A generic framework for individual-based modelling and physical-biological interaction
The increased availability of high-resolution ocean data globally has enabled more detailed analyses of physical-biological interactions and their consequences to the ecosystem. We present IBMlib, which is a versatile, portable and computationally effective framework for conducting Lagrangian simulations in the marine environment. The purpose of the framework is to handle complex individual-level biological models of organisms, combined with realistic 3D oceanographic model of physics and biogeochemistry describing the environment of the organisms without assumptions about spatial or temporal scales. The open-source framework features a minimal robust interface to facilitate the coupling between individual-level biological models and oceanographic models, and we provide application examples including forward/backward simulations, habitat connectivity calculations, assessing ocean conditions, comparison of physical circulation models, model ensemble runs and recently posterior Eulerian simulations using the IBMlib framework. We present the code design ideas behind the longevity of the code, our implementation experiences, as well as code performance benchmarking. The framework may contribute substantially to progresses in representing, understanding, predicting and eventually managing marine ecosystems.
Distribution and timing of spawning Faroe Plateau cod in relation to warming spring temperatures

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Oceans and Arctic, University of the Faroe Islands, Faroe Marine Research Institute
Authors: Maj Ottosen, K. (Intern), Steingrund, P. (Ekstern), Magnussen, E. (Ekstern), Payne, M. (Intern)
Pages: 14-23
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 198
A trait-based approach to understanding marine communities composition, assembly and diversity

A species occurs and thrives in a community thanks to its capacity to grow, reproduce and feed in its surrounding environment. Understanding how and why some species thrive in particular areas has often been touched upon by studying the species composition of communities. Traditionally, communities are characterised by their taxonomic diversity, such as their species richness or the evenness in their abundances. However, there is growing evidence that it is not the taxonomic identity of the species per se that control its presence and abundance in a given environment but its characteristics. Species traits refer to quantitatively or qualitatively measurable characteristics of a species. Characterizing species by their key traits can permit an understanding of general mechanisms and unravel the processes affecting coexistence in communities. The aim of this thesis was to apply the trait-based approach to study the composition of marine communities located in the European Seas and relate their spatial patterns to environmental and anthropogenic pressures.

The species composition of communities can be constrained by several processes, such as competition and the environment. Using a trait-based approach, we studied the diversity and the processes influencing the composition of demersal fish communities in the Baltic Sea. We found that species richness was sharply decreasing from the saline Kattegat to the brackish Gdansk Bay, trait richness tended to decrease at a lower rate. We found that the species co-occurring in the Eastern Baltic Sea were in general more ecologically similar, in terms of their traits, than expected by random chance alone with a strong influence of the environment and notably the salinity gradient on the distribution and trait composition of the communities. While traits are increasingly used in community ecology, they are often selected and used without a consistent framework. We made use of a theoretical framework that defines life history strategies as a combination of key traits and their trade-offs to investigate large-scale patterns and drivers of fish community composition across European Seas. We assembled an extensive number of surveys in the European seas and collected reproductive traits for more than 300 fish species present in these surveys. Based on their traits, fish species could be categorized into three strategies that reflect the evolutionary and environmental constraints acting on the species. The strategies’ prevalence exhibited strong geographical patterns which could be explained by spatial variability in annual sea surface temperature, temperature seasonality, depth and fishing intensity. Due to their tight coupling to the environment, notably temperature and fishing, life history strategies could be a suitable tool to monitor and understand community changes in response to natural and anthropogenic stressors, including climate change. Spatial patterns of community mean traits and their relationship with the environment are generally assessed on a single taxonomic group. As a result, it is still unclear whether the relationship found for one taxonomic group can be generalised to other taxonomic groups that compose the ecosystem. Yet, understanding the responses of these different groups to environmental pressures is a prerequisite to conserve and manage ecosystems. We studied the spatial pattern of community traits of three key taxonomic groups in the North Sea: copepods, benthos, and fish. We extracted the community composition of these groups from three scientific surveys covering the entire North Sea and combined them with key life history traits common to all three groups: adult size, offspring size and fecundity. While many of the traits co-varied in space and notably demonstrated a latitudinal gradient, none of the traits had a consistent, either positive or negative, relationship across all taxa. The spatial trait-variability could be explained by taxonspecific habitat condition. Thus, trait responses to environmental gradient cannot be generalized across these marine taxonomic groups, pointing toward potential complex responses of multi-taxe communities to environmental changes.

This thesis highlights the value of using traits to understand why communities are composed of a specific set of species and how the mean traits of these communities varies along environmental and anthropogenic gradient. This thesis stresses the utility of the trait-based approach, due to its generality, to compare communities at different scales, from different regions as well as communities composed of different taxonomic entities. The trait-based approach still has a lot to offer to unravel the processes controlling the composition of communities and species distribution, and its use in marine ecology has yet to be extended to other domains, such as understanding the impacts of functional traits composition on the ecosystem functioning in the marine realm.
A trait database for marine copepods

The trait-based approach is gaining increasing popularity in marine plankton ecology but the field urgently needs more and easier accessible trait data to advance. We compiled trait information on marine pelagic copepods, a major group of zooplankton, from the published literature and from experts and organized the data into a structured database. We collected 9306 records for 14 functional traits. Particular attention was given to body size, feeding mode, egg size, spawning strategy, respiration rate, and myelination (presence of nerve sheathing). Most records were reported at the species level, but some phylogenetically conserved traits, such as myelination, were reported at higher taxonomic levels, allowing the entire diversity of around 10 800 recognized marine copepod species to be covered with a few records. Aside from myelination, data coverage was highest for spawning strategy and body size, while information was more limited for quantitative traits related to reproduction and physiology. The database may be used to investigate relationships between traits, to produce trait biogeographies, or to inform and validate trait-based marine ecosystem models. The data can be downloaded from PANGAEA, doi:10.1594/PANGAEA.862968
From traits to life-history strategies: Deconstructing fish community composition across European seas
The life history of a species is determined by trade-offs between growth, survival and reproduction to maximize fitness in a given environment. Following a theoretical model, we investigate whether the composition of marine fish communities can be understood in terms of a set of lifehistory strategies and whether the prevalence of the strategies follows specific spatial patterns that can be related to the environment.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Instituto Español de Oceanografía, Thünen Institute of Sea Fisheries, Marine and Freshwater Research Institute
Authors: Pécuchet, L. (Intern), Lindegren, M. (Intern), Hidalgo, M. (Ekstern), Delgado, M. (Ekstern), Esteban, A. (Ekstern), Fock, H. O. (Ekstern), Gil de Sola, L. (Ekstern), Punzón, A. (Ekstern), Sólundsson, J. (Ekstern), Payne, M. R. (Intern)
Pages: 812-822
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.4 SJR 4.061 SNIP 1.903
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.57 SNIP 2.051 CiteScore 6.67
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.433 SNIP 2.386 CiteScore 6.92
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.171 SNIP 2.543 CiteScore 7.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.266 SNIP 2.236 CiteScore 6.56
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.808 SNIP 1.995 CiteScore 5.68
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.947 SNIP 2.187
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 4.134 SNIP 2.188
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.598 SNIP 2.045
Scopus rating (2007): SJR 2.723 SNIP 1.561
Scopus rating (2006): SJR 2.381 SNIP 1.697
Scopus rating (2005): SJR 2.36 SNIP 1.659
Scopus rating (2004): SJR 2.068 SNIP 1.323
Scopus rating (2003): SJR 1.411 SNIP 1.091
Scopus rating (2002): SJR 0.898 SNIP 0.997
Managing living marine resources in a dynamic environment: the role of seasonal to decadal climate forecasts

Recent developments in global dynamical climate prediction systems have allowed for skillful predictions of climate variables relevant to living marine resources (LMRs) at a scale useful to understanding and managing LMRs. Such predictions present opportunities for improved LMR management and industry operations, as well as new research avenues in fisheries science. LMRs respond to climate variability via changes in physiology and behavior. For species and systems where climate-fisheries links are well established, forecasted LMR responses can lead to anticipatory and more effective decisions, benefitting both managers and stakeholders. Here, we provide an overview of climate prediction systems and advances in seasonal to decadal prediction of marine-resource relevant environmental variables. We then describe a range of climate-sensitive LMR decisions that can be taken at lead-times of months to decades, before highlighting a range of pioneering case studies using climate predictions to inform LMR decisions. The success of these case studies suggests that many additional applications are possible. Progress, however, is limited by observational and modeling challenges. Priority developments include strengthening of the mechanistic linkages between climate and marine resource responses, development of LMR models able to explicitly represent such responses, integration of climate driven LMR dynamics in the multi-driver context within which marine resources exist, and improved prediction of ecosystem-relevant variables at the fine regional scales at which most marine resource decisions are made. While there are
fundamental limits to predictability, continued advances in these areas have considerable potential to make LMR
managers and industry decision more resilient to climate variability and help sustain valuable resources. Concerted dialog
between scientists, LMR managers and industry is essential to realizing this potential.

**General information**

**State:** Published

**Organisations:** National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Princeton
University, National Oceanographic and Atmospheric Administration, CSIRO Oceans and Atmosphere, Institut Pierre
Simon Laplace, Gulf of Maine Research Institute, Centre National de la Recherche Scientifique, CNRM Centre National de
Recherches Meteorologiques, Bureau of Meteorology, CSIRO, University of Washington, Rutgers University, University of
South Carolina, George Mason University, Institute of Marine Research, CLS

**Authors:** Tommasi, D. (Ekstern), Stock, C. A. (Ekstern), Hobday, A. J. (Ekstern), Methot, R. (Ekstern), Kaplan, I. C.
(Ekstern), Paige Eveson, J. (Ekstern), Holsman, K. (Ekstern), Miller, T. J. (Ekstern), Gaichas, S. (Ekstern), Gehlen, M.
(Ekstern), Pershing, A. (Ekstern), Vecchi, G. A. (Ekstern), Msadek, R. (Ekstern), Delworth, T. (Ekstern), Mark Eakin, C.
(Ekstern), Haltuch, M. A. (Ekstern), Séférian, R. (Ekstern), Spillman, C. M. (Ekstern), Hartog, J. R. (Ekstern), Siedlecki, S.
(Ekstern), Samhouri, J. F. (Ekstern), Muhling, B. (Ekstern), Asch, R. G. (Ekstern), Pinsky, M. L. (Ekstern), Saba, V. S.
(Ekstern), Kapnick, S. B. (Ekstern), Gaitan, C. F. (Ekstern), Rykaczewski, R. R. (Ekstern), Alexander, M. A. (Ekstern),
Xue, Y. (Ekstern), Pegion, K. V. (Ekstern), Lynch, P. (Ekstern), Payne, M. (Intern), Kristiansen, T. (Ekstern), Lehodey, P.
(Ekstern), Werner, F. E. (Ekstern)

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**Main Research Area:** Technical/natural sciences

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- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 3.4 SJR 1.922 SNIP 1.278
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.703 SNIP 1.348 CiteScore 3.34
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.909 SNIP 1.461 CiteScore 3.65
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 2.397 SNIP 1.595 CiteScore 3.87
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 2.741 SNIP 1.794 CiteScore 4.17
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 2.279 SNIP 1.341 CiteScore 3.41
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 2.643 SNIP 1.586
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.669 SNIP 1.829
- Web of Science (2009): Indexed yes
Marine Ecosystem Climate Services - Forecasting biology at end-user relevant time-scales

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Payne, M. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publicaton: Research › Conference abstract for conference – Annual report year: 2017

Plankton biogeography: An exploration of patterns, drivers, functions, and predictability

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Brun, P. G. (Intern), Payne, M. (Intern), Kiørboe, T. (Intern)
Number of pages: 196
Publication date: 2017

Publication information
Publisher: DTU Aqua. National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2017

Predicting ecosystems for managing a dynamic ocean

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, CSIRO, Bureau of Meteorology, Princeton University, CSIRO Marine and Atmospheric Research
Authors: Hobday, A. J. (Ekstern), Hartog, J. R. (Ekstern), Spillman, C. M. (Ekstern), Payne, M. (Intern), MacKenzie, B. (Intern), Tommasi, D. (Ekstern)
Publication date: 2017

Publication information
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 taxonony-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

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Journal: P L o S One
Volume: 12
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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
The Sub-Polar Gyre Index - a community data set for application in fisheries and environment research

Scientific interest in the sub-polar gyre of the North Atlantic Ocean has increased in recent years. The sub-polar gyre has contracted and weakened, and changes in circulation pathways have been linked to changes in marine ecosystem productivity. To aid fisheries and environmental scientists, we present here a time series of the Sub-Polar Gyre Index (SPG-I) based on monthly mean maps of sea surface height. The established definition of the SPG-I is applied, and the first EOF (empirical orthogonal function) and PC (principal component) are presented. Sensitivity to the spatial domain and time series length are explored but found not to be important factors in terms of the SPG-I’s interpretation. Our time series compares well with indices presented previously. The SPG-I time series is freely available online (http://dx.doi.org/10.7489/1806-1), and we invite the community to access, apply, and publish studies using this index time series.

