

PML

Plymouth Marine
Laboratory



From climate to oceanography to plankton

Angus Atkinson

Tim Smyth



Extreme weather – the Wet Wok



1. Plymouth L4 station: 30-year temperature and zooplankton trends
2. Wider scale context: North Atlantic climatic warming
3. Seasonality, resilience and population controls

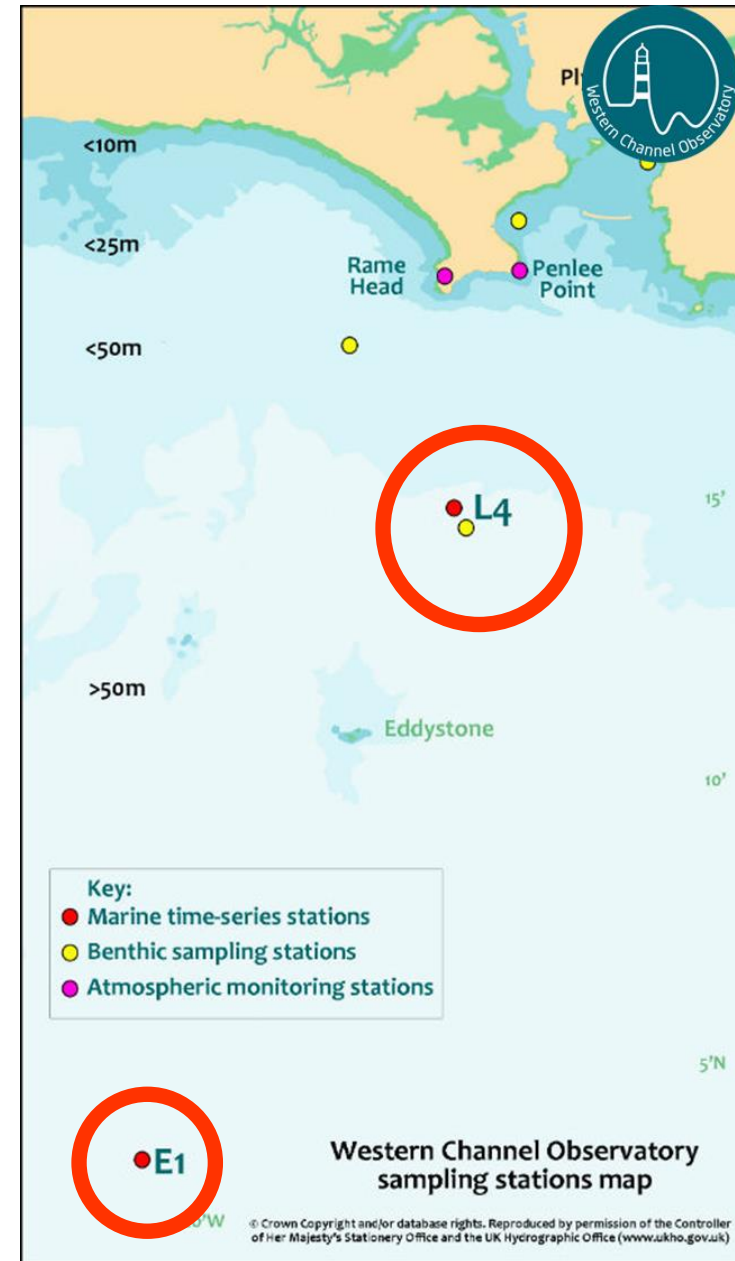
Sampling started in 1888 when the Plymouth Laboratory of the Marine Biological Association of the UK (MBA) was opened

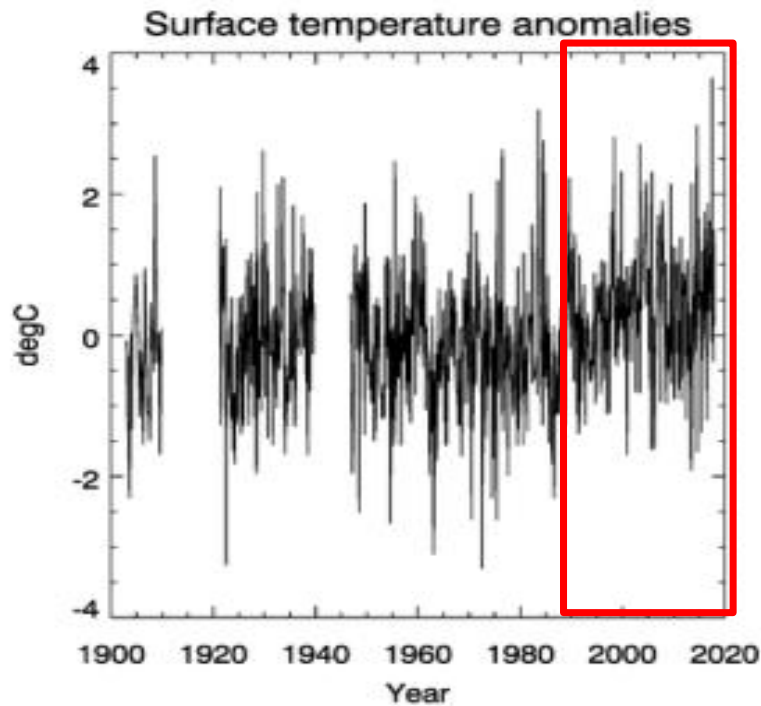
1. L4 weekly data span 30 years
2. Time series and process sites
3. Pelagic, benthic, atmospheric
4. Taxonomic resolution

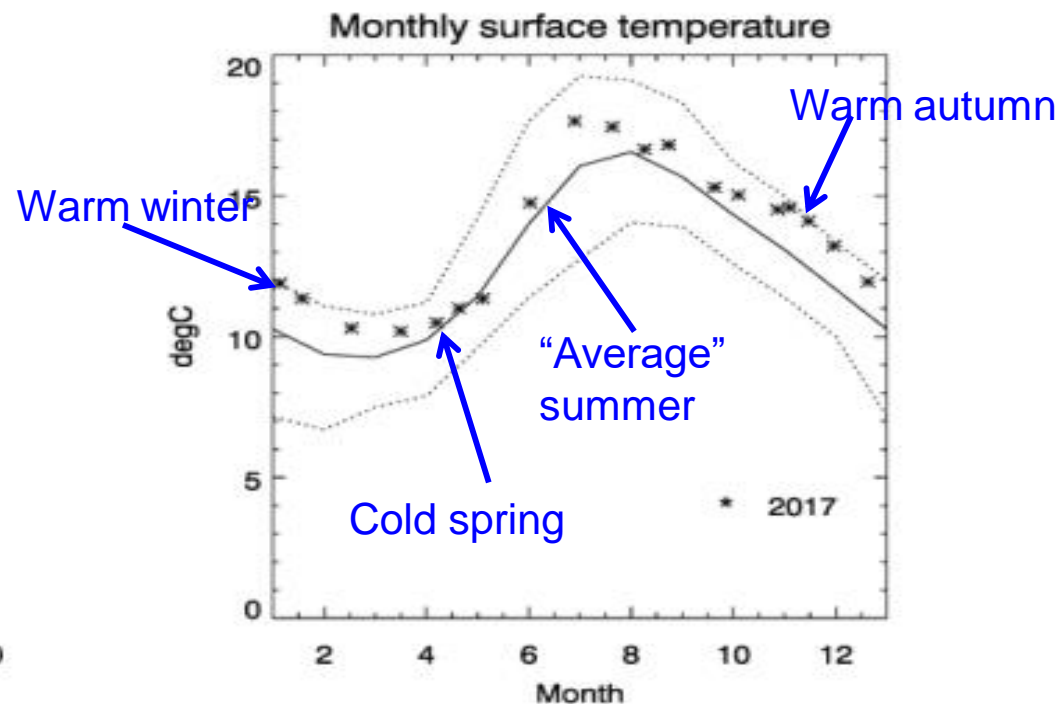
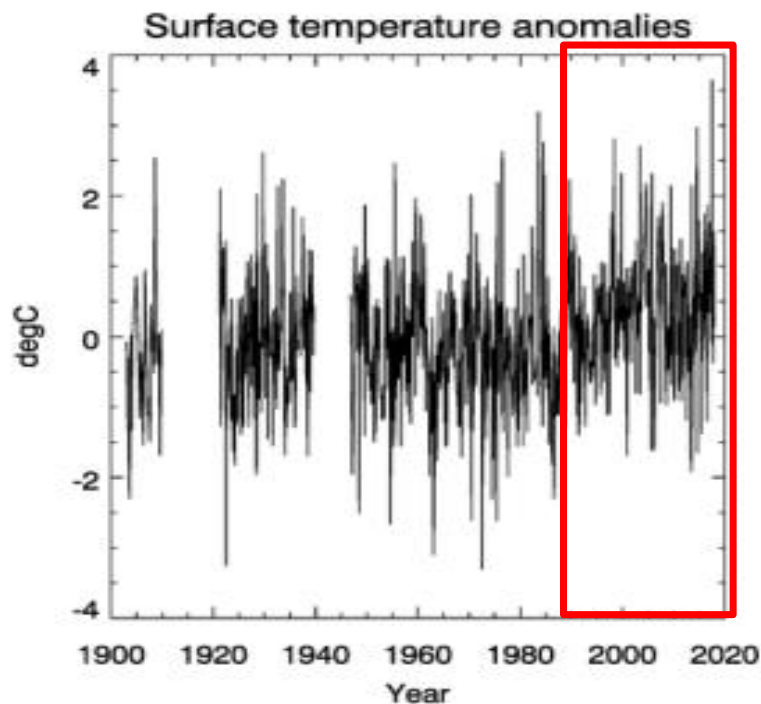
<http://www.westernchannelobservatory.org.uk/>

