Inter- and intra-annual variations in the fish community structure related to abiotic drivers in the Sylt-Rømø Bight, southeastern North Sea

Victor Odongo [1,2], Harald Asmus[1], Sabine Horn[1], Johannes Rick[1], Harald Ahnelt[3], Maarten Boersma [1,2], Karen Helen Wiltshire[1]

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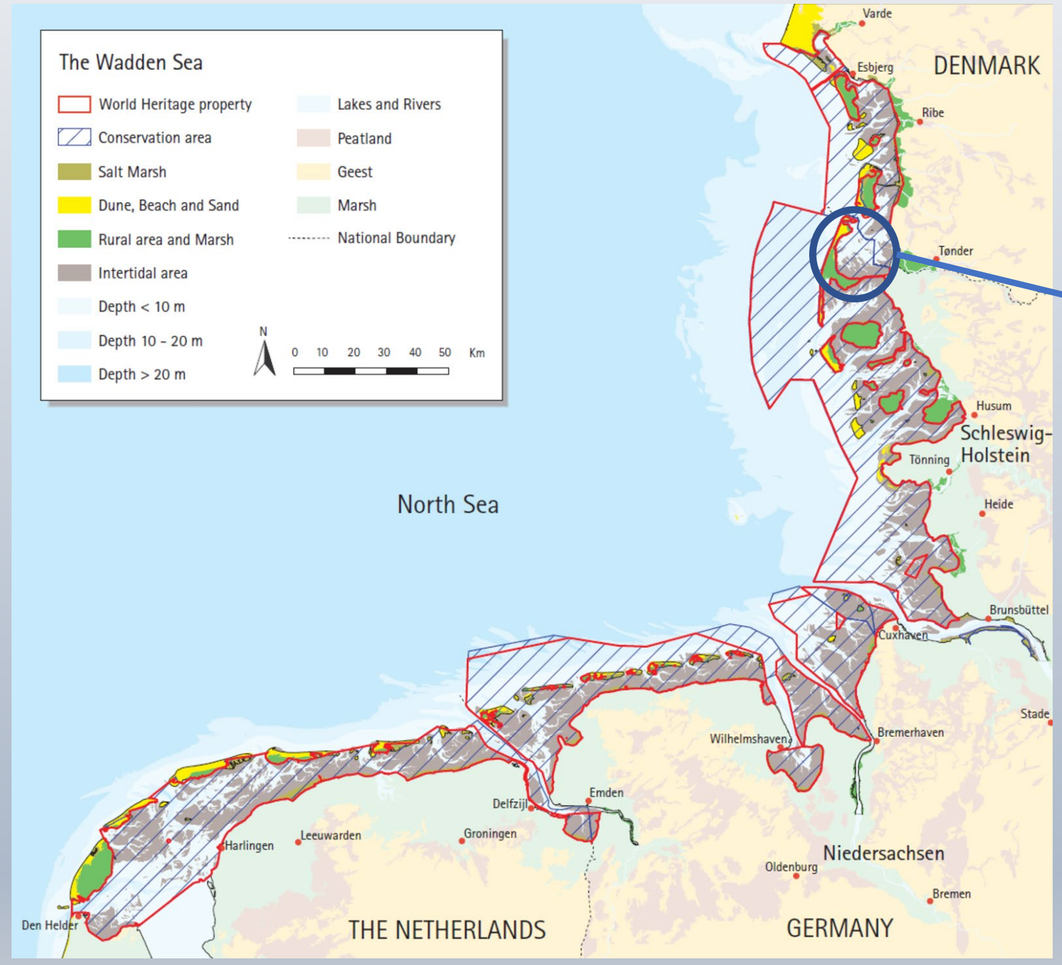
INTRODUCTION

The Wadden Sea



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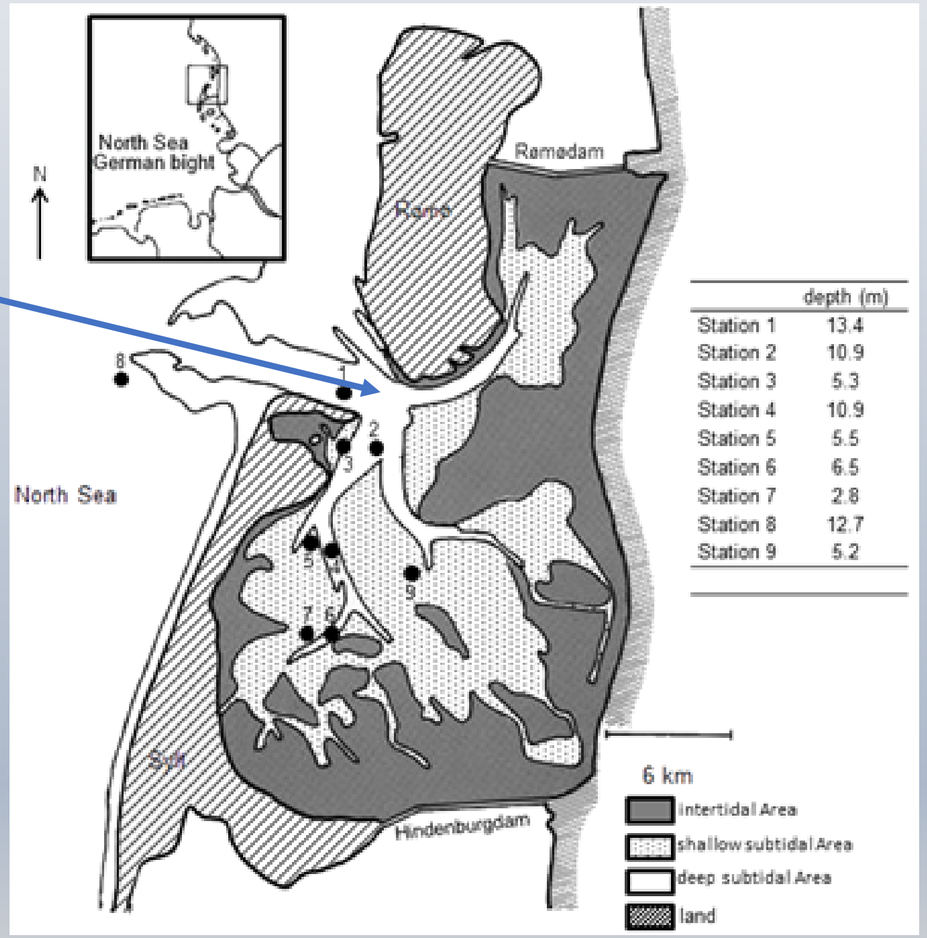
The Sylt-Rømø Bight (SRB)



	depth (m)
Station 1	13.4
Station 2	10.9
Station 3	5.3
Station 4	10.9
Station 5	5.5
Station 6	6.5
Station 7	2.8
Station 8	12.7
Station 9	5.2

AIM

Inter- and intra-annual variations in the fish community structure related to abiotic drivers in the Sylt-Rømø Bight

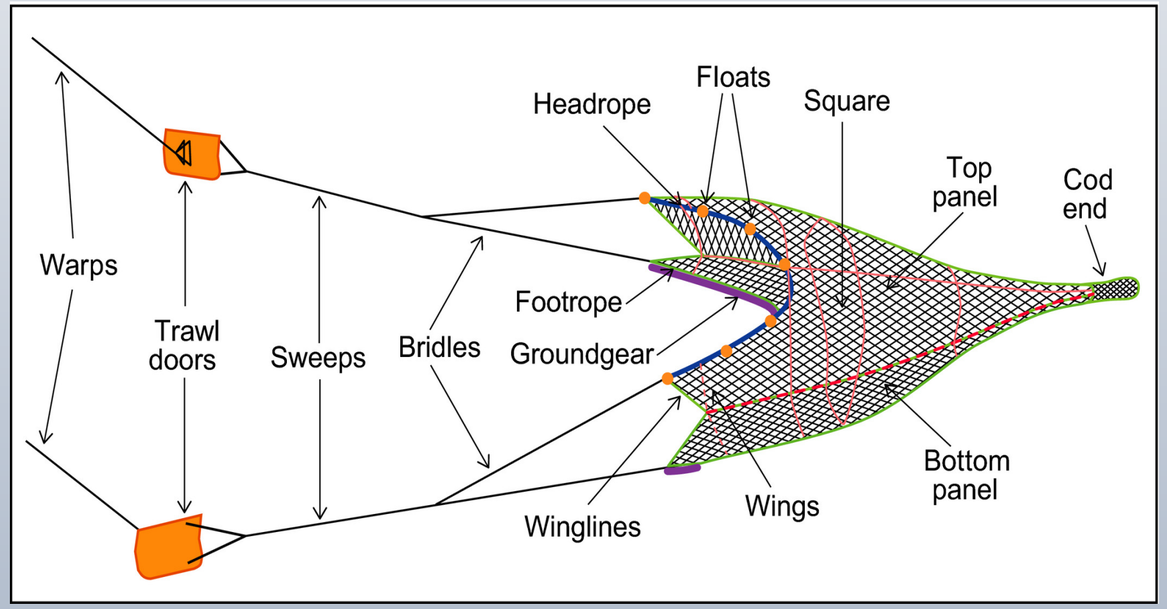
Specifically

- The fish community and long-term trends
- The common patterns and seasonal assemblages
- Effects of environmental variables
- Seasonal variations in community structure

