SIMERPO 3-4 October 2021 Vigo, Spain

Spatio-temporal variability of mid-size pelagic fishes in the Gulf of Cadiz shelf waters in relation to climatic and environmental drivers

José Antonio Canseco[1], María Ángeles Torres[2], Edwin Niklitschek[1], Fernando Ramos[2]

Introduction

Modeling spatio-temporal patterns of mid-size pelagic fish species (MSPFS) distribution and density is of great interest from the standpoint of both their management and conservation. Herein, temporal changes in the spatial patterns of five MSPFS off the Gulf of Cadiz are analyzed from acoustic surveys data (2007-2017).

In particular, we evaluated intra-specific variability over time and space and relate such fluctuations to environmental and climatic drivers aimed to provide support to the implementation of a future ecosystem approach to fisheries management in this region.

Material and methods

Study area:

- Gulf of Cadiz ICES 9a South (Fig. 1)

Datasets:

- ECOCADIZ acoustic *surveys* (2007-2017), summer season and continental shelf (20-200 m)
- *Spatial indicators*: center of gravity, inertia and isotropy (Bez, 1997)
- *Environmental drivers*: sea surface temperature, sea surface chlorophyll (Rodell et al. 2007) and salinity.
- *Climatic drivers*: North Atlantic Oscillation and Atlantic Multidecadal Oscillation.

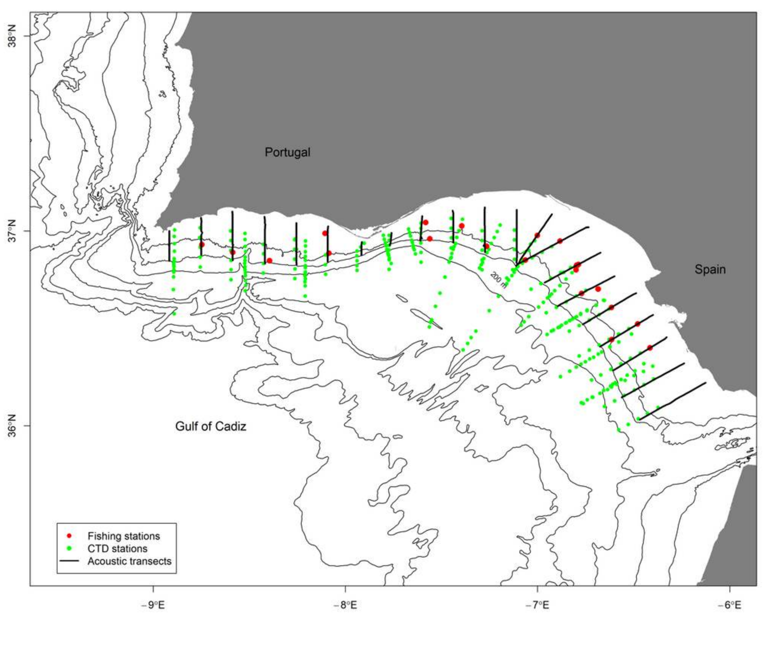


Fig. 1. Study area showing the acoustic transects, fishing and CTD stations conducted during a standard ECOCADIZ survey

Statistical analyses:

- GAMM modeling, Correlation tests. All statistical analyses and mapping were conducted and coded in R.
- Geostatistical modeling: probability of presence, conditional density and relative abundance index (RAI) through INLA

