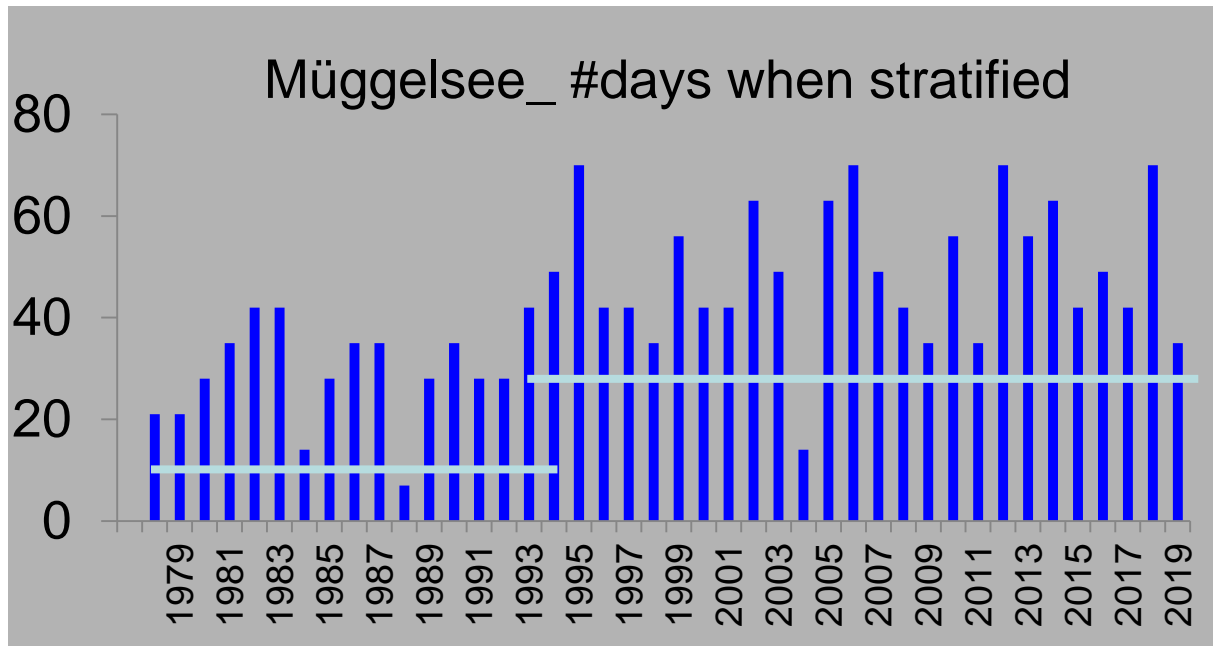
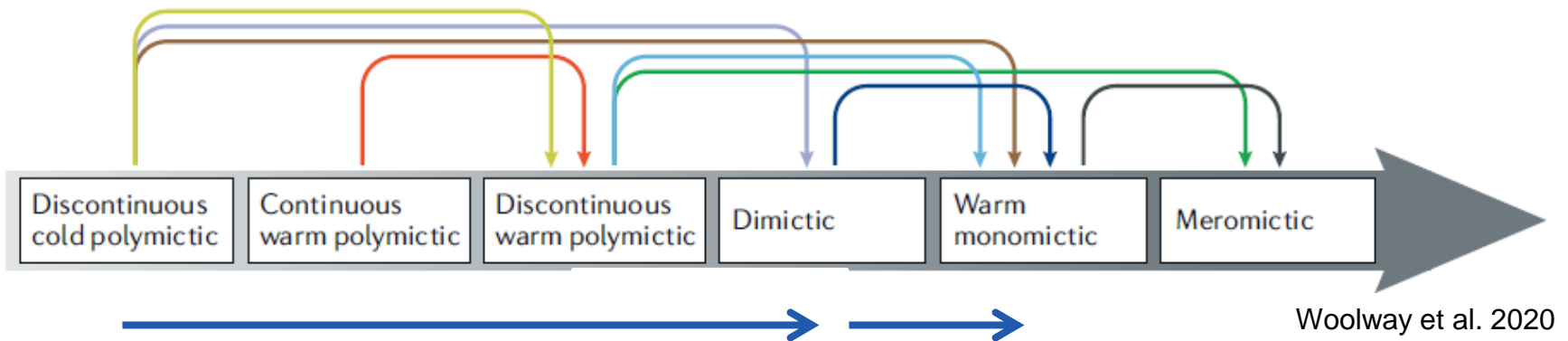
Geographical zones  
polar  
temperate  
tropic

