



SAPIENZA
UNIVERSITÀ DI ROMA



INSTITUTO
ESPAÑOL DE
OCEANOGRAFÍA



Storytelling based on a data limited situation: the dynamics of the small pelagic community in the Celtic ecoregion

Carpi P., Russo T., Van Der Kooij J., Velasco F. & Saraux C.

PICES/ICES SMALL PELAGIC SYMPOSIUM

Victoria, 6-11 March 2017

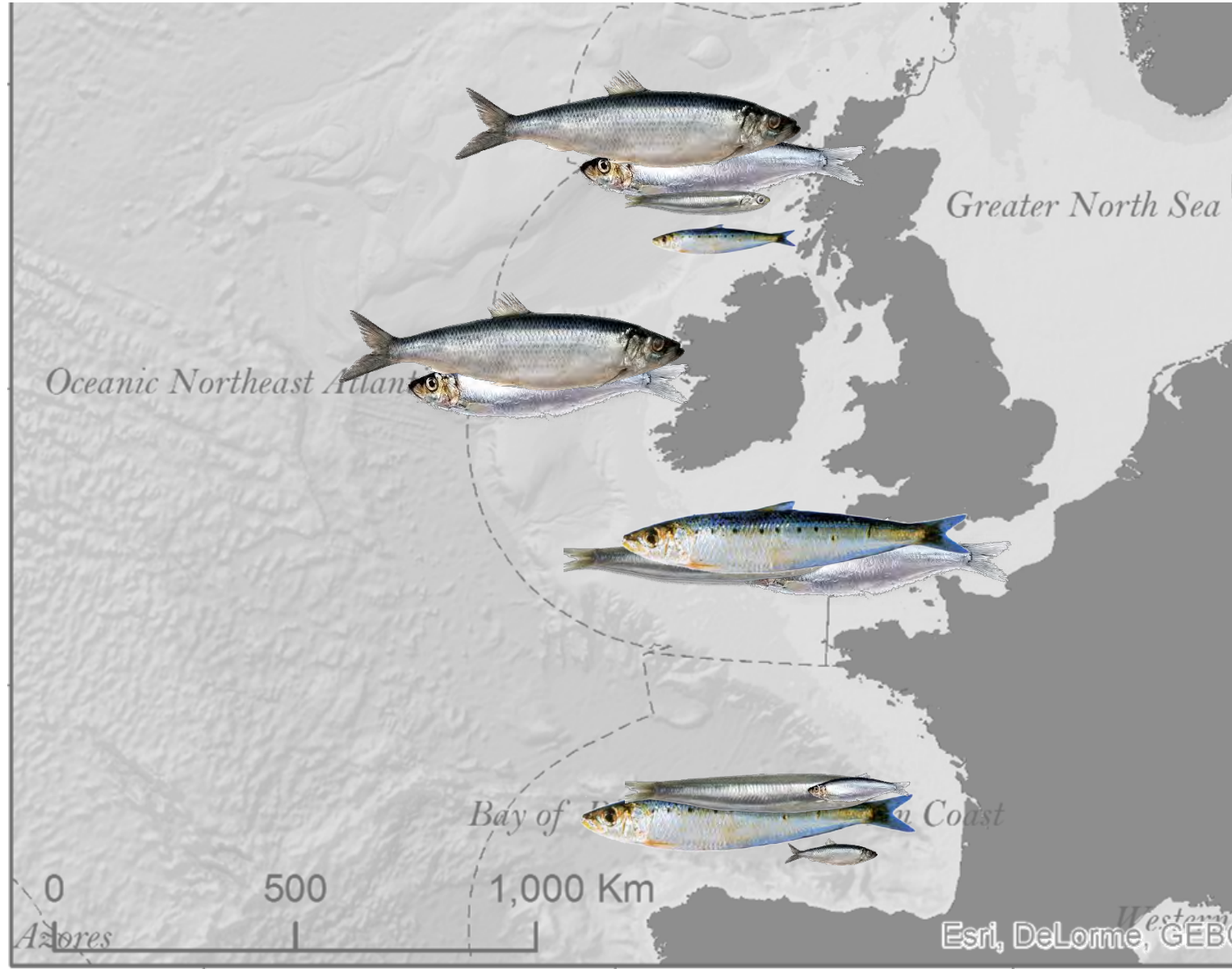


Aim of the study

Capturing the long-term spatial dynamics of anchovy, sardine, sprat and herring in the Celtic Sea ecoregion making use of the information available from bottom trawl survey.



Setting the scene: the area



Setting the scene: the data

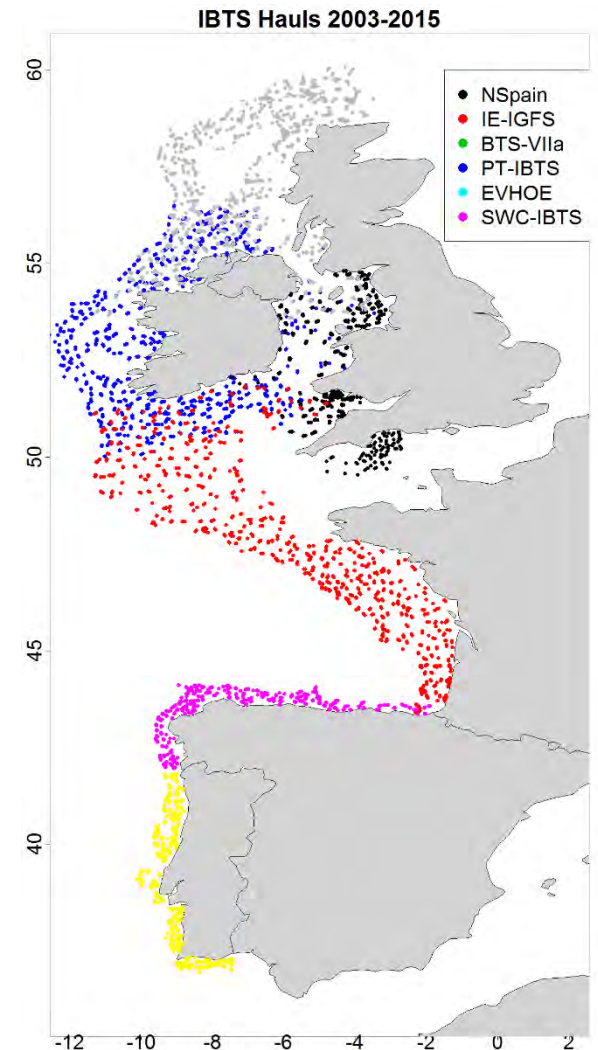
Bottom trawl survey time series: longest and widest coverage.

