FINAL PRESENTATION GROUP4

What have we learned? (so far...)

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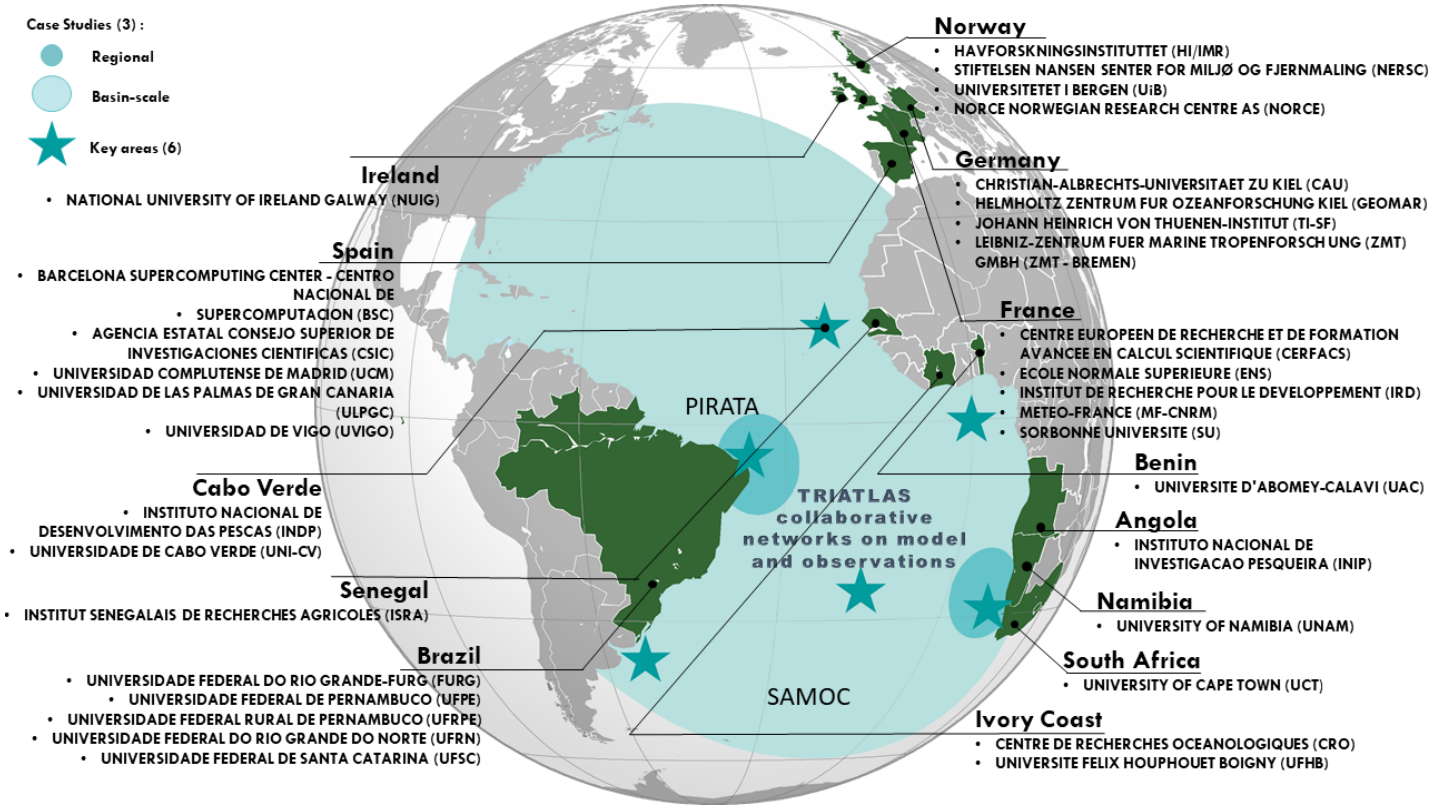
TRIATLAS OBJECTIVES

- ✓ To assess the status of the South and Tropical Atlantic marine ecosystem
- ✓ Develop a framework for predicting its future changes
- ✓ Contribute to the sustainable management of human activities in the Atlantic Ocean as a whole.



- ✓ There are **things we know we know** about the SOUTH AND TROPICAL ATLANTIC (state of knowledge!)
- ✓ There are **things we know we don't know** (to be assessed within TRIATLAS; Physical and Human drivers coming from 'different planets')
- ✓ There are things **we don't know we don't know** (for sure!)

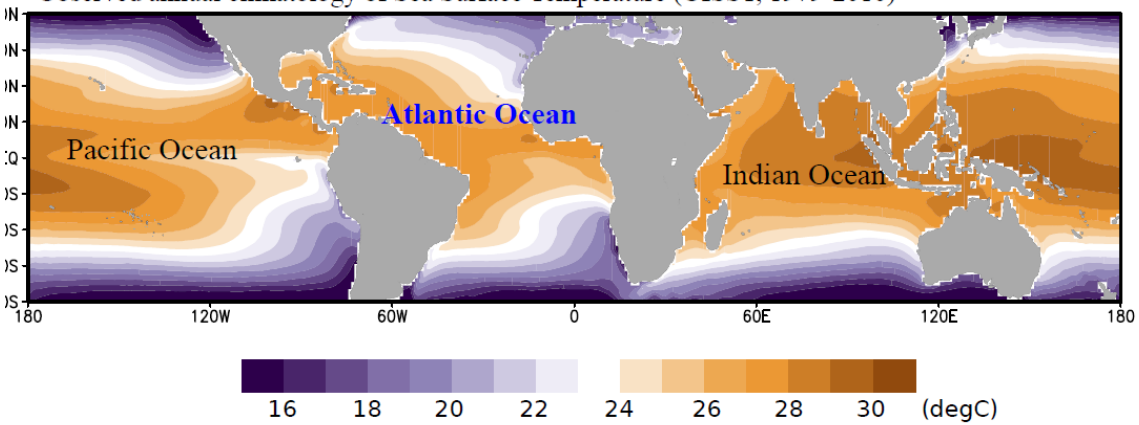
THANK YOU HANS!

