



Marine Ecological Time Series: What are they telling us about the ocean?

Laura Lorenzoni (University of South Florida/NASA, USA)

Todd O'Brien (NOAA, USA)

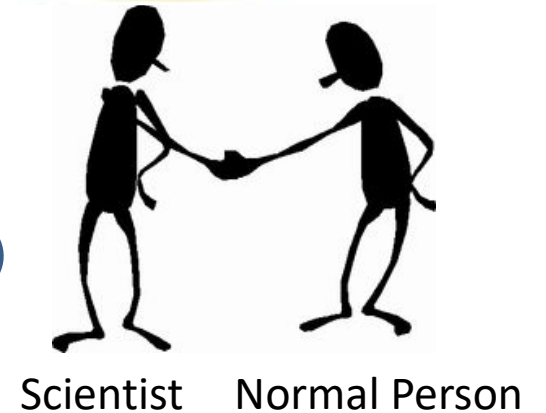
Kirsten Isensee (IOC/UNESCO)

IGMETS Steering Committee and Coordinating Scientists

Time Series Investigators and Participants

What are marine ecological TS telling us about the ocean?

- The oceans are changing with important implications for the economy and food security
- We've got to start thinking outside the box to sustain observations
- Two-legged species are important!



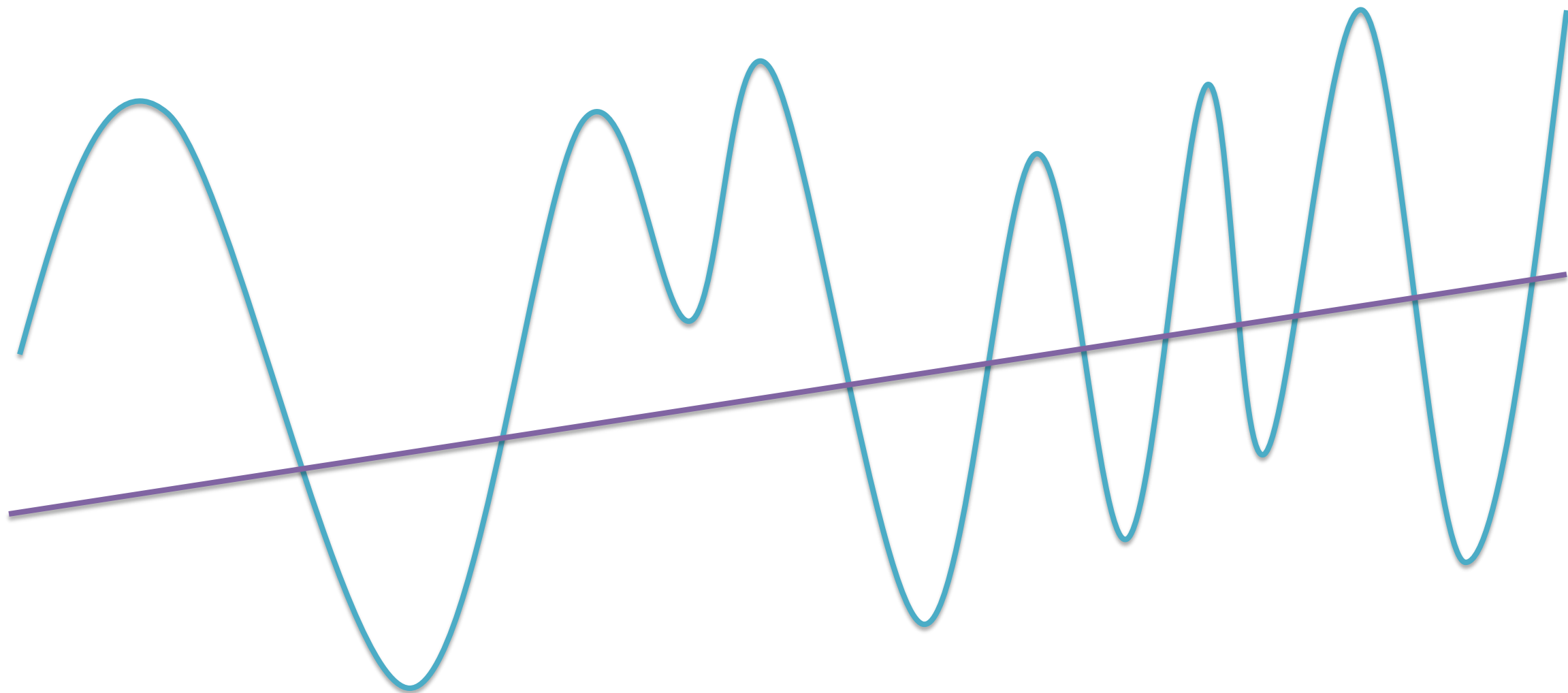
Why are TS so important and why do I care?



Animation credit: N
Center, The SeaWiFS
Visualization Studio,
Group (OBPG). [http:](http://)



Why are TS so important and why do I care?



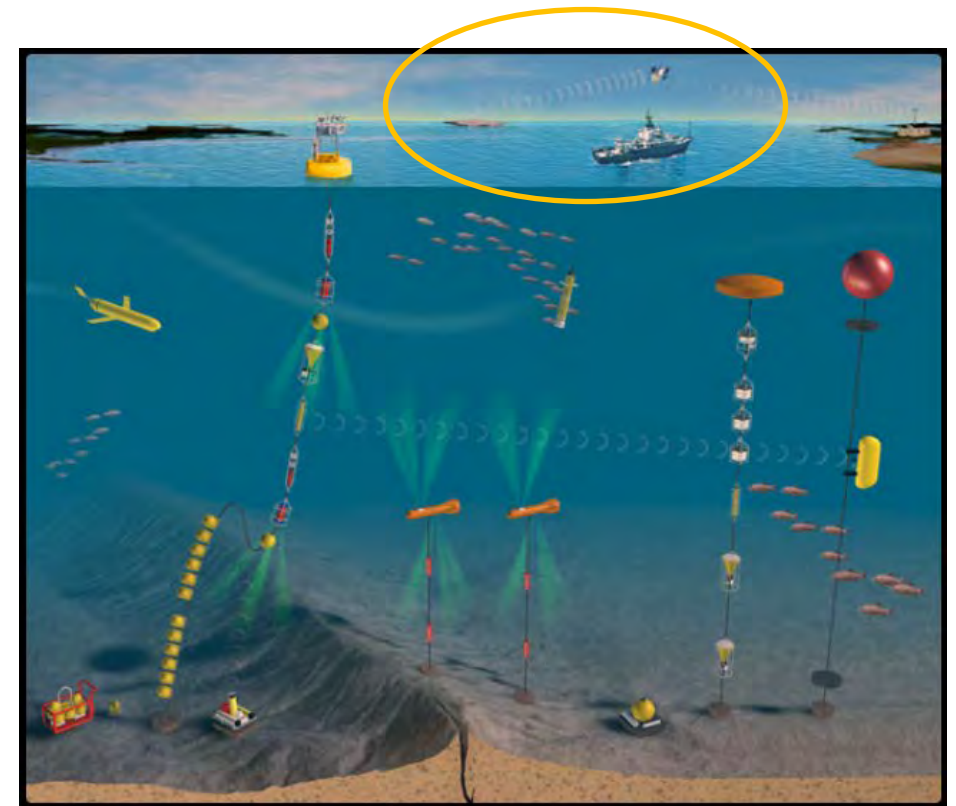
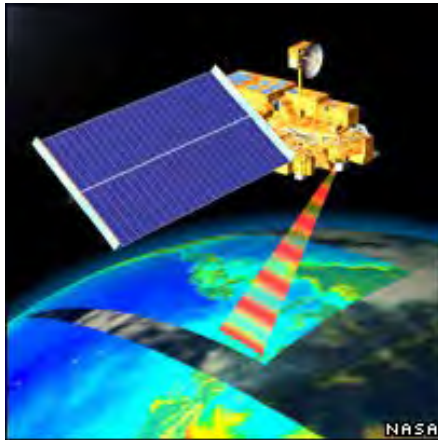
Why are TS so important and why do I care?

