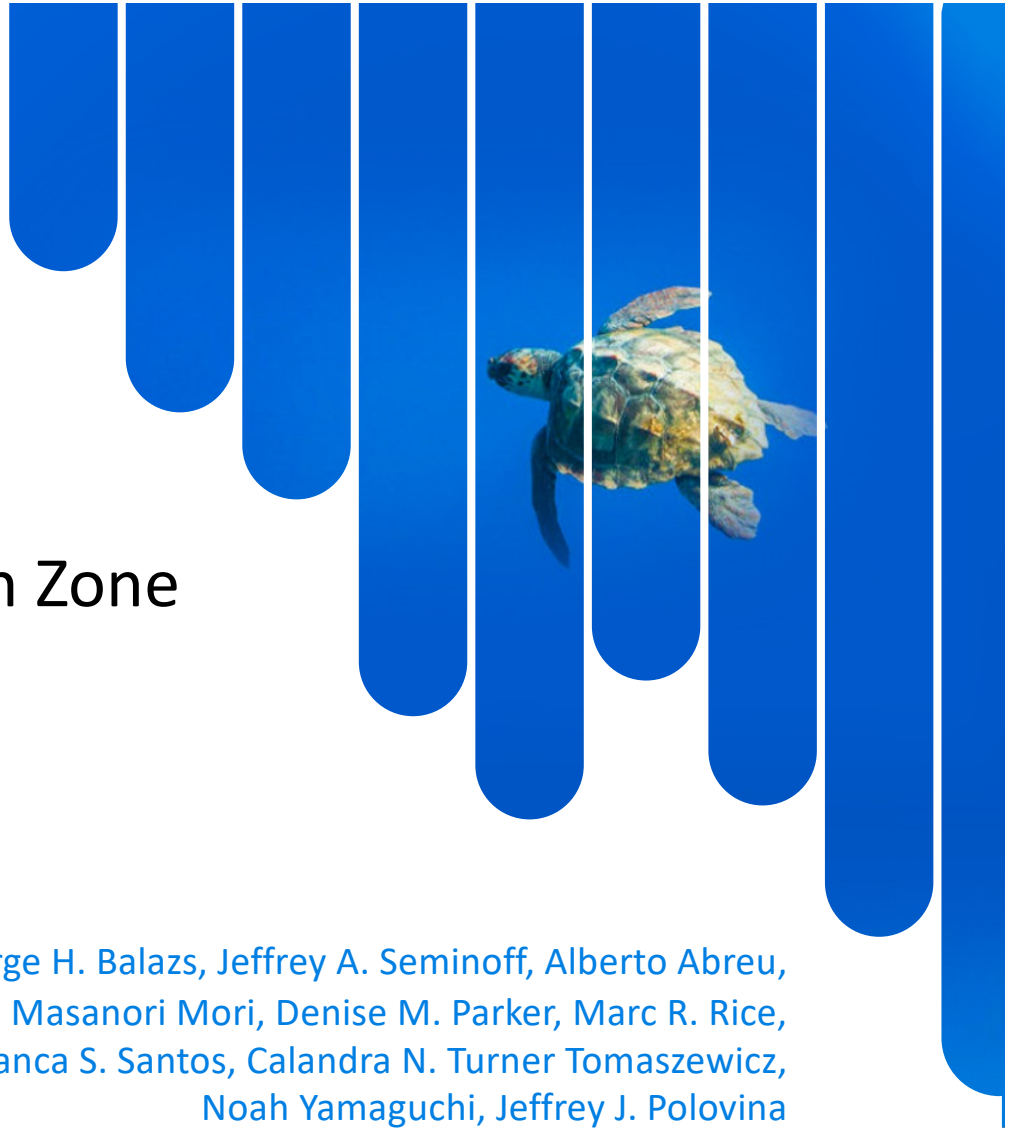
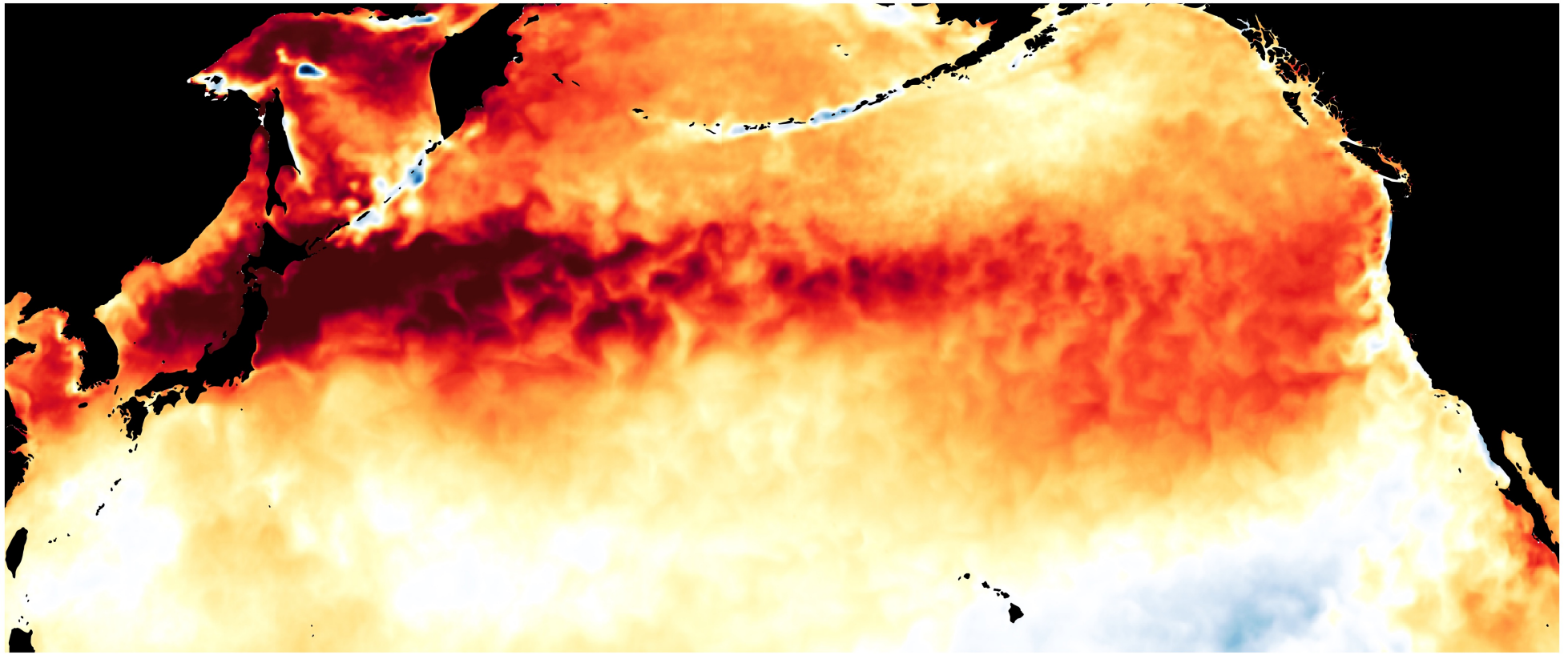
31 October 2024
PICES 2024 Honolulu, Hawaii
S7. BIO/HD Topic Session



Multi-decade northward shift of loggerhead sea turtle pelagic habitat as the eastern North Pacific Transition Zone becomes more oligotrophic

Dana K. Briscoe, Larry B. Crowder, George H. Balazs, Jeffrey A. Seminoff, Alberto Abreu, Catherine A. Lee Hing, Masanori Kurita, Masanori Mori, Denise M. Parker, Marc R. Rice, Tomomi Saito, Bianca S. Santos, Calandra N. Turner Tomaszewicz, Noah Yamaguchi, Jeffrey J. Polovina