--- Arctic/Antarctic Circle  
--- Tropic of Cancer/Capricorn  
— Equator

Data source: O'Reilly et al. 2015, Woolway et al. 2020

Local:  
0.6°C /decade  
(1978-2020)

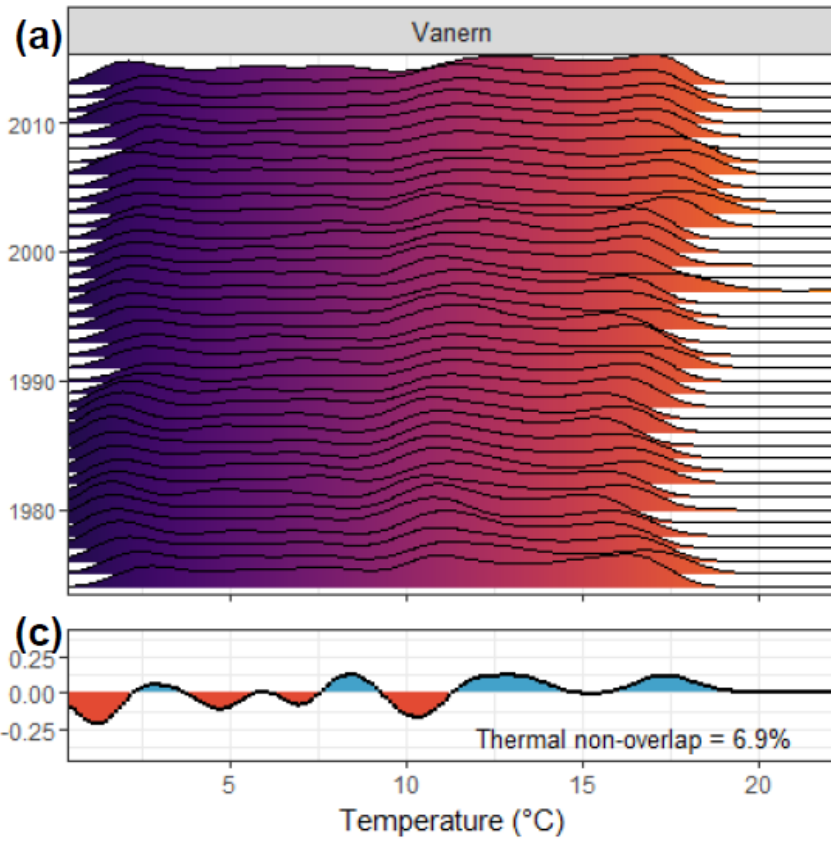
