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.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic, Universidade de Aveiro
Authors: Christensen, A. (Intern), Mariani, P. (Intern), Payne, M. R. (Intern), Dias, J. M. (ed.) (Ekstern)
Pages: e0189956
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 13
Issue number: 1
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.631 SNIP 1.161
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Bioenergetics modeling of the annual consumption of zooplankton by pelagic fish feeding in the Northeast Atlantic

The present study uses bioenergetics modeling to estimate the annual consumption of the main zooplankton groups by some of the most commercially important planktivorous fish stocks in the Northeast Atlantic, namely Norwegian spring-spawning (NSS) herring (Clupea harengus), blue whiting (Micromesistius poutassou) and NEA mackerel (Scomber scombrus). The data was obtained from scientific surveys in the main feeding area (Norwegian Sea) in the period 2005–2010. By incorporating novel information about ambient temperature, seasonal growth and changes in the diet from stomach content analyses, annual consumption of the different zooplankton groups by pelagic fish is estimated. The present study estimates higher consumption estimates than previous studies for the three species and suggests that fish might have a greater impact on the zooplankton community as foragers. This way, NEA mackerel, showing the highest daily consumption rates, and NSS herring, annually consume around 10 times their total biomass, whereas blue whiting consume about 6 times their biomass in zooplankton. The three species were estimated to consume an average of 135 million (M) tonnes of zooplankton each year, consisting of 53–85 M tonnes of copepods, 20–32 M tonnes of krill, 8–42 M tonnes of appendicularians and 0.2–1.2 M tonnes of fish, depending on the year. For NSS herring and NEA mackerel the main prey groups are calanoids and appendicularians, showing a peak in consumption during June and June–July, respectively, and suggesting high potential for inter-specific feeding competition between these species. In contrast, blue whiting maintain a low consumption rate from April to September, consuming mainly larger euphausiids. Our results suggest that the three species can coexist regardless of their high abundance, zooplankton consumption rates and overlapping diet. Accordingly, the species might have niche segregation, as they are species specific, showing annual and inter-annual variability in total consumption of the different prey species. These estimates and their inter-annual and interspecific variation are fundamental for understanding fundamental pelagic predator-prey interactions as well as to inform advanced multispecies ecosystem models.
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
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Flabellum alabastrum deep sea cup coral meadows from West Greenland: Density, catchability and habitat suitability modelling

General information
State: Accepted/In press
Organisations: Arctic Section, National Institute of Aquatic Resources, Section for Marine Living Resources, Natural History Museum of Denmark, Aarhus University
Authors: Jørgensbye, H. (Intern), Tendal, O. S. (Ekstern), Wegeberg, S. (Ekstern), Mosegaard, H. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
ISSN (Print): 0967-0637
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 2.76 SJR 1.45 SNIP 1.119
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.369 SNIP 1.174 CiteScore 2.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.557 SNIP 1.279 CiteScore 2.67
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.077 SNIP 1.314 CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.024 SNIP 1.165 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.916 SNIP 1.164 CiteScore 2.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.865 SNIP 1.202
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.734 SNIP 1.305
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.505 SNIP 1.109
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.694 SNIP 1.144
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.91 SNIP 1.222
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.175 SNIP 1.419
Scopus rating (2004): SJR 2.187 SNIP 1.523
Scopus rating (2003): SJR 1.922 SNIP 1.43
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.091 SNIP 1.711
Scopus rating (2001): SJR 2.699 SNIP 1.654
Integrated ecological-economic fisheries models - evaluation, review and challenges for implementation

Marine ecosystems evolve under many interconnected and area-specific pressures. In order to fulfill society's intensifying and diversifying needs whilst ensuring ecologically sustainable development, more effective marine spatial planning and broader-scope management of marine resources is necessary. Integrated ecological–socioeconomic fisheries models (IESFM) of marine systems are needed to evaluate impacts and sustainability of potential management actions and understand, and anticipate ecological, economic, and social dynamics at a range of scales from local to national and regional. To make these models most effective, it is important to determine how model characteristics and methods of communicating results influence the model implementation, the nature of the advice that can be provided and the impact on decisions taken by managers. This paper presents a global review and comparative evaluation of 35 IESFM's applied to marine fisheries and marine ecosystem resources to identify the characteristics that determine their usefulness, effectiveness and implementation. The focus is on fully integrated models that allow for feedbacks between ecological and human processes though not all the models reviewed achieve that.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Oceans and Arctic, National Oceanographic and Atmospheric Administration, Christian-Albrechts-Universität zu Kiel, CSIRO, University of Washington, Plymouth Marine Laboratory, IFREMER, Thünen Institute of Sea Fisheries, New Economics Foundation, University of British Columbia, University of Vigo, AZTI-Tecnalia, Université Bretagne Loire, Institut de Ciències del Mar-CSIC, Wageningen University, National Marine Fisheries Research Institute, Scottish Pelagic Fishermen's Association, AZTI Technalia, University of Southern Denmark, Swiss Federal Institute of Aquatic Science and Technology, Wageningen IMARES, Commonwealth Scientific and Industrial Research Organisation, University of Copenhagen, Swedish Agency for Marine and Water Management, Stockholm University, Lund University
Pages: 1-29
Publication date: 2018
Main Research Area: Technical/natural sciences
Publication information
Journal: Fish and Fisheries
Volume: 19
Issue number: 1
ISSN (Print): 1467-2960
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 7.7 SJR 3.606 SNIP 3.245
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.668 SNIP 3.034 CiteScore 7.05
Web of Science (2015): Indexed yes
Marine copepods in the Baltic Sea – physiological responses and adaptation to low salinity

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Christensen, A. M. (Intern)
Publication date: 2018

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2018

Marine fisheries in the North East Atlantic: Case Study 4

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Payne, M. (Intern)
Publication date: 2018

Host publication information
Resilience in moving water: Effects of turbulence on the predatory impact of the lobate ctenophore Mnemiopsis leidyi: Mnemiopsis leidyi feeding in turbulence

Despite its delicate morphology, the lobate ctenophore Mnemiopsis leidyi thrives in coastal ecosystems as an influential zooplankton predator. Coastal ecosystems are often characterized as energetic systems with high levels of natural turbulence in the water column. To understand how natural wind-driven turbulence affects the feeding ecology of M. leidyi, we used a combination of approaches to quantify how naturally and laboratory generated turbulence affects the behavior, feeding processes and feeding impact of M. leidyi. Experiments using laboratory generated turbulence demonstrated that turbulence can reduce M. leidyi feeding rates on copepods and Artemia nauplii by >50%. However, detailed feeding data from the field, collected during highly variable surface conditions, showed that wind-driven turbulence did not affect the feeding rates or prey selection of M. leidyi. Additional laboratory experiments and field observations suggest that the feeding process of M. leidyi is resilient to wind-driven turbulence because M. leidyi shows a behavioral response to turbulence by moving deeper in the water column. Seeking refuge in deeper waters enables M. leidyi to maintain high feeding rates even under high turbulence conditions generated by wind driven mixing. As a result, M. leidyi exerted a consistently high predatory impact on prey populations during highly variable and often energetic wind-driven mixing conditions. This resilience adds to our understanding of how M. leidyi can thrive in a wide spectrum of environments around the world. The limits to this resilience also set boundaries to its range expansion into novel areas.

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Danish Shellfish Centre, Marine Biological Laboratory, University of Oregon, Roger Williams University, Woods Hole Oceanographic Institution
Authors: Jaspers, C. (Intern), Costello, J. H. (Ekstern), Sutherland, K. R. (Ekstern), Gemmell, B. (Ekstern), Lucas, K. N. (Ekstern), Tackett, J. (Ekstern), Dodge, K. (Ekstern), Colin, S. P. (Ekstern)
Pages: 445-458
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 63
Issue number: 1
ISSN (Print): 0024-3590
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
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2016): CiteScore 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.374 SNIP 1.445 CiteScore 3.59
Shifts in the Source and Composition of Dissolved Organic Matter in Southwest Greenland Lakes Along a Regional Hydro-climatic Gradient

Dissolved organic matter (DOM) concentration and quality were examined from Arctic lakes located in three clusters across south-west (SW) Greenland, covering the regional climatic gradient: cool, wet coastal zone; dry inland interior; and cool, dry ice-marginal areas. We hypothesized that differences in mean annual precipitation between sites would result in a reduced hydrological connectivity between lakes and their catchments and that this concentrates degraded DOM. The DOM in the inland lake group was characterized by a lower aromaticity and molecular weight, a low soil-like fluorescence, and carbon stable isotope ($\delta^{13}$C-DOC) values enriched by ~2‰ relative to the coastal group. DOC-specific absorbance (SUVA$_{254}$) and DOC-specific soil-like fluorescence (SUVF$_{C_1}$) revealed seasonal and climatic gradients across which DOM exhibited a dynamic we term “pulse-process”: Pulses of DOM exported from soils to lakes during snow and ice melt were followed by pulses of autochthonous DOM inputs (possibly from macrophytes), and their subsequent photochemical and microbial processing. These effects regulated the dynamics of DOM in the inland lakes and suggested that if circumpolar lakes currently situated in cool wetter climatic regimes with strong hydrological connectivity have reduced connectivity under a drier future climate, they may evolve toward an end-point of large stocks of highly degraded DOC, equivalent to the inland lakes in the present study. The regional climatic gradient across SW Greenland and its influence on DOM properties in these lakes provide a model of possible future changes to lake C cycling in high-latitude systems where climatic changes are most pronounced.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, North Carolina State University, Loughborough University, The James Hutton Institute, Nottingham Trent University, University of Essex
Sustainable use of marine resources through offshore wind and mussel farm co-location

Marine Spatial Planning (MSP) can offer significant benefits in terms of economic conservation strategies, optimizing spatial planning and minimizing the impact on the environment. In this paper, we focused on the application of multi-criteria evaluation (MCE) technique for co-locating offshore wind farms and open-water mussel cultivation. An index of co-location sustainability (SI) was developed based on the application of MCE technique constructed with physical and biological parameters on the basis of remote-sensing data. The relevant physical factors considered were wind velocity, depth range, concerning the site location for energy production, and sea surface temperature anomaly. The biological variables used were Chlorophyll-a (as a measurement of the productivity) and Particle Organic Carbon (POC) concentration, in order to assess their influence on the probable benefits and complete the requirements of this management framework. This SI can be easily implemented to do a first order selection of the most promising areas to be more specifically studied in a second order approach based on local field data.
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.029 SNIP 1.229 CiteScore 2.28
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.183 SNIP 1.134 CiteScore 2.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.077 SNIP 1.132
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.294 SNIP 1.26
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.335 SNIP 1.312
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.335 SNIP 1.363
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.223 SNIP 1.548
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.441 SNIP 1.327
Scopus rating (2004): SJR 1.046 SNIP 1.089
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.174 SNIP 1.253
Scopus rating (2002): SJR 0.875 SNIP 1.099
Scopus rating (2001): SJR 0.965 SNIP 0.995
Scopus rating (2000): SJR 0.828 SNIP 0.913
Scopus rating (1999): SJR 0.884 SNIP 0.877
Original language: English
DOIs:
10.1016/j.ecolmodel.2017.10.012
Source: FindIt
Source-ID: 2393282977
Publication: Research - peer-review › Journal article – Annual report year: 2018

The lives and times of jellyfish: Modelling the population dynamics and ecological role of jellyfish in marine pelagic ecosystems

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Schnedler-Meyer, N. A. (Intern)
Publication date: 2018

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2018

The UV filtering potential of drop-casted layers of frustules of three diatom species
Diatoms are in focus as biological materials for a range of photonic applications. Many of these applications would require embedding a multitude of diatoms in a matrix (e.g. paint, crème or lacquer); however, most studies on the photonic and spectral properties of diatoms frustules (silica walls) have been carried out on single cells. In this study, for the first time, we test the spectral properties of layers of frustules of three diatom species (Coscinodiscus granii, Thalassiosira punctifera and Thalassiosira pseudonana), with special focus on transmission and reflectance in the UV range. The transmittance
efficiency in the UV A and B range was: T. pseudonana (56–59%) >C. granii (53–54%) >T. punctifera (18–21%) for the rinsed frustules. To investigate the underlying cause of these differences, we performed X-ray scattering analysis, measurement of layer thickness and microscopic determination of frustule nanostructures. We further tested dried intact cells in the same experimental setup. Based on the sedata we discuss the relative importance of crystal structure properties, nanostructure and quantity of material on the spectral properties of diatom layers. Characterization of the UV protection performance of layers of diatom frustules is of central relevance for their potential use as innovative bio-based UV filters.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, National Institute of Aquatic Resources, Section for Oceans and Arctic, University of Copenhagen, International Iberian Nanotechnology Laboratory, Københavns Universitet
Authors: Su, Y. (Ekstern), Lenau, T. A. (Intern), Gundersen, E. (Ekstern), Kirkensgaard, J. J. K. (Ekstern), Maibohm, C. (Ekstern), Pinti, J. P. A. (Intern), Ellegaard, M. (Forskerdatabase)
Number of pages: 10
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientific Reports
Volume: 8
Article number: 959
ISSN (Print): 2045-2322
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 4.63 SJR 1.625 SNIP 1.401
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.057 SNIP 1.684 CiteScore 5.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.103 SNIP 1.544 CiteScore 4.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.886 SNIP 1.51 CiteScore 4.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.458 SNIP 0.896 CiteScore 2.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
Su_et_al_2018_Scientific_Reports.pdf
DOIs: 10.1038/s41598-018-19596-4
Publication: Research - peer-review › Journal article – Annual report year: 2018

Transgenerational interactions between pesticide exposure and warming in a vector mosquito
While transgenerational plasticity may buffer ectotherms to warming and pesticides separately, it remains unknown how combined exposure to warming and pesticides in the parental generation shapes the vulnerability to these stressors in the offspring. We studied the transgenerational effects of single and combined exposure to warming (4°C increase) and the pesticide chlorpyrifos on life history traits of the vector mosquito Culex pipiens. Parental exposure to a single stressor, either warming or the pesticide, had negative effects on the offspring: both parental exposure to warming and to the pesticide resulted in an overall lower offspring survival, and a delayed offspring metamorphosis. Parental exposure to a
single stressor did, however, not alter the vulnerability of the offspring to the same stressor in terms of survival. Parental pesticide exposure resulted in larger offspring when the offspring experienced the same stressor as the parents. Within both the parental and offspring generations, warming made the pesticide more toxic in terms of survival. Yet, this synergism disappeared in the offspring of parents exposed to both stressors simultaneously because in this condition the pesticide was already more lethal at the lower temperature. Our results indicate that transgenerational effects will not increase the ability of this vector species to deal with pesticides in a warming world. Bifactorial transgenerational experiments are crucial to understand the combined impact of warming and pesticides across generations, hence to assess the efficacy of vector control in a warming world.