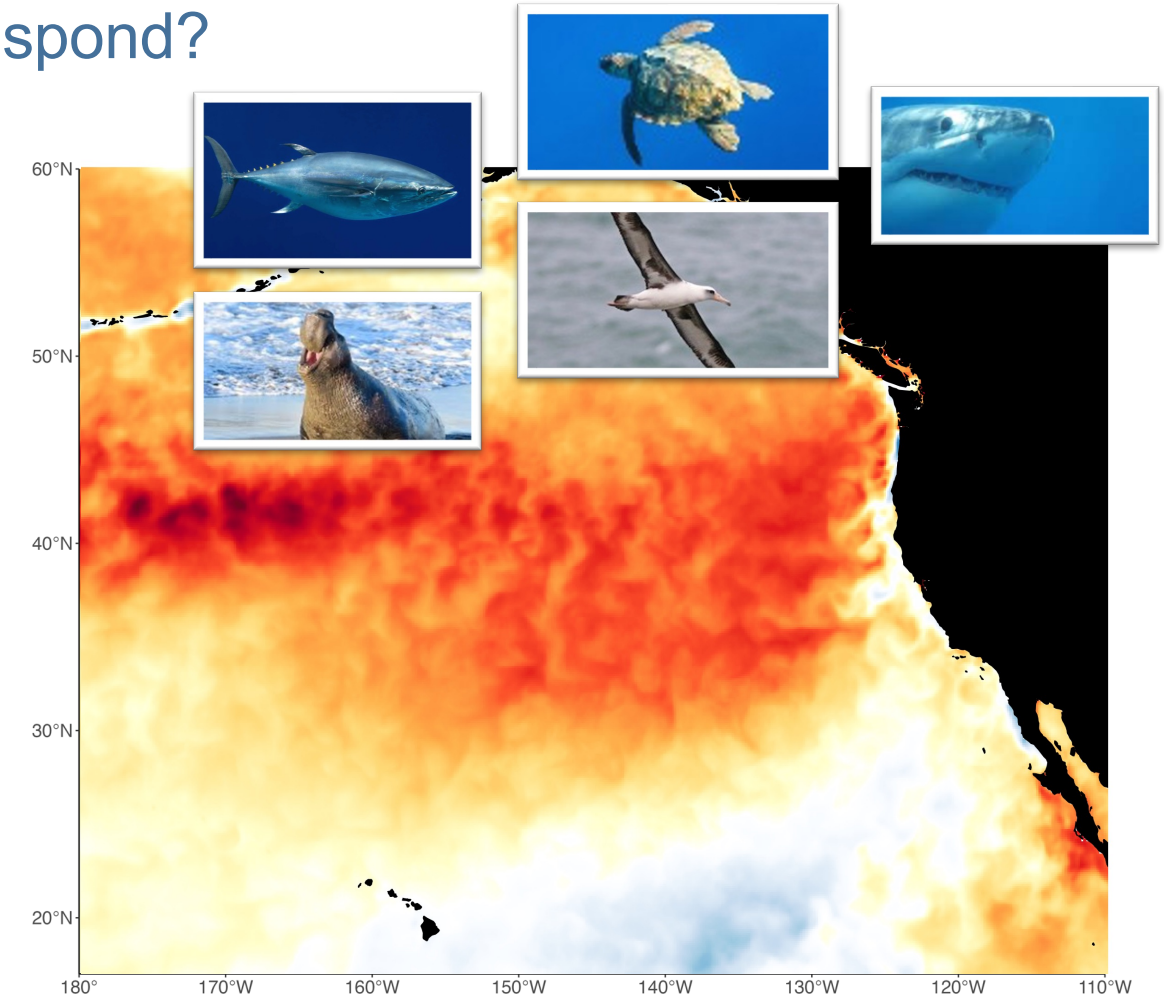
North Pacific Ocean Warming



NOAA Coral Reef Watch
SSTa Aug 2023

How Will Pelagic Species Respond?

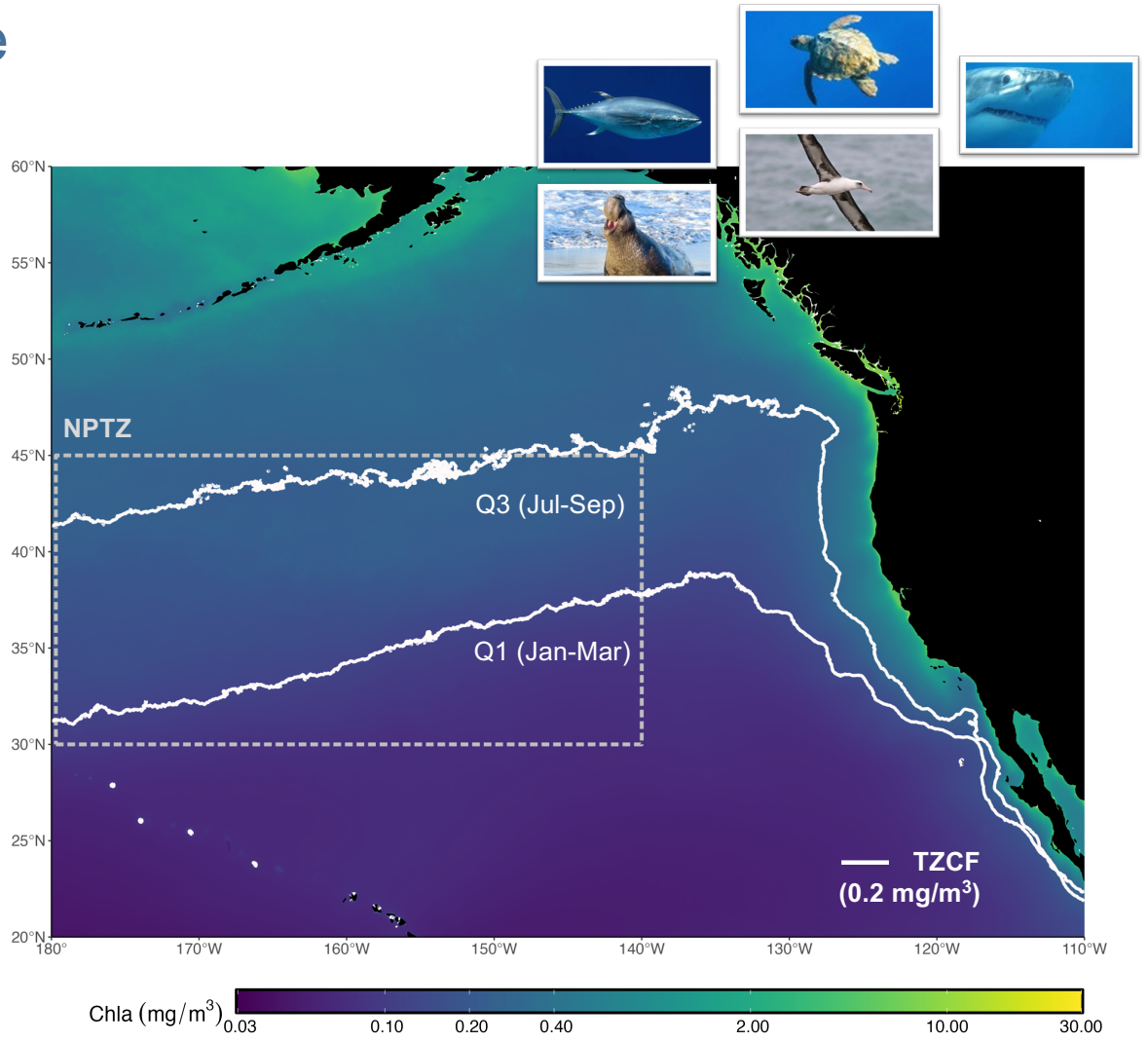
- **Eastern North Pacific**
  Biodiversity hotspot
- **Rapid rate of change**
  Species must adapt | adjust
- **Habitat shifts**
  New challenges for conservation & management