# Projected lake mixing regime shifts



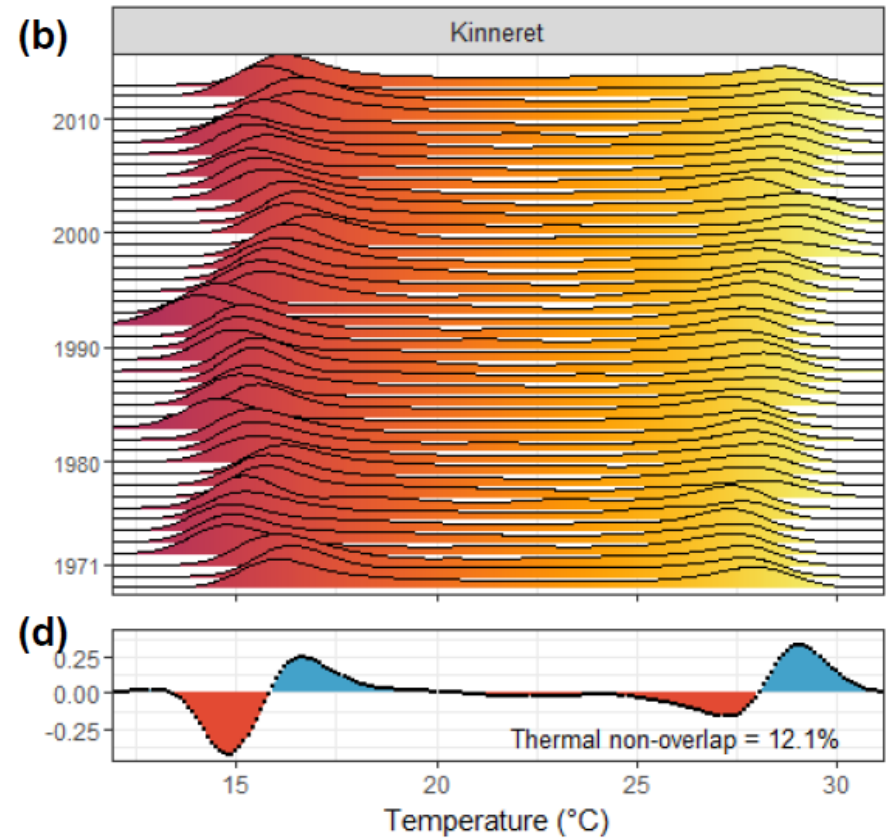
# Change in volume of thermal habitat

1978-1995 versus 1996-2013

## Sweden

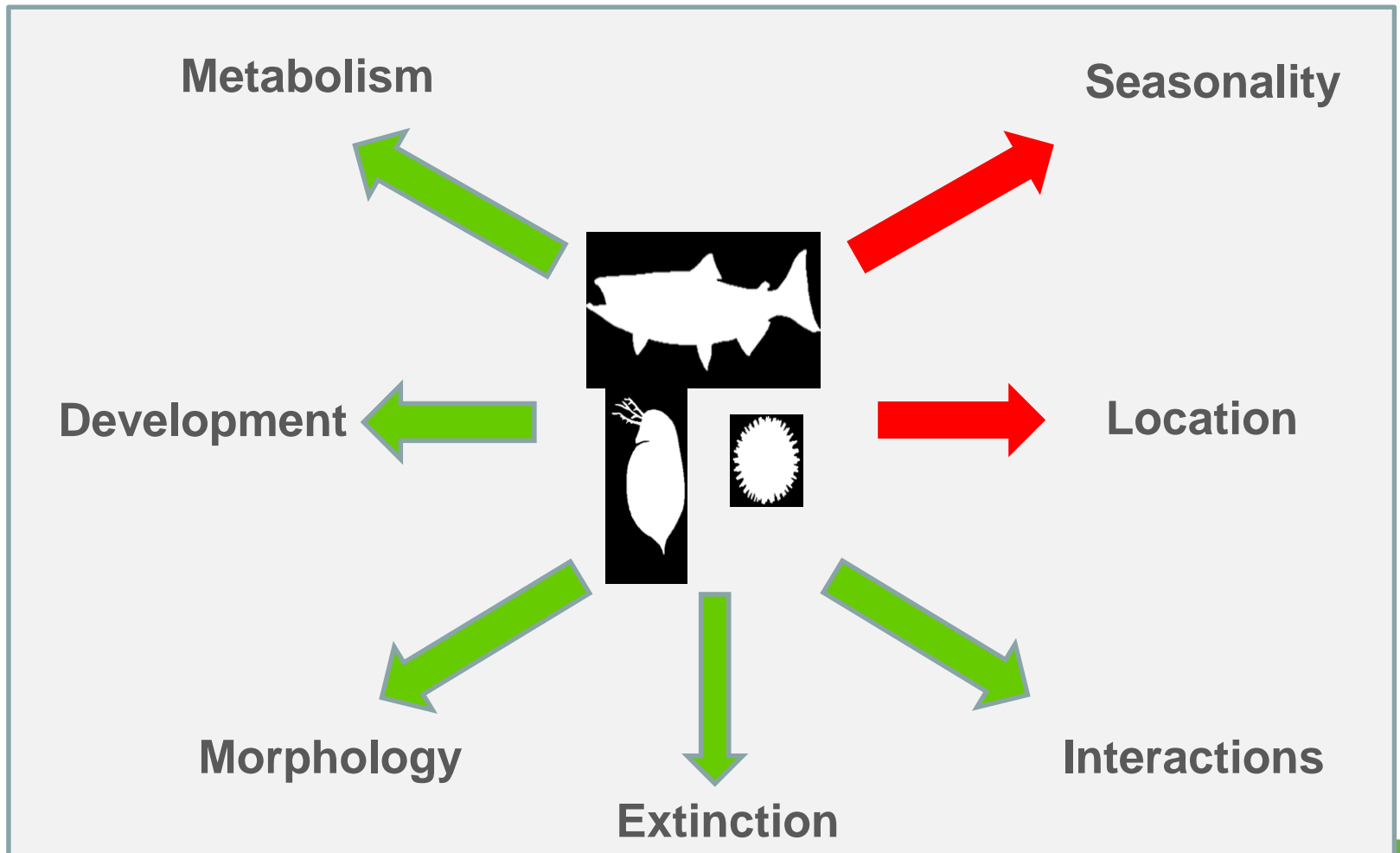


## Israel

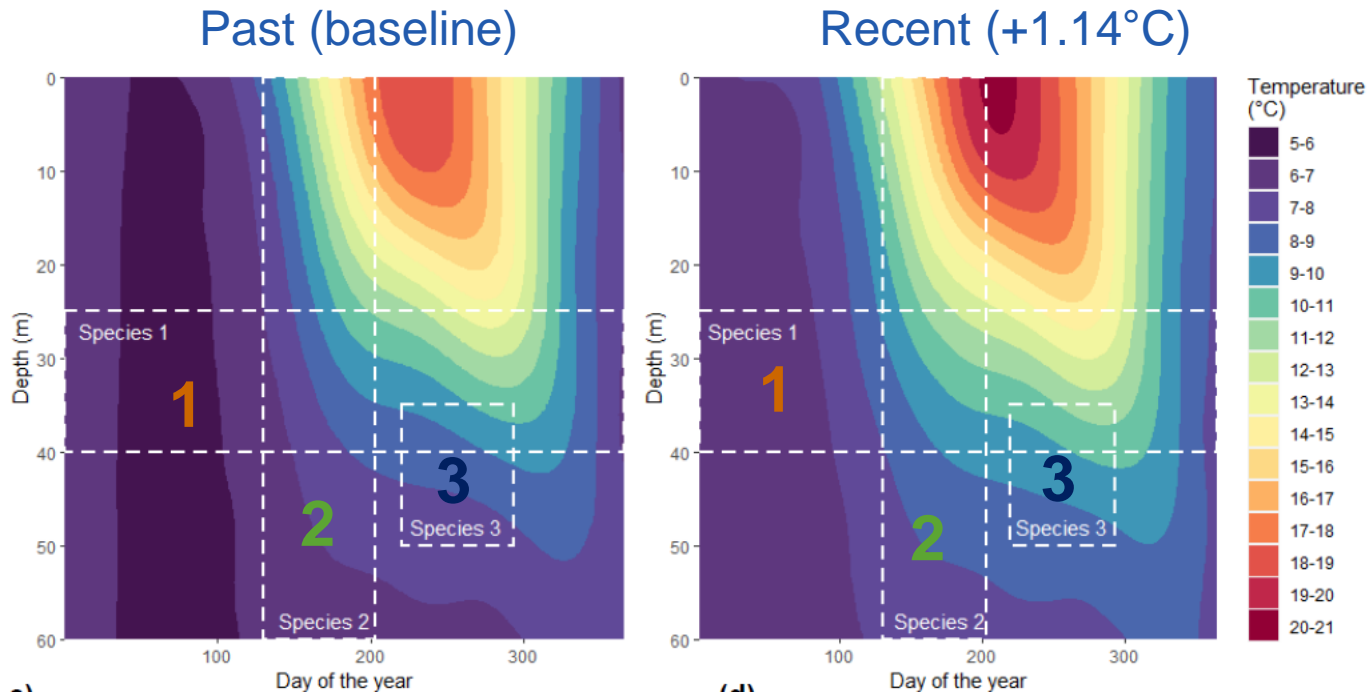