**General information**

State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University of Leuven, Nha Trang University
Authors: Tran, T. T. (Ekstern), Janssens, L. (Ekstern), Dinh, K. V. (Intern), Stoks, R. (Ekstern)
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Evolutionary Applications (Online)
ISSN (Print): 1752-4563
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 4.96 SJR 2.299 SNIP 1.478
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.666 SNIP 1.392 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.356 SNIP 1.402 CiteScore 4.23
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.478 SNIP 1.432 CiteScore 4.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.185 SNIP 1.179 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 2.427 SNIP 1.216 CiteScore 4.5
Scopus rating (2010): SJR 1.633 SNIP 1.014
Scopus rating (2009): SJR 1.241 SNIP 0.87
Original language: English
Electronic versions:

Postprint
DOI: 10.1111/eva.12605
Source: PublicationPreSubmission
Source-ID: 143291362
Publication: Research - peer-review › Journal article – Annual report year: 2018

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What we once knew – Mapping of marine sediments on the Greenland west coast: Comparing fishers’ ecological knowledge with historical and recent sources

**General information**

State: Accepted/In press
Organisations: Arctic Section, National Institute of Aquatic Resources, Section for Marine Living Resources, Aarhus University
Food availability drives plastic self-repair response in a basal metazoan-case study on the ctenophore Mnemiopsis leidyi

A. Agassiz

Many marine invertebrates including ctenophores are capable of extensive body regeneration when injured. However, as for the invasive ctenophore Mnemiopsis leidyi, there is a constant subportion of individuals not undergoing whole body regeneration but forming functionally stable half-animals instead. Yet, the driving factors of this phenomenon have not been addressed so far. This study sheds new light on how differences in food availability affect self-repair choice and regeneration success in cydippid larvae of M. leidyi. As expected, high food availability favored whole-body regeneration.
However, under low food conditions half-animals became the preferential self-repair mode. Remarkably, both regenerating and half-animals showed very similar survival chances under respective food quantities. As a consequence of impaired food uptake after injury, degeneration of the digestive system would often occur indicating limited energy storage capacities. Taken together, this indicates that half-animals may represent an alternative energy-saving trajectory which implies self-repair plasticity as an adaptive trade-off between high regeneration costs and low energy storage capacities. We conclude that self-repair plasticity could lead to higher population fitness of ctenophores under adverse conditions such as in ships’ ballast water tanks which is postulated to be the major vector source for the species’ spreading around the globe.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Norwegian University of Science and Technology, GEOMAR - Helmholtz Centre for Ocean Research Kiel, University of Florida
Authors: Bading, K. T. (Ekstern), Kaehlert, S. (Ekstern), Chi, X. (Ekstern), Jaspers, C. (Intern), Martindale, M. Q. (Ekstern), Javidpour, J. (Ekstern)
Publication date: 1 Dec 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Scientific Reports
Volume: 7
Issue number: 1
Article number: 16419
ISSN (Print): 2045-2322
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 4.63 SJR 1.625 SNIP 1.401
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.057 SNIP 1.684 CiteScore 5.3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.103 SNIP 1.544 CiteScore 4.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.886 SNIP 1.51 CiteScore 4.06
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.458 SNIP 0.896 CiteScore 2.44
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
ISI indexed (2011): ISI indexed no
Original language: English
Electronic versions:
Publishers version
DOIs:
10.1038/s41598-017-16346-w
Links:
https://www.nature.com/articles/s41598-017-16346-w
Source: Scopus
Source-ID: 85035356315
Publication: Research - peer-review › Journal article – Annual report year: 2017
62 years of population dynamics of European perch (Perca fluviatilis) in a mesotrophic lake tracked using angler diaries: The role of commercial fishing, predation and temperature

Standardised angler diaries could produce useful proxy data for assessing fish population density and size distribution, but few rigorous studies about their utility exist. We use 62 years of angling diary data (1949–2010), from a large mesotrophic lake, to investigate population structure (abundance, mean size and record size) of European perch (Perca fluviatilis L.) in relation to the impact of three commercial fishers with different fishing strategies, pike (Esox lucius L.) predation and temperature. We found that anglers' harvest rates of perch varied by a factor of 10 over time, indicating large variation in population abundance over decadal time scales. Our statistical analysis revealed that the anglers' harvest rates of perch were related to pike CPUE (proxy of pike predation), temperature and commercial fishing directly through the harvest of perch and indirectly through the harvest of pike, the top predator of the lake. The size distribution and growth rates of perch caught by anglers also changed substantially during the study period, most likely controlled by density-dependent mechanisms as well as size-selective commercial harvest. The effect of selective harvest on size-structure was stronger than ecological density dependence. We conclude that commercial harvesting may exert strong impacts on the quality of the angling experiences, at least in the studied case. Moreover, our work showcases the value of detailed angler diaries to study and monitor changes in freshwater fish populations, but it also underlines the need for supplementary data on biotic and abiotic factors to reach the full potential of angler diary data.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Oceans and Arctic, Humboldt-University of Berlin
Authors: Skov, C. (Intern), Jansen, T. (Intern), Arlinghaus, R. (Ekstern)
Pages: 71-79
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 195
ISSN (Print): 0165-7836
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
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
Acanthoecid choanoflagellates from the Atlantic Arctic Region - a baseline study
The examination and statistical analysis of loricate choanoflagellate material collected from Greenland waters during the period 1988-1998 represents a de facto baseline study of heterotrophic nanoflagellates from the Atlantic Arctic Region. The geographic sites sampled are Disko Bay (West Greenland) and the high-arctic North-East Water (NEW) and North Water (NOW) polynya. The analyses encompass close to 50 taxa. Some of these are described as new species, i.e. Acanthocorbis glacialis, A. reticulata and Diaphanoeca dilatanda. Two distinct clusters of species that are separated in time and space occur at all three sampling sites. A PCA analysis of NEW and NOW data points to that one community is linked to e.g. an early season high nutrient and low phytoplankton biomass scenario, whereas the other is predominant when nutrient levels are exhausted and the phytoplankton biomass high or declining. The material additionally allows for a comprehensive examination of e.g. the Cosmoeca ventricosa morphological variability encountered, as well as puts on record bimodal size variability within a number of species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Thomsen, H. A. (Intern), Østergaard, J. B. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Heliyon
Volume: 3
Issue number: 7
Article number: e00345
ISSN (Print): 2405-8440
Ratings:
Scopus rating (2016): CiteScore 0.55 SJR 0.173 SNIP 0.423
Original language: English
Ecology, Microbiology
Electronic versions:
Publishers version
Acute and semi-chronic toxicity of vanadium tested on copepods of the species Temora longicornis

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Environmental Engineering, Environmental Chemistry, Technical University of Denmark
Authors: Kristiansen, M. H. (Ekstern), Iversen, N. H. (Ekstern), Koski, M. (Intern), Trapp, S. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts Sustain 2017
Place of publication: Kgs. Lyngby, Denmark
Publisher: Technical University of Denmark (DTU)
Article number: Sustain Abstract A-10
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
ABSTRACT BOOK
SustainAbstracts2017c.compressed_13.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Afgrænsning af "Same-Risk-Area's" – et redskab til forvaltning af ballastvandskonventionen

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Marine Living Resources, Litehauz Aps, Styrelsen for Vand & Naturforvaltning (SVANA)
Authors: Hansen, F. T. (Intern), Christensen, A. (Intern), Stuer-Lauridsen, F. (Ekstern), Berggreen, U. C. (Ekstern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Ålelarvernes vækst muligheder i Sargassohavet

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

Ålelarvernes vækstmuligheder i Sargassohavet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Munk, P. (Intern), Ayala, D. J. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Ålelarvers fødeoptagelse i Sargassohavet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Marine Ecology and Oceanography, University of Copenhagen, GEOMAR - Helmholtz Centre for Ocean Research Kiel, Københavns Universitet
Authors: Ayala, D. J. (Intern), Munk, P. (Intern), Lundgreen, R. B. C. (Intern), Traving, S. J. (Ekstern), Jaspers, C. (Intern), Riemann, L. (Ekstern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Analysis of marine protected areas – in the Danish part of the North Sea and the Central Baltic around Bornholm: Part 1: The coherence of the present network of MPAs

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Monitoring and Data, DHI Denmark, Geological Survey of Denmark and Greenland, Aarhus University, University of Copenhagen
Number of pages: 105
Publication date: 2017
Publication information
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
ISBN (Electronic): 978-87-7481-245-6
Original language: English
Series: DTU Aqua Report
Number: 325-2017
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Publication: Research › Report – Annual report year: 2018

Analysis of marine protected areas – in the Danish part of the North Sea and the Central Baltic around Bornholm: Part 2: Ecological and economic value, human pressures, and MPA selection

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Monitoring and Data, DHI Denmark, Geological Survey of Denmark and Greenland, Aarhus University, University of Copenhagen
Number of pages: 120
Publication date: 2017
Publication information
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
ISBN (Electronic): 978-87-7481-245-6
Original language: English
Assessing and managing multiple risks in a changing world — The Roskilde recommendations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Civil Engineering, Section for Structural Engineering, Roskilde University, Stockholm University, University of Michigan, DHI Denmark, Simon Fraser University, Delft University of Technology, Enviresearch, Newcastle-upon-Tyne, Halmstad University, Aarhus University, Norwegian Institute for Water Research, University of Aveiro, U.S. Environmental Protection Agency, Norwegian Geotechnical Institute, Polish Academy of Sciences, Chapema Environmental Strategies, University of Gothenburg
Pages: 1-10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Toxicology and Chemistry
Volume: 36
Issue number: 1
ISSN (Print): 0730-7268
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 2.74 SJR 1.19 SNIP 1.031
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.446 SNIP 1.055 CiteScore 3
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.506 SNIP 1.129 CiteScore 2.89
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.653 SNIP 1.092 CiteScore 2.88
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.642 SNIP 1.107 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Assessing pre- and post-zygotic barriers between North Atlantic eels (Anguilla anguilla and A. rostrata)

Elucidating barriers to gene flow is important for understanding the dynamics of speciation. Here we investigate pre- and post-zygotic mechanisms acting between the two hybridizing species of Atlantic eels: Anguilla anguilla and A. rostrata. Temporally varying hybridization was examined by analyzing 85 species-diagnostic single-nucleotide polymorphisms (SNPs; FST 0.95) in eel larvae sampled in the spawning region in the Sargasso Sea in 2007 (N=92) and 2014 (N=460). We further investigated whether genotypes at these SNPs were nonrandomly distributed in post-F1 hybrids, indicating selection. Finally, we sequenced the mitochondrial ATP6 and nuclear ATP5c1 genes in 19 hybrids, identified using SNP and restriction site associated DNA (RAD) sequencing data, to test a previously proposed hypothesis of cytonuclear incompatibility leading to adenosine triphosphate (ATP) synthase dysfunction and selection against hybrids. No F1 hybrids but only later backcrosses were observed in the Sargasso Sea in 2007 and 2014. This suggests that interbreeding between the two species only occurs in some years, possibly controlled by environmental conditions at the spawning grounds, or that interbreeding has diminished through time as a result of a declining number of spawners. Moreover, potential selection was found at the nuclear and the cytonuclear levels. Nonetheless, one glass eel individual showed a mismatch, involving an American ATP6 haplotype and European ATP5c1 alleles. This contradicted the presence of cytonuclear incompatibility but may be explained by that (1) cytonuclear incompatibility is incomplete, (2) selection acts at a later life stage or (3) other genes are important for protein function. In total, the study demonstrates the utility of genomic data when examining pre- and post-zyotic barriers in natural hybrids.

Heredity advance online publication, 9 November 2016; doi:10.1038/hdy.2016.96.
Assessment of drinking water quality at the tap using fluorescence spectroscopy

Treated drinking water may become contaminated while travelling in the distribution system on the way to consumers. Elevated dissolved organic matter (DOM) at the tap relative to the water leaving the treatment plant is a potential indicator of contamination, and can be measured sensitively, inexpensively and potentially on-line via fluorescence and absorbance spectroscopy. Detecting elevated DOM requires potential contamination events to be distinguished from natural fluctuations in the system, but how much natural variation to expect in a stable distribution system is unknown. In this study, relationships between DOM optical properties, microbial indicator organisms and trace elements were investigated for households connected to a biologically-stable drinking water distribution system. Across the network, humic-like fluorescence intensities showed limited variation (RSD = 3.5-4.4%), with half of measured variation explained by interactions with copper. After accounting for quenching by copper, fluorescence provided a very stable background signal (RSD)
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. While 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 taxon-specific habitat condition. Thus, trait responses to environmental gradient cannot be generalized across these marine taxonomic groups, pointing toward potential complex responses of multi-taxa 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
Avoiding pitfalls in interdisciplinary education

As the world’s social-environmental problems increasingly extend across boundaries, both disciplinary and political, there is a growing need for interdisciplinarity, not only in research per se, but also in doctoral education. We present the common pitfalls of interdisciplinary research in doctoral education, illustrating approaches towards solutions using the Nordic Centre for Research on Marine Ecosystems and Resources under Climate Change (NorMER) research network as a case study. We provide insights and detailed examples of how to overcome some of the challenges of conducting interdisciplinary research within doctoral studies that can be applied within any doctoral/postdoctoral education programme, and beyond. Results from a selfevaluation survey indicate that early-career workshops, annual meetings and research visits to other institutions were the most effective learning mechanisms, whereas single discipline-focused courses and coursework were among the least effective learning mechanisms. By identifying the strengths and weaknesses of components of NorMER, this case study can inform the design of future programmes to enhance interdisciplinarity in doctoral education, as well as be applied to science collaboration and academic research in general.