North Pacific Transition Zone

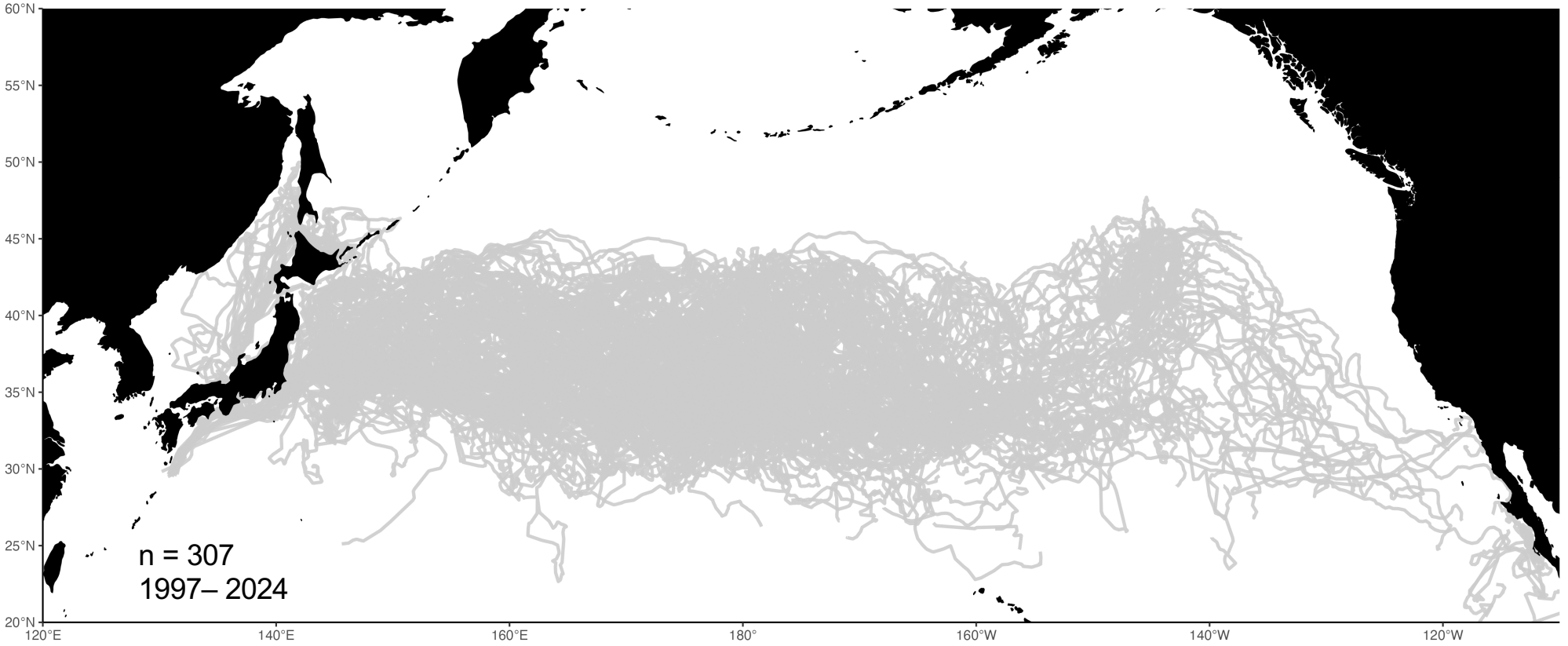
- Forage habitat & key oceanographic boundary
- Transition Zone Chla Front (TZCF)

- Expansion of oligotrophic waters (< 0.2 mg/m^3)
- Short-term studies & model projections … Gaps at decadal scale



North Pacific Loggerhead Sea Turtles

(Caretta caretta)



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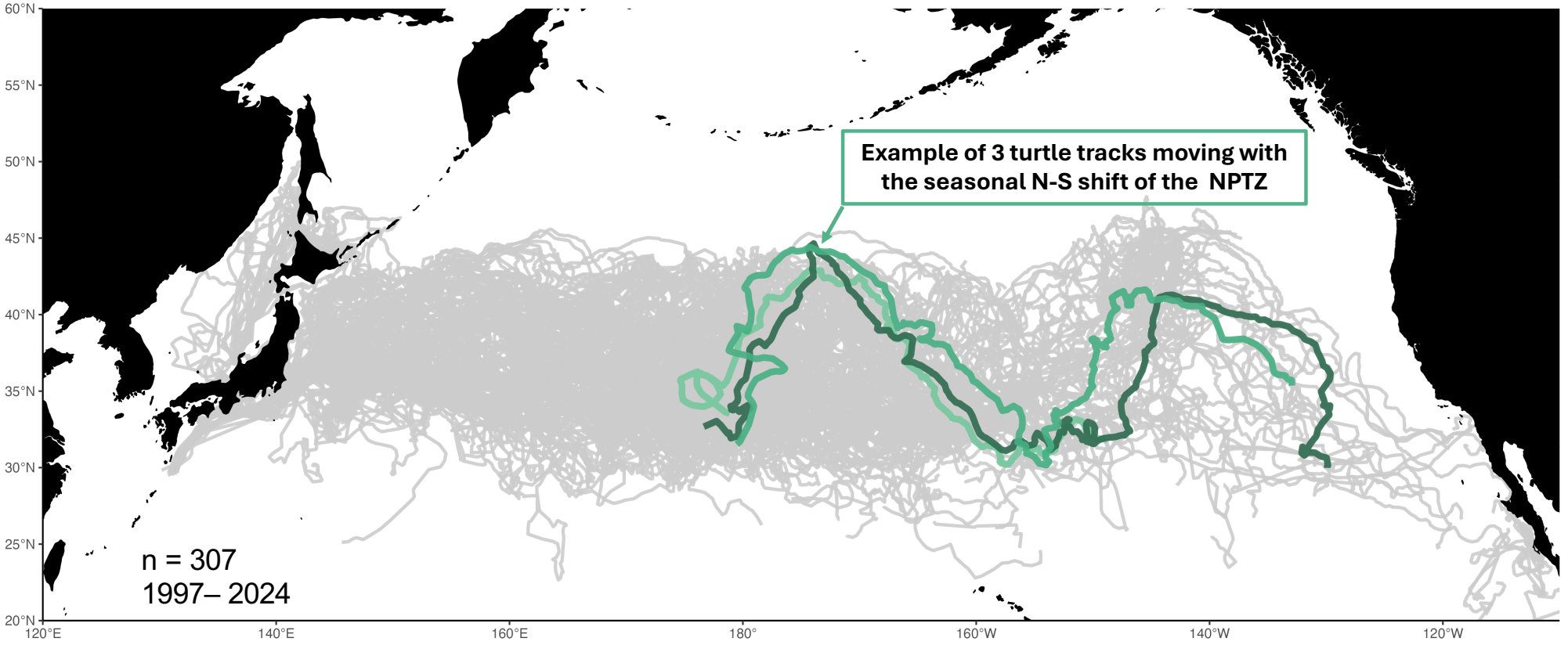
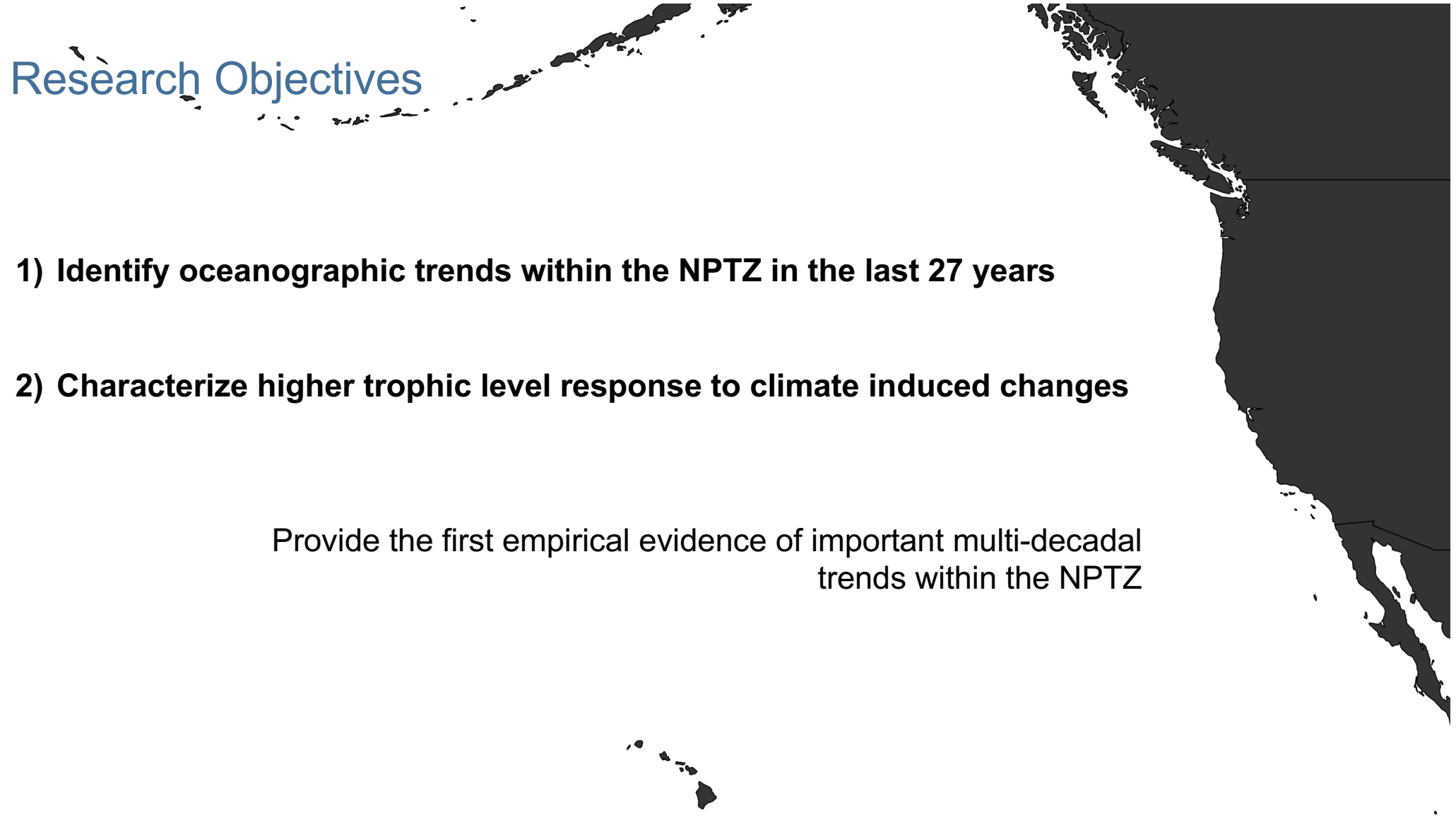