Challenges: vessel, gear differences

Reporting:

- Tow position & depth
- Gear parameters

Acronym	Country, ICES Areas	Quarter	Vessel, Gear (year range)
EVHOE	France, 8.a-d, 7.f-j	4	Thalassa – GOV (2001-2015)
IGFS	Ireland, 6.a, 7.b-k	4	Celtic Voyager – Mini GOV (2001-2002) Celtic Explorer – GOV (2003-2015)
SWC-IBTS	Scotland, 6.a, 7.b	1,4	Scotia – GOV (2001-2015)
BTS-VIIa	Ireland, 7.a	1,4	RV Corystes – rock hopper trawl (1993-2015)
SP-NORTH	Spain, 8.b-c	4	Cornide de Saavedra – BAK (2001-2012); Miguel Oliver – BAK (2013-2015)
PT-IBTS	Portugal, 9a	4	RV Noruega – Stern trawler (2002-2015)



Setting the scene: the analysis

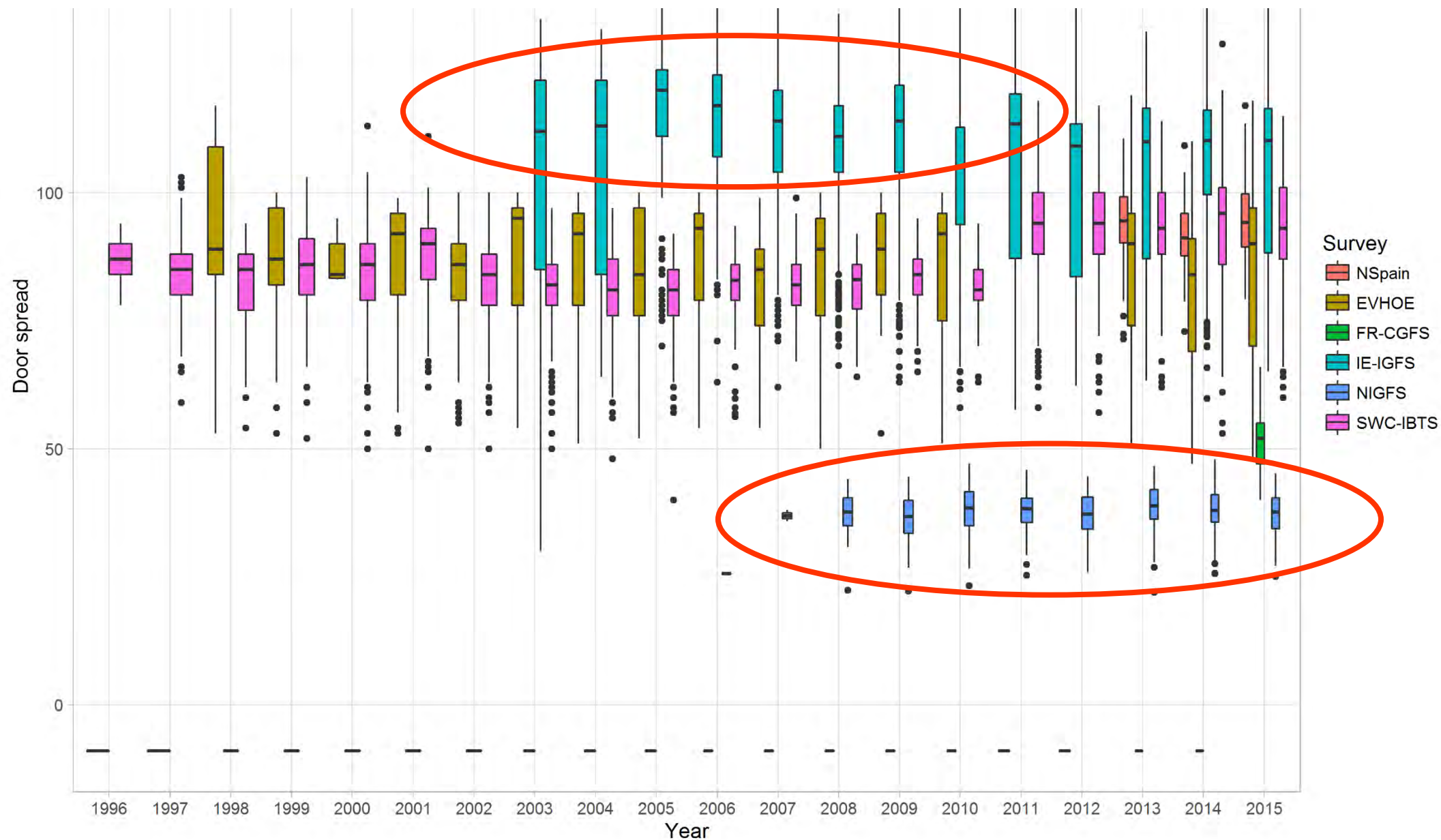
Two approaches

1. Spatial indicators:
 - 1a – Data standardization
 - 1b - Estimation of the centre of gravity on the standardized data
2. Artificial Neural Network to detect and characterize common trends occurring at different sampling sites and geographical regions (Self-Organizing Maps).

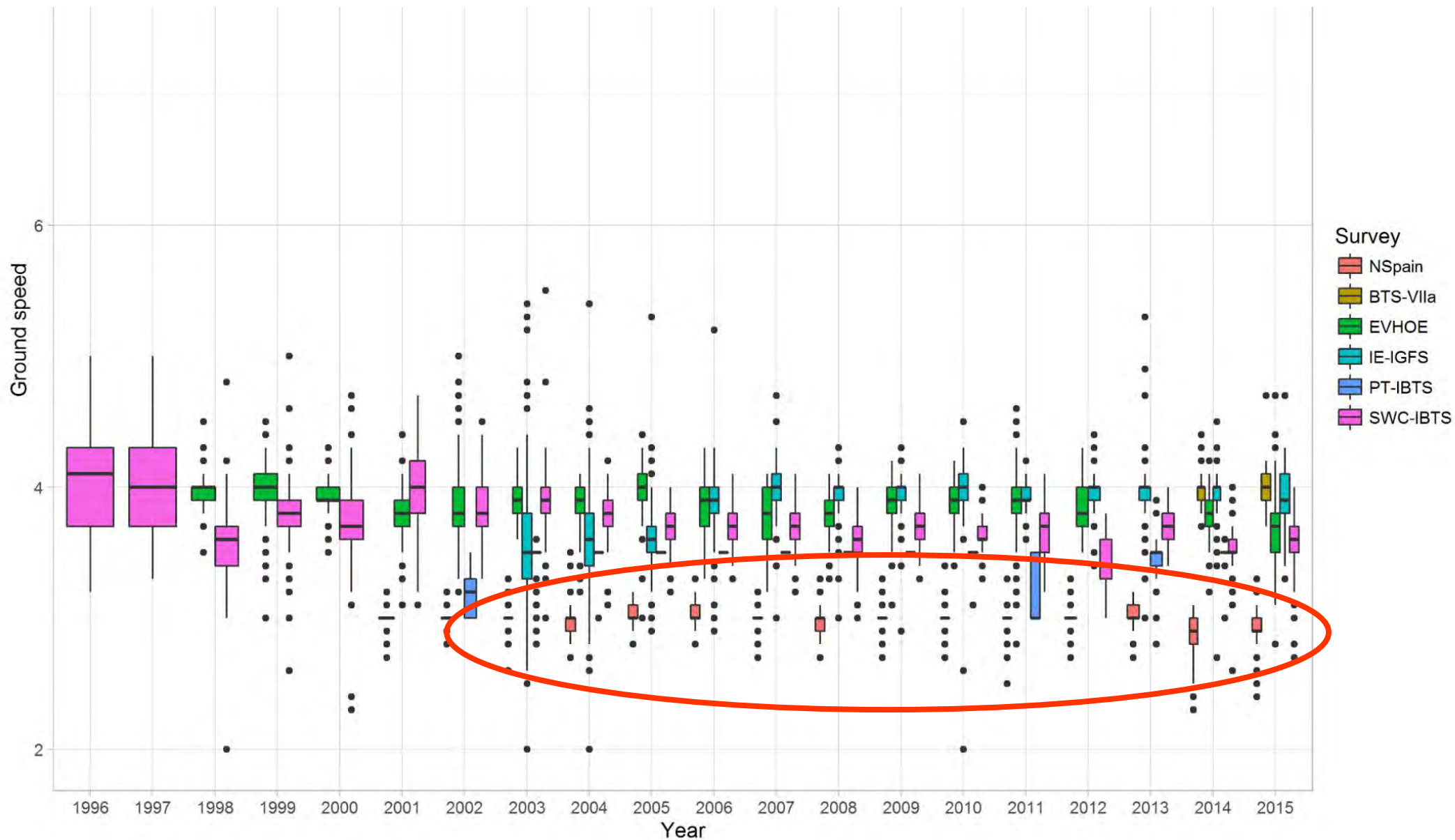
1a - Data standardization... But how?