Southward et al. (Adv Mar Biol 2005)

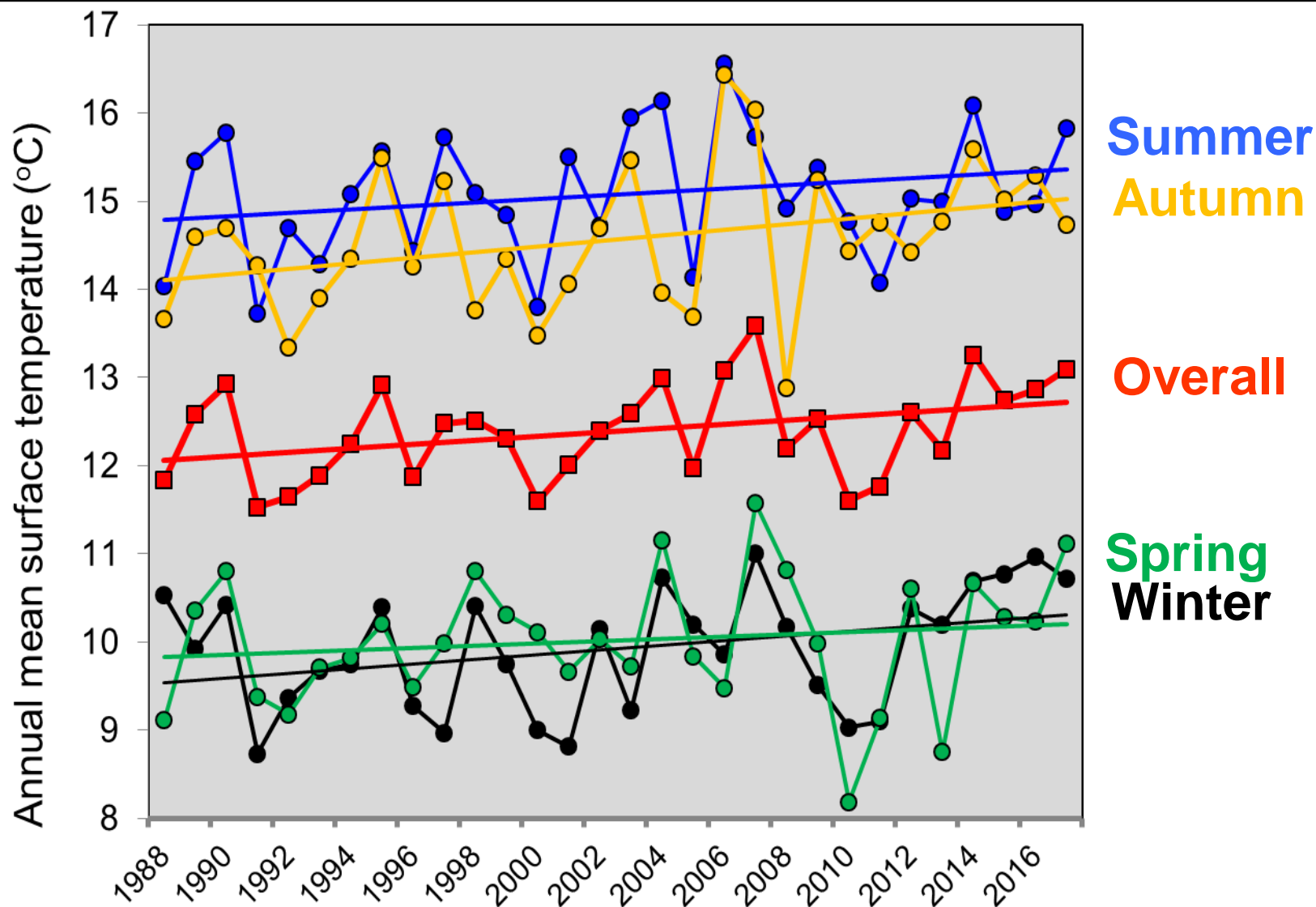
Smyth et al. (Progr Oceanogr 2015)