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Marine Scotland Science
Authors: Berx, B. (Ekstern), Payne, M. (Intern)
Pages: 259-266
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Earth System Science Data
Volume: 9
Issue number: 1
ISSN (Print): 1866-3508
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 7.28 SJR 4.647 SNIP 2.504
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 5.282 SNIP 2.822 CiteScore 7.07
Web of Science (2015): Indexed yes
Translating advances in Arctic climate science to climate services across the Northern Hemisphere

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Miller, R. (Ekstern), Payne, M. (Intern), Keil, K. (Ekstern), Kolstad, E. W. (Ekstern), Ballester, J. (Ekstern), Lesser, P. (Ekstern), Vangsbo, P. (Ekstern)
Publication date: 2017
Event: Poster session presented at European Climate Change Adaptation Conference , Glasgow, United Kingdom.
Main Research Area: Technical/natural sciences
Published: Research - Technical/natural sciences – Annual report year: 2017

Variation that can be expected when using particle tracking models in connectivity studies
•A suite of ocean circulation and Lagrangian models were compared to determine inter-model uncertainty and variation.
•Absolute results (positions, temperatures, etc.) varied between models, but trends were comparable.
•More plaice than sole larvae reached a marine protected area although released in the same area but at different times.
•About 10% of all herring larvae released in the southern North Sea were located in a wind-park area when becoming juvenile.

General information
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Main Research Area: Technical/natural sciences
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Journal: Journal of Sea Research
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
A trait database for marine copepods

The trait-based approach is gaining increasing popularity in marine plankton ecology but the field urgently needs more and easier accessible trait data to advance. We compiled trait information on marine pelagic copepods, a major group of zooplankton, from the published literature and from experts, and organised the data into a structured database. We collected 9345 records for 14 functional traits. Particular attention was given to body size, feeding mode, egg size, spawning strategy, respiration rate and myelination (presence of nerve sheathing). Most records were reported on the species level, but some phylogenetically conserved traits, such as myelination, were reported on higher taxonomic levels,
allowing the entire diversity of around 10 800 recognized marine copepod species to be covered with few records. Besides myelination, data coverage was highest for spawning strategy and body size while information was more limited for quantitative traits related to reproduction and physiology. The database may be used to investigate relationships between traits, to produce trait biogeographies, or to inform and validate trait-based marine ecosystem models. The data can be downloaded from PANGAEA, doi:10.1594/PANGAEA.862968.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Brun, P. G. (Intern), Payne, M. R. (Intern), Kiørboe, T. (Intern)
Pages: 1-33
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Earth System Science Data Discussions
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DOIs:
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Source-ID: 2306809783
Publication: Research - peer-review → Journal article – Annual report year: 2016

A trait database for marine copepods

General information
State: Published
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Publication date: 2016

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DOIs:
10.1594/PANGAEA.862968
Links:
https://doi.pangaea.de/10.1594/PANGAEA.862968
Publication: Research › Dataset – Annual report year: 2017

Forecasting the spawning distribution of blue whiting (Micromesistius poutassou)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Miesner, A. K. (Intern), Payne, M. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Source: PublicationPreSubmission
From traits to life history strategies: deconstructing fish community composition across European Seas

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

Marine Climate Services - Forecasting the state of the ocean at end-user relevant time-scale
Recent advances in oceanographic modelling mean that today we can forecast the state of the ocean with meaningful skill up to a decade in advance. Such forecasts are potentially of great value to society, as they span the gap between the short (days-to-weeks) time scales of weather forecasts and the long (century) time-scales of climate projections: importantly, these are the time scales where most users make important decisions. However, a translation step is required to convert the outputs from these models, which are typically physical variables, into variables that are directly relevant to end-users (e.g. distribution and productivity of fish stocks) to create so-called "climate services". As an example of this process and its potential, I will describe the development of skilful forecasts of a biological variable on this 1-10 year time scale: the distribution of bluefin tuna (Thunnus thynnus) in the North Atlantic. Further opportunities for forecasting variables, both globally and that are of direct relevance to Danish end-users will also be presented.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Payne, M. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
Sustain Abstract S-2
Publication: Research › peer-review › Conference abstract for conference – Annual report year: 2016

Reproductive traits (Fecundity, egg diameter, parental care) of marine European fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Publication date: 2016

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Original language: English
Main Research Area: Technical/natural sciences
DOIs: 10.1594/PANGAEA.868610
Links:
https://doi.pangaea.de/10.1594/PANGAEA.868610
Publication: Research › Dataset – Annual report year: 2017
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

The predictive skill of species distribution models for plankton in a changing climate

Statistical species distribution models (SDMs) are increasingly used to project spatial relocations of marine taxa under future climate change scenarios. However, tests of their predictive skill in the real-world are rare. Here, we use data from the Continuous Plankton Recorder program, one of the longest running and most extensive marine biological monitoring programs, to investigate the reliability of predicted plankton distributions. We apply three commonly used SDMs to 20 representative plankton species, including copepods, diatoms, and dinoflagellates, all found in the North Atlantic and adjacent seas. We fit the models to decadal subsets of the full (1958–2012) dataset, and then use them to predict both forward and backward in time, comparing the model predictions against the corresponding observations. The probability of correctly predicting presence was low, peaking at 0.5 for copepods, and model skill typically did not outperform a null model assuming distributions to be constant in time. The predicted prevalence increasingly differed from the observed prevalence for predictions with more distance in time from their training dataset. More detailed investigations based on four focal species revealed that strong spatial variations in skill exist, with the least skill at the edges of the distributions, where prevalence is lowest. Furthermore, the scores of traditional single-value model performance metrics were contrasting and some implied overoptimistic conclusions about model skill. Plankton may be particularly challenging to model, due to its short life span and the dispersive effects of constant water movements on all spatial scales, however there are few other studies against which to compare these results. We conclude that rigorous model validation, including comparison against null models, is essential to assess the robustness of projections of marine planktonic species under climate change.
Functional traits, rather than taxonomic identity, determine the fitness of individuals in their environment: traits of marine organisms are therefore expected to vary across the global ocean as a function of the environment. Here, we quantify such spatial and seasonal variations based on extensive empirical data and present the first global biogeography of key traits (body size, feeding mode, relative offspring size and myelination) for pelagic copepods, the major group of marine zooplankton. We identify strong patterns with latitude, season and between ocean basins that are partially (c. 50%) explained by key environmental drivers. Body size, for example decreases with temperature, confirming the temperature-size rule, but surprisingly also with productivity, possibly driven by food-chain length and size-selective predation. Patterns unrelated to environmental predictors may originate from phylogenetic clustering. Our maps can be used as a test-bed for trait-based mechanistic models and to inspire next-generation biogeochemical models.

**Trait biogeography of marine copepods: an analysis across scales**

Functional traits, rather than taxonomic identity, determine the fitness of individuals in their environment: traits of marine organisms are therefore expected to vary across the global ocean as a function of the environment. Here, we quantify such spatial and seasonal variations based on extensive empirical data and present the first global biogeography of key traits (body size, feeding mode, relative offspring size and myelination) for pelagic copepods, the major group of marine zooplankton. We identify strong patterns with latitude, season and between ocean basins that are partially (c. 50%) explained by key environmental drivers. Body size, for example decreases with temperature, confirming the temperature-size rule, but surprisingly also with productivity, possibly driven by food-chain length and size-selective predation. Patterns unrelated to environmental predictors may originate from phylogenetic clustering. Our maps can be used as a test-bed for trait-based mechanistic models and to inspire next-generation biogeochemical models.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Uncertainties in projecting climate-change impacts in marine ecosystems

Projections of the impacts of climate change on marine ecosystems are a key prerequisite for the planning of adaptation strategies, yet they are inevitably associated with uncertainty. Identifying, quantifying, and communicating this uncertainty is key to both evaluating the risk associated with a projection and building confidence in its robustness. We review how uncertainties in such projections are handled in marine science. We employ an approach developed in climate modelling by breaking uncertainty down into (i) structural (model) uncertainty, (ii) initialization and internal variability uncertainty, (iii) parametric uncertainty, and (iv) scenario uncertainty. For each uncertainty type, we then examine the current state-of-the-art in assessing and quantifying its relative importance. We consider whether the marine scientific community has addressed these types of uncertainty sufficiently and highlight the opportunities and challenges associated with doing a better job. We find that even within a relatively small field such as marine science, there are substantial differences between subdisciplines in the degree of attention given to each type of uncertainty. We find that initialization uncertainty is rarely treated explicitly and reducing this type of uncertainty may deliver gains on the seasonal-to-decadal time-scale. We conclude that all parts of marine science could benefit from a greater exchange of ideas, particularly concerning such a universal problem such as the treatment of uncertainty. Finally, marine science should strive to reach the point where scenario uncertainty is the dominant uncertainty in our projections.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Plymouth Marine Laboratory, University of British Columbia, North Pacific Marine Science Organization, IFREMER, Dalhousie University, National Oceanographic and Atmospheric Administration, Dragonfly Data Science, University of Washington, Universidade de Lisboa
Pages: 1272-1282
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: ICES Journal of Marine Science
Volume: 73
Issue number: 5
ISSN (Print): 1054-3139
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 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Can we understand and predict the distributional shifts of pelagic fish?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Payne, M. (Intern)
Number of pages: 1
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:

Bibliographical note
ICES CM 2015/S:02
Publication: Research › Conference abstract for conference – Annual report year: 2015

Controlling factors in fish early life history and how they combine to influence trophic links across the North Atlantic Ocean.

General information
Ecological niches of open ocean phytoplankton taxa

We characterize the realized ecological niches of 133 phytoplankton taxa in the open ocean based on observations from the MAREDAT initiative and a statistical species distribution model (MaxEnt). The models find that the physical conditions (mixed layer depth, temperature, light) govern large-scale patterns in phytoplankton biogeography over nutrient availability. Strongest differences in the realized niche centers were found between diatoms and coccolithophores. Diatoms (87 species) occur in habitats with significantly lower temperatures, light intensity and salinity, with deeper mixed layers, and with higher nitrate and silicate concentrations than coccolithophores (40 species). However, we could not statistically separate the realized niches of coccolithophores from those of diazotrophs (two genera) and picophytoplankton (two genera). Phaeocystis (two species) niches only clearly differed from diatom niches for temperature. While the realized niches of diatoms cover the majority of niche space, the niches of picophytoplankton and coccolithophores spread across an intermediate fraction and diazotroph and colonial Phaeocystis niches only occur within a relatively confined range of environmental conditions in the open ocean. Our estimates of the realized niches roughly match the predictions of Reynolds' C-S-R model for the global ocean, namely that taxa classified as nutrient stress tolerant have niches at lower nutrient and higher irradiance conditions than light stress tolerant taxa. Yet, there is considerable within-class variability in niche centers, and many taxa occupy broad niches, suggesting that more complex approaches may be necessary to capture all aspects of phytoplankton ecology.
Environmental determinates of blue whiting (Micromesistius poutassou) spawning distribution

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Miesner, A. K. (Intern), Payne, M. (Intern)
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Bibliographical note
ICES C.M. 2015/
Publication: Research › Conference abstract for conference – Annual report year: 2016
Making and using predictions of species distributions to improve survey design

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Payne, M. (Intern)
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers_version

Bibliographical note
ICES CM 2015/C:08
Publication: Research › Conference abstract for conference – Annual report year: 2015

