

Winter convection blows life

- A Bird's-eye view



Hjálmar Hátún
And many good people ☺

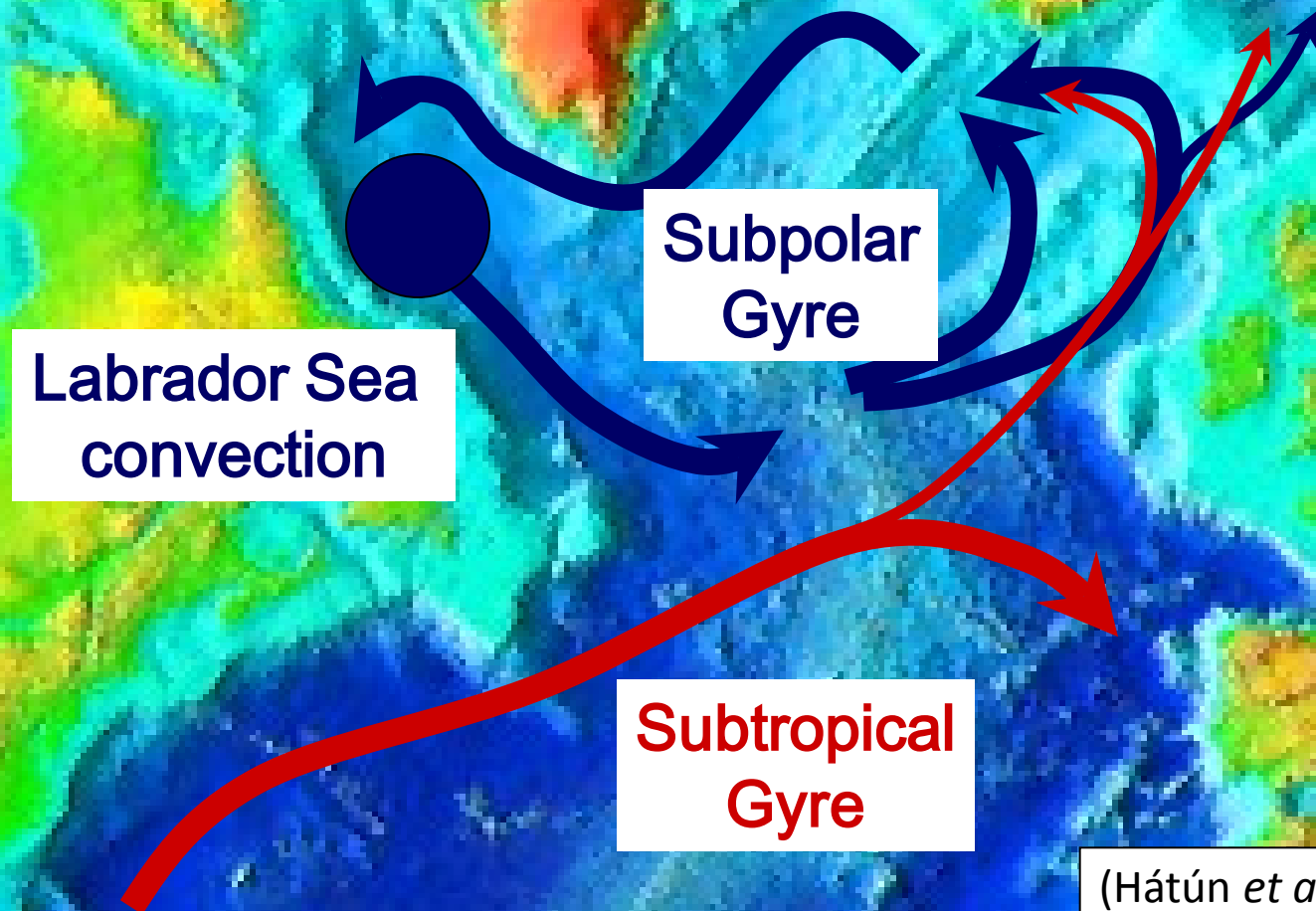


Max-Planck-Institut
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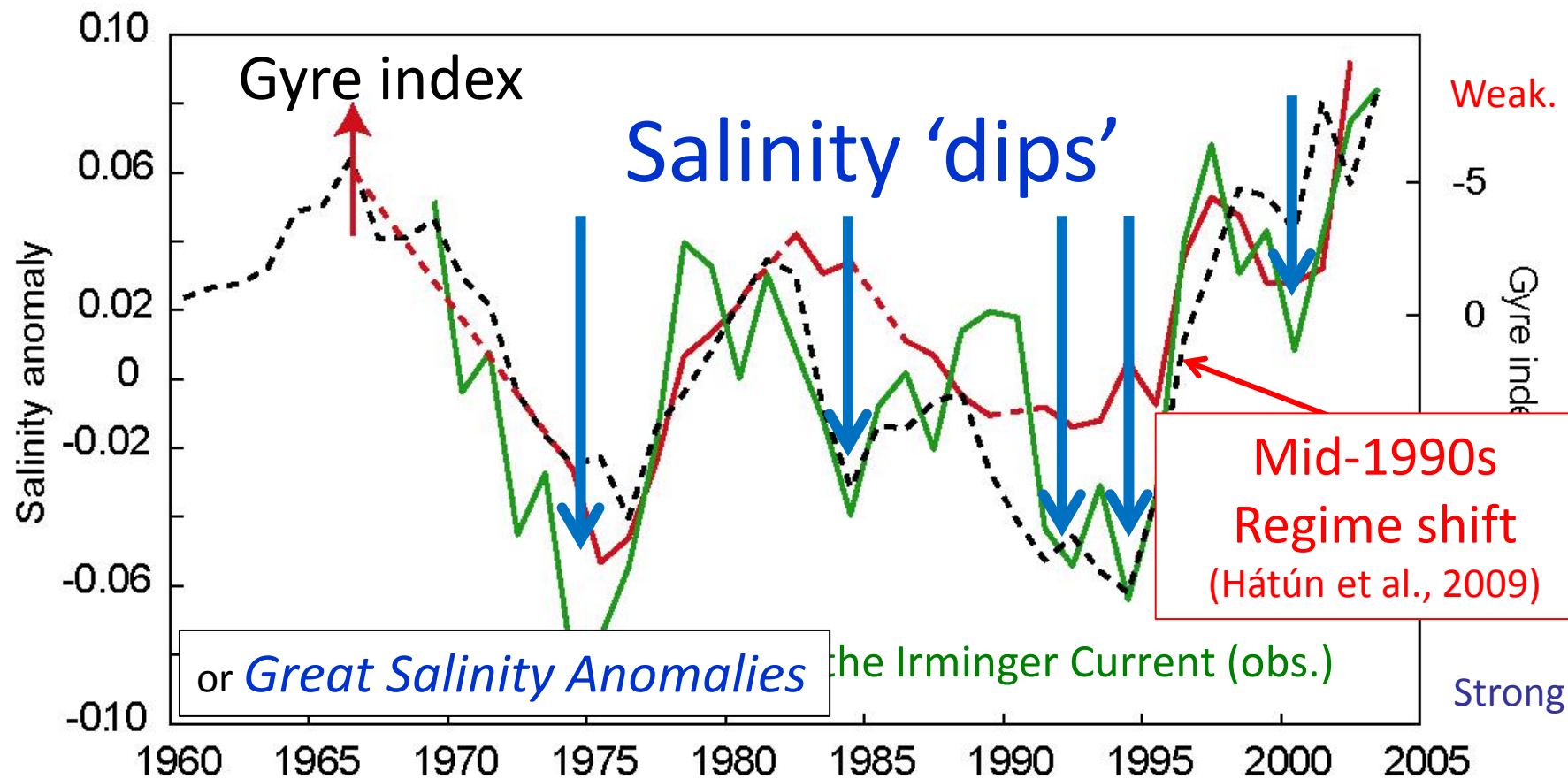
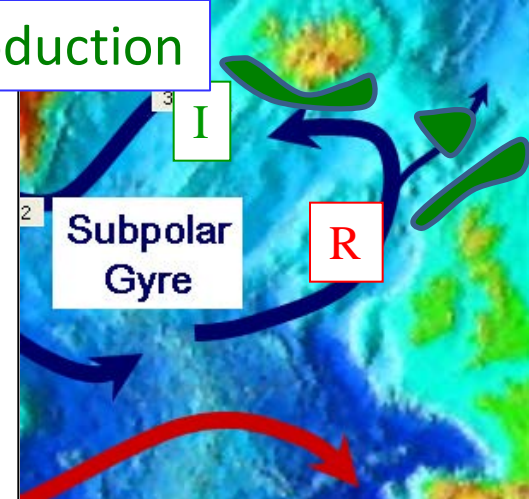
The subpolar gyre