General information

State: Published

Pages: 121-129
Publication date: 2017
Main Research Area: Technical/natural sciences
Billedmosaik til kortlægning af udbredelse af jomfruhummer

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Living Resources, Section for Maritime Service
Authors: Lundgren, B. (Intern), Stage, B. (Intern), Pedersen, E. M. (Intern), Lisbjerg, D. (Intern)
Publication date: 2017
Event: Poster session presented at Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences

Biomasser af alger og hårdbundsfana samt produktion af fiskeføde på et naturligt stenrev

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Aarhus University, DHI Denmark
Blåfinnet tuns færden skal undersøges i danske farvande

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Freshwater Fisheries Ecology, Section for Ecosystem based Marine Management
Authors: MacKenzie, B. (Intern), Aarestrup, K. (Intern), Christoffersen, M. (Intern)
Pages: 11
Publication date: 2017

Calanus hyperboreus and the lipid pump
Lipid-fuelled overwintering by copepods can be a regionally important contribution to carbon sequestration in the deep oceans. Here, we estimate the contribution for Calanus hyperboreus, found in abundance in the northern reaches of the North Atlantic and Arctic Ocean. Estimates for regions with high overwintering populations, Fram Strait, Greenland Sea and Iceland Sea lie between 3.5 gC m\textsuperscript{-2} yr\textsuperscript{-1} and 6.0 gC m\textsuperscript{-2} yr\textsuperscript{-1} at depths of 1000-3000 m, comparable to the flux of detrital organic carbon at commensurate depths. Apart from the variation in the abundance of overwintering populations, these estimates are most sensitive to mortality rates. We present a general model based on metabolic theory and isomorphism that can be used to constrain estimates for data poor species in other parts of the global ocean.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management
Authors: Visser, A. (Intern), Grenning, J. B. (Intern), Jonasdottir, S. (Intern)
Pages: 1155-1165
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 62
Issue number: 3
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Calibration, standardization, and quantitative analysis of multidimensional fluorescence (MDF) measurements on complex mixtures (IUPAC Technical Report)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, National University of Ireland, University of Copenhagen
Carbon bioavailability in a high Arctic fjord influenced by glacial meltwater, NE Greenland
The land-to-ocean flux of organic carbon is increasing in glacierized regions in response to increasing temperatures in the Arctic (Hood et al., 2015). In order to understand the response of the coastal ecosystem metabolism to the organic carbon input it is essential to determine the bioavailability of the different carbon sources in the system. We quantified the bacterial turnover of organic carbon in a high Arctic fjord system (Young Sound, NE Greenland) during the ice-free period (July-October 2014) and assessed the quality and quantity of the 3 major organic carbon sources; (1) local phytoplankton
production (2) runoff from land-terminating glaciers and a lowland river and (3) inflow from the ocean shelf. We found that
despite relatively low concentrations of DOC in the rivers, the bioavailability of the river–DOC was significantly higher than
in the fjord, and characterized by high cell-specific bacterial production and low C:N ratios. In contrast, the DOC source
entering via inflow of coastal shelf waters had high DOC concentrations with high C:N and low specific bacterial
production. The phytoplankton production in the fjord could not sustain the bacterial carbon demand, but was still the
major source of organic carbon for bacterial growth. We assessed the bacterial community composition and found that
communities were specific for the different water types i.e., the bacterial community of the coastal inflow water could be
traced mainly in the subsurface water, while the glacial river community strongly dominated the surface water in the fjord

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Greenland
Institute of Natural Resources, Aarhus University, Uni Research AS, University of Bergen, University of Copenhagen,
Instituto Andaluz de Ciencias de la Tierra (CSIC-UGR)
Authors: Paulsen, M. L. (Intern), Nielsen, S. E. B. (Intern), Müller, J. (Ekstern), Møller, E. F. (Ekstern), Stedmon, C. A.
(Intern), Juul Pedersen, T. (Ekstern), Markager, S. (Ekstern), Sejr, M. K. (Ekstern), Delgado Huertas, A. (Ekstern),
Larsen, A. (Ekstern), Middelboe, M. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 4
Article number: 176
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
bacterial carbon demand, bacterial diversity, dissolved organic matter, runoff, glacial meltwater, high arctic ecosystems,
Young Sound
Electronic versions:
Publishers version
DOIs:
10.3389/fmars.2017.00176
Links:
Source: FindIt
Source-ID: 2371235780
Publication: Research - peer-review > Journal article – Annual report year: 2017

Changes in distributional patterns of plaice Pleuronectes platessa in the central and eastern North Sea; do declining
nutrient loadings play a role?
Since the beginning of the 1990s, there has been a change in the relative distribution of smaller age-classes of plaice
Pleuronectes platessa (age 1–3) in the North Sea. The abundances have increased in deeper, more offshore
areas, while coastal abundances have been stagnant or declining. For the same time period available time series data on
nutrient conditions in the coastal North Sea area show that the freshwater nitrogen loading has decreased by about 50%.
While nutrient concentrations in the ambient environment have been shown to influence growth in juvenile plaice through
influence on their prey, we here inspect the potential linkage between distributional changes in plaice and the decline in
nutrient loading. We compare plaice observations in coastal areas in the eastern North Sea, which have experienced large
changes in eutrophication, with observations for the Dogger Bank, a large sandbank in a shallow offshore area of the North
Sea. The Dogger Bank was used as a reference location assuming this area has been less influenced from coastal
eutrophication but similar regional climate conditions, and here we found no changes in the abundances of juvenile plaice.
The increase in the use of offshore habitats as nursery areas by juvenile plaice in the North Sea appears not related to
water depth per se but driven by specific processes dominating in near-shore areas and may be related to changes in
nutrient loadings. This point to the

importance of separating more general depth-related factors from conditions specific for near-shore areas, such as
nutrient loadings in coastal waters and export offshore. The concurrent changes in environment and in distribution of
juvenile plaice may have implications for environmental and fisheries management

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Department of Electrical Engineering, Section for Marine Ecology and Oceanography, Japan International Research Centre for Agricultural Sciences
Authors: Støttrup, J. G. (Intern), Munk, P. (Intern), Kodama, M. (Ekstern), Stedmon, C. (Intern)
Pages: 164-172
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Sea Research
Volume: 127
ISSN (Print): 1385-1101
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 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.115 SNIP 1.06 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.371 SNIP 1.28 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.267 SNIP 1.242
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.261 SNIP 1.071
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.289 SNIP 1.156
Scopus rating (2007): SJR 1.402 SNIP 1.179
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.325 SNIP 1.165
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.987 SNIP 0.923
Scopus rating (2004): SJR 0.932 SNIP 0.957
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.146
Changes in food web function and diversity due to non-indigenous species

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic, Abo Academy University, University of Erlangen-Nuremberg
Authors: Lehtiniemi, M. (Ekstern), Bonsdorff, E. (Ekstern), Funk, S. (Ekstern), Herlevi, H. (Ekstern), Huwer, B. (Intern), Jaspers, C. (Intern)
Number of pages: 127
Publication date: 2017

Host publication information
Title of host publication: Report assessing the effects of key NIS on ecosystem functioning
Main Research Area: Technical/natural sciences
DOI: 10.3289/BIO-C3_D2.3
Publication: Research › Report chapter – Annual report year: 2017

Characterising and predicting the distribution of Baltic Sea flounder during the spawning season

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Swedish University of Agricultural Sciences
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Characterizing and predicting the distribution of Baltic Sea flounder (Platichthys flesus) during the spawning season
Identification of essential fish habitats (EFH), such as spawning habitats, is important for nature conservation, sustainable fisheries management and marine spatial planning. Two sympatric flounder (Platichthys flesus) ecotypes are present in the Baltic Sea, pelagic and demersal spawning flounder, both displaying ecological and physiological adaptations to the low-salinity environment of this young inland sea. In this study we have addressed three main research questions: 1) What environmental conditions characterize the spatial distribution and abundance of adult flounder during the spawning season? 2) What are the main factors defining the habitats of the two flounder ecotypes during the spawning season? 3) Where are the potential spawning areas of flounder? We modelled catch per unit of effort (CPUE) of flounder from gillnet surveys conducted over the southern and central Baltic Sea in the spring of 2014 and 2015 using generalized additive models. A general model included all the stations fished during the survey while two other models, one for the demersal and one for the pelagic flounder flounder, included only the stations where each flounder ecotype should dominate. The
The general model captured distinct ecotype-specific signals as it identified dual salinity and water depth responses. The model for the demersal spawning flounder revealed a negative relation with the abundance of round goby (Neogobius melanostomus) and a positive relation with Secchi depth and cod abundance. Vegetation and substrate did not play an important role in the choice of habitat for the demersal ecotype. The model for the pelagic spawning flounder showed a negative relation with temperature and bottom current and a positive relation with salinity. Spatial predictions of potential spawning areas of flounder showed a decrease in habitat availability for the pelagic spawning flounder over the last 20 years in the central part of the Baltic Sea, which may explain part of the observed changes in populations’ biomass. We conclude that spatiotemporal modelling of habitat availability can improve our understanding of fish stock dynamics and may provide necessary biological knowledge for the development of marine spatial plans.
Cryptic Sebastes norvegicus species in Greenland waters revealed by microsatellites

Identification of cryptic species can have profound implications in fishery management, conservation and biodiversity contexts. In the North Atlantic, the genus Sebastes is currently represented by four species, although additional cryptic species have been assumed. The connectivity of the gene-pools within the genus in Greenland waters, in particular, remains largely unexplored. Using a panel of 13 microsatellite markers for 720 fish, we explored the species complex of Sebastes norvegicus in Greenland waters. Genetic analyses provided evidence for three cryptic species in samples that were morphologically identified as S. norvegicus. They were termed S. norvegicus-A, S. norvegicus-B, and S. norvegicus giants. A few phenotypic features exist to identify adult S. norvegicus giants, but no characteristics have been...
identified for the two other cryptic species. The proposed cryptic species should be recognized in the management regime to ensure sustainable exploitation and conservation of Sebastes species in Greenland waters.

**General information**

State: Published

Organisations: Arctic Section, National Institute of Aquatic Resources, Section for Oceans and Arctic, Institute of Marine Research, University of Washington, Greenland Institute of Natural Resources, UiT The Arctic University of Norway

Authors: Saha, A. (Ekstern), Hauser, L. (Ekstern), Hedeholm, R. (Ekstern), Planque, B. (Ekstern), Fevolden, S. (Ekstern), Boje, J. (Intern), Johansen, T. (Ekstern)

Pages: 2148-2158

Publication date: 2017

Main Research Area: Technical/natural sciences

**Publication information**

Journal: ICES Journal of Marine Science

Volume: 74

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

Web of Science (2004): Indexed yes

Web of Science (2003): Indexed yes

Web of Science (2002): Indexed yes

Web of Science (2001): Indexed yes
Die Geister der Meere

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Jaspers, C. (Intern)
Pages: 10-14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: ARTE Magazine
Issue number: June
Original language: German
Publication: Communication › Journal article – Annual report year: 2017

Diel vertical interactions between Atlantic cod Gadus morhua and sprat Sprattus sprattus in a stratified water column

Information about species interactions at a spatial scale comparable to the perceptive abilities of the involved species is crucial for establishment of predictive food consumption models at the population level. Nevertheless, such information is sparse due to methodological constraints. We studied the diel vertical dynamics of species interactions between Atlantic cod Gadus morhua and its major clupeid prey, sprat Sprattus sprattus, at a location in the Bornholm Basin of the central Baltic Sea during late winter. This was accomplished by combining acoustic information on diel vertical fish distribution, time of ingestion of individual sprat estimated from cod stomach content data and observed vertical profiles of salinity, temperature and oxygen content. Predation by cod took place primarily at dusk and dawn during ascent and descent of sprat associated with school dissolution and formation, respectively. Cod resided close to the bottom outside these temporal predation windows. Sprat schools were located at the same depth as cod in the daylight hours, whereas at night dispersed sprat were situated higher in the water column. These vertical dynamics could be explained by fitness optimization using bioenergetics and trade-offs between temperature, oxygen saturation of the water and predation risk. This study forms a first step towards providing a mechanistic background for the predatory impact of cod at the basin scale and beyond

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Section for Marine Ecology and Oceanography
Authors: Andersen, N. G. (Intern), Lundgren, B. (Intern), Neuenfeldt, S. (Intern), Beyer, J. (Intern)
Pages: 195-209
Diet composition and food consumption rate of harbor porpoises (Phocoena phocoena) in the western Baltic Sea

Stomach content composition and prey-specific consumption rates of juvenile and adult harbor porpoises (Phocoena phocoena) were estimated from a data set including 339 stomachs collected over a 32 yr period (1980–2011) in the western Baltic Sea. The stomach contents were mainly hard parts of fish prey and in particular otoliths. The bias originating from differential residence time of otoliths in the stomachs was addressed by use of a recently developed approach. Atlantic cod and herring were the main prey of adults, constituting on average 70% of the diet mass. Juvenile porpoises also frequently consumed gobies. Here, the mass contribution by gobies was on average 25%, which was as much as cod. Other species such as whiting, sprat, eelpout, and sandeels were of minor importance for both juveniles and adults. The diet composition differed between years, quarters, and porpoise acquisition method. Yearly consumption rates for porpoises in the western Baltic Sea were obtained in three scenarios on the daily energy requirements of a porpoise in combination with an estimate including the 95% CLs of the porpoise population size. Cod of age groups 1 and 2 and intermediate-sized herring suffered the highest predation from porpoises.
Distributions of dissolved organic matter in the central Arctic Ocean

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Reader, H. (Intern), Stedmon, C. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences

Dynamics of grazer induced toxin production in Pseudo-nitzschia and the physiological effect on Calanus copepods

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, University of Copenhagen, University of Gothenburg, Alfred-Wegener-Institute für Polar und Meeresforschung
Authors: Harðardóttir, S. (Intern), Hjort-Jensen, D. M. (Ekstern), Eklund, J. (Ekstern), Wohlrab, S. (Ekstern), Krock, B. (Ekstern), Selander, E. (Ekstern), Nielsen, T. G. (Intern), John, U. (Ekstern), Lundholm, N. (Ekstern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences

Dynamics of phytoplankton blooms in turbulent vortex cells
Turbulence and coherent circulation structures, such as submesoscale and mesoscale eddies, convective plumes and Langmuir cells, play a critical role in shaping phytoplankton spatial distribution and population dynamics. We use a framework of advection-reaction-diffusion equations to investigate the effects of turbulent transport on the phytoplankton population growth and its spatial structure in a vertical two-dimensional vortex flow field. In particular, we focus on how turbulent flow velocities and sinking influence phytoplankton growth and biomass aggregation. Our results indicate that conditions in mixing and growth of phytoplankton can drive different vertical spatial structures in the mixed layer, with the depth of the mixed layer being a critical factor to allow coexistence of populations with different sinking speed. With increasing mixed layer depth, positive growth for sinking phytoplankton can be maintained with increasing turbulent flow velocities, allowing the apparently counter-intuitive persistence of fast sinking phytoplankton populations in highly turbulent and deep mixed layers. These dynamics demonstrate the role of considering advective transport within a turbulent vortex and can help to explain observed phytoplankton biomass during winter in the North Atlantic, where the overturn of deep convection has been suggested to play a critical role in phytoplankton survival.