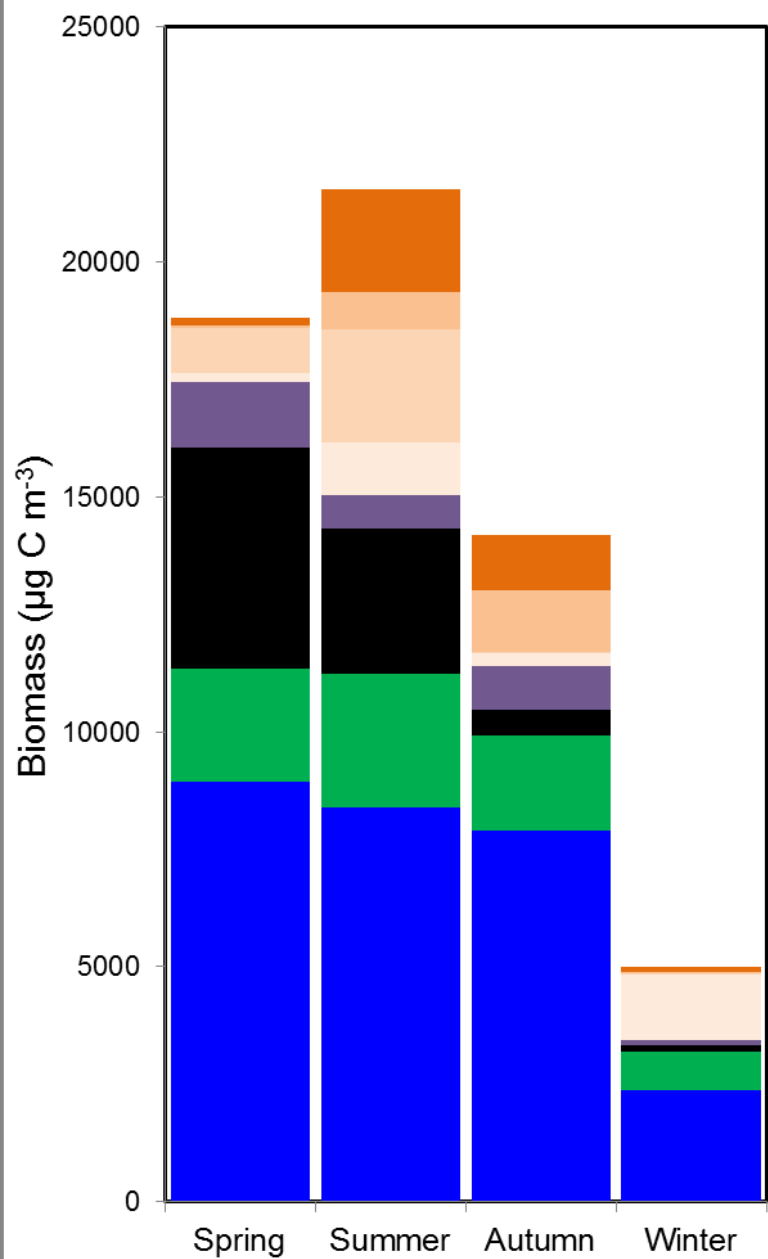




L4: similar surface warming over 30 y



L4: Composition of zooplankton biomass



Medusae

Siphonophores

Ctenophores

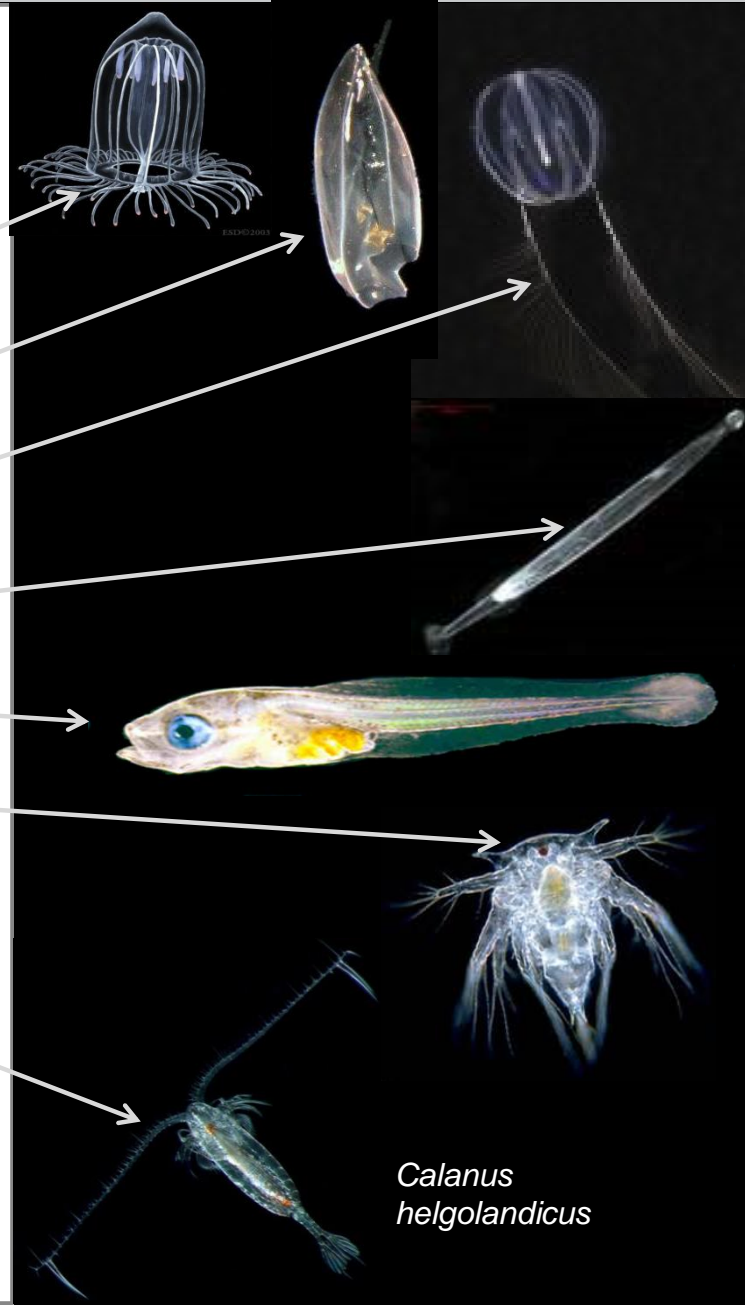
Chaetognaths

Fish larvae

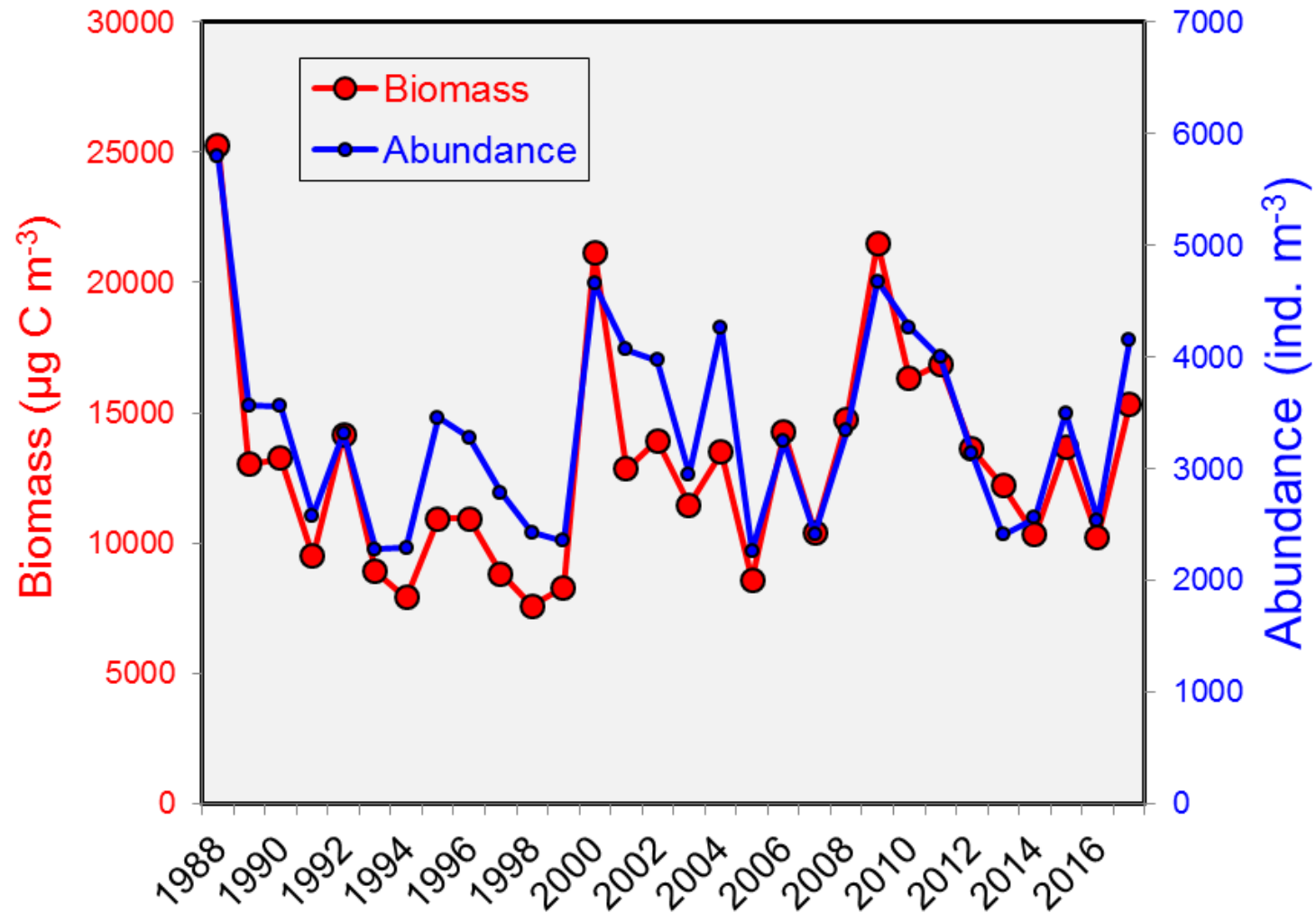
Meroplankton

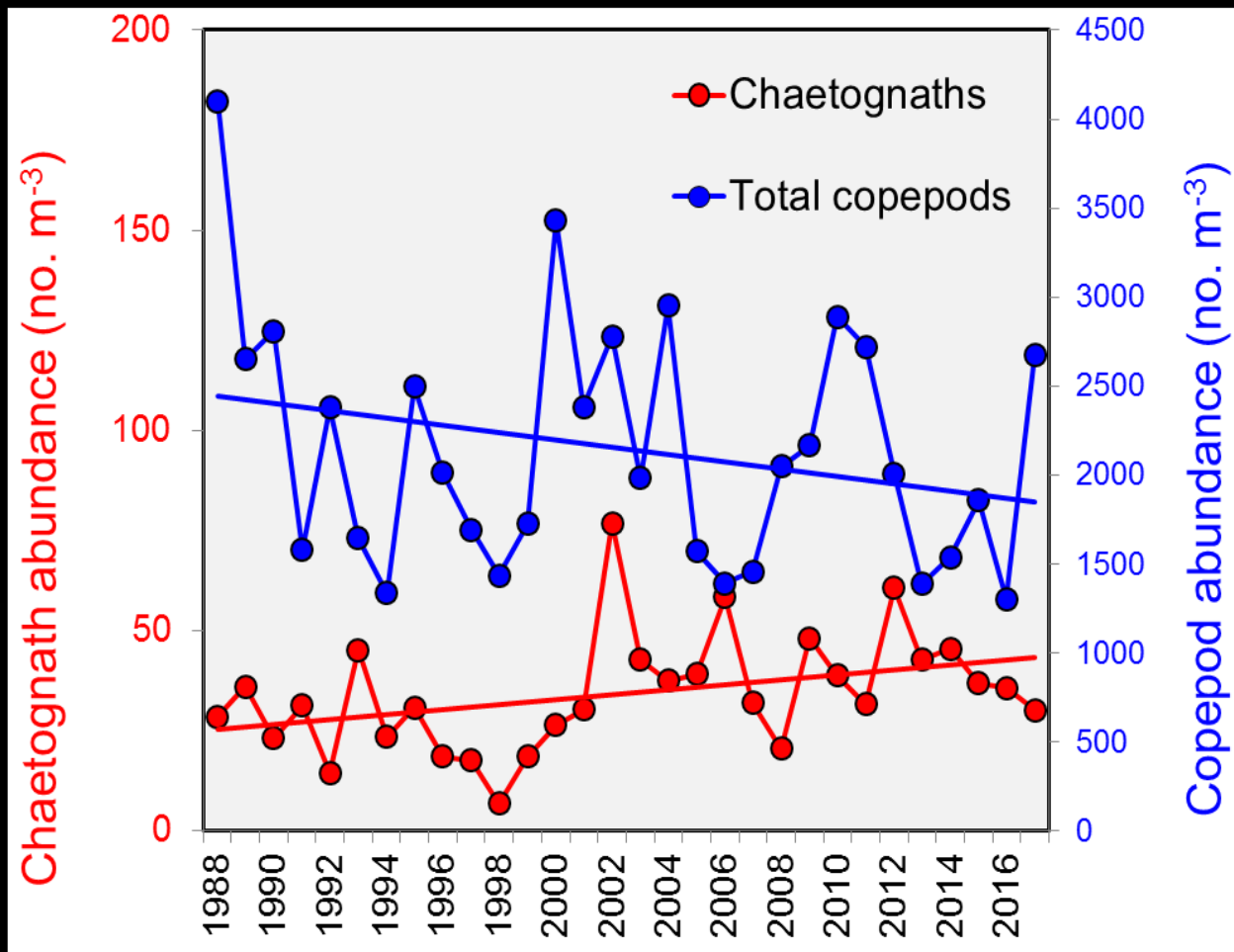