(Hátún *et al.*, Science 2005)

The Subpolar Gyre - salinity 'dips'

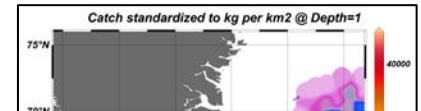
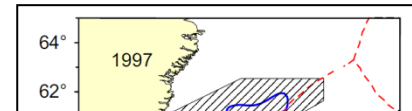
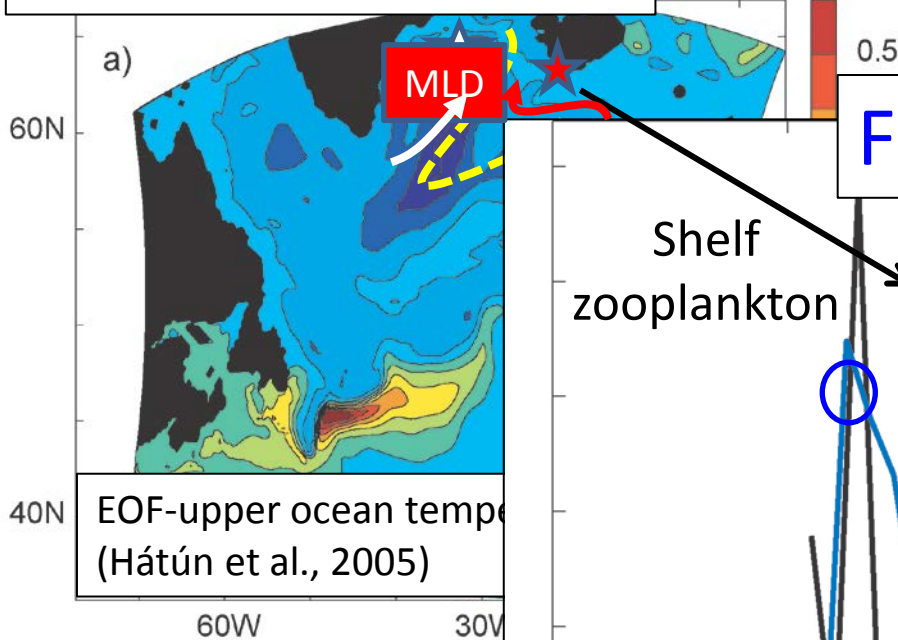
On-shelf biological production



The biologically productive *sub-arctic front*

(Hátún et al., 2016a)

Bluefin tuna
(Mackenzie, Payne et al., 2014)



Frontal shift towards Iceland

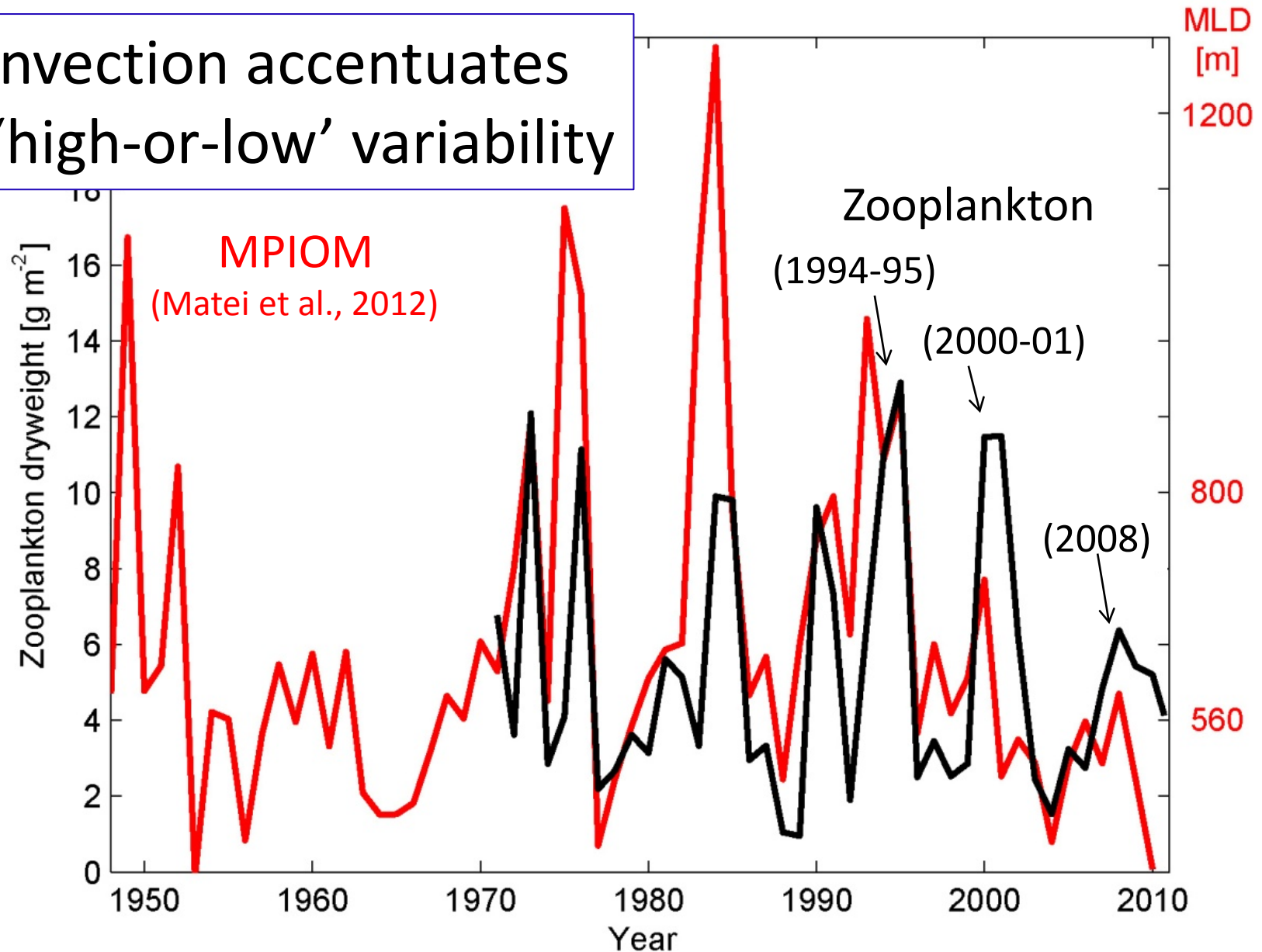
Shelf
zooplankton

Gyre Index

Increased zooplankton abundance
when the *sub-arctic front* is shifted towards Iceland

zooplankton on the south Iceland shelf

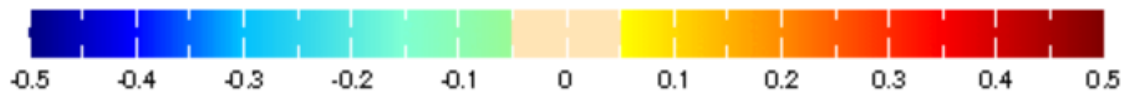
Convection accentuates
the 'high-or-low' variability