1a - Data standardization... But how?



1a - Data standardization... But how?



1a – Geostatistical Log Gaussian Cox Process Model

- Allows for overdispersed and zero inflated data
- Spatial and temporal correlation between cells
- Correlation within cells
 - Nugget effect
- No spatial stratification assumption
- No separation of zeros from positive catches

- Spatial grid of 50km x 50km

1a – Geostatistical Log-Gaussian Cox Process Model

Data used: from 2003 to 2015.

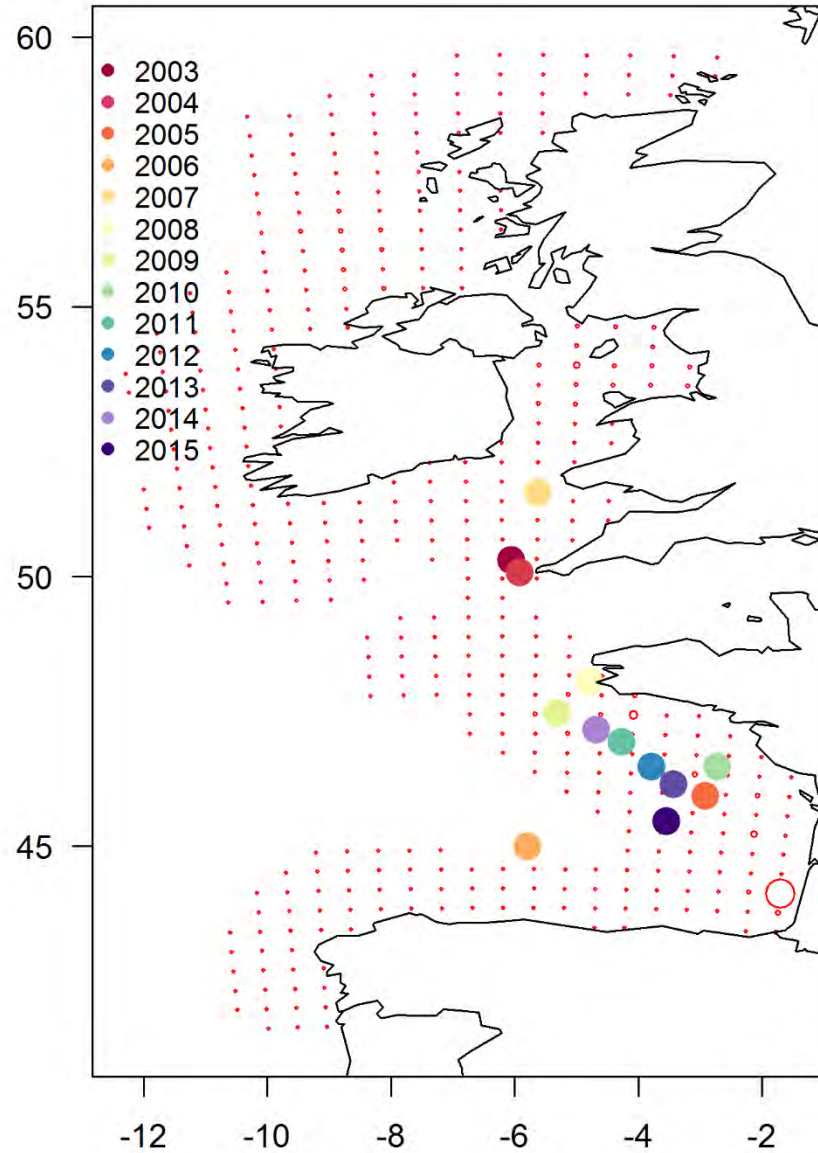
The model consisted of three main elements:

- The large scale spatio-temporal aspects (position * year);
- The local patchiness (position);
- The survey catchability (survey * year).

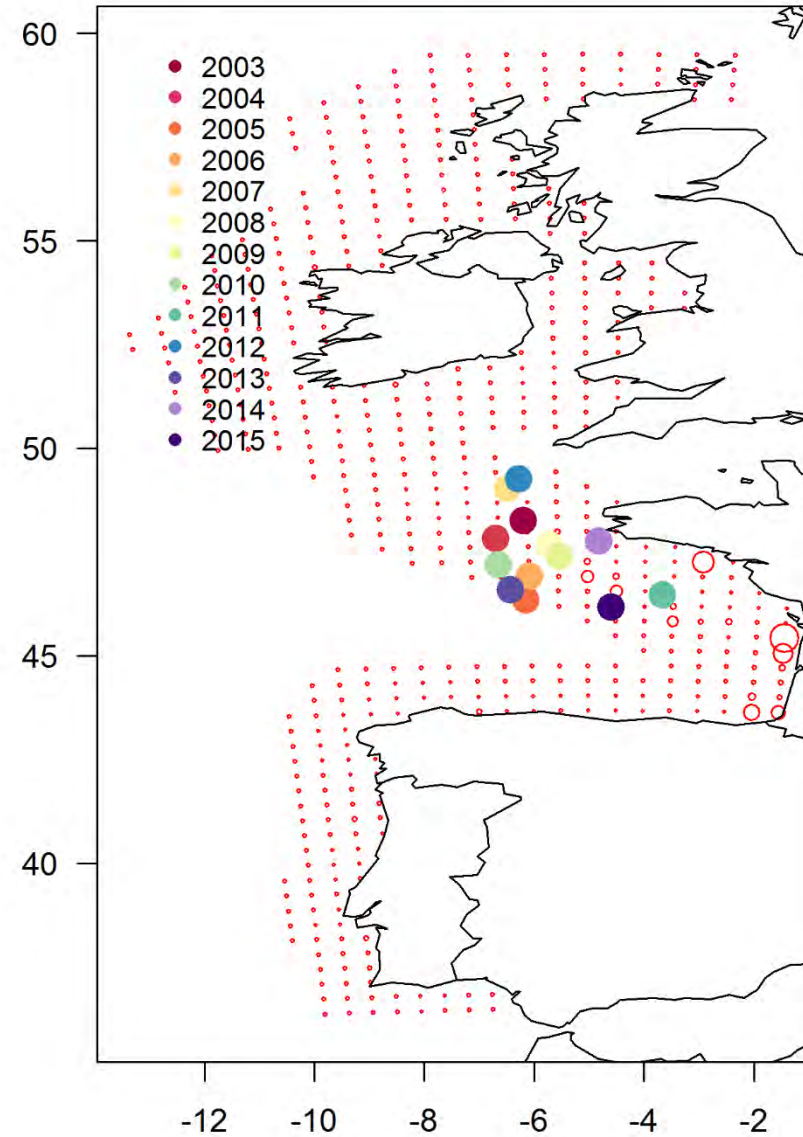
Inclusion and exclusion of nugget effect was tested → Preferred model without the nugget effect.