Research Objectives

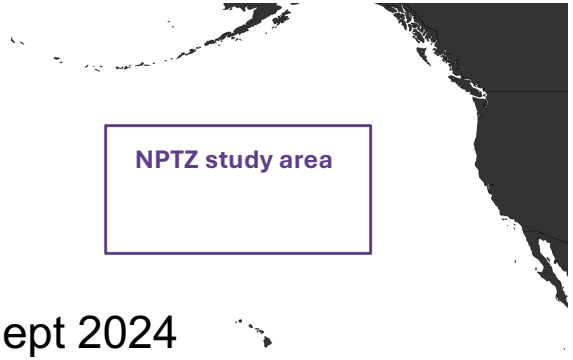


1) **Identify oceanographic trends within the NPTZ in the last 27 years**

2) **Characterize higher trophic level response to climate induced changes**

Provide the first empirical evidence of important multi-decadal trends within the NPTZ

Methods | NPTZ Trends



- SST
- Chla
- Oligotrophic Area (< 0.2 mg/m^3)
- Turtle Latitude

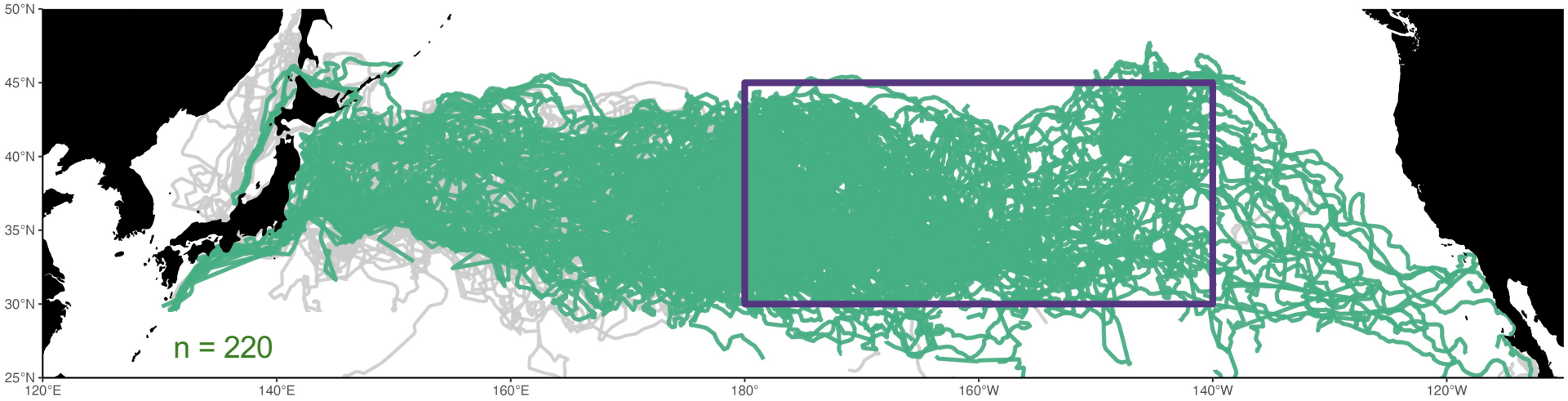
1. Calculate spatial means : Sept 1997 – Sept 2024
   Monthly, Q1 (Jan-Mar), & Q3 (Jul-Sep), annual