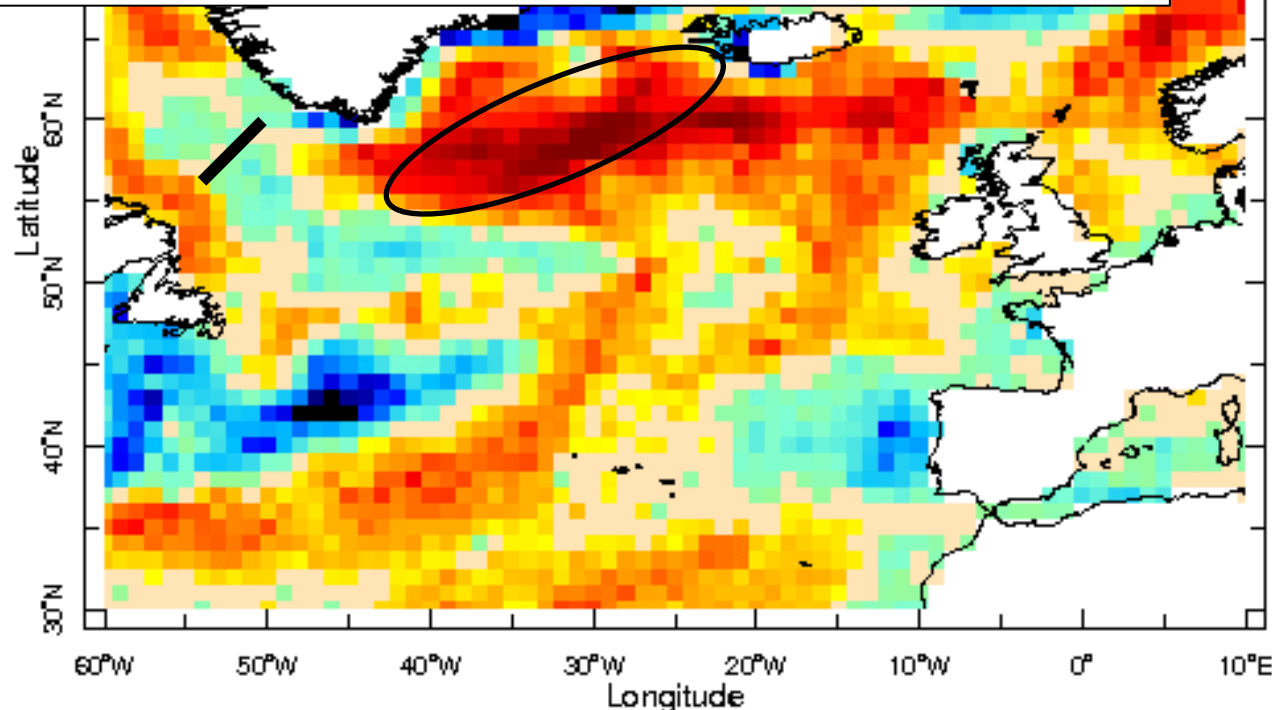
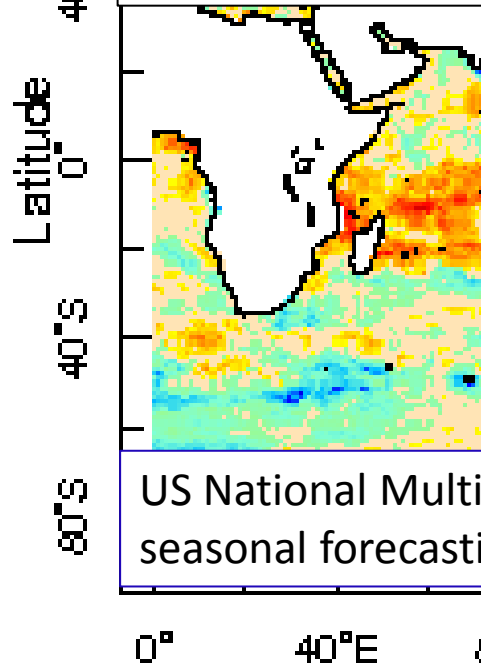
SST Predictability

Intra-seasonal to inter-annual

Ranked probability
skill score

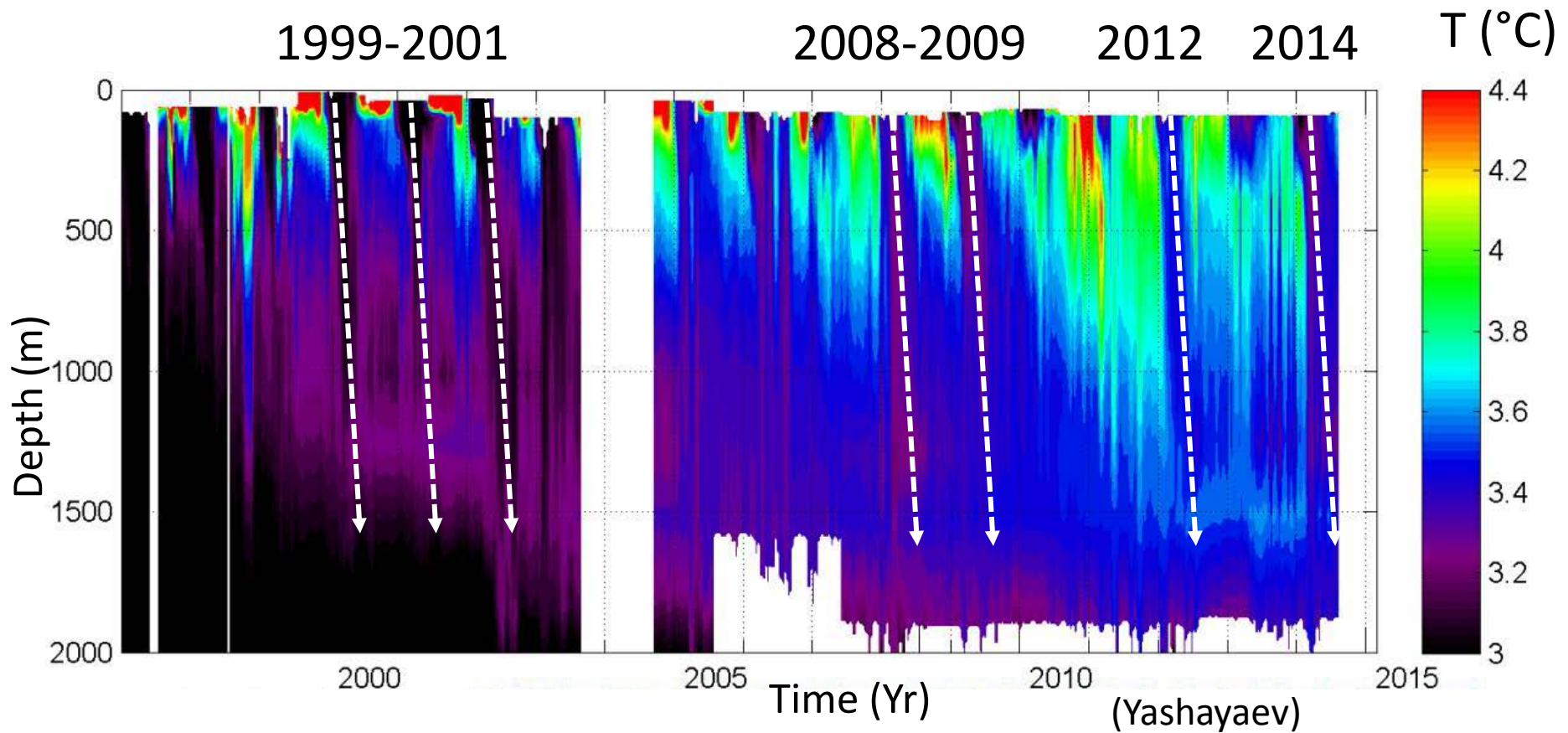
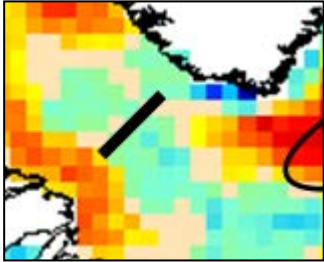