- This is an era where we are seeing extremes



What Time-Series?

- Ways to measure stuff in the ocean



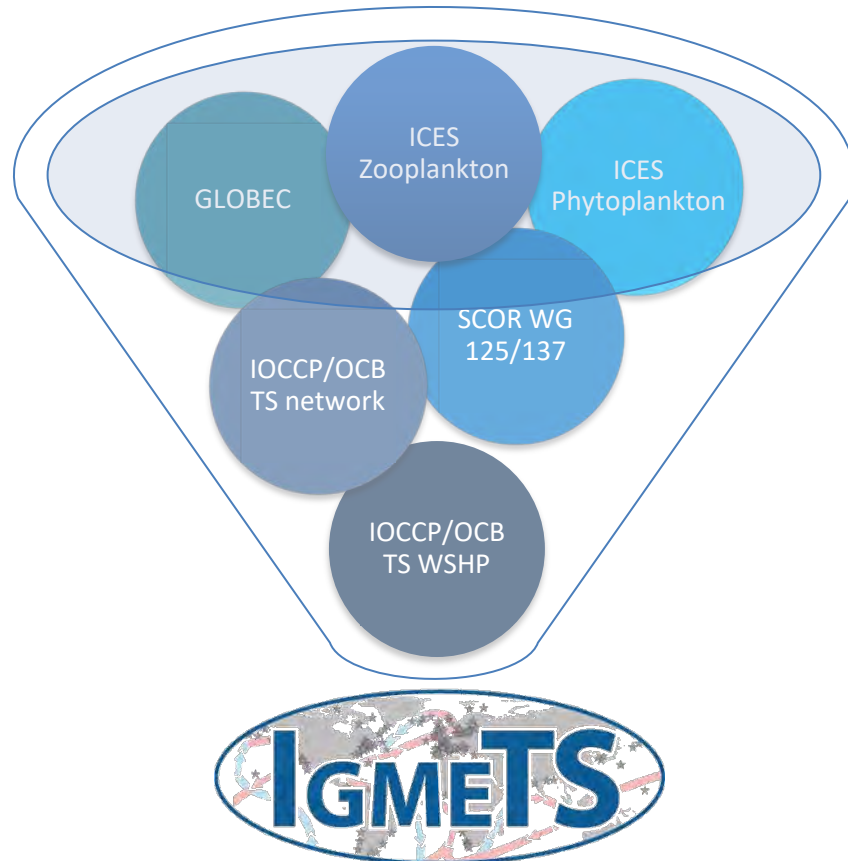
- IGMETS (<http://igmets.net/>)

<http://www.whoi.edu/page.do?pid=10977&tid=282&cid=14146>



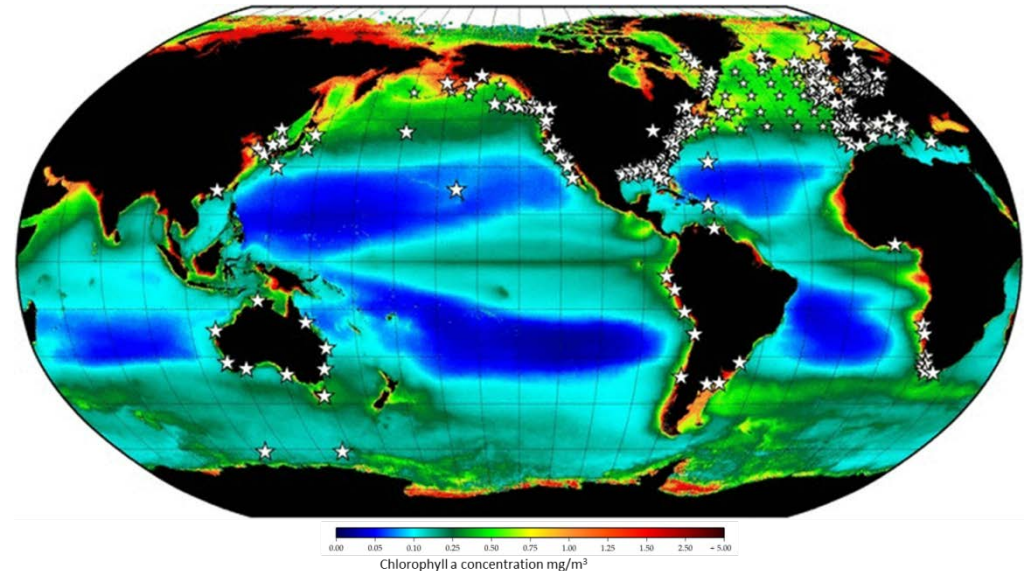
International Group for Marine Ecological Time Series

Analysis and synthesis of global marine ecological changes
as seen through biogeochemical and plankton time series.



Previous and ongoing activities within the
scientific community which led up to the
IGMETS effort.

- Started in 2014 as a means to assess global and regional ocean changes through ship-based, biogeochemical time series.
- Combining multiple TS enables assessment of regional and global variability via large spatial-scale analyses.
- It builds on a series of previous activities



Map showing Time Series sites involved in the IGMETS
assessment.



International Group for Marine Ecological Time Series

Analysis and synthesis of global marine ecological changes as seen through biogeochemical and plankton time series.