Other holoplankton

Copepods

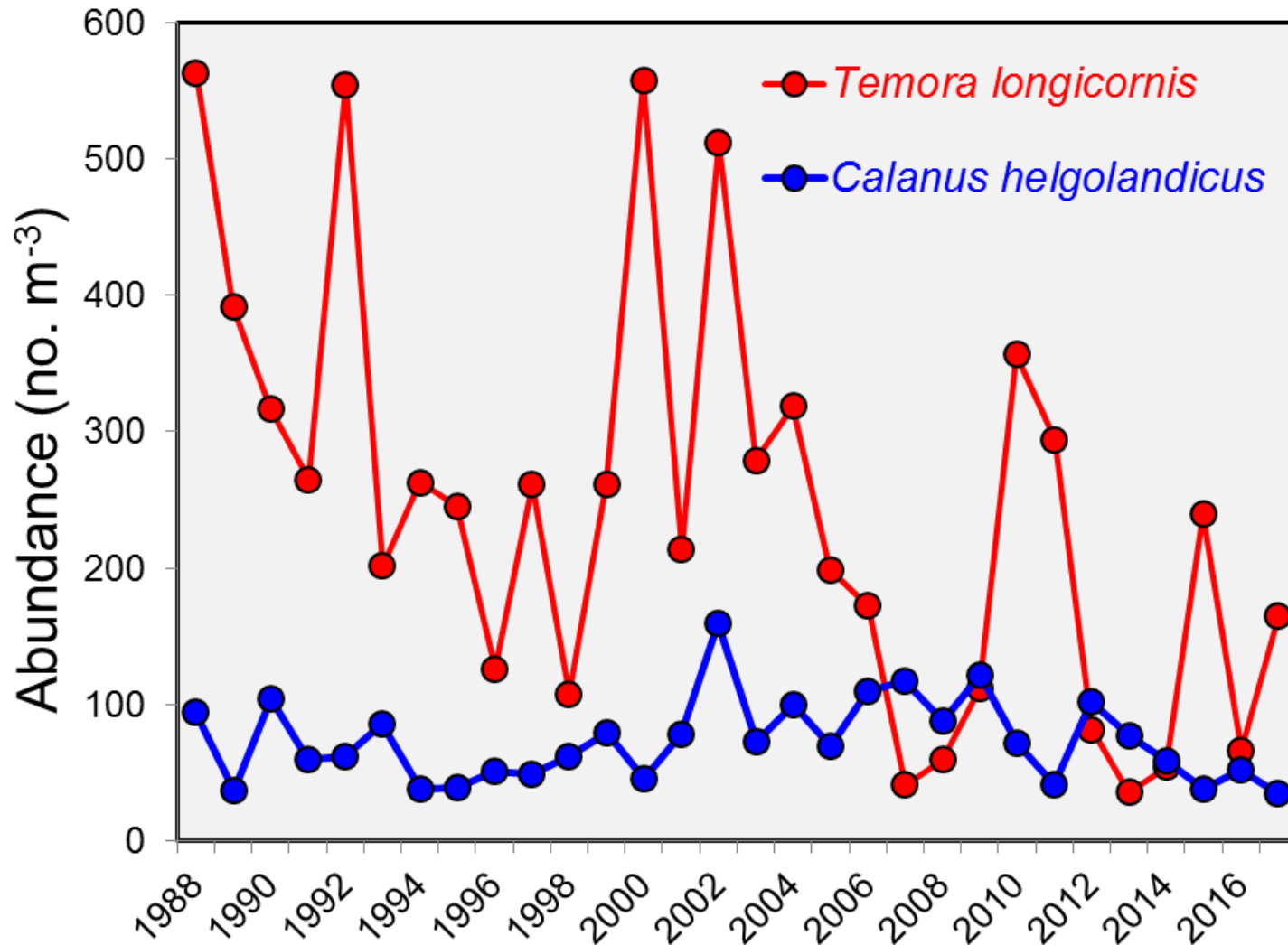


Total mesozooplankton shows no clear trend

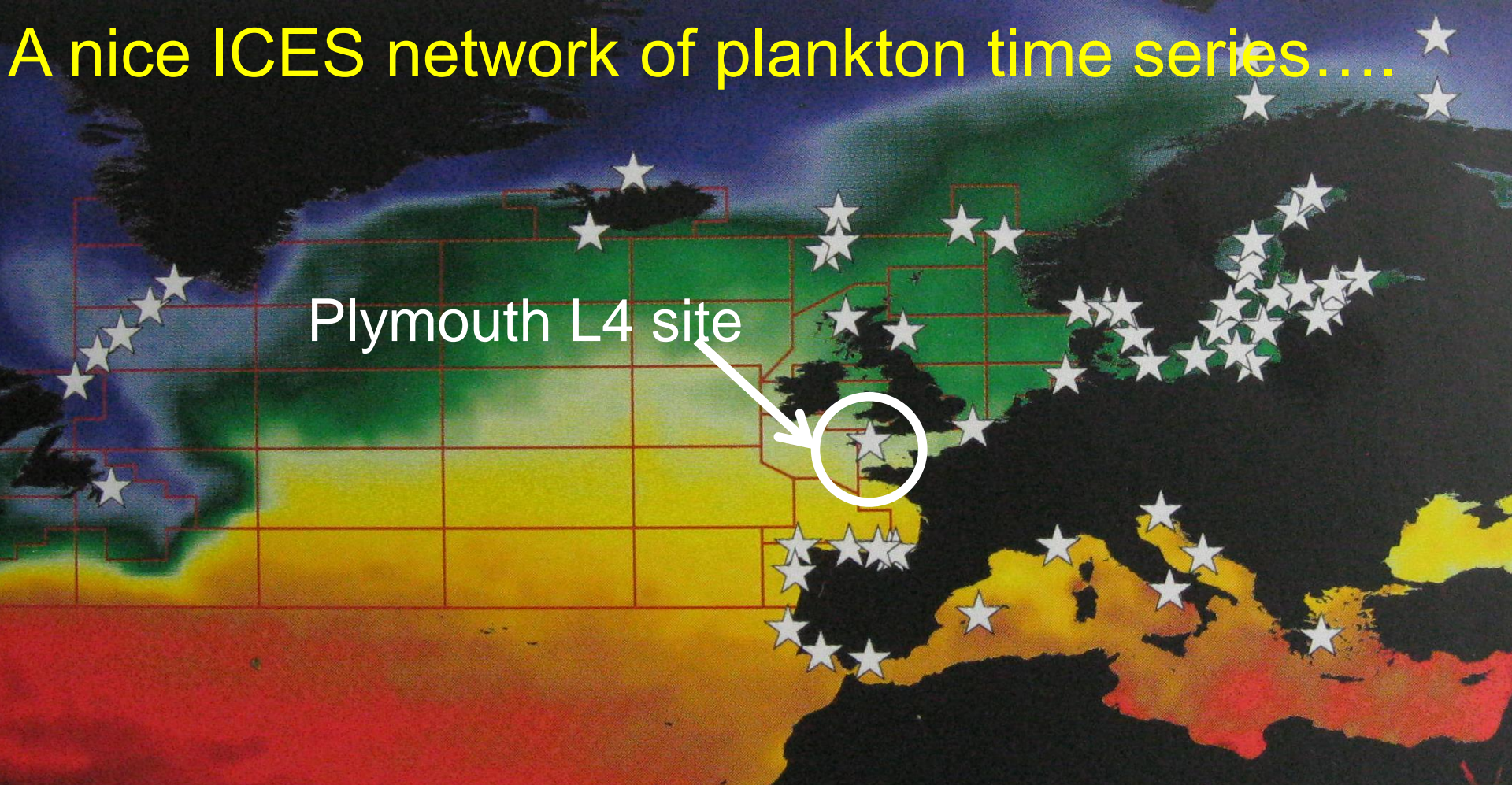




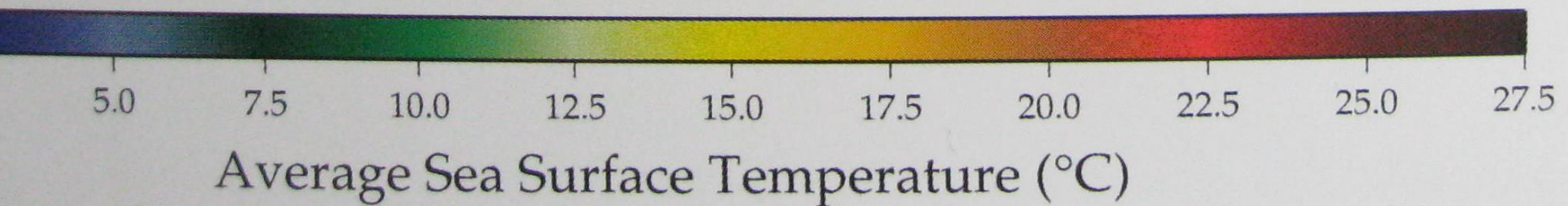
Contrasting stability of species densities



A nice ICES network of plankton time series....