2. Generalized Additive Mixed Models (GAMMs)
   y ~ s(seasonal) + trend

3. Discrete year groups
   1997-2000 | 2004-2008 | 2010-2013 | 2023-2024

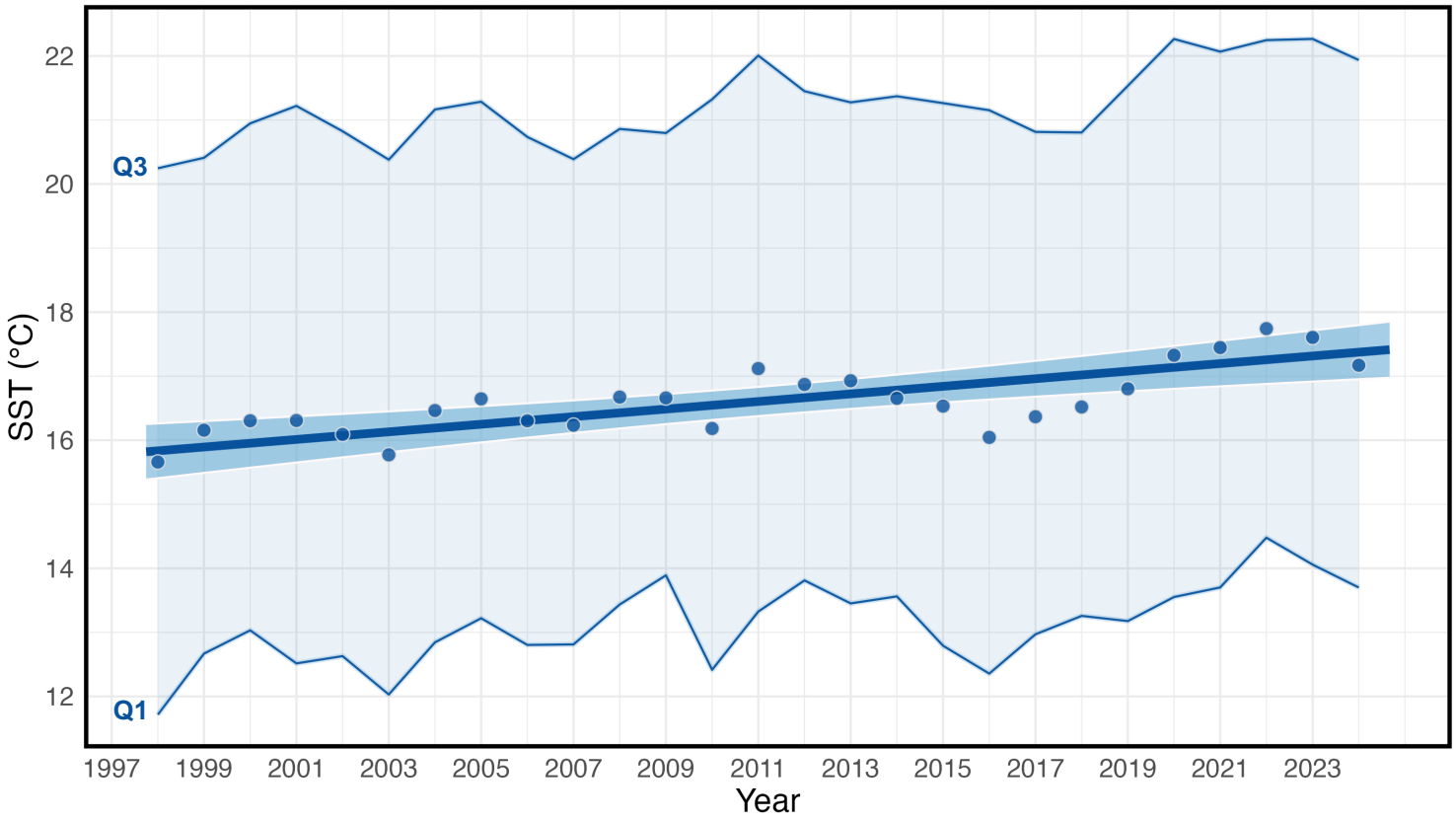
Methods | NPTZ Trends

- Turtle Latitude | 1997-2013 (n=167) & 2023-2024 (n=53)



Results | NPTZ Trends

- SST
- Chla
- Oligotrophic Area
- Turtle Latitude



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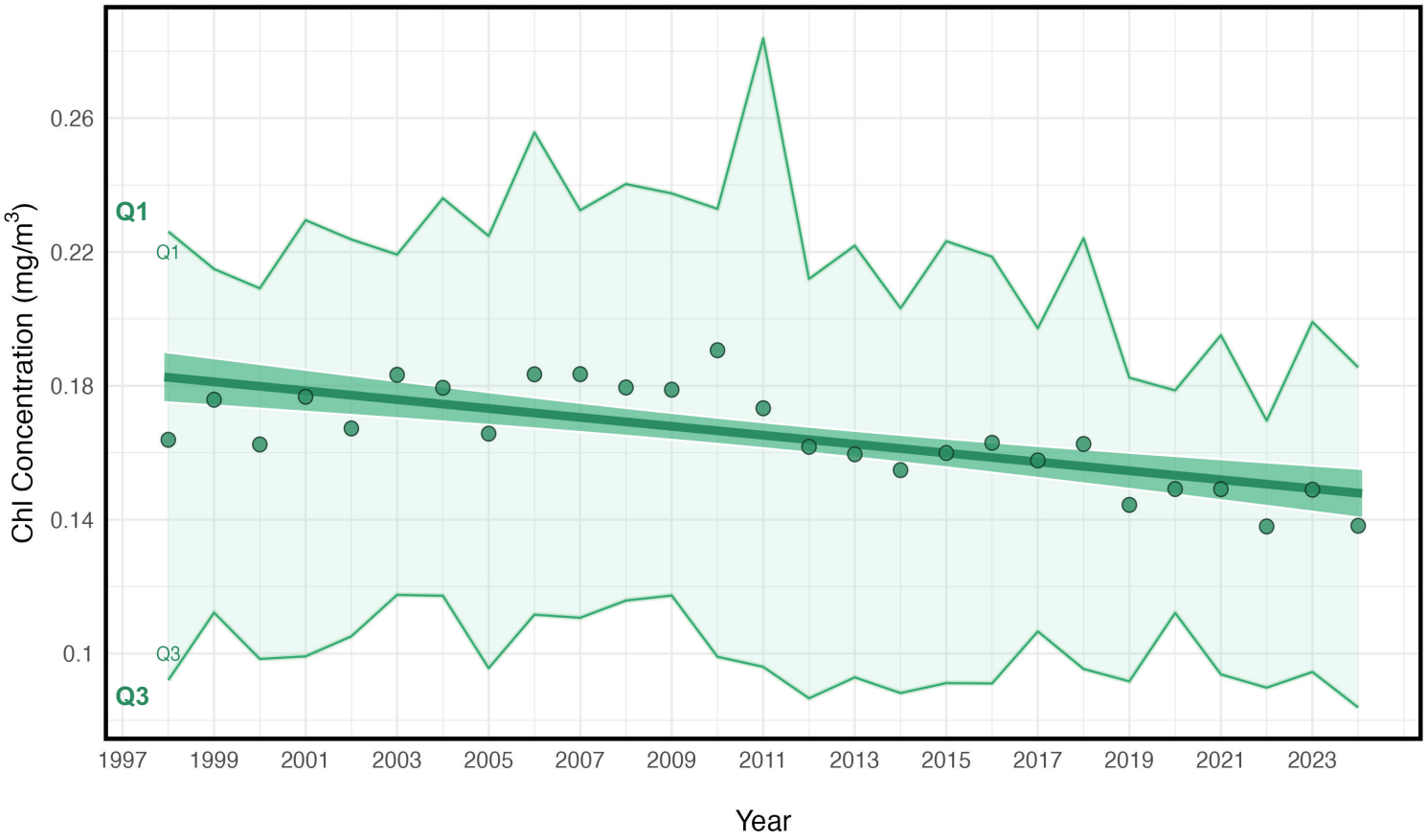