Measuring evolutionary adaptation of phytoplankton with local field observations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Brun, P. G. (Intern), Kiørboe, T. (Intern), Payne, M. (Intern)
Pages: E5223-E5224
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Proceedings of the National Academy of Sciences
Volume: 112
Issue number: 38
ISSN (Print): 0027-8424
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.56 SJR 6.321 SNIP 2.629
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.767 SNIP 2.682 CiteScore 8.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.853 SNIP 2.725 CiteScore 8.86
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 6.989 SNIP 2.73 CiteScore 9.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 6.792 SNIP 2.682 CiteScore 9.49
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 6.771 SNIP 2.636 CiteScore 9.31
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Modelled niche centres and niche breadths of open ocean phytoplankton taxa

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, ETH Zurich, Xiamen University
Publication date: 2015

Publication information
Original language: English
Main Research Area: Technical/natural sciences
DOIs: 10.1594/PANGAEA.858006
Links: https://doi.pangaea.de/10.1594/PANGAEA.858006
Publication: Research › Dataset – Annual report year: 2017

Quirky patterns in time-series of estimates of recruitment could be artefacts
The accessibility of databases of global or regional stock assessment outputs is leading to an increase in meta-analysis of the dynamics of fish stocks. In most of these analyses, each of the time-series is generally assumed to be directly comparable. However, the approach to stock assessment employed, and the associated modelling assumptions, can have an important influence on the characteristics of each time-series. We explore this idea by investigating recruitment time-series with three different recruitment parameterizations: a stock–recruitment model, a random-walk time-series model, and non-parametric “free” estimation of recruitment. We show that the recruitment
time-series is sensitive to model assumptions and this can impact reference points in management, the perception of variability in recruitment and thus undermine meta-analyses. The assumption of the direct comparability of recruitment time-series in databases is therefore not consistent across or within species and stocks. Caution is therefore required as perhaps the characteristics of the time-series of stock dynamics may be determined by the model used to generate them, rather than underlying ecological phenomena. This is especially true when information about cohort abundance is noisy or lacking.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, International Council for the Exploration of the Sea, Wageningen IMARES, Institute of Marine Research, Agri-Food and Biosciences Institute
Authors: Dickey-Collas, M. (Ekstern), Hinzen, N. (Ekstern), Nash, R. (Ekstern), Schön, P. (Ekstern), Payne, M. (Intern)
Pages: 111-116
Publication date: 2015
Main Research Area: Technical/natural sciences

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Journal: ICES Journal of Marine Science
Volume: 72
Issue number: 1
ISSN (Print): 1054-3139
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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 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Spatial linkages in the early life history of north eastern Atlantic herring populations across the north of the British Isles

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Flødevign Research Station, University of Bergen, Institute of Marine Research
Authors: Nash, R. D. (Ekstern), Payne, M. (Intern), Albretsen, J. (Ekstern), Geffen, A. J. (Ekstern)
Number of pages: 2
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Synoptic-scale analysis of mechanisms driving surface chlorophyll dynamics in the North Atlantic
Several hypotheses have been proposed for the onset of the spring phytoplankton bloom in the North Atlantic. Our main objective is to examine which bottom-up processes can best predict the annual increase in surface phytoplankton concentration in the North Atlantic by applying novel phenology algorithms to ocean colour data. We construct indicator fields and time series which, in various combinations, provide models consistent with the principle dynamics previously proposed. Using a multimodel inference approach, we investigate the evidence supporting these models and how it varies in space. We show that, in terms of bottom-up processes alone, there is a dominant physical mechanism, namely mixed-layer shoaling, that best predicts the interannual variation in the initial increase in surface chlorophyll across large sectors of the North Atlantic. We further show that different regions are governed by different physical phenomena and that wind-driven mixing is a common component, with either heat flux or light as triggers. We believe these findings to be relevant to the ongoing discussion on North Atlantic bloom onset.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute, Nansen Environmental and Remote Sensing Center
Authors: Ferreira, A. S. (Intern), Hatun, H. (Ekstern), Counillon, F. (Ekstern), Payne, M. (Intern), Visser, A. (Intern)
Pages: 3641-3653
Publication date: 2015
Main Research Area: Technical/natural sciences
Understanding diversity shifts by characterising the community

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Fredricson, J. (Ekstern), Payne, M. (Intern)
Number of pages: 2
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Understanding observed copepod distributions with a trait data base

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Brun, P. G. (Intern), Kiørboe, T. (Intern), Payne, M. (Intern)
Publication date: 2015
Event: Poster session presented at Trait-based Approaches to Ocean Life, Waterville Valley, New Hampshire, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2015

A cascade of warming impacts brings bluefin tuna to Greenland waters
Rising ocean temperatures are causing marine fish species to shift spatial distributions and ranges, and are altering predator-prey dynamics in food webs. Most documented cases of species shifts so far involve relatively small species at lower trophic levels, and consider individual species in ecological isolation from others. Here we show that a large highly migratory top predator fish species has entered a high latitude sub-polar area. Bluefin tuna, Thunnus thynnus Linnaeus 1758, were captured in waters east of Greenland (65°N) in August 2012 during exploratory fishing for Atlantic mackerel, Scomber scombrus Linnaeus 1758. The bluefin tuna were captured in a single net-haul in 9-11 °C water together with 6 tonnes of mackerel, which is a preferred prey species and itself a new immigrant to the area. Regional temperatures in August 2012 were historically high and contributed to a warming trend since 1985, when temperatures began to rise. The presence of bluefin tuna in this region is likely due to a combination of warm temperatures that are physiologically more tolerable and immigration of an important prey species into the region. We conclude that a cascade of climate change impacts is restructuring the food web in east Greenland waters.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Marine Living Resources, Danish Meteorological Institute, Greenland Institute of Natural Resources
Authors: MacKenzie, B. (Intern), Payne, M. (Intern), Boje, J. (Intern), Høyer, J. L. (Ekstern), Siegstad, H. (Ekstern)
Publication date: 2014
Event: Abstract from ESSAS Annual Science Meeting, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

A cascade of warming impacts brings bluefin tuna to Greenland waters
Rising ocean temperatures are causing marine fish species to shift spatial distributions and ranges, and are altering predator-prey dynamics in food webs. Most documented cases of species shifts so far involve relatively small species at lower trophic levels, and consider individual species in ecological isolation from others. Here, we show that a large highly migratory top predator fish species has entered a high latitude subpolar area beyond its usual range. Bluefin tuna, Thunnus thynnus Linnaeus 1758, were captured in waters east of Greenland (65°N) in August 2012 during exploratory fishing for Atlantic mackerel, Scomber scombrus Linnaeus 1758. The bluefin tuna were captured in a single net-haul in 9-11 °C water together with 6 tonnes of mackerel, which is a preferred prey species and itself a new immigrant to the area. Regional temperatures in August 2012 were historically high and contributed to a warming trend since 1985, when temperatures began to rise. The presence of bluefin tuna in this region is likely due to a combination of warm temperatures that are physiologically more tolerable and immigration of an important prey species into the region. We conclude that a cascade of climate change impacts is restructuring the food web in east Greenland waters.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Marine Living Resources, Technical University of Denmark, Danmarks Meteorologisk Institut, Greenland Institute of Natural Resources
Authors: MacKenzie, B. R. (Intern), Payne, M. R. (Intern), Boje, J. (Intern), Heyer, J. L. (Ekstern), Siegstad, H. (Ekstern)
Pages: 2484-2491
Publication date: 2014
Main Research Area: Technical/natural sciences
Accuracy and precision in the calculation of phenology metrics

Phytoplankton phenology (the timing of seasonal events) is a commonly used indicator for evaluating responses of marine ecosystems to climate change. However, phenological metrics are vulnerable to observation-(bloom amplitude, missing data, and observational noise) and analysis-related (temporal resolution, preprocessing technique, and phenology metric) processes. Here we consider the impact of these processes on the robustness of four phenology metrics (timing of maximum, 5% above median, maximum growth rate, and 15% of cumulative distribution). We apply a simulation-testing approach, where a phenology metric is first determined from a noise- and gap-free time series, and again once it has been modified. We show that precision is a greater concern than accuracy for many of these metrics, an important point that has been hereto overlooked in the literature. The variability in precision between phenology metrics is substantial, but it can be improved by the use of preprocessing techniques (e.g., gap-filling or smoothing). Furthermore, there are important differences in the inherent variability of the metrics that may be crucial in the interpretation of studies based upon them. Of the considered metrics, the 15% of cumulative distribution metric best satisfies the precision criteria. However, the 5% above median metric is comparable in terms of precision and exhibits more inherent variability. We emphasize that the choice of phenology metric should be determined by the specific nature of the question being asked. We believe these findings to be useful to the current discussion on phenology metrics of phytoplankton dynamics.
A resolution to the blue whiting (Micromesistius poutassou) population paradox?

We provide the strongest evidence to date supporting the existence of two independent blue whiting (Micromesistius poutassou (Risso, 1827)) populations in the North Atlantic. In spite of extensive data collected in conjunction with the fishery, the population structure of blue whiting is poorly understood. On one hand, genetic, morphometric, otolith and drift modelling studies point towards the existence of two populations, but, on the other hand, observations of adult distributions point towards a single population. A paradox therefore arises in attempting to reconcile these two sets of information. Here we analyse 1100 observations of blue whiting larvae from the Continuous Plankton Recorder (CPR) from 1948-2005 using modern statistical techniques. We show a clear spatial separation between a northern spawning area, in the Rockall Trough, and a southern one, off the Porcupine Seabight. We further show a difference in the timing of spawning between these sites of at least a month, and meaningful differences in interannual variability. The results therefore support the two-population hypothesis. Furthermore, we resolve the paradox by showing that the acoustic observations cited in support of the single-population model are not capable of resolving both populations, as they occur too late in the year and do not extend sufficiently far south to cover the southern population: the confusion is the result of a simple observational artefact. We conclude that blue whiting in the North Atlantic comprises two populations.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Pointin, F. (Intern), Payne, M. R. (Intern)
A resolution to the blue whiting (Micromesistius poutassou) population paradox?
Biogeographic classification of the Caspian Sea

Like other inland seas, the Caspian Sea (CS) has been influenced by climate change and anthropogenic disturbance during recent decades, yet the scientific understanding of this water body remains poor. In this study, an eco-geographical classification of the CS based on physical information derived from space and in-situ data is developed and tested against a set of biological observations. We used a two-step classification procedure, consisting of (i) a data reduction with self-organizing maps (SOMs) and (ii) a synthesis of the most relevant features into a reduced number of marine ecoregions using the Hierarchical Agglomerative Clustering (HAC) method. From an initial set of 12 potential physical variables, 6 independent variables were selected for the classification algorithm, i.e., sea surface temperature (SST), bathymetry, sea ice, seasonal variation of sea surface salinity (DSSS), total suspended matter (TSM) and its seasonal variation (DTSM). The classification results reveal a robust separation between the northern and the middle/southern basins as well as a separation of the shallow near-shore waters from those off-shore. The observed patterns in ecoregions can be attributed to differences in climate and geochemical factors such as distance from river, water depth and currents. A comparison of the annual and monthly mean Chl $a$ concentrations between the different ecoregions shows significant differences (Kruskal–Wallis rank test, $P < 0.05$). In particular, we found differences in phytoplankton phenology, with differences in the date of bloom initiation, its duration and amplitude between ecoregions. A first qualitative evaluation of differences in community composition based on recorded presence-absence patterns of 27 different species of plankton, fish and benthic invertebrate also confirms the relevance of the ecoregions as proxies for habitats with common biological characteristics.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Gorgan University of Agricultural Sciences and Natural Resources, ETH Zurich
Authors: Fendereski, F. (Ekstern), Vogt, M. (Ekstern), Payne, M. (Intern), Lachkar, Z. (Ekstern), Gruber, N. (Ekstern), Salmanmahiny, A. (Ekstern), Hosseini, S. A. (Ekstern)
Pages: 6451-6470
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Biogeosciences
Volume: 11
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ISSN (Print): 1726-4170
Ratings:
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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 4.25 SJR 2.328 SNIP 1.305
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.453 SNIP 1.324 CiteScore 4.04
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.194 SNIP 1.363 CiteScore 4.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.468 SNIP 1.425 CiteScore 4.21
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.366 SNIP 1.312 CiteScore 3.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts

This paper reviews the current knowledge on the ecology of widely distributed pelagic fish stocks in the North Atlantic basin with emphasis on their role in the food web and the factors determining their relationship with the environment. We consider herring (Clupea harengus), mackerel (Scomber scombrus), capelin (Mallotus villosus), blue whiting (Micromesistius poutassou), and horse mackerel (Trachurus trachurus), which have distributions extending beyond the continental shelf and predominantly occur on both sides of the North Atlantic. We also include albacore (Thunnus alalunga), bluefin tuna (Thunnus thynnus), swordfish (Xiphias gladius), and blue marlin (Makaira nigricans), which, by contrast, show large-scale migrations at the basin scale. We focus on the links between life history processes and the environment, horizontal and vertical distribution, spatial structure and trophic role. Many of these species carry out extensive migrations from spawning grounds to nursery and feeding areas. Large oceanographic features such as the North Atlantic subpolar gyre play an important role in determining spatial distributions and driving variations in stock size. Given the large biomasses of especially the smaller species considered here, these stocks can exert significant top-down pressures on the food web and are important in supporting higher trophic levels. The review reveals commonalities and differences between the ecology of widely distributed pelagic fish in the NE and NW Atlantic basins, identifies knowledge gaps and modelling needs that the EURO-BASIN project attempts to address. © 2014 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Centre for Ocean Life, IFREMER, Institute of Marine Research, AZTI-Tecnalia, Fisheries and Oceans Canada, CLS Satellite Oceanography Division, University of Massachusetts, Marine Research Institute, National Oceanographic and Atmospheric Administration, University of Strathclyde, Faroe Marine Research Institute
Pages: 219–243
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication information
Journal: Progress in Oceanography
Projects:
Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts
Publication: Research - peer-review › Journal article – Annual report year: 2014

Distributional shifts of species in the North Atlantic: the rule or the exception?
This work addresses recent shifts in the distribution of marine pelagic fish in the northern North Atlantic and attempts to set them in the context of climate variability, climate change, population dynamics and migration processes. Shifts in the distribution of North-east Atlantic mackerel, and the associated political dispute over fishing rights, has drawn much attention in recent years. However, a closer examination of spatial distributions of pelagic fish in this region suggests that such shifts are not by any means unique: several other examples, both well- and less-well-known, are presented and discussed here. These examples are then used to illustrate the potential importance of various mechanisms that can control the distribution of these species, such as climate variability and change, and population and migration dynamics. A set of simple analytical approaches is demonstrated that can be used to assess the relative importance of each of these mechanisms. Finally, these observations are drawn together to reveal a picture of a dynamic ecosystem in a constant state of flux and to emphasis the necessity

From fish to phytoplankton

Hazard Warning: model misuse ahead
The use of modelling approaches in marine science, and in particular fisheries science, is explored. We highlight that the choice of model used for an analysis should account for the question being posed or the context of the management problem. We examine a model-classification scheme based on Richard Levins' 1966 work suggesting that models can only achieve two of three desirable model attributes: realism, precision, and generality. Model creation, therefore, requires trading-off of one of these attributes in favour of the other two: however, this is often in conflict with the desires of end-users (i.e. managers or policy developers). The combination of attributes leads to models that are considered to have empirical, mechanistic, or analytical characteristics, but not a combination of them. In fisheries science, many examples can be found of models with these characteristics. However, we suggest that models or techniques are often employed without consideration of their limitations, such as projecting into unknown space without generalism, or fitting empirical models and inferring causality. We suggest that the idea of trade-offs and limitations in modelling be considered as an essential first step in assessing the utility of a model in the context of knowledge for decision-making in management
How can we distinguish between competing explanations of year class strength?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), MacKenzie, B. (Intern), Butenschön, M. (Ekstern), Payne, M. (Intern)
Modelled spatial and seasonal distribution of Blue Whiting (Micromesistius poutassou) larvae in the North-East Atlantic (1951 to 2005)

Blue whiting (Micromesistius poutassou, http://www.marinespecies.org/aphia.php?p=taxdetails&id=126439) is a small mesopelagic planktivorous gadoid found throughout the North-East Atlantic. This data contains the results of a model-based analysis of larvae captured by the Continuous Plankton Recorder (CPR) during the period 1951-2005. The observations are analysed using Generalised Additive Models (GAMs) of the spatial, seasonal and interannual variation in the occurrence of larvae. The best fitting model is chosen using the Akaike Information Criteria (AIC). The probability of occurrence in the continuous plankton recorder is then normalised and converted to a probability distribution function in space (UTM projection Zone 28) and season (day of year). The best fitting model splits the distribution into two separate spawning grounds north and south of a dividing line at 53°N. The probability distribution is therefore normalised in these two regions (i.e. the space-time integral over each of the two regions is 1). The modelled outputs are on a UTM Zone 28 grid: however, for convenience, the latitude ("lat") and longitude ("lon") of each of these grid points are also included as a variable in the NetCDF file. The assignment of each grid point to either the Northern or Southern component (defined here as north/south of 53°N), is also included as a further variable ("component"). Finally, the day of year ("doy") is stored as the number of days elapsed from and included January 1 (i.e. doy=1 on January 1) - the year is thereafter divided into 180 grid points.

Phytoplankton bloom and subpolar gyre induced dynamics in the North Atlantic

Several hypotheses have been promoted for phytoplankton bloom onset in the North Atlantic. First we show that the bloom dynamics in the northeastern corner stand out from the rest of the subpolar Atlantic, and thus warrants focused attention. We hypothesized that, for this region, late and weak blooms are expected in years of a strong subpolar gyre, i.e. strong atmospheric forcing, and cold and low saline conditions. We apply novel phenology algorithms to satellite ocean colour data, and analyse the outcome together with the subpolar gyre index.

We find that the relationship between the bloom dynamics and the subpolar gyre is complex, showing no clear spatial pattern. Our hypothesis is therefore partly refuted, probably due to the disparity in the temporal and spatial resolutions of the subpolar gyre index, compared to indices describing spring bloom dynamics. The annually averaged gyre index represents the integrated oceanic dynamics over the Northern North Atlantic, while the timing of the spring bloom is more governed by direct atmospheric forcing during the pre-bloom weeks.

We, therefore, further investigate which published theories (Sverdrup [1953], Siegel et al [2002], Huisman et al [2002], Townsend et al [1994], and Taylor and Ferrari [2011]) for bloom onset are suited for this region. We construct indicator fields and time series which in various combinations provide models consistent with the principle dynamics proposed in these theories. Using a multi-model inference approach, we investigate the spatially dependent ranking of these models. It appears that different theories apply at different regions within the North-East Atlantic, depending on the local physical dynamics.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Pointin, F. (Intern), Payne, M. (Intern)
Publication date: 2014

Phytoplankton bloom and subpolar gyre induced dynamics in the North Atlantic

Several hypotheses have been promoted for phytoplankton bloom onset in the North Atlantic. First we show that the bloom dynamics in the northeastern corner stand out from the rest of the subpolar Atlantic, and thus warrants focused attention. We hypothesized that, for this region, late and weak blooms are expected in years of a strong subpolar gyre, i.e. strong atmospheric forcing, and cold and low saline conditions. We apply novel phenology algorithms to satellite ocean colour data, and analyse the outcome together with the subpolar gyre index.

We find that the relationship between the bloom dynamics and the subpolar gyre is complex, showing no clear spatial pattern. Our hypothesis is therefore partly refuted, probably due to the disparity in the temporal and spatial resolutions of the subpolar gyre index, compared to indices describing spring bloom dynamics. The annually averaged gyre index represents the integrated oceanic dynamics over the Northern North Atlantic, while the timing of the spring bloom is more governed by direct atmospheric forcing during the pre-bloom weeks.

We, therefore, further investigate which published theories (Sverdrup [1953], Siegel et al [2002], Huisman et al [2002], Townsend et al [1994], and Taylor and Ferrari [2011]) for bloom onset are suited for this region. We construct indicator fields and time series which in various combinations provide models consistent with the principle dynamics proposed in these theories. Using a multi-model inference approach, we investigate the spatially dependent ranking of these models. It appears that different theories apply at different regions within the North-East Atlantic, depending on the local physical dynamics.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute, Nansen Environmental and Remote Sensing Center
Authors: Ferreira, A. S. (Intern), Hátún, H. (Ekstern), Counillion, F. (Ekstern), Payne, M. (Intern), Visser, A. (Intern)
Publication date: 2014
Event: Abstract from ESSAS Annual Science Meeting, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014
A neural network-based estimate of the seasonal to inter-annual variability of the Atlantic Ocean carbon sink

The Atlantic Ocean is one of the most important sinks for atmospheric carbon dioxide (CO2), but this sink is known to vary substantially in time. Here we use surface ocean CO2 observations to estimate this sink and the temporal variability from 1998 to 2007 in the Atlantic Ocean. We benefit from (i) a continuous improvement of the observations, i.e., the Surface Ocean CO2 Atlas (SOCAT) v1.5 database and (ii) a newly developed technique to interpolate the observations in space and time. In particular, we use a 2 step neural network approach to reconstruct basin-wide monthly maps of the sea surface partial pressure of CO2 (pCO2) at a resolution of 1° × 1°. From those, we compute the air–sea CO2 flux maps using a standard gas exchange parameterization and high-resolution wind speeds. The neural networks fit the observed pCO2 data with a root mean square error (RMSE) of about 10 μatm and with almost no bias. A check against independent time series data reveals a larger RMSE of about 17 μatm. We estimate a decadal mean uptake flux of −0.45 ± 0.15 Pg C yr−1 for the Atlantic between 44° S and 79° N, representing the sum of a strong uptake north of 18° N (−0.39 ± 0.10 Pg C yr−1), outgassing in the tropics (18° S–18° N, 0.11 ± 0.07 Pg C yr−1), and uptake in the subtropical/temperate South Atlantic south of 18° S (−0.16 ± 0.06 Pg C yr−1), consistent with recent studies. We find the strongest seasonal variability of the CO2 flux in the temperature driven subtropical North Atlantic, with uptake in winter and outgassing in summer. The seasonal cycle is antiphased in the subpolar latitudes relative to the subtropics largely as a result of the biologically driven winter-to-summer drawdown of CO2. Over the analysis period (1998 to 2007) sea surface pCO2 increased faster than that of the atmosphere in large areas poleward of 40° N, but many other parts of the North Atlantic increased more slowly, resulting in a barely changing Atlantic carbon sink north of the equator (−0.007 Pg C yr−1 decade−1). Surface ocean pCO2 was also increasing less than that of the atmosphere over most of the Atlantic south of the equator, leading to a substantial trend toward a stronger CO2 sink for the entire South Atlantic (−0.14 Pg C yr−1 decade−1). The Atlantic carbon sink varies relatively little on inter-annual time-scales (±0.04 Pg C yr−1; 1σ)
Characteristic sizes of life in the oceans - from bacteria to whales

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Ecosystem based Marine Management
Publication date: 2013
Event: Abstract from International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
Estimating phytoplankton phenology metrics from noisy, gappy data

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Publication date: 2013
Event: Poster session presented at International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Links:
Publication: Research › Conference abstract for conference – Annual report year: 2013

Fisheries: Climate change at the dinner table

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Payne, M. (Intern)
Pages: 320-321
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature
Volume: 497
Issue number: 7449
ISSN (Print): 0028-0836
Ratings:
BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 13.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 14.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 14.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 14.96
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 14.01
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 13.96
Fisheries: Manage declines

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: MacKenzie, B. R. (Intern), Payne, M. R. (Intern)
Pages: 314
Publication date: 2013
Main Research Area: Technical/natural sciences

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Journal: Nature
Volume: 495
Issue number: 7441
ISSN (Print): 0028-0836
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BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 13.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 14.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 14.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 14.96
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
From phytoplankton to fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern), Payne, M. (Intern)
Publication date: 2013
Event: Abstract from NorMER Annual Meeting 2013, Reykjavik, Iceland.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Immigranter sydfra på tallerkenen

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Payne, M. (Intern), Kiørboe, T. (Intern)
Pages: 3
Publication date: 2013

Publication information
Pages (from-to): 3
Newspaper: Weekendavisen
No.: 20
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Recruitment decline in North Sea herring is accompanied by reduced larval growth rates

