Zooplankton Dynamics in the NW Atlantic

Andrew Pershing and **Adam Kemberling**

apershing@climatecentral.org

CLIMATE CENTRAL

Acknowledgements:

Charles Greene

National Science Foundation

Gulf of Maine Research Institute

Science. Education. Community.

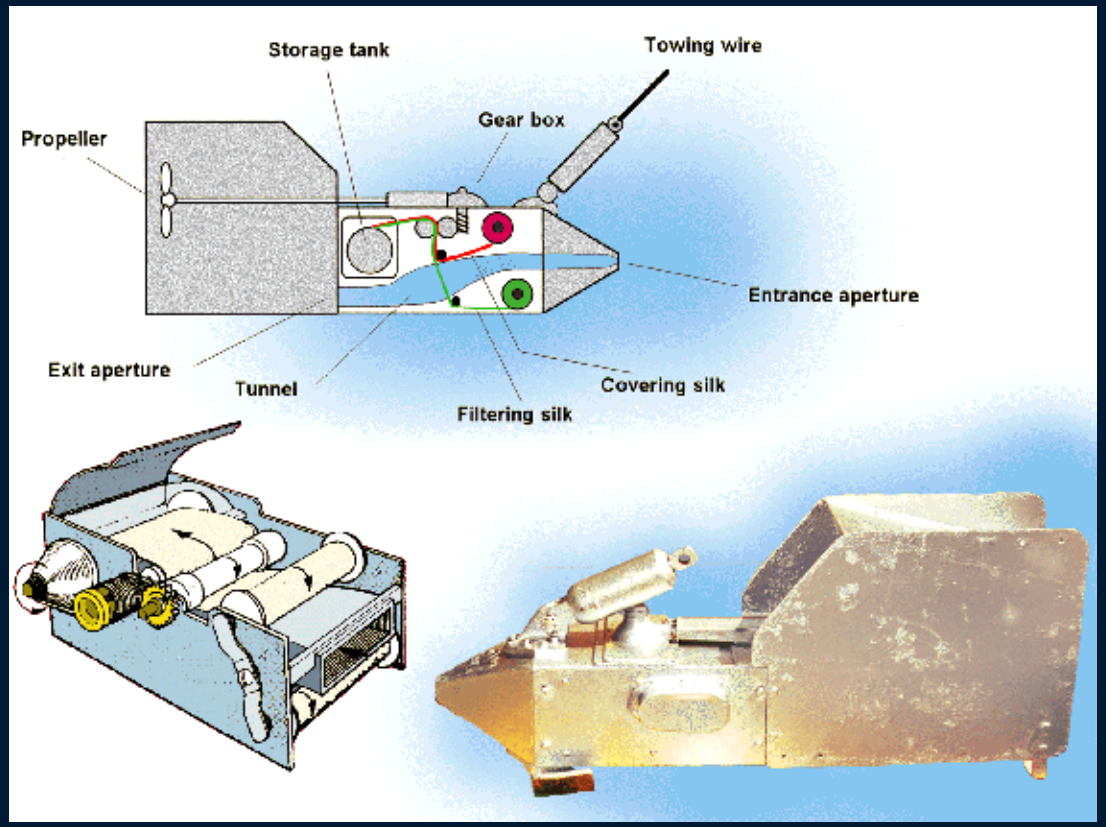
Overview

- Zooplankton changes
- Why *Calanus* declines
- Synthesis of warming—>whales

- Pershing & Kemberling (2023) Decadal comparisons identify the drivers of persistent changes in the zooplankton community structure in the northwest Atlantic. ICES Journal of Marine Science in review

CLIMATE CENTRAL

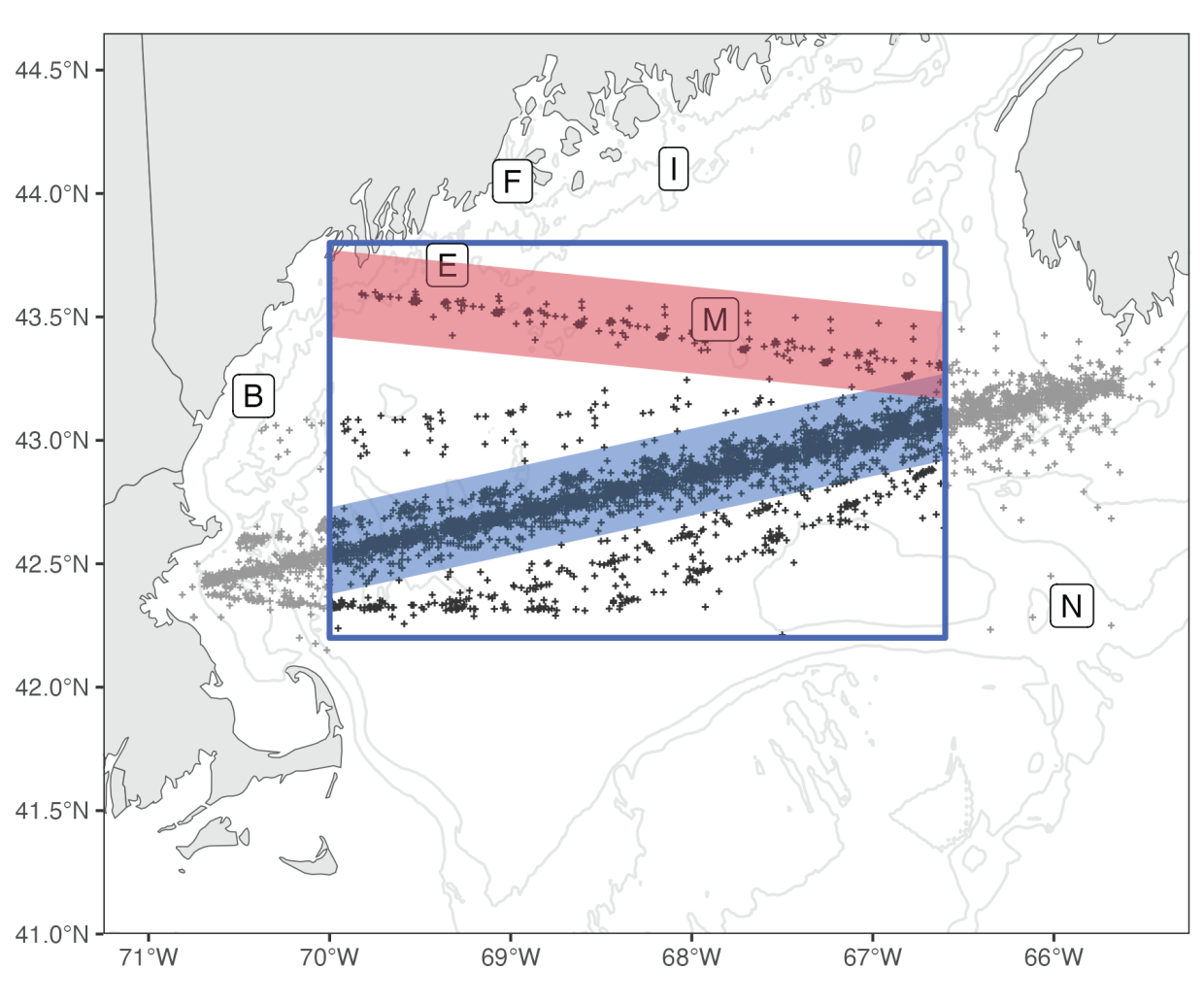
Continuous Plankton Recorder



- Spatial record of plankton abundance
- Can be towed from commercial ships
- Long-term record

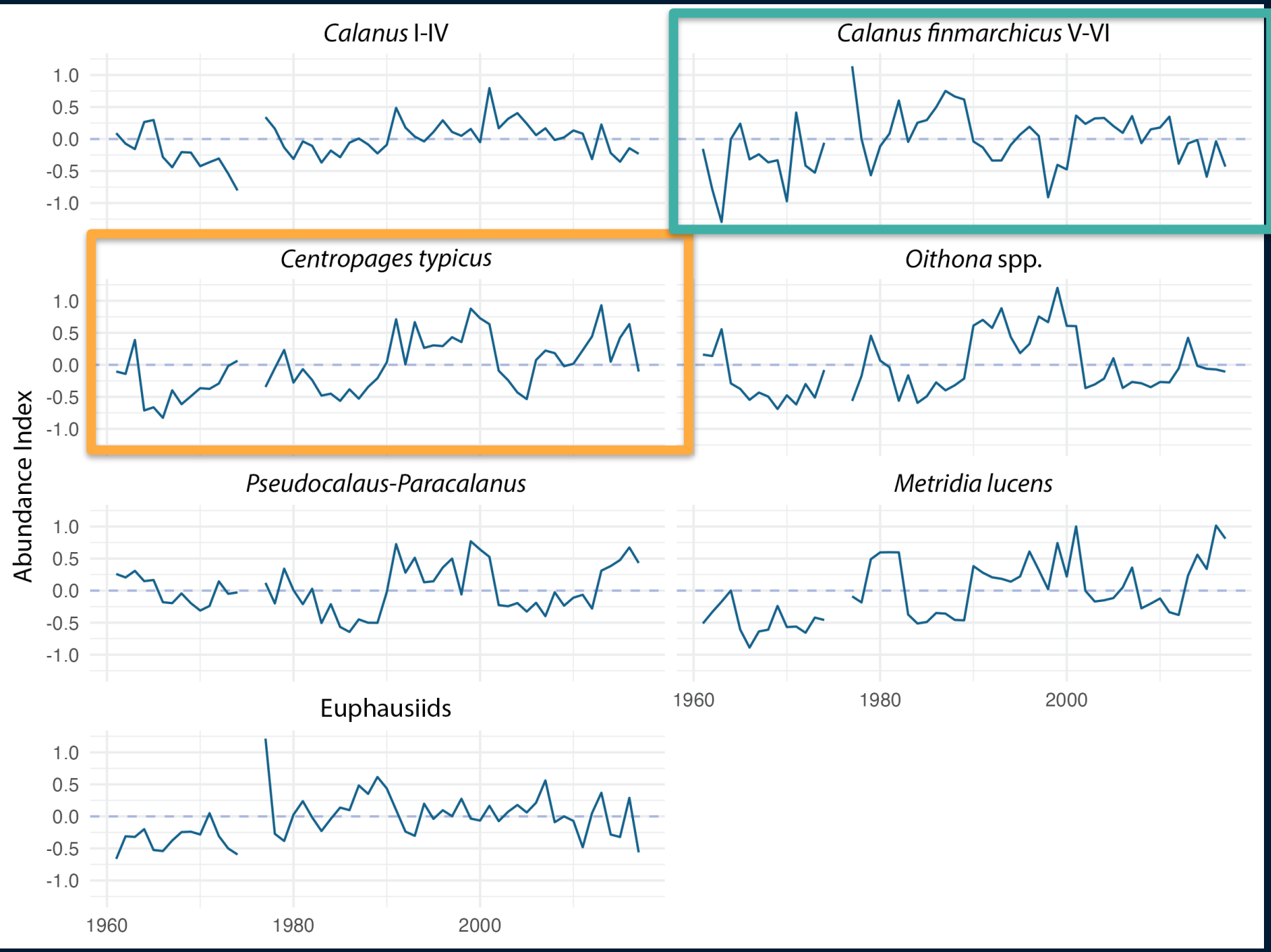
CLIMATE CENTRAL

Gulf of Maine CPR



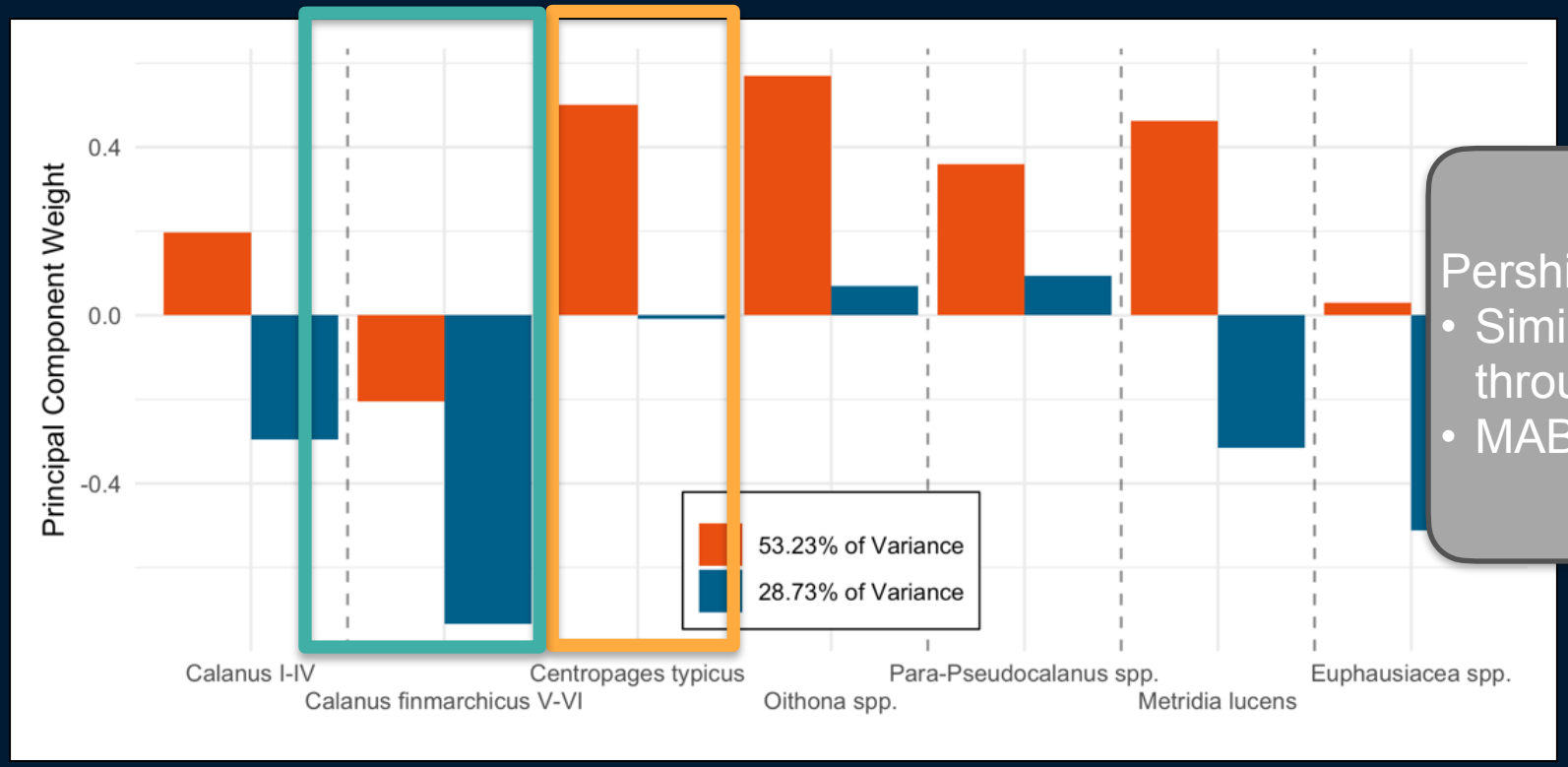
- 1961:Launched by NMFS
- 2014: MBA UK picks up, route changed
- 2017: survey paused due to funding
- 2021: survey resumed with NMFS+MBA

CLIMATE CENTRAL



CLIMATE CENTRAL

Community Patterns

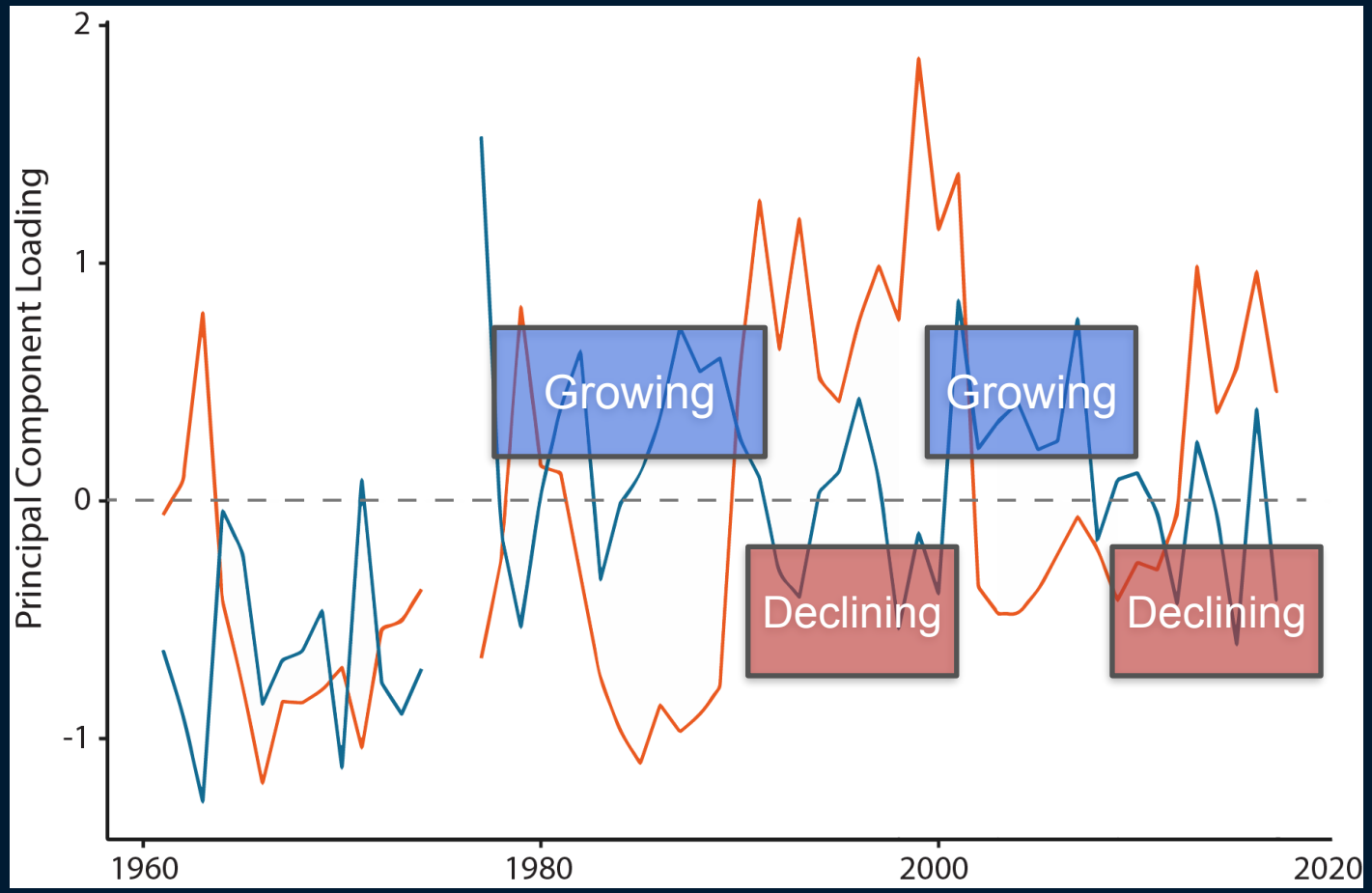


Pershing et al. 2010:
- Similar associations occur throughout the NW Atlantic
- MAB correlated w/ GoM

- Mode 1: small copepods
- Mode 2: Calanus
- Associations stable through time. Consistent with Pershing et al. 2005.

CLIMATE CENTRAL

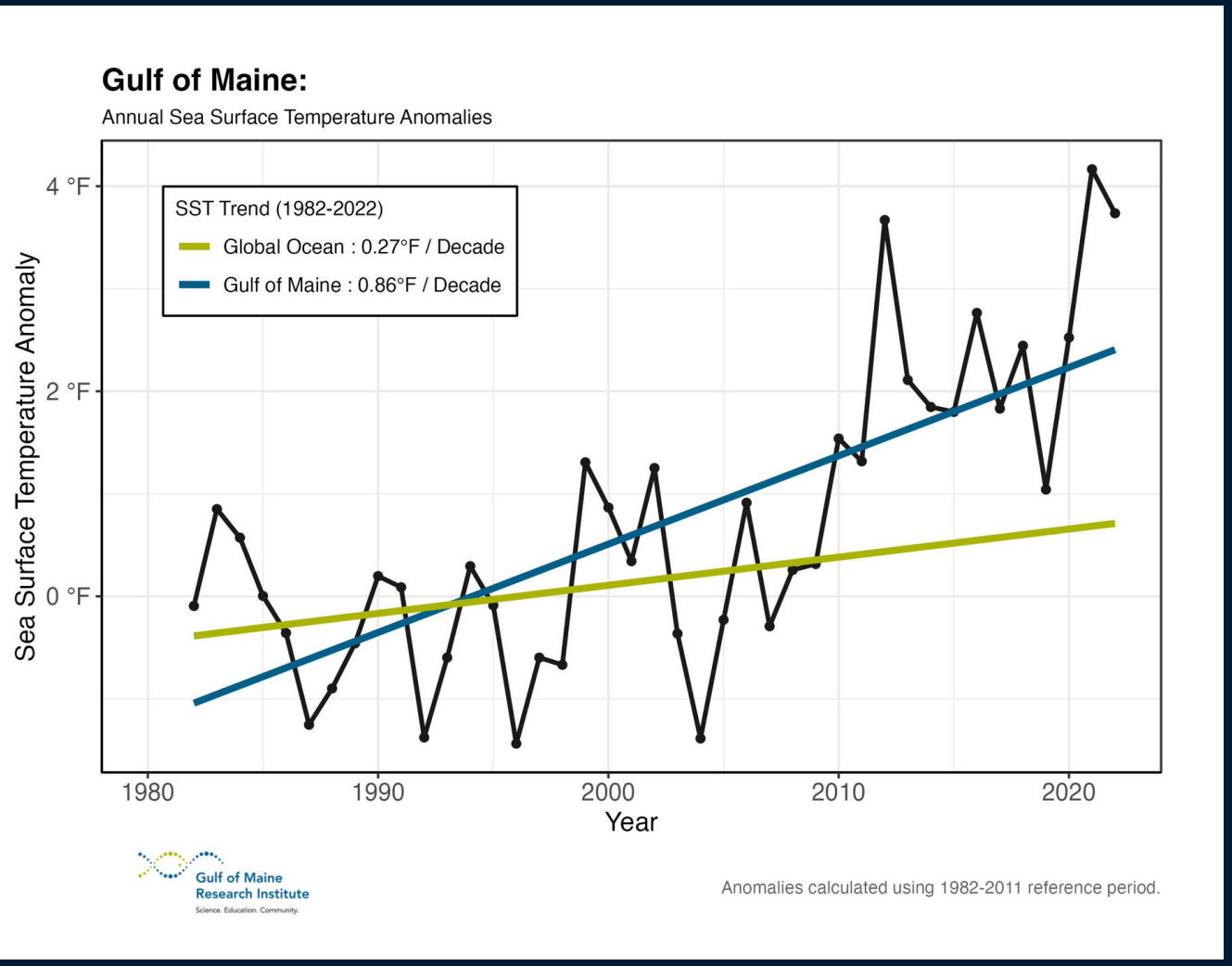
Community Patterns: Decadal changes



- High *Calanus* in
  - 1980s
  - 2000s
- Low *Calanus* in
  - 1990s
  - 2010s

CLIMATE CENTRAL

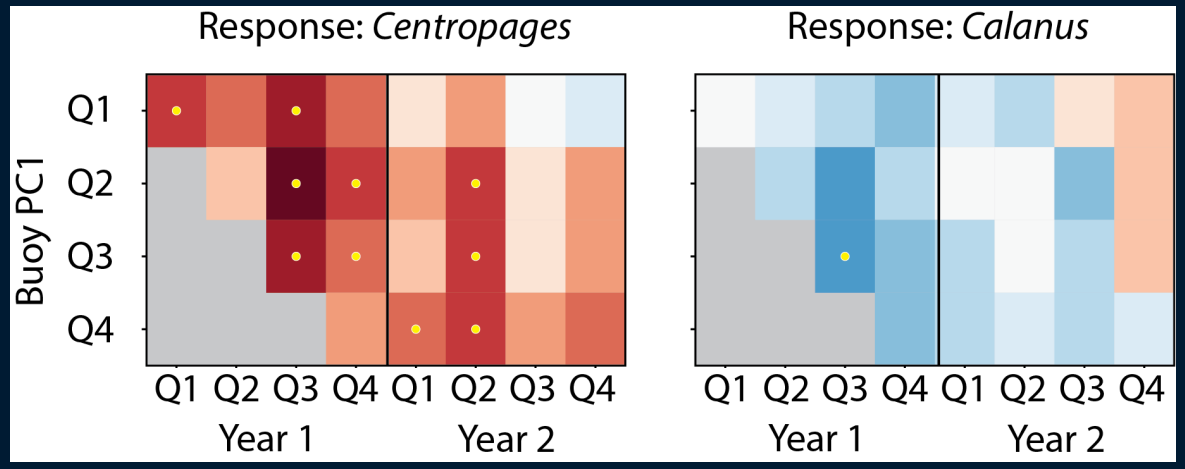
What drives plankton changes?



- Low *Calanus periods*
  - 1990s—cool fresh
  - 2010s—hot salty
- Not a simple temperature story
  - Stratification
  - Seasonal

CLIMATE CENTRAL

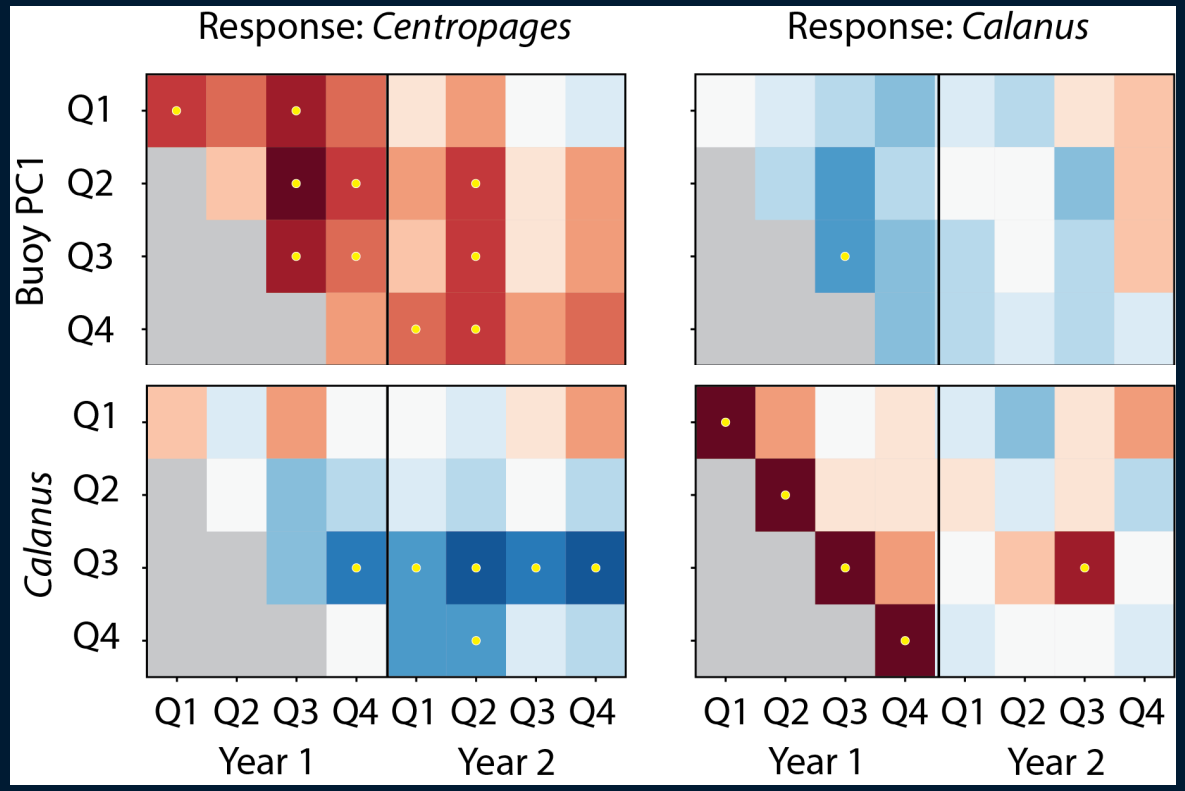
What drives plankton changes?



- Compare with buoy data
  - 2001-2017
  - Mode 1= hot+salty
- *Centropages* increases, *Calanus* decreases

CLIMATE CENTRAL

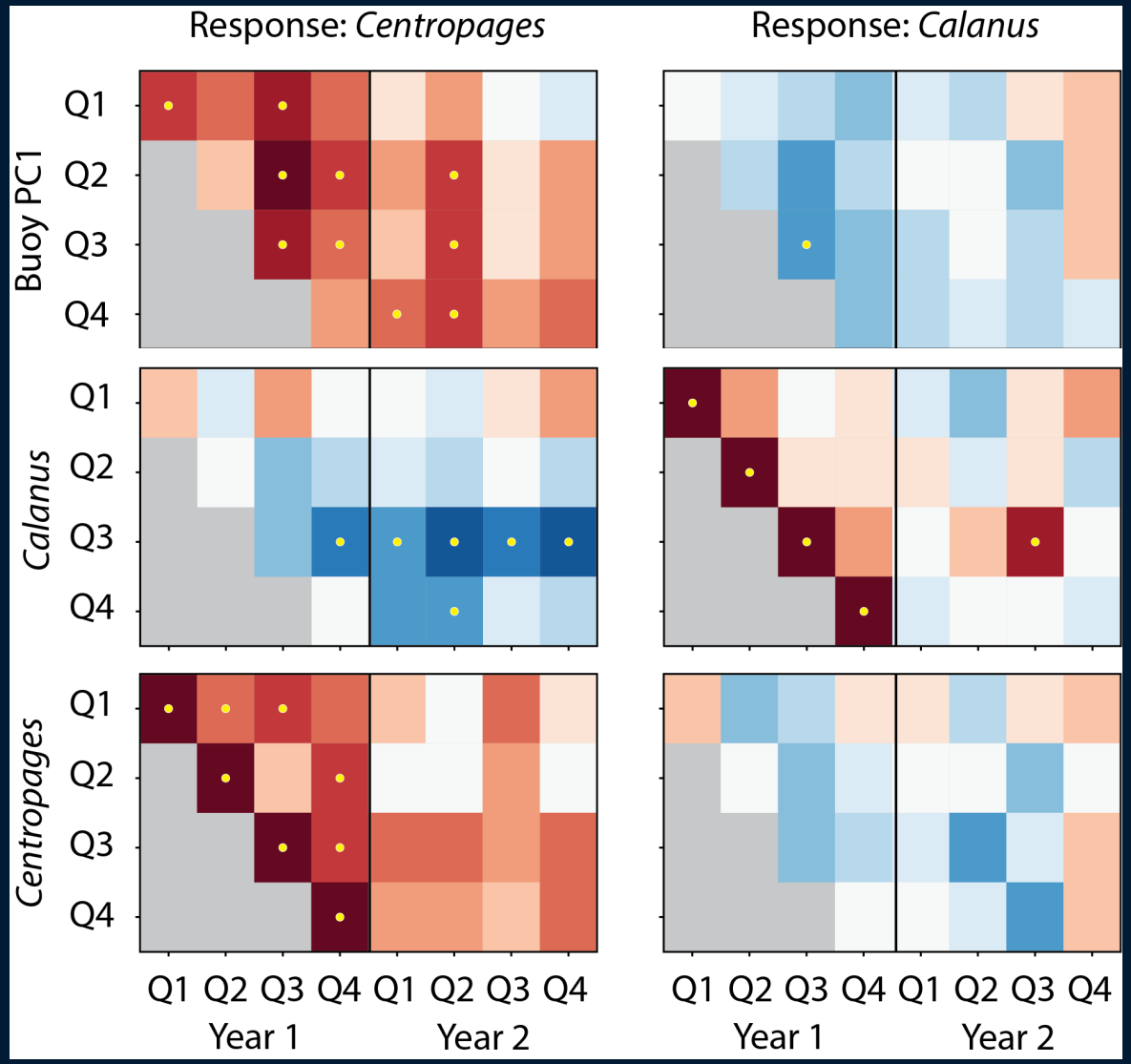
What drives plankton changes?



- Compare with buoy data
  - 2001-2017
  - Mode 1= hot+salty
- *Centropages* increases, *Calanus* decreases
- *Calanus* leads

CLIMATE CENTRAL

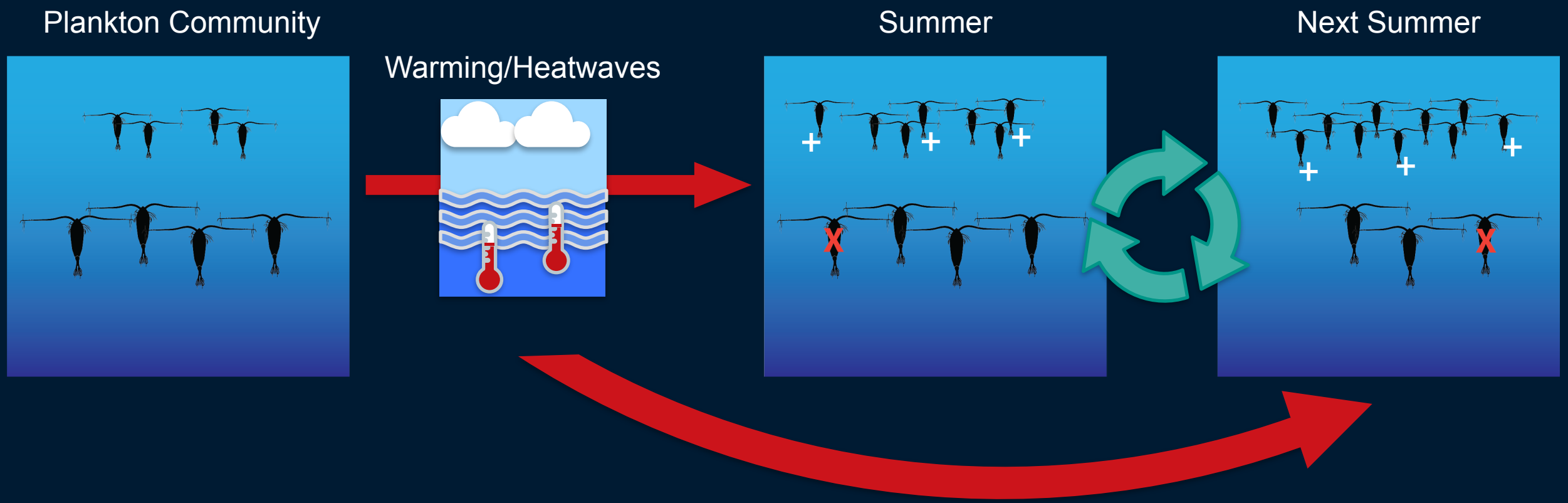
What drives plankton changes?



- Compare with buoy data
  - 2001-2017
  - Mode 1= hot+salty
- *Centropages* increases, *Calanus* decreases
- *Calanus* leads
- *Centropages* persists

CLIMATE CENTRAL

Hypothesis

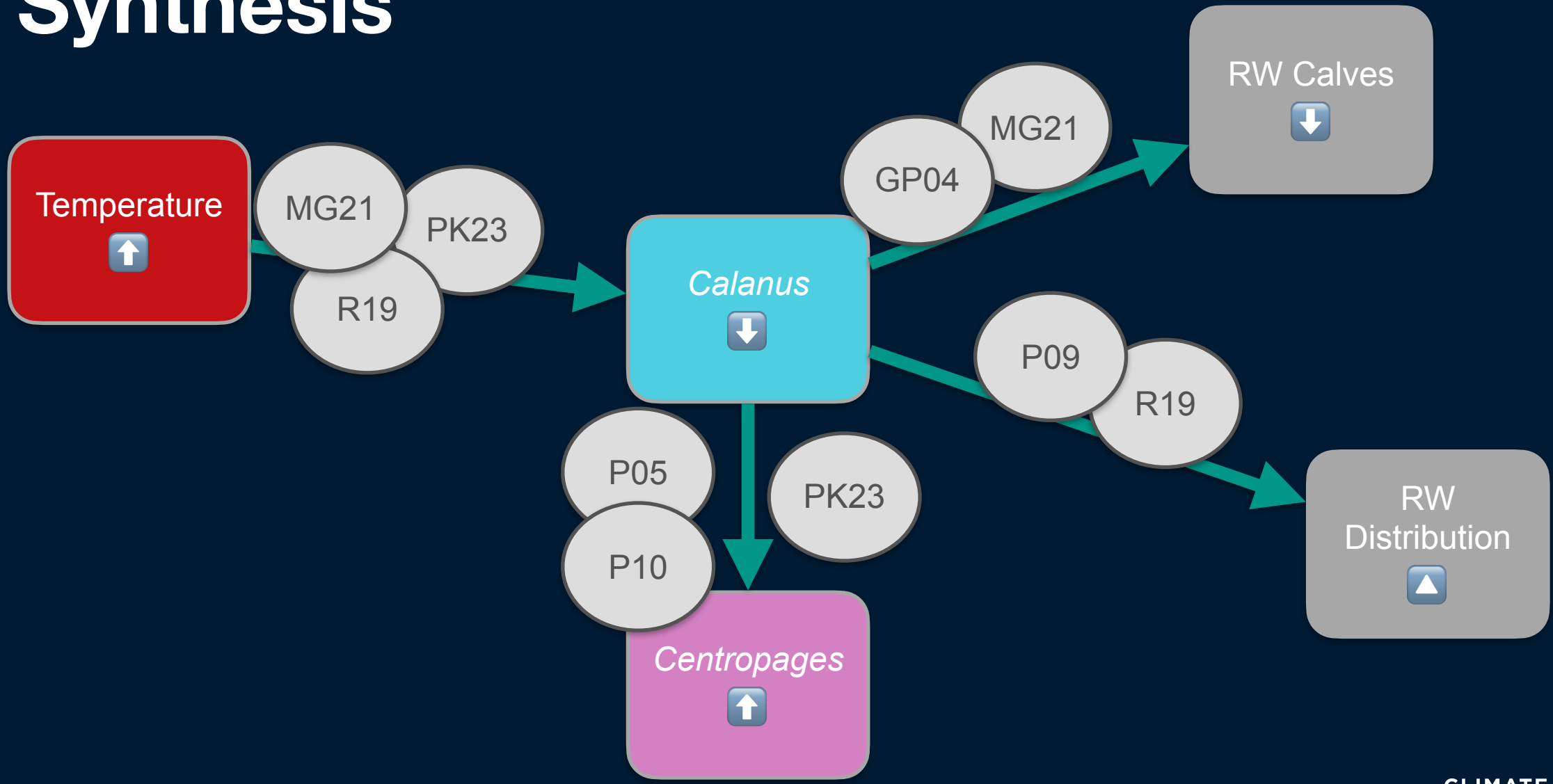


References

- **GP04:** Greene & Pershing (2004) Climate and the conservation biology of the North Atlantic right whale: the right whale at the wrong time? Frontiers in Ecology and the Environment 2, 29-34
- **MG21**: Meyer-Gutbrod (2021), Ocean regime shift is driving collapse of the North Atlantic right whale population. Oceanography 34, 22-31.
- **P09**: Pendleton et al., Regional scale mean matters: mean copepod concentration indicates relative abundance of North Atlantic right whales. Mar. Ecol.-Prog. Ser. 378, 211-225
- **P05**: Pershing et al. (2005). Interdecadal variability in the Gulf of Maine zooplankton community with potential impacts on fish recruitment. ICES Journal of Marine Science 62, 1511-1523
- **P10:** Pershing et al. (2010) Pattern and scale of variability among Northwest Atlantic Shelf plankton communities. Journal of Plankton Research 32, 1675-1684
- **P21**: Pershing et al., Climate impacts on the Gulf of Maine ecosystem: A review of observed and expected changes in 2050 from rising temperatures. Elem Sci Anth 9, 00076 (2021).
- **PK23**: Pershing & Kemberling (2023) Decadal comparisons identify the drivers of persistent changes in the zooplankton community structure in the northwest Atlantic. ICES Journal of Marine Science in review
- **R19**: Record et al.,(2019) Rapid climate-driven circulation changes threaten conservation of endangered North Atlantic right whales. Oceanography 32

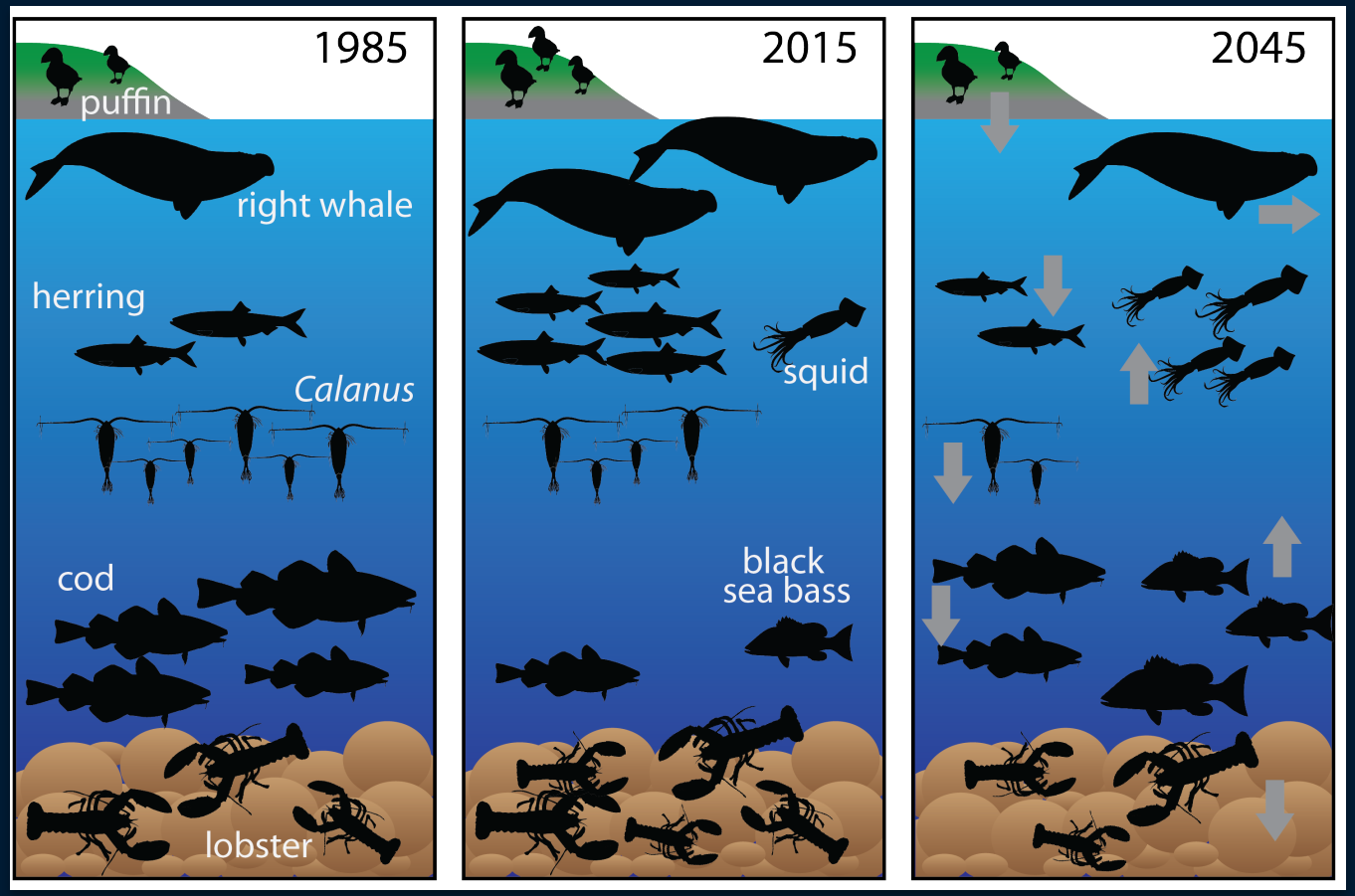
CLIMATE CENTRAL

Synthesis



CLIMATE CENTRAL

Future



- Warming will continue
  - Good *Calanus* years will be increasingly scarce
  - Right whales will be on the move

- Pershing et al., Climate impacts on the Gulf of Maine ecosystem: A review of observed and expected changes in 2050 from rising temperatures. Elem Sci Anth 9, 00076 (2021).

CLIMATE CENTRAL