Kraemer et al., in press

# Adapt, move, or die...



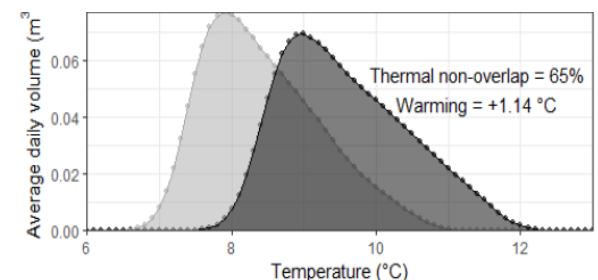
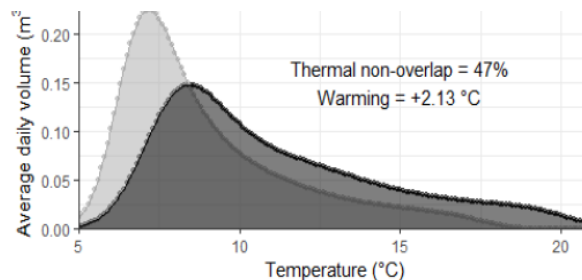
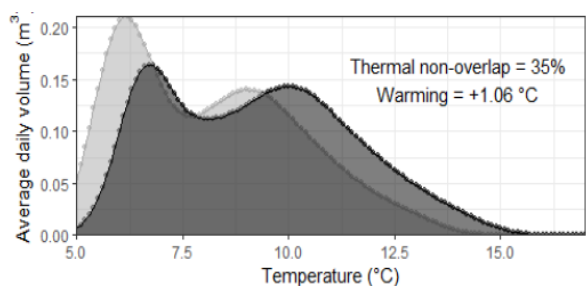
# Change in thermal habitat for three model species