Amongst the highest predictability potential in the World



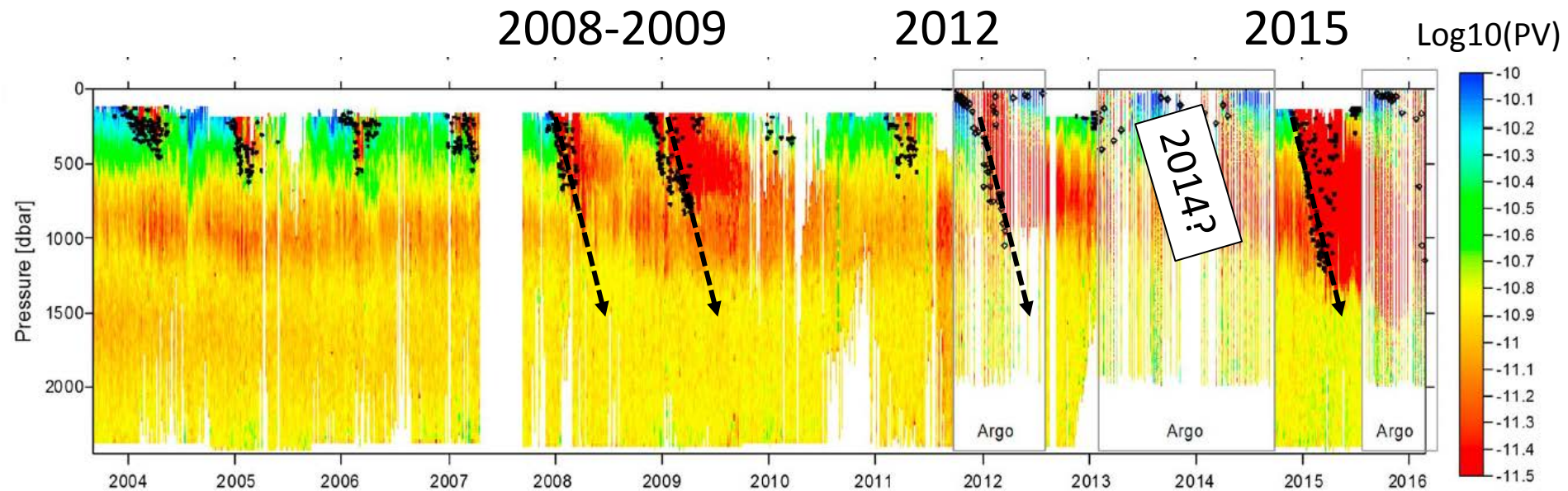
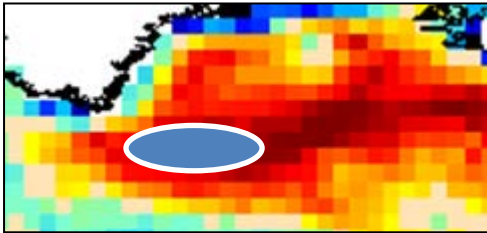
The Labrador Sea

- convection years



The southern Irminger Sea

- convection years

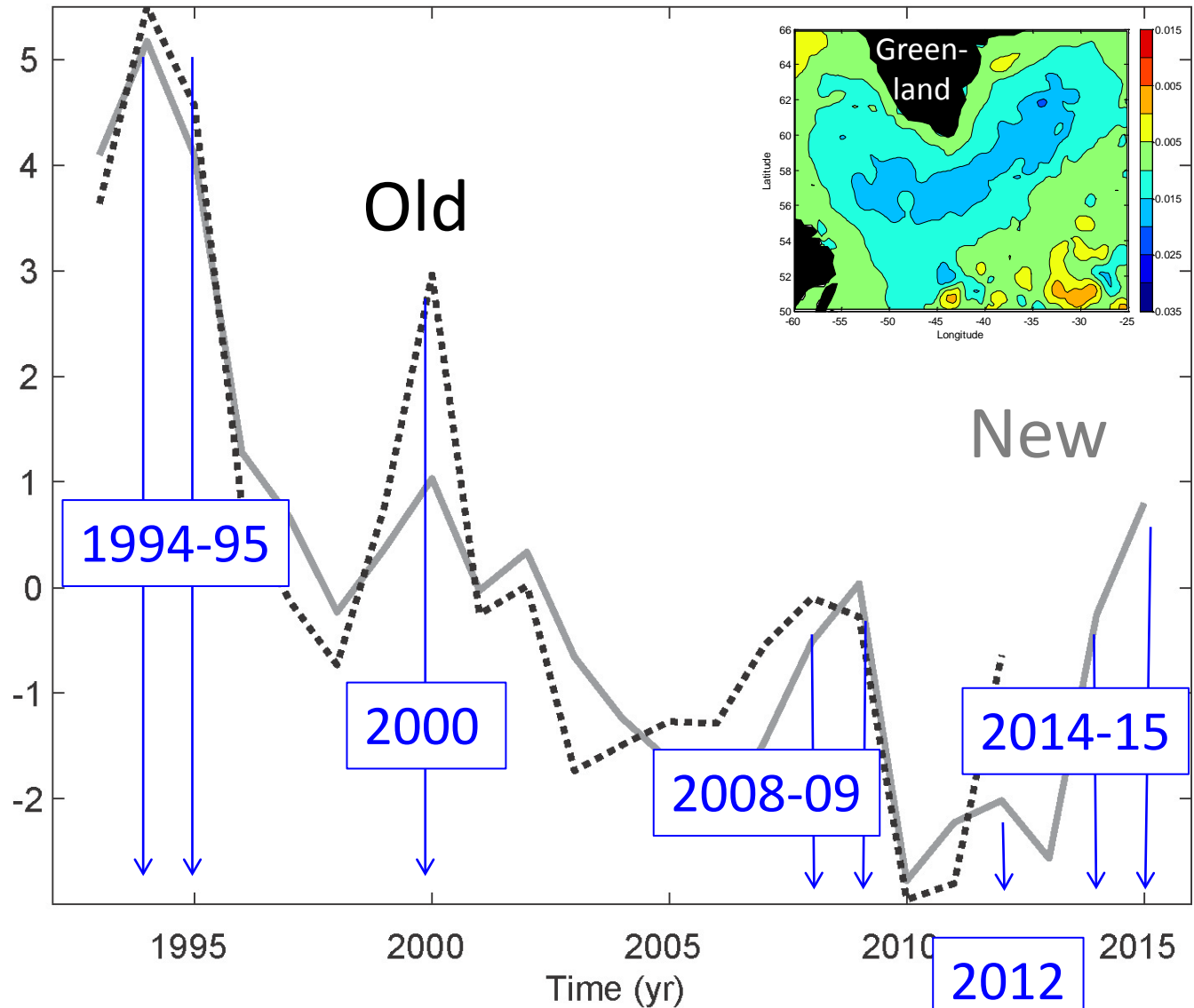


(de Jong and de Steur, 2016)

