WGACEGG acoustic and egg-based survey products for monitoring anchovy and sardine populations in the European Atlantic area ecosystem

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Background:

- The ICES Working Group on Acoustic and Egg Surveys (WGACEGG) coordinates the pelagic integrated surveys in ICES Areas 7, 8 and 9.
- Surveys provide fisheries-independent, acoustic and/or egg-based estimates of the biomass and demographic structure of sardine and anchovy populations.
- Survey biomass estimates are main inputs to manage commercially important small pelagic stocks in the European Atlantic area (EAA).
- WGACEGG also compiles standard, high resolution gridded maps of anchovy and sardine eggs, adult biomass, and in-situ hydrological parameters.
- Example of series of gridded maps analysis to assess anchovy and sardine habitat distribution and occupancy in the EAA, over the 2004-2017 period.

Material and Methods

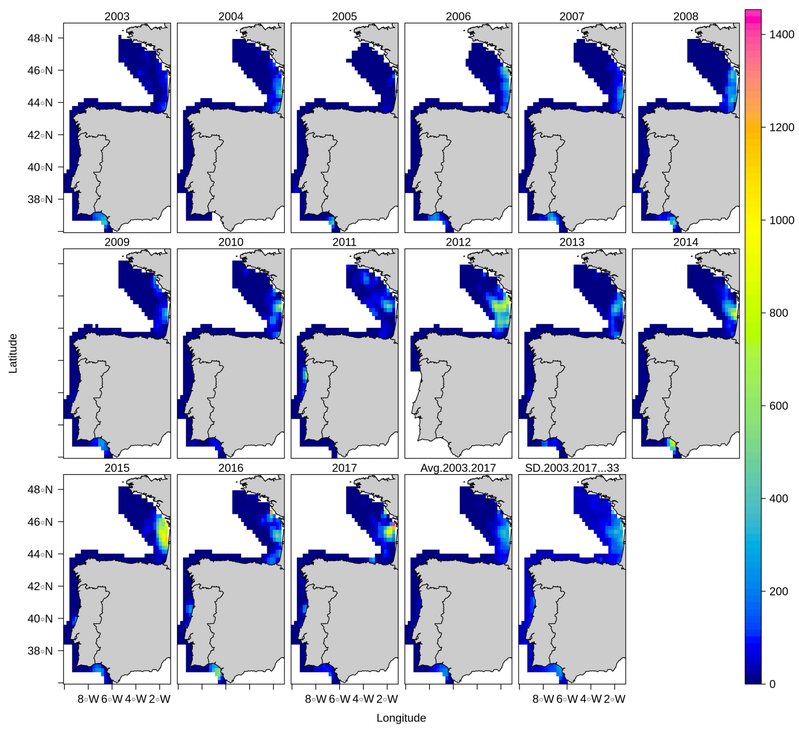
Data

WGACEGG gridded maps

Standard gridded maps obtained using a spatial smoothing procedure (Massé et al. 2018):

- from Gibraltar to English Channel;
- from spring (>2003) and autumn (>2015) surveys;
- high resolution (15x15km cells);
- Anchovy and sardine acoustic density (NASC);
- Egg counts from continuous fish egg sampler and vertical nets;
- Sea surface salinity (SSS) and temperature (SST).

Fig. 1: Anchovy NASC gridded maps



Method

Multiple Factorial Analysis (MFA) (~ PCA on grouped data) performed on 2004-2008, 2010-2011, 2013-2017 data:

- Environment (SST and SSS) gridded maps from spring surveys;
- Fish (anchovy and sardine) NASC gridded maps from spring surveys;
- Map cells as rows, annual parameter values as columns, grouped by years (Doray et al. 2018)
- Environment and fish variables summarised by their two first MFA loadings (MFA1&2)

Relationships between environment and fish MFA1&2 explored to define distribution drivers

Results

Environment

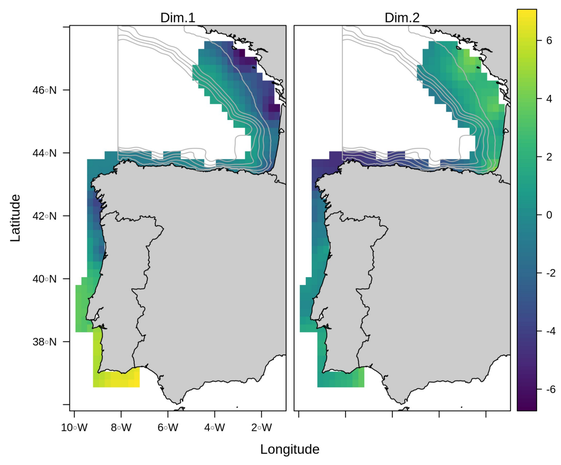
MFA1 (43% var. expl.) positively correlated with SSS, and frequently with SST (Fig. 2)