Spec1: one depth

Spec 2: one season

Spec 3: one depth one season





# Thermal habitat change *Planktothrix rubescens* (Lake Zürich)

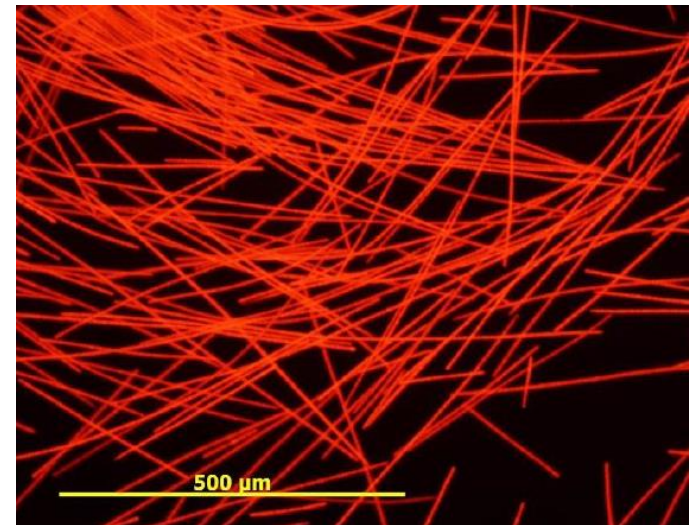
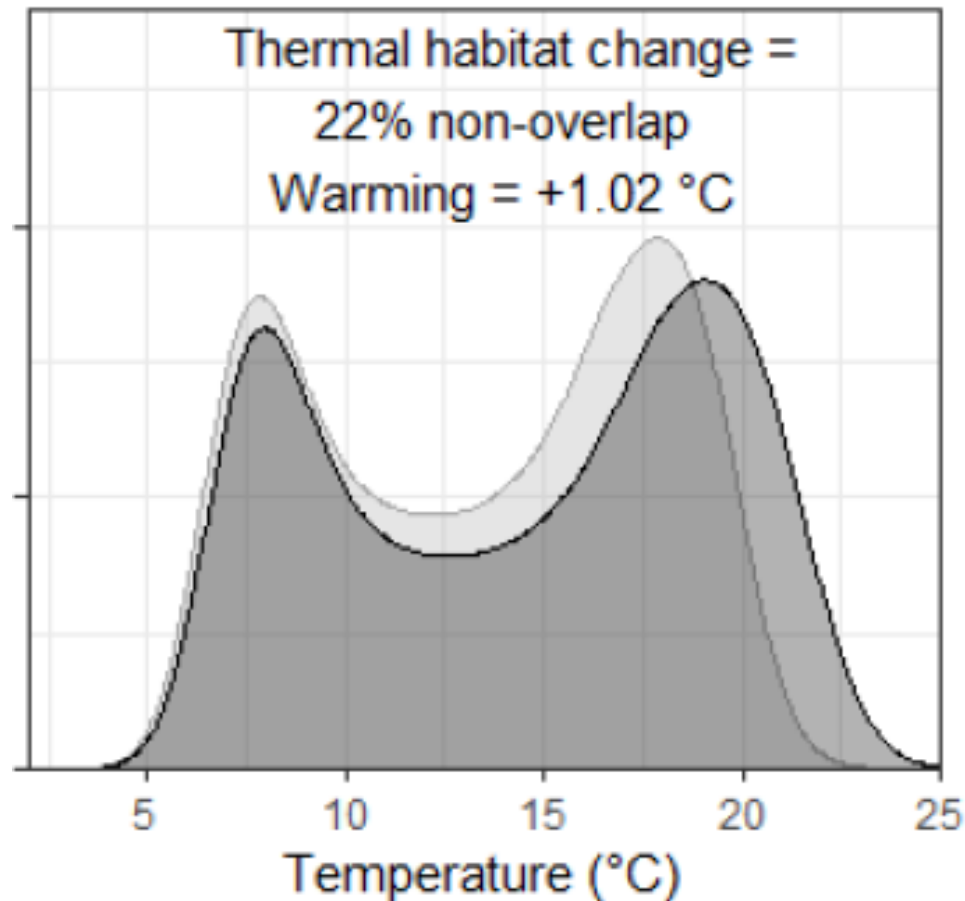
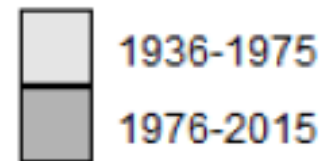