Results and discussion

Spatial patterns

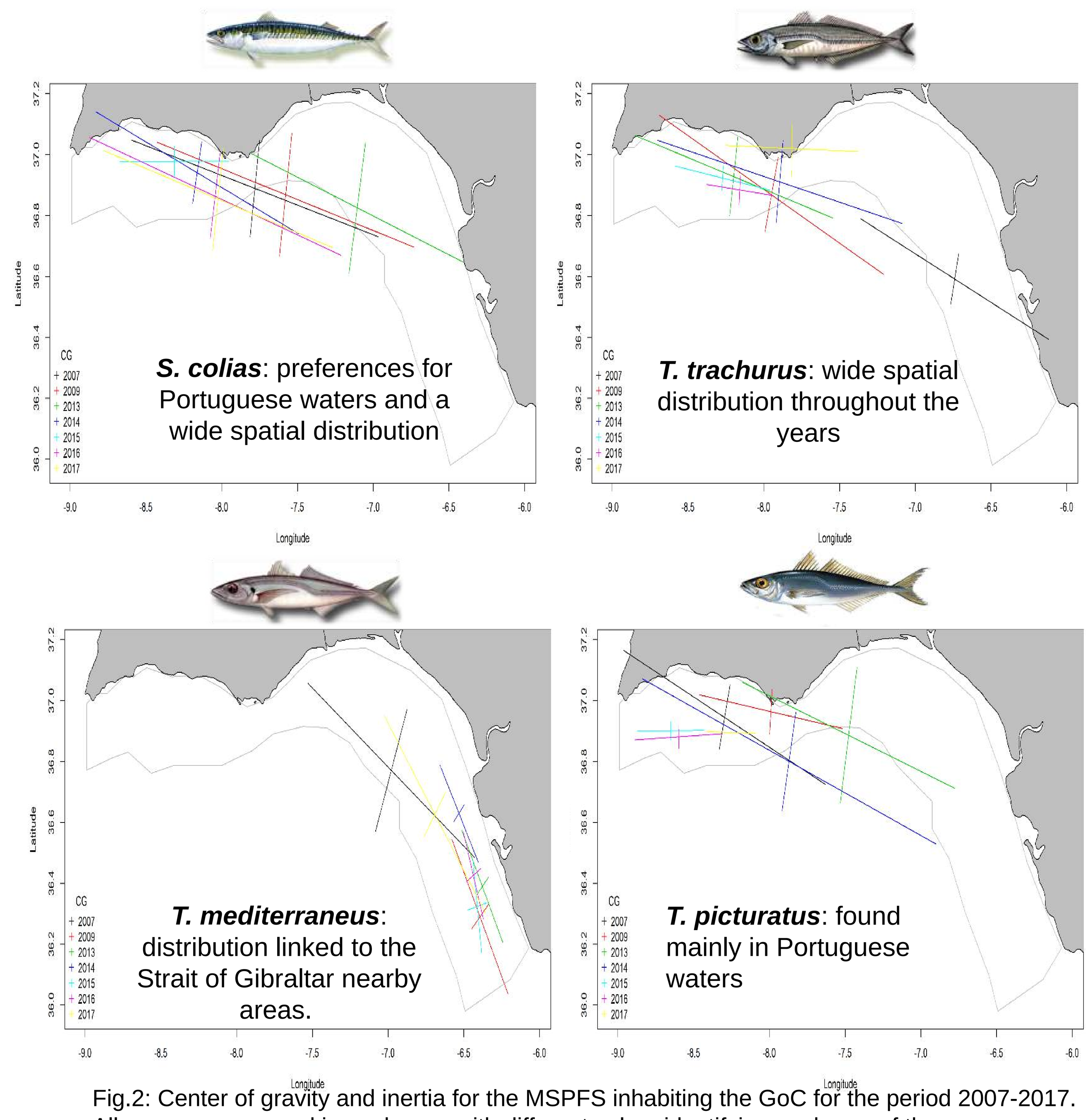


Fig.2: Center of gravity and inertia for the MSPFS inhabiting the GoC for the period 2007-2017. All years are grouped in each map with different colors identifying each one of them

Probability of presence (p) and acoustic density (d)

