Temporal and spatial differences between taxonomic and trait biodiversity in a large marine ecosystem: Causes and consequences

Biodiversity is a multifaceted concept, yet most biodiversity studies have taken a taxonomic approach, implying that all species are equally important. However, species do not contribute equally to ecosystem processes and differ markedly in their responses to changing environments. This recognition has led to the exploration of other components of biodiversity, notably the diversity of ecologically important traits. Recent studies taking into account both taxonomic and trait diversity have revealed that the two biodiversity components may exhibit pronounced temporal and spatial differences. These apparent incongruences indicate that the two components may respond differently to environmental drivers and that changes in one component might not affect the other. Such incongruences may provide insight into the structuring of communities through community assembly processes, and the resilience of ecosystems to change. Here we examine temporal and spatial patterns and drivers of multiple marine biodiversity indicators using the North Sea fish community as a case study. Based on long-term spatially resolved survey data on fish species occurrences and biomasses from 1983 to 2014 and an extensive trait dataset we: (i) investigate temporal and spatial incongruences between taxonomy and trait-based indicators of both richness and evenness; (ii) examine the underlying environmental drivers and, (iii) interpret the results in the context of assembly rules acting on community composition. Our study shows that taxonomy and trait-based biodiversity indicators differ in time and space and that these differences are correlated to natural and anthropogenic...
drivers, notably temperature, depth and substrate richness. Our findings show that trait-based biodiversity indicators add information regarding community composition and ecosystem structure compared to and in conjunction with taxonomy-based indicators. These results emphasize the importance of examining and monitoring multiple indicators of biodiversity in ecological studies as well as for conservation and ecosystem-based management purposes.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, University of Copenhagen
Authors: Dencker, T. S. (Intern), Pécuchet, L. (Intern), Beukhof, E. (Intern), Richardson, K. (Ekstern), Payne, M. R. (Intern), Lindegren, M. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: P L o S One
Volume: 12
Issue number: 12
Article number: e0189731
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.631 SNIP 1.161
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.473 SNIP 0.985
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.323 SNIP 0.96
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.289 SNIP 0.525
Web of Science (2006): Indexed yes
Records of five bryozoan species from offshore gas platforms rare for the Dutch North Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Wageningen University, Wageningen IMARES, Royal Belgian Institute of Natural Sciences
Authors: Beukhof, E. D. (Intern), Coolen, J. W. P. (Ekstern), van der Weide, B. E. (Ekstern), Cuperus, J. (Ekstern), de Blauwe, H. (Ekstern), Lust, J. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Biodiversity Records
Volume: 9
Issue number: 1
ISSN (Print): 1755-2672
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2016): SJR 0.213 SNIP 0.267 CiteScore 0.33
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.27 SNIP 0.41 CiteScore 0.44
Scopus rating (2014): SJR 0.294 SNIP 0.58 CiteScore 0.42
Scopus rating (2013): SJR 0.285 SNIP 0.464 CiteScore 0.4
Scopus rating (2012): SJR 0.221 SNIP 0.358 CiteScore 0.35
Original language: English
Electronic versions:
Publishers version
DOIs:
10.1186/s41200-016-0086-6
Source: FindIt
Source-ID: 2347241540
Publication: Research - peer-review › Journal article – Annual report year: 2016

Spatial structuration of life history traits: congruence between multiple taxa and environmental drivers in the North Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

Spatio-temporal changes in life-history traits of the North Sea fish community under climate change and fishing

General information
State: Published
Projects:

**A trait-based approach for predicting fish community structure, function and services under climate change and exploitation**

National Institute of Aquatic Resources  
Period: 15/03/2016 → 14/03/2019  
Number of participants: 3  
PhD Student: Beukhof, Esther (Intern)  
Supervisor: Andersen, Ken Haste (Intern)  
Main Supervisor: Lindegren, Martin (Intern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: Marie Curie (EU-stipendium)  
Project: PhD

**MARmaED is an EU Initial Training Network that unifies specific and complementary competences in marine sciences from Norway, Finland, Denmark, the Netherlands, Germany and France to investigate how the cumulative stress from biodiversity loss, climate change and harvesting will affect Europe’s complex marine systems and the consequences for optimal resource management. MARmaED incorporates feedbacks between the socioeconomic and the ecological systems that give rise to critical transitions.**

This project is coordinated by University of Oslo, Norway.

The project is funded by EU, Marie Curie.

National Institute of Aquatic Resources  
Centre for Ocean Life  
University of Oslo  
University of Hamburg  
Åbo Academy University  
Wageningen University  
University of Helsinki  
University of Bergen  
Météo-France  
Period: 01/10/2015 → 01/10/2019  
Number of participants: 4  
Research area: Marine Populations and Ecosystem Dynamics  
Project participant:
Lindegren, Martin (Intern)  
Phd Student:  
van Gemert, Rob (Intern)  
Beukhof, Esther (Intern)  
Project Manager, academic:  
Andersen, Ken Haste (Intern)  
Project