1b - Centre of gravity – Preliminary results

Anchovies



Sardine



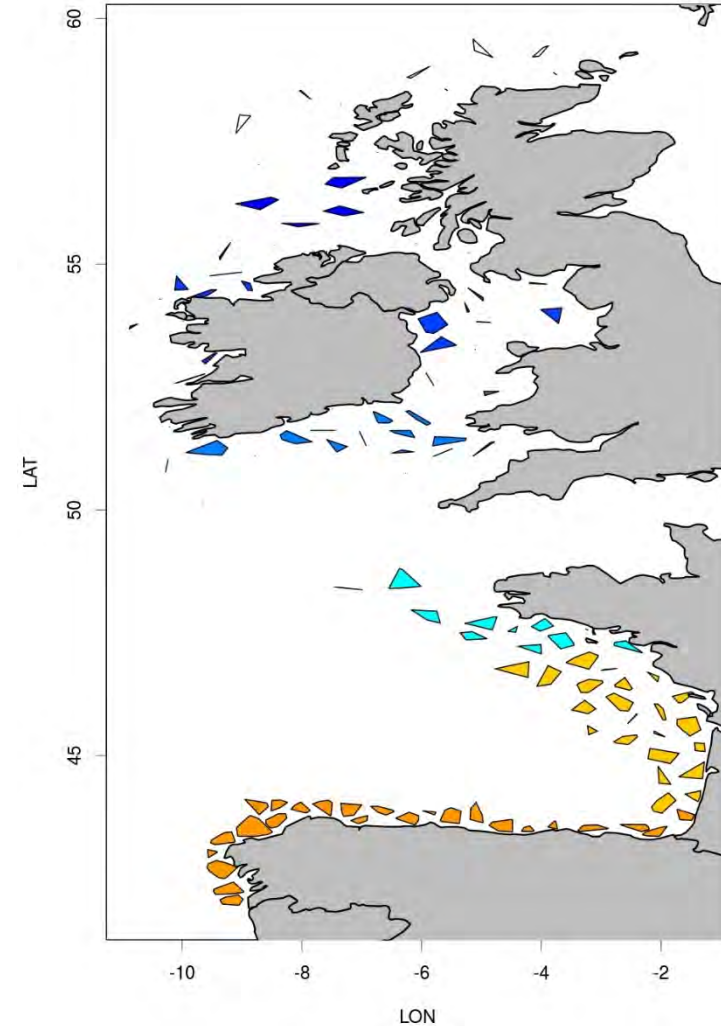
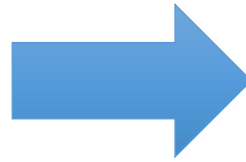
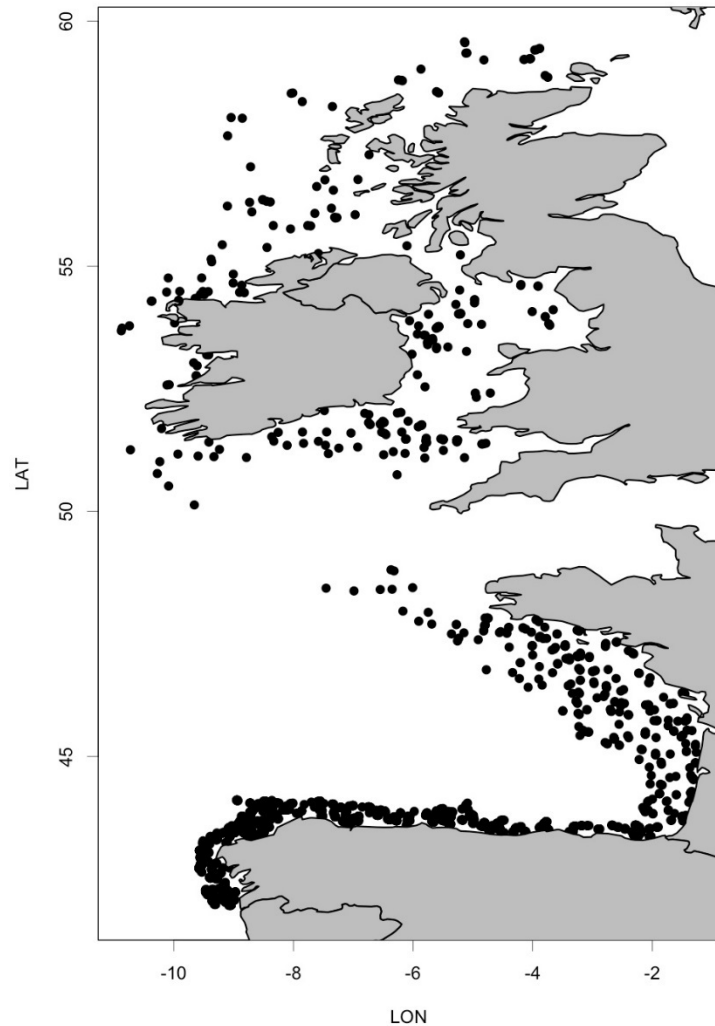
Setting the scene: the analysis

Two approaches:

1. Spatial indicators:
 - 1a – Data standardization
 - 1b - Estimation of the centre of gravity on the standardized data
2. Artificial Neural Network to detect and characterize common trends occurring at different sampling sites and geographical regions (Self-Organizing Maps).