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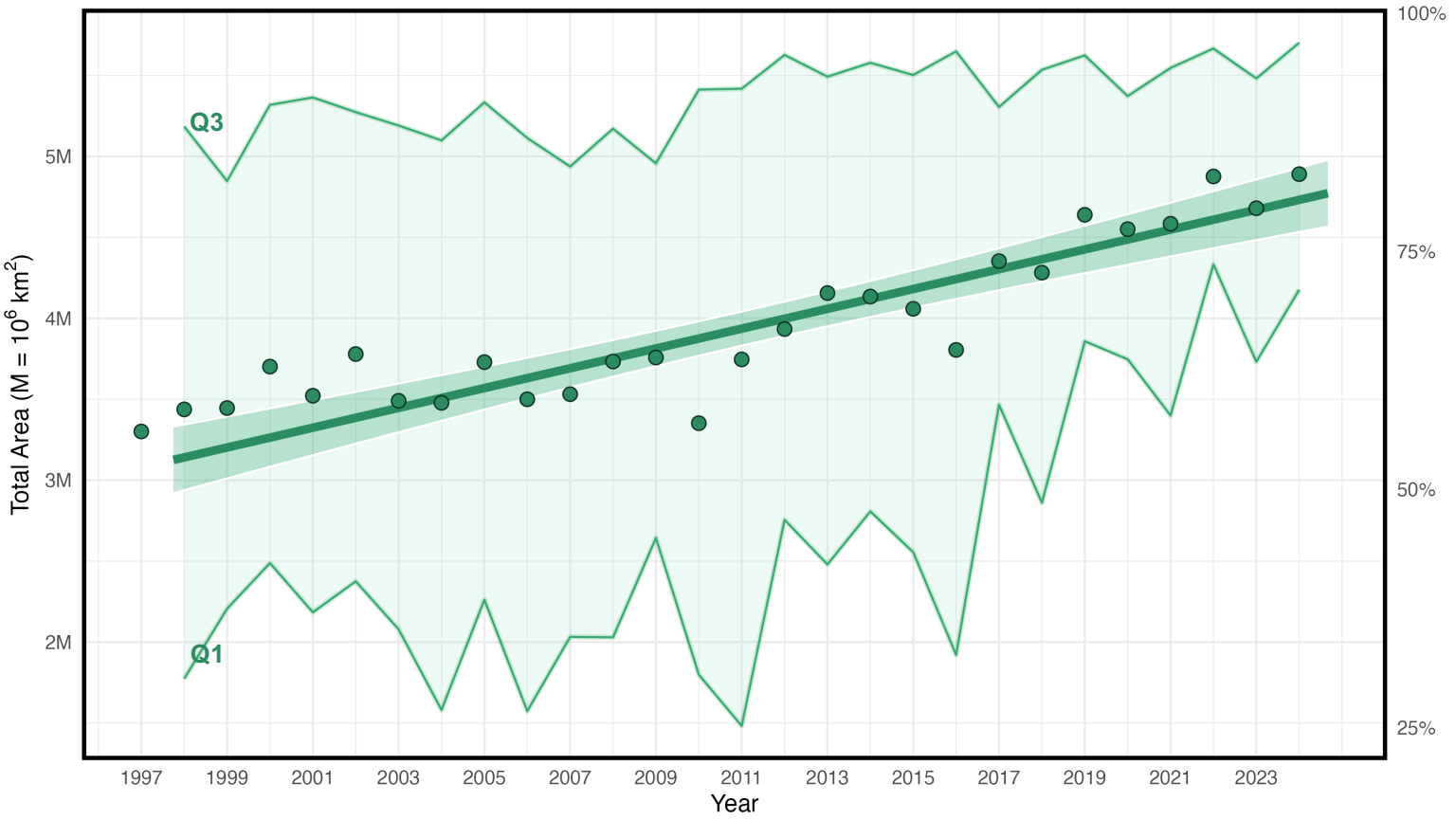
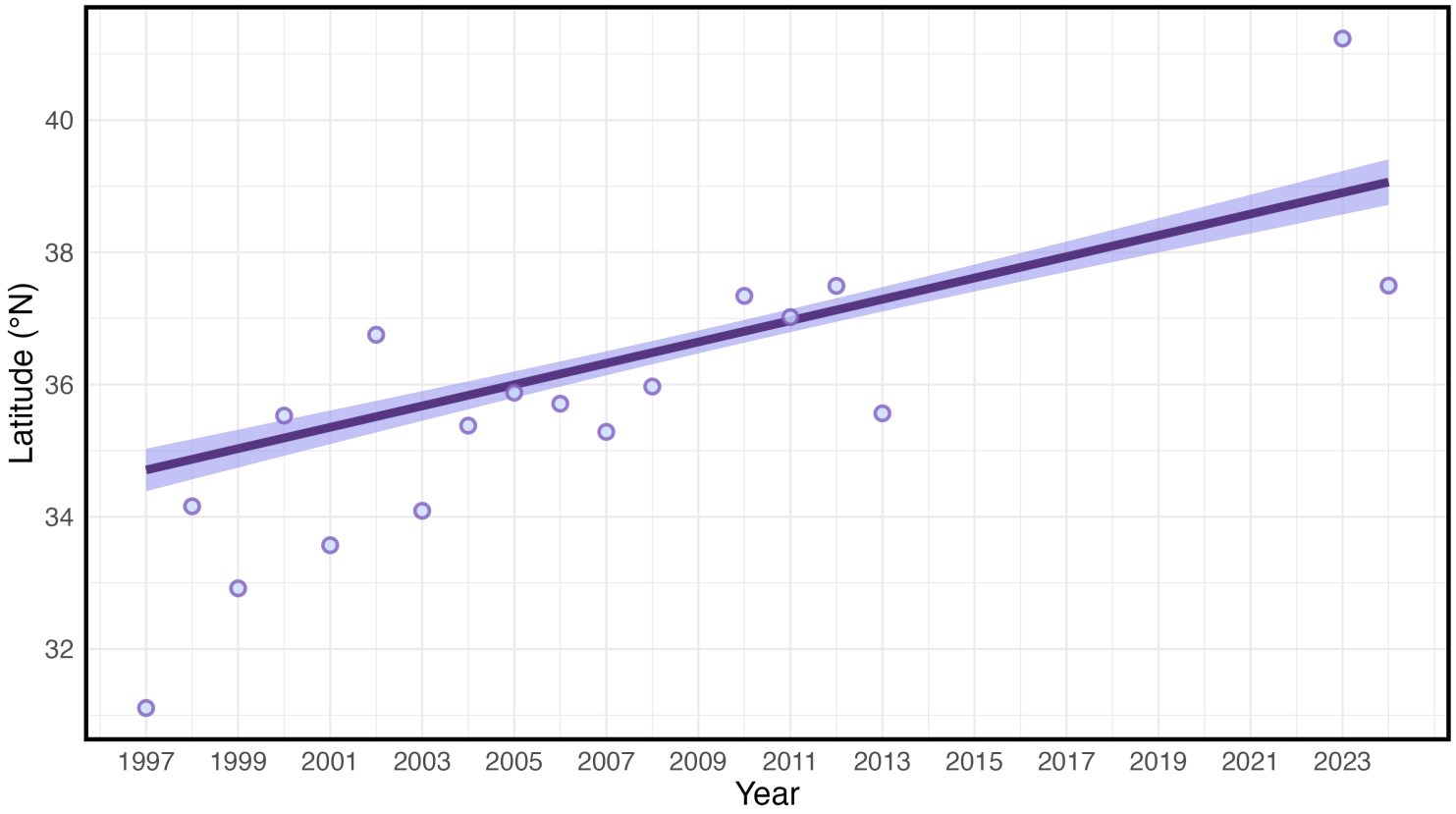
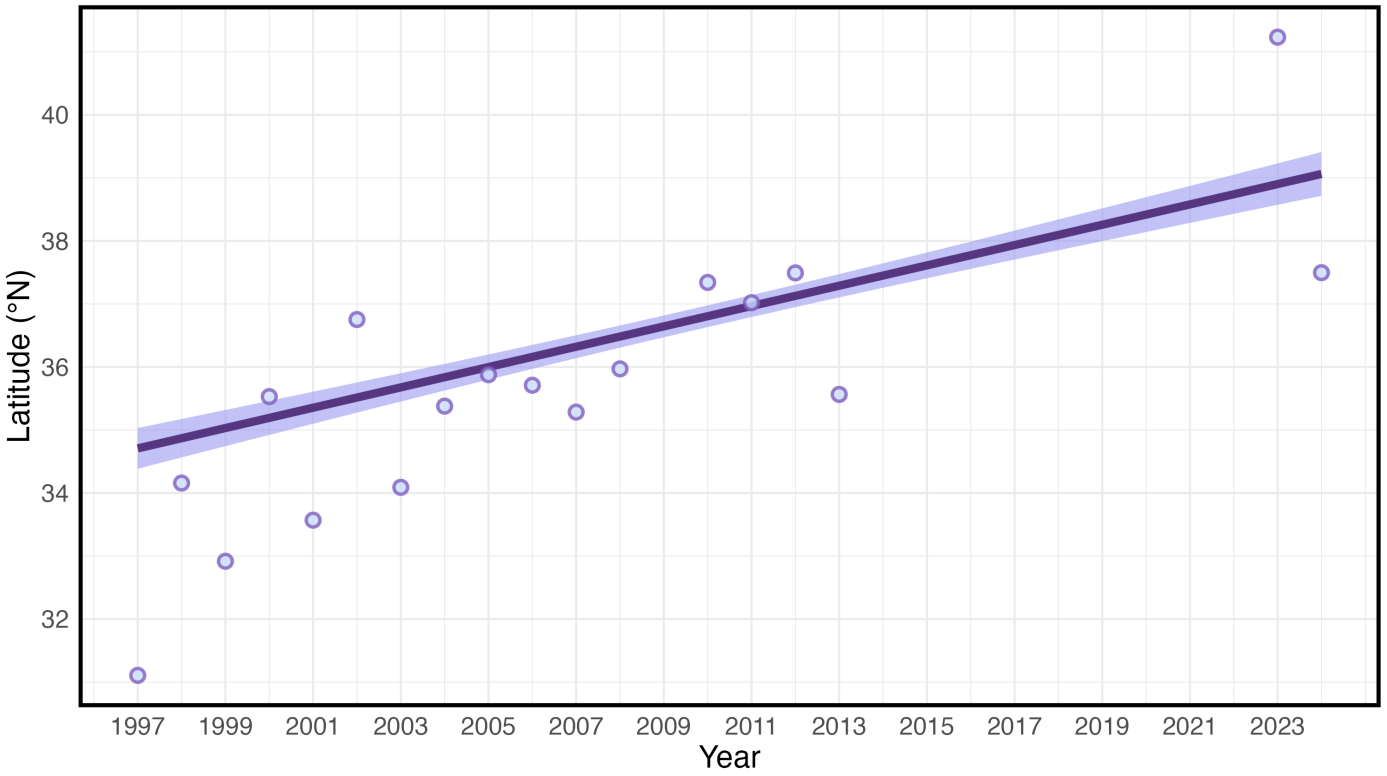