The altimetry-based gyre index

New altimetry:
DUACS 2014

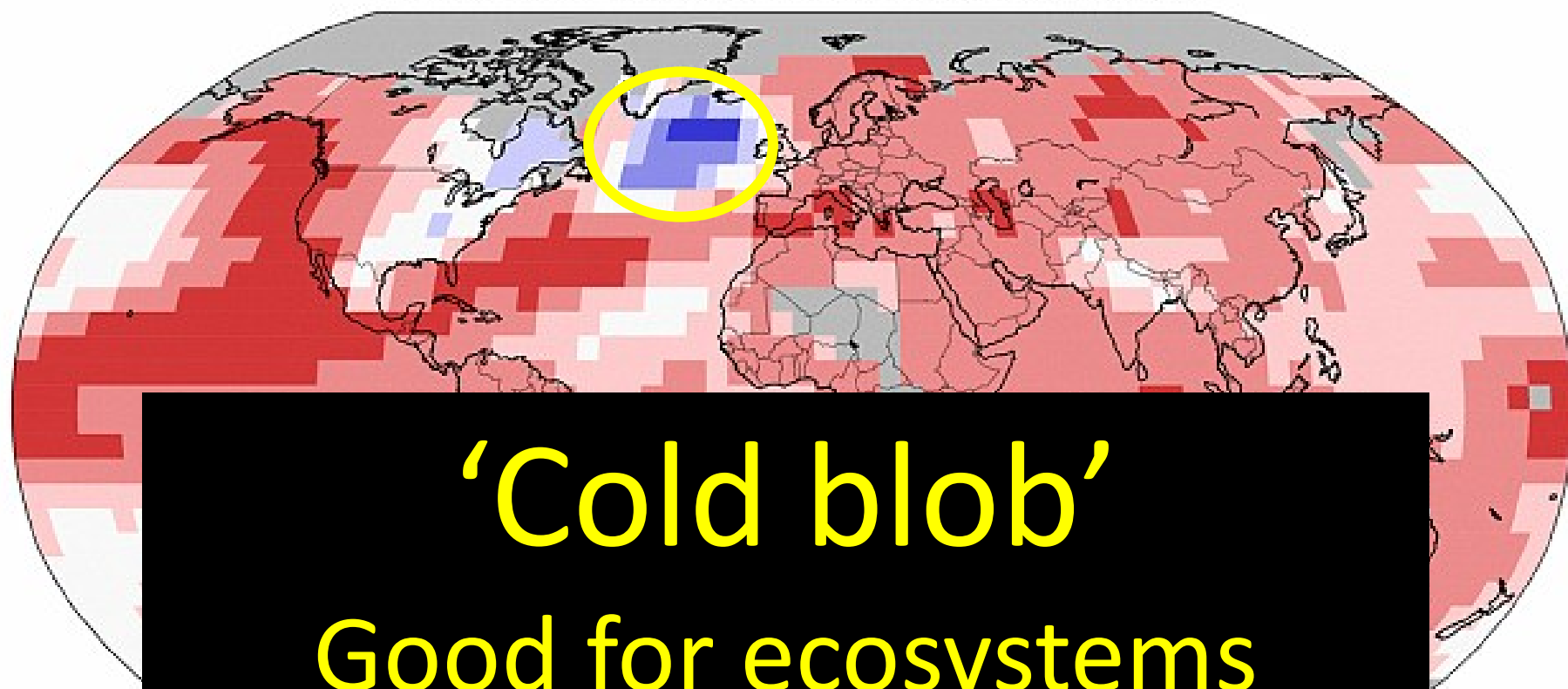
Coarser resol.
over subarctic
waters



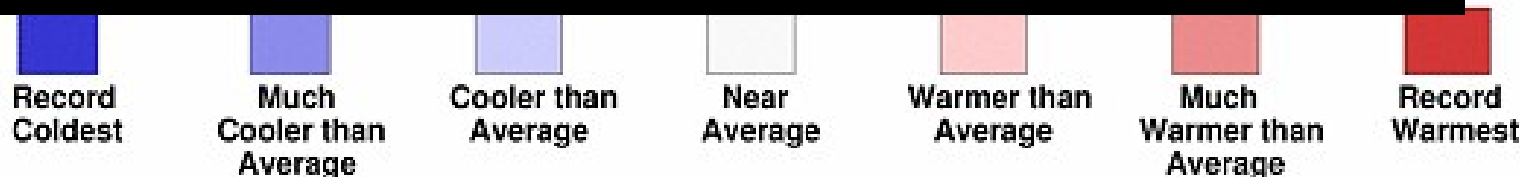
Land & Ocean Temperature Percentiles Jan–Aug 2015

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



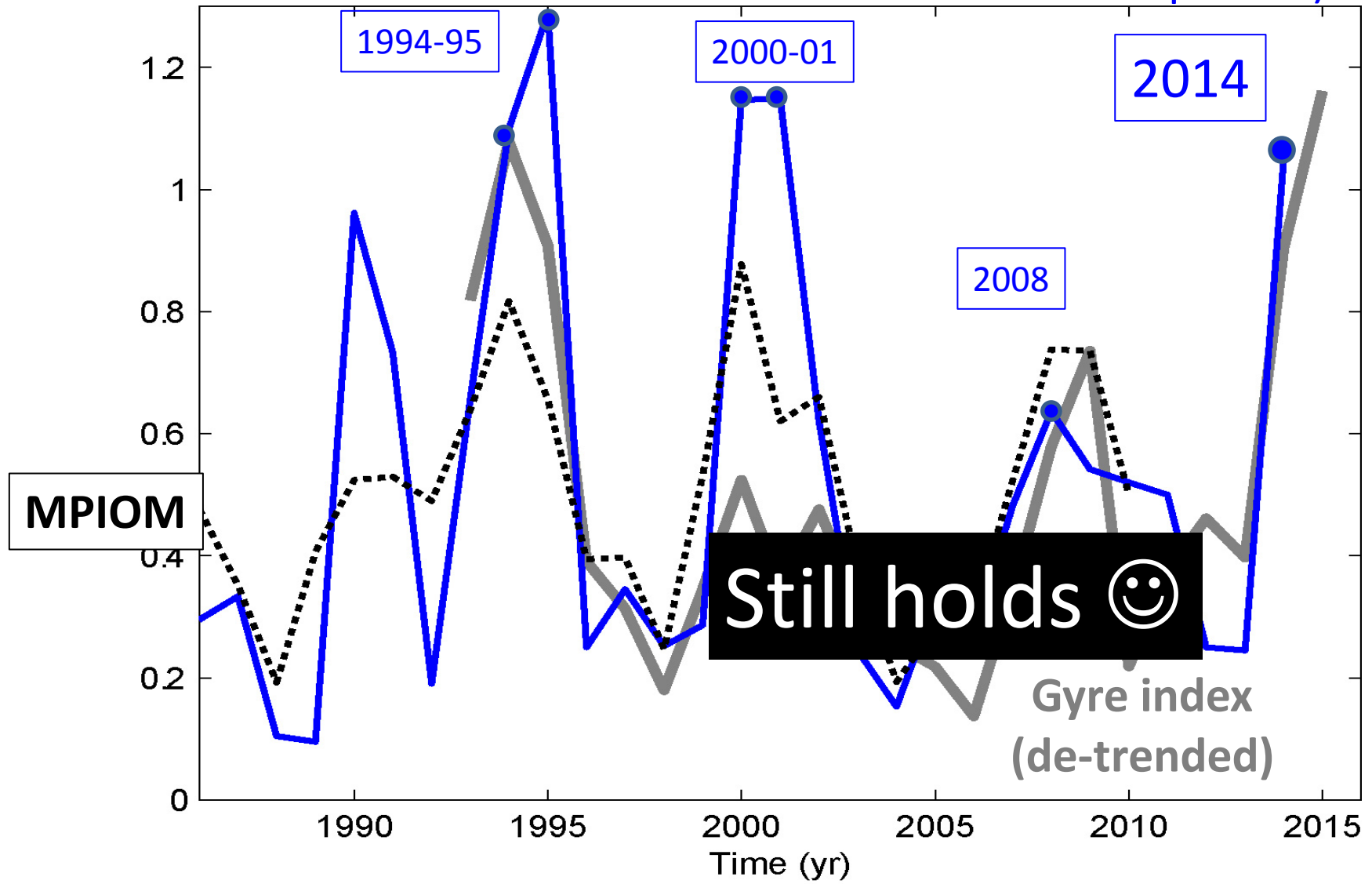
‘Cold blob’
Good for ecosystems
- as suggested by Hátún et al., 2016a