The stock of North Sea autumn spawning herring (Clupea harengus L.) has shown an unprecedented sequence of ten years of sharply reduced recruitment, in spite of a high spawning biomass. Recent work has identified this below-expected recruitment as being determined during the larval phase; however, the underlying mechanism remains elusive. In this study we analysed archived larval samples captured before and after the onset of the reduced survival to test the hypothesis of a concurrent change in the larval growth rate. Individual larval growth rates, averaged over the 21 days prior to capture, were estimated for two hundred larvae from four different years using a model-based analysis of the otolith ring-widths. Hydrographic-backtracking models complemented the otolith analysis by reconstructing the environmental history and spawning origin of each larva. A significant reduction in net larval growth rate of 8%, concurrent with the reduced larval survival and recruitment, was identified: after correcting for the effect of other explanatory variables (e.g. temperature changes), the gross reduction was found to be 12%. This reduction is most probably due to changes in either the amount or quality of available food. The study demonstrates the potential in coupling of two different techniques, the otolith microstructure analysis and the hydrographic modelling, for affording new insights into fish early-life history. Finally, the study provides a novel indication of the association between reduced growth and larvae survival, thereby narrowing the range of potential mechanisms underlying the observed reduction in the recruitment of North Sea autumn spawning herring.
The dynamics of the marine nitrogen cycle across the last deglaciation

We use a geochemical box model to investigate the changes in marine N-fixation and denitrification required to match the observed sedimentary $\delta^{15}N$ changes between 30 kyr B.P. and the late Holocene. This is achieved by optimizing a set of seven parameters that describe the strengths of three ocean-internal N feedbacks and the response of the oceanic N cycle to four external forcings. Scenarios that best match the $\delta^{15}N$ constraints indicate a strong transient decrease in N-fixation in the early deglacial in response to the decrease in iron input by dust. Around 15 kyr B.P., N-fixation rebounds primarily in response to an abrupt increase in water column denitrification caused by an expansion of anoxia. Benthic denitrification is not well constrained by our model but tends to increase in sync with water column denitrification. As a result of the transient imbalance between N-fixation and denitrification, we infer a glacial-to-interglacial decrease in the marine N inventory of between 15 and 50%. The model diagnoses this reduction in order to simultaneously fit the data from all ocean basins, requiring it to reduce the degree by which water column denitrification in the oxygen minimum zones is influencing the $\delta^{15}N$ of nitrate of the whole ocean (dilution effect). Our optimal solution suggests a glacial N cycle that operated at nearly the same rates as that in pre-industrial times, but sensitivity cases with substantially lower rates fit the data only marginally worse. An important caveat of our study is the assumption of an unchanging ocean circulation. An initial sensitivity experiment shows that this affects primarily the magnitude of the change in the N inventory, while the diagnosed deglacial dynamics with global marine N-fixation taking a dip before the onset of denitrification remains a robust result.
The North Sea autumn spawning herring (Clupea harengus L.) Spawning Component Abundance Index (SCAI)
The North Sea autumn-spawning herring (Clupea harengus) stock consists of a set of different spawning components. The dynamics of the entire stock have been well characterized, but although time-series of larval abundance indices are available for the individual components, study of the dynamics at the component level has historically been hampered by missing observations and high sampling noise. A simple state-space statistical model is developed that is robust to these problems, gives a good fit to the data, and proves capable of both handling and predicting missing observations well. Furthermore, the sum of the fitted abundance indices across all components proves an excellent proxy for the biomass of the total stock, even though the model utilizes information at the individual-component level. The Orkney-Shetland component appears to have recovered faster from historic depletion events than the other components, whereas the Downs component has been the slowest. These differences give rise to changes in stock composition, which are shown to vary widely within a relatively short time. The modelling framework provides a valuable tool for studying and monitoring the dynamics of the individual components of the North Sea herring stock

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Payne, M. (Intern)
Publication date: 2013

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Coupling otolith microstructure analysis and hydrographic backtracking suggests a mechanism for the 2000s North Sea herring recruitment failure

The North Sea autumn spawning herring (Clupea harengus) has, since the 2002 year class, shown an unprecedented sequence of ten years of sharply reduced recruitment, in spite of a high spawning biomass and low fishing mortality. Recent work has identified this reduction in recruitment level (or stock productivity) as taking place during the larval overwintering phase; however, the underlying mechanism remains elusive. In this study we analysed archived larval samples captured both before and after the onset of the reduced survival to test the hypothesis of a reduction in the larval growth rate. Individual larval growth rates, averaged over the 30 days prior to capture, were estimated for 200 larval otoliths from four different years using a model-based analysis of the ring widths. The otolith measurements were complemented with additional information derived from hydrographic backtracking models (e.g. average temperature experienced, time available for feeding and spawning origin) to reconstruct the recent history of the larvae. A mixed-modelling approach was then employed to analyse the combined data: after correcting for the effect of the other variables, a significant reduction in larval growth rate, associated with the onset of the reduced recruitment, was identified. These results suggest that the reduced recruitment is associated with a reduction in the growth rate of the larval survivors, most probably through changes in either the amount or quality of the available food. Furthermore, this study demonstrates how coupling two different techniques (otolith microstructure analysis and hydrographic modelling) can yield unique insights into fish ecology.

How the Subpolar gyre strength influences phytoplankton blooms dynamics in the North Atlantic

Changes in the North Atlantic Subpolar gyre (NASPG) have been linked to the interannual variability of primary production. However, little is known about the mechanisms behind both environmental processes, and how the NASPG strength may extend its potential impacts to higher trophic levels, including early life stages of commercial fish species. We assess NASPG strength effect on North Atlantic phytoplankton bloom dynamics. We analyse time-series (from 1998 to 2010) of chlorophyll a (Chl a, from the Globcolour project) annual anomaly as a proxy of phytoplankton abundance, and of sea surface height (SSH, from the AVISO project) as a proxy of current strength. Three regions were strategically chosen to characterize positions relative to the NASPG, describing: region 1—the northern part of NASPG, including the Irminger Current (IC); region 2—the North Atlantic Current (NAC), its northwards drift, and the influence of the NASPG strength; and region 3—the within-NASPG dynamics. It is hypothesized that a strong NASPG index will be associated with a low-abundance, late phytoplankton bloom, possibly induced by higher heat losses, and thus lower temperatures. A correlation between the annual anomaly in chlorophyll concentrations and the gyre index was found for the southern region (region 3).

Indications of a strong influence of NASPG index are related to areas within the gyre, which may have an impact in the ecosystem functioning. The results also suggest that physical forcing other than the strength of the NASPG influence the primary production of the more northerly regions east and west of Iceland.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Ross, S. D. (Intern), Payne, M. (Intern), Worsøe Clausen, L. (Intern), Nash, R. D. (Ekstern)
Number of pages: 33
Publication date: 2012
Event:
Main Research Area: Technical/natural sciences
Electronic versions:
J1412.pdf
Links:
Publication: Research › Paper – Annual report year: 2012
Long-term retrospective analysis of mackerel spawning in the North Sea: A new time series and modeling approach to CPR data

We present a unique view of mackerel (Scomber scombrus) in the North Sea based on a new time series of larvae caught by the Continuous Plankton Recorder (CPR) survey from 1948-2005, covering the period both before and after the collapse of the North Sea stock. Hydrographic backtrack modelling suggested that the effect of advection is very limited between spawning and larvae capture in the CPR survey. Using a statistical technique not previously applied to CPR data, we then generated a larval index that accounts for both catchability as well as spatial and temporal autocorrelation. The resulting time series documents the significant decrease of spawning from before 1970 to recent depleted levels. Spatial distributions of the larvae, and thus the spawning area, showed a shift from early to recent decades, suggesting that the central North Sea is no longer as important as the areas further west and south. These results provide a consistent and unique perspective on the dynamics of mackerel in this region and can potentially resolve many of the unresolved questions about this stock.
It has been suggested that observed spatial variation in mackerel fisheries, extending over several hundreds of kilometers, is reflective of climate-driven changes in mackerel migration patterns. Previous studies have been unable to clearly demonstrate this link. In this paper we demonstrate correlation between temperature and mackerel migration/distribution as proxied by mackerel catch data from both scientific bottom trawl surveys and commercial fisheries. We show that mackerel aggregate and migrate distances of up to 500 km along the continental shelf edge from mid-November to early March. The path of this migration coincides with the location of the relatively warm shelf edge current and, as a consequence of this affinity, mackerel are guided towards the main spawning area in the south. Using a simulated time series of temperature of the shelf edge current we show that variations in the timing of the migration are significantly correlated to temperature fluctuations within the current. The proposed proxies for mackerel distribution were found to be significantly correlated. However, the correlations were weak and only significant during periods without substantial legislative or technical developments. Substantial caution should therefore be exercised when using such data as proxies for mackerel distribution. Our results include a new temperature record for the shelf edge current obtained by embedding the available hydrographic observations within a statistical model needed to understand the migration through large parts of the life of adult mackerel and for the management of this major international fishery.
Modelling the mixing of herring stocks between the Baltic and the North Sea from otolith data

Herring catches in the western Baltic, Kattegat and Skagerrak consist of a mixture of stocks, mainly North Sea autumn spawners (NSAS) and western Baltic spring spawners (WBSS), which is managed through a single TAC. Catches of these two stocks are split using otolith microstructures from Danish and Swedish commercial landings and surveys samples for the purpose of stock assessment. But the split estimates from sampling data are highly variable and noisy. Better understanding of the migration and exploitation patterns involved could therefore potentially improve the stock assessment as well as provide solutions to the complex management of this mix. The stock-specific seasonal trends in distribution of
the two main stocks from otolith data were analysed using a generalized linear mixed model (GLMM) of stock composition. The results show a clear seasonal and age-related pattern and are consistent with existing ideas about the migration patterns of WBSS and NSAS within Division IIIa and adjacent waters. This work therefore provides the foundation for the development of a more rational management of the herring stocks in this area.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Population Ecology and Genetics, Department of Informatics and Mathematical Modeling, Mathematical Statistics, Section for Ocean Ecology and Climate
Authors: Ulrich, C. (Intern), Post, S. L. (Ekstern), Worsøe Clausen, L. (Intern), Berg, C. W. (Intern), Deurs, M. V. (Intern), Mosegaard, H. (Intern), Payne, M. (Intern)
Number of pages: 20
Publication date: 2012
Event:
Main Research Area: Technical/natural sciences
Electronic versions: J0212.pdf
Publication: Research › Paper – Annual report year: 2012

Subpolar gyre strength influences phytoplankton bloom dynamics

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

The rise and fall of the NE Atlantic blue whiting (Micromesistius poutassou)
The Northeast Atlantic blue whiting (Micromesistius poutassou) stock has undergone striking changes in abundance in the last 15 years. The stock increased dramatically in the late 1990s due to a succession of eight unusually strong year classes and dropped again equally dramatically after 2005 when the recruitment collapsed to former levels. The North Atlantic subpolar gyre has previously been shown to have a strong influence on the behaviour of this stock: synchronous changes in the gyre and recruitment suggest a causal linkage and the possibility of forecasting recruitment. A range of mechanisms are reviewed that may explain these observed changes, with two major candidate hypotheses being identified. One hypothesis suggests that the large mackerel (Scomber scombrus) stock in this region may feed on the pre-recruits of blue whiting, with the spatial overlap between blue whiting and mackerel being regulated by the subpolar gyre. Alternatively, variations in the physical environment may have given rise to changes in the amount, type and availability of food for larvae and juveniles, impacting their growth and survival and therefore recruitment. It was not possible to draw firm conclusions about the validity of either of these hypotheses: nevertheless, forecasting recruitment to this stock may be possible in the future if the underlying mechanisms can be resolved.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
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Publication date: 2012
Main Research Area: Technical/natural sciences
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Journal: Marine Biology Research
Volume: 8
Issue number: 5-6
ISSN (Print): 1745-1000
Ratings:
Weak subpolar Gyre lead to early blooms

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute
Publication date: 2012
Event: Abstract from NorMER Annual Meeting 2012, Helsinki, Finland.
Does larval mortality influence population dynamics? An analysis of North Sea herring (Clupea harengus) time series

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Fässler, S. M. (Ekstern), Payne, M. (Intern), Brunel, T. (Ekstern), Dickey-Collas, M. (Ekstern)
Pages: 530-543
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 20
Issue number: 6
ISSN (Print): 1054-6006
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.704 SNIP 0.987
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.139 SNIP 0.231
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Does operational oceanography address the needs of fisheries and applied environmental scientists?