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Section for Oceans and Arctic, Centre for Ocean Life, University of Bergen
Authors: Lindemann, C. (Ekstern), Visser, A. (Intern), Mariani, P. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Royal Society. Interface
Volume: 14
Issue number: 136
ISSN (Print): 1742-5689
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 3.04
Dynamiske brugerstyrede havkort til værdiløft af dansk industrifiskeri (GUDP-VIND)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic, Section for Marine Ecology and Oceanography, AnchorLab, Danish Meteorological Institute, Danish Fishermen's Producers' Organization
Authors: Mosegaard, H. (Intern), Pedersen, E. M. (Intern), Sparrevohn, C. R. (Ekstern), Lund, H. S. (Ekstern), Skov, O. (Ekstern), Dueholm, M. (Ekstern), She, J. (Ekstern), Christensen, A. (Intern), Stage, B. (Intern), Worsøe Clausen, L. (Intern), Deurs, M. V. (Intern), Bekkevold, D. (Intern), Andersen, N. G. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Eastern Baltic cod recruitment revisited—dynamics and impacting factors
The Eastern Baltic cod abundance started rapidly to increase in the mid-2000s as evidenced by analytical stock assessments, due to increased recruitment and declining fishing mortality. Since 2014, the analytical stock assessment is not available, leaving the present stock status unclear and casting doubts about the magnitude of the recent increase in recruitment. Earlier studies identified main factors impacting on cod reproductive success to be related to the loss of two out of three spawning areas in the 1980s caused by lack of major Baltic inflows with a concurrent reduction in salinity and oxygen. Other important factors include prey availability for first-feeding larvae, egg predation by sprat and herring and cannibalism on juveniles, all in one way or the other related to the prevailing hydrographic conditions. These factors cannot explain increased reproductive success in the last decade, as the period was characterized by an absence of large-scale Baltic inflows since 2003 and persistent anoxic conditions in the bottom water of the deep Baltic basins. This questions the perception of the increased recruitment in later years and challenges our present understanding of cod recruitment dynamics in the Baltic Sea. In this contribution, we review evidence from the recent literature supplemented by information from latest research cruises to elucidate whether cod reproductive success indeed has increased during the last decade, and we suggest the key processes responsible for the recent dynamics in cod recruitment and outline directions for future research.
Ecological effects of scrubber water discharge on coastal plankton: Potential synergistic effects of contaminants reduce survival and feeding of the copepod Acartia tonsa

To meet the oncoming requirements for lower sulphur emissions, shipping companies can install scrubbers where the exhaust is sprayed with seawater and subsequently discharged to the sea. The discharge water has a pH around 3 and contains elevated concentrations of vanadium, nickel, lead and hydrocarbons. We investigated 1) the threshold concentrations of scrubber discharge water for survival, feeding and reproduction of the copepod Acartia tonsa, 2) whether the effects depend on the exposure route and 3) whether exposure to discharge water can be detected in field-collected organisms. A direct exposure to discharge water increased adult copepod mortality and reduced feeding at metal concentrations which were orders of magnitude lower than the lethal concentrations in previous single-metal studies. In contrast, reproduction was not influenced by dietary uptake of contaminants. Scrubber water constituents could have synergistic effects on plankton productivity and bioaccumulation of metals, although the effects will depend on their dilution in the marine environment.
**Ecological effects of scrubber water discharge on coastal plankton: Potential synergistic effects of contaminants reduce survival and feeding of the copepod *Acartia tonsa***

**General information**
- **State:** Published
- **Organisations:** National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Environmental Engineering, Environmental Chemistry
- **Authors:** Koski, M. (Intern), Stedmon, C. (Intern), Trapp, S. (Intern)
- **Number of pages:** 1
- **Publication date:** 2017

**Host publication information**
- **Title of host publication:** Book of Abstracts Sustain 2017
- **Main Research Area:** Technical/natural sciences
- **Conference:** Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017

**Effect of exposure on salmon lice *Lepeophtheirus salmonis* population dynamics in Faroese salmon farms**

We assessed variations in salmon lice *Lepeophtheirus salmonis* population dynamics in Faroese salmon farms in relationship to their physical exposure to local circulation patterns and flushing with adjacent waters. Factors used in this study to quantify physical exposure are estimates of the freshwater exchange rate, the tidal exchange rate and dispersion by tidal currents. Salmon farms were ranked according to the rate of increase in the average numbers of salmon lice per fish. In a multiple linear regression, physical exposure together with temperature were shown to have a significant effect on the rate of lice infection. The sites with low exposure revealed higher rates of self-infection and internally driven outbreak dynamics, while high-exposure sites showed lower rates of self-infection, tending towards externally driven outbreak dynamics. The low-exposure sites also appeared to have a lower threshold of salmon stocking numbers for outbreaks of infection. The study presents a simple method of characterizing salmon farming fjords in terms of their different exposure levels and how they relate to potential self-infection at these sites.

**General information**
- **State:** Published
- **Organisations:** National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Aquaculture Research Station of the Faroes
Effects of elevated pH on marine copepods in mass cultivation systems: practical implications

Female tolerance to pH (8.0–9.5) by six marine copepods, Oithona similis, Temora longicornis, Acartia spp., Centropages typicus, Pseudocalanus elongatus and Eurytemora affinis was investigated to identify robust species for live feed production. The species with the most oceanic-neritic distribution, O. similis, exhibited 72 h LC50 at pH 8.39 ± 0.11 (±95% CL) whereas the most estuarine E. affinis had LC50 at pH 9.51 ± 0.04. The rest had LC50 at intermediary pH's. Egg hatching by a selection of species, Acartia spp., C. typicus and E. affinis, was unaffected by pH up to 9.0–9.5. Nauplii from both Acartia spp. and C. typicus had higher mortality at pH 9.5 than at the other pH regimes while E. affinis nauplii were not affected by pH. Wild Acartia spp. and A. tonsa from a culture showed some differences in response although of minor practical importance for aquaculture; both produced no eggs at pH 9.5, A. tonsa exhibited significantly higher egg production at all other pH's than 9.5, both showed egg hatching invariant of pH, but gradually increasing nauplii mortality with pH. We suggest active/passive selection to obtain the most pH robust species able to cope with accidently, but frequently, elevated pH in aquaculture systems.
Effects of global warming and pollutants on marine copepods across space and time

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Dinh, K. V. (Intern), Nielsen, T. G. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts Sustain 2017
Publisher: Technical University of Denmark
Article number: A-1
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
SustainAbstracts2017c.compressed_5.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Effects of oil spill responses on key Arctic zooplankton species

The copepod Calanus glacialis is a key species in the Arctic ecosystem. Increased shipping and oil and gas activities in the Arctic increase the risk of an oil spill. It is therefore important to study the potential consequences of an oil spill on this key species in the Arctic ecosystems. As a part of a large joint industry initiative (www.arcticresponsetechnology.org) a first of its kind mesocosm experiment was executed in an Arctic fjord of the Island of Svalbard. Effects of natural attenuation of the oil, in-situ burning and chemical dispersion were studied on grazing, egg production and hatching of the Arctic copepod Calanus glacialis. Eight mesocosms with open top and bottom were deployed in the sea ice in Van Mijenfjorden, Svalbard, in February 2015. Two replicates were used for all treatments. After application, surface ice was allowed to re-establish. Water was collected from the top 2 cm water column in March and just before sea ice break up in May, and was used in two 14-day incubation experiments with C. glacialis collected in Isfjorden. Copepods were fed during the experiment and eggs and pellets were quantified daily. Egg hatching was determined in the beginning and end of the experiment. There was no significant effect of the oil spill treatments on average cumulated specific pellet production or egg hatching success. However in May, the average cumulated specific egg production was significantly higher in the dispersed oil treatment compared to the control from day 2 (+ 169 %) until the end of the experiment (+ 41 %)

General information
Environmental effects on the availability of shallow and deep-water hake to the demersal trawl survey in Namibian waters

Studies on several demersal fish species have shown that variability in environmental conditions (including oxygen, temperature, wind and time of day) during trawling may result in differences in the catching efficiency of the trawl gear, which may cause differences in abundance estimations of stocks. This is even complicated in the case of the Cape hakes, Merluccius capensis and Merluccius paradoxus, which are known to perform diurnal vertical migrations possibly for spawning or in search of food. These abundance estimations, together with commercial catch-at-age and catch per unit effort (CPUE) indices, are key input data into the stock assessment model that guides scientific TAC (Total allowable catch) recommendations and other management measure advices, for the Namibian hake stocks. The overall aim of this PhD study was to investigate the effects of environmental conditions (close to the sea bed during trawls) on trawl survey abundance indices through an analysis of existing survey CPUE data, in order to gain a better understanding of the behavioral processes involved. This is crucial for improving the reliability of the hake stock assessment, and it is directly linked to the validation or modification of the current assessment practices. This PhD thesis is made up of a synthesis of four papers with varying objectives. Paper I attempted to study diel patterns in survey trawl catch rates for Namibian hakes using the solar zenith angle of the sun as a proxy for light level near the bottom. The main aim was to examine the effect of diel bias on catchability within and between years, and to explore the implications for survey abundance estimation and the consistency of the survey time-series. Results indicate that time of day has an effect on survey catch rates, mostly for M. capensis, where lower catch rates were obtained during the night, in shallower waters. The second objective (Paper II) was to study the effects of environmental variables and other covariates (temperature, oxygen, salinity as well as geometrical position, time of day and year) on survey trawl catch rates at different size groups (juvenile, small, medium and large) of the two hake species. Most of the years, the environmental data were collected independent of the fishing operations usually on few selected transects with limited spatial overlap between the CTD and the trawl stations. The results, however, indicate that the most important covariates affecting catch rates were bottom oxygen, bottom depth, geometrical position and bottom temperature. This is an indication that the size structure of the two species as observed in the survey may have been affected by the behavioral reactions in response to the environmental conditions. These results were confirmed by those of Paper III, which used data collected by a trawl-mounted instrument package, which allows the data collection simultaneously to the trawl operations. There is an indication that the use of a trawl-mounted instrument package can provide reliable information on environmental variables for an improved understanding and interpretation of survey catch rates and subsequent use in stock assessment models for provision of scientific advice on resources. Paper IV was an investigation into diel feeding ecology through food composition based on recent stomach samples in order to gain insight into biological explanation of the observed dynamics of survey catchability. Both hake species fed more on semi-demersal and demersal components of the prey field, which predominantly consisted of horse mackerel, jacoper and Atlantic green eye for M. capensis, and grenadier and cephalopods (squid and cuttlefish) for M. paradoxus. Other prey items were pelagic like krill and myctophids. Hake-on-hake predation was observed, with both hake species occurring as prey in the stomachs of M. capensis while only M. paradoxus occurred in the stomachs of M. paradoxus. This study was unfortunately limited by an insufficient number of samples and inadequate geographical coverage. It can, however, be used as a basis to plan future studies that should then also encompass the use of a gastric evacuation model to estimate the time of the day for ingestion of individual prey items and to quantify hake cannibalism from stomach content data. Results of the different papers are synthesized in relation to diagnosing environmental effects on survey catchability and then suggestions for time series adjustments is provided.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Pancic, M. (Intern), Köhler, E. (Intern), Paulsen, M. L. (Intern), Toxværd, K. U. (Intern), Le Floch, S. (Ekstern), Hjorth, M. (Ekstern), Nielsen, T. G. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskmøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017
Erfaringsopsamling med kirurgisk implantering af akustiske transmittere i sortmundet kutling

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Christoffersen, M. (Intern), Solokova, M. (Ekstern), Svendsen, J. C. (Intern), Deurs, M. V. (Intern), Behrens, J. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version.pdf
Publication: Research › Conference abstract for conference – Annual report year: 2017

Evaluating dispersal potential of an invasive fish by the use of aerobic scope and osmoregulation capacity
Non-indigenous species (NIS) can impact marine biodiversity and ecosystem structure and function. Once introduced into a new region, secondary dispersal is limited by the physiology of the organism in relation to the ambient environment and by complex interactions between a suite of ecological factors such as presence of predators, competitors, and parasites. Early prediction of dispersal potential and future 'area of impact' is challenging, but also a great asset in taking appropriate management actions. Aerobic scope (AS) in fish has been linked to various fitness-related parameters, and may be valuable in determining dispersal potential of aquatic invasive species in novel environments. Round goby, Neogobius melanostomus, one of the most wide-ranging invasive fish species in Europe and North America, currently thrives in brackish and fresh water, but its ability to survive in high salinity waters is unknown to date. We show that AS in round goby is reduced by 30% and blood plasma osmolality increased (indicating reduced capacity for osmoregulation) at salinities approaching oceanic conditions, following slow ramping (5 PSU per week) and subsequent long-term acclimation to salinities ranging between 0 and 30 PSU (8 days at final treatment salinities before blood plasma osmolality measurements, 12-20 additional days before respirometry). Survival was also reduced at the highest salinities yet a significant proportion (61%) of the fish survived at 30 PSU. Reduced physiological performance at the highest salinities may affect growth and competitive ability under oceanic conditions, but to what extent reduced AS and osmoregulatory capacity will slow the current 30 km year-1 rate of advance of the species through the steep salinity gradient from the brackish Baltic Sea and into the oceanic North Sea remains speculative. An unintended natural experiment is in progress to test whether the rate of advance slows down. At the current rate of advance the species will reach the oceanic North Sea by 2018/2019, therefore time for taking preventative action is short.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Behrens, J. W. (Intern), Deurs, M. V. (Intern), Christensen, E. A. F. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 12
Issue number: 4
Article number: e0176038
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
Evidence of local and regional freshening of Northeast Greenland coastal waters

The supply of freshwater to fjord systems in Greenland is increasing as a result of climate change-induced acceleration in ice sheet melt. However, insight into the marine implications of the melt water is impaired by lack of observations demonstrating the fate of freshwater along the Greenland coast and providing evaluation basis for ocean models. Here we present 13 years of summer measurements along a 120km transect in Young Sound, Northeast Greenland and show that sub-surface coastal waters are decreasing in salinity with an average rate of 0.12 ± 0.05 per year. This is the first observational evidence of a significant freshening on decadal scale of the waters surrounding the ice sheet and comes from a region where ice sheet melt has been less significant. It implies that ice sheet dynamics in Northeast Greenland could be of key importance as freshwater is retained in southward flowing coastal currents thus reducing density of water masses influencing major deep water formation areas in the Subarctic Atlantic Ocean. Ultimately, the observed freshening could have implications for the Atlantic meridional overturning circulation.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Aarhus University, ClimateLab, ASIAQ Greenland Survey, Greenland Institute of Natural Resources
Authors: Sejr, M. K. (Ekstern), Stedmon, C. A. (Intern), Bendtsen, J. (Ekstern), Abermann, J. (Ekstern), Juul-Pedersen, T. (Ekstern), Mortensen, J. (Ekstern), Rysgaard, S. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientific Reports
Extraction of microplastic from biota: recommended acidic digestion destroys common plastic polymers

The chemical digestion of tissue from marine biota for microplastic analysis is currently conducted following a variety of protocols published in scientific literature. Often there is a lack of information on whether and to which degree the applied chemicals are destructive to microplastic particles of various polymer types. In the present study we report that a digestion protocol recently recommended by ICES using nitric and perchloric acid has strong detrimental effects on several common plastic polymers, in particular polyamide and polyurethane and to a lesser degree acrylonitrile butadiene styrene, polymethyl methacrylate and polyvinylchloride. Raman spectroscopic measurements revealed changes in peak occurrence and intensity for several polymers that did not otherwise show visual macroscopic changes. We developed and tested an alkaline digestion protocol in order to preserve small microplastic particles while removing organic tissue material. We recommend this method for the development of guidelines for plastic microplastic monitoring in biota.
Fangstjournalen november 2017

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Oceans and Arctic
Authors: Skov, C. (Intern), Jansen, T. (Intern)
Pages: 56
Faster or slower: Has growth of juvenile eastern Baltic cod changed?