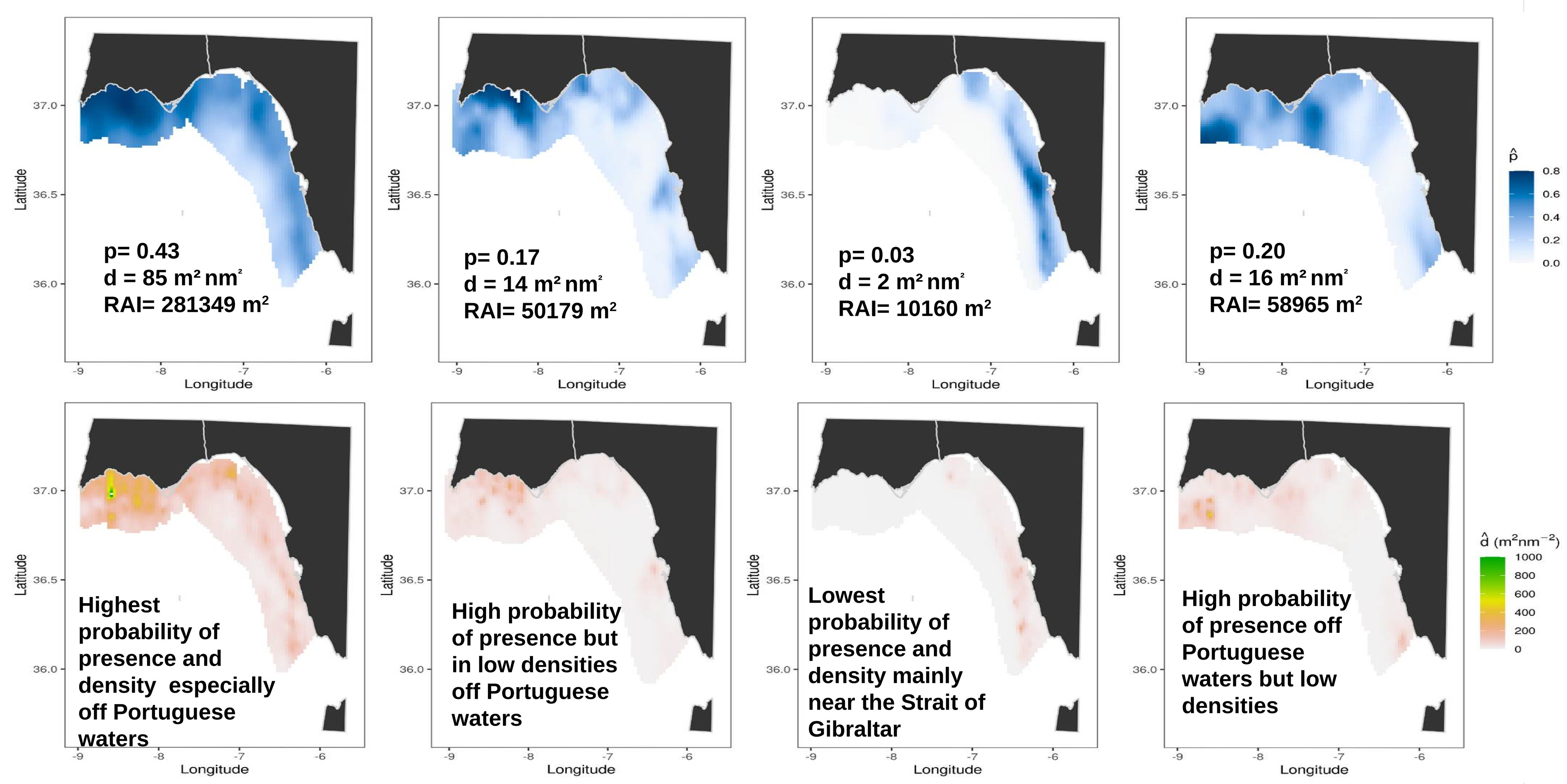