Although many oceanographic data products are now considered operational, continued dialogue between data producers and their user communities is still needed. The fisheries and environmental science communities have often been criticized for their lack of multidisciplinarity, and it is not clear whether recent developments in operational oceanographic products are addressing these needs. The International Council for the Exploration of the Sea (ICES) Working Group on Operational Oceanographic products for Fisheries and Environment (WGOOFE) identified a potential mismatch between user requirements and the perception of requirements by the providers. Through a questionnaire (98 respondents), WGOOFE identified some of these issues. Although products of physical variables were in higher demand, several biological parameters scored in the top 10 rankings. Users placed specific focus on historic time series products with monthly or annual resolution and updating on similar time scales. A significant percentage requested access to numerical data rather than graphical output. While the outcomes of this survey challenge our views of operational oceanography, several initiatives are already attempting to close the gap between user requirements and products available.
Ecotypes as a concept for exploring responses to climate change in fish assemblages

How do species-rich fish assemblages respond to climate change or to other anthropogenic or environmental drivers? To explore this, a categorization concept is presented whereby species are assigned with respect to six ecotype classifications, according to biogeography, horizontal and vertical habitat preference, trophic guild, trophic level, or body size. These classification schemes are termed ecotypology, and the system is applied to fish in the North Sea using International Bottom Trawl Survey data. Over the period 1977–2008, there were changes in the North Sea fish community that can be related to fish ecotypes. Broadly speaking, there were steady increases in abundance of species that were either Lusitanian, small-bodied, or low-/mid-trophic-level ecotypes, and generally declining or only marginally increasing trends of most Boreal, large-bodied, or high-trophic-level ecotypes or combinations of them. The post-1989 warm biological regime appears to have favoured pelagic species more than demersal species. These community-level patterns agree with the expected responses of ecotypes to climate change and also with anticipated vulnerability to fishing pressure.
Phytoplankton spring bloom influence on larval and juvenile fish survival

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern), Payne, M. (Intern)
Publication date: 2011
Event: Abstract from NorMER Annual Meeting 2011, Oslo, Norway.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2011

Realized habitats of early-stage North Sea herring: looking for signals of environmental change
Realized habitats of North Sea herring for two larval and two juvenile stages were estimated over the past 30 years, using abundances from surveys tied to modelled estimates of temperature and salinity. Newly hatched larvae (NHL) were found mainly in water masses of 9–11°C, pre-metamorphosis larvae (PML) around 5–6°C, juveniles aged 0 in summer around 13–14°C, and juveniles aged 1 in winter around 4–5°C. The median salinity in which the NHL were distributed was 34.4–35.0 and 33.7–33.9, respectively, for PML and juveniles. Interannual variations in temperature and geographic variables in the North Sea were compared with the time-series of realized habitats. The realized temperature habitats of the NHL did not change over time, but the habitat of juveniles in summer may be associated with higher temperatures. Juveniles aged 1 in winter are found in waters colder than the average for the North Sea, a result also reflected in their geographic shift east into shallower water. The results suggest that juveniles could be limited by temperature, but may also track changes in food or predator distribution, and/or internal population dynamics. Time-series analysis of realized salinity habitats was not possible with the available data because of differences between model outputs.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Röckmann, C. (Ekstern), Dickey-Collas, M. (Ekstern), Payne, M. (Intern), ter Hofstede, R. (Ekstern), Pinnegar, J. (Ekstern)
Pages: 537-546
Lessons learned from stock collapse and recovery of North Sea herring: a review

The collapse and recovery of North Sea herring in the latter half of the 20th century had both ecological and economic consequences. We review the effect of the collapse and investigate whether the increased understanding about the biology, ecology, and stock dynamics gained in the past three decades can aid management to prevent further collapses and improve projections of recovery. Recruitment adds the most uncertainty to estimates of future yield and the potential to reach biomass reference points within a specified time-frame. Stock–recruitment relationships must be viewed as being fluid and dependent on ecosystem change. Likewise, predation mortality changes over time. Management aimed at maximum sustainable yield (MSY) fishing mortality targets implies interannual variation in TACs, and variability in supply is therefore unavoidable. Harvest control rules, when adhered to, aid management greatly. We advocate that well-founded science can substantially contribute to management through improved confidence and increased transparency. At present, we cannot predict the effects of collapse or recovery of a single stock on the ecosystem as a whole. Moreover, as managers try to reconcile commitments to single-species MSY targets with the ecosystem-based approach, they must consider the appropriate management objectives for the North Sea ecosystem as a whole.
Mind the gaps: a state-space model for analysing the dynamics of North Sea herring spawning components

The North Sea autumn-spawning herring (Clupea harengus) stock consists of a set of different spawning components. The dynamics of the entire stock have been well characterized, but although time-series of larval abundance indices are available for the individual components, study of the dynamics at the component level has historically been hampered by missing observations and high sampling noise. A simple state-space statistical model is developed that is robust to these problems, gives a good fit to the data, and proves capable of both handling and predicting missing observations well. Furthermore, the sum of the fitted abundance indices across all components proves an excellent proxy for the biomass of the total stock, even though the model utilizes information at the individual-component level. The Orkney–Shetland component appears to have recovered faster from historic depletion events than the other components, whereas the Downs component has been the slowest. These differences give rise to changes in stock composition, which are shown to vary widely within a relatively short time. The modelling framework provides a valuable tool for studying and monitoring the dynamics of the individual components of the North Sea herring stock.
The role of spatial processes in North Sea herring larval survival and recruitment

**General information**

State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Payne, M. (Intern), Christensen, A. (Intern), Munk, P. (Intern), Nash, R. D. (Ekstern), Dickey-Collas, M. (Ekstern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Trends in mortality of young herring larvae - evidence of a link to recruiting year-class strength

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Fässler, S. M. M. (Ekstern), Dickey-Collas, M. (Ekstern), Payne, M. (Intern), Brunel, T. (Ekstern)
Publication date: 2010
Main Research Area: Technical/natural sciences

Climate-driven changes in suitable habitats for North Sea fish: Physiological constraints on the survival of early life stages

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Peck, M. A. (Ekstern), Payne, M. (Intern), Daewel, U. (Ekstern), Hufnagl, M. (Intern), Alekseeva, I. (Ekstern), Schrum, C. (Ekstern)
Publication date: 2009
Main Research Area: Technical/natural sciences

Comment on "Does the fall phytoplankton bloom control recruitment of Georges Bank, haddock, Melanogrammus aeglefinus, through parental condition?"
In the paper "Does the fall phytoplankton bloom control recruitment of Georges Bank haddock, Melanogrammus aeglefinus, through parental condition?", Friedland et al. (Can. J. Fish. Aquat. Sci. 65(6): 1076-1086, 2008) examine a sizable number of hypotheses aiming to explain the recruitment patterns observed in Georges Bank haddock. The authors focus on a correlation between the size of the autumnal phytoplankton bloom and the survivor ratio (recruitment), concluding this to be the main factor determining recruitment, via the mechanism of adult condition at the time of spawning. Here we examine this result in close detail and re-analyse some of the data presented in the paper. We show that the recruitment metric upon which Friedland et al. base their conclusions inadvertently biases the analysis in favour of high recruitment events and against low recruitments. As a consequence, Friedland et al. disregard correlations that are, in fact, significant. Furthermore, we show that the parental condition hypothesis hinges upon a single, highly uncertain data point, without which the correlation is no longer significant. We find that evidence for the parental condition hypothesis is weak, and that in performing the analysis in the chosen manner, Friedland et al. have overlooked alternative hypotheses.

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Wageningen IMARES, University of Bergen
Authors: Payne, M. (Intern), Dickey-Collas, M. (Ekstern), Nash, R. D. (Ekstern)
Pages: 869-872
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 66
Issue number: 5
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<td>BFI-level 2</td>
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<td>2003</td>
<td>BFI-level 2</td>
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<td>BFI-level 2</td>
<td>SJR 1.928 SNIP 1.436 CiteScore 1.01</td>
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Original language: English

DOIs:
Finding the signal in the noise: objective data-selection criteria improve the assessment of western Baltic spring-spawning herring

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Payne, M. (Intern), Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern)
Pages: 1673-1680
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 66
Issue number: 8
ISSN (Print): 1054-3139
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 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Large bio-geographical shifts in the north-eastern Atlantic Ocean: From the subpolar gyre, via plankton, to blue whiting and pilot whales

Pronounced changes in fauna, extending from the English Channel in the south to the Barents Sea in the north-east and off Greenland in the north-west, have occurred in the late 1920s, the late 1960s and again in the late 1990s. We attribute these events to exchanges of subarctic and subtropical water masses in the north-eastern North Atlantic Ocean, associated with changes in the strength and extent of the subpolar gyre. These exchanges lead to variations in the influence exerted by the subarctic or Lusitanian biomes on the intermediate faunistic zone in the north-eastern Atlantic. This strong and persistent bottom-up bio-physical link is demonstrated using a numerical ocean general circulation model and data on four trophically connected levels in the food chain – phytoplanктон, zooplankton, blue whiting, and pilot whales. The plankton data give a unique basin-scale depiction of these changes, and a long pilot whale record from the Faroe Islands offers an exceptional temporal perspective over three centuries. Recent advances in simulating the dynamics of the subpolar gyre suggests a potential for predicting the distribution of the main faunistic zones in the north-eastern Atlantic a few years into the future, which might facilitate a more rational management of the commercially important fisheries in this region.

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Pages: 149-162
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 80
Issue number: 3/4
ISSN (Print): 0079-6611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.4 SJR 1.922 SNIP 1.278
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.703 SNIP 1.348 CiteScore 3.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.909 SNIP 1.461 CiteScore 3.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.397 SNIP 1.595 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Recruitment in a changing environment: the 2000s North Sea herring recruitment failure

Environmentally induced change appears to be impacting the recruitment of North Sea herring (Clupea harengus). Despite simultaneously having a large adult population, historically low exploitation, and Marine Stewardship Council accreditation (implying sustainability), there have been an unprecedented 6 sequential years of poor juvenile production (recruitment). Analysis suggests that the poor recruitment arises during the larval overwintering phase, with recent survival rates greatly reduced. Contemporary warming of the North Sea has caused significant changes in the plankton community, and a recently identified regime shift around 2000 shows close temporal agreement with the reduced larval survival. It is, therefore, possible that we are observing the first consequences of this planktonic change for higher trophic levels. There is no indication of a recovery in recruitment in the short term. Fishing mortality is currently outside the agreed management plan, and forecasts show a high risk of the stock moving outside safe biological limits soon, potentially precipitating another collapse of the stock. However, bringing the realized fishing mortality back in line with the management plan would likely alleviate the problem. This illustrates again that recruitment is influenced by more than just spawning-stock biomass, and that changes in other factors can be of equal, or even greater, importance. In such dynamically changing environments, recent management success does not necessarily guarantee future sustainability.