METHODOLOGY

Monthly juvenile fish monitoring in the SRB

Data: 2007 – 2019



© SEAFISH

- Species identification
- Numbers - at - Length

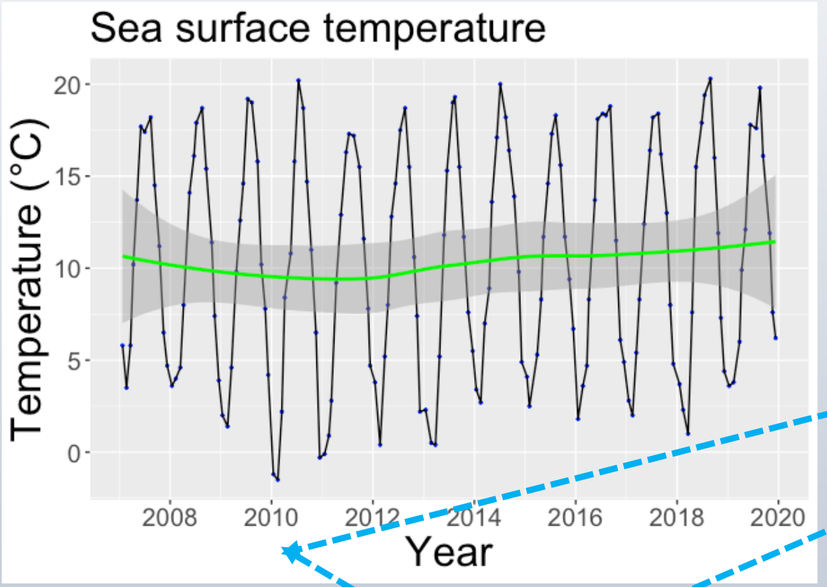
Environmental variables

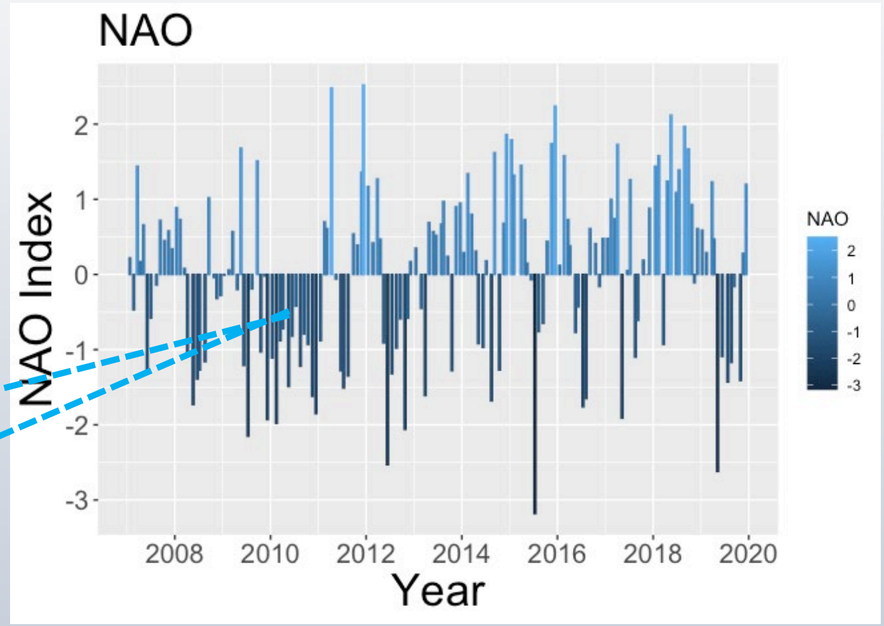
- Sea surface temperature (SST)
- Seasons: Winter, Spring, Summer, Autumn
- Salinity (Sal)
- Chlorophyll a (Chl_a)
- North Atlantic Oscillation (NAO) +

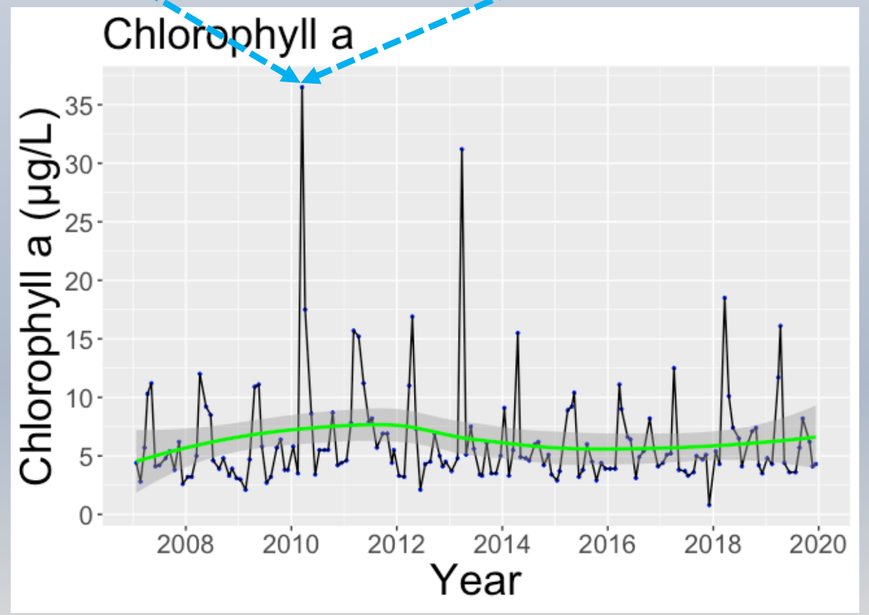
  NAO_Winter

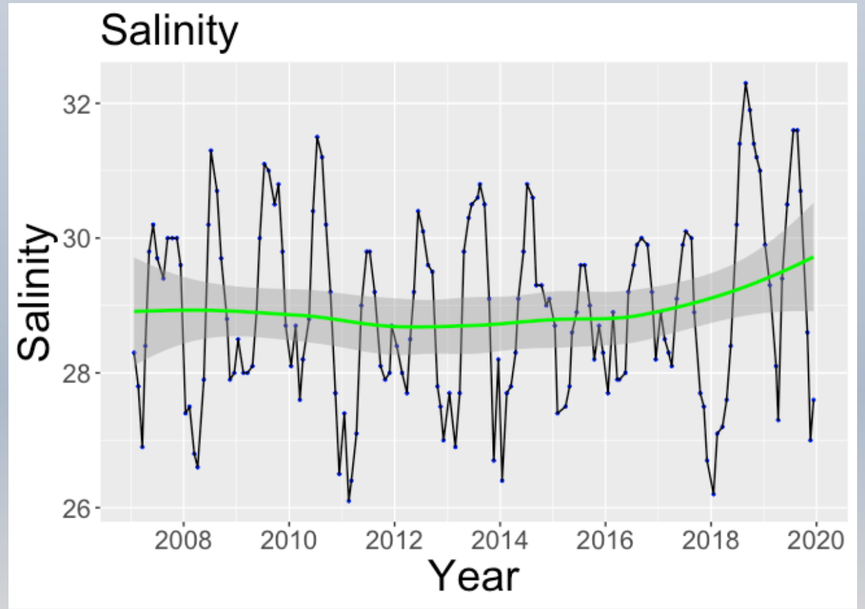
RESULTS:

Trends of environmental variables



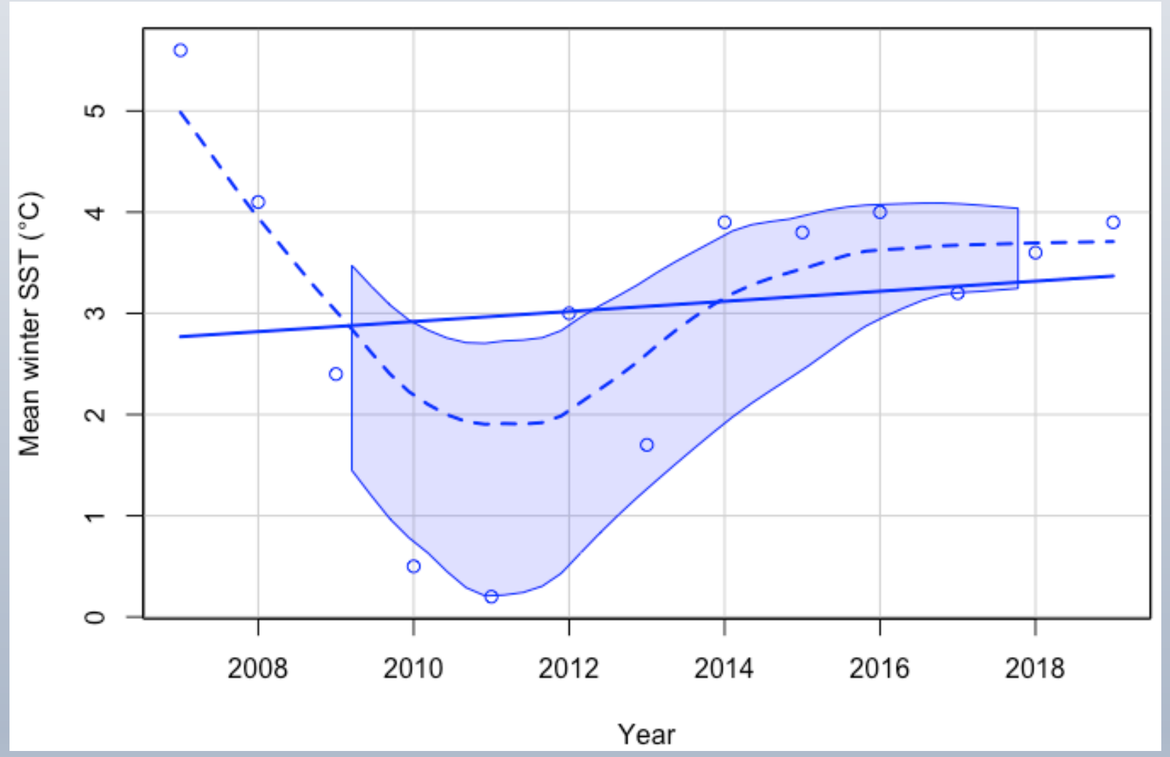




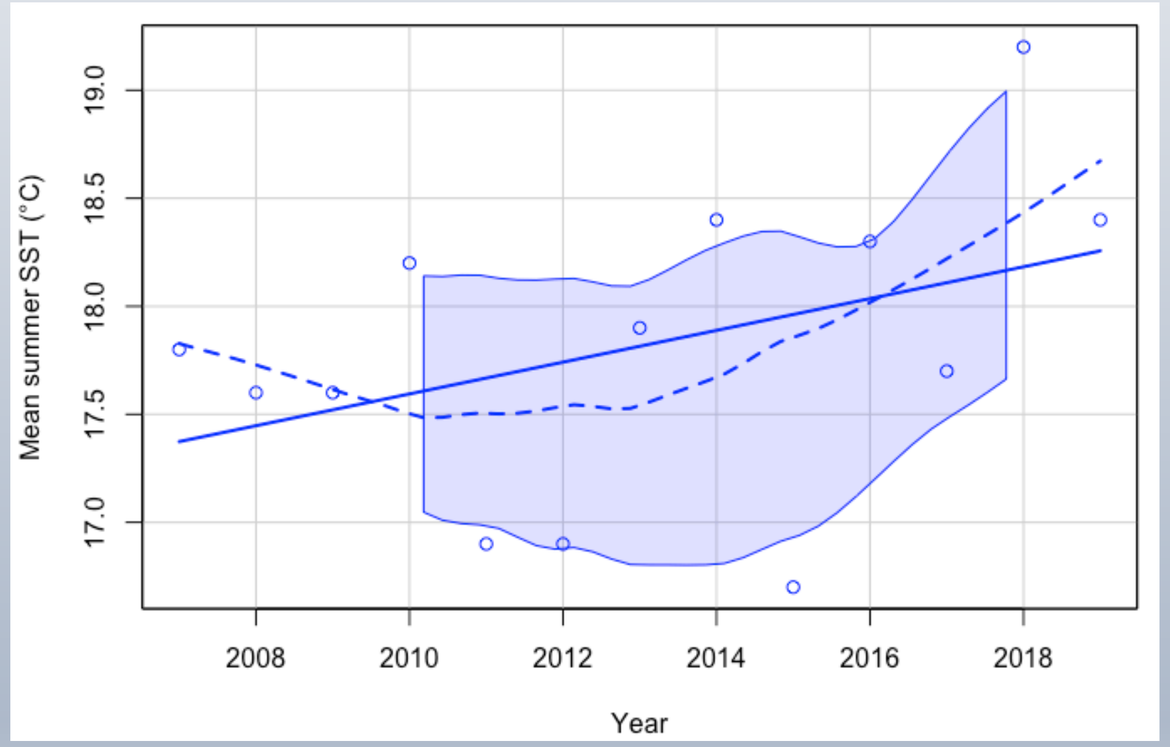


Inter-annual mean SST variations

Winter



Summer



The fish community

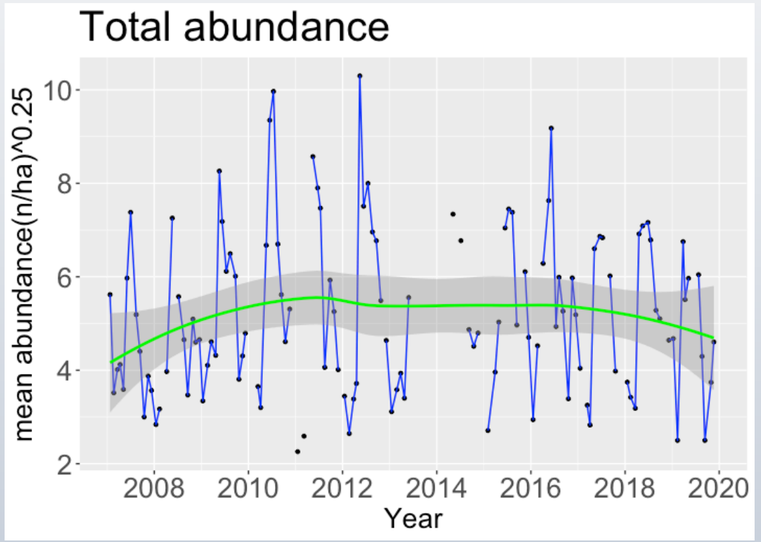
Fifty-five fish species, Fourteen orders, Thirty-two families

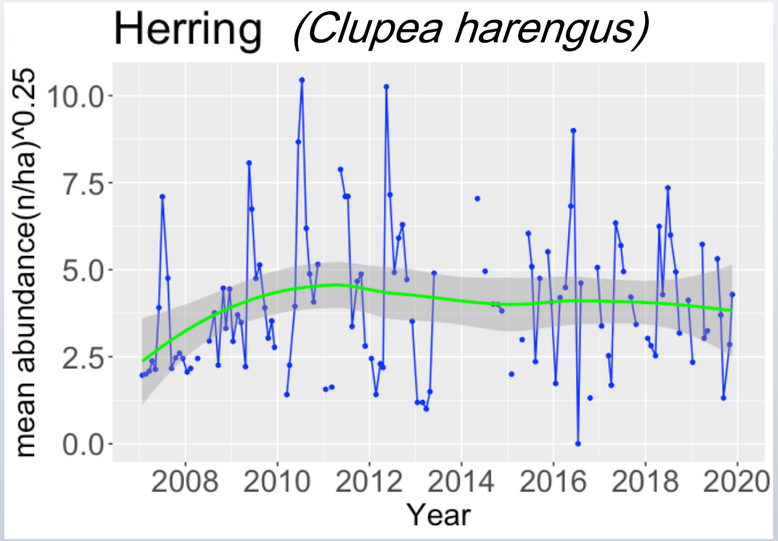
Biogeographic guild/habitat	Number
Boreal benthopelagic	4
Boreal benthic	14
Boreal pelagic	5
Lusitanian benthopelagic	2
Lusitanian benthic	18