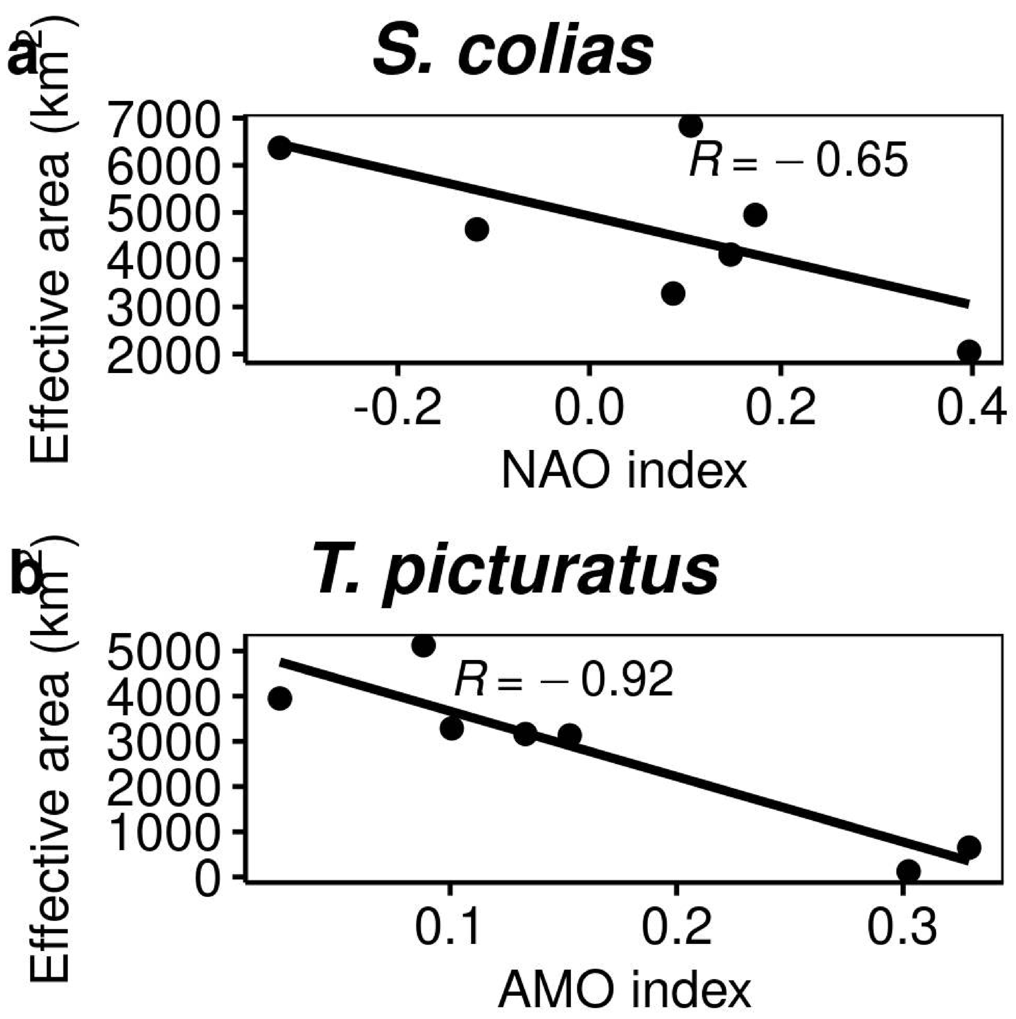