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Payne, M. (Intern), Hatfield, E. (Ekstern), Dickey-Collas, M. (Ekstern), Falkenhaug, T. (Ekstern), Gallego, A. (Ekstern), Gröger, J. (Ekstern), Licandro, P. (Ekstern), Llope, M. (Ekstern), Munk, P. (Intern), Röckmann, C. (Ekstern), Schmidt, J. (Ekstern), Nash, R. (Ekstern)
Recruitment in a changing environment: the role of oceanographic processes in blue whiting population dynamics

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Payne, M. (Intern), Hátún, H. (Ekstern), Christensen, A. (Intern), Jacobsen, J. A. (Ekstern)
Publication date: 2009

Host publication information
Title of host publication: ICES C.M.
Volume: E:19
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 267626
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

The North Atlantic subpolar gyre regulates the spawning distribution of blue whiting (Micromesistius poutassou Risso)

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Hátún, H. (Ekstern), Payne, M. (Intern), Jacobsen, J. A. (Ekstern)
Pages: 759-770
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 66
Issue number: 5
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Vertical movements of Atlantic cod (Gadus morhua) in the North Sea and the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Neuenfeldt, S. (Intern), Payne, M. (Intern), Righton, D. (Ekstern), Van der Kooij, J. (Ekstern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 243324
Publication: Research - peer-review › Journal article – Annual report year: 2009

What can we learn from the stock collapse and recovery of North Sea herring? A review
The collapse and recovery of North Sea herring in the latter half of the twentieth century has been well documented. With hindsight and the benefit of almost 40 years of extra data and studies, we can now obtain a clear view of the impact of the collapse and the recovery on the stock, the fishery, and the North Sea system. The study will review the changes in productivity in terms of growth, maturity, natural mortality and recruitment and the changes in distribution and demography of the stock associated with the collapse and recovery. It will also comment on the impact on the genetic makeup of the stock and potential consequences for fisheries induced change. This will then be considered in the context of the
ecosystem as a whole and how the fisheries were affected. A final synthesis section first will look at how we can take these issues into management of North Sea herring, viaprojections and advice and secondly highlight the relevant lessons for the management of other fish stocks and other marine shelf ecosystems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Wageningen IMARES, Institute of Marine Research, University of Aberdeen, University of Hamburg, Marine Scotland, International Commission for the Conservation of Atlantic Tunas, University of Bergen
Authors: Dickey-Collas, M. (Ekstern), Nash, R. (Ekstern), Brunel, T. (Ekstern), van Damme, C. (Ekstern), Marshall, C. (Ekstern), Payne, M. (Intern), Corten, A. (Ekstern), Geffen, A. (Ekstern), Peck, M. (Ekstern), Hatfield, E. (Ekstern), Hintzen, N. (Ekstern), Enberg, K. (Ekstern), Kell, L. (Ekstern), Simmonds, J. (Ekstern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2009

IBTS Q1 Sprat (Sprattus sprattus) index calculation algorithm. Implementation in R and comparison with the index used in assessment

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Jansen, T. (Intern), Payne, M. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences
Publication information
Journal: ICES Council Meeting
Volume: ACOM:02
Issue number: WD:8
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 229074
Publication: Research › Conference article – Annual report year: 2008

Et flerårigt grundlag for dansk industrifiskeri: Biologisk vurdering af ressourcegrundlaget og analyse af forvaltningsmodeller

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries Advice, Section for Management Systems, Section for Monitoring
Authors: Kirkegaard, E. (Intern), Jensen, H. (Intern), Mosegaard, H. (Intern), Vinther, M. (Intern), Payne, M. (Intern), Nielsen, J. R. (Intern), Daliskov, J. (Intern)
Number of pages: 63
Publication date: 2007

Publication information
Place of publication: Charlottenlund
Publisher: Danmarks Tekniske Universitet. Danmarks Fiskeriundersøgelser
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226192
A multi-component approach to salt and water diffusion in cheese
A theoretically based model was developed using the Maxwell-Stefan equation to predict the salt gain and moisture loss of cheese during brine salting. The model was used to predict changes in the salt and moisture profile, and dimensions of the cheese. The best solutions were obtained when the diffusivities were made functions of porosity and salt concentration. For Gouda cheese the predicted moisture and salt/moisture profiles were within 0.6% moisture and 0.3% salt/moisture of published experimental data. The model predicted an overall gain in salt of 1.55% by weight, an overall reduction in moisture from 43.4 to 41.0%, a mass loss of 1.5% and a volume reduction of 2.6% after 8 days of brining. (C) 2000 Published by Elsevier Science Ltd. All rights reserved.

General information
State: Published
Organisations: University of Canterbury
Authors: Payne, M. (Intern), Morison, K. (Ekstern)
Pages: 887-894
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication Information
Journal: International Dairy Journal
Volume: 9
Issue number: 12
ISSN (Print): 0958-6946
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.34 SJR 1.125 SNIP 1.255
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.978 SNIP 1.17 CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.061 SNIP 1.175 CiteScore 2.24
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.238 SNIP 1.408 CiteScore 2.79
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.282 SNIP 1.467 CiteScore 2.55
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.269 SNIP 1.499 CiteScore 2.73
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BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.622 SNIP 1.751
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.457 SNIP 1.519
Scopus rating (2007): SJR 1.223 SNIP 1.633
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.362 SNIP 1.774
Scopus rating (2005): SJR 1.2 SNIP 1.507
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.427 SNIP 1.715
Scopus rating (2003): SJR 1.199 SNIP 1.354
Scopus rating (2002): SJR 0.906 SNIP 1.173
Scopus rating (2001): SJR 0.881 SNIP 1.039
Scopus rating (2000): SJR 1.049 SNIP 1.051
Scopus rating (1999): SJR 1.046 SNIP 1.051

Original language: English

FOOD, WHITE CHEESE, ION-EXCHANGE, cheese, diffusion, sodium chloride, Maxwell-Stefan, Food Science, Agriculture, Biology and Environmental Sciences, Cheese, Diffusion, Sodium chloride, cheese moisture, food analysis, model, porosity, salinity, salt, Gouda cheese dairy product, mathematical model, Maxwell-Stefan equation mathematical equation, salt 7647-14-5 diffusion, water 7732-18-5 diffusion, 04500, Mathematical biology and statistical methods, 10060, Biochemistry studies - General, 13502, Food technology - General and methods, Computational Biology, brine salting food processing method, Foods, Models and Simulations, BRINING, CHEESE, CHLORIDES, DIFFUSION, DIFFUSIVITY, MODELLING, MOISTURE, MOISTURE CONTENT, NACL, SALT, Milk and dairy products

DOIs:
10.1016/s0958-6946(99)00157-0

Source: FindIt
Source-ID: 931930
Publication: Research - peer-review › Journal article – Annual report year: 1999

Projects:

Marine Ecosystem Climate Services
National Institute of Aquatic Resources
Period: 01/09/2016 → 31/08/2020
Number of participants: 3
Phd Student:
Miesner, Anna Katharina (Intern)
Supervisor:
MacKenzie, Brian (Intern)
Main Supervisor:
Payne, Mark (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Climate Change and European Aquatic Resources (CERES) (39344)
CERES advances a cause-and-effect understanding of how climate change will influence Europe's most important fish and shellfish resources and the economic activities depending on them. It will provide tools and develop adaptive strategies allowing fisheries and aquaculture sectors and their governance to anticipate and prepare for adverse changes or future benefits of climate change.

The project has 24 additional partners spread across Europe and is coordinated by University of Hamburg, Germany.

The project is funded by EU, Horizon 2020.

National Institute of Aquatic Resources
Section for Oceans and Arctic
University of Hamburg
Period: 01/03/2016 → 29/02/2020
Number of participants: 3
Research areas: Marine Populations and Ecosystem Dynamics & Oceanography & Shellfish and seaweed
Project participant:
Nielsen, J. Rasmus (Intern)
Saurel, Camille (Intern)
Project Manager, academic:
Payne, Mark (Intern)
Functional diversity in marine ecosystems - linking biodiversity to ecosystem integrity

National Institute of Aquatic Resources
Period: 01/09/2015 → 02/12/2018
Number of participants: 4
PhD Student:
Dencker, Tim Spaanheden (Intern)
Supervisor:
Grønkjær, Peter (Ekstern)
Payne, Mark (Intern)
Main Supervisor:
Lindegren, Martin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

A trait-based approach towards understanding benthic-pelagic pathways in marine ecosystems

National Institute of Aquatic Resources
Period: 15/12/2013 → 06/06/2017
Number of participants: 7
PhD Student:
Pécuchet, Laurène (Intern)
Supervisor:
Andersen, Ken Haste (Intern)
Payne, Mark (Intern)
Main Supervisor:
Lindegren, Martin (Intern)
Examiner:
MacKenzie, Brian (Intern)
Nordström, Marie C. (Ekstern)
Primicerio, Raul (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

A trait-based approach to Plankton Biogeography

National Institute of Aquatic Resources
Period: 01/12/2013 → 08/02/2017
Number of participants: 6
PhD Student:
Brun, Philipp Georg (Intern)
Supervisor:
Kiørboe, Thomas (Intern)
Main Supervisor:
Payne, Mark (Intern)
Examiner:
Wisz, Mary (Intern)
Borregaard, Michael K. (Ekstern)
Record, Nicholas R. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
**North Atlantic climate (NACLIM) (38945)**

The North Atlantic Ocean is one of the most important drivers for the global ocean circulation and its variability on time scales beyond inter-annual. Global climate variability is to a large extent triggered by changes in the North Atlantic sea surface state. The quality and skill of climate predictions depends crucially on a good knowledge of the northern sea surface temperatures (SST) and sea ice distributions. On a regional scale, these parameters strongly impact on weather and climate in Europe, determining precipitation patterns and strengths, as well as changes in temperature and wind patterns. Knowledge of these factors, and of their development in the years to come, is of paramount importance for society and key economic sectors, which have to base their planning and decisions on robust climate information. NACLIM will contribute to this goal.

DTU Aqua is the leader of work package developing such climate services for marine ecosystems, pioneering the translation of decadal-scale forecasts of the ocean’s physical environment to forecasts of the biological environment.

There are 18 project partners in total. See [http://naclim.zmaw.de/Consortium.2126.0.html](http://naclim.zmaw.de/Consortium.2126.0.html)

The project is coordinated by University of Hamburg, Germany.

The project is funded by EU, Framework Programme 7.

**Section for Marine Ecology and Oceanography**

National Institute of Aquatic Resources

**Section for Oceans and Arctic**

**Period:** 01/11/2012 → 31/01/2017

**Number of participants:** 3

**Research areas:** Marine Populations and Ecosystem Dynamics & Oceanography

**Project participant:**

MacKenzie, Brian (Intern)

Phd Student:

Miesner, Anna Katharina (Intern)

Project Manager, academic:

Payne, Mark (Intern)

**Center for Ocean Life (COOL) - a Villum-Kahn Rasmussen Centre of excellence for the study of life in a changing ocean (38960)**

Our goal is to develop a fundamental understanding and predictive capability of marine ecosystems through the use of novel trait-based approaches and models.

The Centre is organized around three main research activities:

- Identification and mechanistic description of the traits and trade-offs required to characterize the main Darwinian missions (feed, survive, reproduce) of the various life forms in the ocean through experimental and theoretical work, as well as analysis of literature data.
- Models: scaling of individual behavior to population and ecosystem dynamics through the development of trait-based models.
- Testing model prediction by comparing to observed trait patterns in the ocean.

The Centre involves biologists, physicists, chemists, and mathematicians and has a very strong training component through the supervision of master students, and about 30 PhD and postdoctoral fellows as well as by offering PhD summer schools and organizing international workshops. The Centre in addition host many visiting students and scientists.

The Centre is lead by DTU Aqua.

The project is funded by the Villum Kahn-Rasmussen Foundation (Velux Foundations) as well as through various national and European fellowship programs (Research Council, H.C. Ørsted Fellowship programme, Marie Curie, Carlsberg Foundation, etc).

**National Institute of Aquatic Resources**

**Centre for Ocean Life**

**Roskilde University**
University of Copenhagen
Massachusetts Institute of Technology
University of Oxford
Michigan State University
University of Bergen
Kiel University

**Period:** 01/01/2012 → 31/12/2017
**Number of participants:** 10
**Research areas:** Oceanography & Marine Populations and Ecosystem Dynamics & Marine Living Resources & Ecosystem-based Marine Management

**Project participant:**
Andersen, Ken Haste (Intern)
Visser, Andre (Intern)
Stedmon, Colin (Intern)
Gislason, Henrik (Intern)
Payne, Mark (Intern)
Thygesen, Uffe Høgsbro (Intern)
MacKenzie, Brian (Intern)
Mariani, Patrizio (Intern)
Nielsen, Torkel Gissel (Intern)

**Project Manager, academic:**
Kiørboe, Thomas (Intern)

**Project**

**Match and mismatch in the ocean (38897)**
Only a very small fraction of the enormous amount of eggs that a fish population spawns survives the larval stage and enters the population as young fish: the majority die as larvae. The synchronicity between the timing of the plankton blooms and the food requirements of larval fish is thought to be one of the most important factors for the survival of larvae. This “match-mismatch” hypothesis will be tested using data from fish populations across the planet and global satellite observations of plankton dynamics. The results will increase our understanding of why fish populations vary throughout time and thereby contribute to their sustainable management.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Centre for Ocean Life

**Swiss Federal Institute of Technology**

**Period:** 01/01/2011 → 01/04/2012
**Number of participants:** 1
**Research area:** Oceanography

**Project Manager, academic:**
Payne, Mark (Intern)

**Project**

**Developing fisheries management indicators and targets (DEFINEIT) (38763)**
DEFINEIT constructed operational models of fish stock dynamics explicitly taking into account exploitation and climatic conditions and combine these models with basic economic models. To ensure an outstanding scientific level in each of these areas, the project brought together key competences in operational multispecies modelling, stock recruitment relationships, population dynamics of non-target fish species and economic modelling of fisheries from a wide geographic area ranging from the Barents Sea to the North Sea. The project used multispecies models to investigate changes in predation induced by differences in the distribution and the amount of alternative food. Effects of technical interactions in the fishing process were considered to avoid delivering management advice for different stocks which is mutually inconsistent. Integrating the knowledge gained, the project suggested methods for estimating reference points. The project identified the main causes of variation in recruitment patterns between stocks as well as the key processes from spawning to recruitment of selected stocks. The consequences of using proxies to describe stock reproductive potential were determined and survival during early life stages was investigated in order to identify the role of the physical and biological environment. The improved understanding of recruitment variability was used in individual stock assessment and included in multispecies models to provide reliable predictions. The maximum level of fishing effort consistent with sustainment of
susceptible species was estimated along with the effect of discard of by-catch on economic yield. The project developed
resource indicators that combine economic, social and biological indicators and relate directly to the benefit for the society.
Future stock dynamics limits to sustainable ecosystem exploitation and the fishing levels delivering maximum sustainable
economic yield under selected climatic scenarios were analyzed in unison to ensure the delivery of mutually consistent
management advice. General properties of the ecosystems were used to suggest rules of thumb for management in areas
where the amount of data available is insufficient to construct similar models.