Photo credit: Thomas Posch

Time period



Kraemer et al., in press

# **Thermal habitat changes in 139 lakes globally 1978–1995 versus 1996–2013**

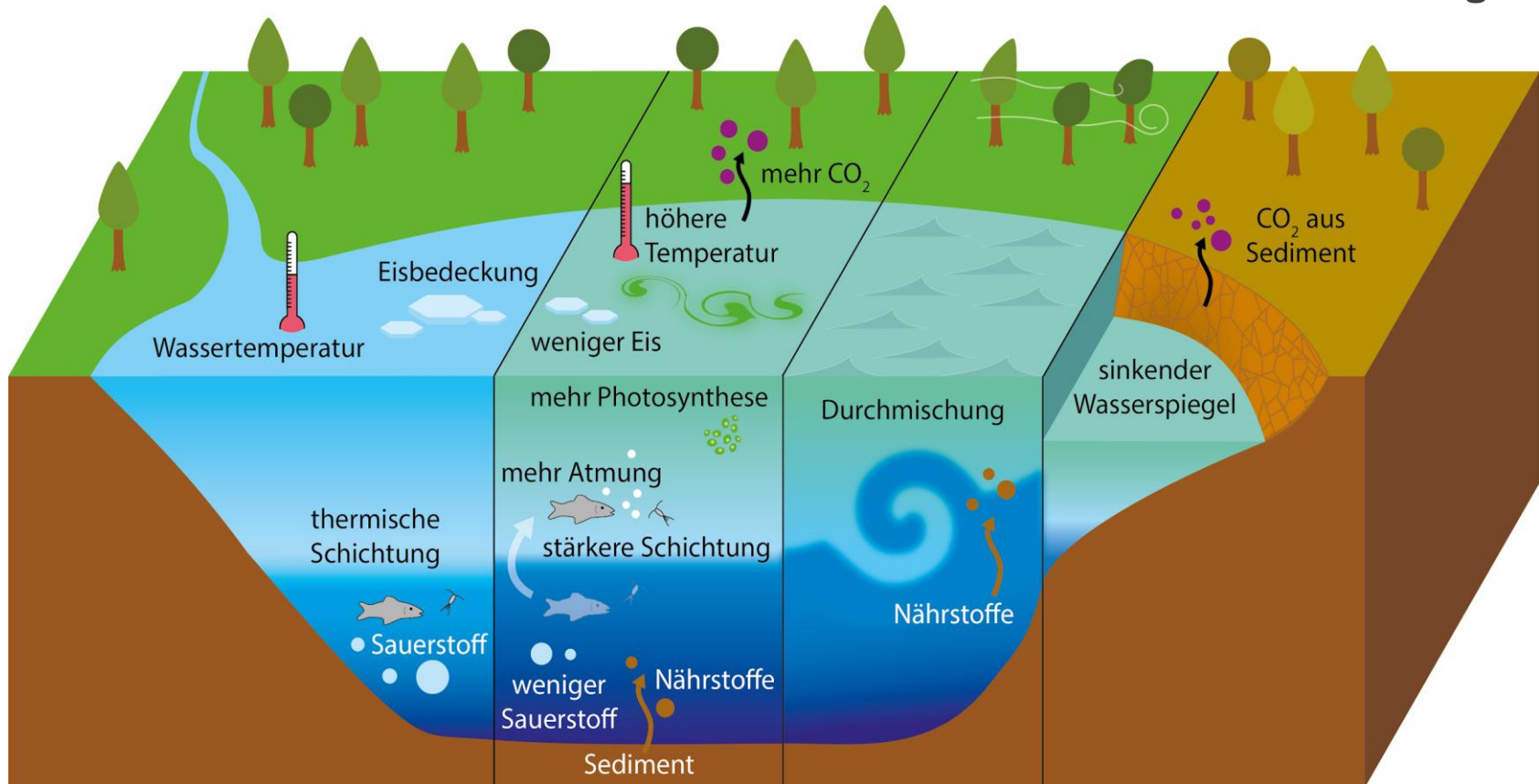