SINGLE TIME SERIES ANALYSIS

Identification of temporal patterns

Understanding of local processes

Establishment of local baselines

JOINT TIME SERIES ANALYSIS

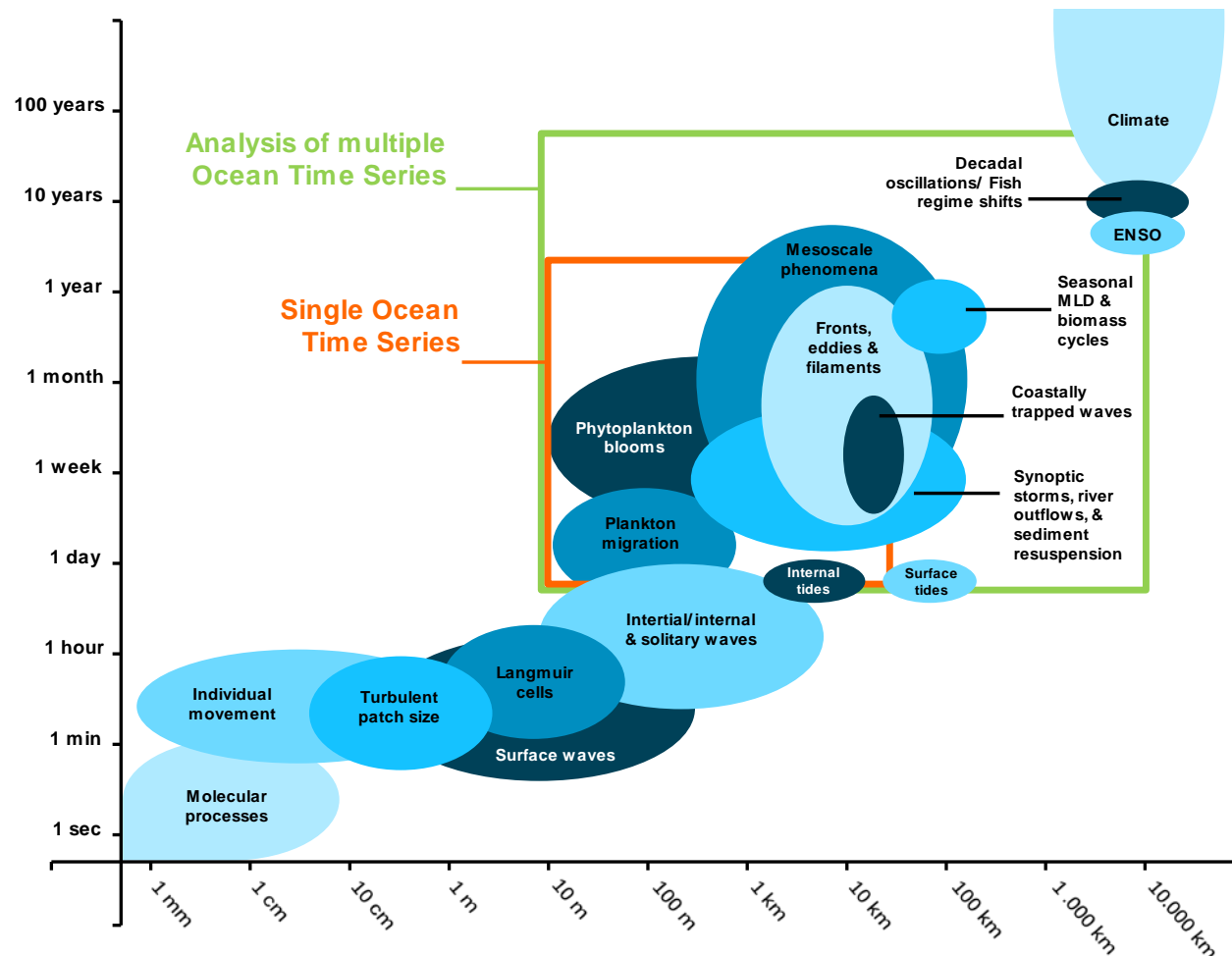
Identification of temporal and spatial patterns

Establishment of regional baselines

Separation of stressors

Understanding of regional and global processes

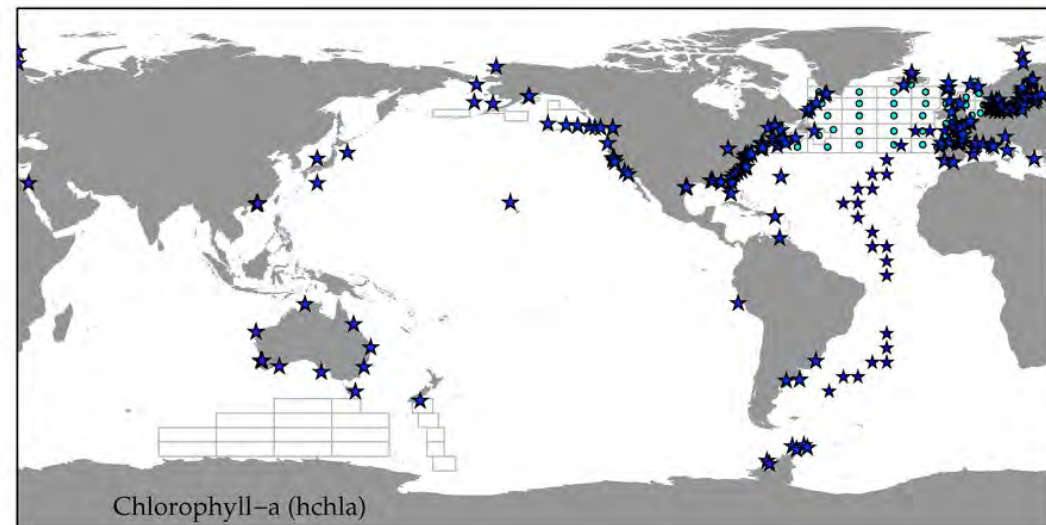
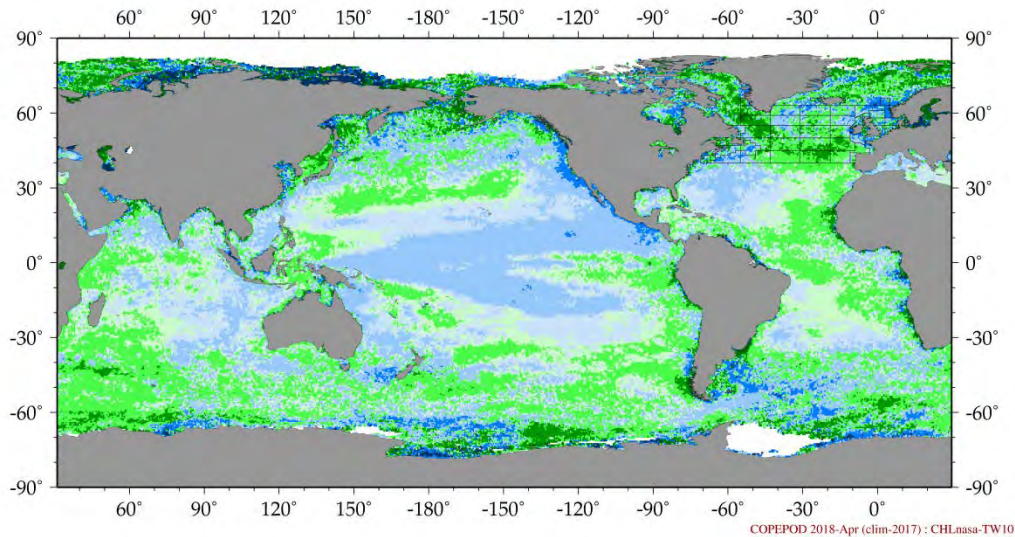
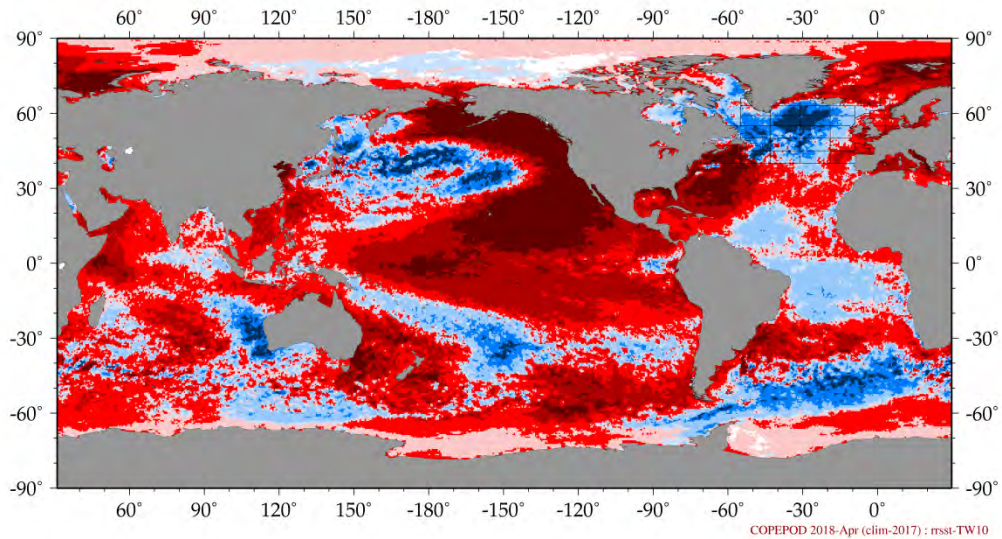
Projection and forecasting



