POGO-16 meeting, Sta. Cruz de Tenerife (Spain), 26-29 January 2015

Enhancing visibility of and access to long-term data

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UN OCÉANO, UN FUTURO

1914-2014 I CENTENARIO INSTITUTO ESPAÑOL DE OCEANOGRAFÍA

Premises:

- an observation not made today is lost forever
- existing observations are lost if not made accessible
- the collective value of data sets is greater than its dispersed value
- open access to standardised time series data must be pursued as a common, coordinated international goal

Ship-based biogeochemical and ecological time-series

- one of the most valuable tools to characterize and quantify:
  - **ocean carbon fluxes**
  - **biogeochemical processes**
- long, temporally resolved datasets needed to characterize:
  - ocean climate
  - biogeochemistry
  - ecosystem change
- **local** relevance but …
- insights on linkages between climate variability and ocean biogeochemistry at **regional, basin and world ocean scales** can be gained from several time-series geographically distributed

Main breakthroughs in:

- understanding variability
- trophic dynamics and interactions
- role of biology in ocean carbon cycle
- new understanding of impacts on biodiversity
- biogeochemical modelling

Future of time-series is in:

- detecting climate change
- new process understanding and new technology development
- advanced analysis

Henson (2014) Phil Trans R Soc A
Mieszkowska et al. (2005) MBA Occassional Publications

Challenges :

- **no substitute** exists for adequate observations
- **models** will evolve and improve, but, without data, will be untestable
- **repeated and multiple uses** of time-series observations:
    - adequately **sampled**
    - carefully **quality controlled, archived and accessible** data
- financial and scientific **support**: long-term investment but sustained short-term action required
- active **engagement of research and monitoring** components

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

IGMETS

International Group for Marine Ecological Time Series

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

Institutions:

IOC-UNESCO, ICES, IOCCP, OCB, NOAA

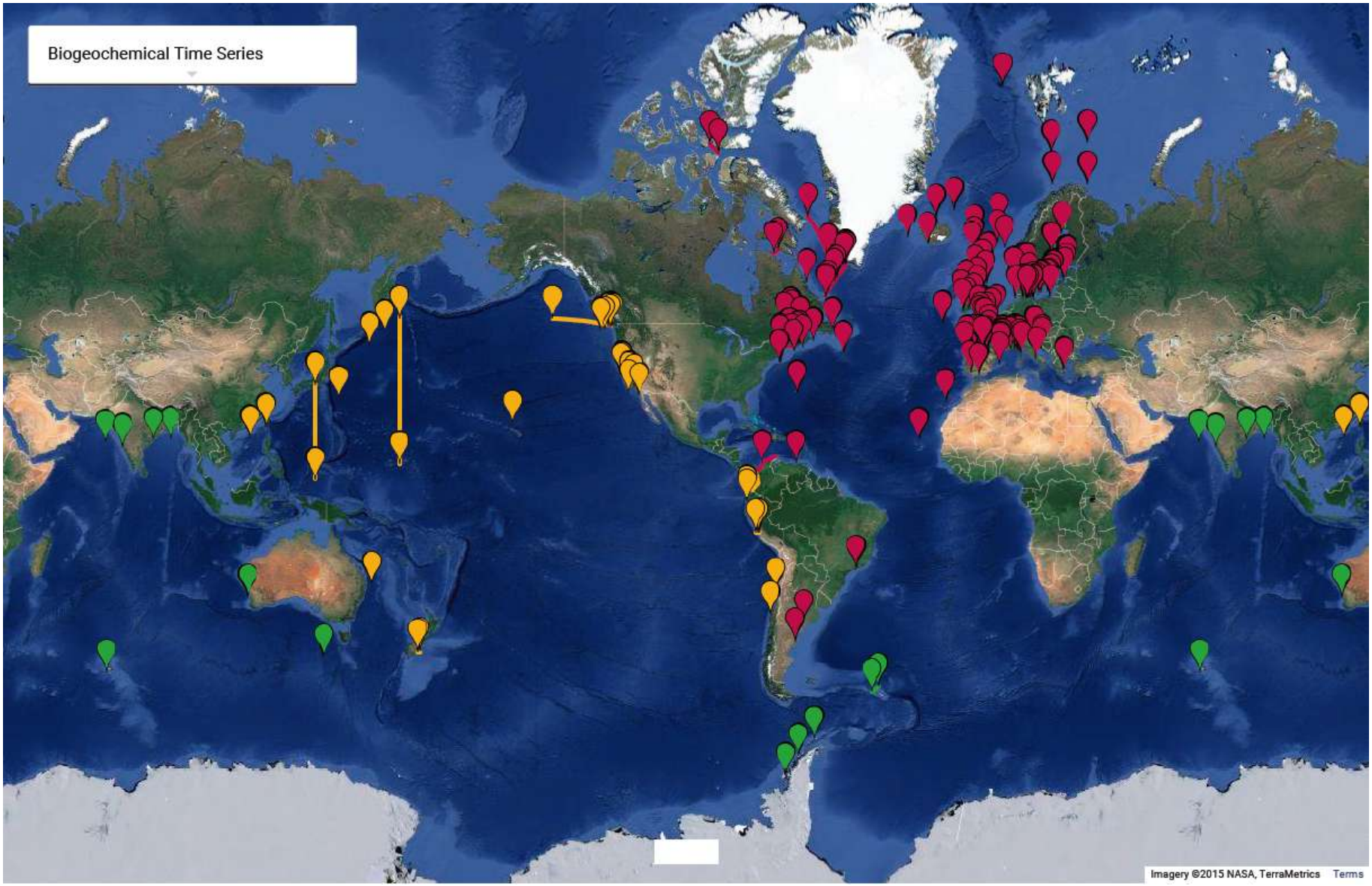
Current members:

10 representatives of institutions involved in the compilation of ship-based, biological and biogeochemical time series


UNESCO

Background:

- Compilation of metadata of shipboard biogeochemical long term observations (ocean time-series) by IOC in IOCCP and OCB Programmes
- **Aim:** standardizing sampling and analytical protocols for key biogeochemical parameters being measured across sites
- Workshop in 2012 (33 time-series represented)
    - = international network of shipboard biogeochemical time-series sites
    - = catalogue and map

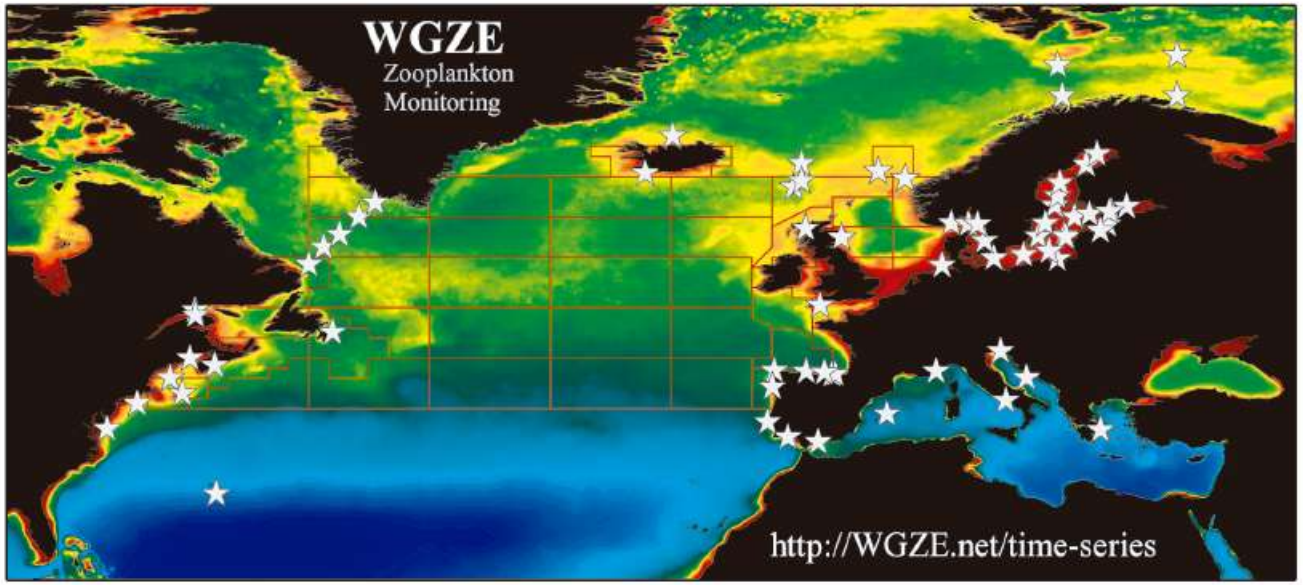

Biogeochemical Time Series
Imagery ©2015 NASA, TerraMetrics
Terms

The ICES experience:

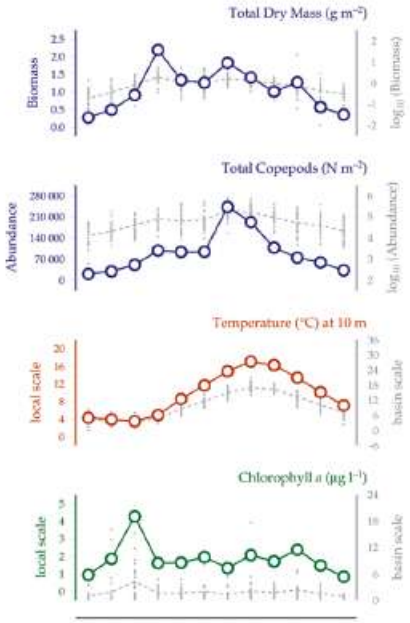
hydrography

zooplankton

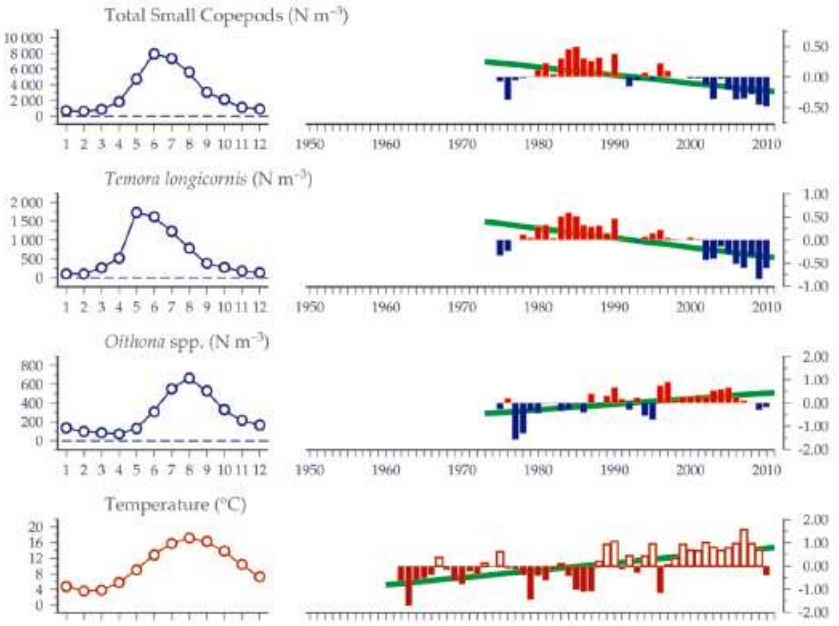
phytoplankton and microbes



Seasonal Summary Plot



Multiple-Variable Comparison Plot



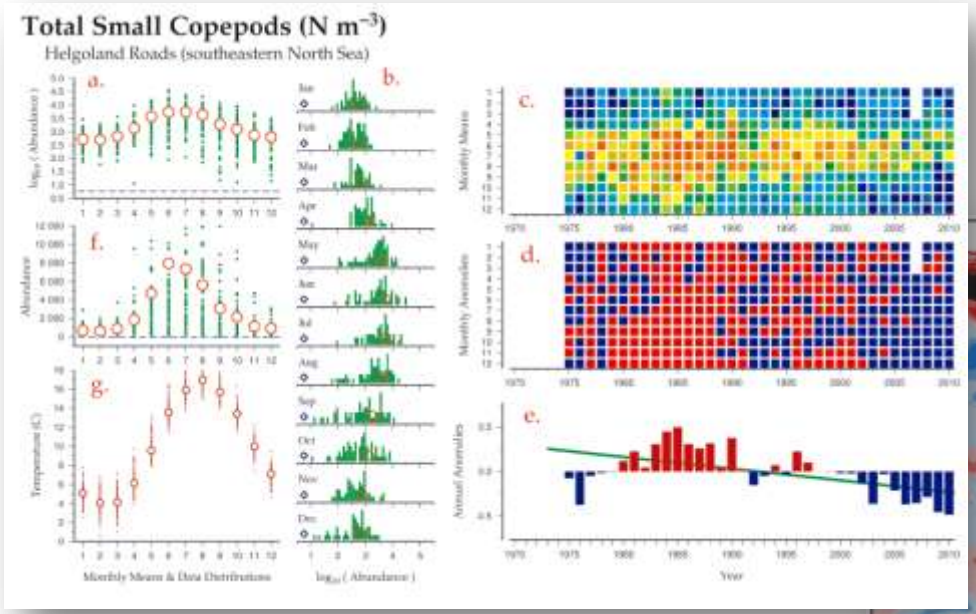
IGMETS Objectives:

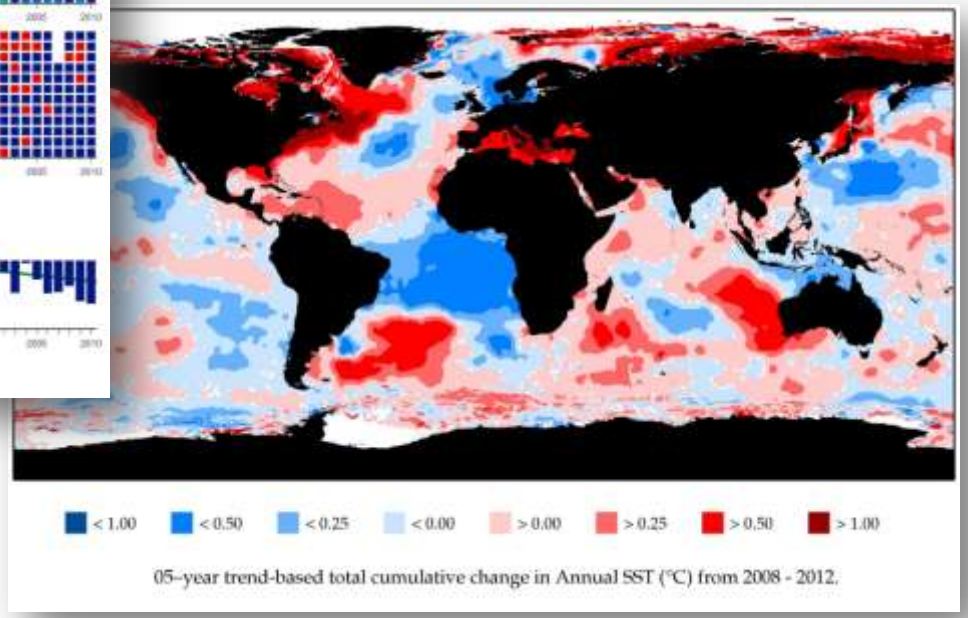
- look at holistic changes within different ocean regions
- explore plausible reasons and connections at a global level
- highlight any locations of especially large changes that may be of special importance

This compilation will facilitate better coordination, communication, and data intercomparability among time-series.

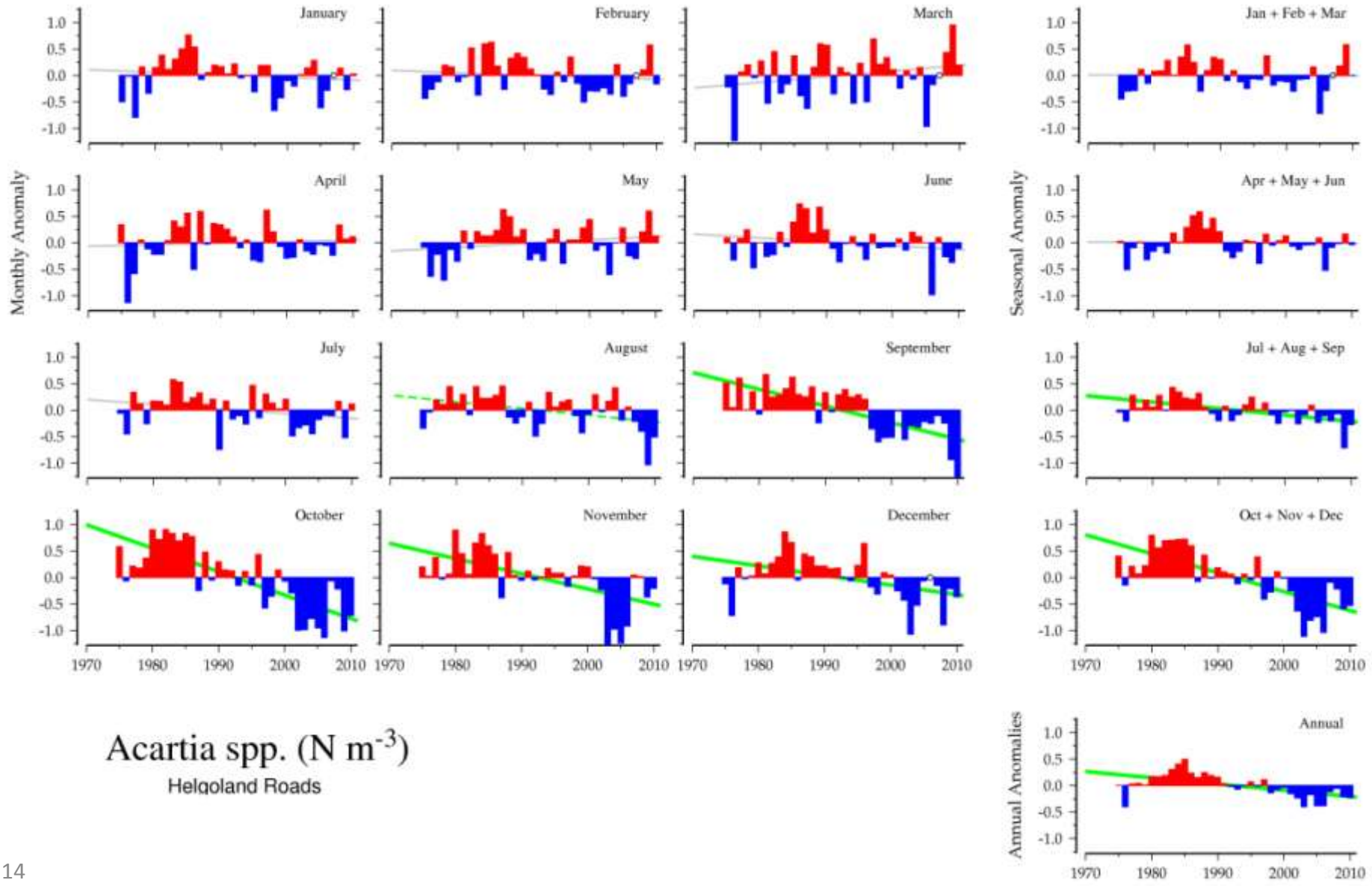
Methods:

Integration of a suite of in situ biogeochemical variables from time-series stations, together with satellite-derived information





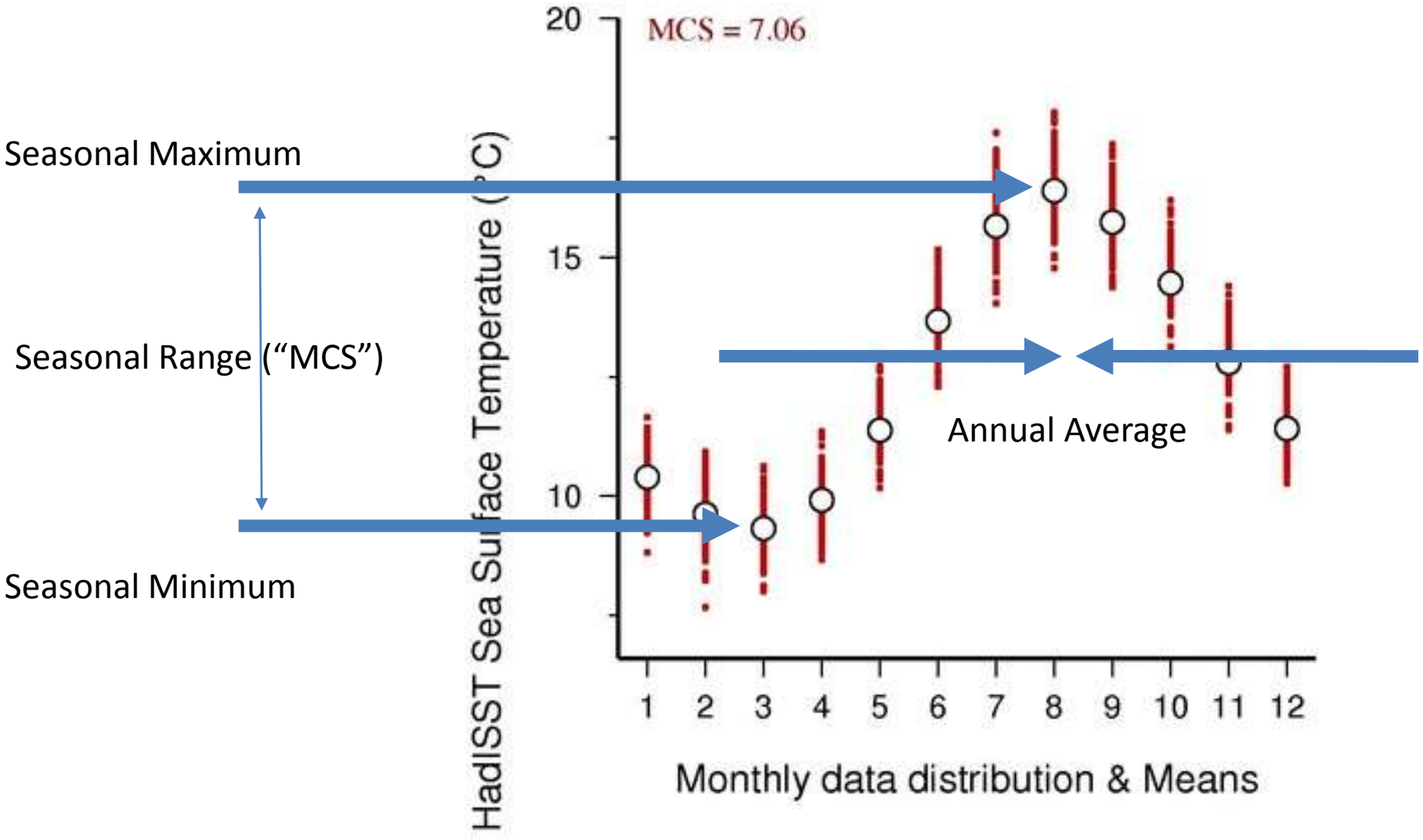
Month-based interannual trends … (and seasonal and annual trends)



Acartia spp. (N m^{-3})

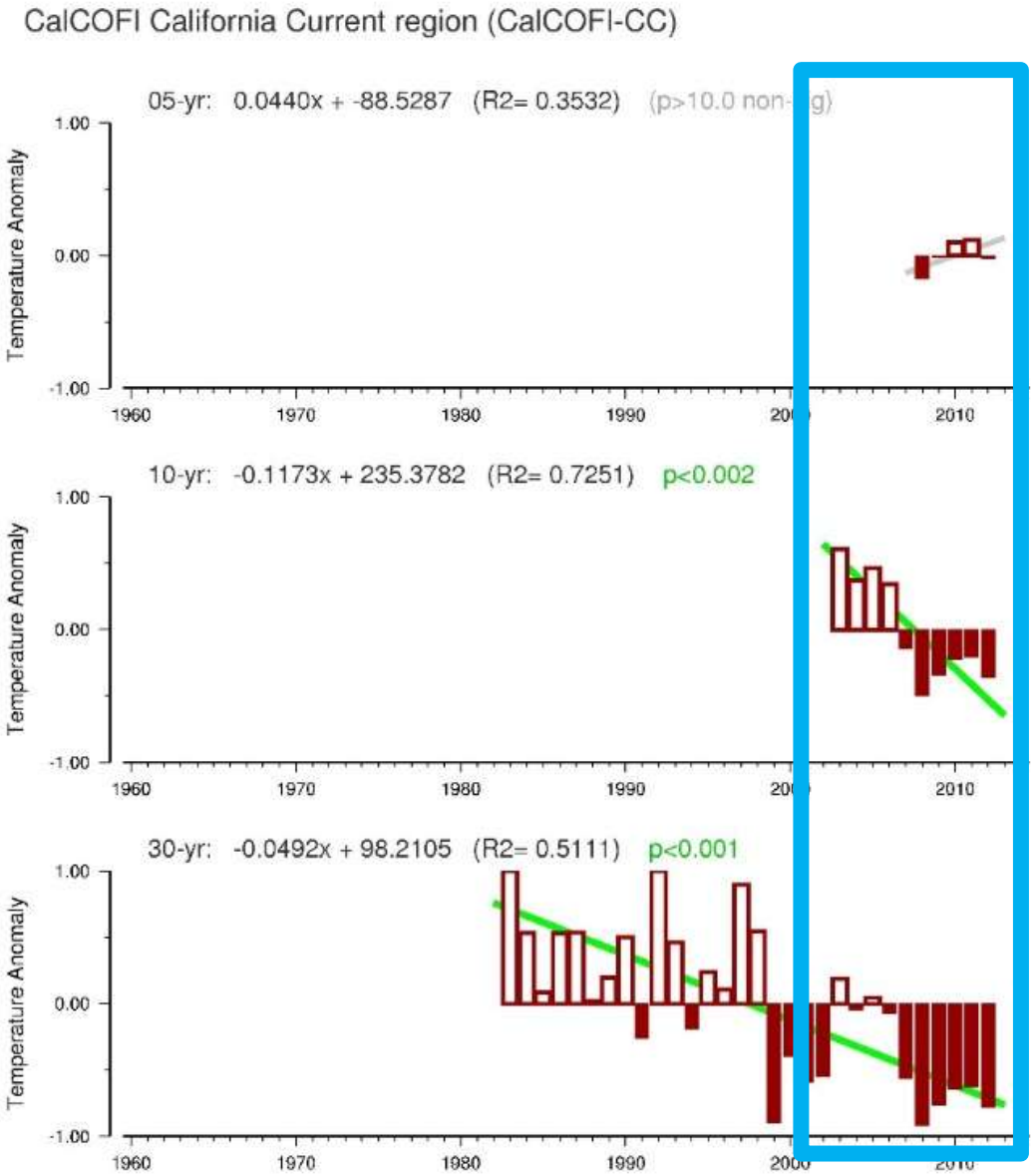
Helgoland Roads

Dealing with seasonality:



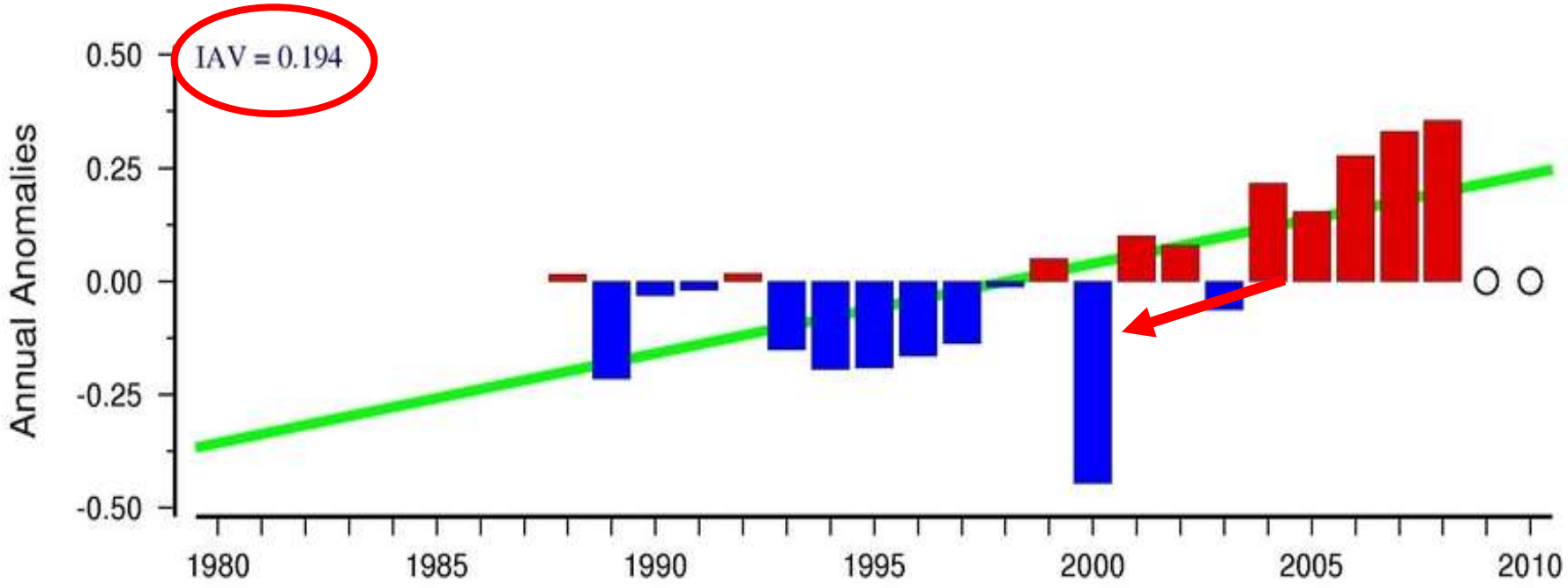
“Time Window Anomalies”

- 5-year Window
  - 2008-2012
- 10-year Window
  - 2003-2012
- 30-year Window
  - 1983-2012



Comparing time-series and time-windows:

IAV = Root Mean Squares (RMS) of the annual anomalies



IGMETS Roadmap:

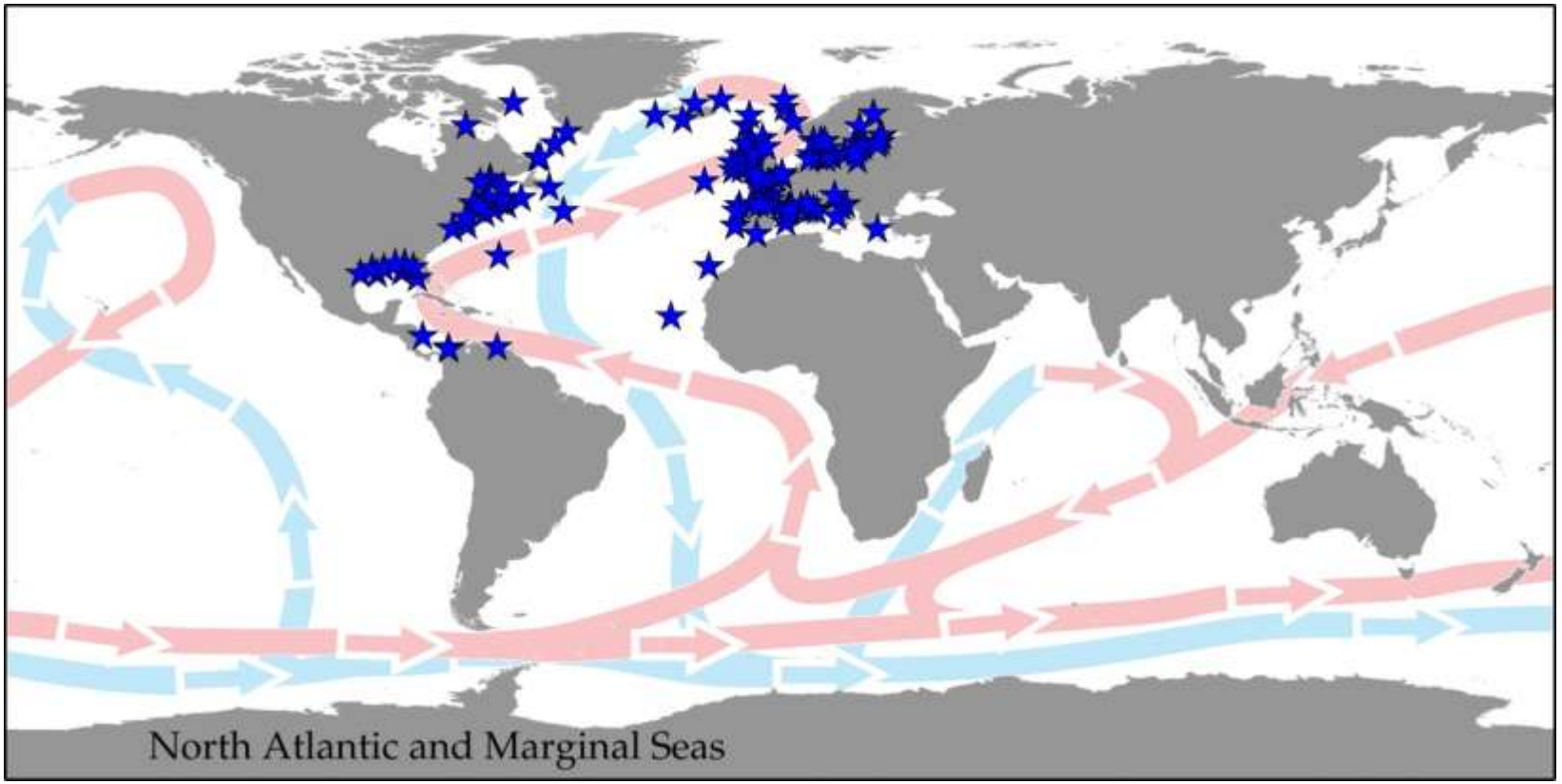
Year	Month	Task	Dissemination
2014	March	Creation of expert group, Initial design	design of dissemination strategy
	April	Contact Time-Series	start drafting dissemination articles and presentations
	December 2014	Review of report structure and design of chapters	review of article drafts
2015	January	Contact Time-Series (cont.)	Nature Geoscience article draft, Estuaries article draft
	February	Start drafting of report	AAAS meeting (San Jose, CA, USA)
	March	Draft of chapters (cont.)	III Symposium on Climate Change on the Ocean (Santos, Brazil)
	April	First Draft of Chapters – call for comments	
	June	Second Draft of Chapters – call for comments	World Oceans Day & IOC Assembly (Paris)
	July/August	Finalize drafting report & external review	OCB workshop
	September	Last revision of the report	ICES ASC (Copenhagen)
	October	Report printed	PICES meeting

Sections of IGMETS Report:

North Atlantic and Marginal Seas

Antonio Bode et al.

The series:



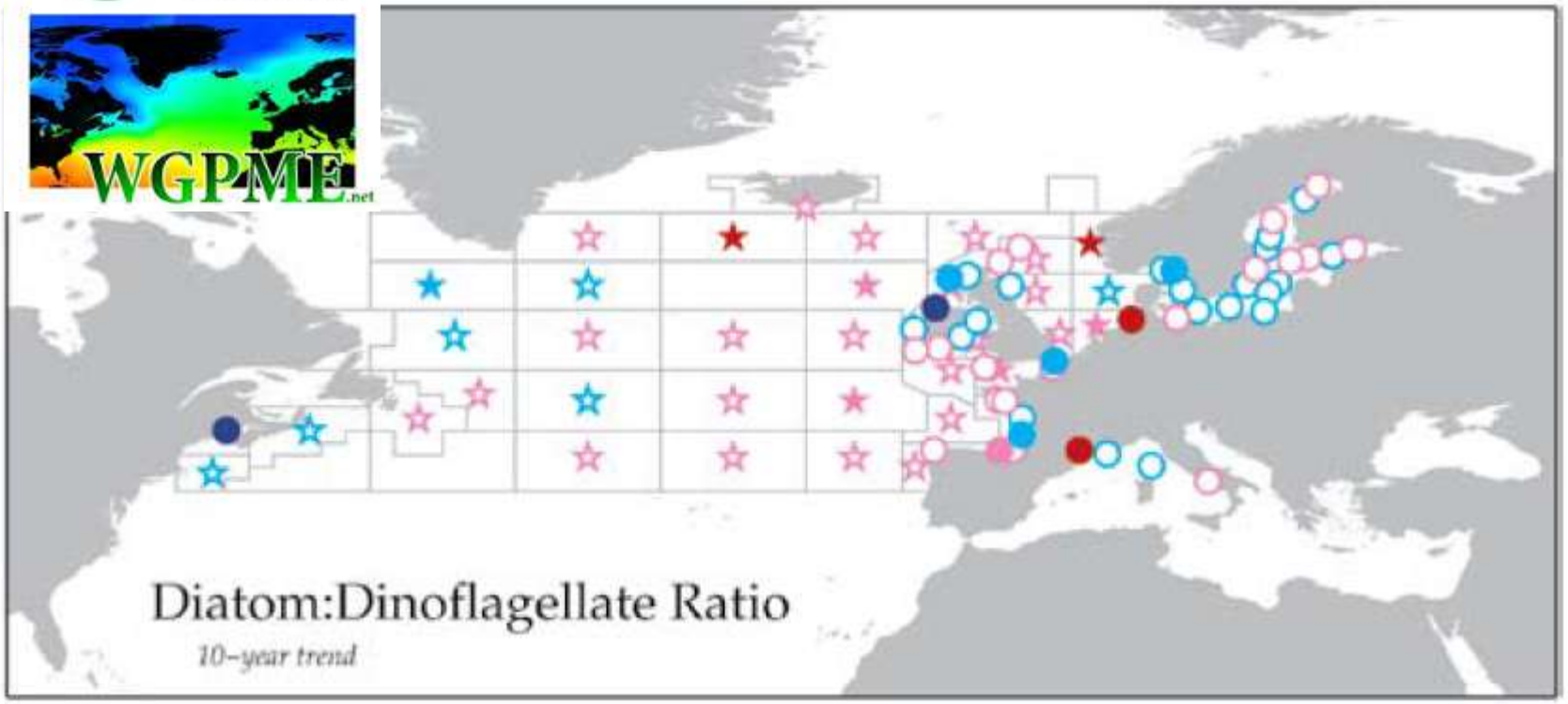
What do we expect?

Lessons learned from *in situ* time-series (plankton and/or ecosystem):

- Phytoplankton: (CPR, ICES WGPME, ICES CRR Climate Change)
  - diatom / dinoflagellate changes
  - phenology (mostly N Sea)
  - biomass & production (coastal)
- Zooplankton: (CPR, ICES WGZE)
  - poleward migrations (copepods)
  - changes in total abundance & biomass (mostly copepods)
  - changes in jellyfish (Mediterranean, Black Sea, N Atlantic)
- Biogeochemistry: (BATS, ESTOC, PAP, RADIALES)
  - upwelling (NE Atlantic)
  - regime shifts (N Sea, Bay of Biscay)
  - export (deep waters)
  - eutrophication (coastal waters)
  - N fixation (subtropical ocean)

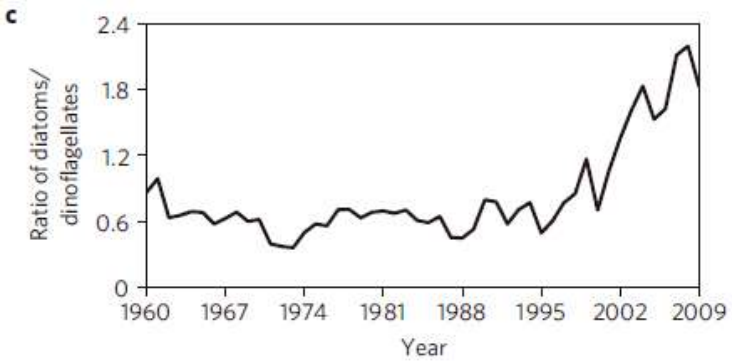
Phytoplankton

Phytoplankton functional groups



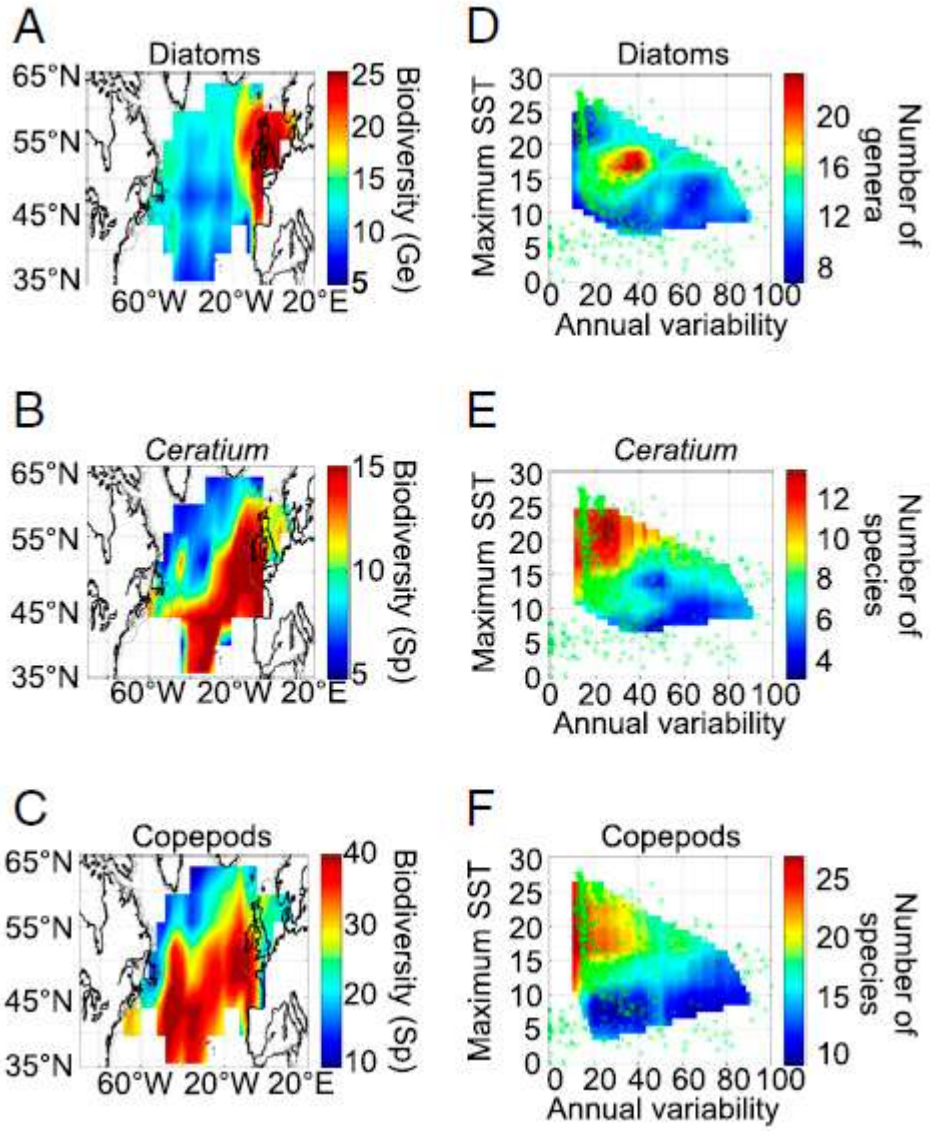
O'Brien et al. ICES CRR 2012

Phyto- and zooplankton diversity changes



Hinder et al., Nature Climate Change 2012

CPR

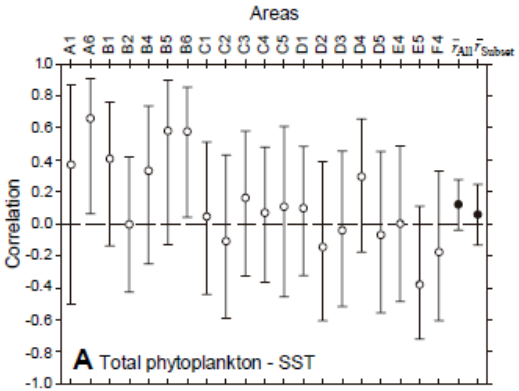


Beaugrand et al., PNAS 2010

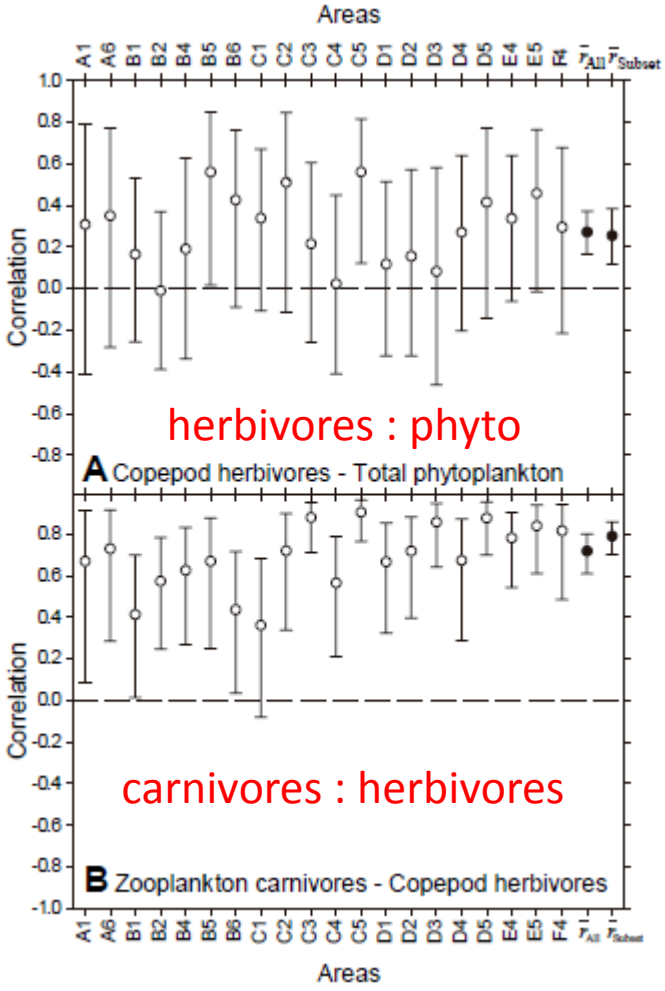
Phenology:

Phyto- and Zooplankton

CPR

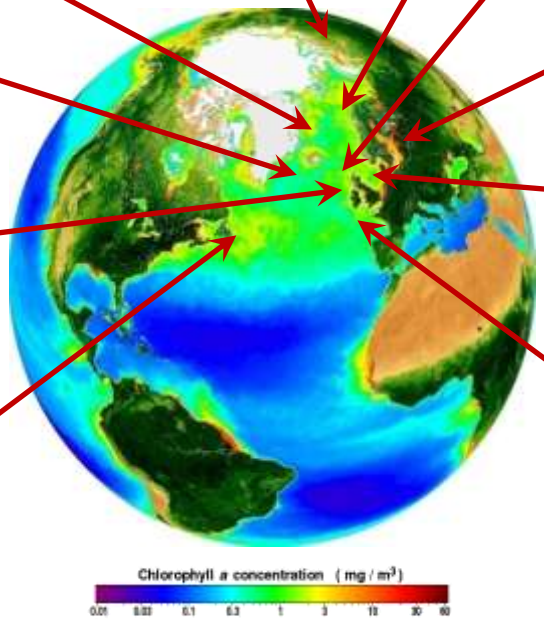


SST : phytoplancton



Richardson & Schoeman Science 2004

Primary production (and biomass) trends



Norwegian Sea (=) (1991-2008)

Barents Sea (+) (1957-2008)

Färoe I. (=) (1990-2007)

Greenland & Iceland (+) (1994-2009)

NE Atlantic (-) (+) (1958-2004)

Baltic Sea (=) (-) (+) (1950-2007)

North Sea (=) (+) (1947-2007)

Celtic Sea (=) (+) (1960-2003)

NW Shelf (+) (=) (-) (1978-2007)

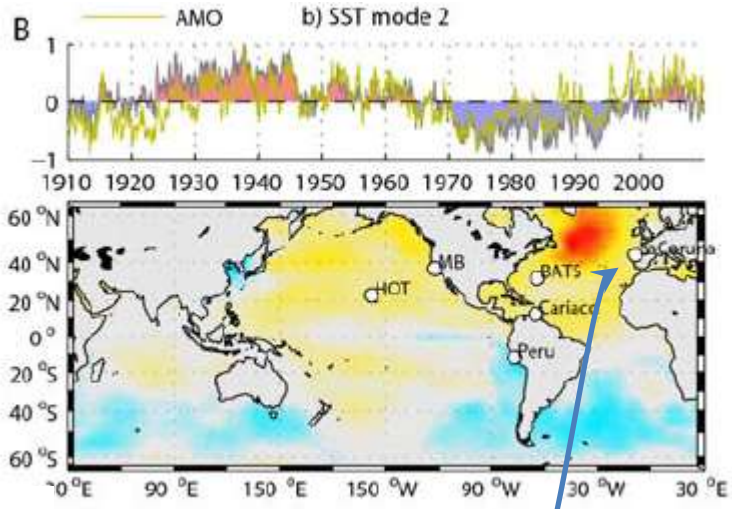
SE shelf (=) (+) (1958-2006)

(including satellite data)

Compiled from info in Bpde et al., ICESCRR 2011

Primary production (and biomass)

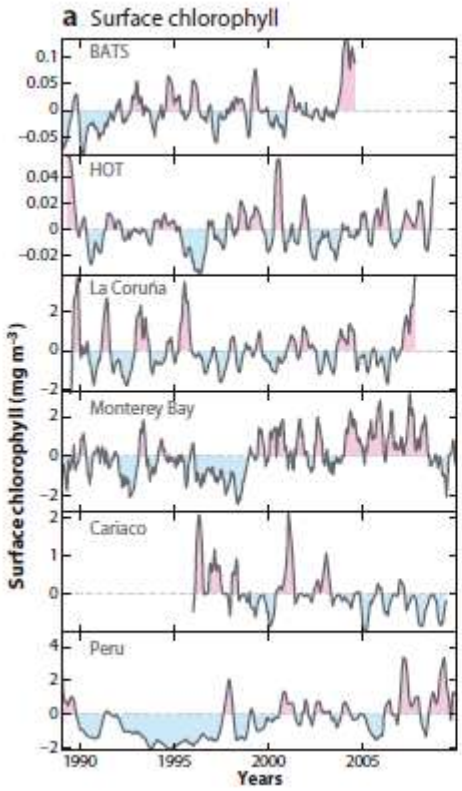
temperature anomalies

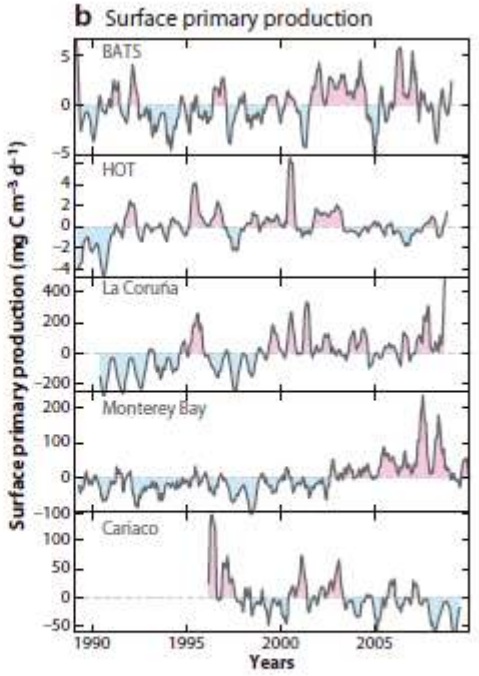


1988-2006

ocean

shelf



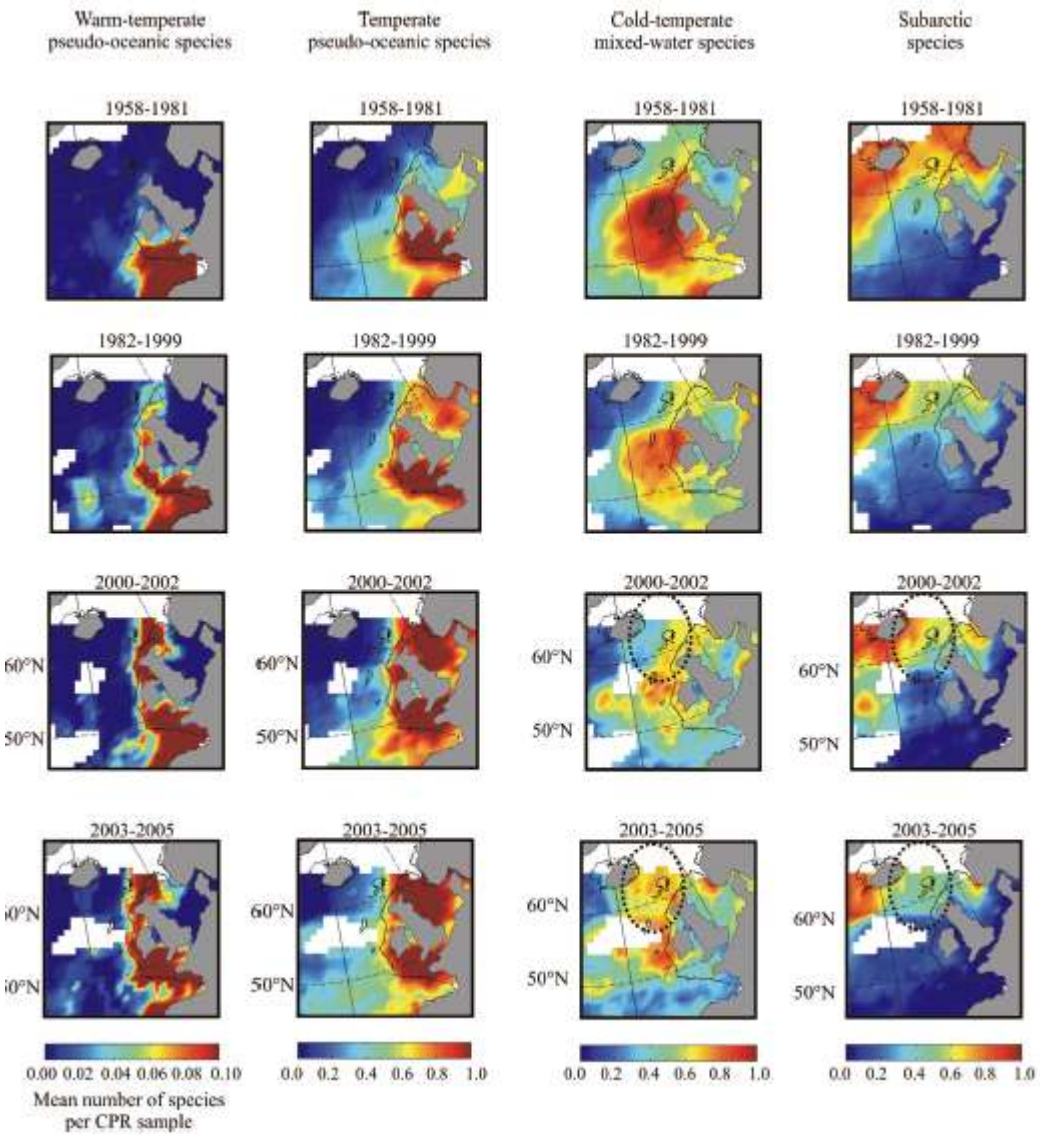


in situ

Chavez et al. Annu. Rev. Mar. Sci. 2011

Zooplankton: changes in distribution

CPR (copepods)



1958-1981

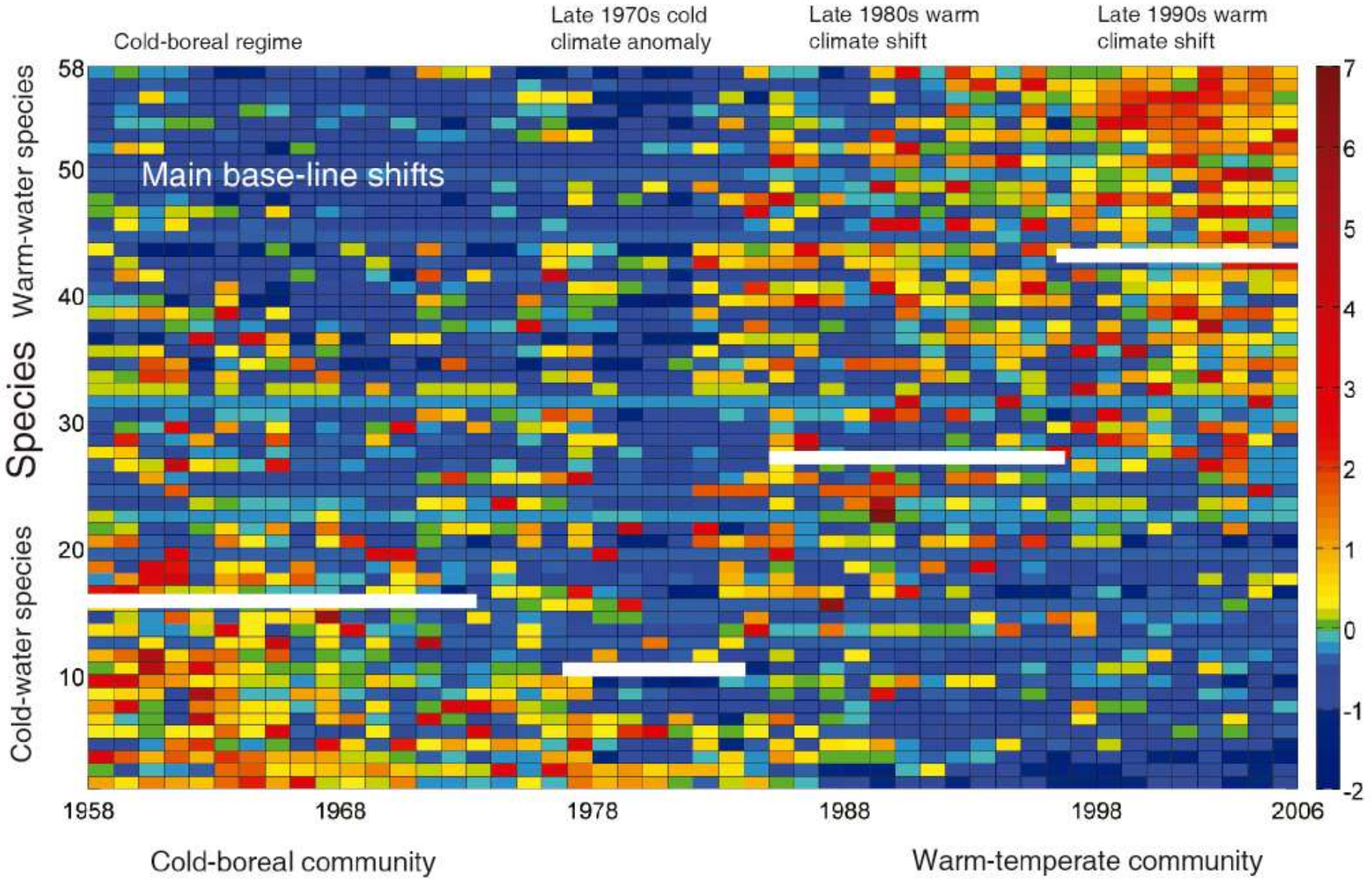
1982-1999

2000-2002

2002-2005

Reid et al. Charting Progress 2010

Regime shifts

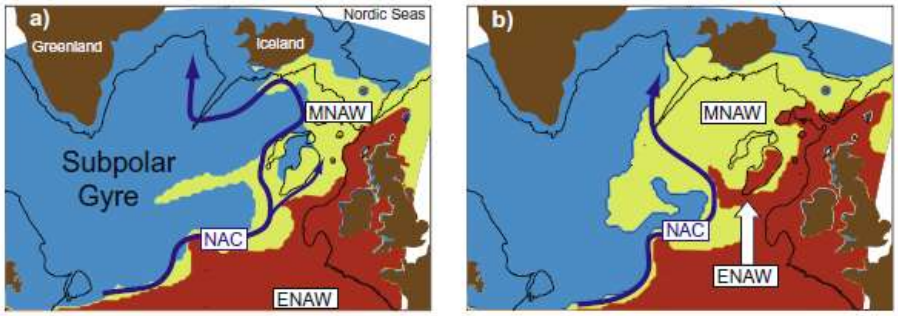


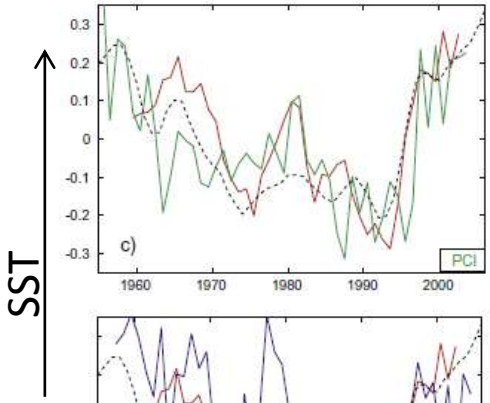
CPR (phyto- and zooplankton species)

Reid et al. Charting Progress 2010

Regime shifts

Subpolar gyre

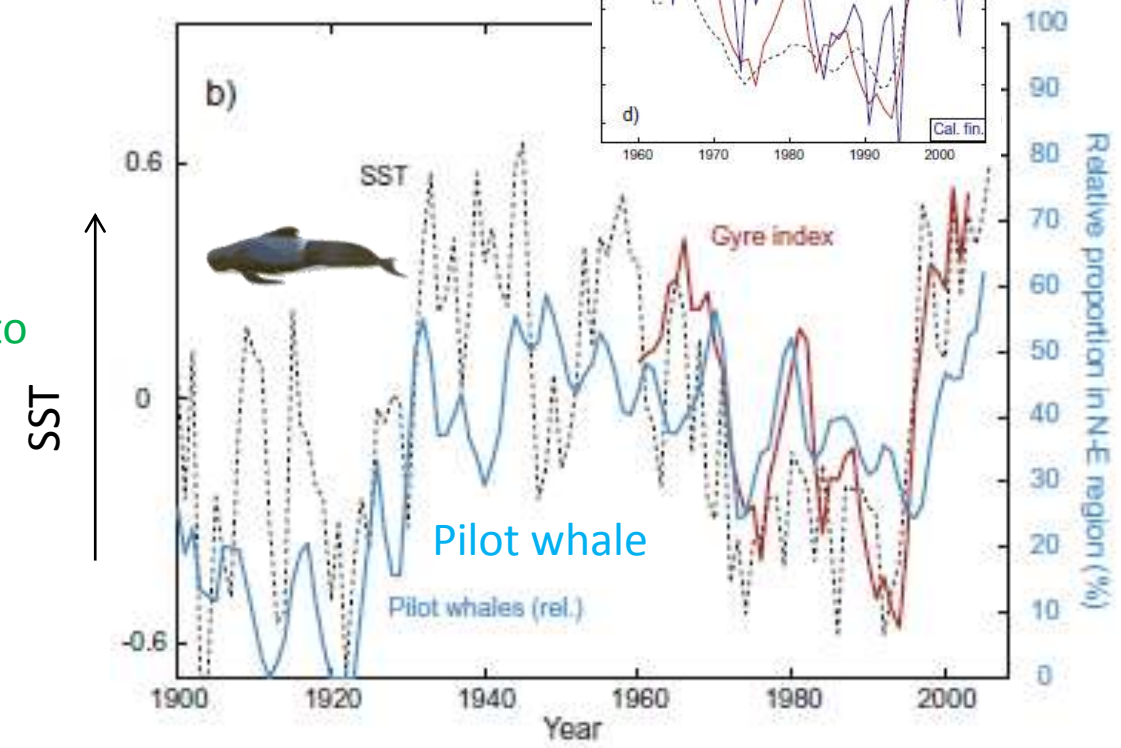




phytoplankton

zooplankton

Responses coupled to climate

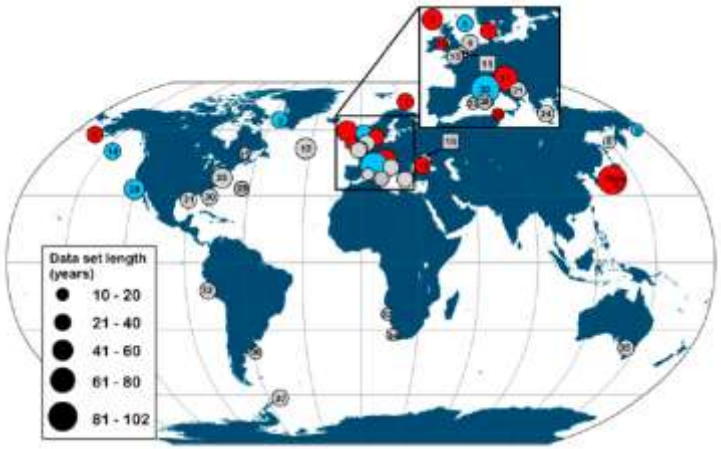


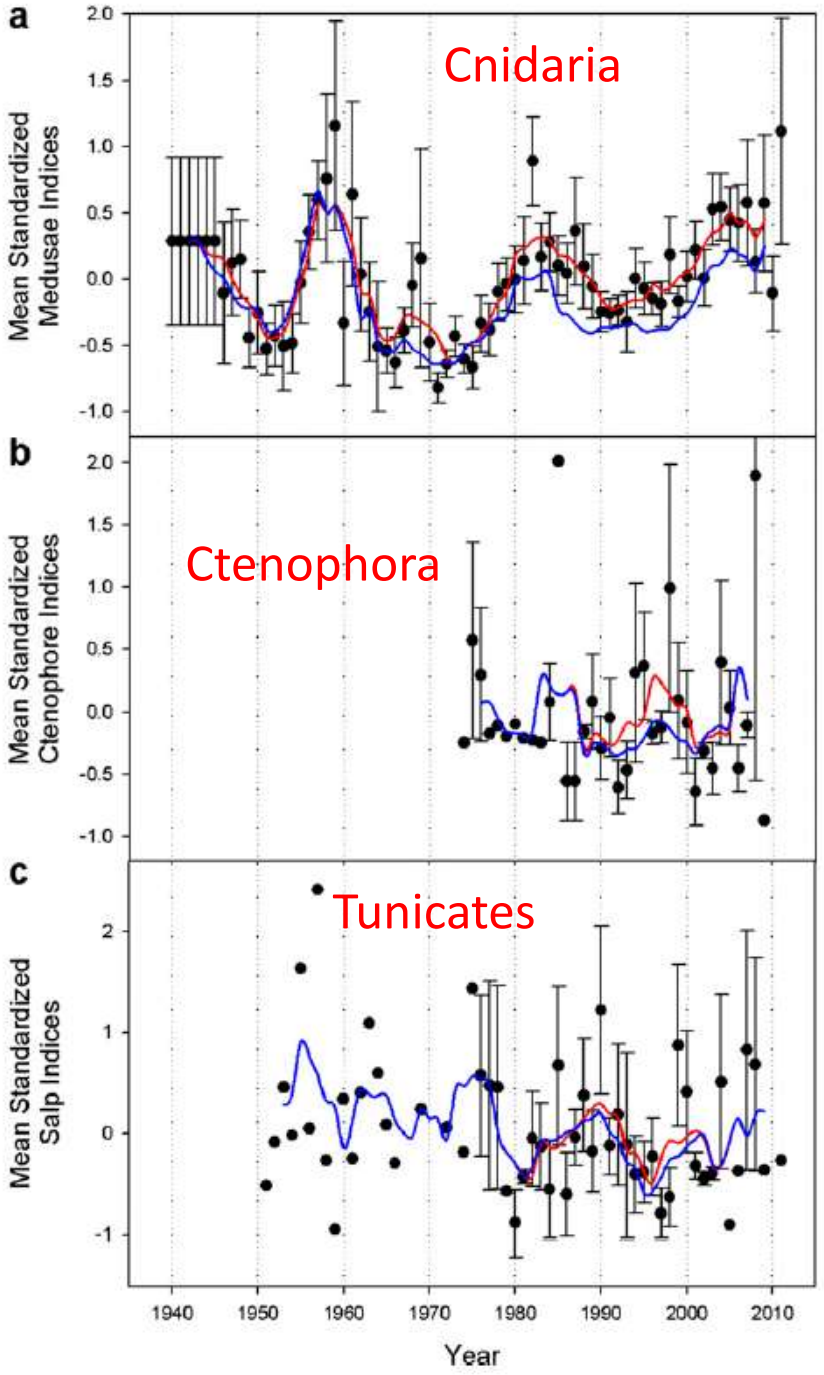
(deviations from the mean)

Hatun et al. PiO 2009

Jellyfish (and other gelatinous plankton)

Decadal cycles

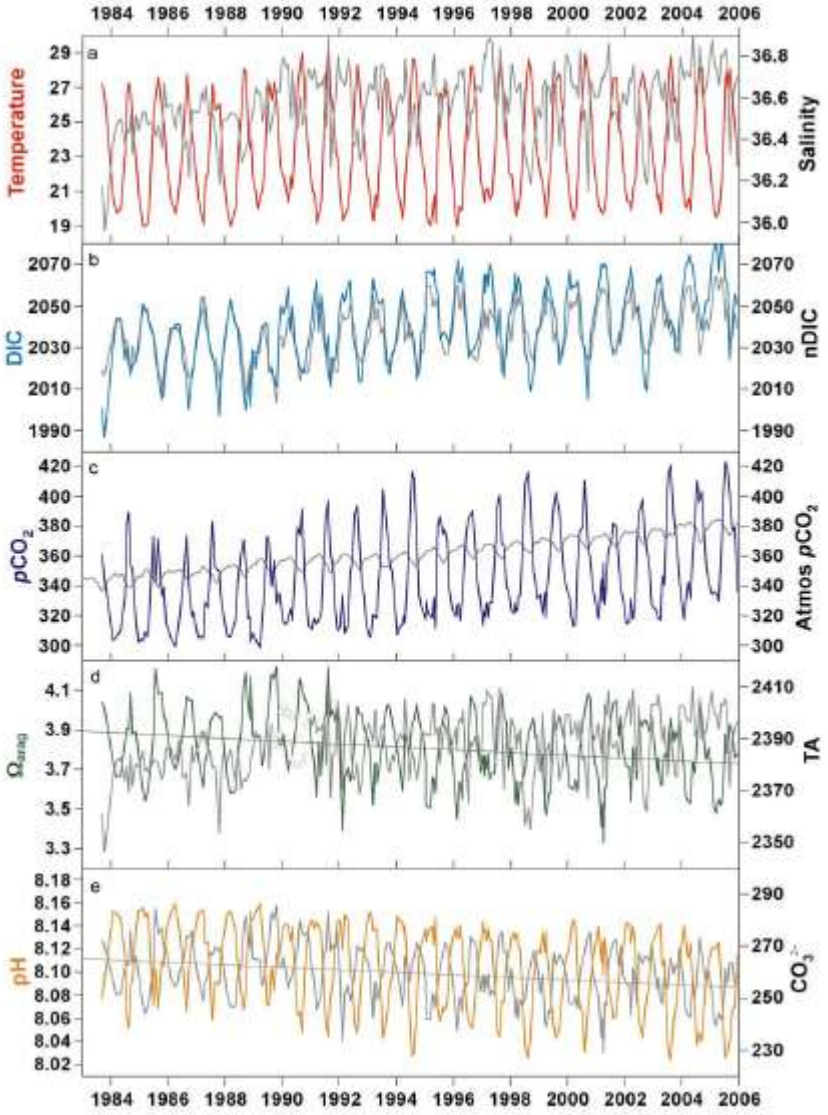




Condon et al. PNAS 2013

CO_2 and related variables:

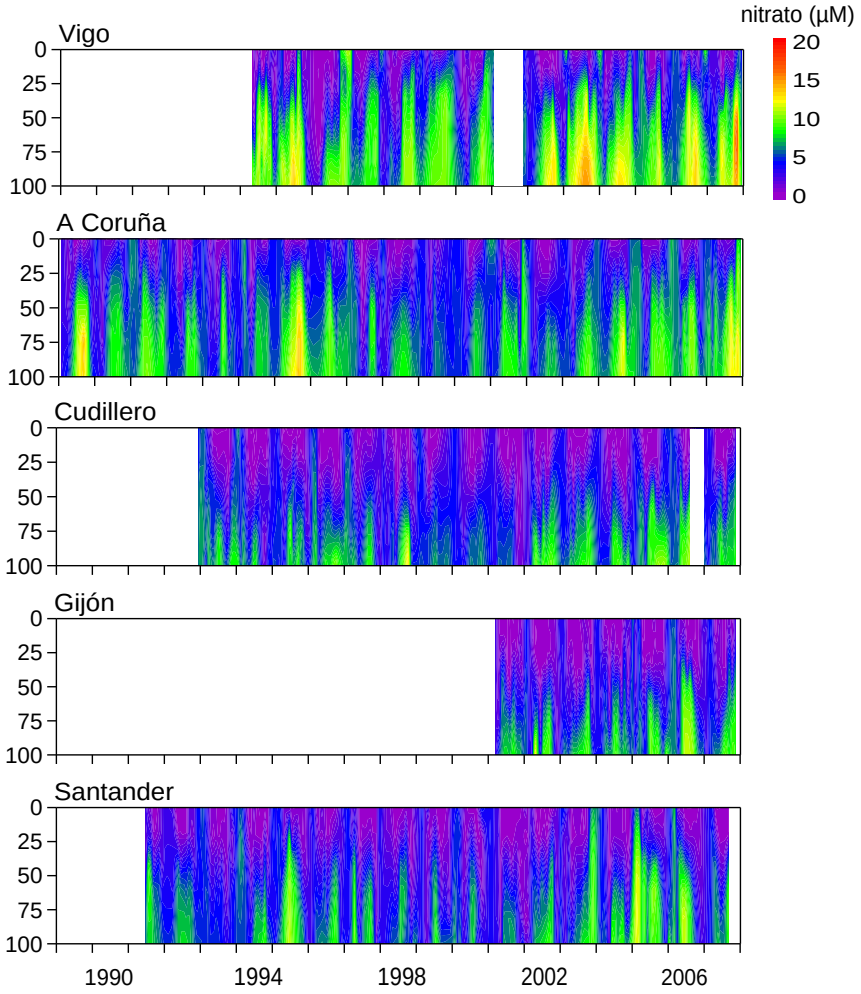
BATS



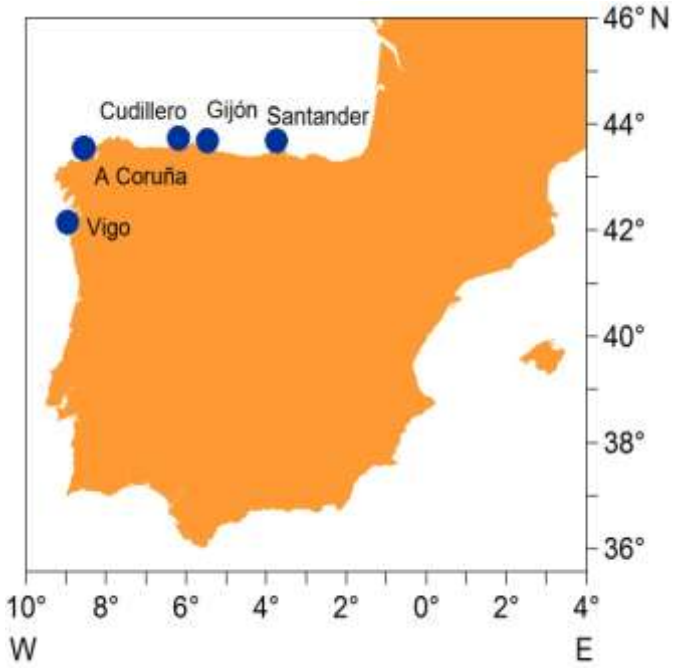
Bates, PiO 2007

Dissolved nutrients:

nitrate



RADIALES



http://www.seriestemporales-ieo.com/

How can we help?

- stimulate development of additional time series
  - e.g. in the coastal ocean / developing countries
- connect the time series to socio-economic issues
  - to avoid lack of interest in sustaining the series
- encourage researchers from time-series to engage in joint analyses and publications
  - to open “the data vault” and reward the operators
- create a community of time-series operators and stakeholders
  - to facilitate harmonization of the observations and access to data