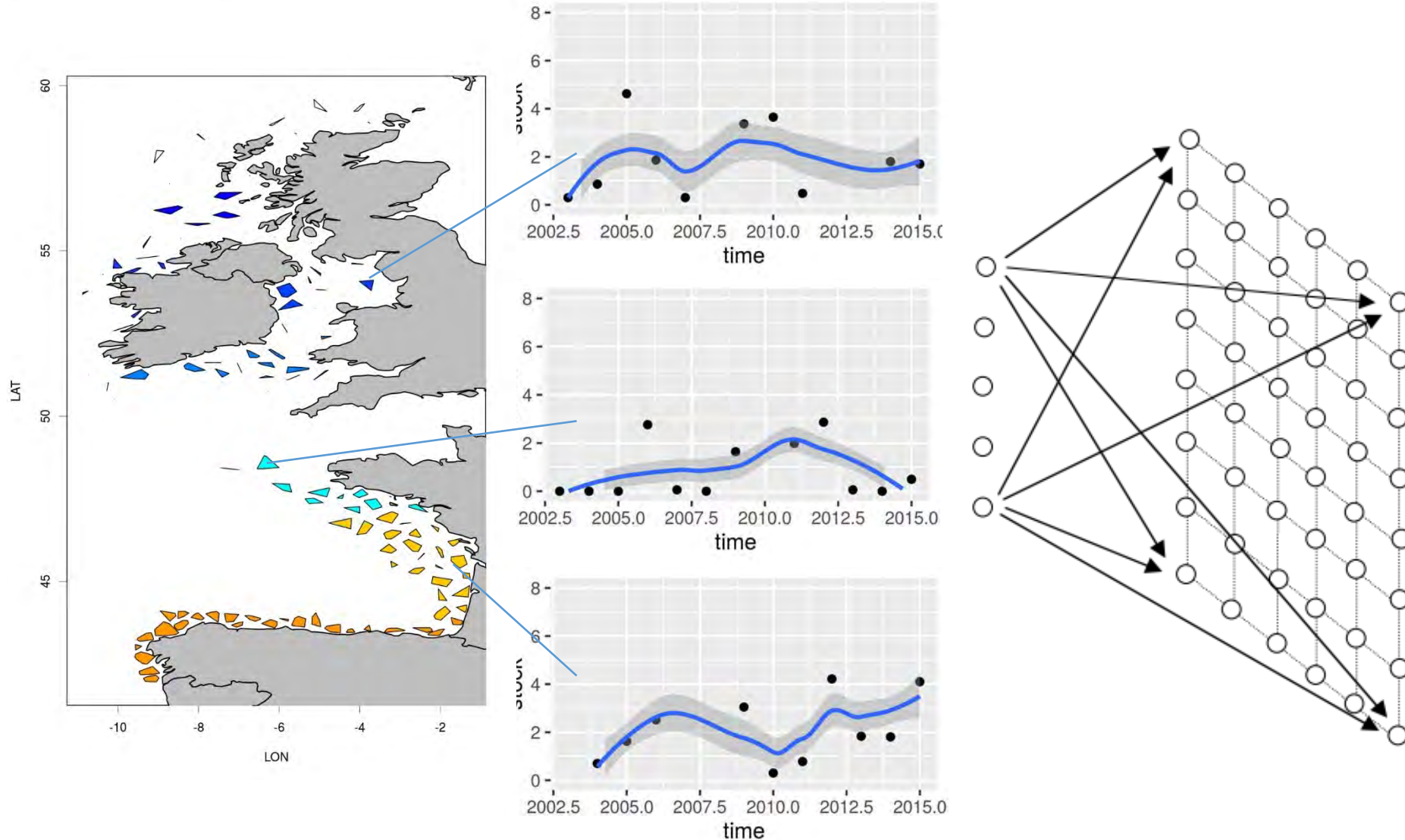
2. Artificial Neural Network: SOM method

Step 1: from hauls to polygons



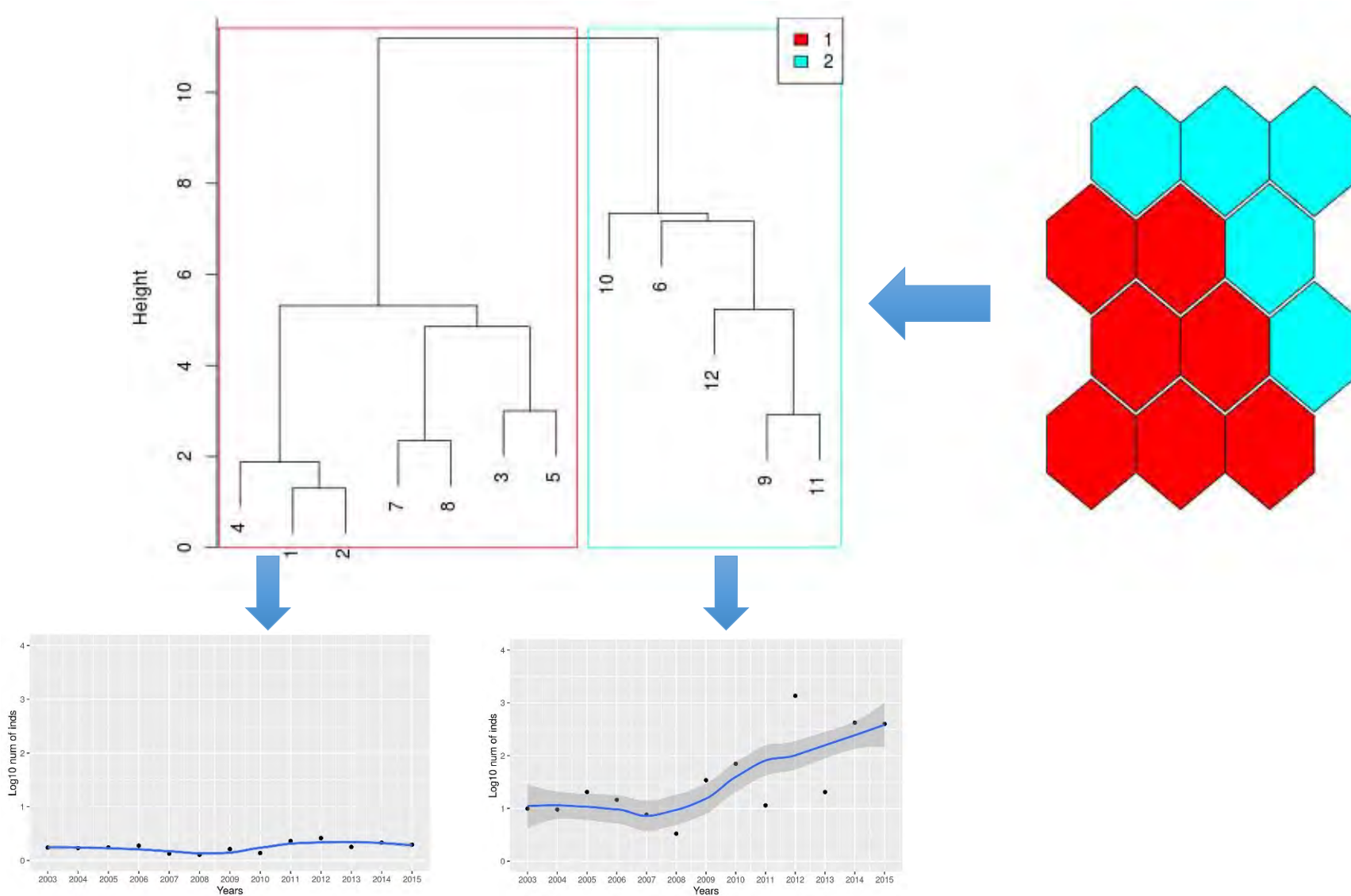
2. Artificial Neural Network

Step 2: Generation of survey-integrated trends and SOM training on log-abundance data