Feeding behavior and capture success of turbot Psetta maxima larvae during the transition from upright to tilted swimming position

Aquaculture production of high-quality marine fish larvae might be hampered by poor success in larval initiation of exogenous feeding or the lack of appropriate live feed in their first feeding period. The period of larval metamorphosis may further constrain the successful rearing of flatfish larvae. In order to ascertain changes in feeding during metamorphosis of flatfish, we here compared feeding behavior when larvae of turbot Psetta maxima were either swimming upright or tilted. Using video recordings, we compared the attack rate and prey capture success between flexion (12-13 days-post-hatch, stage 4b-4c) swimming predominantly in upright position and post-flexion (16-17 days-post-hatch, stage 5a-5b) larvae in tilted swimming mode. Both larval groups were fed on copepod nauplii and copepodites. Our results showed a capture success of <50% during the flexion stage, increasing to 73% in the post-flexion stage, and larvae were more successful when feeding on nauplii than when offered copepodite stages. An ontogenetic shift from intermittent to cruise swimming was observed during the metamorphosis concomitant with improved hunting skills. Thus larvae appeared to be able to successfully complete metamorphosis without compromising their feeding ability on copepod prey.
Feeding on dispersed vs. aggregated particles: The effect of zooplankton feeding behavior on vertical flux

Zooplankton feeding activity is hypothesized to attenuate the downward flux of elements in the ocean. We investigated whether the zooplankton community composition could influence the flux attenuation, due to the differences of feeding modes (feeding on dispersed vs. aggregated particles) and of metabolic rates. We fed 5 copepod species-three calanoid, one harpacticoid and one poecilamastoid-micronutrient food, in either dispersed or aggregated form and measured rates of respiration, fecal pellet production and egg production. Calanoid copepods were able to feed only on dispersed food; when their food was introduced as aggregates, their pellet production and respiration rates decreased to rates observed for starved individuals. In contrast, harpacticoids and the poecilamastoid copepod Oncaea spp. were able to feed only when the food was in the form of aggregates. The sum of copepod respiration, pellet production and egg production rates was equivalent to a daily minimum carbon demand of ca. 10% body weight(-1) for all non-feeding copepods; the carbon demand of calanoids feeding on dispersed food was 2-3 times greater, and the carbon demand of harpacticoids and...
Oncaea spp. feeding on aggregates was >7 times greater, than the resting rates. The zooplankton species composition combined with the type of available food strongly influences the calculated carbon demand of a copepod community, and thus also the attenuation of vertical carbon flux.

**General information**

State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Universite de Bretagne Occidentale
Authors: Koski, M. (Intern), Boutorh, J. (Ekstem), De La Rocha, C. L. (Ekstem)
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: P L o S One
Volume: 12
Issue number: 5
Article number: e0177958
ISSN (Print): 1932-6203
Ratings:
  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 1
  Web of Science (2017): Indexed yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 1
  Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 1
  Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
  ISI indexed (2011): ISI indexed no
  Web of Science (2011): Indexed yes
  BFI (2010): BFI-level 1
  Scopus rating (2010): SJR 2.631 SNIP 1.161
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 1
  Scopus rating (2009): SJR 2.473 SNIP 0.985
  Web of Science (2009): Indexed yes
  BFI (2008): BFI-level 1
  Scopus rating (2008): SJR 2.323 SNIP 0.96
  Web of Science (2008): Indexed yes
  Scopus rating (2007): SJR 1.289 SNIP 0.525
  Web of Science (2006): Indexed yes

Original language: English
MULTIDISCIPLINARY, COPEPOD ACARTIA-TONSA, OCEANS TWILIGHT ZONE, SUB-ARCTIC PACIFIC, MARINE SNOW, FECAL PELLETS, PLANKTONIC COPEPOD, RESPIRATION RATES, NORTHEAST PACIFIC, CALANOID COPEPODS, SEASONAL PATTERNS
Fertilization strategies for Sea Bass Dicentrarchus labrax (Linnaeus, 1758): effects of pre-incubation and duration of egg receptivity in seawater

Studying gamete biology can provide important information about a species fertilization strategy as well as their reproductive ecology. Currently, there is a lack of knowledge about how long sea bass Dicentrarchus labrax eggs can remain viable after being activated in seawater. The objectives of this study were to understand the effects of pre-incubation of fresh and overripe sea bass eggs in seawater and to determine the duration of egg receptivity. Pooled eggs (fresh and overripe) from four females were pre-incubated in seawater for 0 min (control), 0.5 min, 1 min, 3 min, 10 min and 30 min and then fertilized by pooled sperm from four males. The fresh eggs had a higher fertilization success than overripe eggs. Our results revealed a significant effect of pre-incubation time for both the fresh (P < 0.01) and overripe eggs (P < 0.01). Fertilization success of eggs significantly declined for both these treatments after 3 min of pre-incubation, which clearly indicates that sea bass eggs are able to be fertilized by sperm for up to 3 min after release into seawater. This study has particular importance for understanding fertilization strategies, reproductive potential, as well as reproductive ecology of sea bass

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of South Bohemia, IFREMER
Authors: Siddique, M. A. M. (Ekstern), Butts, I. (Intern), Linhart, O. (Ekstern), Macias, A. D. (Ekstern), Fauvel, C. (Ekstern)
Pages: 386–394
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Research
Volume: 48
Issue number: 2
ISSN (Print): 1355-557X
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 1.23 SJR 0.555 SNIP 0.926
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.79 SNIP 1.1 CiteScore 1.37
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.674 SNIP 0.943 CiteScore 1.23
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.815 SNIP 0.984 CiteScore 1.43
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.77 SNIP 0.958 CiteScore 1.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Fish egg predation by Baltic sprat and herring: do species characteristics and development stage matter?

Predation of eggs by clupeids has been identified as a major factor contributing to early life stage mortality of Baltic cod. We used data from ichthyoplankton sampling and clupeid stomach analyses to investigate whether eggs of other fish species are to a similar extent subject to predation, and how predation pressure differs between egg development stages. Cod, sprat and rockling eggs dominated in the ichthyoplankton fraction in herring and sprat diet, whereas flounder and dab eggs occurred only occasionally. In spring, cod eggs at advanced development stages were positively and sprat eggs generally negatively selected by both predators, while fish eggs were non-selectively consumed in summer. Predation is suggested to account for a large fraction of mortality of cod eggs at older stages, i.e. those eggs, which have survived the often detrimentally low oxygen concentration in and below the permanent halocline. The consumption rates of sprat eggs at all development stages relative to production rates were considerably lower compared to cod, suggesting that egg predation is of lesser importance for sprat recruitment.
Fishery and management of Greenland halibut in East Greenland

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Boje, J. (Intern), Gundersen, A. C. (Ekstern)
Publication date: 2017

Host publication information
Title of host publication: Sustainable bio-resources: Management, product development and raw material quality
Publisher: Orkana
ISBN (Print): 978-82-8104-290-2
Main Research Area: Technical/natural sciences
Publication: Research › peer-review › Book chapter – Annual report year: 2017

Fouragerings-strategi hos ådselædende slimål i Kattegat

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Arctic Section
Publication date: 2017
Event: Poster session presented at Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2017

Geister der Meere

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Jaspers, C. (Intern)
Pages: 21
Publication date: 2017

Publication information
Pages (from-to): 21
Newspaper: Die Welt
No.: 10. Juni
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2017

Optimal and sustainable management of fish resources cannot be ensured without a thorough understanding of the migration patterns and population (demographic stock) structure. Recent studies suggest that these aspects of the economically and ecologically important deepwater hake Merluccius paradoxus are not reflected in the current
assessment and management practices for the Benguela Current Large Marine Ecosystem. In this study, we compiled
data from multiple demersal trawl surveys from the entire distribution area and applied state-of-the-art geostatistical
population modelling (GeoPop) to estimate growth rate, mortality, and spatial and temporal distribution patterns of M.
paradoxus. The data and the model enabled us to follow temporal and spatial changes in the distribution and infer
movements from the recruitment/nursery areas, through the juvenile phase and the adults' migration to the spawning
areas outside/upstream of the nursery areas. The results indicated one primary recruitment/nursery area on the west
coast of South Africa and a secondary less-productive recruitment/nursery area on the south coast near Port Elizabeth.
Juveniles initially migrated away from the main recruitment area, followed by natal homing by larger individuals. This
pattern was highly consistent through the time-series of the study. This perception of a, primarily, panmictic population that
performs tranboundary migrations between Namibia and South Africa corresponds largely to the hypothesis and data
plots given in recent studies. We recommend that fisheries assessment, advice and management take into consideration
these aspects of the
distribution and population (stock) structure of M. paradoxus

**General information**

**State:** Published  
**Organisations:** National Institute of Aquatic Resources, Section for Oceans and Arctic, Department of Applied
Mathematics and Computer Science, Section for Marine Living Resources, Department for Agriculture, Forestry and
Fisheries, Ministry of Fisheries and Marine Resources  
**Authors:** Jansen, T. (Intern), Kristensen, K. (Intern), Fairweather, T. P. (Ekstern), Kainge, P. I. (Intern), Kathena, J. (Intern)
, Durholtz, M. (Ekstern), Beyer, J. (Intern), Thygesen, U. H. (Intern)
**Pages:** 349-361  
**Publication date:** 2017

**Publication information**

**Journal:** African Journal of Marine Science  
**Volume:** 39  
**Issue number:** 3  
**ISSN (Print):** 1814-232X

**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 1.36 SJR 0.661 SNIP 0.8  
**BFI (2015):** BFI-level 1  
**Scopus rating (2015):** SJR 0.696 SNIP 0.732 CiteScore 1.19  
**Web of Science (2015):** Indexed yes  
**BFI (2014):** BFI-level 1  
**Scopus rating (2014):** SJR 0.568 SNIP 0.879 CiteScore 1.15  
**BFI (2013):** BFI-level 1  
**Scopus rating (2013):** SJR 0.71 SNIP 0.749 CiteScore 1.25  
**ISI indexed (2013):** ISI indexed yes  
**Web of Science (2013):** Indexed yes  
**BFI (2012):** BFI-level 1  
**Scopus rating (2012):** SJR 0.529 SNIP 0.488 CiteScore 1.04  
**ISI indexed (2012):** ISI indexed yes  
**Web of Science (2012):** Indexed yes  
**BFI (2011):** BFI-level 1  
**Scopus rating (2011):** SJR 0.608 SNIP 0.611 CiteScore 1.15  
**ISI indexed (2011):** ISI indexed yes  
**BFI (2010):** BFI-level 1  
**Scopus rating (2010):** SJR 0.857 SNIP 0.611  
**BFI (2009):** BFI-level 1  
**Scopus rating (2009):** SJR 1.091 SNIP 0.836  
**BFI (2008):** BFI-level 1  
**Scopus rating (2008):** SJR 0.921 SNIP 0.62
Global biogeochemical provinces of the mesopelagic zone

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Oceans and Arctic, University of British Columbia, Sorbonne Universités, National Oceanography Centre, Nova Southeastern University, University of Cape Town, CNRS
Authors: Reygondeau, G. (Intern), Guidi, L. (Ekstern), Beaugrand, G. (Ekstern), Henson, S. A. (Ekstern), Koubbi, P. (Ekstern), MacKenzie, B. (Intern), Sutton, T. T. (Ekstern), Fioroni, M. (Ekstern), Maury, O. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Biogeography
ISSN (Print): 0305-0270
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 4.35
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.58
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.54
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.42
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.95
BFI (2010): BFI-level 2
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2007): Indexed yes
Original language: English
DOIs:
Global distribution of dissolved organic matter along the aquatic continuum: Across rivers, lakes and oceans

Based on an extensive literature survey containing more than 12,000 paired measurements of dissolved organic carbon (DOC) concentrations and absorption of chromophoric dissolved organic matter (CDOM) distributed over four continents and seven oceans, we described the global distribution and transformation of dissolved organic matter (DOM) along the aquatic continuum across rivers and lakes to oceans. A strong log-linear relationship ($R^2 = 0.92$) between DOC concentration and CDOM absorption at 350 nm was observed at a global scale, but was found to be ecosystem-dependent at local and regional scales. Our results reveal that as DOM is transported towards the oceans, the robustness of the observed relation decreases rapidly ($R^2$ from 0.94 to 0.44) indicating a gradual decoupling between DOC and CDOM. This likely reflects the decreased connectivity between the landscape and DOM along the aquatic continuum. To support this hypothesis, we used the DOC-specific UV absorbance (SUVA) to characterize the reactivity of the DOM pool which decreased from 4.9 to 1.7 m2 gC$^{-1}$ along the aquatic continuum. Across the continuum, a piecewise linear regression showed that the observed decrease of SUVA occurred more rapidly in freshwater ecosystems compared to marine water ecosystems, suggesting that the different degradation processes act preferentially on CDOM rather than carbon content. The observed change in the DOM characteristics along the aquatic continuum also suggests that the terrestrial DOM pool is gradually becoming less reactive, which has profound consequences on cycling of organic carbon in aquatic ecosystems.