- Higher SSS and sometimes SST in southern areas, offshore Biscay and Cantabrian Sea

MFA2 (29% var. expl.) positively correlated with SST (Fig. 2)

- Higher SST in coastal Biscay and southern areas
- no warming trend at this time of the year

Fig. 2: Maps of environment MFA1 (left) and MFA2 (right) loadings averaged over time



Fish spatio-temporal distribution

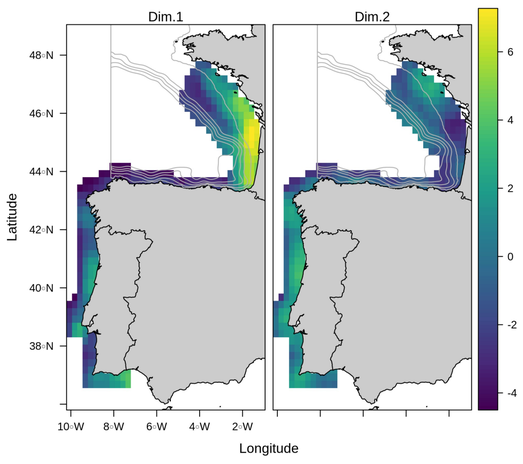
Anchovy and sardine NASC consistently correlated with fish MFA1 (48% var. expl.)

- persistent fish core distribution areas: SW Iberican and Southern Biscay areas (MFA1>0 in Fig. 3)

Sardine NASC correlated with MFA2 (15% var. expl.)

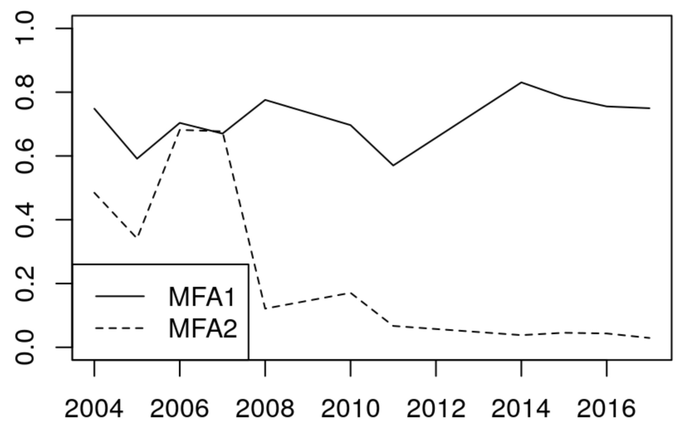
- more sardine in Western Iberican and North coastal Biscay areas until 2007 (MFA2>0 in Fig. 3)
- after 2007, sardine NASC has dropped (Fig. 4)

Fig. 3: Maps of fish MFA1 (left) and MFA2 (right) loadings averaged over time



Results

Fig. 4: Time series of fish MFA1&2 loadings averaged over map cells



Drivers of fish distribution

Habitats

- Environment MFA1&2 explain 3% and 53% of fish MAF1, respectively (linear model)
  - anchovy and sardine habitats defined by higher SST in southern areas and coastal Biscay
- Fish MFA2 not explained by environment MFA1&2 (linear model)

Fishing

- Fish landings explain 67% of fish MFA2 in W. Iberican area (Generalised linear model, Gamma family, log-link)

Discussion and conclusions

First synoptic assessment of anchovy and sardine habitat extension and occupation variability at the European Atlantic Area scale

MFA1&2 derived from fish and environment datasets are useful proxies to summarise spatial and temporal variability of ecosystem components

Anchovy and sardine large scale distribution is correlated with relatively higher SST in southern Iberican and coastal Biscay areas

Sardine higher densities in western Iberican and offshore northern Biscay areas are not explained by available environmental indices

Landings seem to have had a significant effect on decreasing sardine densities in Western Iberican area

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- Poster made with rmarkdown and Flexdashboard poster https://github.com/odeleongt/flexdashboard-poster

References

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