**Average: 6 % non-overlap**

**Restricted by season and depth:  
19 % non-overlap**

Kraemer et al., in press

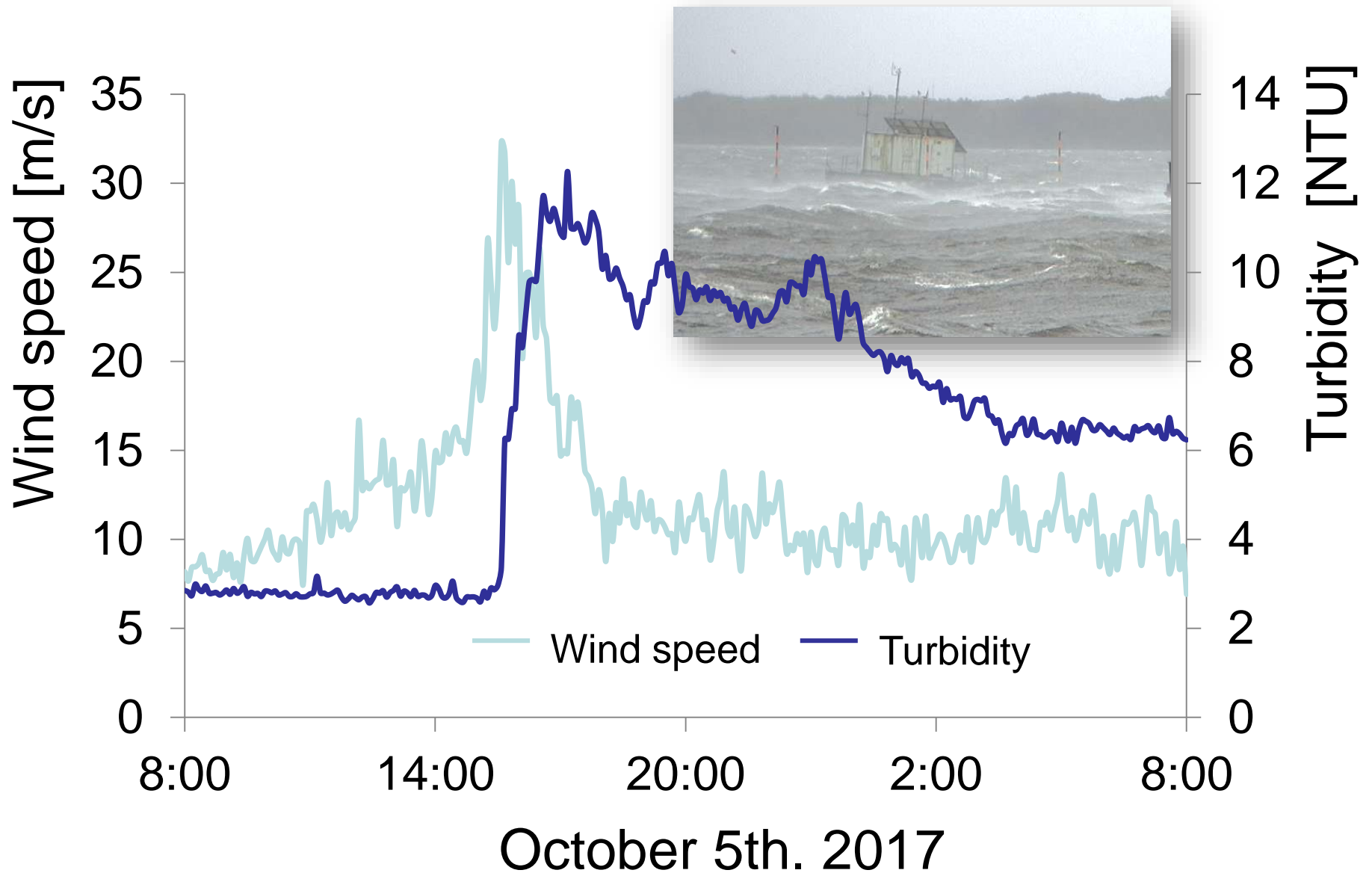
# Climate change and Freshwater / feedbacks to the climate