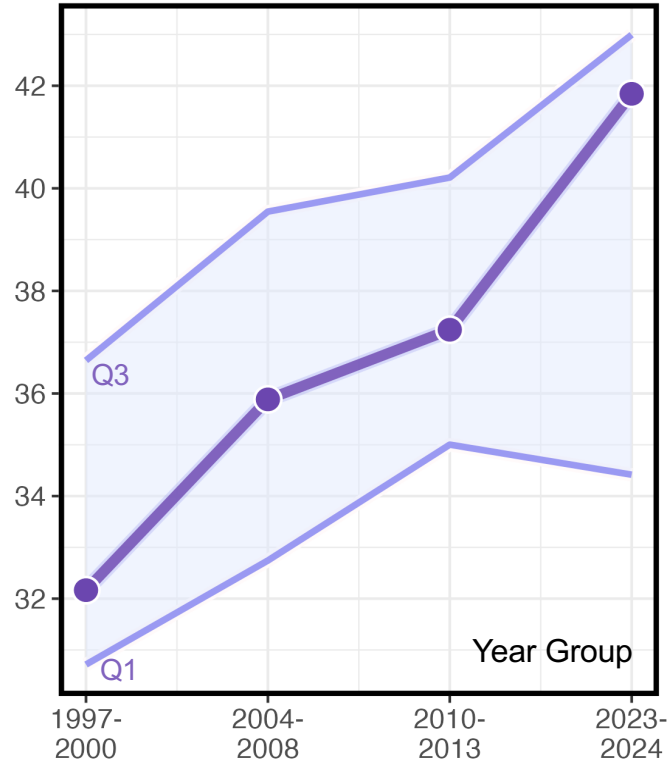
Results | NPTZ Trends

- SST
- Chla
- Oligotrophic Area
- Turtle Latitude

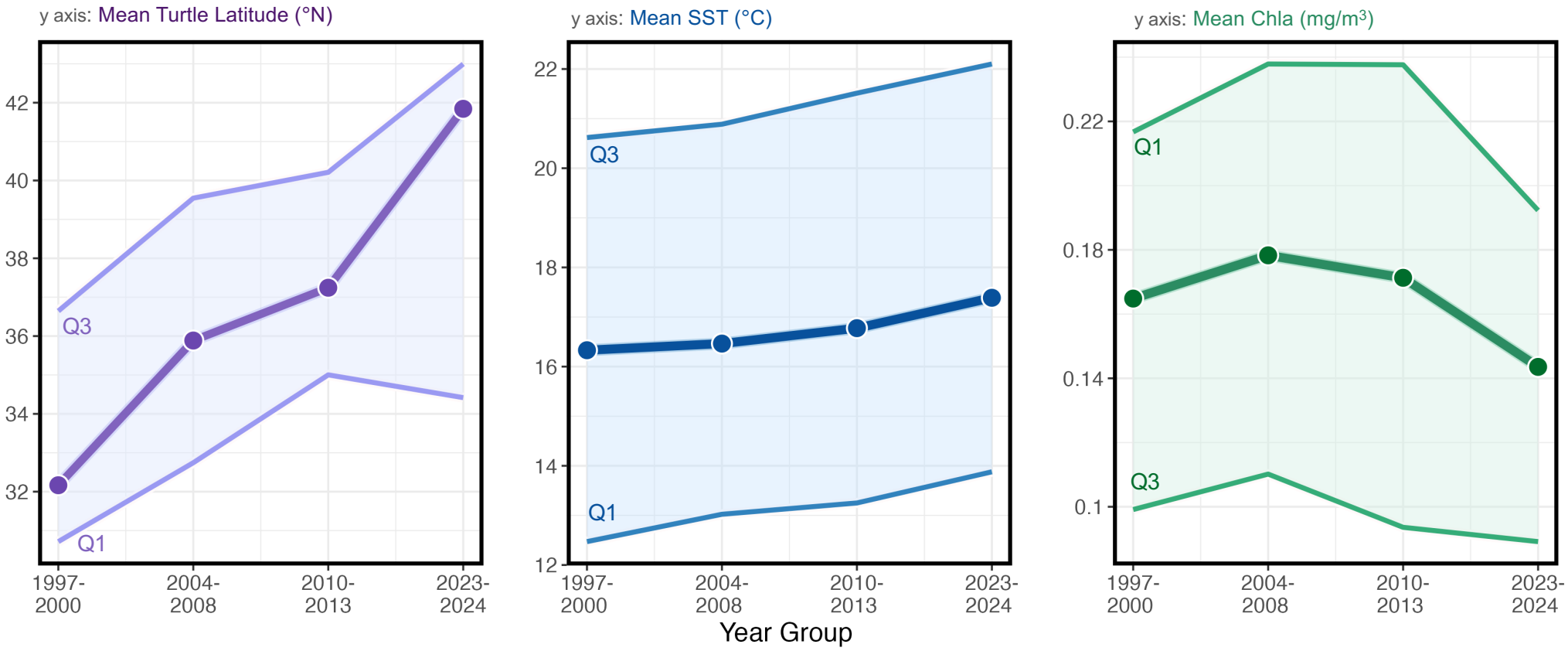


Results | Mean Loggerhead Latitude within the NPTZ





Results | Discrete Year Groups: Turtles, SST, and Chla



Summary

Over the past 27 years:

- NPTZ has warmed by 1.6°C
- Chla concentrations have decreased by almost 20% since 2011
- Experienced 28% increase in total oligotrophic habitat
- Greatest rate of change in winter

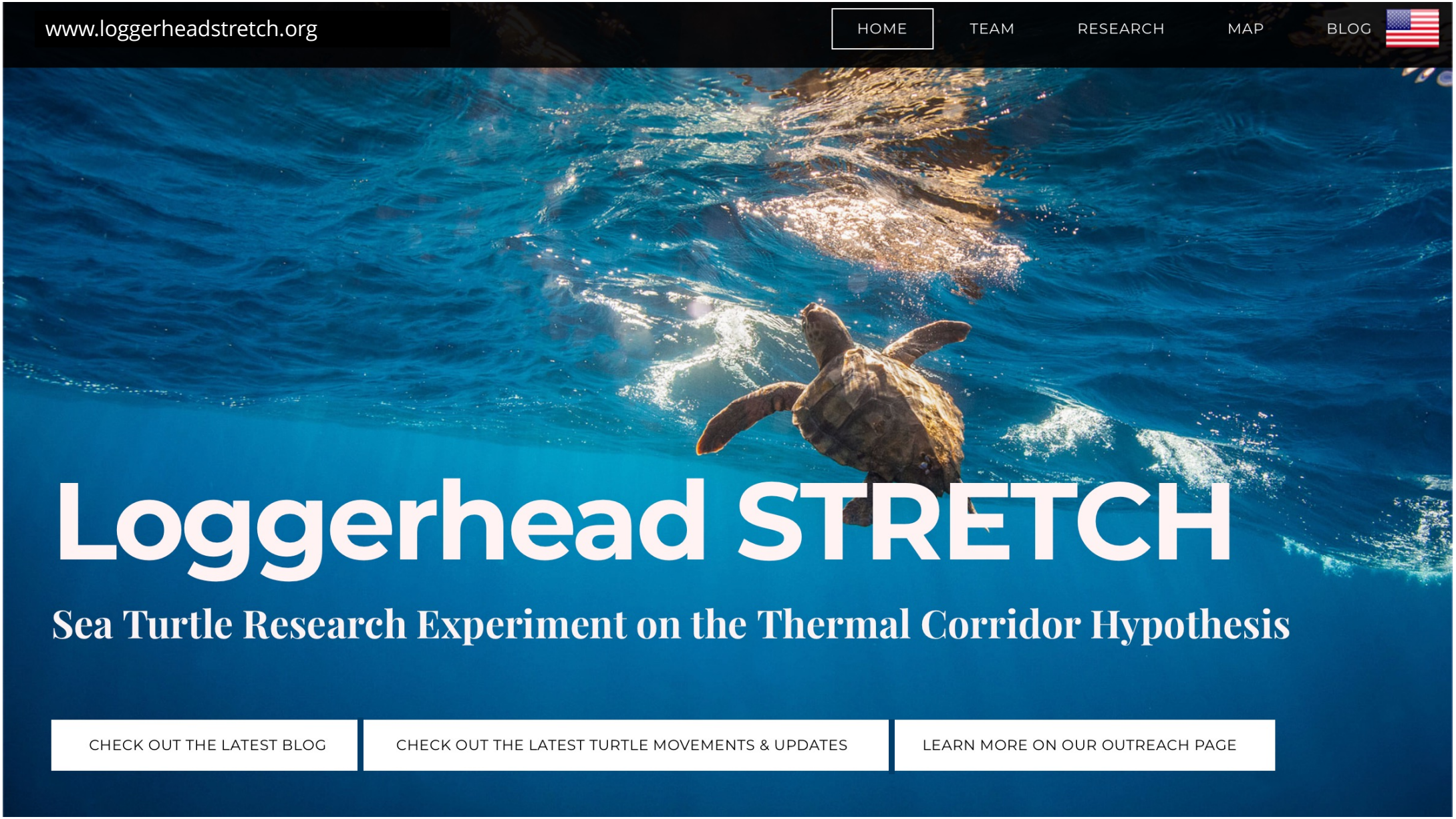
- In response, loggerhead habitat has shifted north 450-600 km (exceeding global average[1])

- This sentinel species dataset documents significant ecosystem response

- Evidence of multi-decadal trends offers insights for management approaches in a changing ocean

Photo: Ralph Pace

[1]Poloczanska et al. (2013)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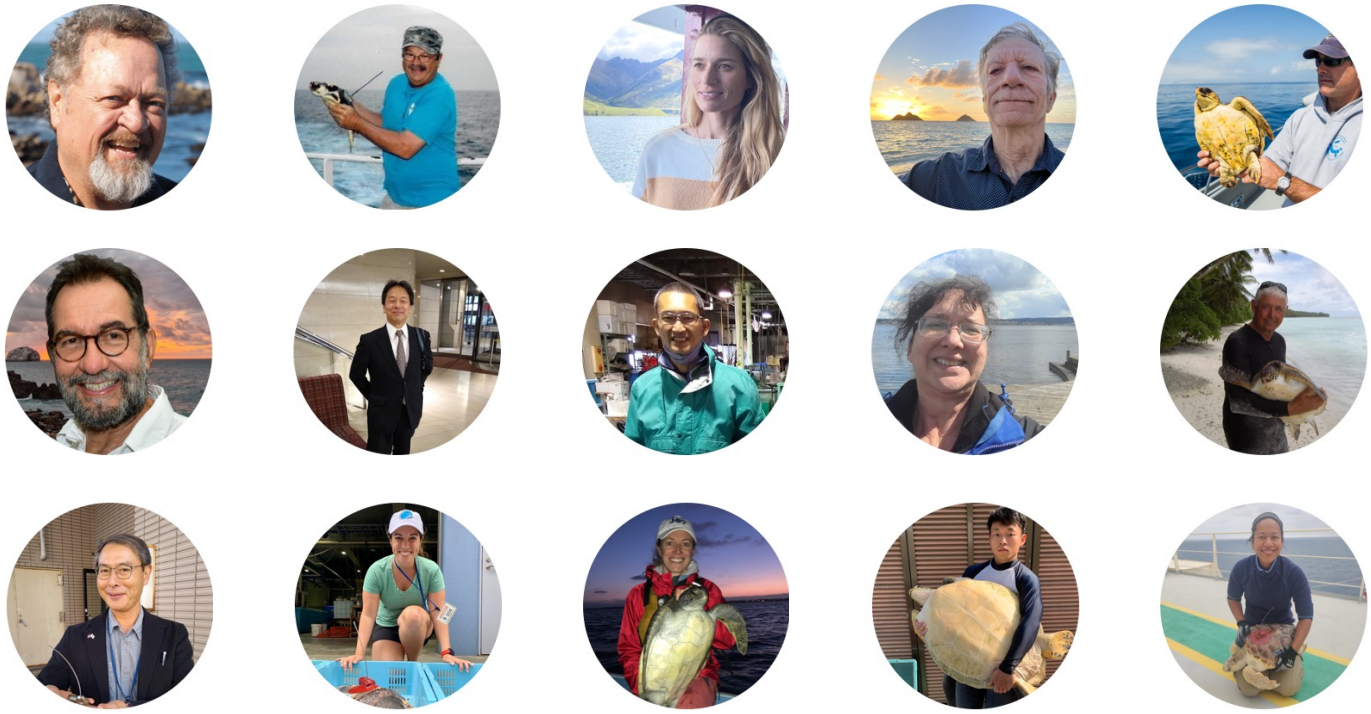
Thank you!



SEA TURTLE RESEARCH EXPERIMENT ON THE THERMAL CORRIDOR HYPOTHESIS

GORDON AND BETTY MOORE FOUNDATION

NATIONAL GEOGRAPHIC

PORT OF NAGOYA PUBLIC AQUARIUM

高知大学 Kochi University

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