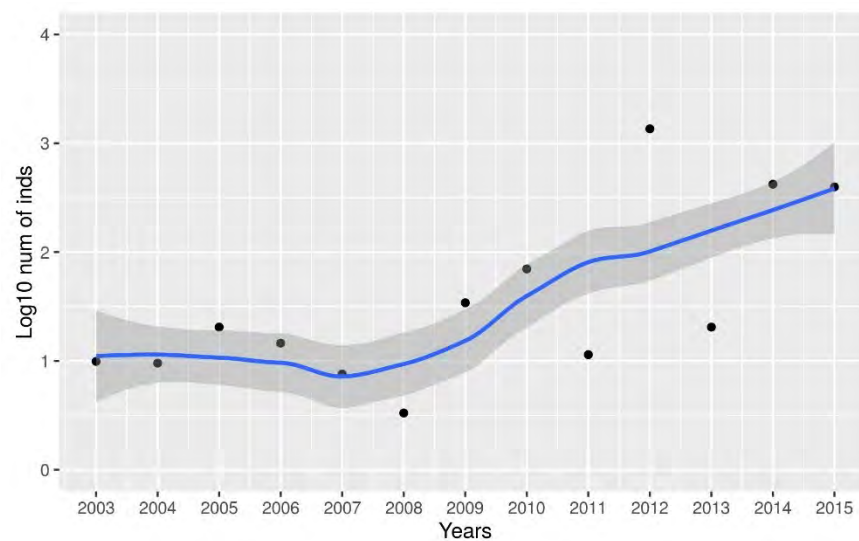
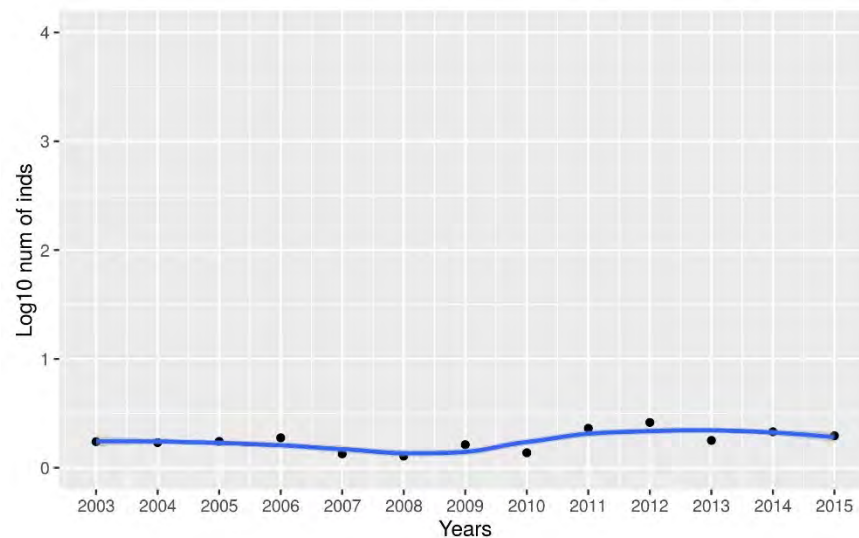
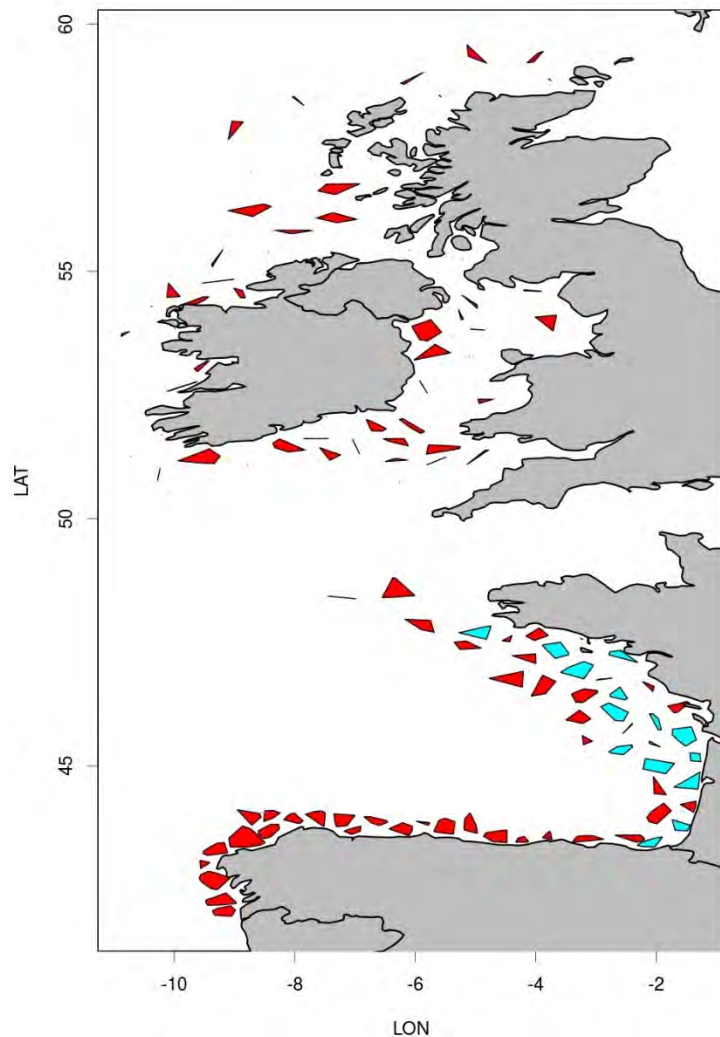
2. Artificial Neural Network