.....these are now starting to be analysed as a whole

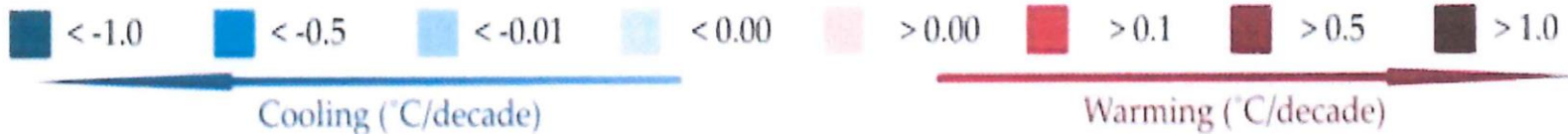
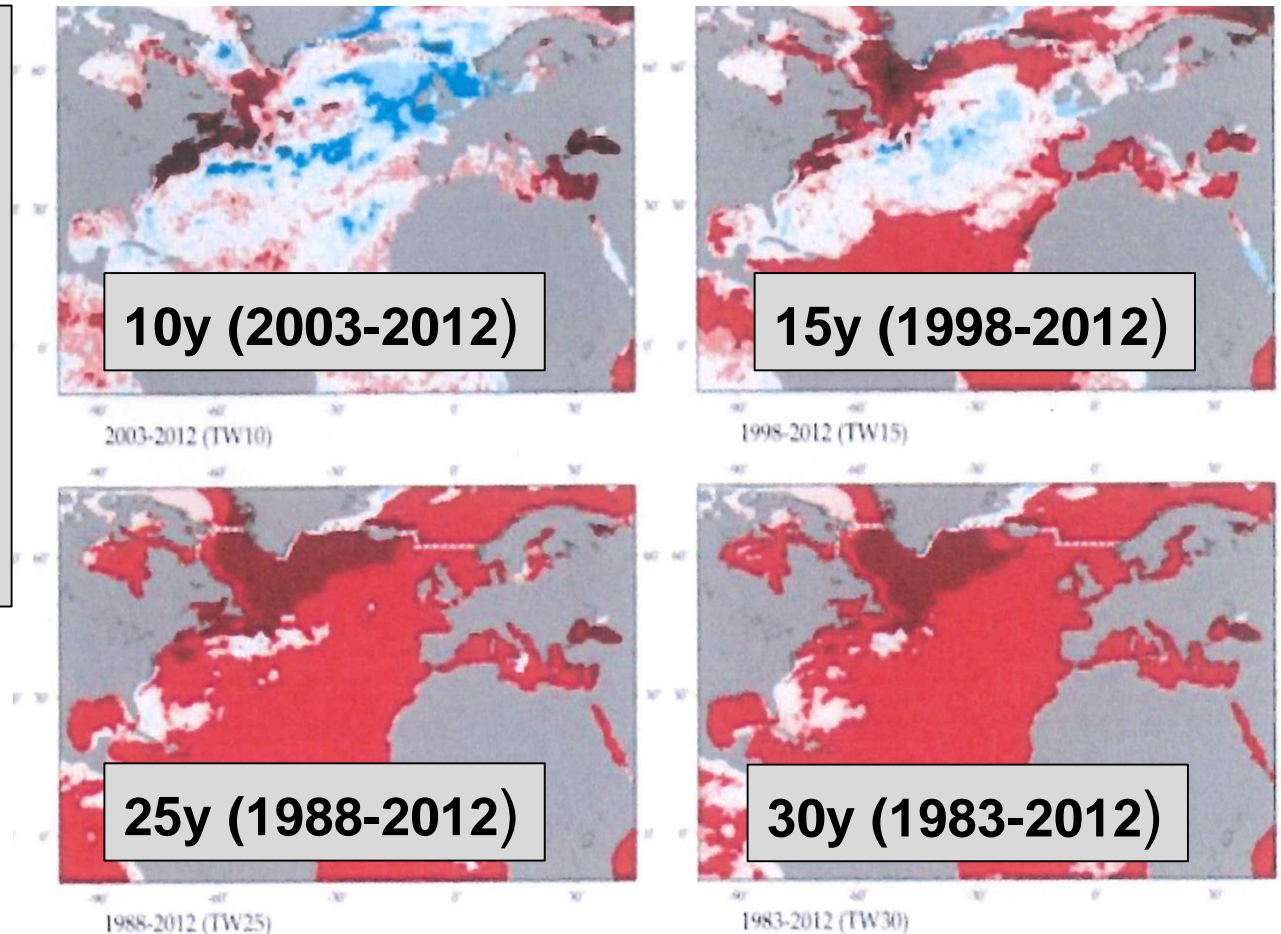


IGMETS: International Group of Marine Ecological Time Series

IGMETS interactive explorer and IGMETS Global Compilation of time series:

very useful catalogue

[Google: IGMETS](#)



Time Series Explorer

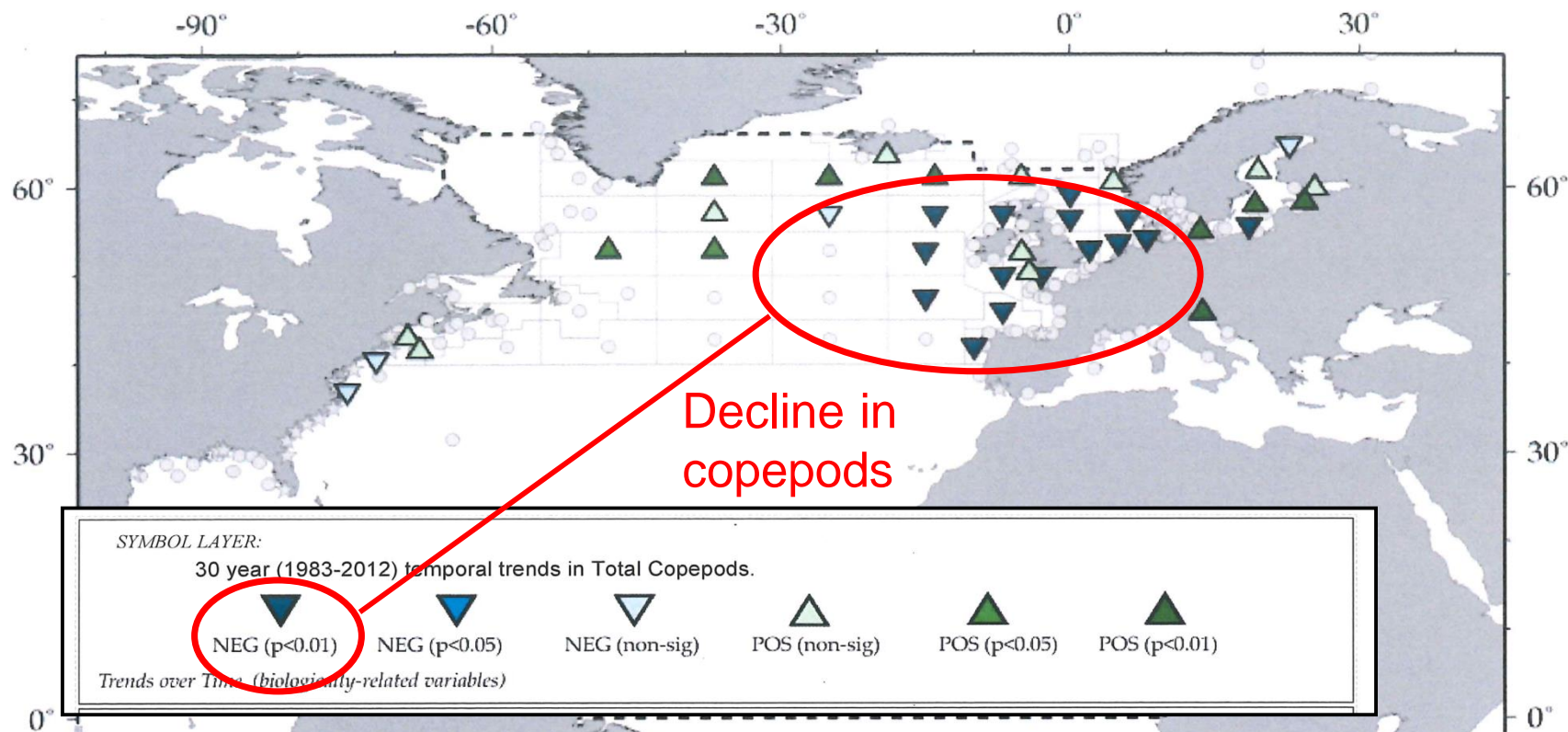


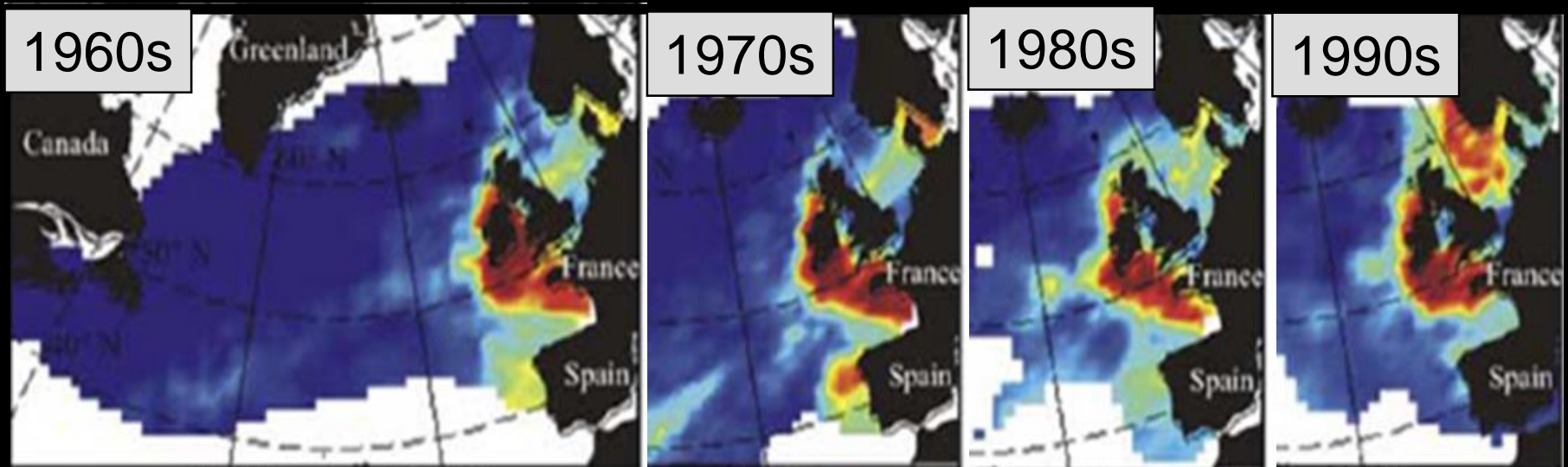
The International Group for
Marine Ecological Time Series

○ Entire World | ○ Arctic Ocean | ● North Atlantic | ○ South Atlantic | ○ Southern Ocean | ○ Indian Ocean | ○ North Pacific | ○ South Pacific]

IGMETS Trends 2016-Sept

[trendstat-SMK : **ztotc** : 30yr : allts]

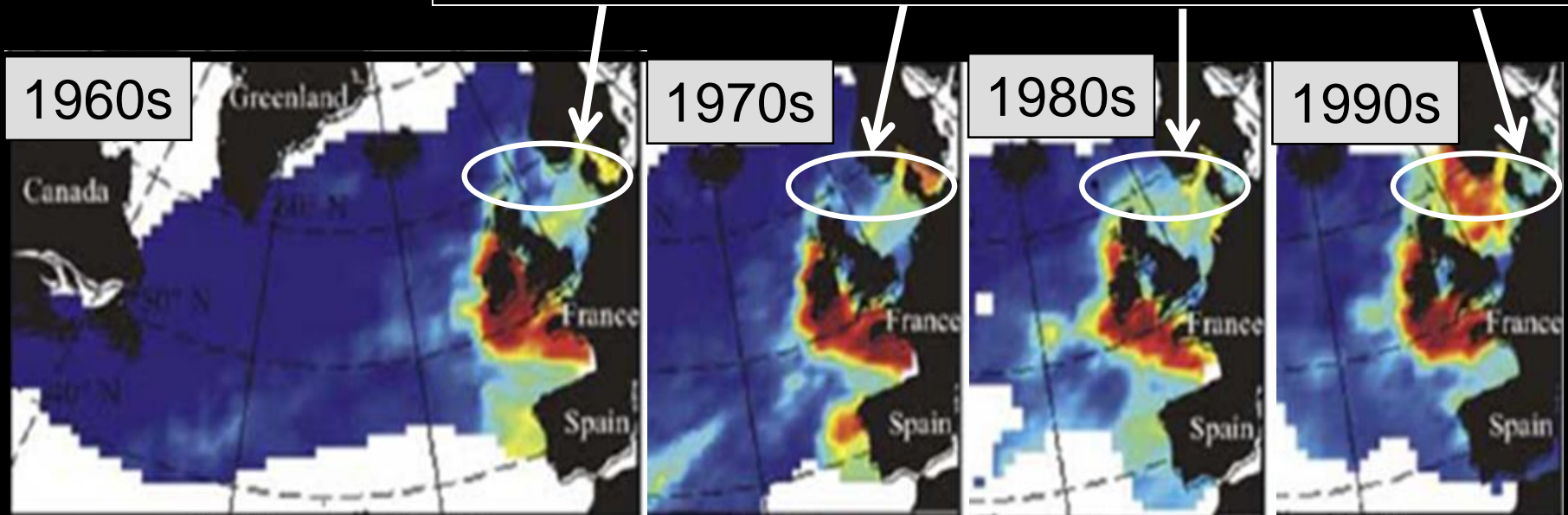




Calanus helgolandicus

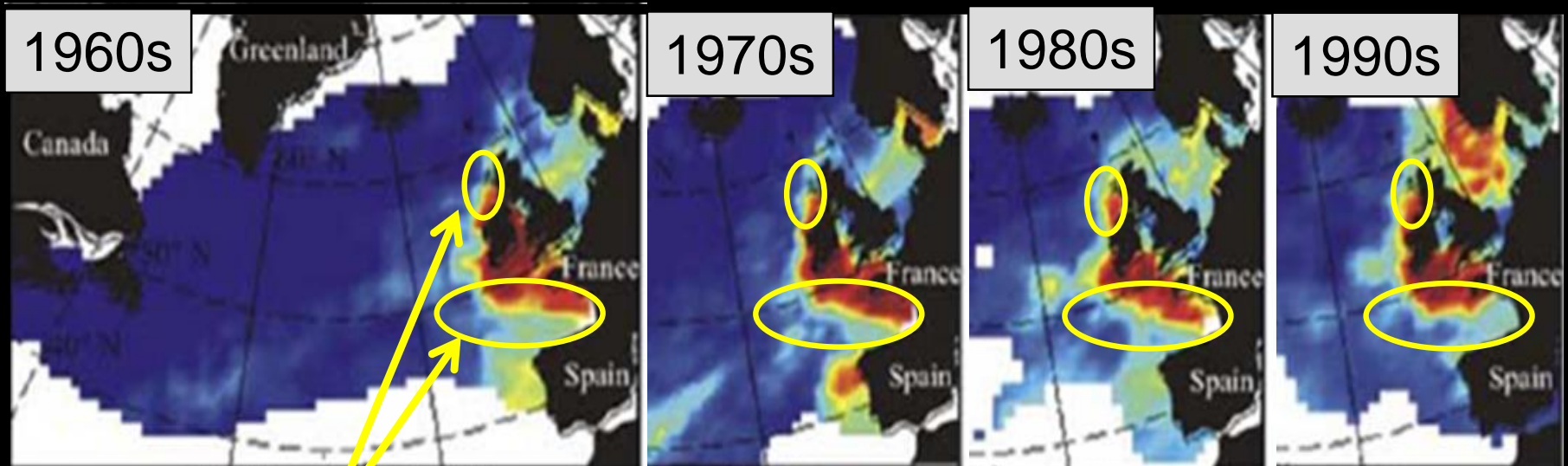
From Bonnet et al. Progr Oceanog (2005)

Some areas are being invaded....



Calanus helgolandicus

From Bonnet et al. Progr Oceanog (2005)

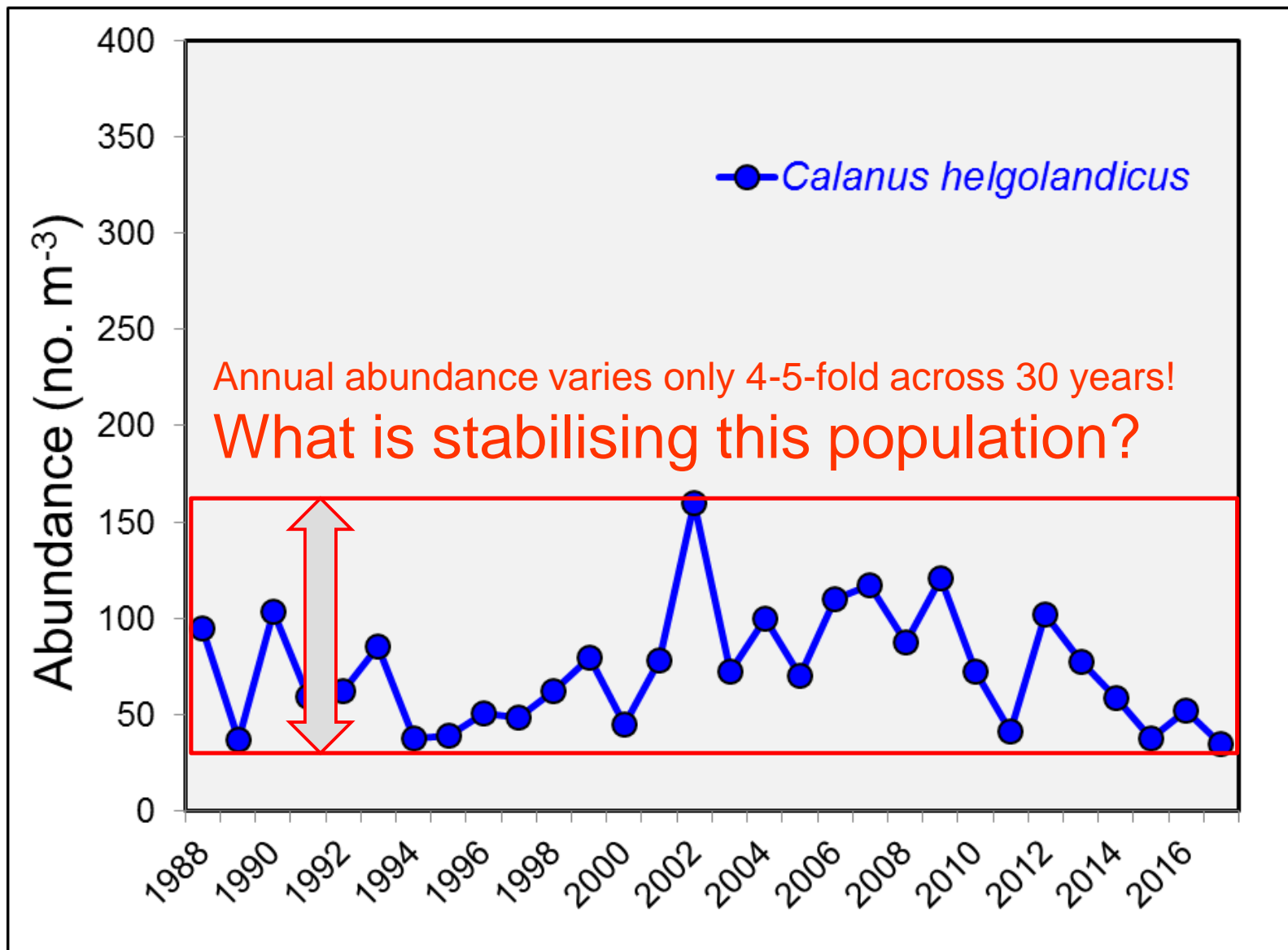


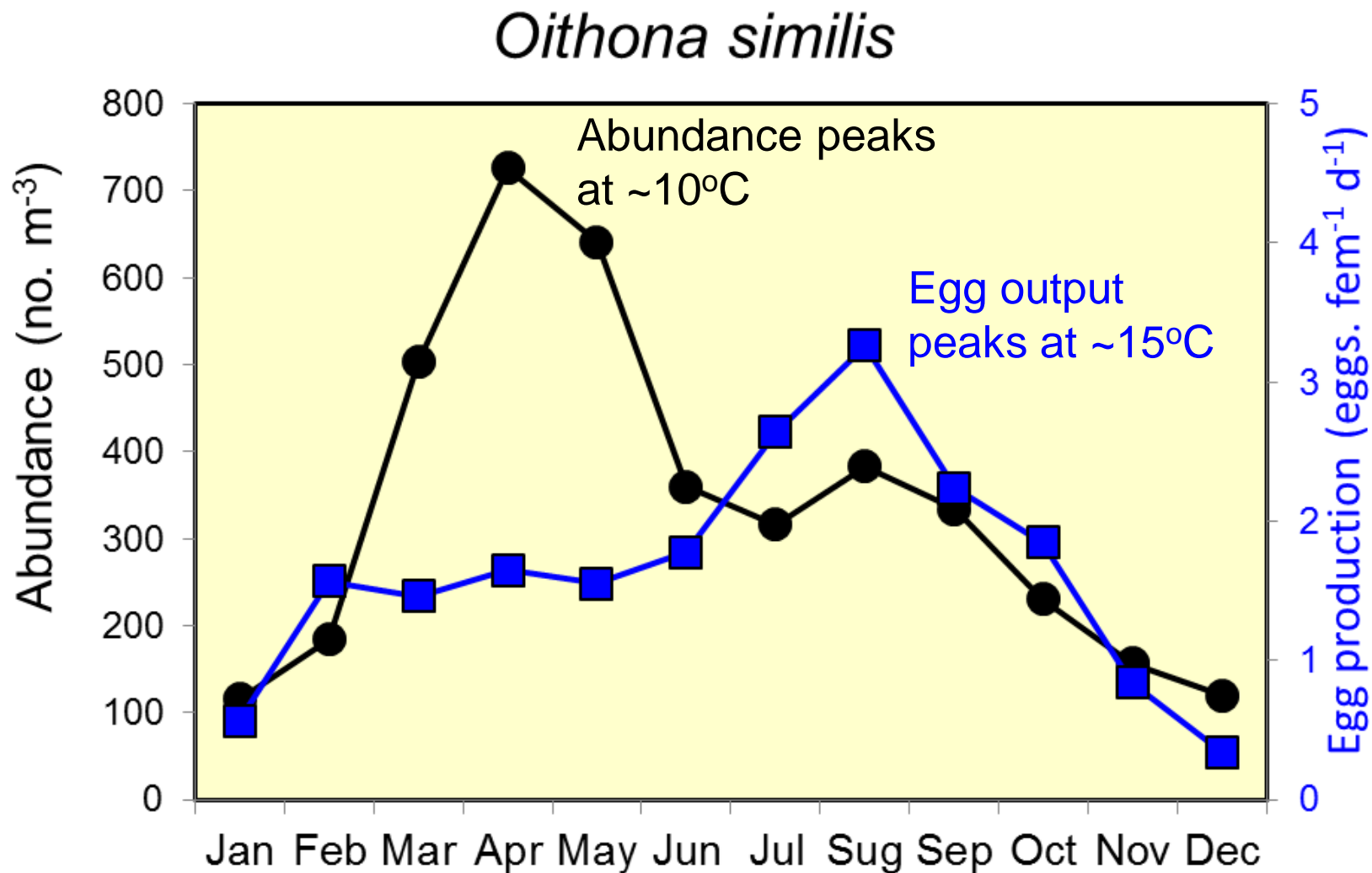
.....but other areas are more static

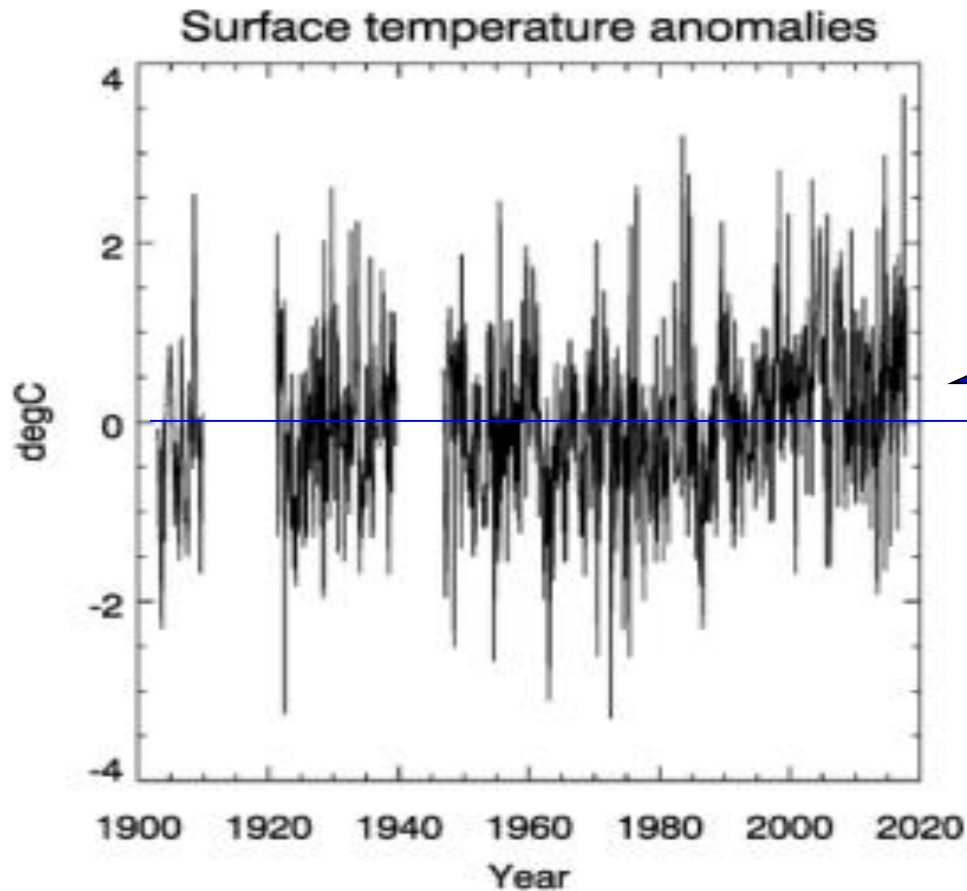
Calanus helgolandicus

From Bonnet et al. Progr Oceanog (2005)

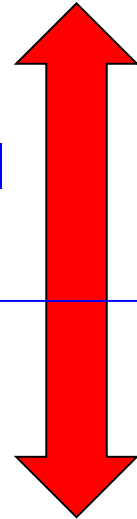
What factors control population sizes?







Climate
warming signal



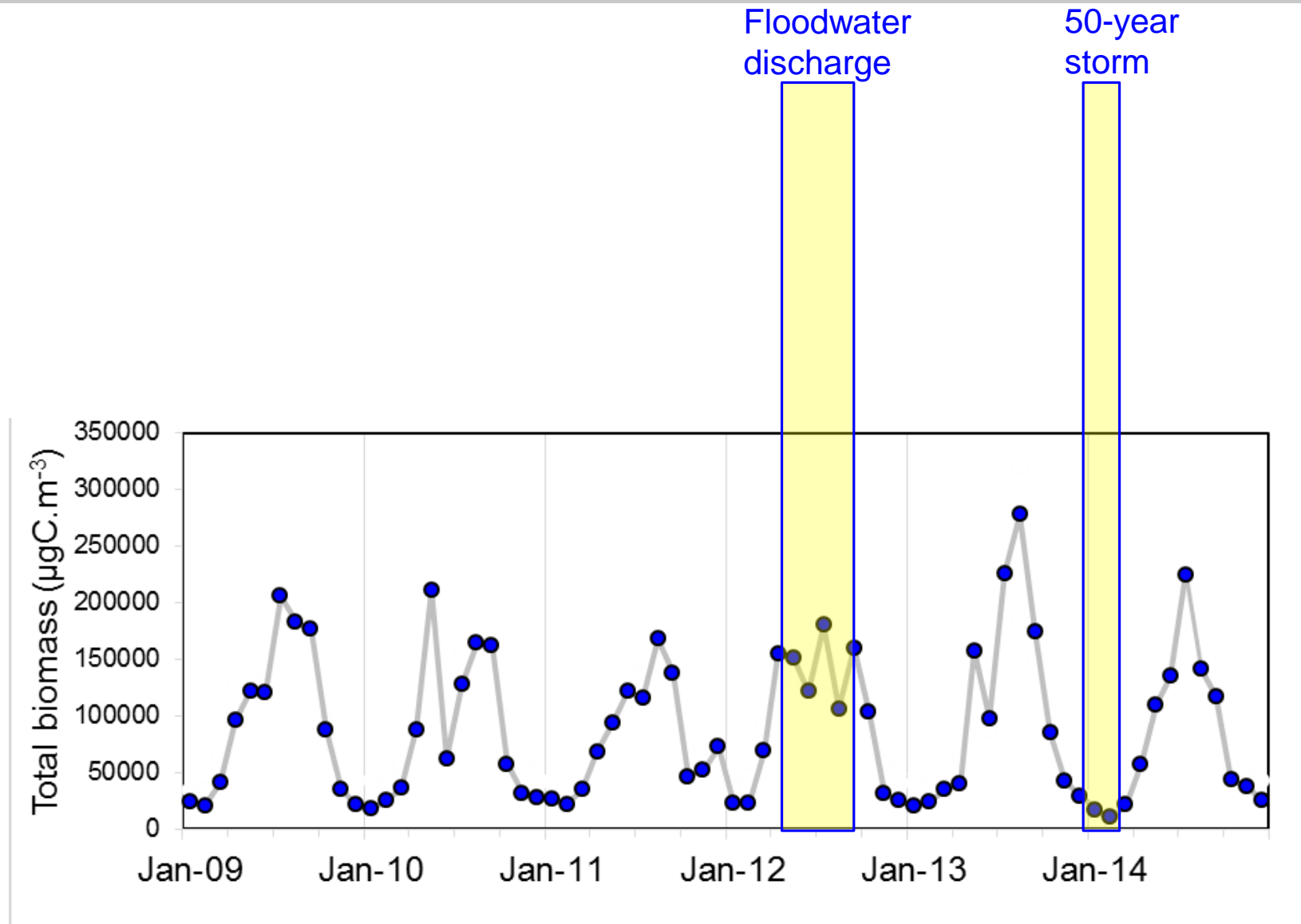
Weather, seasonality
and inter-annual variability



Floods 2012



Storms 2013/2014



Frequency of extreme weather events is projected to increase with climatic warming
(Comeau and Rahmsdorf, Nature Climate Change 2012)

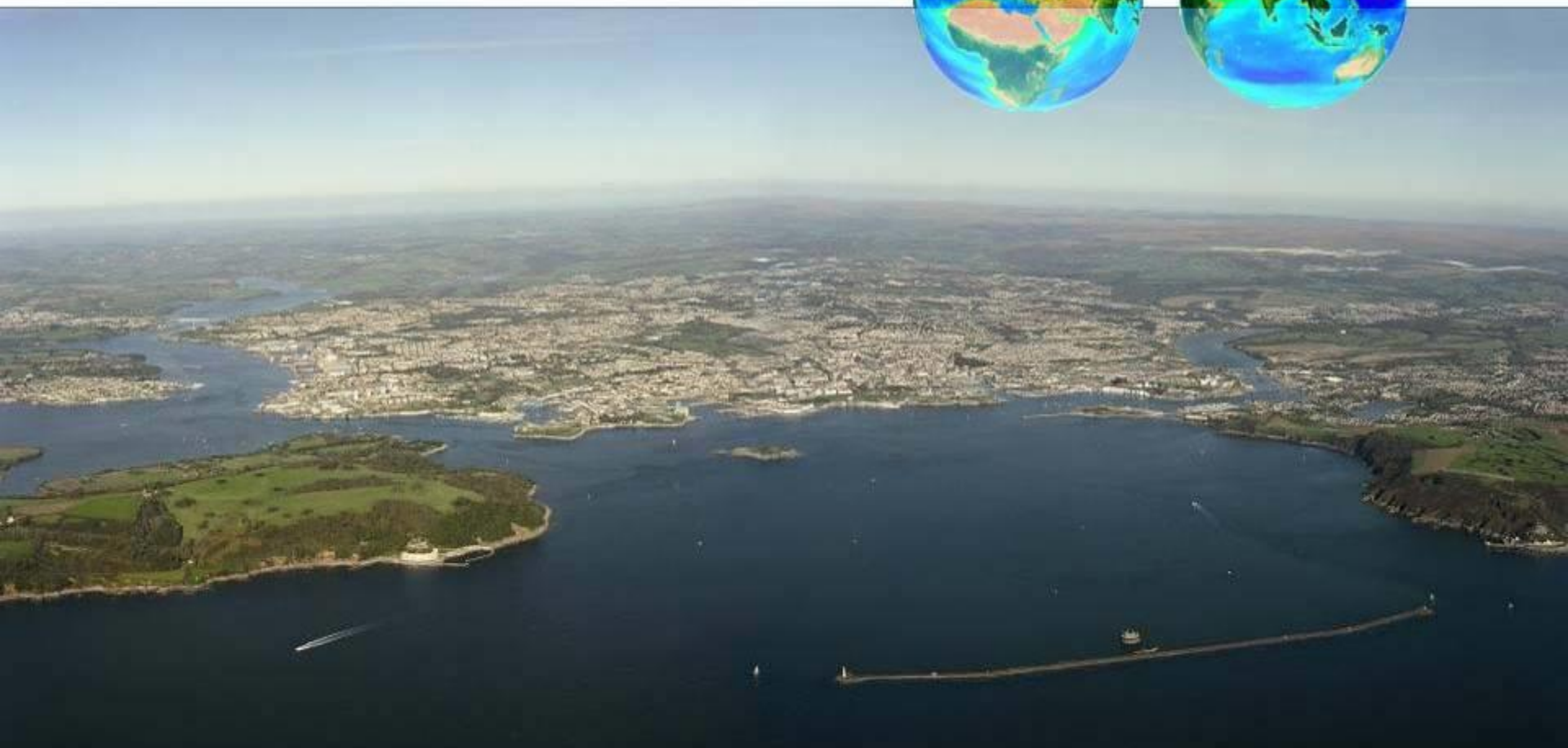
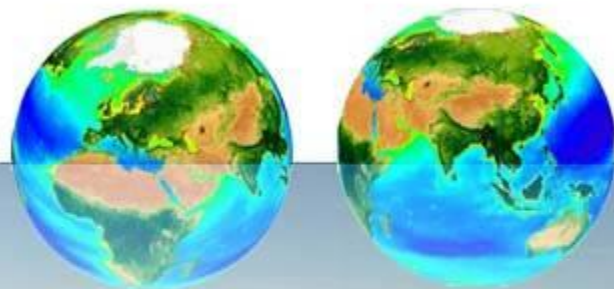
Plot produced by Martin Lilley

Conclusions

1. Climate scale response is often small and masked
2. Remarkable resilience of species and ecosystems
3. Top down (predation) controls are key



Thank you



With thanks to crews and scientists for maintaining the Western Channel Observatory, Kristian McConville, Jacqueline Maud, Louise Cornwell, Martin Lilley for their plots, PML zooplankton analysts Andrea McEvoy, Amanda Beesley, plus Martin Edwards (SAHFOS).