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Section for Oceans and Arctic, Aarhus University
Authors: Massicotte, P. (Ekstern), Asmala, E. (Ekstern), Stedmon, C. (Intern), Markager, S. (Ekstern)
Pages: 180-191
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
Volume: 609
ISSN (Print): 0048-9697
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 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.674 SNIP 1.642 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.847 CiteScore 4.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.527 SNIP 1.759 CiteScore 3.73
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.773 SNIP 1.811 CiteScore 3.7
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.798 SNIP 1.681 CiteScore 3.61
Global patterns in marine predatory fish

Large teleost (bony) fish are a dominant group of predators in the oceans and constitute a major source of food and livelihood for humans. These species differ markedly in morphology and feeding habits across oceanic regions; large pelagic species such as tunas and billfish typically occur in the tropics, whereas demersal species of gadoids and flatfish dominate boreal and temperate regions. Despite their importance for fisheries and the structuring of marine ecosystems, the underlying factors determining the global distribution and productivity of these two groups of teleost predators are poorly known. Here, we show how latitudinal differences in predatory fish can essentially be explained by the inflow of energy at the base of the pelagic and benthic food chain. A low productive benthic energy pathway favours large pelagic species, whereas equal productivities support large demersal generalists that outcompete the pelagic specialists. Our findings demonstrate the vulnerability of large teleost predators to ecosystem-wide changes in energy flows and hence provide key insight to predict the responses of these important marine resources under global change.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, University of Tasmania
Authors: van Denderen, P. D. (Intern), Lindegren, M. (Intern), MacKenzie, B. (Intern), Watson, R. (Ekstern), Andersen, K. H. (Intern)
Heterotrophic nanoflagellate grazing facilitates subarctic Atlantic bloom development

The subarctic Atlantic phytoplankton spring bloom is one of the largest biological features of the ocean; however, processes initiating the bloom are still not well understood. We hypothesize that the microbial grazing food chain plays an important role in creating a pre-bloom condition with top-down control of small-sized phytoplankton, thus paving the way for a diatom-dominated spring bloom. To assess the trophic role of protist grazers during the winter to spring transition, 3 experiments were performed using size-fractionated surface water from the Iceland Basin (March−April 2012). These experiments demonstrated heterotrophic nanoflagellates (HNF) grazing of picophytoplankton to be a key pathway, even though these are rarely considered as important phytoplankton grazers in high-latitude systems. The growth rate of HNF was significantly correlated to the biomass of picophytoplankton and was substantially higher than the growth of the larger microzooplankton (MZP), i.e. ciliates and dinoflagellates. During the first experiment, small phytoplankton dominated and overall protist grazing (HNF + MZP) was low. In the later experiments, MZP grazing on HNF became evident; however, MZP were not able to control the community of larger phytoplankton (>10 μm), which became more abundant. Our experiments thus support the hypothesis that pre-bloom conditions promote a build-up of large phytoplankton, i.e. diatoms. We found that the high growth rates of HNF together with the relaxed MZP grazing pressure allow HNF to respond rapidly to the early primary production by picophytoplankton and maintain a strong top-down control on these. We suggest that this succession may be an important mechanism that allows large diatoms, rather than picophytoplankton, to become the dominant primary producers during the subarctic Atlantic spring bloom.
How old are you—Evaluation of age reading methods for the invasive round goby (Neogobius melanostomus, Pallas 1814)

In the Baltic, the first observation of the round goby (Neogobius melanostomus, Pallas 1814) was made in 1990. Within the past decade the species became invasive and spread rapidly throughout the Baltic Sea. Studies about the fishes potential impacts on resident species promote the need for an increasing knowledge of their basic stock structures such as growth rates, longevity and mortality, which all rely on accurate estimates of age. Former studies on the round goby have used several different age reading techniques. In this study, we compared three standard otolith preparation methods for ageing and present the best procedure for the invasive round goby. The results showed significant differences
in age estimates of the same fish between the different preparation methods and between readers. The estimation of the first annulus, the first year, was the most problematic. The overall agreement was lowest when reading the whole otoliths while the best performance was achieved with sectioned and stained preparation method. Depending on method used the growth estimates also differed. The results question comparability between previous studies and highlight the importance of harmonised aging procedures for the round goby for obtaining correct estimates of population parameters such as growth rate, age at maturity, and longevity

**General information**

State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Swedish University of Agricultural Sciences, Thünen Institute of Baltic Sea Fisheries, Institute of Food Safety Animal Health and Environment BIOR, Swedish University of Agricultural Sciences, University of Gdansk, Finnish Environment Institute
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Applied Ichthyology
ISSN (Print): 0175-8659
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 0.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.99
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs:
10.1111/jai.13596
Publication: Research - peer-review › Journal article – Annual report year: 2017
Hvordan undervandsdroner og robotter kan hjælpe med at monitere det arktiske marine miljø

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Edelvang, K. (Intern)
Pages: 254-264
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Tidsskriftet Grønland
Issue number: 3
ISSN (Print): 0017-4556
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: Danish
Links:
https://issuu.com/greenland/docs/tg-3-2017-gratis-artikel
Publication: Research › Journal article – Annual report year: 2017

Identifying salmon lice transmission characteristics between Faroese salmon farms
Sea lice infestations are an increasing challenge in the ever-growing salmon aquaculture sector and cause large economic losses. The high salmon production in a small area creates a perfect habitat for parasites. Knowledge of how salmon lice planktonic larvae disperse and spread the infection between farms is of vital importance in developing treatment management plans to combat salmon lice infestations. Using a particle tracking model forced by tidal currents, we show that Faroese aquaculture farms form a complex network. In some cases as high as 10% of infectious salmon lice released at one farm site enter a neighboring fjord containing another farm site. Farms were characterized as emitters, receivers or isolated, and we could identify two clusters of farms that were largely isolated from each other. The farm characteristics are a valuable input for the development of management plans for the entire Faroese salmon industry.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Oceans and Arctic, Aquaculture Research Station of the Faroes
Authors: Kragesteen, T. J. (Intern), Simonsen, K. (Ekstern), Visser, A. (Intern), Andersen, K. H. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture Environment Interactions
ISSN (Print): 1869-215X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Increased tolerance to oil exposure by the cosmopolitan marine copepod Acartia tonsa

Oil contamination is an environmental hazard to marine ecosystems, but marine organism tolerance to oil after many generations of exposure remains poorly known. We studied the effects of transgenerational oil exposure on fitness-related traits in a cosmopolitan neritic copepod, Acartia tonsa. Copepods were exposed to an oil compound, the PAH pyrene, at concentrations of 1, 10, 100 and 100+ (the saturated pyrene concentration in seawater) nM over two generations and measured survival, sex ratio, size at maturity, grazing rate and reproductive success. Exposure to the pyrene concentration of 100+ nM resulted in 100% mortality before adulthood in the first generation. At the pyrene concentration of 100 nM, pyrene reduced grazing rate, increased mortality, reduced the size of females and caused lower egg production and hatching success. Importantly, we found strong evidence for increased tolerance to pyrene exposure in the second generation: the reduction in size at maturity of females was less pronounced in the second generation and survival, egg production and hatching success were recovered to control levels in the second generation. The increased tolerance of copepods to oil contamination may dampen the direct ecological consequences of a coastal oil spill, but it raises the concern whether a larger fraction of oil components accumulated in survived copepods, may be transferred up the food web.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Krause, K. E. (Ekstern), Dinh, K. V. (Intern), Nielsen, T. G. (Intern)
Pages: 87-94
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
Volume: 607-608
ISSN (Print): 0048-9697
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
Influence of swimming behavior of copepod nauplii on feeding of larval turbot (Scophthalmus maximus)

Feeding in larval fish is influenced by a range of factors and among these are the morphological and behavioral characteristics of their prey. We investigated the influence of the swimming behavior of two species of calanoid copepods, Acartia tonsa and Temora longicornis, on larval turbot feeding. The nauplii of these species represent two contrasting swimming behaviors: A. tonsa is a jump-sink type swimmer, while T. longicornis is a cruise swimming type. Three replicates of ten larvae aged 7 and 9 days post hatch (DPH) were observed feeding on one of the two copepod species using a 2-dimensional video setup. The results showed that the duration of aiming postures by turbot larvae was 2.3 times higher when turbot larvae approached T. longicornis as compared to A. tonsa nauplii, indicating that larvae can more easily position themselves, preparing for attack, when the prey is of the jump-sink type. The attack speed of turbot larvae feeding on A. tonsa nauplii decreased slightly from DPH 7 to DPH 9, whereas it increased when attacking T. longicornis nauplii. Capture success rate by turbot larvae feeding on A. tonsa was 58% and slightly higher, but not significantly different to capture success rate when feeding on T. longicornis (54%). We conclude that the differences between behavior and other characteristics of these prey species have only minor effect on larval fish feeding, suggesting that copepods species for live feed should be selected according to their ease to culture more than to their species-specific characteristics.

Influence of swimming behavior of copepod nauplii on feeding of larval turbot (Scophthalmus maximus)

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Insight into understanding water mass circulation and origins in the central Arctic Ocean using dissolved organic matter as a tracer

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Woods Hole Oceanographic Institution, Alfred Wegener Institute for Polar and Marine Research, Norwegian Polar Institute
Authors: Stedmon, C. (Intern), Reader, H. (Intern), Laney, S. (Ekstern), Rabe, B. (Ekstern), Granskog, M. A. (Ekstern)
Publication date: 2017
Event: Abstract from Dansk Havforskmøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences

Lessons from the first generation of marine ecological forecast products

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University of California, Santa Cruz, Dalhousie University, Wageningen IMARES, NOAA, Woods Hole Oceanographic Institution, Max Planck Institute for Meteorology, Gulf of Maine Research Institute, Institute of Marine Research, AZTI Technalia, CSIRO Marine and Atmospheric Research
Publication date: 2017
Main Research Area: Technical/natural sciences
Linking climate change to community-level impacts on copepods via a new, trait-based model: Life-history and metabolic mechanisms compared

A new, trait-based copepod model ("Coltrane": Copepod Life-history Traits and Adaptation to Novel Environments) has been developed, drawing on past work on both optimal annual routines and trait-based plankton metacommunity models, in order to evaluate climate impacts on copepods via 1) phenology and life history and 2) temperature and energy budgets in a unified framework. In an idealized global-scale testbed, the model correctly predicts life strategies in large Calanus spp. ranging from multiple generations per year to multiple years per generation. In a Bering Sea testbed, the model replicates the dramatic variability in the abundance of C. glacialis/marshallae observed between warm and cold years of the 2000s, and indicates (consistent with recent field studies) that sea ice-linked prey phenology is a more important driver than temperature per se. In a Disko Bay, West Greenland testbed, the model predicts the viability of a spectrum of large-copepod strategies from income breeders with a adult size ~100 μgC reproducing once per year through capital breeders with an adult size > 1000 μgC with a multiple-year generation length. This spectrum corresponds closely to the observed life histories and physiology of local populations of C. finmarchicus, C. glacialis, and C. hyperboreus. Furthermore, the model replicates the observed range of stored lipid content of these copepod populations (30–60%, C. finmarchicus–C. hyperboreus), suggesting a means for linking changes in temperature and primary production to the energy content as well as size structure of the copepod community.
Linking spawning ground extent to environmental factors - patterns and dispersal during the egg phase of four North Sea fishes

Previous studies have shown that four commercially important demersal species, namely cod (Gadus morhua), haddock (Melanogrammus aeglefinus), whiting (Merlangius merlangus) and plaice (Pleuronectes platessa) spawn in distinct areas across the North Sea. Based on two comprehensive ichthyoplankton surveys in 2004 and 2009, the present study uses Generalized Additive Mixed Models (GAMMs) to delimit these spawning grounds using the distribution of recently spawned eggs, investigates their relationship to specific environmental conditions and examines egg dispersal during their development. Results indicate that presence/absence of early stage eggs is more related to temporal and topographic variables, while egg densities are closely linked with hydrography. Egg distribution patterns were relatively consistent during development and only changed near hatching. Compared to historic observations, the location of the spawning grounds appeared stable on the broad scale but centres of egg abundance varied between the surveyed years. Potential effects of long-term climate change and anthropogenic short-term disturbances, such as seismic surveys, on fish reproduction are discussed, pointing out the demand for multi-species studies on these issues.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Marine Ecology and Oceanography, IFREMER, Wageningen IMARES, Scottish Association for Marine Science, Institute of Marine Research, Marine Scotland Science
Authors: Höffle, H. (Intern), van Damme, C. J. G. (Ekstern), Fox, C. J. (Ekstern), Lelièvre, S. (Ekstern), Loots, C. (Ekstern), Nash, R. D. (Ekstern), Yaz, S. (Ekstern), Wright, P. J. (Ekstern), Munk, P. (Intern)
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 decisions more resilient to climate variability and help sustain valuable resources. Concerted dialog between scientists, LMR managers and industry is essential to realizing this potential.
Mapping sediments in the Greenlandic EEZ

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

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
Publication: Research › Conference abstract for conference – Annual report year: 2017

Marine food webs in a changing ocean: Are we ignoring important plankton components?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Jaspers, C. (Intern)
Publication date: 2017
Event: Abstract from IHF - Special seminar, Hamburg, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Marine snow particles in the oligotrophic Sargasso Sea as analysed by amplicon sequencing: composition and linkage to the plankton