Fig.3: Predicted overall distribution (p) and density (d) of the MSPFS *S. colias, T. trachurus, T. mediterraneus* and *T. picturatus* estimated by fitting a spatio-temporal model for the period 2007-2017.

Climatic drivers



Negative relations were only found between *S. colias* effective area and the NAO index and *T. picturatus* effective area and the AMO index

Fig.4: Correlation between a) the NAO climatic index and the effective area of *S. colias* and b) the AMO index and the effective area of *T. picturatus*.

Response to environmental variability

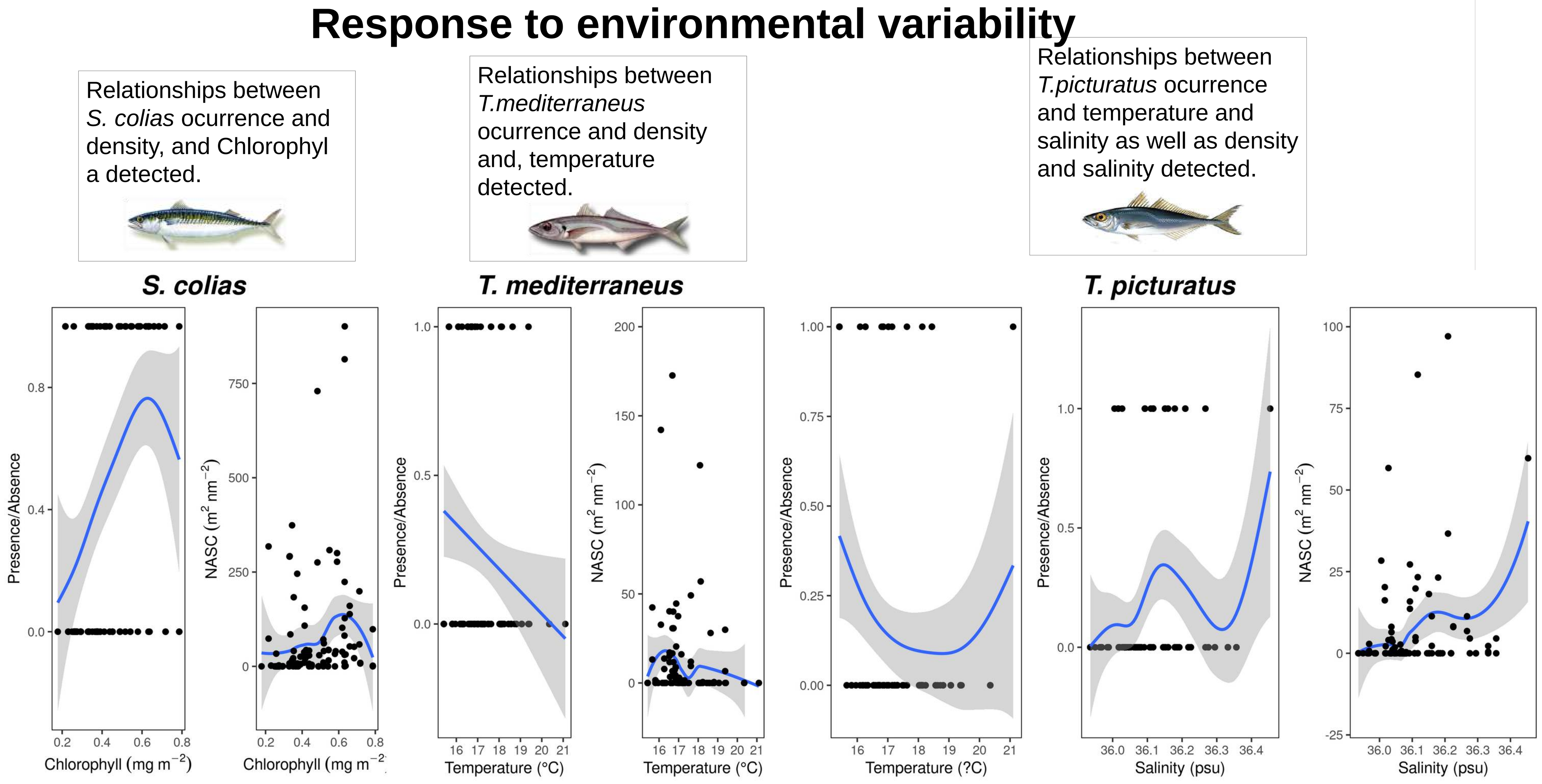


Fig.5: Fitted and observed values of the environmental variables affecting the presence/absence and acoustic density of the MSPFS *S.colias, T. mediterraneus* and *T. picturatus.* No relationships were observed for T. trachurus

Conclusions and future directions

The main findings of the present work will serve as increased knowledge about the studied species and as management tools for the implementation of an ecosystem based approach to fisheries management. Some species such as *S.colias* and *T. picturatus* use the GoC as recruitment areas while most of them (except *T. mediterraneus*) use the upwelling system south of Portugal as a feeding area. Future research is already being performed to estimate and map habitat suitability for each MSPFS populations considering more environmental variables aimed to establish essential fish habitats.

Acknowledgments

Thanks to the Instituto Español de Oceanografía, the scientific team from the acoustic surveys and Marina Delgado, Luis Silva, Jorge Tornero and Gustavo Freire.

References

-Bez, N., 1997. Statistiques individuelles et géostatistique transitive en écologie halieutique. Thèse Dr. En géostatistique. ENSMP, France, 276p.
-Lindgren F, Rue H, Lindström J (2011) An explicit link between Gaussian fields and Gaussian Markov random fields: the stochastic partial differential equation approach. J R Stat Soc Ser B Stat Methodol 73:423–498.
-Rodell M & Kato H. Beaudoing, NASA/GSFC/HSL (08.16.2007), GLDAS CLM Land Surface Model L4 3 Hourly 1.0 x 1.0 degree Subsetted,version 001, Greenbelt, Maryland, USA:Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed Enter User Data Access Date at doi:10.5067/83NO2QDLG6M0

[1]Centro i~mar, Universidad de Los Lagos, Chile, [2] Instituto Español de Oceanografía. Centro Oceanográfico de Cádiz. Puerto pesquero, muelle de levante s/n, 11006, Cádiz, Spain. Email: joseantonio.canseco@alumnos.ulagos.cl.cl