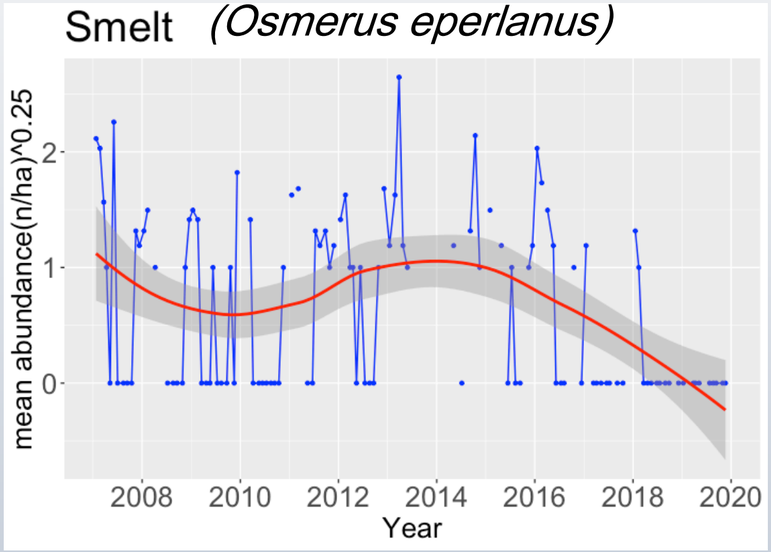
Biogeographic guild/habitat	Number
Lusitanian pelagic	9
Atlantic benthopelagic	1
Atlantic benthic	1
Atlantic pelagic	1

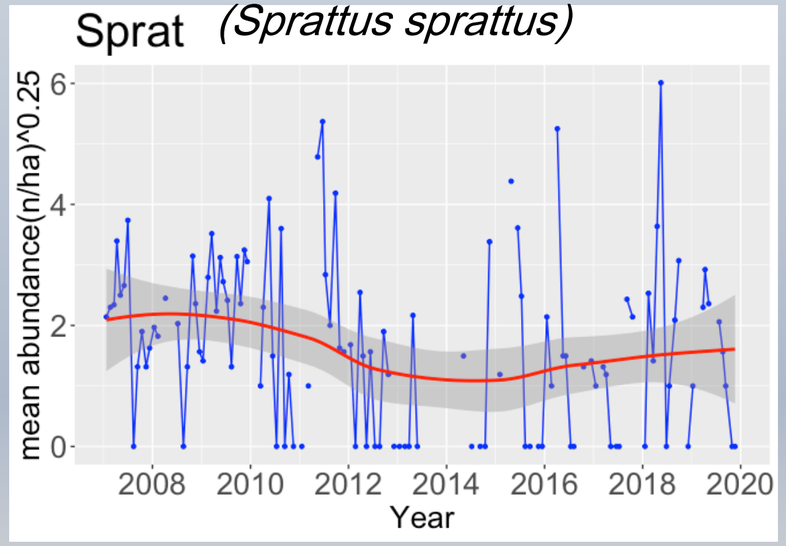
Includes eight (8) new and excludes four (4) species in comparison to a similar survey (1990 – 1994)

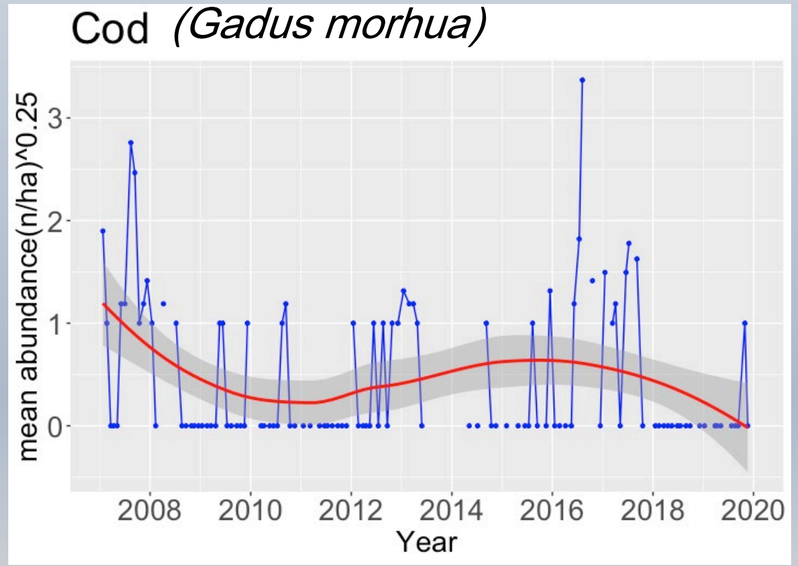
Fish species trends

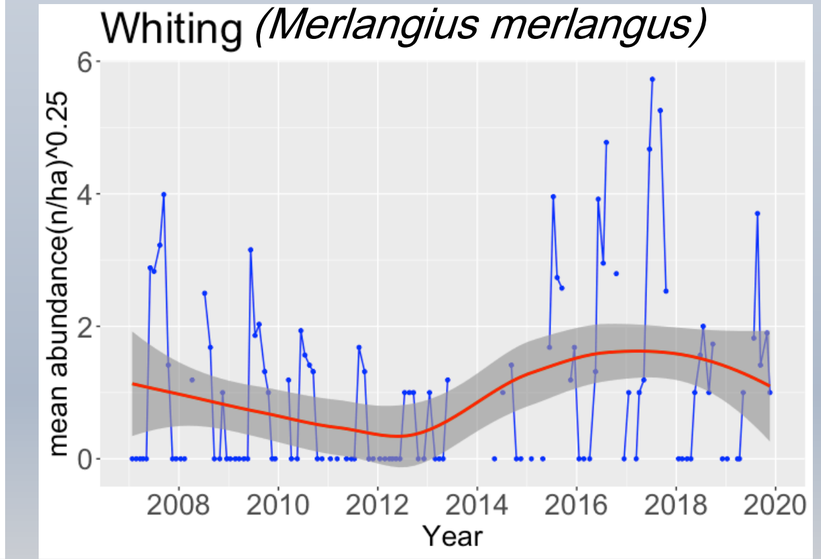










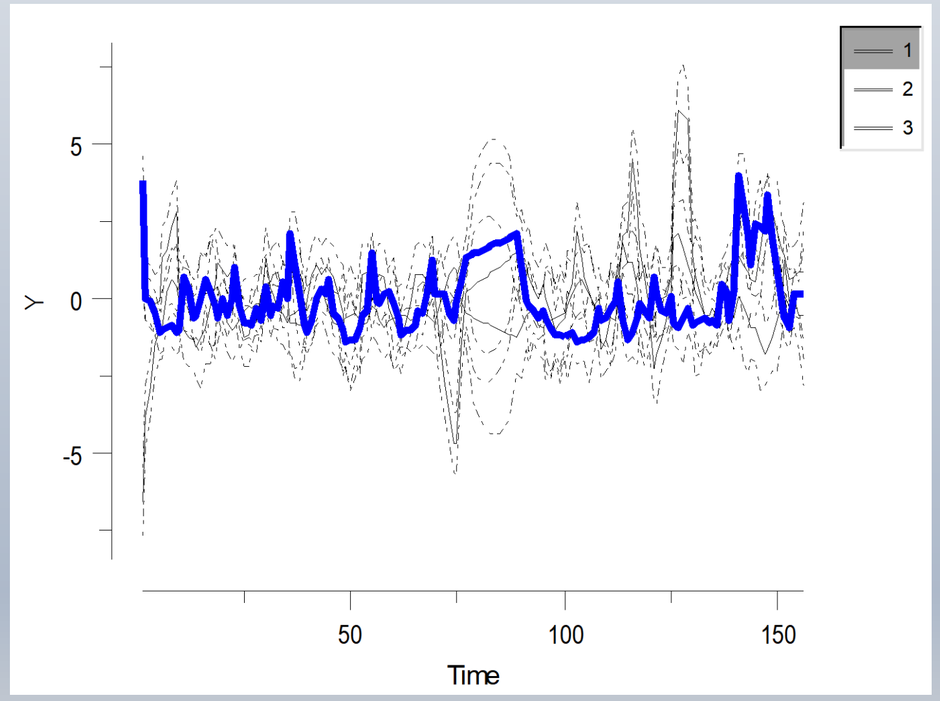


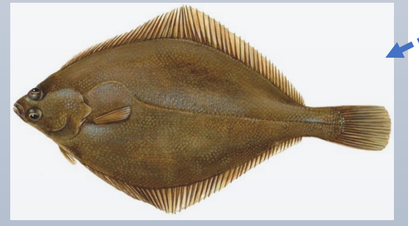
Common patterns and seasonal assemblages

Dynamic Factor Analysis (DFA): N time series ~ linear combination of M common trends + constant level parameters + Expl. variables + noise