Adapted from Dickey 2002

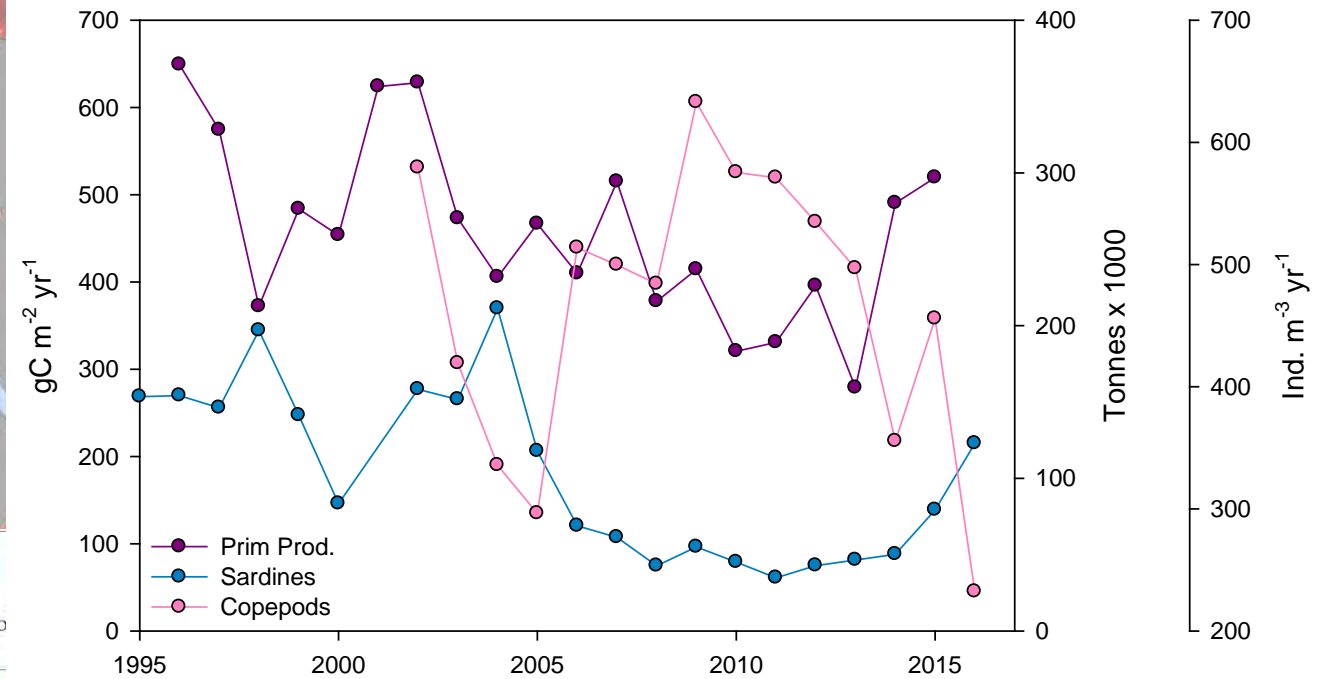
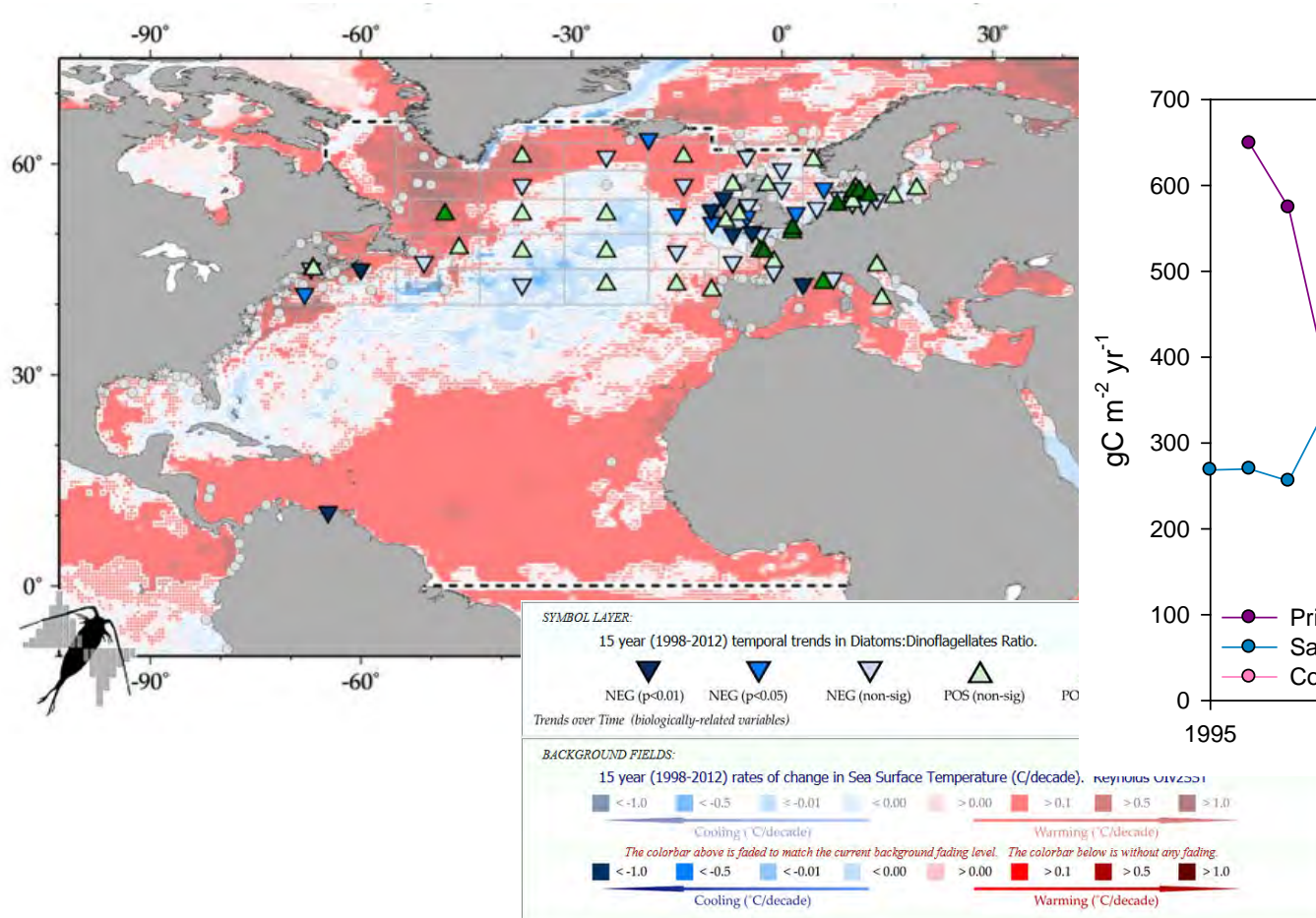
What are marine ecological TS telling us about the ocean?

- Generalized warming trend (35 yrs)
- Regional shifts in plankton species
- Changes in biogeochemistry



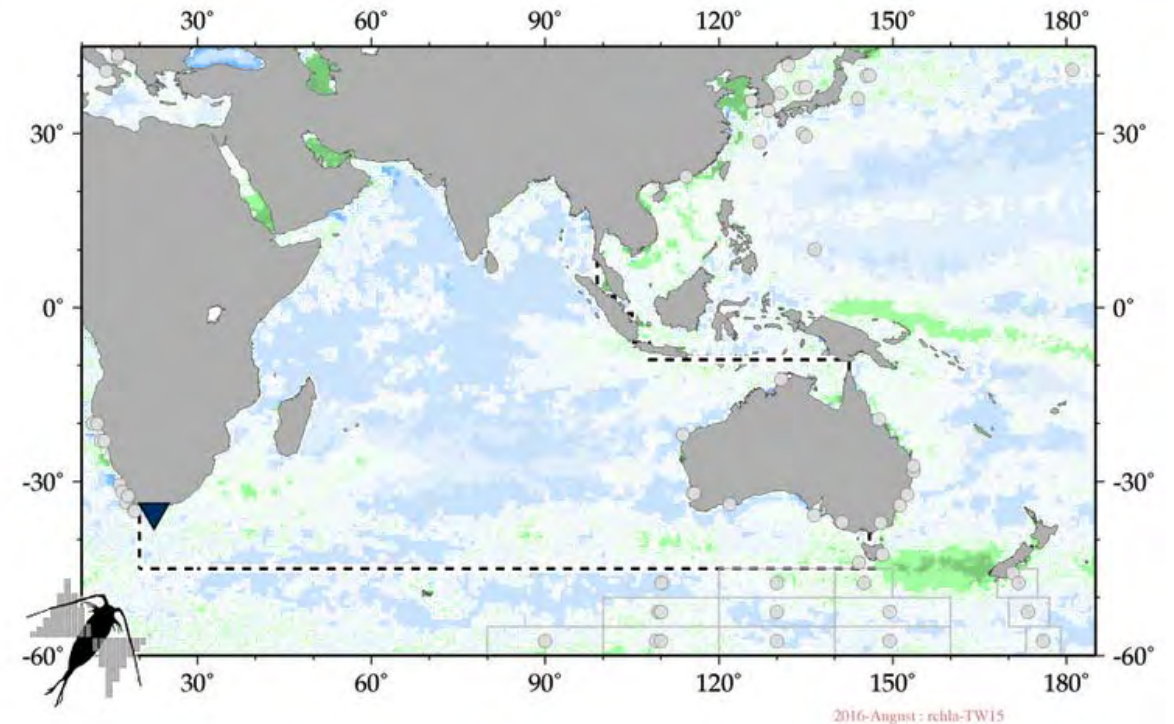
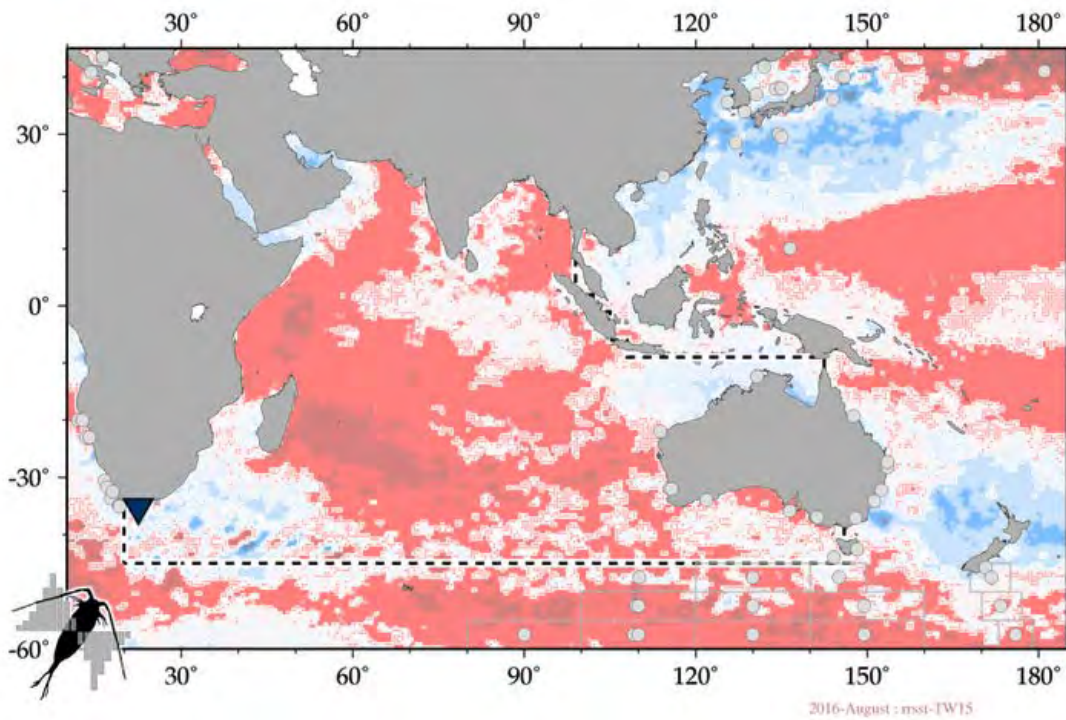
North Atlantic and Caribbean

- Species shift
- Large-scale climate drivers vs. anthropogenic forcings

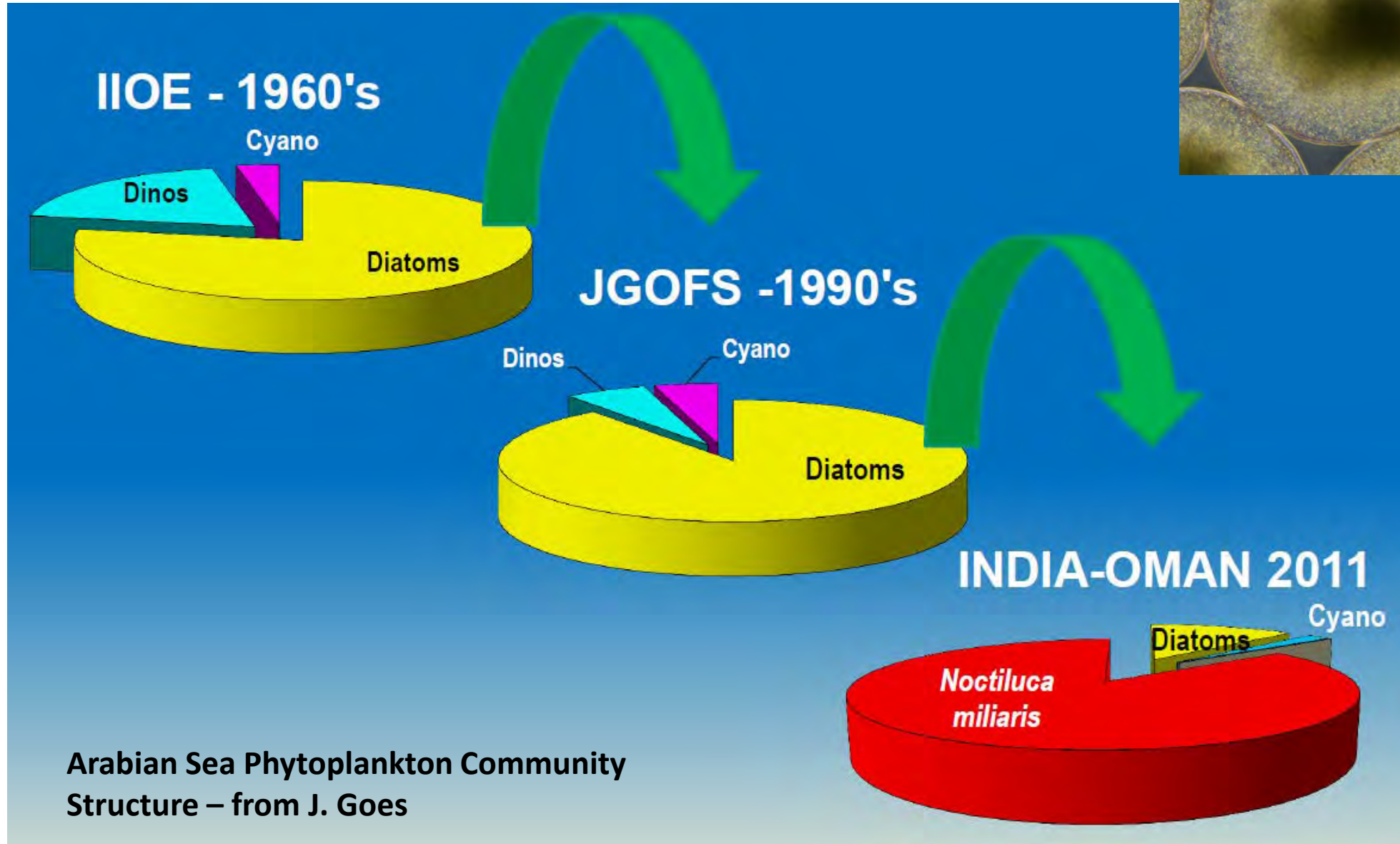
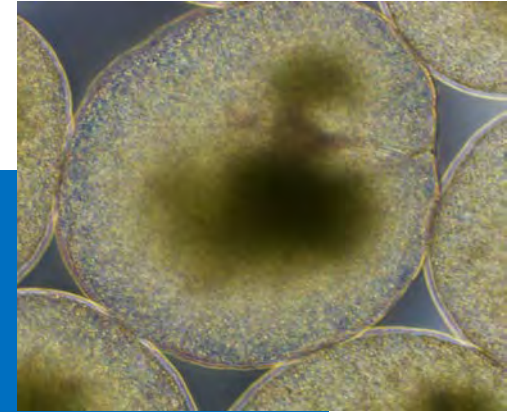


Indian Ocean

- Sustained warming
- Significant biogeochemical changes and species shift

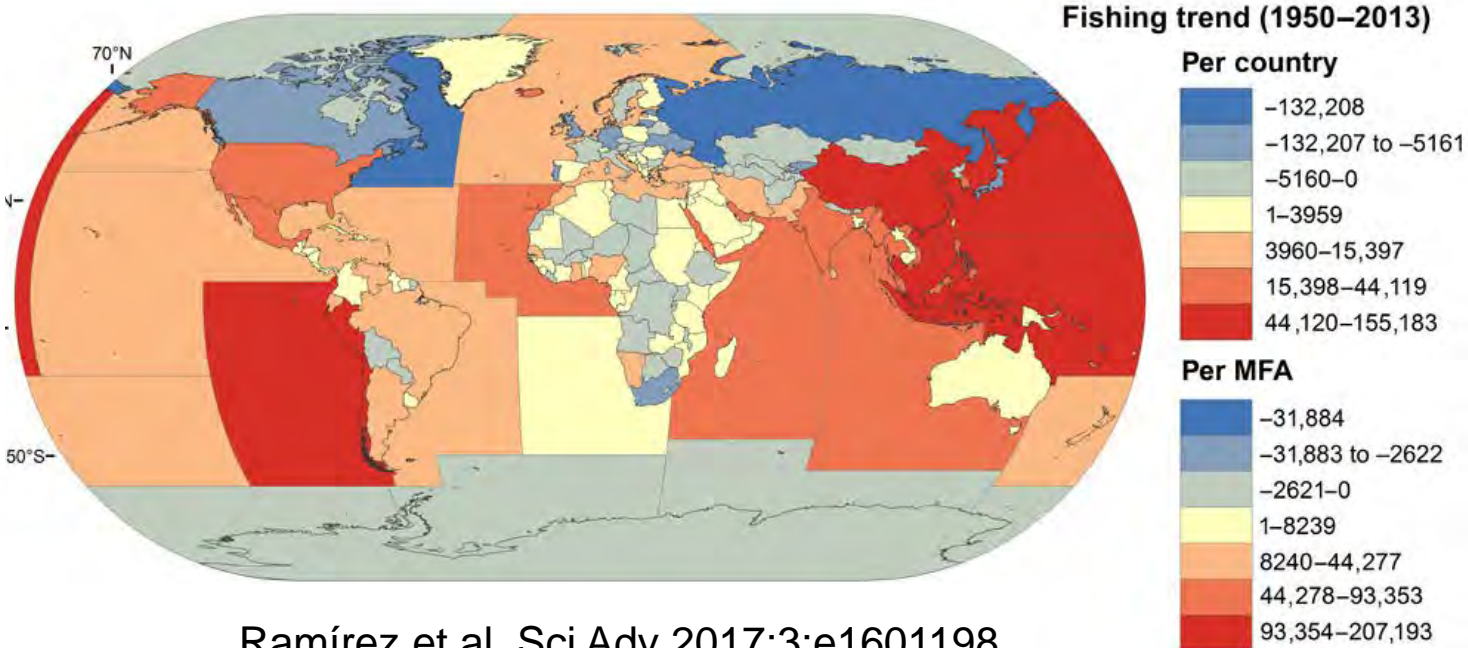


Indian Ocean



Arabian Sea Phytoplankton Community Structure – from J. Goes

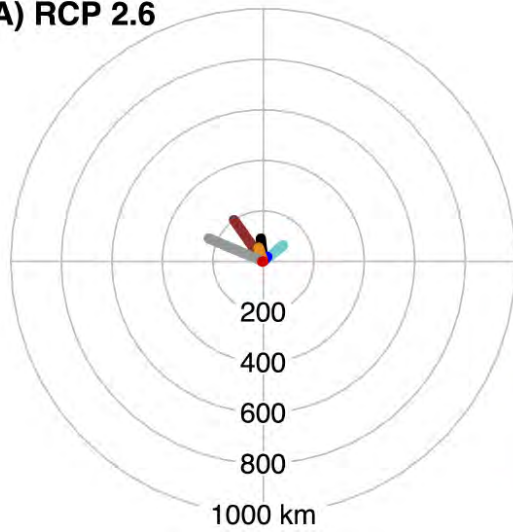
From the ocean to the table



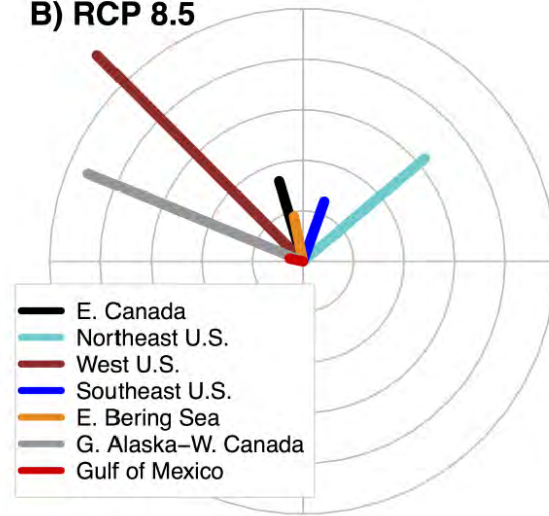
Ramírez et al. Sci Adv 2017;3:e1601198

From the ocean to the table?

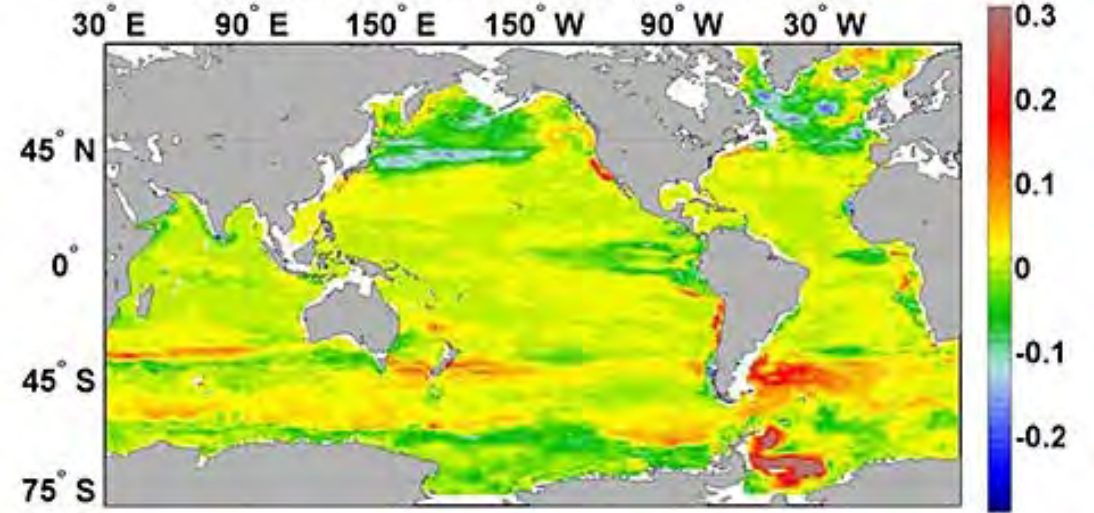
A) RCP 2.6



B) RCP 8.5

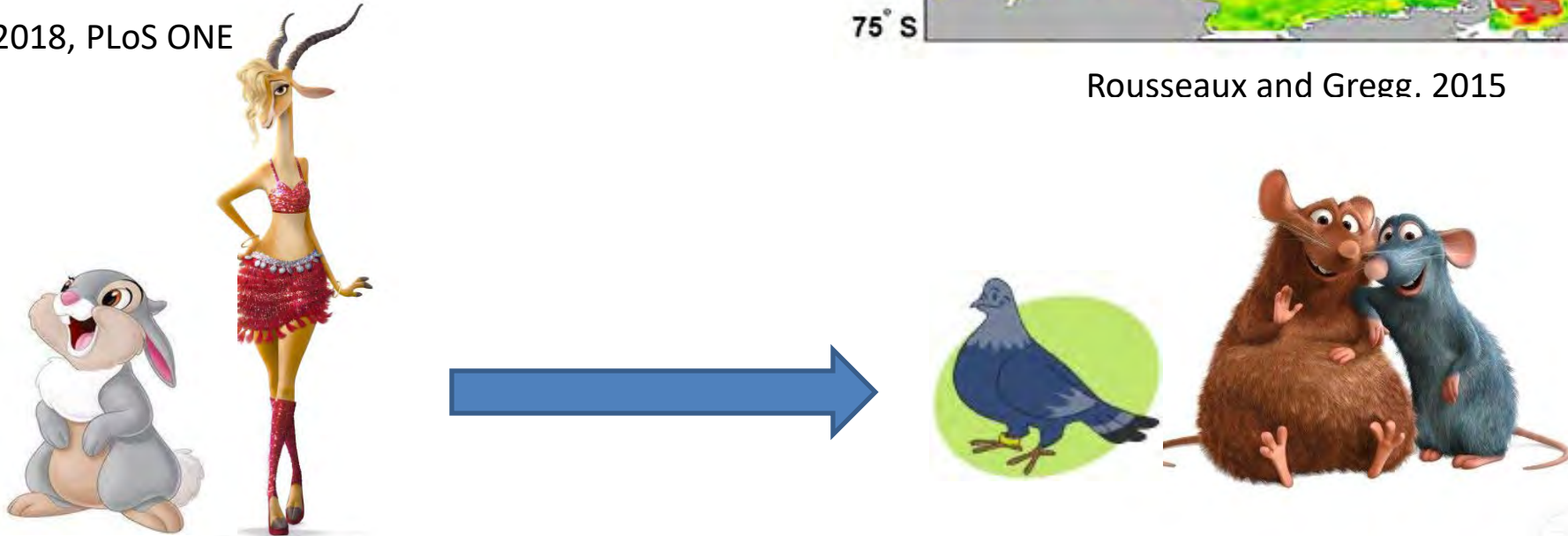


(c) Diatoms Difference (2012-1998)

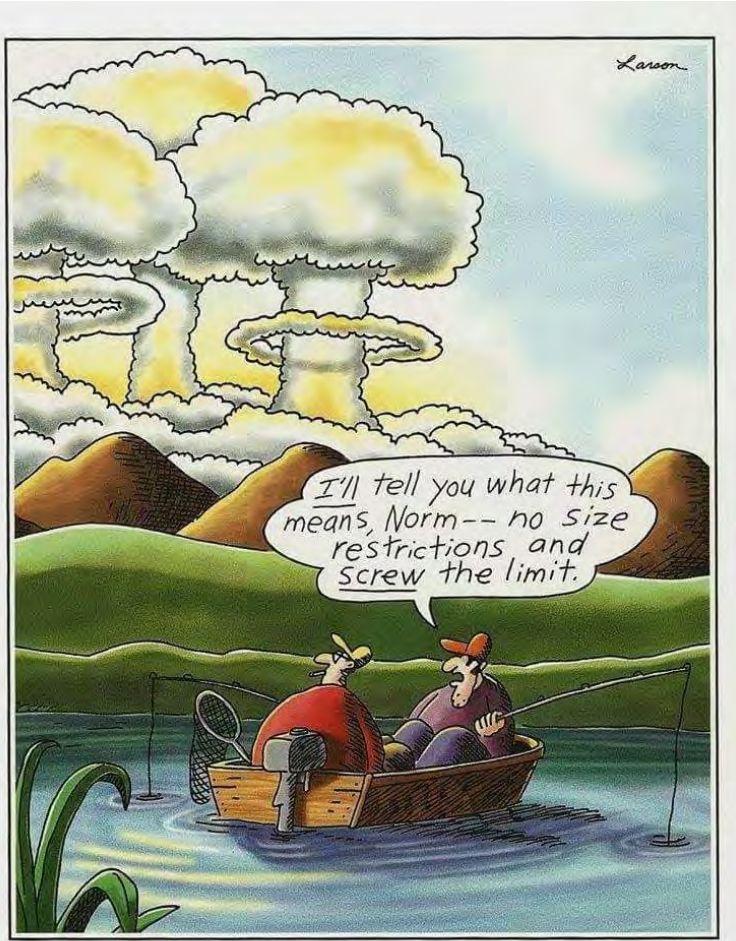


Morley et al., 2018, PLoS ONE

Rousseaux and Gregg. 2015



That was a great presentation, so what?



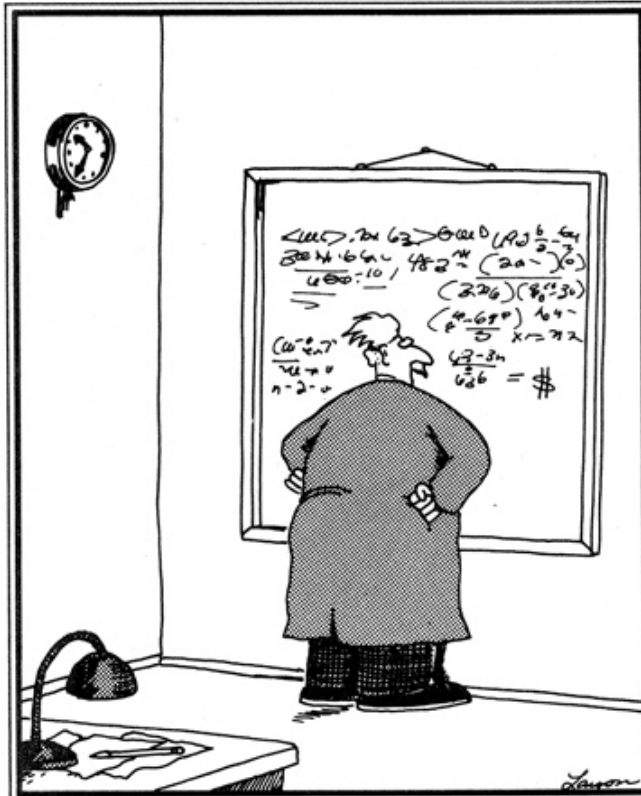
- Some things still need to be done by ship
- Science is already developing tools to draw down costs of sampling
- Why are we still struggling with funding these things, if they are so important?



"Everyone can just put down their loot and plunder, and Sven here—yes, old Sven, who was in charge of reading the tide chart—has something to say to us all."

That was a great presentation, so what?

- What can we do about it?
- Core set of measurements
- Stakeholder engagement
- Nations will choose what's best for them, not necessarily what's right
- Don't showcase just the problem; showcase alternatives



Einstein discovers that time is actually money.



That was a great presentation, so what?

- Extensive reference to ocean by policy makers
- Fit for purpose data, relevant for society/ stakeholders

