Marine fish traits follow fast-slow continuum along coastal-offshore gradient

Beukhof, Esther Deborah; Frelat, Romain; Pécuchet, Lauréne; Fock, Heino; Punzón, Antonio; Sólmundsson, Jón; Moellmann, Christian; Lindegren, Martin

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Marine fish traits follow environmental gradients across European seas

Esther Beukhof¹, Romain Frelat², Laurène Pécuchet¹, Heino Fock³, Antonio Punzon⁴, Jón Sólmundsson⁵, Christian Möllmann² and Martin Lindegren¹

¹Centre for Ocean Life, DTU Aqua, Lyngby, Denmark; ²Institute of Hydrobiology and Fisheries, University of Hamburg, Hamburg, Germany; ³Institute of Sea Fisheries, Thünen Institute, Hamburg, Germany; ⁴Instituto Español de Oceanografía, Madrid, Spain; ⁵Marine Research Institute, Reykjavik, Iceland

Introduction

One of the major goals in biogeography is describing and understanding species distributions. However, when focusing on species-environment relationships, one may miss the mechanistic understanding of what underlies these distributions. Therefore, trait-environment relationships are useful in explaining where species occur, since traits determine which environment a species can inhabit. In this study, we apply this trait-based approach to Europe’s marine fish communities.

Aims of this study

1) To identify key traits for marine fish that explain fish species distributions;
2) To identify the most important relationships between marine fish traits and the environment.

Data

SITES & SPECIES:
≈2200 sampling sites and ≈250 species from scientific surveys done in the continental shelf seas of Europe (combination of publicly available and institutional data).

ENVIRONMENT: depth, temperature, salinity, Chlorophyll (Chl) concentration, seasonal variability in temperature and monthly variability in Chl-concentration (NOAA; GlobColour).

Results

TRAITS: 7 quantitative traits

The first axis of the RLO analysis (RLQ 1) explained 95% of the variation. In terms of traits, RLQ 1 represents a fast-slow continuum, mainly characterized by age at maturity, lifespan and the growth coefficient K.

ENVIRONMENT:

RLQ 1 represents a depth gradient, along which also vary: temperature (Temp.), seasonal variability in temperature (Temp.ssn), chlorophyll concentration (Chl) and seasonal variability in Chl (Chl.sd).

SAMPLING SITES:

The RLQ 1 scores of the sampling sites follow a coastal-to-offshore gradient, thereby corresponding to the depth gradient that was found to be an important determinant for fish species distributions.

The fourth-corner analysis confirmed the importance of the three traits that characterize the fast-slow continuum as well as depth as an important environmental variable. The analysis also revealed significant relationships of the fast-slow traits with temperature and with the variability in temperature and Chl-concentration.

Conclusions

We demonstrated that marine fish species can be characterized according to their traits along a fast-slow continuum. Traits in particular related to growth and maturity are key for explaining fish species distributions. The trait continuum is strongly determined by a depth gradient. Along this gradient, other factors vary, such as temperature, productivity and seasonality, which help in explaining species distributions and the structure of marine fish communities.

References


DTU Aqua
National Institute of Aquatic Resources