Early / current state      CC affected state      Impact of extremes  
Storms      Droughts

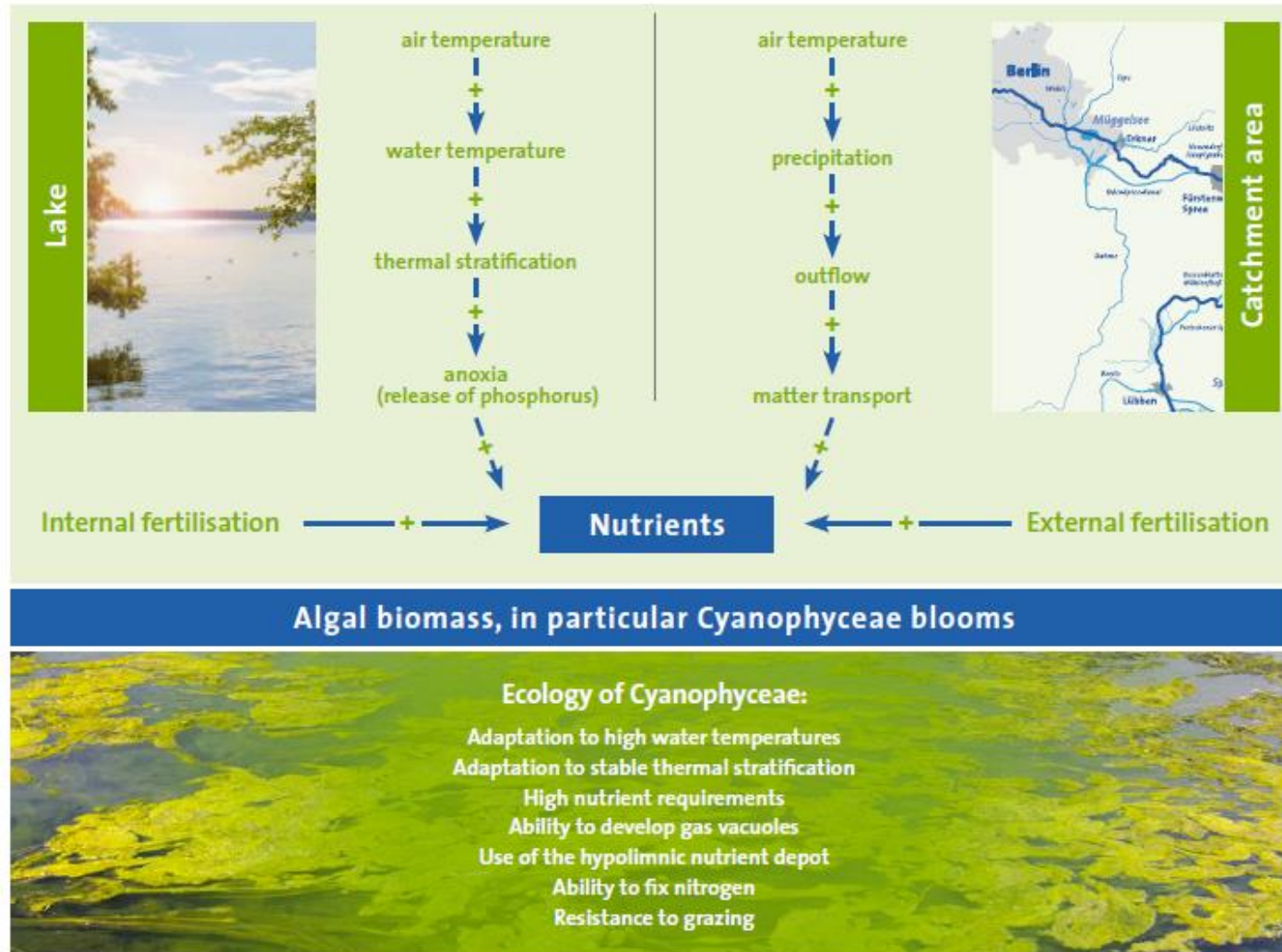


Adrian & Kraemer 2020

# Orcan XAVIER at Lake Müggelsee



# Ecological consequences



Adrian & Shatwell 2018