Impact of recent convection

- Iceland zooplankton

(Hátún et al., 2016a, updated)



Seabirds



Broad decline in NE Atlantic kittiwakes



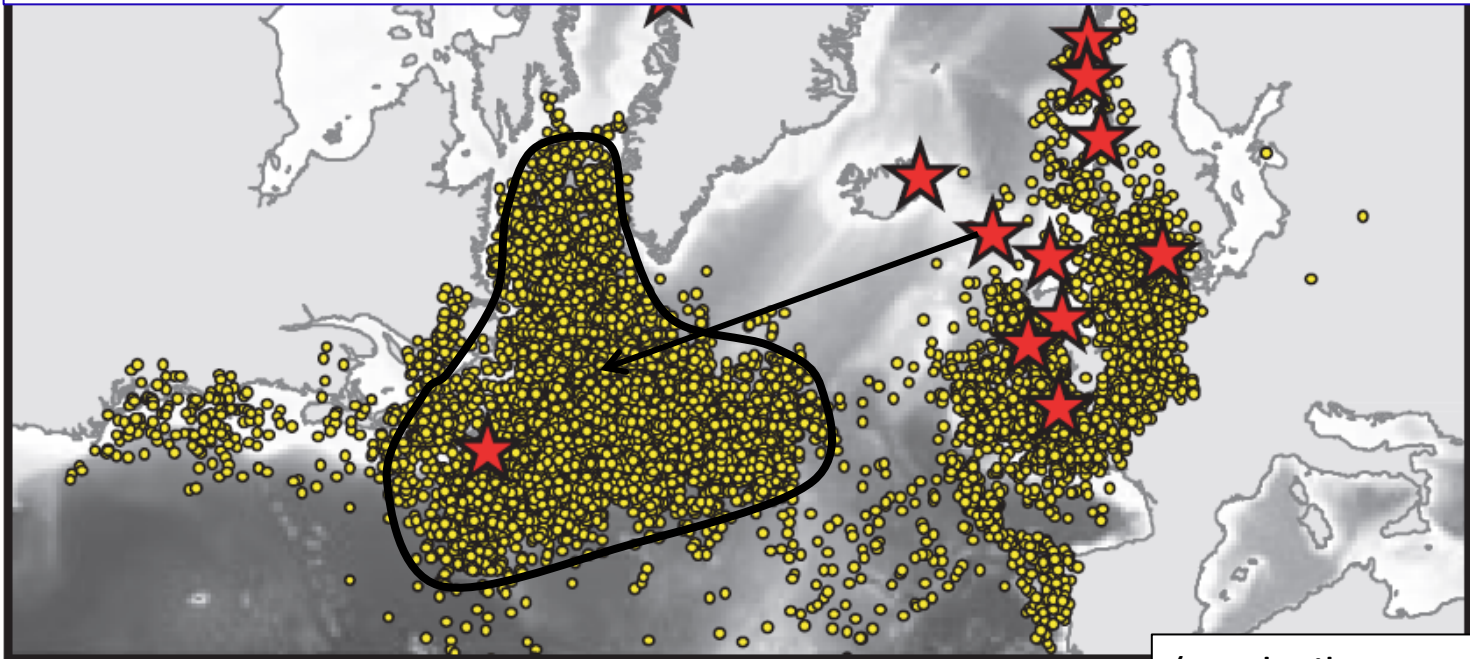
- Large and concomitant declines in chick production (*breeding success*)
- Typically associated with warming – physical processes elusive
- Link to the subpolar gyre mentioned qualitatively



Winter migration of seabirds (kittiwakes)



Feed within the subpolar gyre



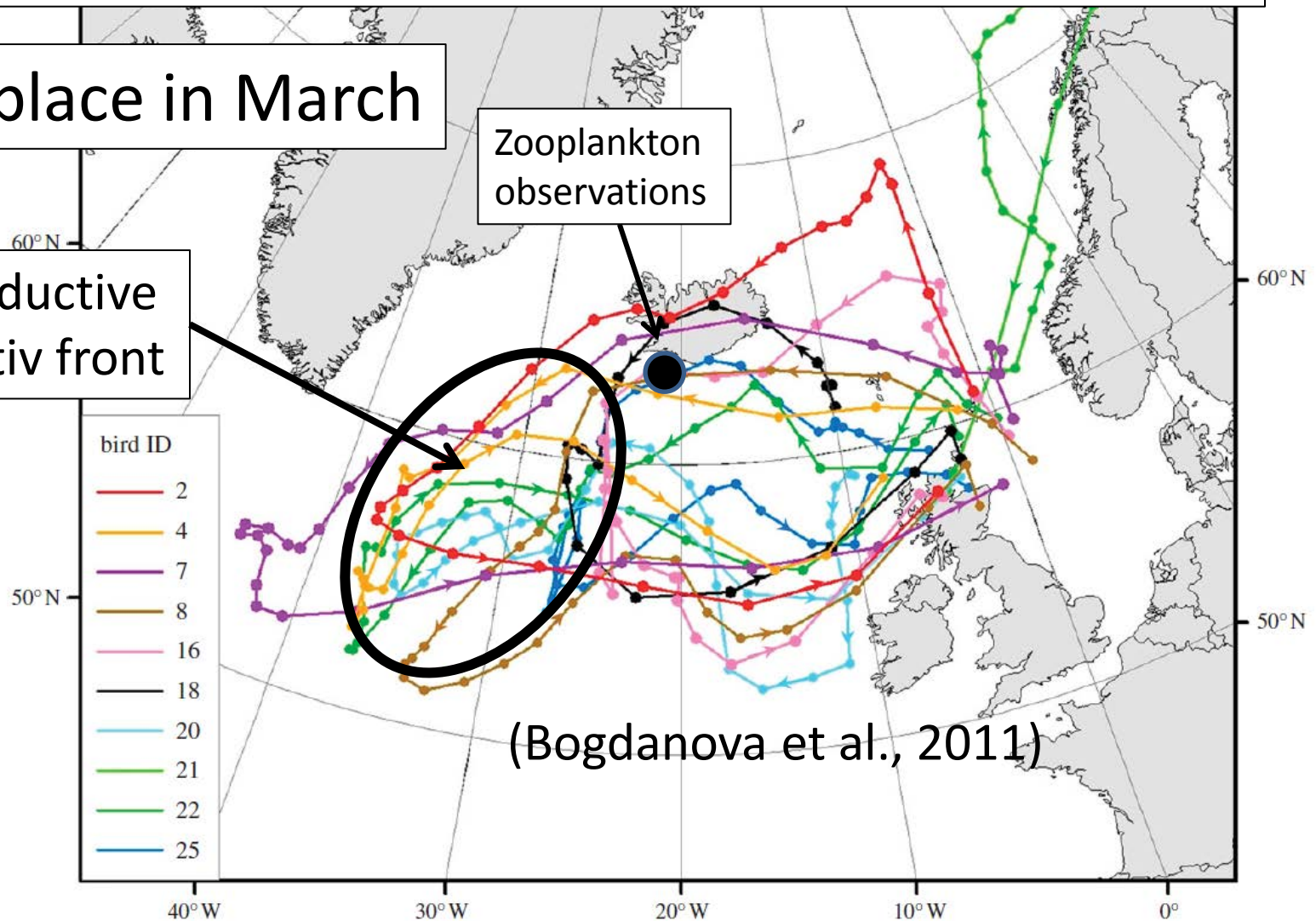
(Frederiksen, et al. 2011)