The project was coordinated by DTU Aqua.

The project was funded by EU, MariFish, ERA-NET.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management

Cefas
Institute of Marine Research
Hellenic Centre for Marine Research
Marine Research Institute
University of Copenhagen
University of St Andrews
University of Southern Denmark
Wageningen IMARES

Imperial College of Science, Technology and Medicine
Period: 01/01/2009 → 30/06/2012
Number of participants: 9
Research areas: Ecosystem based Marine Management & Marine Living Ressources & Marine Populations and
Ecosystem Dynamics & Population Genetics
Project participant:
Gislason, Henrik (Intern)
Payne, Mark (Intern)
Worsøe Clausen, Lotte (Intern)
Mosegaard, Henrik (Intern)
Bekkevold, Dorte (Intern)
Eg Nielsen, Einar (Intern)
Vinther, Morten (Intern)
Lewy, Peter (Intern)
Project Manager, academic:
Rindorf, Anna (Intern)

Development of a method for long term spatially resolved management of the herring fishery in the North Sea and Illa
taking the migration of the primary herring stocks, the fishery pattern and by-catch of mackerel into consideration (URSIN)
(38731)

The overall objective is to develop a tool to create long-term management plans for the two main herring stocks in the
North Sea and Illa, which may allow the industry an optimum use of the population under safe conditions relating to
population maintenance and catch of mackerel.

The project will further develop, test and optimize a method for the quantification and prediction of herring stock spatial
distribution in relation to life stages that is based on existing methods. This quantification of the migration patterns will
provide more solid understanding of population development under various conditions. Moreover, the method will include
a modeling of the herring fleet behavior, allowing for merging of herring spatial distribution in relation to life stage and
hence potential economic value of fishing pattern. The historical and current behavior of the herring fleets will be quantified
in collaboration with the industry. Similarly, mackerel skull occurrence will be mapped as it is of great importance for the
herring fleet behavior, due to the economic incentives to minimize this by-catch.

The objective of the project is to generate a scientifically based tool for prediction of utilization of herring that can be used
in future scientific advice to management, and information on optimal harvest strategies for the fishery in collaboration with
the fishing industry. This is partly to increase the transparency and credibility of the scientific work and increase security in
the input data and thus reduce uncertainty in the advice given in the end. Collaboration with industry includes Pelagic PO,
Skagen PO and Esbjerg Fishermen and covers all types of fishing for herring (both industrial and human consumption).

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Pelagic Producers Organisation
Danish Fishermen's Association

Period: 01/01/2009 → 31/12/2011
Number of participants: 6
Research area: Marine Living Resources
Project participant:
Payne, Mark (Intern)
Mosegaard, Henrik (Intern)
Dijkman, Teunis Johannes (Intern)
Nielsen, Anders (Intern)

Project Manager, organisational:
Ulrich, Clara (Intern)
Project Manager, academic:
Worsøe Clausen, Lotte (Intern)

Judgement and knowledge in fisheries involving stakeholders (JAKFISH) (38132)
JAKFISH aimed at developing institutions, practices and tools for dealing with scientific support to European Marine policy under high uncertainty. The objectives of JAKFISH are: (i) to examine and develop these institutions, practices and tools that allow complexity, uncertainty and ambiguity to be dealt with effectively within participatory decision-making processes, (ii) to examine how scientific information is used and what types of roles scientists play in the formulation of policies, (iii) to study how the current scientific processes take into account the multi-objective nature of fisheries management, and (iv) to synthesize the obtained views and to redefine the institutional role of science in EU polices to improve the overall governance in CFP.

Two parallel tracks were followed: First, a number of case studies involving participatory modeling processes with stakeholders involvements were developed, for support in policy decision-making: Western Baltic herring, Central Baltic herring, North Sea nephrops and Mediterranean swordfish. Second, sociological analyses of the practices and institutional forms that can most effectively involve the wider community in debates over developing science-based policies were carried in various regions both within Europe (North Sea, Baltic, Mediterranean) and outside (USA, Australia). Ultimately, both tracks were linked into a single synthesis.

The project was coordinated by IMARES, Wageningen UR, The Netherlands.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
Institute of Marine Research
Aalborg University
Hellenic Centre for Marine Research
University of Tartu
University of Helsinki
University of Portsmouth
Dialogik gemeinnützige Gesellschaft für Kommunikations- und Kooperationsforschung mbH

Period: 01/01/2008 → 31/12/2011
Number of participants: 5
Research area: Fisheries Management
Contact person:
Mosegaard, Henrik (Intern)
Project participant:
Worsøe Clausen, Lotte (Intern)
Payne, Mark (Intern)
Nielsen, Anders (Intern)

Project Manager, academic:
Ulrich, Clara (Intern)

Resolving climatic impacts on fish stocks (RECLAIM) (38109)
Climate change will impact fisheries resources and challenge managers to develop sustainable exploitation strategies. Knowledge on the impacts of climate on fisheries resources is still fragmentary.

RECLAIM will summarize current knowledge, test process understanding, improve predictive capacity and formulate future research hypotheses by examining trophic processes, geographical distributions and essential habitat requirements for marine and shellfish in the NE-Atlantic.

A conceptual framework will be developed to distinguish between processes acting on individual (physiology, behavior), population (predation, competition) and ecosystem (physical habitat qualities, biological productivity, trophic coupling) levels. The framework structures a literature review to detects gaps in knowledge and, where possible, distinguishes between climate and anthropogenic influences.

A comparative analysis follows quantifying climate variability and changes in distribution and productivity of (i) individual species, (ii) selected fish and shellfish communities, and (iii) ecosystem structure and functioning.

Target species represent different commercially important resources, ecosystem components (pelagics, demersals), and play key trophic roles (wasp-waist, apex predators) within NE-Atlantic ecosystems.

Changes in ecosystem structure and functioning will be analyzed from fisheries and scientific survey data including planktonic, benthic and fish production and consumption in relation to climate forcing and fishing. Relevant spatial and temporal scales of climate change and variability will be explored using time series analyses, spatial statistics and coupled 3-D hydrodynamic ecosystem models.

Using a variety of approaches, RECLAIM will both hind cast as well as forecast the effects of climate change on the productivity and distribution of fish and shellfish stocks to formulate hypotheses and research needs to be addressed in future EU research.

The project is coordinated by IMARES, The Netherlands, and has nine partners from the EU.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Period: 01/01/2007 → 31/12/2009
Number of participants: 12
Research area: Marine Populations and Ecosystem Dynamics
Contact person:
Christensen, Asbjørn (Intern)

Project participant:
Neuenfeldt, Stefan (Intern)
MacKenzie, Brian (Intern)
Andersen, Ken Haste (Intern)
Huwer, Bastian (Intern)
Payne, Mark (Intern)
Brander, Keith (Intern)
Gürkan, Zeren (Intern)
Mosegaard, Henrik (Intern)
Geitner, Kerstin (Intern)
Jensen, Henrik (Ekstern)

Project Manager, academic:
Köster, Fritz (Intern)
**Understanding the mechanisms of stock recovery (UNCOVER) (38104)**

The UNCOVER project has produced a rational scientific basis for developing Long-Term Management Plans (LTMP) and recovery strategies for 11 of the ecologically and socioeconomically most important fish stocks/fisheries in the Norwegian and Barents Seas, the North Sea, the Baltic Sea and the Bay of Biscay and Iberian Peninsula.

UNCOVER's objectives were to:
(i) identify changes experienced during stock depletion/collapses,
(ii) to understand prospects for recovery,
(iii) to enhance the scientific understanding of the mechanisms of fish stock/fishery recovery, and
(iv) to formulate recommendations how best to implement LTMPs/recovery plans.

The project recommends that such plans ideally should include:
(i) Consideration of stock-regulating environmental processes,
(ii) Incorporation of fisheries effects on stock structure and reproductive potential,
(iii) Consideration of changes in habitat dynamics due to global change,
(iv) Incorporation of biological and technological multispecies interactions,
(v) Integration of economically optimized harvesting,
(vi) Exploration of the socio-economic implications and political constraints from existing and alternative recovery plans,
(vii) Investigations on the acceptance of plans by stakeholders and specifically incentives for compliance by the fishery,
(viii) Agreements with and among stakeholders.

UNCOVER has provided imperative policy support underpinning the following fundamental areas:
(i) Evolution of the Common Fisheries Policy with respect to several aims of the ‘Green Paper’;
(ii) Contributing to the Marine Strategy Framework Directive with respect to fish stocks/communities;
(iii) achieving Maximum Sustainable Yield (MSY) for depleted fish stocks. This has been done by contributing to LTMPs/recovery plans for fish stocks/fisheries, demonstrating how to shift from scientific advice based on limit reference points towards setting and attaining targets such as MSY, and furthering ecosystem-based management through incorporating multispecies, environmental and habitat, climate variability/change, and human dimensions into these plans.

The project was coordinated by Institut für Ostseefischerei, Bundesforschungsanstalt für Fischerei, Germany.

National Institute of Aquatic Resources
Section for Marine Living Resources
Bundesforschungsanstalt für Fischerei
Marine Research Unit, Marine and Food Technological Centre
Cefas
University of Portsmouth
Marine Laboratory
Instituto Español de Oceanografía
Aalborg University
Leibniz Institut für Meereswissenschaften, Universität Kiel
IFREMER
Institute of Marine Research
Sea Fisheries Institute
Knipovich Polar Research Institute of Marine Fisheries and Oceanography
Nederlands Instituut voor Visserij Onderzoek b.v.

University of Aberdeen
University of Bergen
University of Hamburg

**Period:** 01/01/2006 → 31/12/2010
**Number of participants:** 14
**Research areas:** Marine Living Resources & Fish Biology

**Contact person:**
Köster, Fritz (Intern)

**Project participant:**
Activities:

**ICES - Working Group on Widely Distributed Stocks - WGWIDE (External organisation)**
*Period: 2015*
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

**Related external organisation**

**ICES - Benchmark Workshop on Pelagic Stocks - WKPELA (External organisation)**
*Period: 2014*
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

**Related external organisation**

**ICES - Working Group on Widely Distributed Stocks - WGWIDE (External organisation)**
*Period: 2014*
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

**Related external organisation**
ICES - Benchmark Workshop on Pelagic Stocks - WKPELA (External organisation)
Period: 2013 → …
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation
ICES - Benchmark Workshop on Pelagic Stocks - WKPELA
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG (External organisation)
Period: 2013 → …
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation
ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Widely Distributed Stocks - WGWIDE (External organisation)
Period: 2013 → …
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation
ICES - Working Group on Widely Distributed Stocks - WGWIDE
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on Global Assessment of the Implications of Climate Change on the Spatial Distribution of Fish and Fisheries - WKSICCME-Spatial (External organisation)
Period: 2013 → …
Mark Payne ( Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation
ICES - Workshop on Global Assessment of the Implications of Climate Change on the Spatial Distribution of Fish and Fisheries - WKSICCME-Spatial
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on Northeast Atlantic mackerel monitoring and methodologies including science and industry involvement - WKNAMMM (External organisation)
Period: 2013 → …
Mark Payne (Participant)
National Institute of Aquatic Resources
Centre for Ocean Life
Degree of recognition: International

Related external organisation

ICES - Workshop on Northeast Atlantic mackerel monitoring and methodologies including science and industry involvement - WKNAMMM
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar