Plankton as Storytellers: Foraminifera

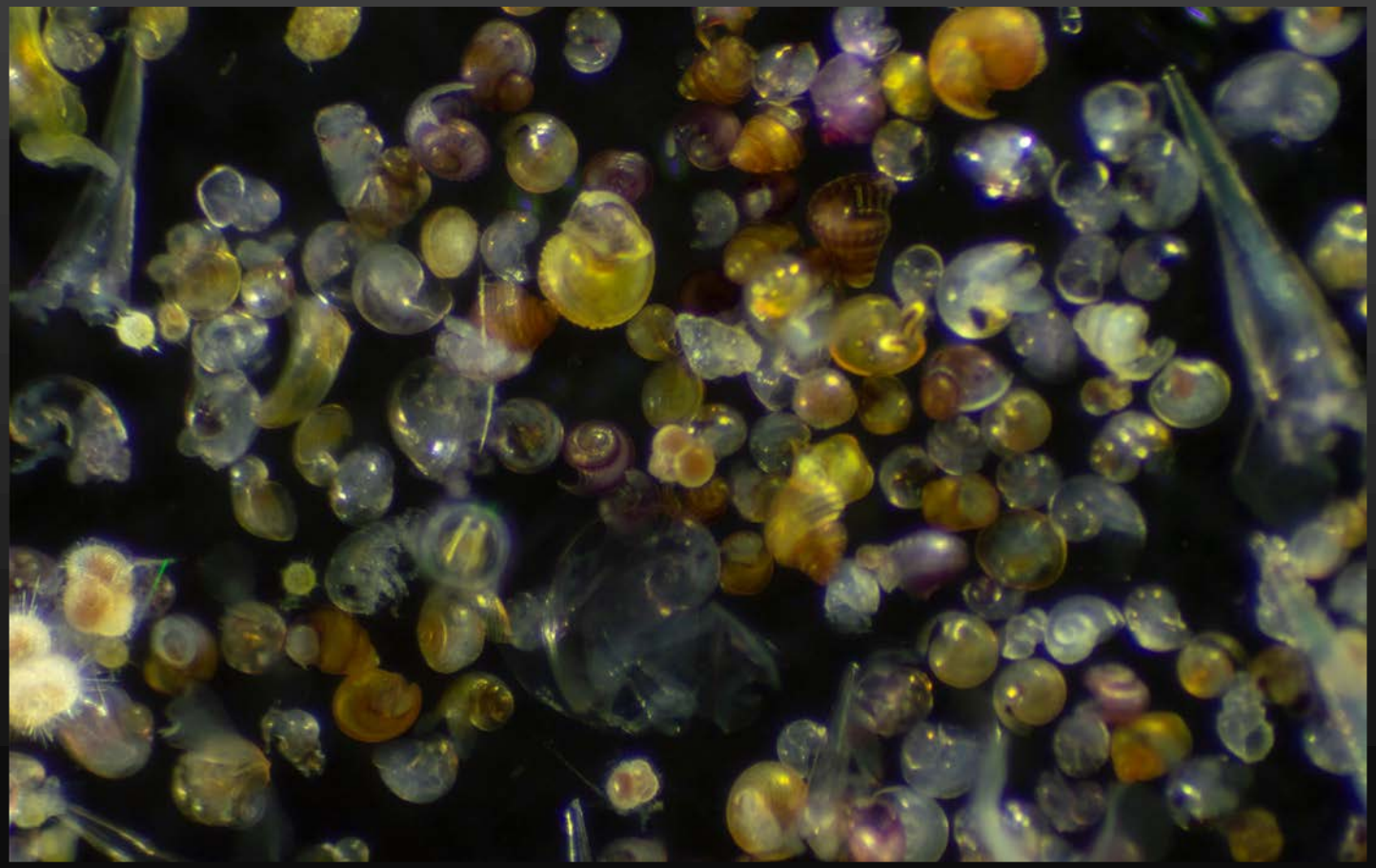


Image credit: K. Lane

Modified from a talk by M. Kelsey Lane, Ph.D. Student, Oregon State University

Meet the 'Forams'

Who are we? A family of…

Single celled organisms that….

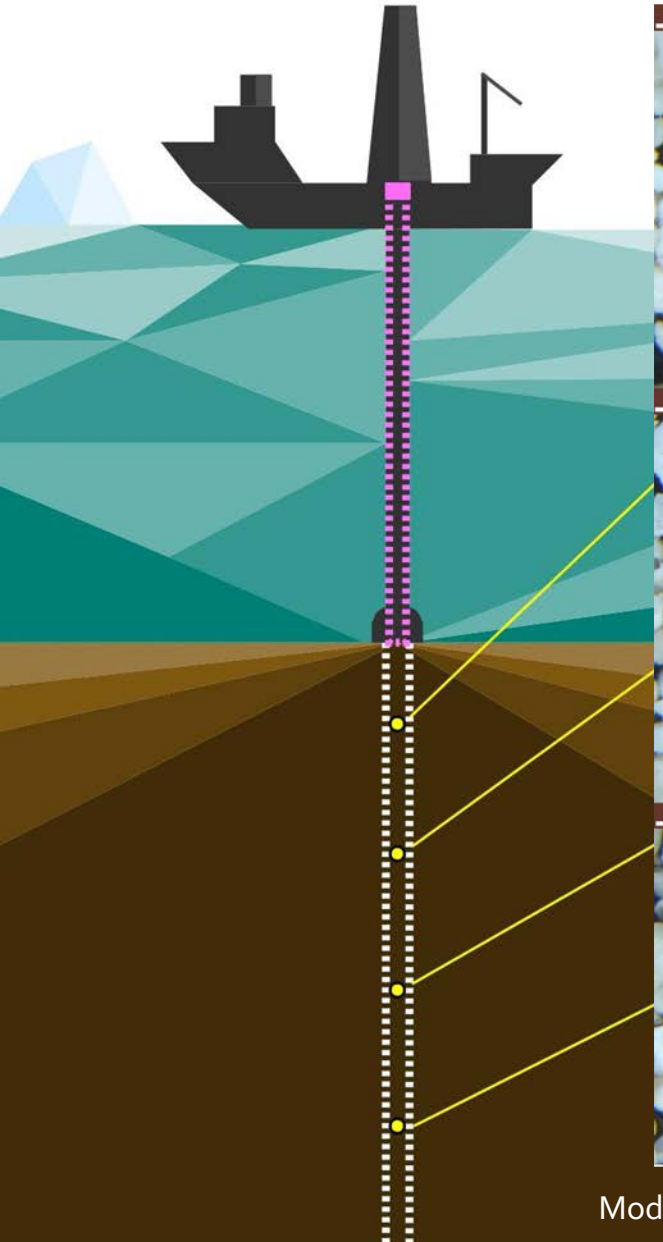
- Drift with currents and waves
- Build calcium carbonate shells, "tests"
- Have short life cycles
- Prefer specific ocean temperatures, based on our type
- Help build the fossil record when our tests drift to the bottom of the ocean

Image credit: Capotondi et al, 2015

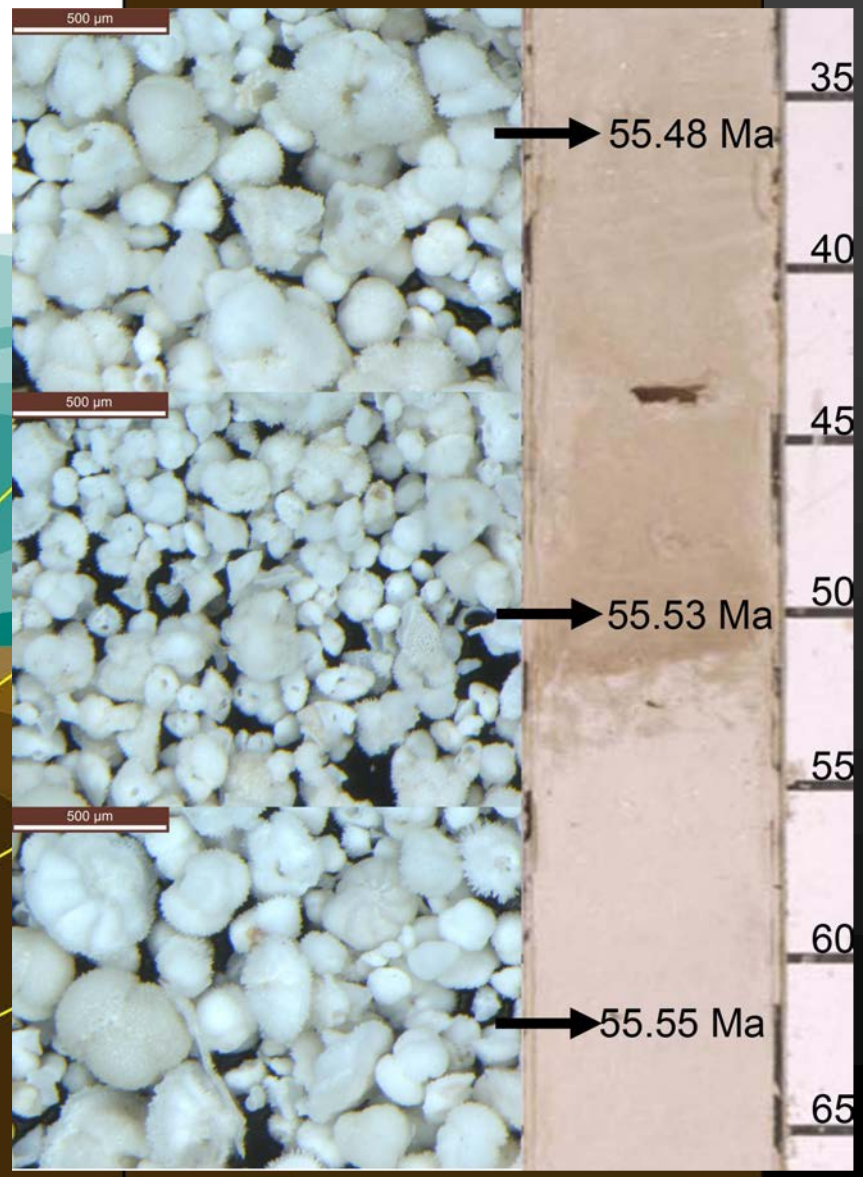
https://youtu.be/mEml7kTDHqY

Image credit: Journey to the Microcosmos

Plankton as storytellers: Foraminifera



Foraminifera through time



Modified from IODP & Laura Foster, University of Bristol

Preserved as fossils in deep sea sediments

Record ocean conditions from the past

One of our most valuable tools for understanding the ancient ocean

Foraminifera, or Forams

Image credit: K. Lane

- Many species are like 'Goldilocks'
- Temperature – primary control
- Other factors include salinity and pH

How do bioprovinces correspond to temperature?

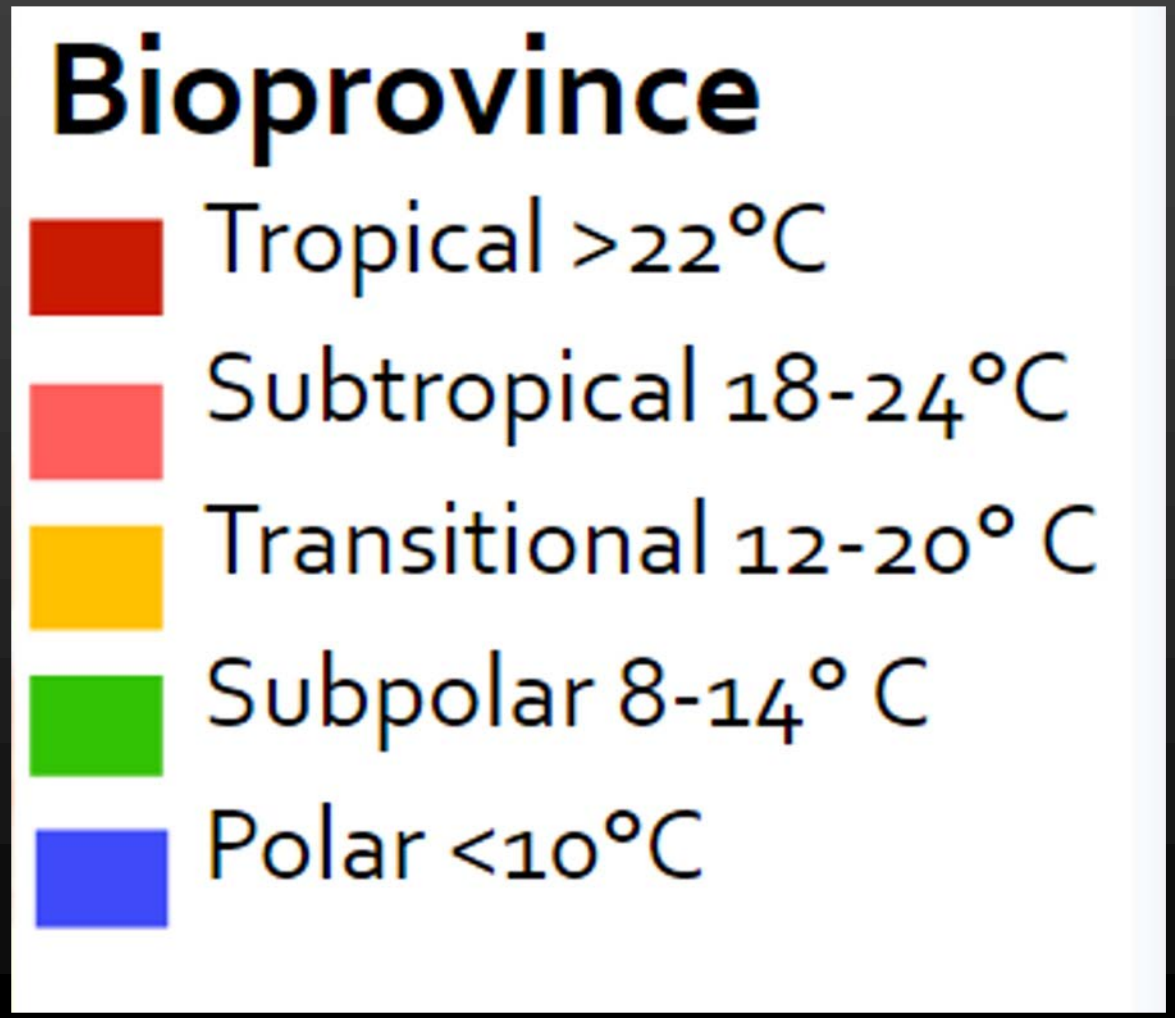


Image credit: K. Lane

Which is the warmest Bioprovince? **Tropical**

Where do you think we typically find it? **Closer to the Equator**

How do bioprovinces correspond to latitude?

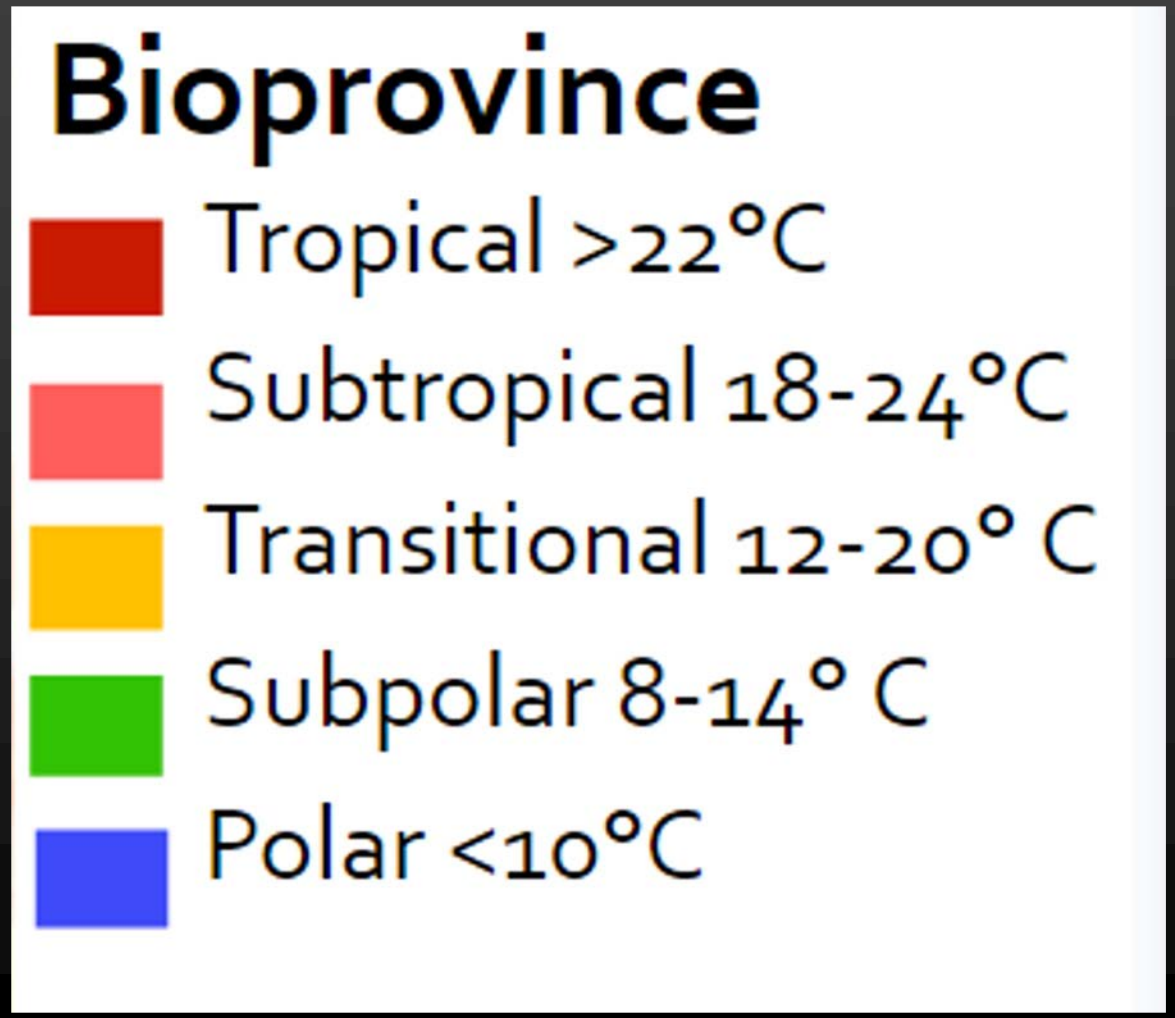


Image credit: K. Lane

Latitude is how far north or south from the Equator.

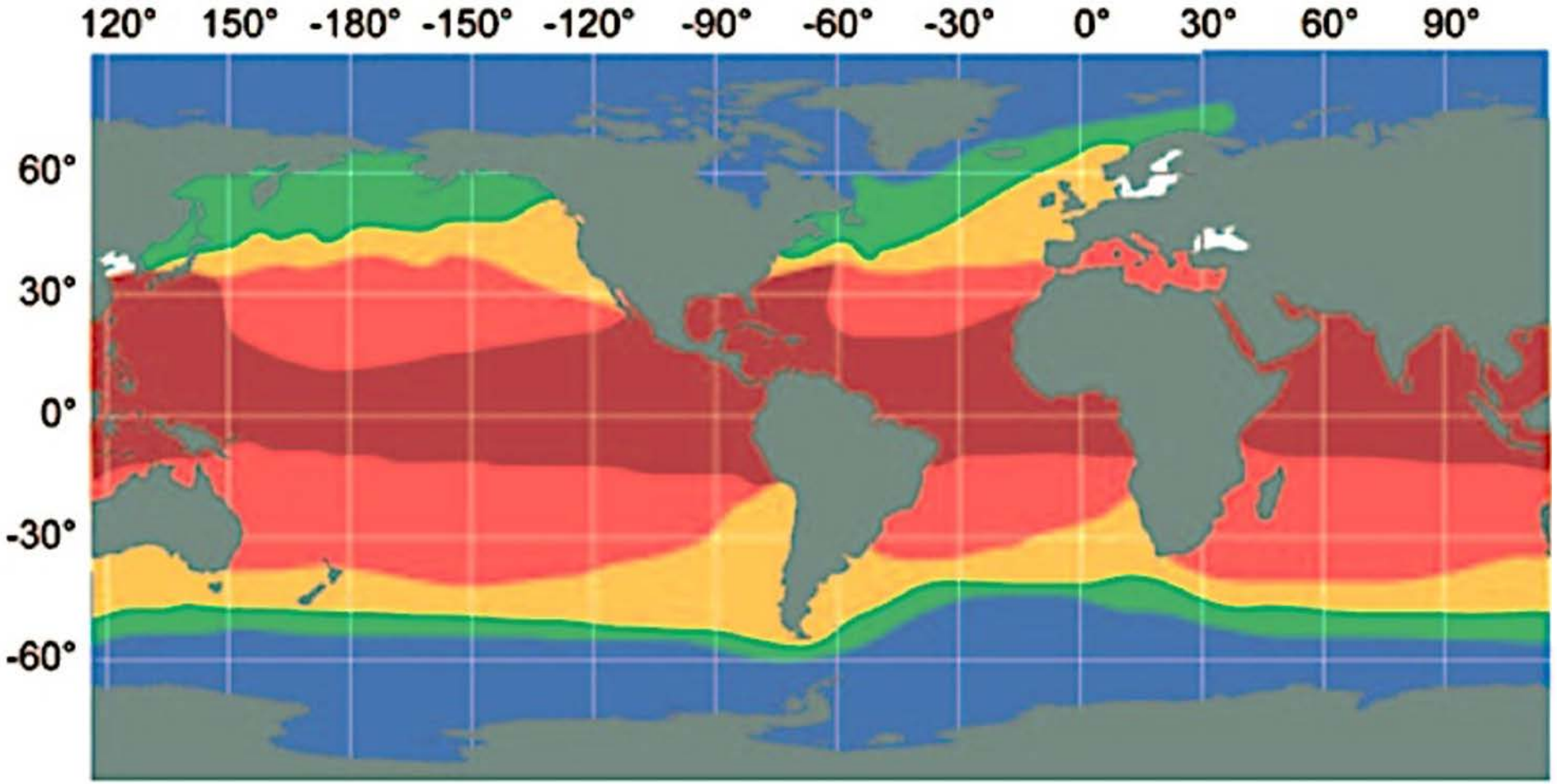
Which is the coldest Bioprovince?

Polar

Where do we typically find it?

Farther from the Equator

Bioprovinces: Where specific forams live



Bioprovince

- Tropical >22°C
- Subtropical 18-24°C
- Transitional 12-20° C
- Subpolar 8-14° C

How does longitude make a difference in temperatures?

How does latitude make a difference in temperatures?

Figure from Kucera (2007)

Oregon State University Researchers

Dr. Jennifer Fehrenbacher (Kelsey Lane's advisor)

Video credit: OSU

https://youtu.be/LeDXrg6mXaY

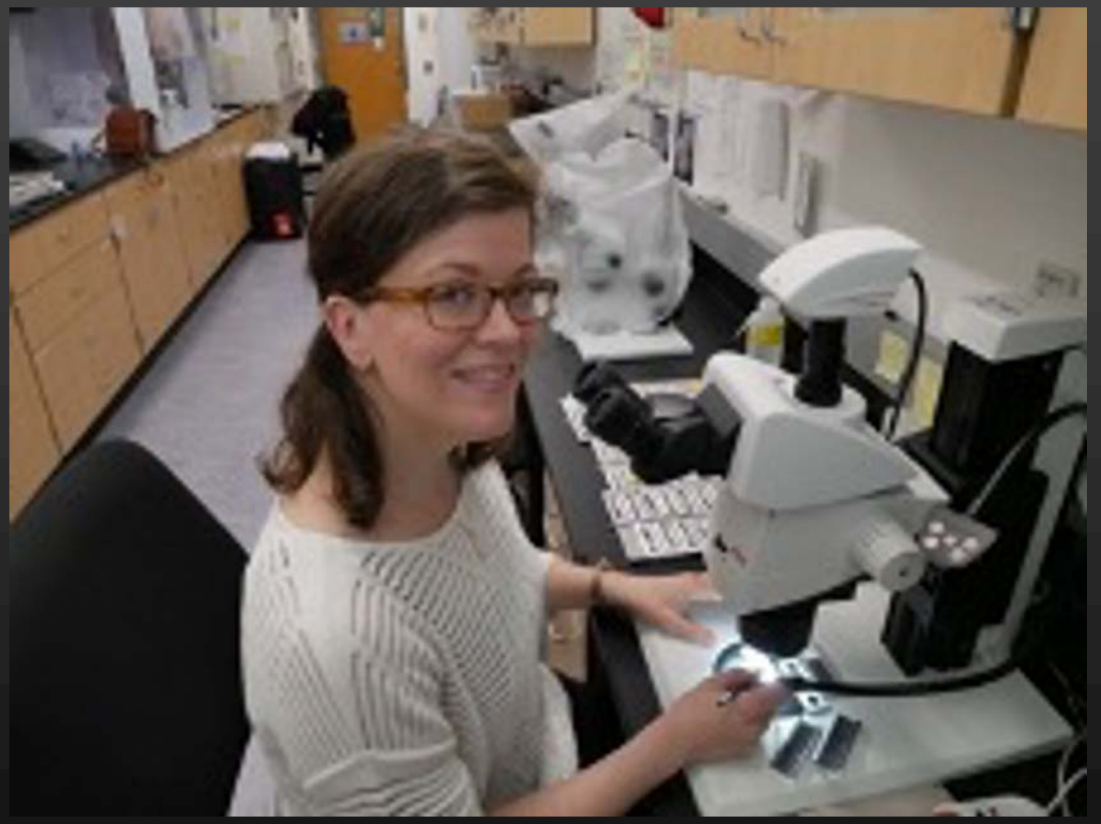
OSU Researcher: Kelsey Lane, PhD Student

- Kelsey grew up in land-locked Rapid City, South Dakota.
- She went to Brown University in Providence, RI and discovered marine science.
- During college, she studied dolphins in Key West, Florida and the rocky shore in Homer, Alaska and decided to pursue science as a career.
- After college, She started working on research vessels & sailboats and sailed the Pacific, Atlantic and Mediterranean Oceans.
- Now, she's a PhD student studying the ocean at Oregon State University.

Image credits: K. Lane

OSU Researcher: Kelsey Lane, PhD Student

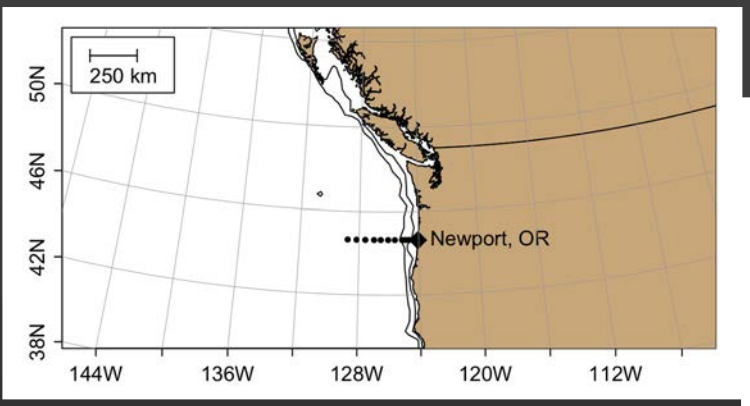
Sampling plankton with a net on the Newport Hydrographic Line. You sample at night as much as you can to capture the most organisms.



Picking foraminifera underneath a microscope. Foraminifera are about the size of a grain of sand, so you need a microscope to identify them to the species level.

Image credits: K. Lane

INTRODUCTION: Newport Hydrographic Line



- Long-term sampling transect off the Oregon coast
- NH5 – sentinel site

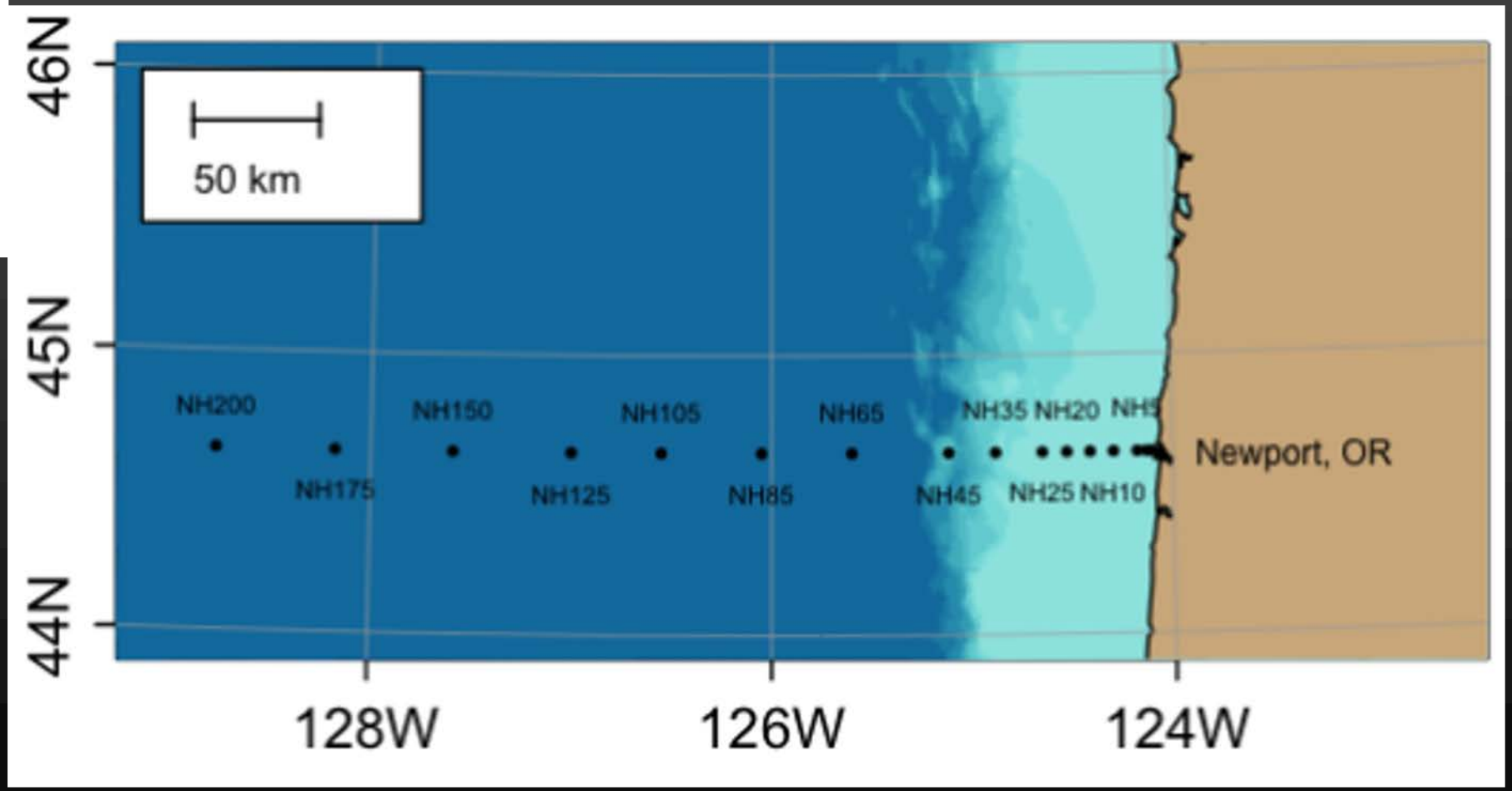


Image credit: K. Lane

OSU researchers found many types under the microscope

Subtropical and Transitional Foraminifera

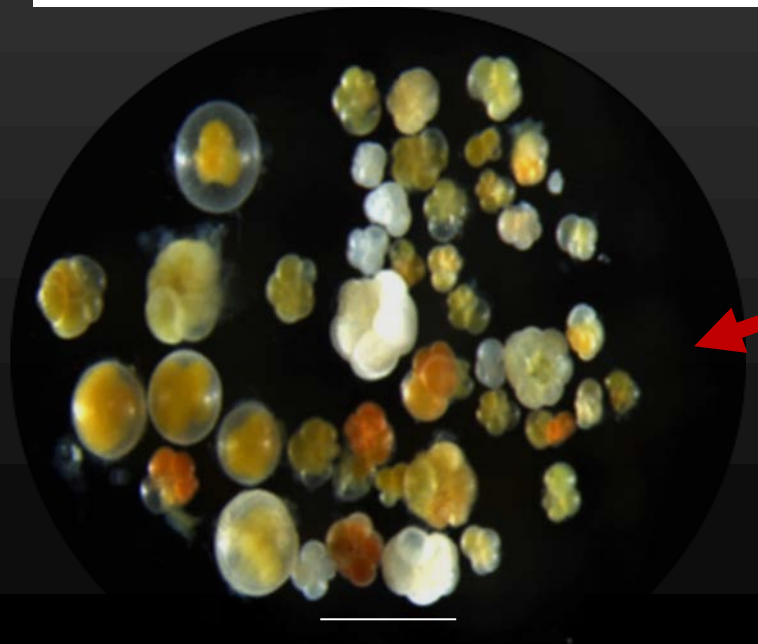
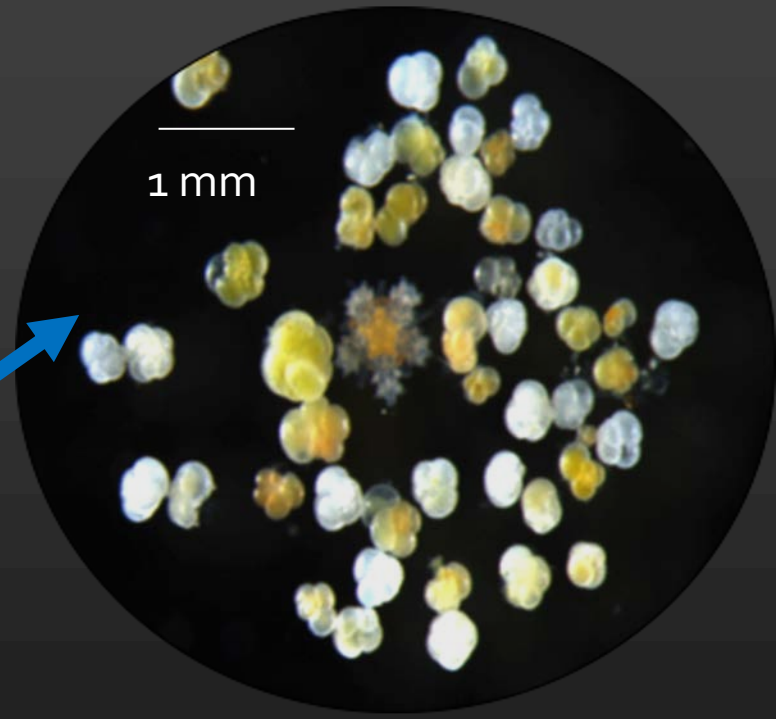
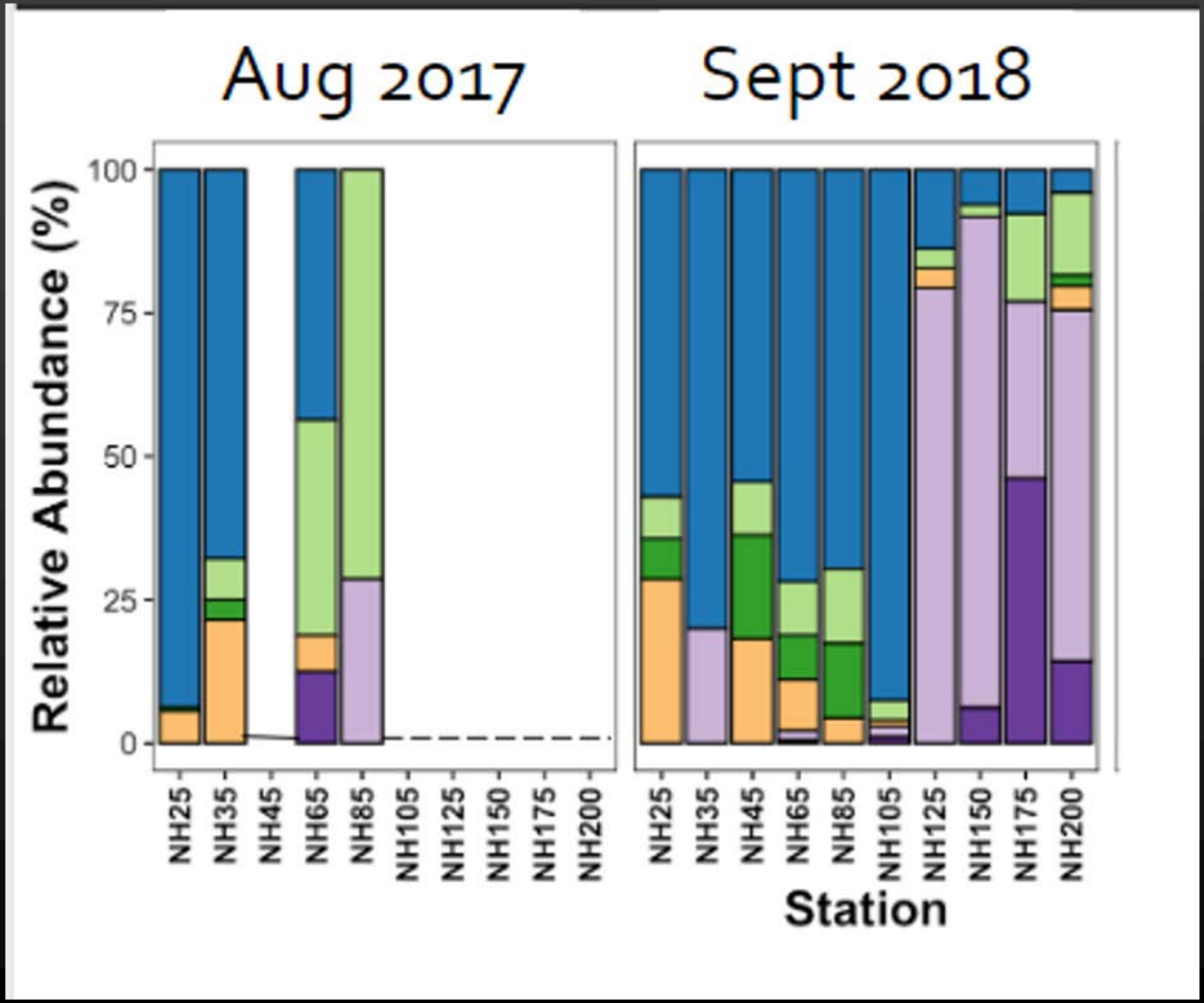


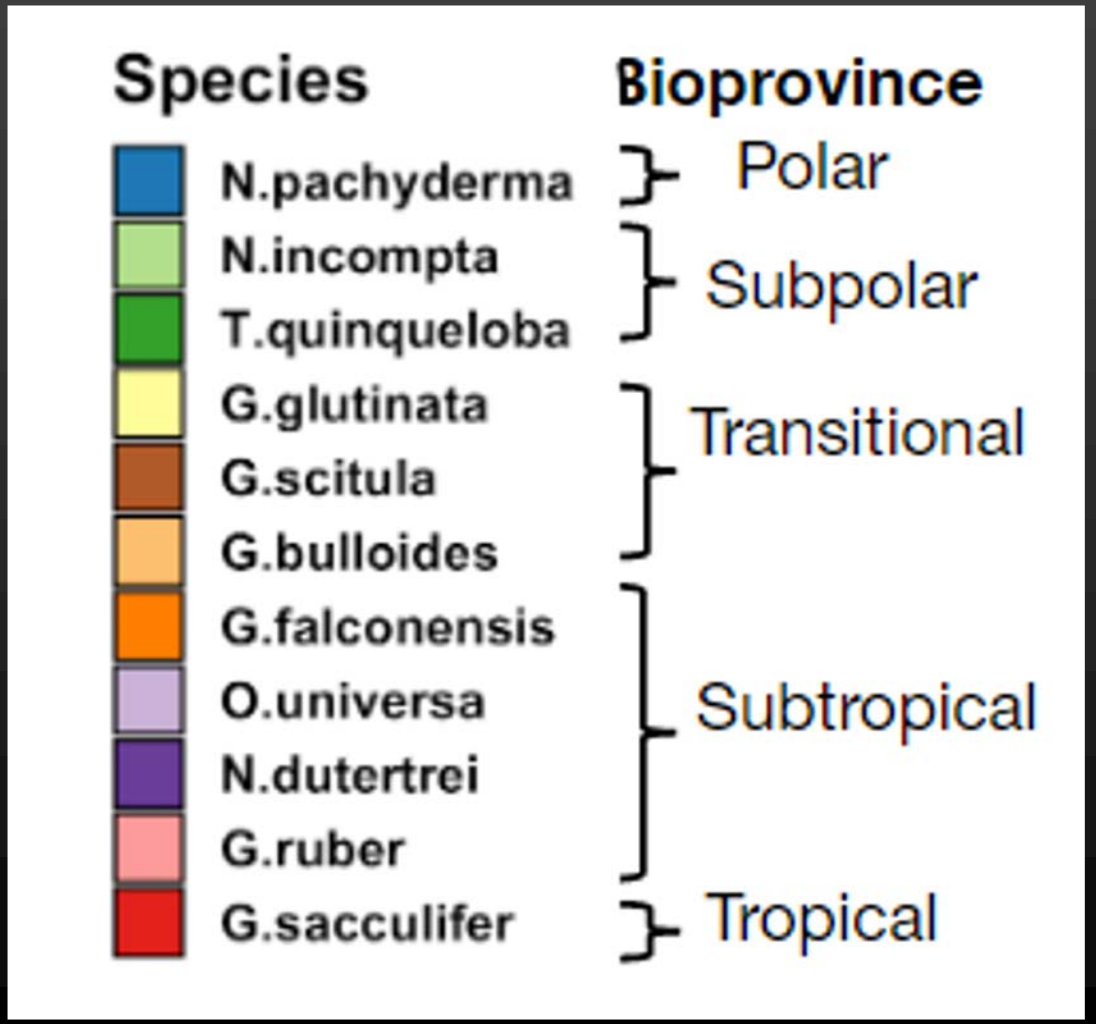
Image credit: K. Lane



Polar, Subpolar, and Transitional Foraminifera

The OSU Team's Results 2017-2018





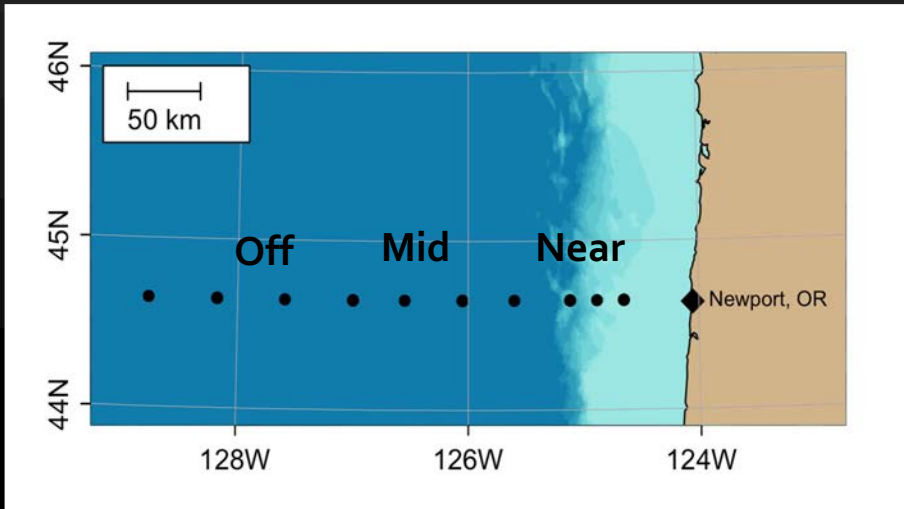
Data credit: K. Lane

Work with a partner or group to answer these questions about the data:

What types of forams were found? What are their names?

In which bioprovince are they typically found?

What do you notice about foram relative abundances as you look at near, mid and offshore areas?



How can we explain this distribution?

What do you notice about the distribution of plankton?

What reasons might explain the distribution?

What reasons might explain the changes in distribution from one year to the next?

Plankton as Storytellers: What are they telling us?

What can these plankton tell us about 2017 and 2018?

How might these years have been different?

How different might they have been?

Bonus: How do we collect plankton?

Kelsey Lane, OSU researcher, collecting plankton on the R/V Pacific Storm

4/28/2022

https://youtu.be/wG-L5QodRsQ

METHODS: Plankton Sampling

Image credits: K. Lane

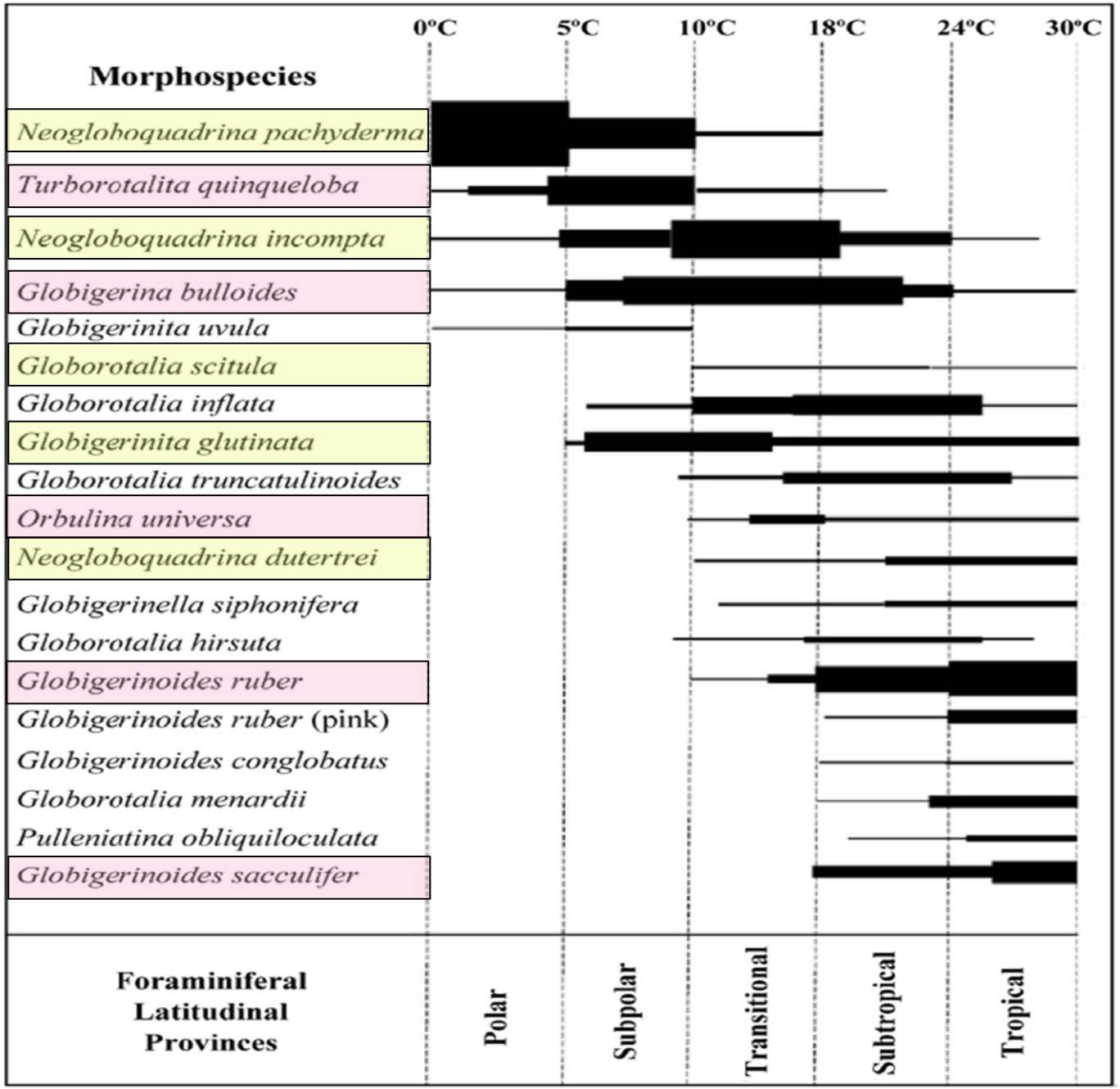
>6000 foraminifera

METHODS: Environmental Data

Image credit: K. Lane

ENVIRONMENTAL VARIABLES

- Temperature
  - SST
  - Average 100m Temperature
- Salinity
  - SSS
  - Average 100m Salinity
- Extracted Chlorophyll-a


0°C
5°C
10°C
18°C
24°C
30°C
Morphospecies
Neoglohoquadrina pachyderma
Turborotalita quinqueloba
Neogloboquadrina incompta
Globigerina bulloides
Globigerinita uvula
Globorotalia scitula
Globorotalia inflata
Globigerinita glutinata
Globorotalia truncatulinoides
Orbulina universa
Neogloboquadrina dutertrei
Globigerinella siphonifera
Globorotalia hirsuta
Globigerinoides ruber
Globigerinoides ruber (pink)
Globigerinoides conglobatus
Globorotalia menardii
Pulleniatina obliquiloculata
Globigerinoides sacculifer
Foraminiferal Latitudinal Provinces
Polar
Subpolar
Transitional
Subtropical
Tropical