Step 3: Clustering of SOM units to identify the main trends



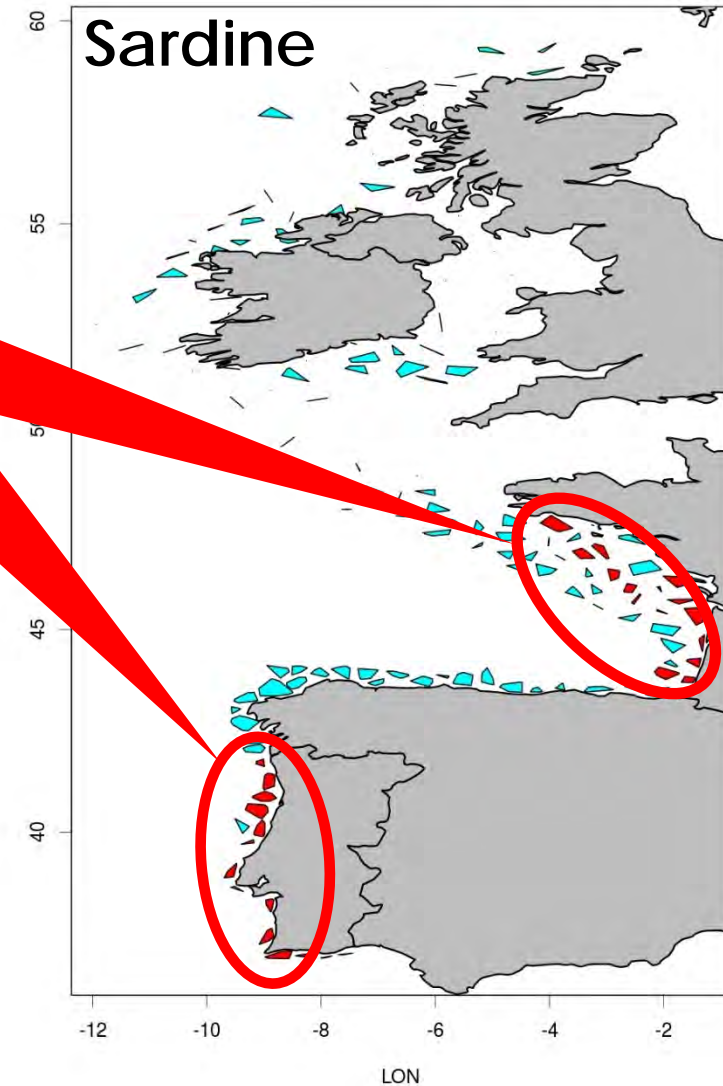
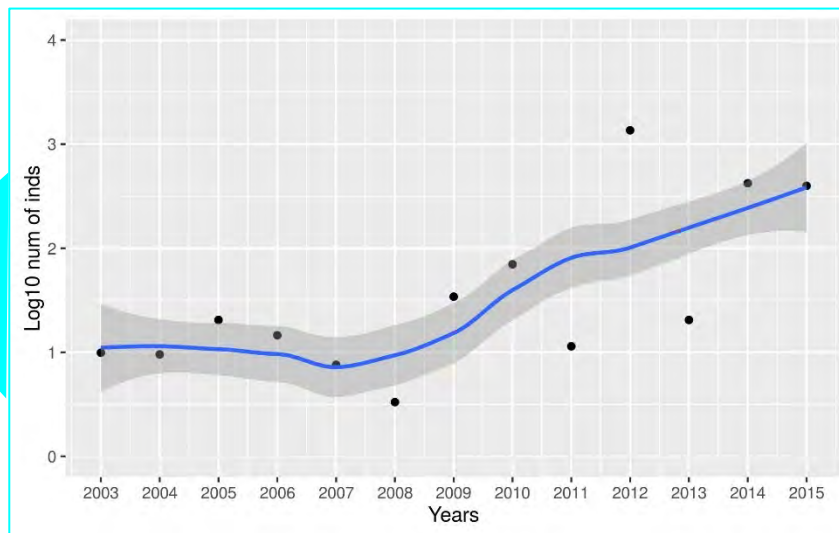
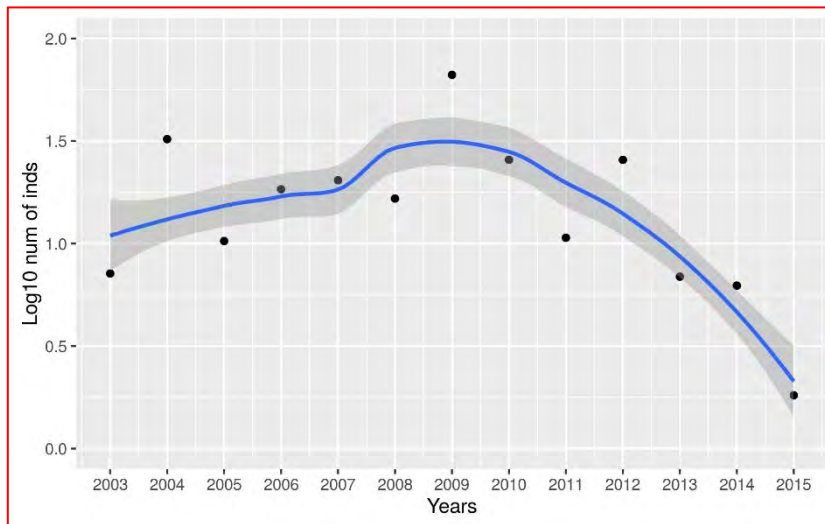
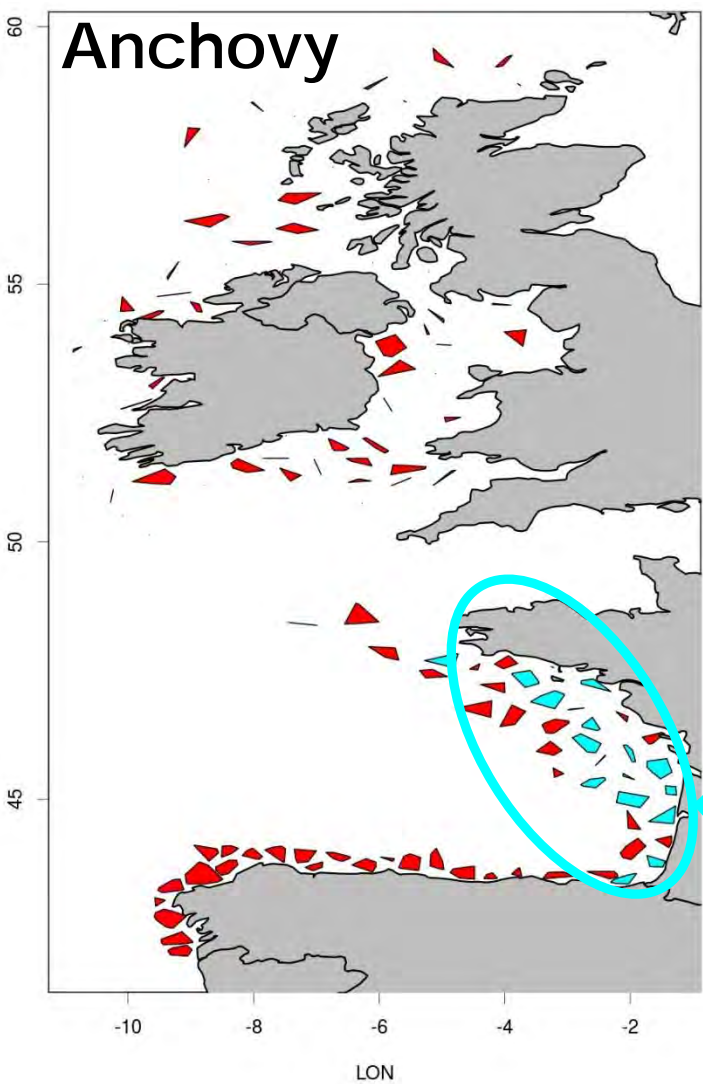
2. Artificial Neural Network