We know we know about Atlantic Climate (thanks to Noel and Shunya)

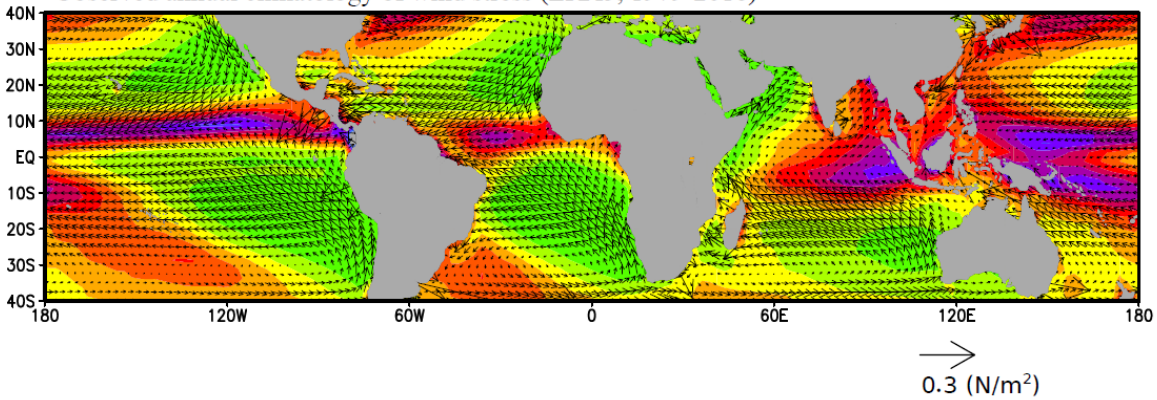
Understanding the climate of south and tropical Atlantic

Associated long term trends, shifts and variations in climatic parameters

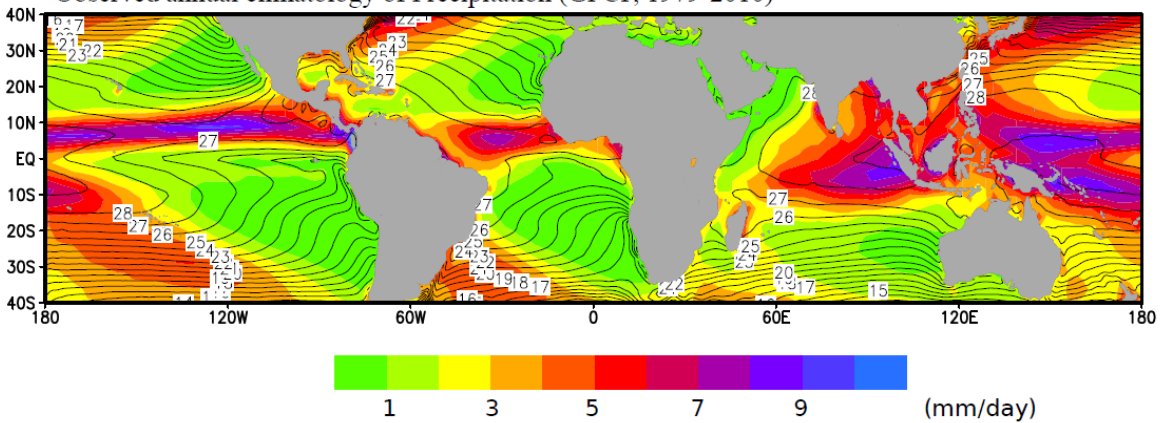
Observed annual climatology of Sea Surface Temperature (OISST, 1979-2010)