Pre-breeding exodus

Takes place in March

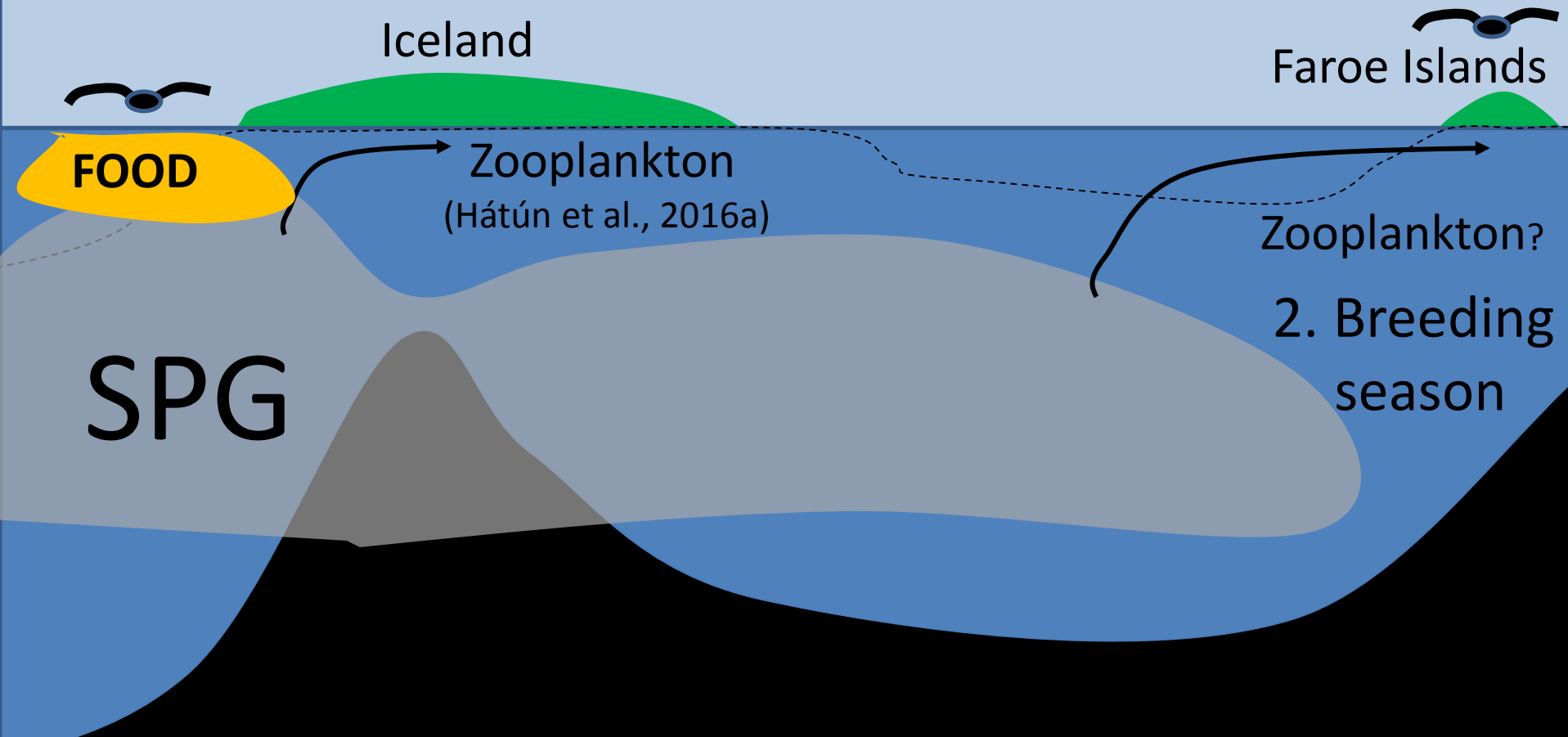
The productive sub-arctic front

Zooplankton observations



Potential subpolar gyre regulation

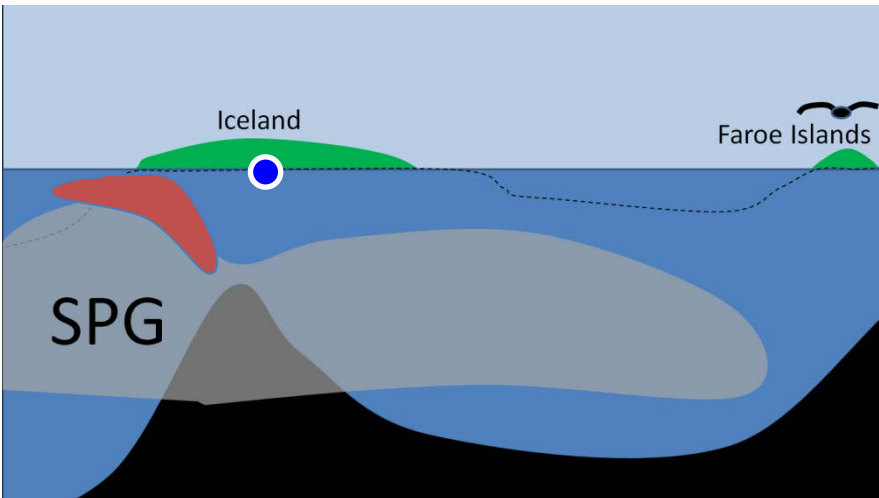
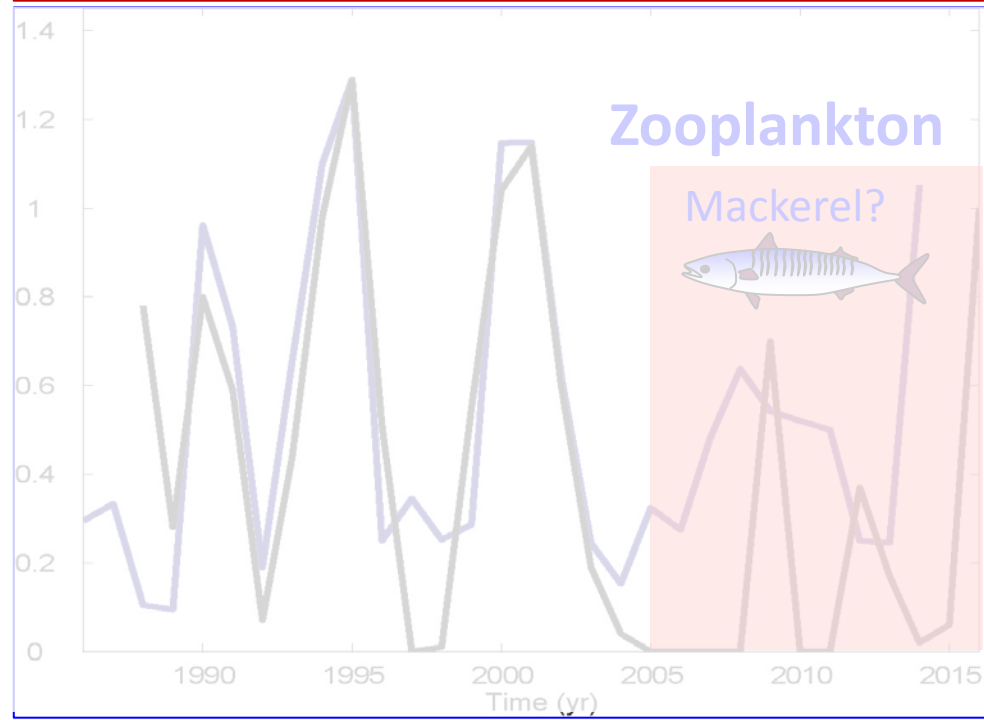
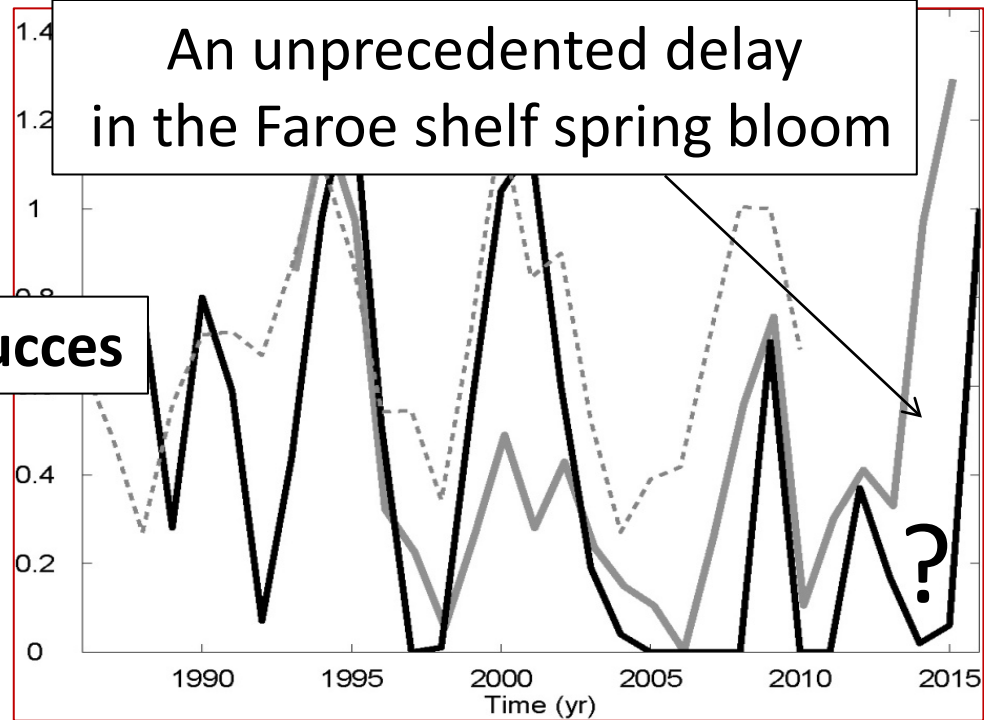
1. Non-breeding season



