Spatio-temporal variation of the plankton trophic interaction in the North Sea

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database
regime shifts

North Sea

Reid et al. (1998) updated
regime shifts

Daskalov et al. (2007)
regime shifts

Baltic Sea

Möllmann et al. (2008)
spatial info

regionalization

Edwards et al. (2001)

Leterme et al. (2008)

Several studies

McQuatters-G. et al. (2007)
spatial info

regionalization

decadal averaging

Edwards et al. (2006)
First eigenvector and principal component (24.35% of the total variability)

First principal component

$r = 0.67, p < 0.001$

Only a few studies focused on distributional changes.
Look into the distributional patterns by using the spatial information explicitly.

Simultaneously include temporal and spatial variation in a single statistical model.

Have this reorganization affected the spatial distribution of plankton?

Biomass of functional groups – trophic interactions.
methods

distributions
methods

distributions

1958 - 1987

1988 - 2004

Latitude

Longitude

A

B

PCI

1.2
1.0
0.8
0.6
0.4
0.2


PCI

1.2
1.0
0.8
0.6

A B

Year
methods

3 distributions
Cross Validation
model's out-of-sample predictive performance
Phytoplankton Colour

(a) 1958-1979
1980-1987
1988-2004

Latitude
Longitude
PCI

Year
PCI
results

Diatoms


results

Dinoflagellates

results

Zooplankton Biomass


(b) Year

mg m$^{-3}$

Llope et al. (under review)
results

Meroplankton Biomass

Llope et al. (under review)
conclusions

Large spatio-temporal variability with ~3 different distribution over the last 50 years
conclusions

1. Large spatio-temporal variability with ~3 different distribution over the last 50 years.

2. The late-80s don’t concentrate the most Important changes across functional groups!

   Functional diversity ≠ Response diversity
2\textsuperscript{nd} question

Do trophic interactions play a role?

Look into interactions between herbivores and phytoplankton [both total and main groups]
methods

Spatially-explicit

Accounts for non-additivity

Includes varying-coefficient
results

Herbivores - Total phytoplankton

Llope et al. (in preparation)
results

Herbivores - Diatoms/Dinoflagellates

**HER distribution, >1972**

**DIA 2nd regime, >1972**

**DIN 2nd regime, >1972**

**D** (Graph showing trend over years with thresholds indicated)

Llope et al. (in preparation)
conclusions

Trophic regulation as a dynamic property

the North Sea system has become a more regionalized system since the drastic decrease in diatoms of the late 1960s
conclusions

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from bottom-up to top-down?
Trophic regulation as a dynamic property

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Trophic regulation as a dynamic property

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from classic diatom-dominated phytoplankton community to a more microbial loop type of community?
thanks!

funding:

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