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Danish Shellfish Centre, Københavns Universitet, Aarhus University
Authors: Lundgren, R. B. C. (Ekstern), Ayala, D. J. (Intern), Jaspers, C. (Intern), Traving, S. J. (Forskerdatabase), Lombard, F. (Ekstern), Grossart, H. (Ekstern), Munk, P. (Intern), Nielsen, T. G. (Intern), Riemann, L. (Ekstern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Maturity of Greenland Halibut (Reinhardtius hippoglossoides W.) in East Greenland, Faroe Islands and Hatton Bank area.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Gundersen, A. C. (Ekstern), Larssen, W. M. E. (Ekstern), Tuene, S. (Ekstern), Boje, J. (Intern), Ofstad, L. H. (Ekstern)
Publication date: 2017

Host publication information
Title of host publication: Sustainable bio-resources: Management, product development and raw material quality
Publisher: Orkana
Metagenomic insights into zooplankton-associated bacterial communities

Zooplankton and microbes play a key role in the ocean's biological cycles by releasing and consuming copious amounts of particulate and dissolved organic matter. Additionally, zooplankton provide a complex microhabitat rich in organic and inorganic nutrients in which bacteria thrive. In this study, we assessed the phylogenetic composition and metabolic potential of microbial communities associated with crustacean zooplankton species collected in the North Atlantic. Using Illumina sequencing of the 16S rRNA gene we found significant differences between the microbial communities associated with zooplankton and those inhabiting the surrounding seawater. Metagenomic analysis of the zooplankton-associated microbial community revealed a highly specialized bacterial community able to exploit zooplankton as microhabitat and thus, mediating biogeochemical processes generally underrepresented in the open ocean. The zooplankton-associated bacterial community is able to colonize the zooplankton's internal and external surfaces by using a large set of adhesion mechanisms and to metabolize complex organic compounds released or exuded by the zooplankton such as chitin, taurine and other complex molecules. Moreover, the high number of genes involved in iron and phosphorus metabolisms in the zooplankton-associated microbiome suggests that this zooplankton-associated bacterial community mediates specific biogeochemical processes (through the proliferation of specific taxa) that are generally underrepresented in the ambient waters. This article is protected by copyright. All rights reserved.
Microbiota – host interactions: Linking microbiota associations to fitness in a basal metazoan

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Jaspers, C. (Intern), Weiland-Bräuer, N. (Ekstern), Schmitz-Streit, R. (Ekstern), Reusch, T. (Ekstern)
Publication date: 2017
Event: Poster session presented at Metaorganism Seminar, Kiel, Germany.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2017

Migration patterns of the Faroe Plateau cod (Gadus morhua, L.) revealed by data storage tags

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Faroe Marine Research Institute, Danish Meteorological Institute, University of the Faroe Islands
Authors: Maj Ottosen, K. (Intern), Pedersen, M. W. (Intern), Eliassen, S. K. (Ekstern), Steingrund, P. (Ekstern), Magnussen, E. (Ekstern), Rasmussen, T. A. S. (Ekstern)
Pages: 37-45
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication information
Journal: Fisheries Research
Volume: 195
ISSN (Print): 0165-7836
Ratings:
Modelling Jellyfish in marine ecosystems

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Schnedler-Meyer, N. A. (Intern), Kiørboe, T. (Intern), Mariani, P. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Multi-decadal cod reproductive habitat variability in the Baltic Sea and its impact on reproductive success

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Plikshs, M. (Ekstern), MacKenzie, B. (Intern), Müller-Karulis, B. (Ekstern)
Publication date: 2017
Event: Abstract from ICES Annual Science Conference 2017, Fort Lauderdale, United States.
Main Research Area: Technical/natural sciences

No increase in marine microplastic concentration over the last three decades - A case study from the Baltic Sea

Microplastic is considered a potential threat to marine life as it is ingested by a wide variety of species. Most studies on microplastic ingestion are short-term investigations and little is currently known about how this potential threat has developed over the last decades where global plastic production has increased exponentially. Here we present the first long-term study on microplastic in the marine environment, covering three decades from 1987 to 2015, based on a unique sample set originally collected and conserved for food web studies. We investigated the microplastic concentration in plankton samples and in digestive tracts of two economically and ecologically important planktovorous forage fish species, Atlantic herring (Clupea harengus) and European sprat (Sprattus sprattus), in the Baltic Sea, an ecosystem which is under high anthropogenic pressure and has undergone considerable changes over the past decades. Surprisingly, neither the concentration of microplastic in the plankton samples nor in the digestive tracts changed significantly over the investigated time period. Average microplastic concentration in the plankton samples was 0.21±0.15particles m⁻³. Of 814 fish examined, 20% contained plastic particles, of which 95% were characterized as microplastic.

General information
State: Accepted/In press
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic, University of Copenhagen, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Beer, S. (Ekstern), Garm, A. (Ekstern), Huwer, B. (Intern), Dierking, J. (Ekstern), Nielsen, T. G. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
ISSN (Print): 0048-9697
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 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
No increase in marine microplastic concentration over the last three decades – A case study from the Baltic Sea

General information
State: Published
Organic Fe speciation in the Eurasian Basins of the Arctic Ocean and its relation to terrestrial DOM

The bio-essential trace metal iron (Fe) has poor inorganic solubility in seawater, and therefore dissolution is dependent on organic complexation. The Arctic Ocean is subject to strong terrestrial influences which contribute to organic solubility of Fe, particularly in the surface. These influences are subject to rapid changes in the catchments of the main contributing rivers. Here we report concentrations and binding strengths of Fe-binding organic ligands in relation to spectral properties of Dissolved Organic Matter (DOM) and concentrations of humic substances. Full-depth profiles of Fe and Fe-binding organic ligands were measured for 11 stations, good agreement to previous studies was found with ligand concentrations between 0.9 and 2.2. equivalent. nM of Fe (Eq.nM. Fe) at depths. >. 200. m. We found nutrient-like profiles of Fe in the Atlantic-influenced Nansen basin, surface enrichment in the surface over the Amundsen and Makarov basins and scavenging effects in the deep Makarov basin. A highly detailed surface transect consisting of two sections crossing the surface flow from the Siberian continental shelf to the Fram Strait, the TransPolar Drift (TPD), clearly indicates the flow path of the riverine contribution to Fe and Fe-binding organic ligands with concentrations of 0.7 to 4.4. nM and 1.6 to 4.1. Eq.nM. Fe, respectively. This is on average 4.5 times higher in DFe and 1.7 times higher in Fe-binding organic ligands than outside the TPD flow path. Conditional binding strengths of ligands in the entire dataset were remarkably similar at 11.45. , 12.63. Increased organic Fe-binding organic ligand concentrations were evident in the Arctic Ocean surface. To better identify the organic substances responsible for Fe complexation in the Arctic Ocean, diverse analytical approaches and a standard other than Suwannee River Fulvic Acid are recommended.
Overview of coralline red algal crusts and rhodolith beds (Corallinales, Rhodophyta) and their possible ecological importance in Greenland

Coralline red algae are a globally distributed and abundant group of shallow marine benthic calcifiers. They can form important ecosystems that provide a three-dimensional habitat to a large variety of marine organisms. While the study of coralline red algae has traditionally been focused on warm-water habitats, numerous recent reports have now described widespread coralline red algal ecosystems from high-latitude regions, particularly in the Northern Hemisphere. In fact, it is becoming increasingly evident that coralline red algae are likely the dominant marine calcifying organisms on the seafloor of the Arctic and subarctic photic zone. This article gives a first overview of the distribution of coralline red algal crusts and rhodolith (free-living coralline red algal nodules) grounds in Greenland and the first report of rhodoliths in East Greenland. Museum data and recent sampling information have been compiled to develop a distribution map of coralline genera and rhodolith communities. The depth range of coralline red algae in Greenland has been extended by 27 m, from 50 to 77 m depth. In addition, rhodoliths of the normally crust-forming species Clathromorphum compactum are described for the first time from a sheltered Greenland fjord. Based on the data compiled here, it becomes clear that rhodolith communities are a widespread feature of the Greenland shallow shelf areas. Gaining a better understanding of the distribution of these hitherto poorly understood high-latitude ecosystems is essential due to their function as spawning areas and nursery grounds for commercially important fish and invertebrates.
Passive vs Active Knowledge Transfer: boosting grant proposal impact

Research funders are increasingly concerned with measurable socio-economic impact of investment in research, and on increasingly shorter timescales. Innovation, and “open innovation” are the policy priorities of the moment and optimising the flow of ideas along the lab-2-market spectrum is essential for re-use of results, fuelling open innovation, and boosting socio-economic impact or public funded research.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Research Secretariat, Section for Oceans and Arctic, Section for Marine Ecology and Oceanography, AquaTT
Authors: Grigorov, I. (Intern), Bayliss-Brown, G. (Ekstern), Murphy, D. (Ekstern), Thøgersen, T. L. (Intern), Mariani, P. (Intern)
Number of pages: 1
Publication date: 2017
Conference: EGU General Assembly 2017, Vienna, Austria, 24/04/2017 - 24/04/2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Geophysical Research Abstracts
Volume: 19
Article number: 18355-2
ISSN (Print): 1607-7962
Ratings:
- Web of Science (2014): Indexed yes
- ISI indexed (2013): ISI indexed no
- Web of Science (2013): Indexed yes
- ISI indexed (2012): ISI indexed no
- Web of Science (2012): Indexed yes
- ISI indexed (2011): ISI indexed no
- Web of Science (2011): Indexed yes
- BFI (2009): BFI-level 1
Original language: English
Electronic versions:
- EGU2017_18355_2.pdf
Paternal identity impacts embryonic development for two species of freshwater fish

Paternal, compared to maternal, contributions were believed to have only a limited influence on embryonic development and larval fitness traits in fishes. Therefore, the perspective of male influence on early life history traits has come under scrutiny. This study was conducted to determine parental effects on the rate of eyed embryos of Ide, Leuciscus idus and Northern pike, Esox lucius. Five sires and five dams from each species were crossed using a quantitative genetic breeding design and the resulting 25 sib groups of each species were reared to the embryonic eyed stage. We then partition variation in embryonic phenotypic performance to maternal, paternal, and parental interactions using the Restricted Maximum Likelihood (REML) model. Results showed that paternal, maternal, and the paternal × maternal interaction terms were highly significant for both species; clearly demonstrating that certain family combinations were more compatible than others. Paternal effects explained 20.24% of the total variance, which was 2-fold higher than the maternal effects (10.73%) in Ide, while paternal effects explained 18.9% of the total variance, which was 15-fold higher than the maternal effects (1.3%) in Northern pike. Together, these results indicate that male effects are of major importance during embryonic development for these species. Furthermore, this study demonstrates that genetic compatibility between sires and dams plays an important role and needs to be taken into consideration for reproduction of these and likely other economically important fish species.
PIT-tagging method for small fishes: A case study using sandeel (Ammodytes tobianus)

Passive integrated transponder (PIT) tags are commonly used to assess fish movement for use in fisheries management. Here, we investigated physiological and behavioral effects of tagging on sandeels (Ammodytes tobianus) using PIT tags constituting 2.1 ± 0.9% of their body weight. Swimming stamina (RSS), calculated as time spent swimming against the current relative to total swimming time, and tail beat frequency were compared between tagged and untagged fish as was blood hematocrit levels at 7, 14, and 42 d post-tagging. Survival and tag retention were also documented at 14, 42, and 84 d (via x-rays and dissections). RSS was not different between tagged and untagged fish with means (± SD) of 60 ± 9% and 61 ± 12%. Tail beat frequency was not different between tagged and untagged fish at 2.8 ± 0.3 and 3.0 ± 0.4 beats s⁻¹ for tagged and untagged fish, respectively. Likewise, hematocrit was not affected by tagging and levels were between 21–26% for both groups. Survival rates were high and did not differ between groups (96% for tagged and 99% untagged fish). Tag retention was 100%. X-rays and dissections did not reveal any signs of tag movement at 14–84 d, and there was no difference between relative positions of the tags. None of the tags were encapsulated in the body cavity after 14 d, whereas 40 and 56% of the tags were encapsulated in a thin tissue membrane between the intestine and kidney after 42 and 84 d, respectively. After 14 d all incisions had healed with only minor or no signs of the tag insertion site. Collectively, these data provide substantial evidence for the possibility of conducting large-scale tagging studies on this species in the field.
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.938 SNIP 1.142
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.022 SNIP 1.075
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.025 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.906 SNIP 1.134
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.944 SNIP 1.023
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.076 SNIP 1.314
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.299 SNIP 1.22
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.934 SNIP 0.891
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.611 SNIP 0.836
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.546 SNIP 0.865
Original language: English
DOIs:
Source: FindIt
Source-ID: 2357707936
Publication: Research - peer-review › Journal article – 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), Kiorboe, 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

Potentiale for nyt og tættere nordisk samarbejde i Højarktis – SVALGREEN

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University Centre in Svalbard, Aarhus University, University of Copenhagen
Authors: Edelvang, K. (Intern), Christiansen, H. H. (Ekstern), Forchhammer, M. (Ekstern), Skov, H. (Ekstern), Priemé, A. (Ekstern)
Pages: 340-344
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Tidsskriftet Grønland
ISSN (Print): 0017-4556
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: Danish
Publication: Research - peer-review › Journal article – Annual report year: 2018

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
Preliminary results: Deep sea oil spill in the Arctic – effects of pyrene on overwintering Calanus copepods

Polar Oceans are some of the least impacted by human activities due to seasonal or permanent sea ice that limits human access. Projections of future polar ice loss suggest that the impact will increase substantially because of changing environmental conditions and pollution. Arctic Oceans hold a substantial amount of the world's remaining oil and gas reserves, but exploration is extremely technically challenging. To enable proper risk assessment, it is crucial to understand how oil spills can impact Arctic marine ecosystems. During polar night, biological processes in Arctic marine ecosystems are conventionally believed to slow down or cease. Indeed, several marine species have overwintering strategies, such as the Calanus copepods that overwinters for 8-10 months at depths of 200-2000 m and migrate to the productive surface layers to feed on the short Arctic bloom. We conducted a winter experiment with two species of Arctic copepod to study the impact of long term exposure to oil during polar night. We used the ecologically important Calanus hyperboreus (winter breeder) and C. glacialis (spring breeder) as tests species, and quantified effects on the fitness-related traits mortality, egg production, grazing and egg hatching. Females were incubated in bottles with seawater and the oil compound pyrene (in concentrations of 0.1, 1, 10, 100 and 100+ nM) from December to March. They were transferred to clean seawater and fed in excess for 2-3 weeks until termination of the experiment. Mortality was checked daily, and egg and fecal pellets were collected within 24 h of production. Egg hatching success was determined at the beginning, middle and end of the experiment. Preliminary results indicate that C. hyperboreus exhibit a delayed response to pyrene through reduced feeding after transfer to clean seawater. Effects diminish over time, and feeding rate is recovered after 14 days without exposure to oil. Both egg production and feeding rate of C. glacialis is impacted by exposure in a concentration dependent manner after transfer to clean seawater. These findings suggest, that long term oil exposure during overwintering does indeed impact both Calanus species, and that C. hyperboreus seem to be more robust than the smaller C. glacialis. While effects on C. glacialis may have implications for stock recruitment within the season, potential effects on C. hyperboreus are likely delayed until next season. Negative effects on copepods may potentially affect the entire food chain and have severe ecosystem effects.
Productivity and recovery of forage fish under climate change and fishing: North Sea sandeel as a case study