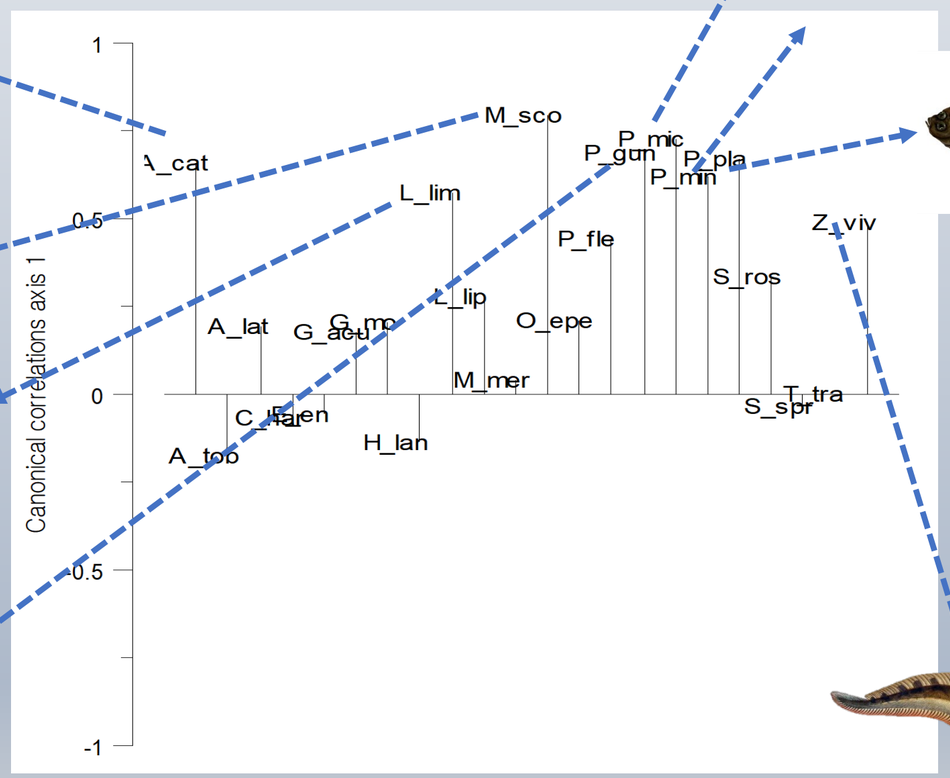
First common pattern

Winter and spring assemblages





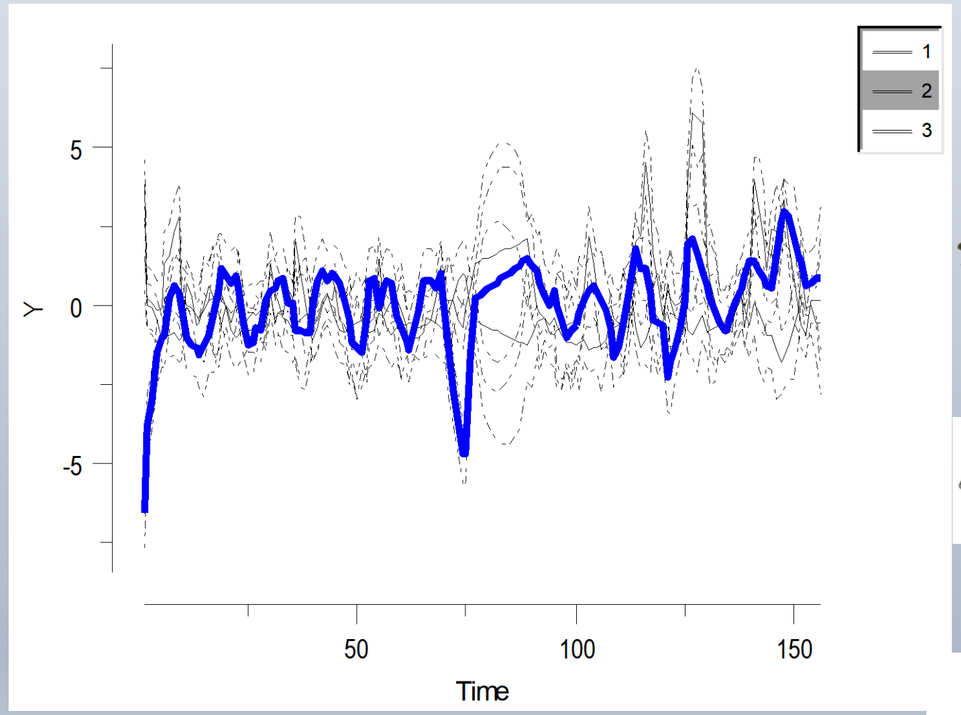
Canonical correlations



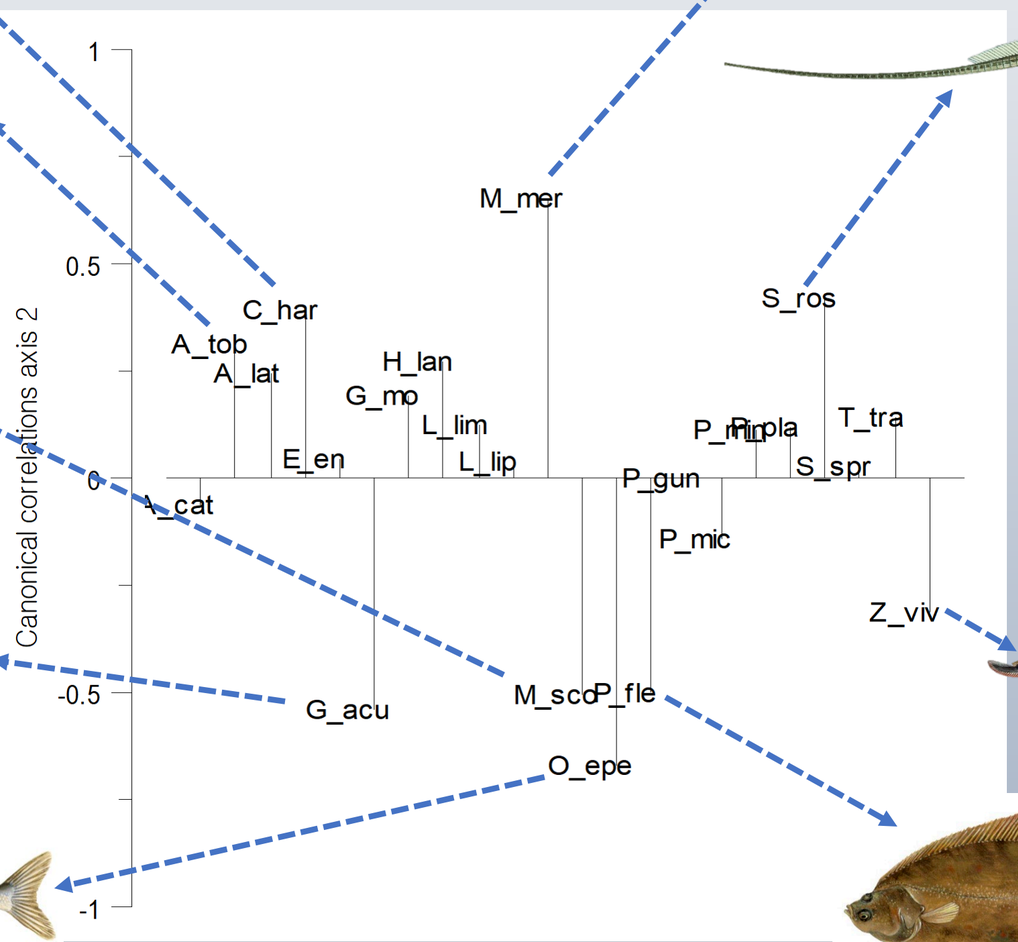
Common patterns

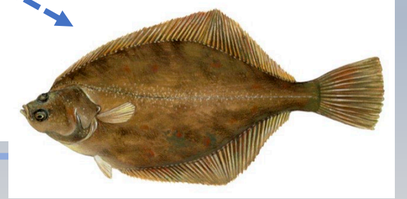
Second common pattern

Summer assemblages



Canonical correlations

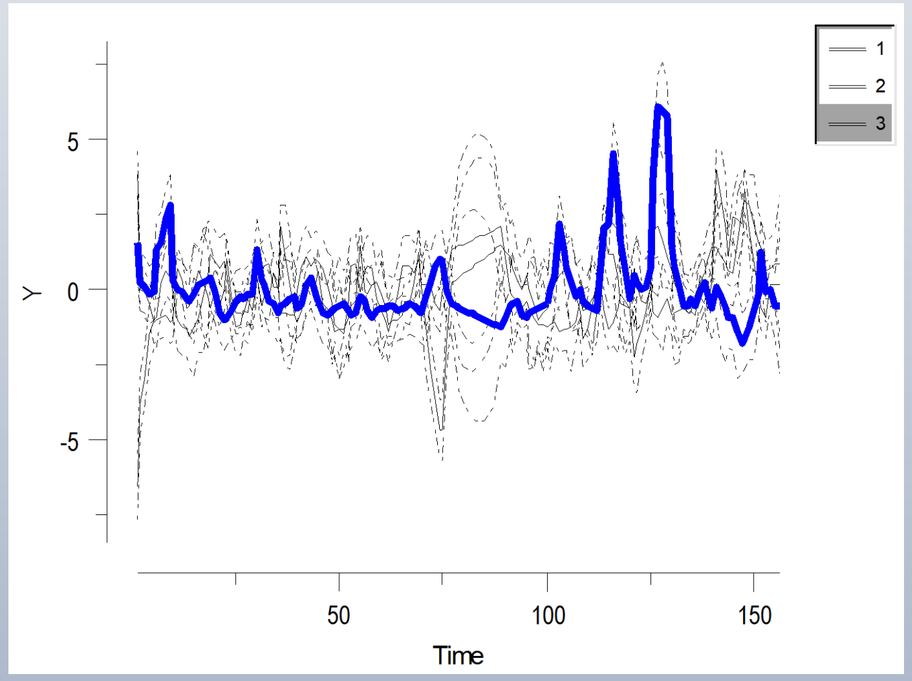




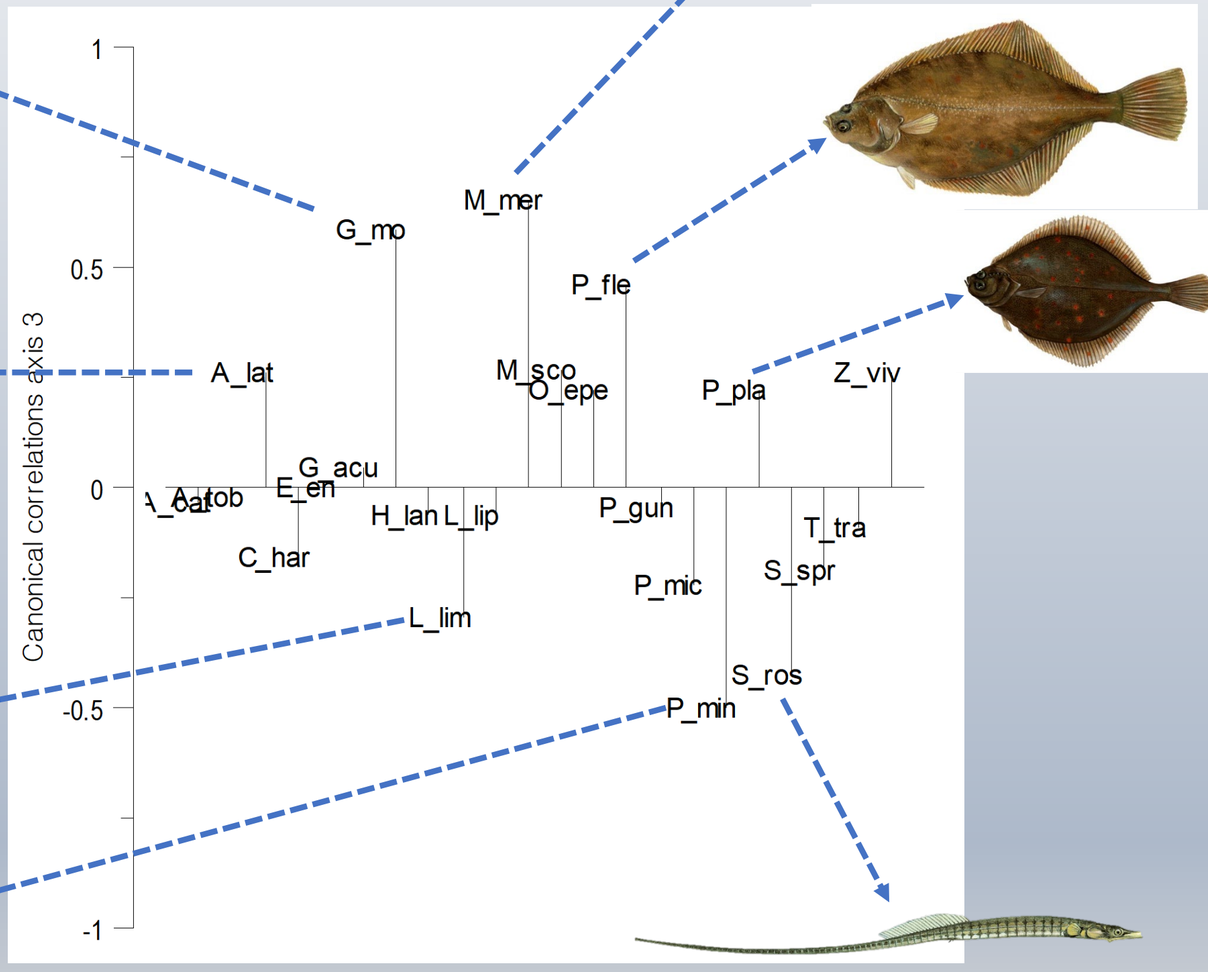
Common patterns

Third common pattern

Autumn assemblages



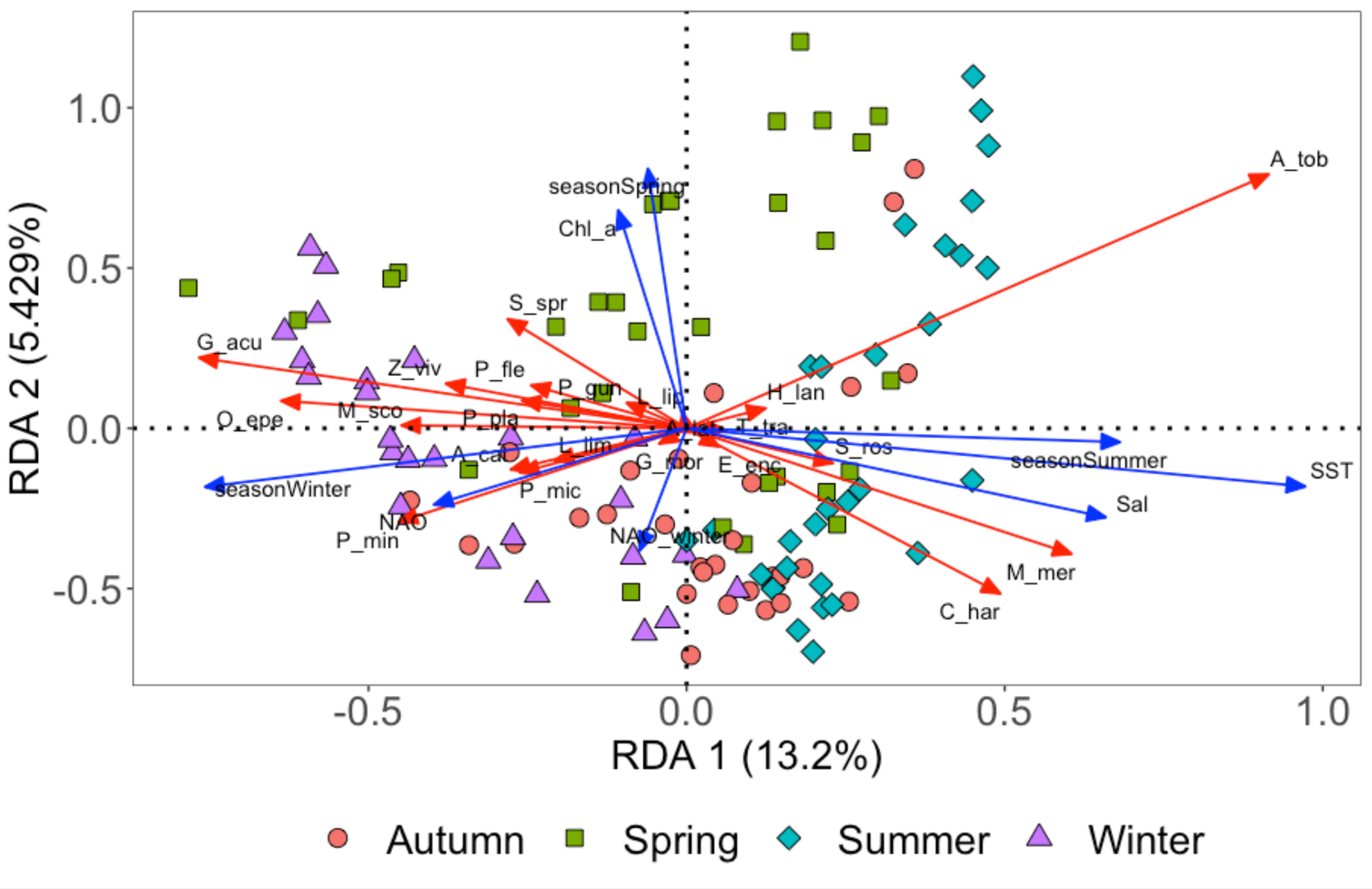
Canonical correlations



Effects of environmental variables on the fish community

Redundancy Analysis (RDA)

RDA Model: Species variations ~ Season + SST + Sal + NAO + NAO_winter + Chl_a



Explained variance:

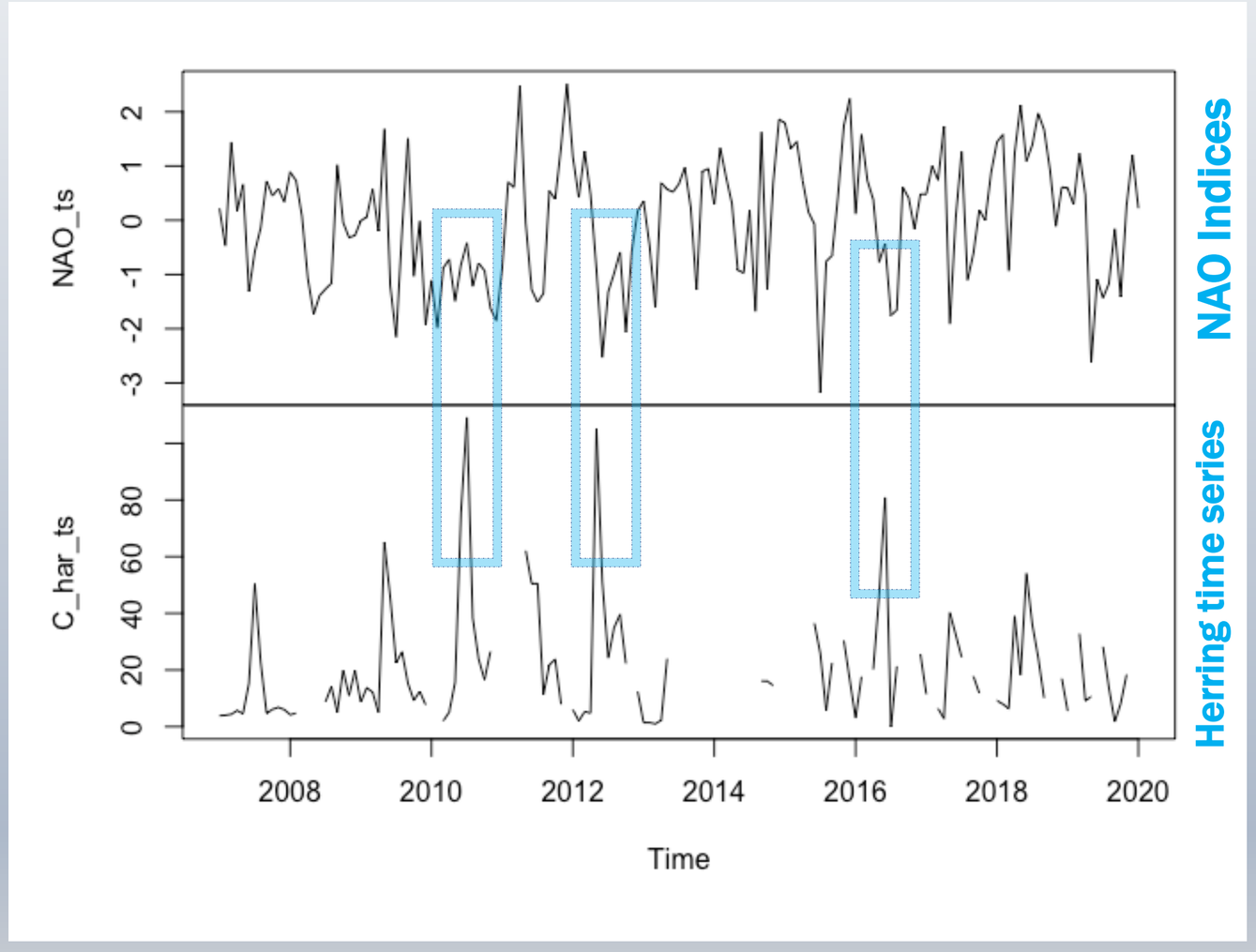
$R^2 = 0.2425$

Significance tests:

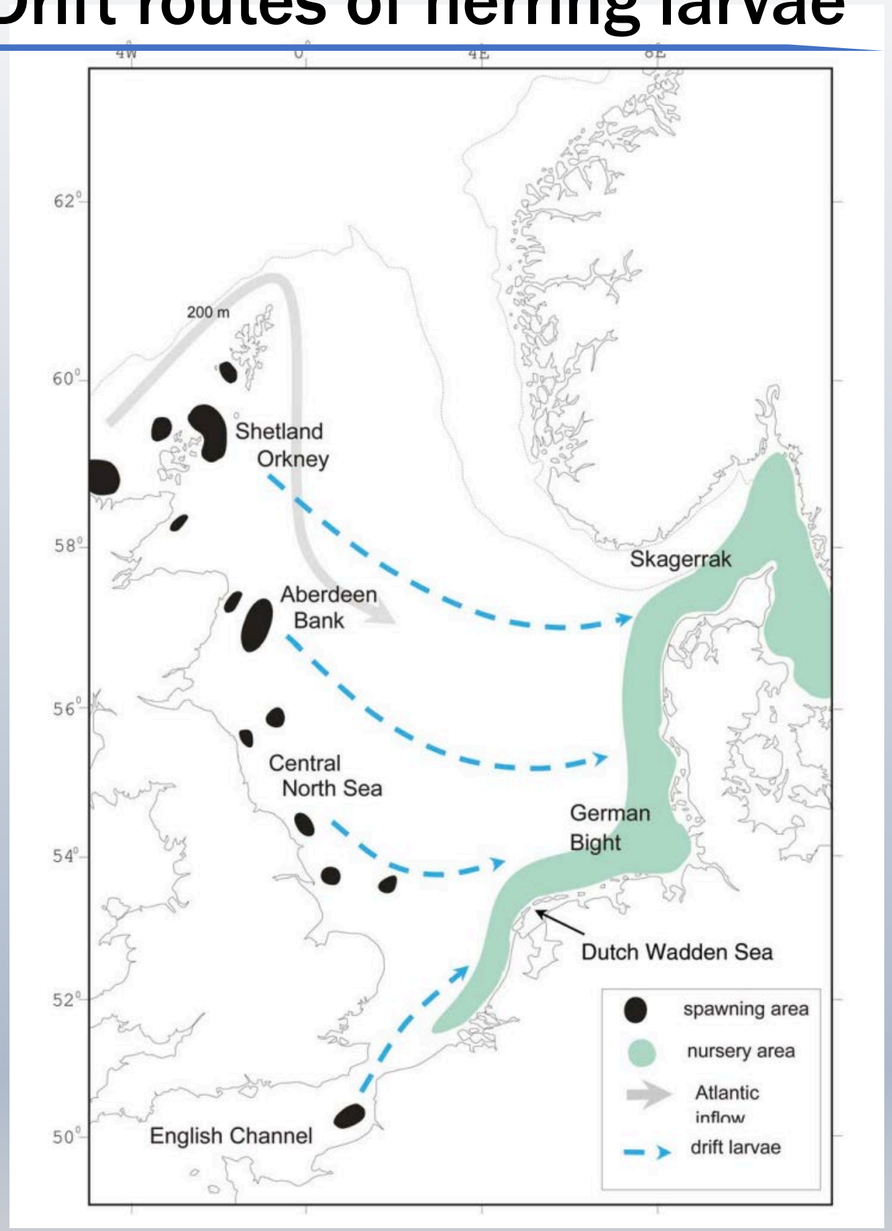
RDA Model: **Spp var. ~ SST + Seasons + Chl_a**

Adjusted $R^2 = 0.1859$

Cross-correlations of NAO and the herring



Drift routes of herring larvae



(© Corten, 2001, 2013)

Seasonal variations in the fish community structure

Jaccard's coefficient = $J(X,Y) = |X \cap Y| / |X \cup Y|$

Jaccard's Coeff.

Season	Winter	Spring	Summer	Autumn
Winter		0.64	0.58	0.68
Spring	0.21		0.79	0.73
Summer	0.64	0.21		0.72
Autumn	0.2	0.13	0.27	

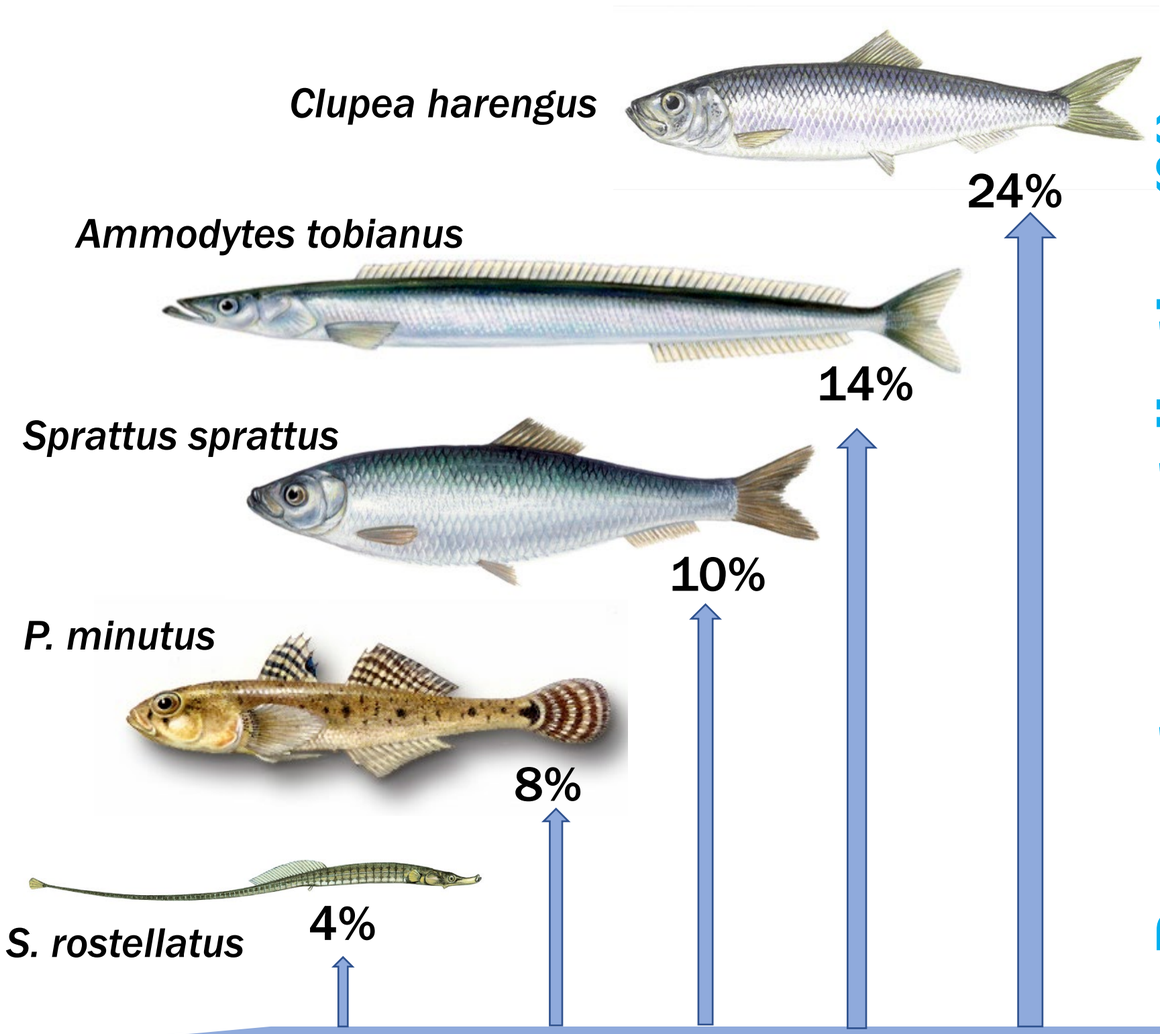
ANOSIM; $R = \frac{(rB - rW)}{(N(N-1)/4)}$

Similarity percentage (SIMPER):

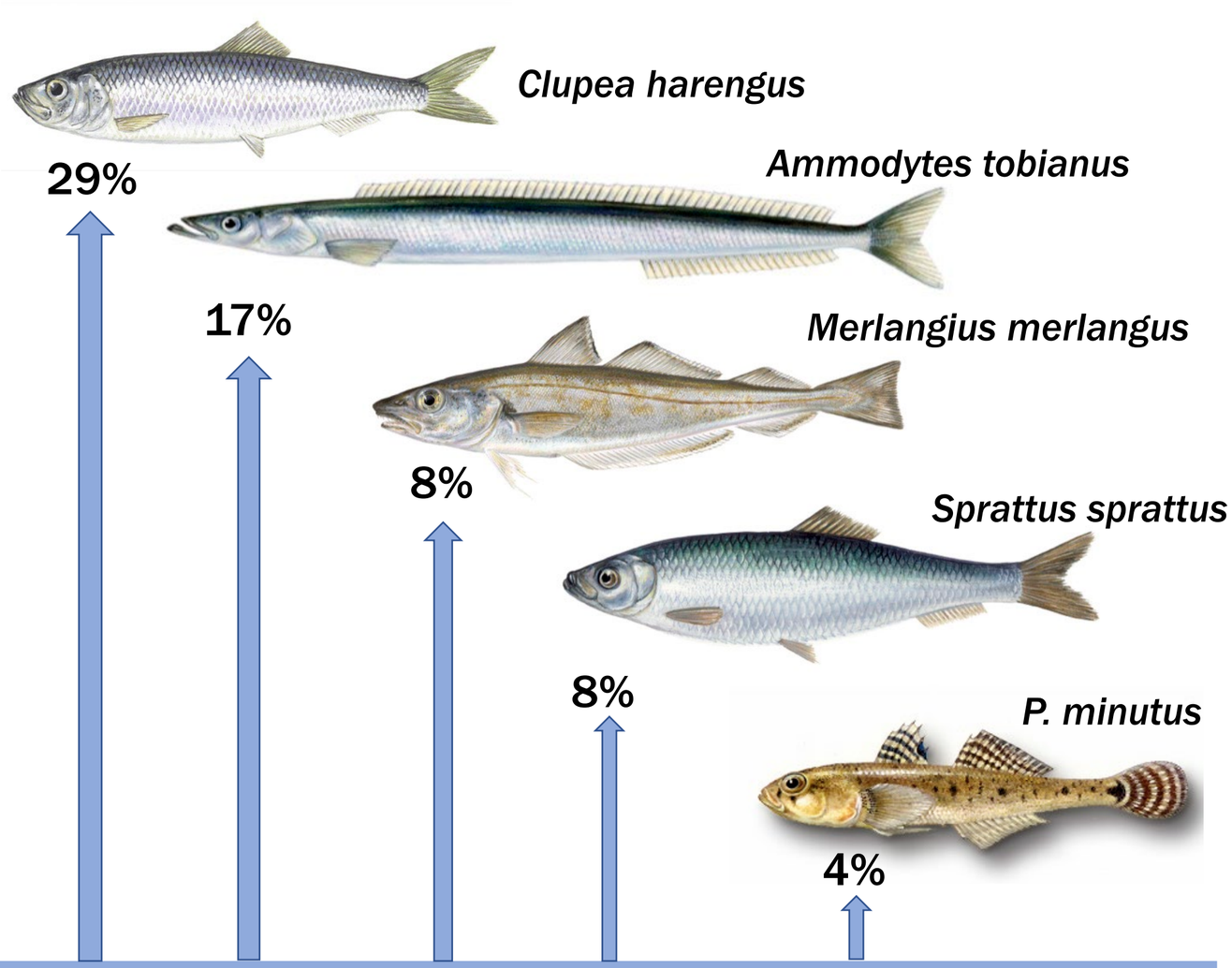
Season	Winter	Spring	Summer	Autumn
Winter				
Spring	58.49			
Summer	67.55	58.03		
Autumn	55.4	56.71	57.15	

Variations in community structure

Winter vs Spring: SIMPER = 58.49%



Winter vs Summer: SIMPER = 67.55%



Percentage contribution (%)

Take home messages

- Negative NAO indices ~ peak *Clupea harengus* abundances.
- SST has a strong and significant effect on the variations in the fish community.
- NAO winter indices indirectly influence the fish community.
- Strong inter- and intra-annual variations in the community structure.
- Unexplained variations? Unidentified variables control the fish dynamics.

With thanks

victor.odongo@awi.de

@Victor_Odongo

Questions

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

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