Remote food 'carry-over effect'

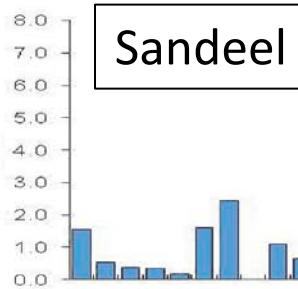
Breeding succes

An unprecedented delay
in the Faroe shelf spring bloom



Local food

O-group fish breeding season

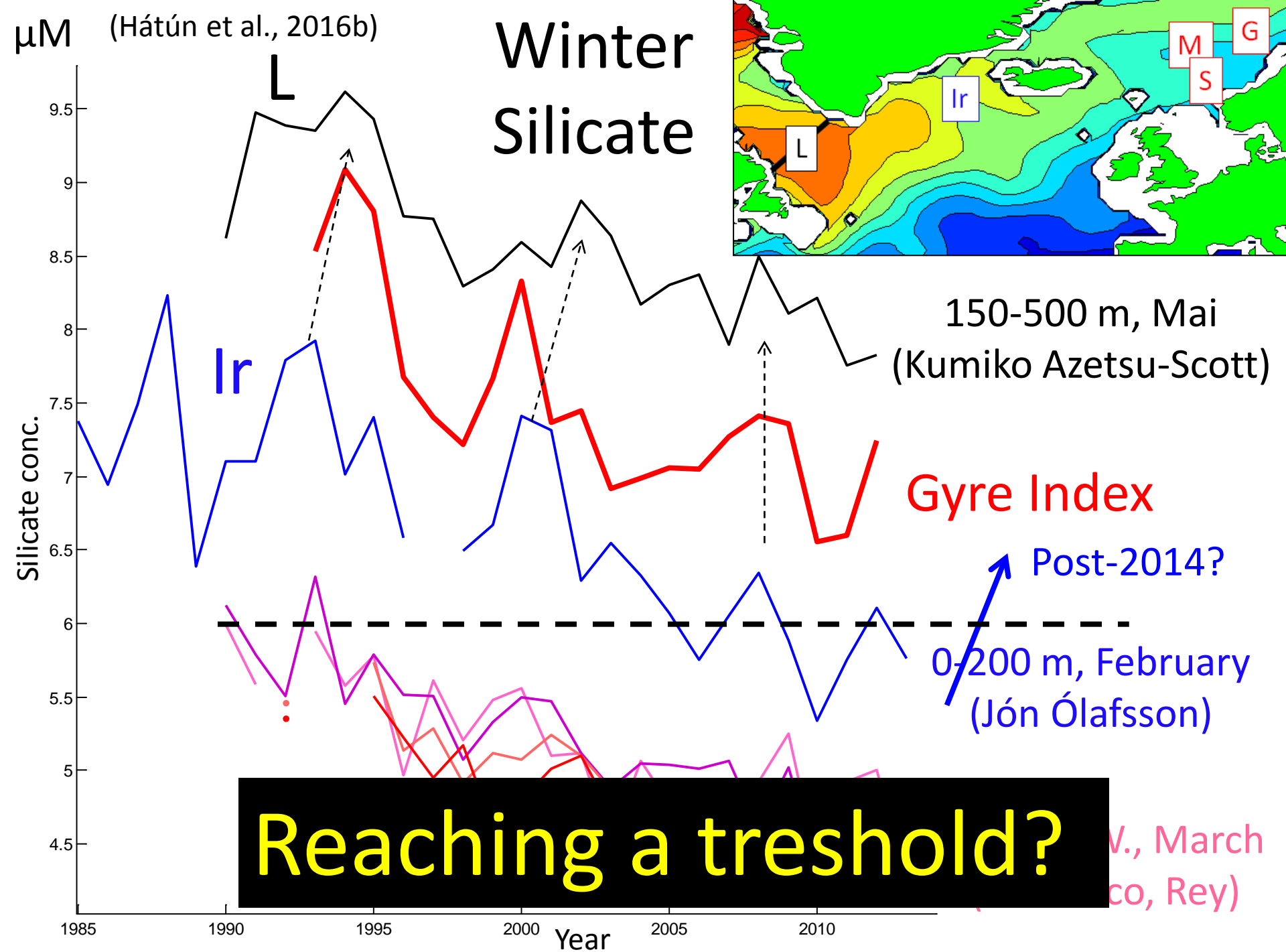


“The 2015 breeding season on the Isle of May NNR proved to be another good year following the general success of 2014”

“Of the six study species, northern fulmar, European shag and black-legged kittiwakes had **one of their most successful seasons on record**”
(<http://www.ceh.ac.uk/isle-may-breeding-season-summaries#2015>)

A general improvement for seabirds in the Faroe Islands in 2014, 2015 and especially in 2016 (pers. Comm Bergur Olsen)

The 2013-2015 has blown life!
- forecasting potential



Conclusions

- Climate is more than temperatures
- Winter convection might induce a predictable signal – 0.5-1.5 years time horizon
- Broad ecosystem improvement after the 2013-2015 winter convection
- Is knowledge on future convection events a prerequisite for making decadal predictions?



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