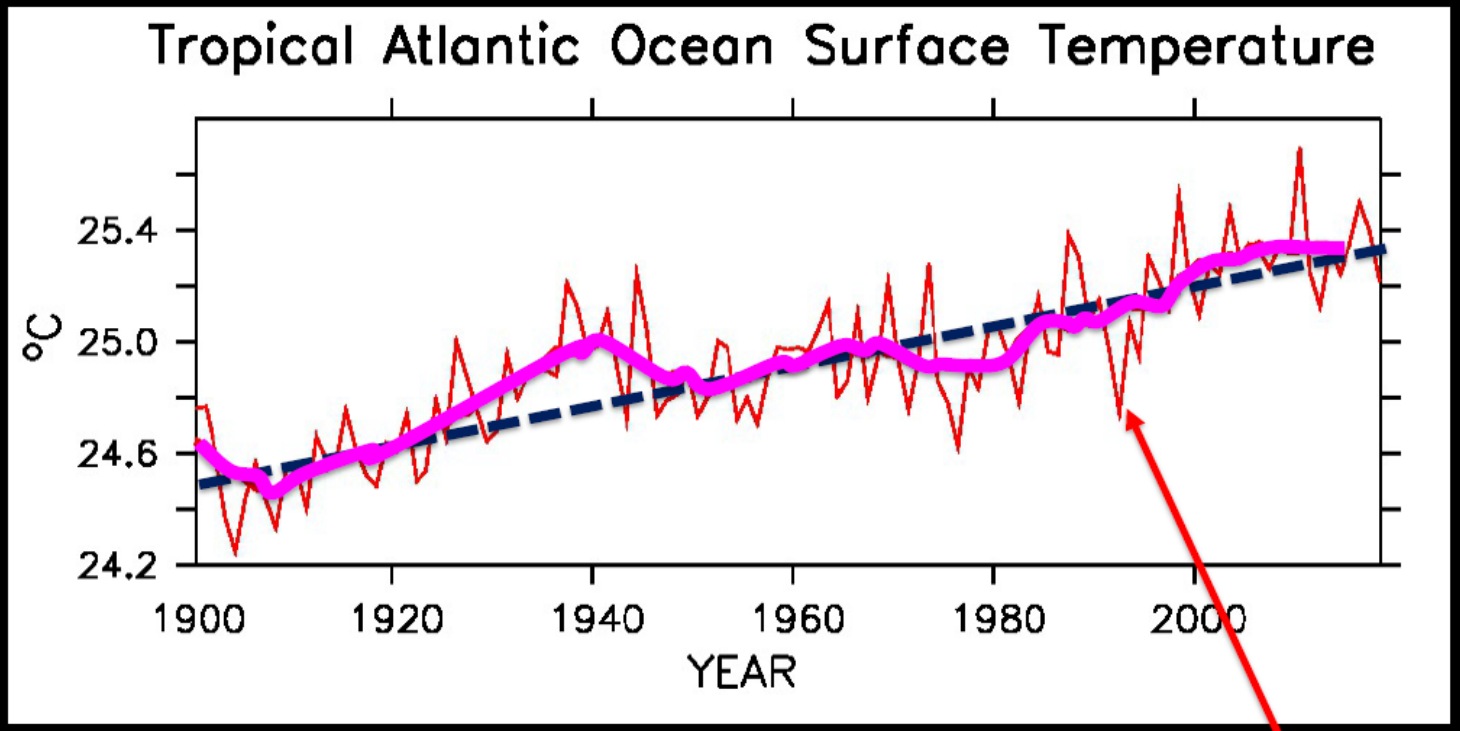
Observed annual climatology of wind stress (ERA5, 1979-2016)



Observed annual climatology of Precipitation (GPCP, 1979-2010)



Causes of short and long-term changes in climate



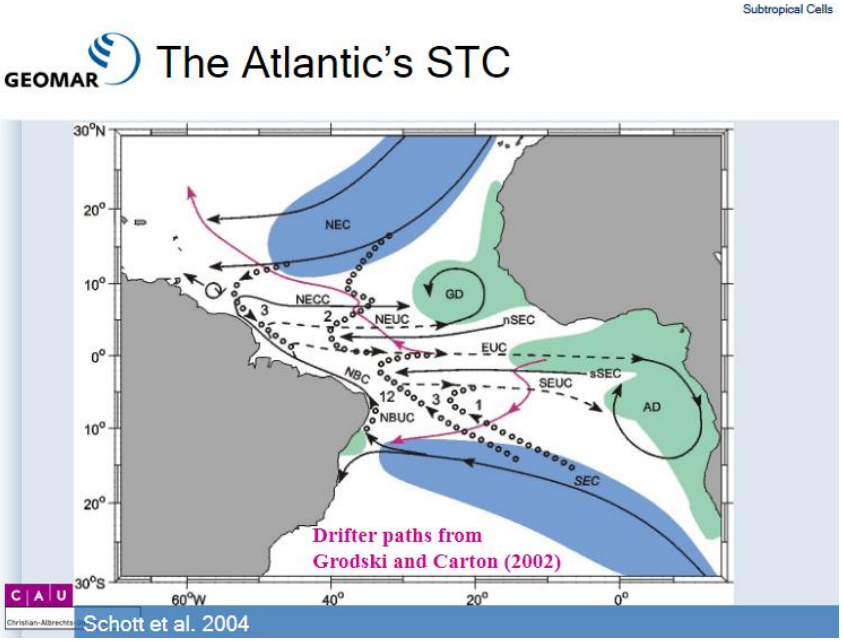
Long-term trend caused mainly by global warming

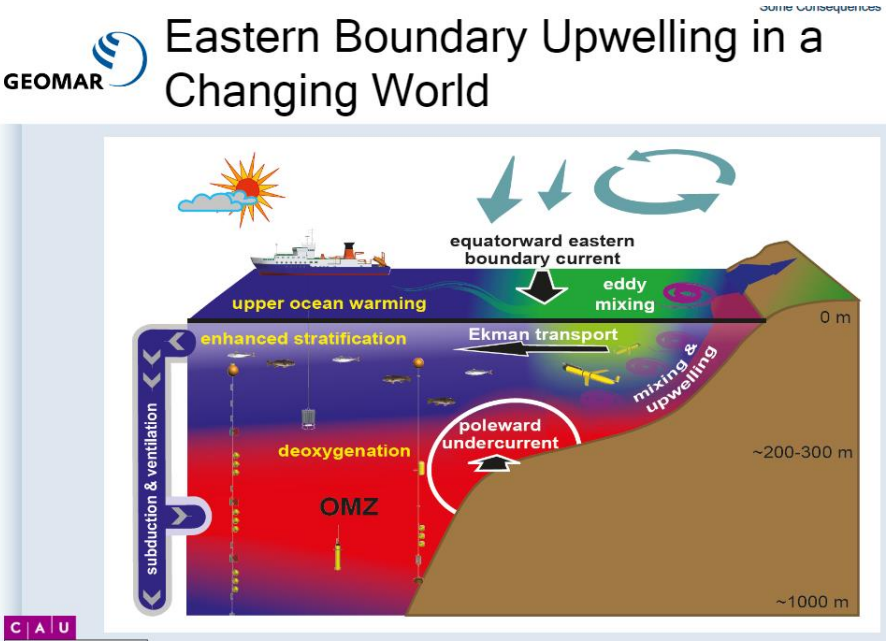
Decade to decade changes caused by both natural and anthropogenic factors

Year to year fluctuations caused by natural processes in the climate system

Things we know we know about south and tropical Atlantic circulation (thanks to Peter, Martin)

- ✓ Sverdrup transport, buoyancy, shallow overturning, Ekman transport
- ✓ Eastern Boundary Upwelling systems
- ✓ Minimum oxygen zones

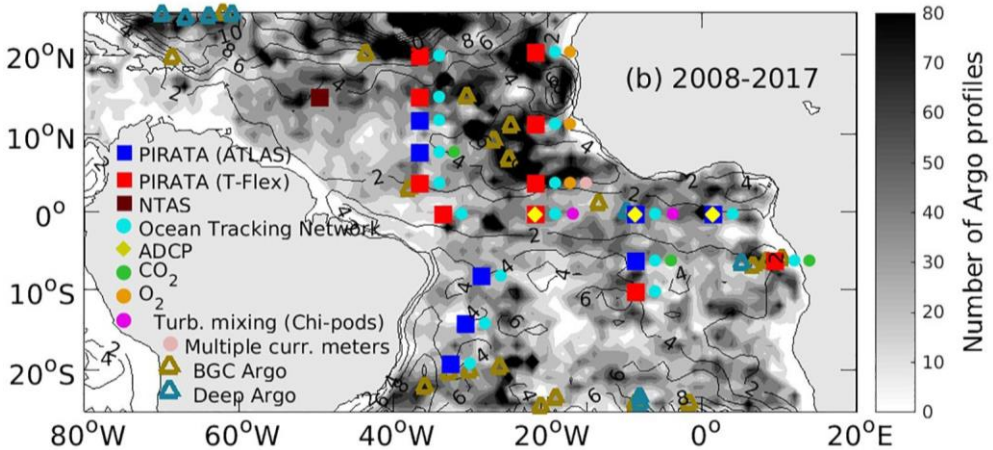


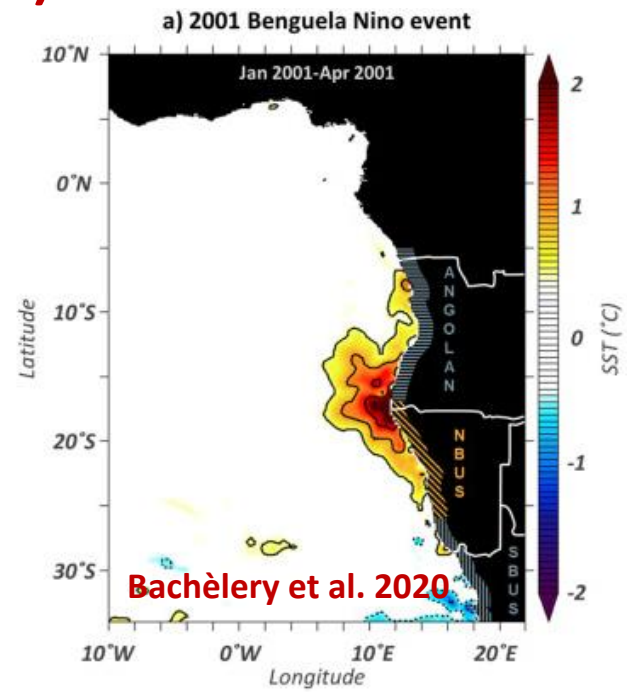


We know we know about Benguela Niños (thanks to Marie-Lou and Mathieu)

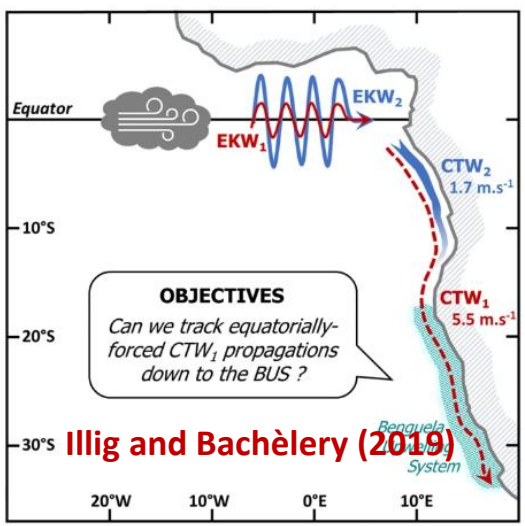
The Tropical Atlantic Observing System

Foltz et al. 2019





Bachèlery et al. 2020



Illig and Bachèlery (2019)

- ✓ A rich network of ocean observations has developed, building on (PIRATA)
- ✓ Benguela Niños: Angola-Benguela front is displaced south, causing the advection of warm, highly saline water
- ✓ Benguela Niños/Niñas are preceded by Kelvin waves – therefore **potential for seasonal prediction (fisheries, heavy precipitation)**

Things we know we know about impacts of human and environment on ecosystem dynamics and modelling (thanks to Lynne, Marta, Ralf, Fran)

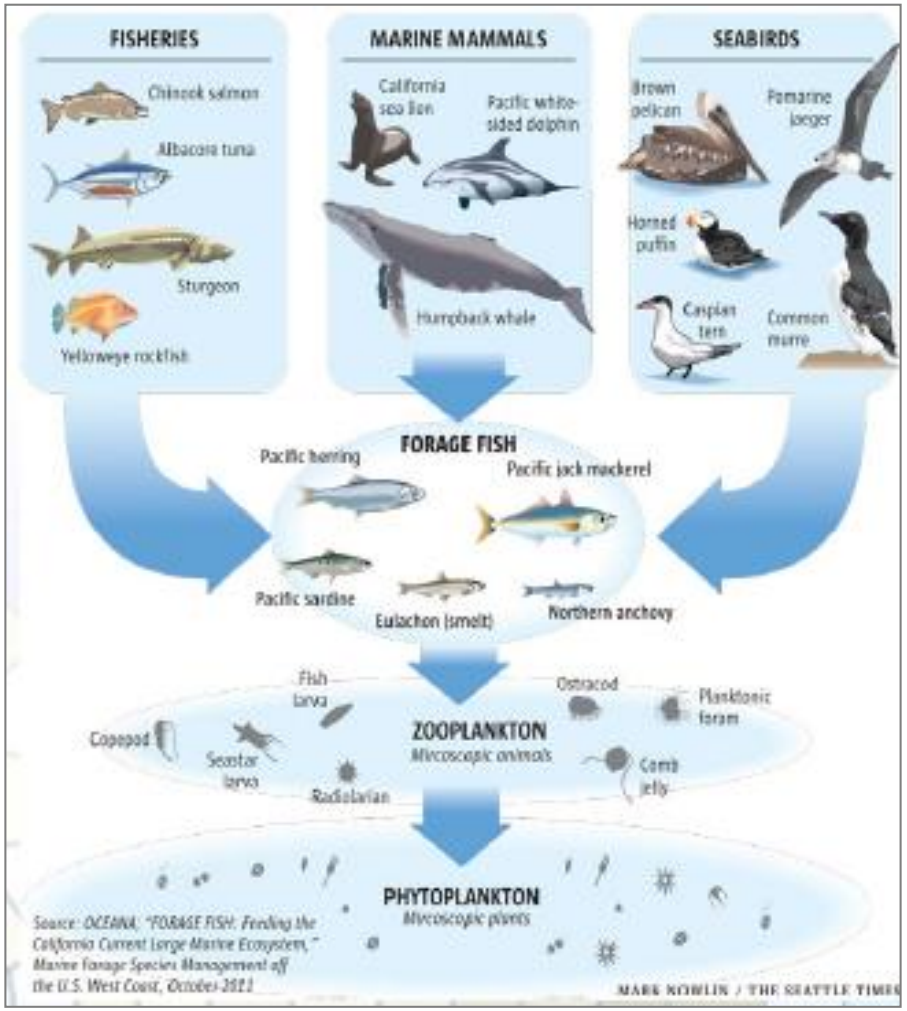
✓ **Introduction to ecosystem modelling**

- To integrate, complete and contextualize single species information
- Not to improve or replace single species assessments
- Key tool for risk assessment

✓ **Ecopath with Ecosim and Ecospace (EwE)**

Used to understand:

- Trophic patterns
- Population dynamics among predators and prey
- Ecopath with Ecosim Tuturial



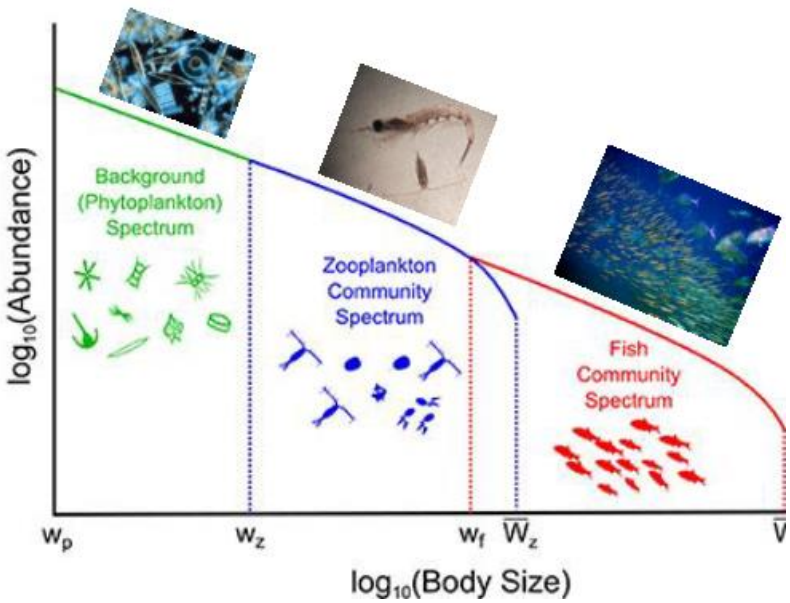
Things we know we know…

Impacts of human and environment on ecosystem dynamics

- ✓ **Understanding predation dynamics through size Spectra and Stable Isotope**
- Stable isotopes as tracers in food web
- Stable isotopes used to calculate the Predator/Prey Ratio
- Combining stable isotope and size to calculate the Trophic Enrichment

- ✓ **Spatial autocorrelations in ecosystem populations**

- Theoretical models to study ecology such as harvesting, competition and predator/prey interactions



We know that we know

Human Drivers

It is not just about science, it is about humans too...

Human indicators to support Ecosystem Approach Fisheries:
- three pillars for a sustainable development: human and ecological well-being, and ability to achieve
- How to look for a community: exposures, vulnerabilities and challenges to adapt
- approaches: Workshops and questionnaires

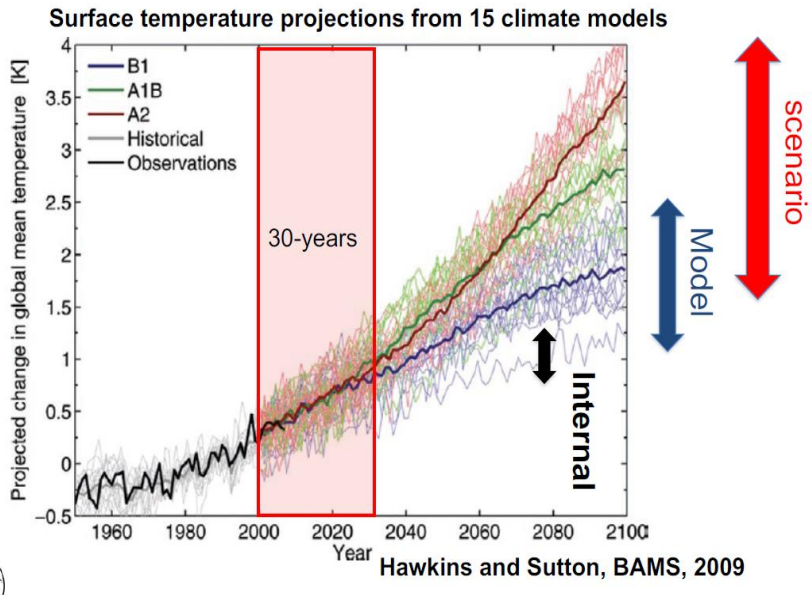
Management fisheries issues, we need to be creatives to lead with things as:
- failures of management decision institutions
- failures of implementation
- distorted incentives in fleets
- distorted communications between research and management decisions

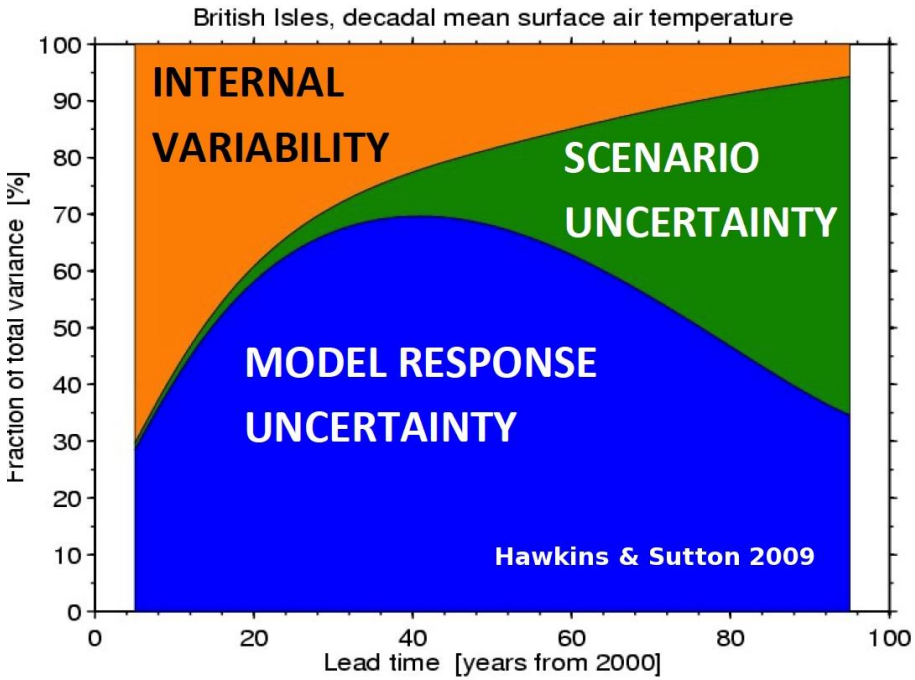
Things we know we don't know about climate science

- ✓ Observational data may be uncertain – need for more complete databases
- ✓ Reducing biases from climate models (work on progress!)
- ✓ Impacts of model coupling (ocean-atmosphere-biogeochemistry-ecosystems; drifts, correction fluxes)
- ✓ Simulation of internal variability modes (to be improved at decadal timescales)
- ✓ Scenarios (that's a different story – next slide)

Externally driven climate projections

Prediction uncertainty: scenario, model, and internal





Things we know we don't know…

HUMAN DRIVERS: FROM LOCAL TO GLOBAL (GENERAL APPLICATION)

Fisheries • Fish stocks • Aquatic Ecosystems ….are in crisis worldwide.

Engagement of diverse groups of stakeholders in decision-making processes

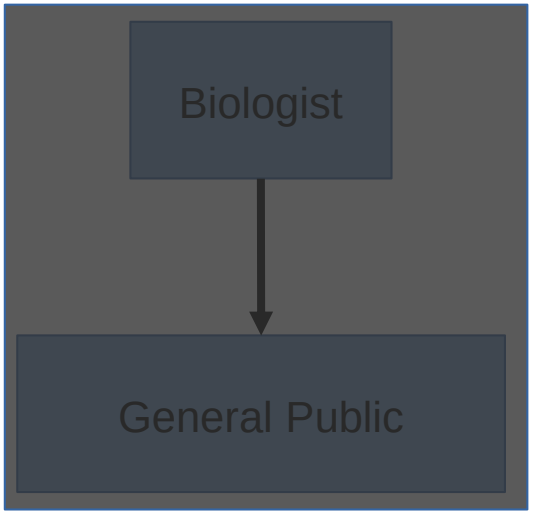
Human dimensions in SA sardine fishery
Ecological risk assessments
Ecological well-being in SA small pelagic fishery
Human well-being in SA small pelagic fishery
Human well-being in Namibian hake fishery
Penguin Pressure Model Working Group

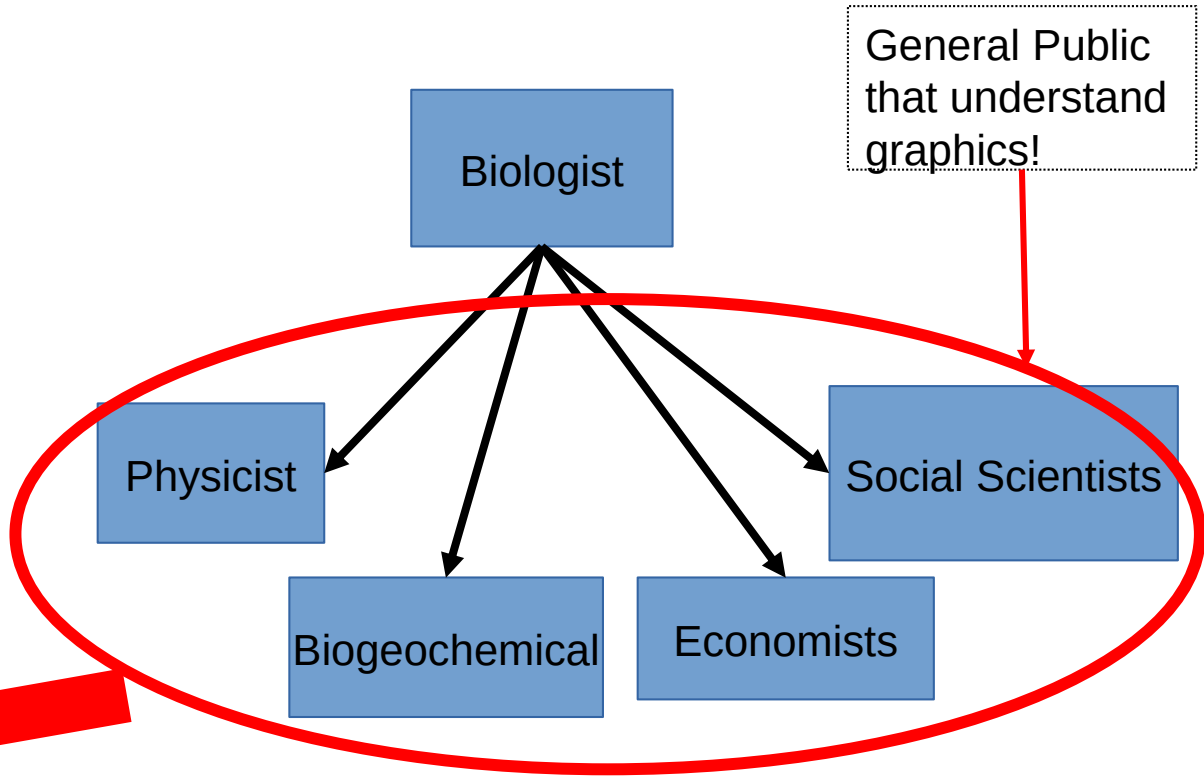
1. HOW to integrate the results in TRIATLAS Regions (South East Atlantic & Tropical Atlantic regions)???
2. Application to other TRIATLAS Regions that lack the information

We know that we don't know

INTERDISCIPLINARY COMMUNICATION IN SCIENCE

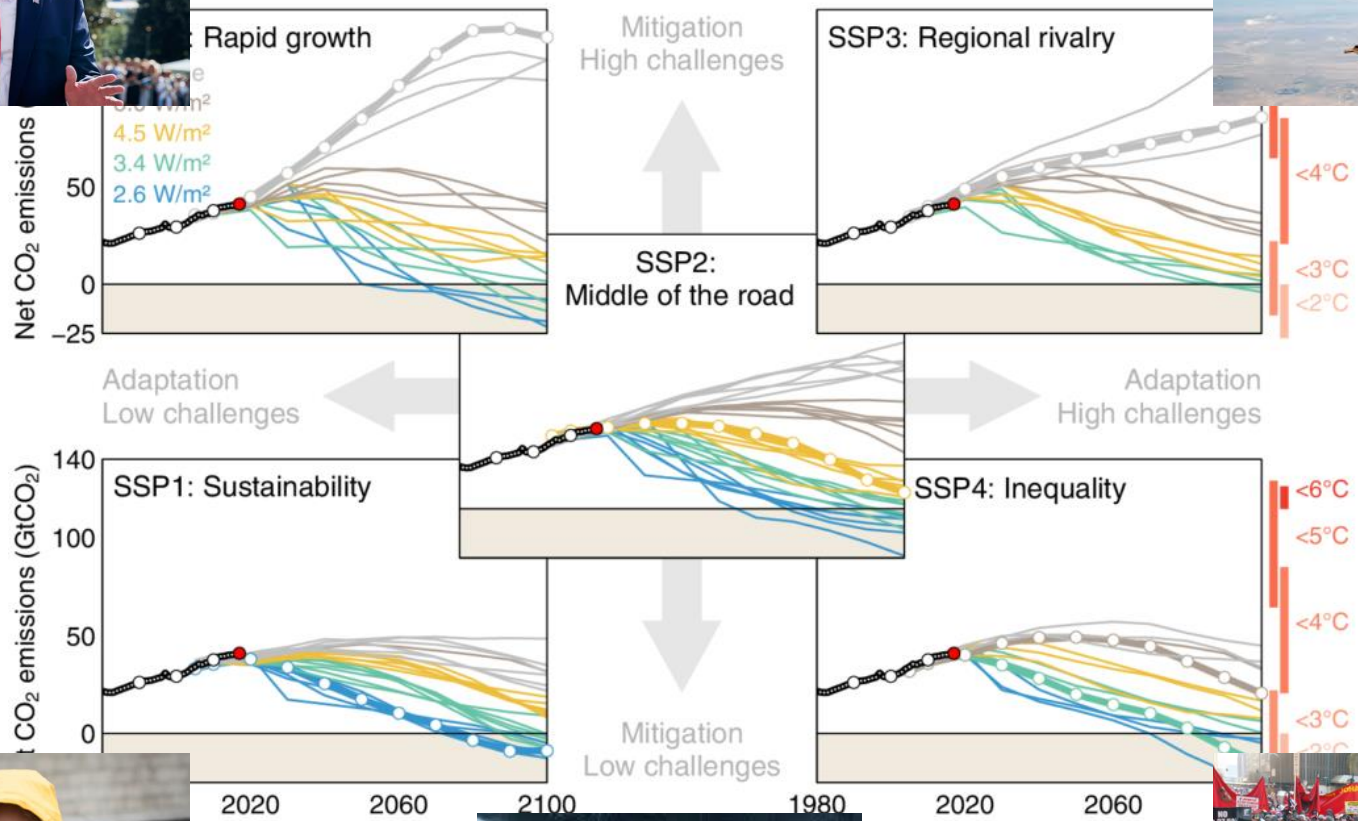
Translation of the mean goals of the presentation for an academic non-specialized public!





We need people to study and develop interdiciplinary communication.

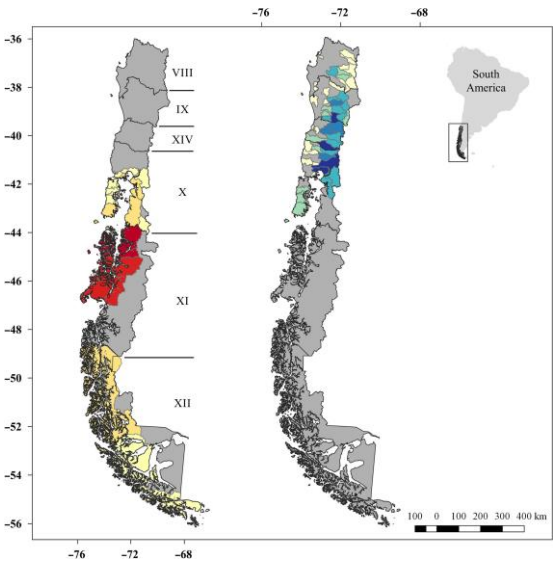
Things we know we don't know about our future society



Things we don't know we don't know

Unexpected processes and mechanisms!

EXAMPLE: The Chilean Salmon Crisis



In the mid '80s, Chile learned that their plankton-rich, inland waters were ideal habitat for salmon aquaculture – even though there were no native salmon runs. Using eggs and technology imported from the U.S. and Norway, they hatched and grew juvenile fish in local freshwater lakes.

Dozens of huge fish farms sprouted along Patagonian shores. The industry grew at a phenomenal rate averaging 25 percent per year. In 1990, Chilean farms exported nearly $100 million worth of salmon.

But aquaculture experts and environmentalists worried that they were growing too fast, taking too many shortcuts with the complex science of fish farming.

The ISA Infectious Salmon Bacteria quickly became an epidemic. Millions of fish died. The infected eggs probably came from Norway. More than 13,000 people lost their jobs.

Conclusions

What we learned!

- ✓ First of all we learned that the nature is much more complex than we can imagine.
- ✓ There is a lot of work to do and it is better to do it in team between different communities in terms of nations and scientist to get better results.
- ✓ The climate is already changing and we should try to avoid more disasters and find optimum and sustainable solutions.
- ✓ We can and should foster collaboration after all the networking done at the summer school – despite coming from “different planets”! (quoting Astrid...)