Step 4: back to spatial data



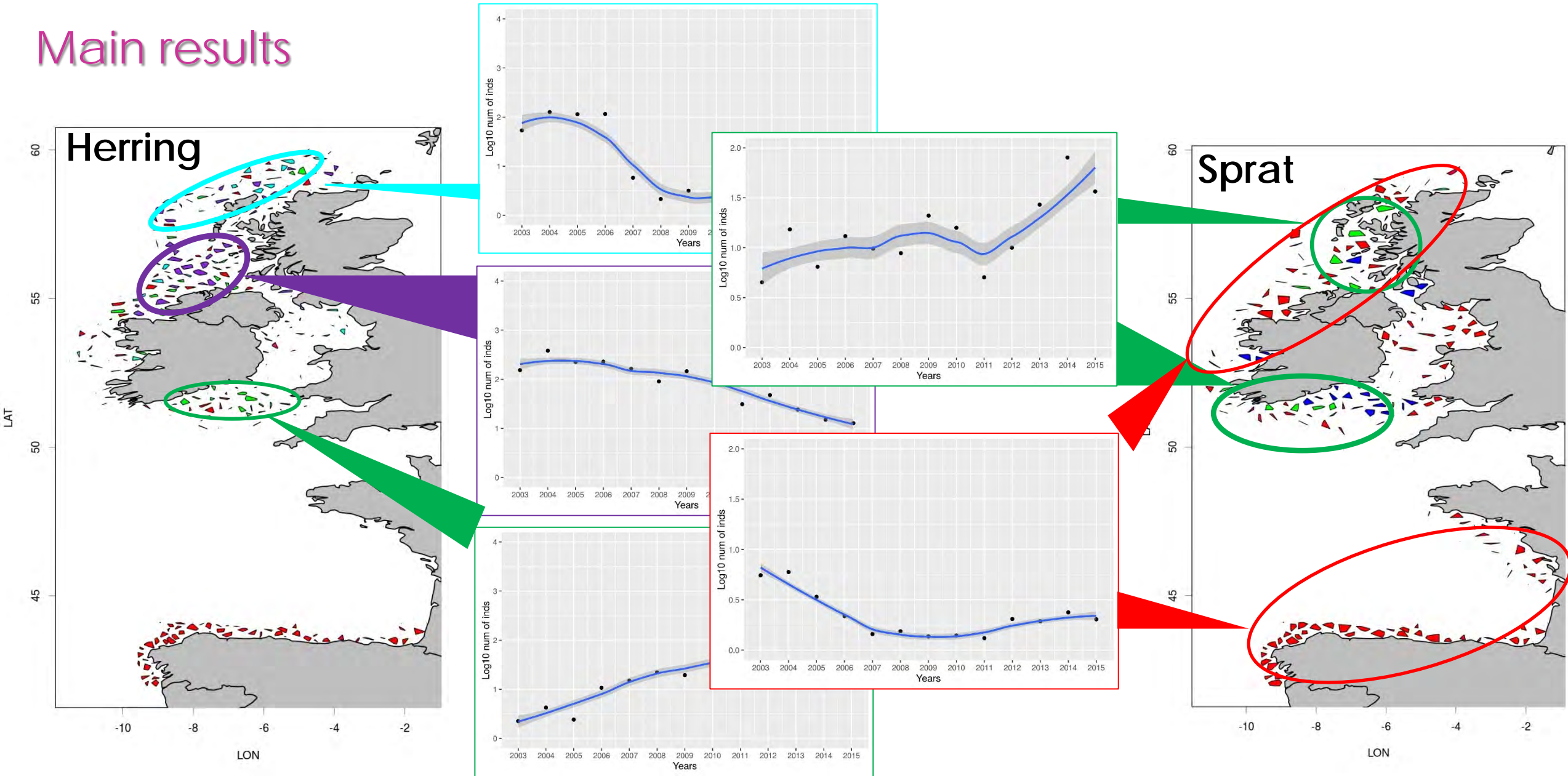
2. Artificial Neural Network

Main results



2. Artificial Neural Network

Main results



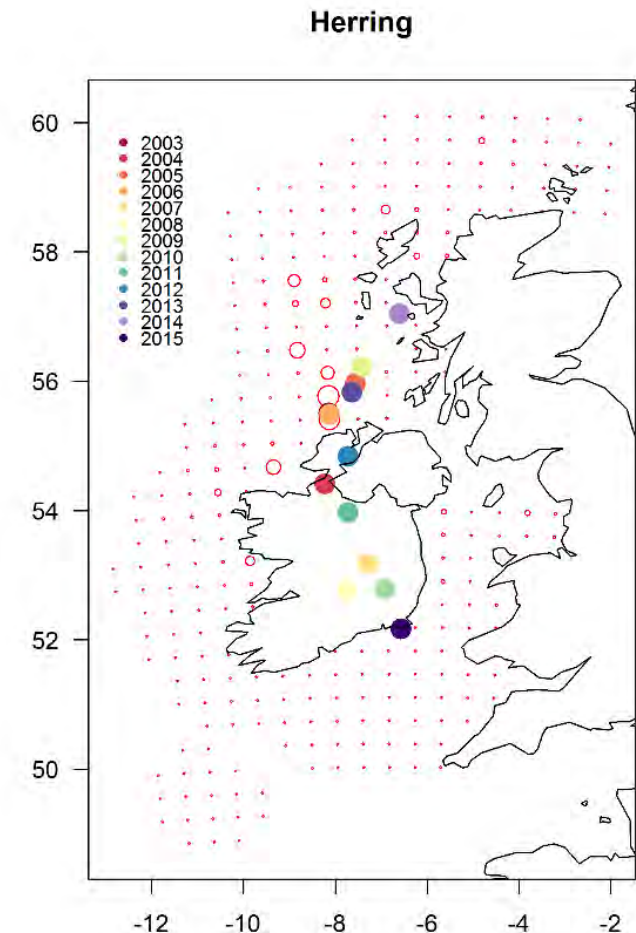
Preliminary conclusions

- The data standardization: the LGC seem a promising approach. Preferred model without the nugget effect: when the nugget effect is removed, most of the variance is captured by the spatio-temporal component.
- The centre of gravity: anchovy tends to move more from north to south; sardine tended to be located offshore, but in recent years they use both coastal and offshore areas.
- Self-organizing maps (SOM): cluster identification was clear in case of anchovy and sardine and the common trends identified are in line with the overall perception of the stocks in the area. Less clear separation for herring and sprat might suggest a stronger influence from local drivers.

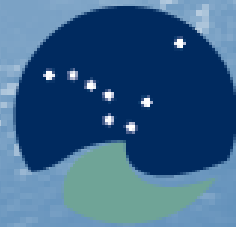
Too early to draw ecological considerations, but the inclusion of environmental factors in the analysis might help understand what drives the observed patterns in the area.

What's next?

- Use of patches to re-estimate centre of gravity for herring and sprat, but also anchovy and sardine;
- More exploration on Log-Gaussian model;
- Add more survey data (e.g. UK);
- Estimate other spatial indicators;
- Validation of the clustering process;
- Inclusion of environmental drivers.



Thanks for your attention!



ICES
CIEM