Forage fish occupy a central position in marine food-webs worldwide by mediating the transfer of energy and organic matter from lower to higher trophic levels. The lesser sandeel (Ammodytes marinus) is one of the ecologically and economically most important forage fish species in the North-east Atlantic, acting as a key prey for predatory fish and seabirds, as well as supporting a large commercial fishery. In this case study, we investigate the underlying factors affecting recruitment and how these in turn affect productivity of the North Sea sandeel using long-term data and modelling. Our results demonstrate how sandeel productivity in the central North Sea (Dogger Bank) depends on a combination of external and internal regulatory factors, including fishing and climate effects, as well as density dependence and food availability of the preferred zooplankton prey (Calanus finmarchicus and Temora longicornis). Furthermore, our model scenarios suggest that while fishing largely contributed to the abrupt stock decline during the late 1990s and the following period of low biomass, a complete recovery of the stock to the highly productive levels of the early 1980s would only be possible through changes in the surrounding ecosystem, involving lower temperatures and improved feeding conditions. To that end, we stress the need for ecosystem-based management accounting for multiple internal and external factors occurring within the broader context of the ecosystem in which forage fish species, such as sandeel, play an important and integral part.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources, Section for Oceans and Arctic, Section for Ecosystem based Marine Management, International Council for the Exploration of the Sea
Authors: Lindegren, M. (Intern), van Deurs, M. (Intern), MacKenzie, B. (Intern), Worsøe Clausen, L. (Intern), Christensen, A. (Intern), Rindorf, A. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
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
Quantifying predation on Baltic cod early life stages
Predation on cod (Gadus morhua) eggs by sprat (Sprattus sprattus) and herring (Clupea harengus) is known to be one of the processes influencing reproductive success of the eastern Baltic cod and has been reported to have contributed to lack of recovery of the stock in the 1990s. This study quantifies the predation on cod eggs in the Bornholm Basin, the major spawning area of cod in the central Baltic Sea, in the 1990s in comparison with the second half of the 2000s. The analyses involve estimating daily consumption rates of predator populations, which are then compared with corresponding daily egg production rates. As a methodological advancement compared with earlier studies, spatially resolved information on predator distribution and abundance is utilized in quantifying predator stock size. This resulted in more realistic consumption estimates in relation to overall egg production compared with earlier studies that consistently overestimated predation pressure by clupeids. Our results suggest a generally lower predation pressure on cod eggs in the mid- to late 2000s, due to a combination of reduced predator abundance and lower daily rations by individual predators.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Institute Management, Thünen Institute of Sea Fisheries, Thünen Institute of Baltic Sea Fisheries
Authors: Neumann, V. (Intern), Schaber, M. (Ekstern), Eero, M. (Intern), Böttcher, U. (Ekstern), Köster, F. (Intern)
Pages: 833-842
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 74
Issue number: 6
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
Registrering af fangster i de danske kystområder med standardredskaber. Nøglefiskerrapport 2014-2016

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Section for Oceans and Arctic
Number of pages: 134
Publication date: 2017

Publication information
Publisher: Institut for Akvatiske Ressourcer, Danmarks Tekniske Universitet
ISBN (Print): 978-87-7481-239-5
ISBN (Electronic): 78-87-7481-238-8
Original language: English

Series: DTU Aqua-rapport
Number: 320-2017
Main Research Area: Technical/natural sciences
Electronic versions:

Publishers version
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forsknings rapporter_siden_2008
Publication: Research › Report – Annual report year: 2017

Sæler og fisk som naturlige måleplatforme

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Boje, J. (Intern)
Pages: 270-276
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Tidsskriftet Grønland
Issue number: 3
ISSN (Print): 0017-4556
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: Danish
Links:
https://issuu.com/greenland/docs/tg-3-2017-gratis-artikel
Publication: Research › Journal article – Annual report year: 2017
Scavenging strategies of hagfish in the Kattegat

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Arctic Section
Publication date: 2017
Event: Poster session presented at Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2017

Seasonal succession in zooplankton feeding traits reveals trophic trait coupling
The seasonal forcing of pelagic communities invokes a succession of the dominant phytoplankton and zooplankton species. Here, we characterize the seasonal succession of the plankton traits and their interactions using observations and model simulations of the plankton community in the western English Channel. We focus on activity traits that characterize the defensive and feeding abilities of zooplankton and distinguish between low risk, low return ambush feeders and high risk, high return feeding-current feeders. While the phytoplankton succession depends on traits related to nutrient acquisition and photosynthesis, it also depends on grazing which couples feeding and motility traits across trophic guilds. Despite interannual variations in the species dominating the protist plankton community, the seasonal trait distribution reveals robust and repeatable seasonal patterns, changing between non-motile cells flourishing in spring and motile community dominating during summer. The zooplankton community is dominated by active feeding-current feeders with peak biomass in the late spring declining during summer. The model reveals how zooplankton grazing reinforces protist plankton seasonal succession and shows how the physical environment controls the vertical structure of plankton communities, where ambush feeders exhibit a preference for greater depths during summer. We characterize the seasonal succession as trophic trait coupling and conjecture that this coupling leads to a trophic trait cascade where successive trophic levels alternate in their expression of activity traits further up in the food chain.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Kenitz, K. (Intern), Visser, A. (Intern), Mariani, P. (Intern), Andersen, K. H. (Intern)
Pages: 1184-1197
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 62
Issue number: 3
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Seasonal succession in zooplankton feeding traits reveals trophic trait coupling

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Kenitz, K. (Intern), Visser, A. (Intern), Mariani, P. (Intern), Andersen, K. H. (Intern)
Publication date: 2017
Event: Abstract from Dansk Havforskermøde, Helsingør, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017
Selection for life-history traits to maximize population growth in an invasive marine species

Species establishing outside their natural range, negatively impacting local ecosystems, are of increasing global concern. They often display life-history features characteristic for r-selected populations with fast growth and high reproduction rates to achieve positive population growth rates (r) in invaded habitats. Here, we demonstrate substantially earlier maturation at a 2 orders of magnitude lower body mass at first reproduction in invasive compared to native populations of the comb jelly Mnemiopsis leidyi. Empirical results are corroborated by a theoretical model for competing life-history traits that predicts maturation at the smallest possible size to optimize r, while individual lifetime reproductive success (R0), optimized in native populations, is near constant over a large range of intermediate maturation sizes. We suggest that high variability in reproductive tactics in native populations is an underappreciated determinant of invasiveness, acting as substrate upon which selection can act during the invasion process.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Danish Shellfish Centre, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Jaspers, C. (Intern), Marty, L. (Intern), Kiørboe, T. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Change Biology
ISSN (Print): 1354-1013
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 8.75 SJR 4.768 SNIP 2.615
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 5.239 SNIP 2.585 CiteScore 8.48
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.636 SNIP 2.693 CiteScore 8.33
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.624 SNIP 2.655 CiteScore 8.4
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.228 SNIP 2.388 CiteScore 7.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 4.385 SNIP 2.23 CiteScore 6.86
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.394 SNIP 2.257
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 4.127 SNIP 2.178
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.934 SNIP 2.203
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 3.09 SNIP 1.837
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.148 SNIP 1.897
Scopus rating (2005): SJR 2.529 SNIP 1.877
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.679 SNIP 1.682
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.557 SNIP 1.561
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.456 SNIP 1.574
Scopus rating (2001): SJR 2.74 SNIP 1.488
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.912 SNIP 1.605
Scopus rating (1999): SJR 2.715 SNIP 1.48
Original language: English
Mnemiopsis leidyi, comb jelly, evolution of life-history traits, evolutionary biology, global change, invasion ecology, jellyfish, reproduction and population growth
DOIs:
10.1111/gcb.13955
Source: FindIt
Source-ID: 2392991252
Publication: Research - peer-review › Journal article – Annual report year: 2017

Sensitivity of a tropical micro-crustacean (Daphnia lumholtzi) to trace metals tested in natural water of the Mekong River

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Ho Chi Minh City University of Technology, Vietnam National University, Nha Trang University, University of Rennes
Authors: Dao, T. (Ekstern), Le, V. (Ekstern), Bui, B. (Ekstern), Dinh, K. V. (Intern), Wiegand, C. (Ekstern), Dao, C. (Ekstern), To, T. (Ekstern), Nguyen, L. (Ekstern), Vo, T. (Ekstern)
Pages: 1360-1370
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Science of the Total Environment
Volume: 574
ISSN (Print): 0048-9697
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 5.09 SJR 1.621 SNIP 1.849
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.674 SNIP 1.642 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.847 CiteScore 4.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.527 SNIP 1.759 CiteScore 3.73
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Spatio-temporal dynamics of cod nursery areas in the Baltic Sea
In this study the drift of eastern Baltic cod larvae and juveniles spawned within the historical eastern Baltic cod spawning grounds was investigated by detailed drift model simulations for the years 1971–2010, to examine the spatio-temporal
dynamics of environmental suitability in the nursery areas of juvenile cod settlement. The results of the long-term model scenario runs, where juvenile cod were treated as simulated passively drifting particles, enabled us to find strong indications for long-term variations of settlement and potentially the reproduction success of the historically important eastern Baltic cod nursery grounds. Only low proportions of juveniles hatched in the Arkona Basin and in the Gotland Basin were able to settle in their respective spawning ground. Ocean currents were either unfavorable for the juveniles to reach suitable habitats or transported the juveniles to nursery grounds of neighboring subdivisions. Juveniles which hatched in the Bornholm Basin were most widely dispersed and showed the highest settlement probability, while the second highest settlement probability and horizontal dispersal was observed for juveniles originating from the Gdansk Deep. In a long-term perspective, wind-driven transport of larvae/juveniles positively affected the settlement success predominately in the Bornholm Basin and in the Bay of Gdansk. The Bornholm Basin has the potential to contribute on average 54% and the Bay of Gdansk 11% to the production of juveniles in the Baltic Sea. Furthermore, transport of juveniles surviving to the age of settlement with origin in the Bornholm Basin contributed on average 13 and 11% to the total settlement in the Arkona Basin and in the Gdansk Deep, respectively. The time-series of the simulated occupied juvenile cod habitat in the Bornholm Basin and in the Gdansk Deep showed a similar declining trend as the Fulton’s K condition factor of demersal 1-group cod, which may confirm the importance of oxygen-dependent habitat availability and its effect on density dependence as a process relevant for recruitment success.

**General information**

**State:** Published  
**Organisations:** National Institute of Aquatic Resources, Section for Oceans and Arctic, GEOMAR - Helmholtz Centre for Ocean Research Kiel, Swedish University of Agricultural Sciences  
**Authors:** Hinrichsen, H. (Ekstern), Dewitz, B. V. (Ekstern), Lehmann, M. (Ekstern), Bergström, U. (Ekstern), Hüsey, K. (Intern)  
**Pages:** 28-40  
**Publication date:** 2017  
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Progress in Oceanography  
**Volume:** 155  
**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  
- 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
Species-specific vulnerability of Arctic copepods to oil contamination and global warming

Arctic ecosystems are predicted to have more severe effects from global warming as during the last decades the temperatures have increased in this region at a rate of 2-4 times higher than the global average. In addition, oil exploitation and shipping activities in the Arctic are predicted to increase under global warming as the result of the retreat of sea ice, posing the risk of oil contamination. It is poorly known how cold adapted copepods in the Arctic deal with the combined effects of global warming and oil exposure. To address this, we exposed females of two copepod species Calanus glacialis and C. finmarchicus to pyrene at three temperatures: 2, 6 and 10°C. Both species co-exist in the Disko Bay, Greenland, but only C. glacialis is a true Arctic species while C. finmarchicus is of north Atlantic origin. Pyrene is one of the most toxic components of crude oil to marine copepods. The temperatures of 2, 6 and 10°C represent the mean sea water temperature during the reproductive season, the 4°C increase in mean temperature by 2100 as predicted by IPCC scenario RCP8.5 (2013) and the extreme sea water temperature, respectively, in Disko Bay. Fourdegree temperature increase did not have an effect on grazing rate and survival of both species. However, the extreme temperature (10°C) increased the grazing rate and mortality of C. glacialis, but not in C. finmarchicus. Exposure to high pyrene strongly reduced survival and grazing rate in both species and this pattern was independent of temperatures. Notably, exposure to high pyrene resulted in ca. 70% of mortality in C. finmarchicus, the species with North Atlantic Origin, that was two times higher than the mortality observed for C. glacialis, the true Arctic species. These results suggest that extreme temperature under global warming and oil contamination may drastically change the relative abundance of the Arctic pelagic copepod community by changing the species-specific vulnerability to extreme temperature and oil exposure.
Spectral signature of suspended fine particulate material on light absorption properties of CDOM

Fine submicron organic particles can represent an important fraction of the dissolved organic matter (DOM) pool in aquatic ecosystems and their optical properties differ from those normally considered dissolved (< 0.2 μm), which means that the choice of filter type/pore size can influence the light absorption characteristics. In this study, a total of 867 paired CDOM absorption spectra (n = 1734) from different ecosystems (lakes, streams, sewages and estuaries) were measured on 0.2 μm and GF/F (nominal pore size 0.7 μm) filters. The aims were to evaluate how fine organic particles influence the spectral signature of the DOM pool and to quantify the effects of choice of filter type.

In aquatic ecosystems influenced by terrestrial DOM (rivers and lakes), the dissolved fraction (here defined as < 0.2 μm) overwhelmed the fine particulate signal (0.2–0.7 μm) which did not contribute significantly to the absorption signal. In contrast, freshly-produced fine particles released by phytoplankton significantly increased measured CDOM absorption in productive environments with low terrestrial background. Our results demonstrate that the choice of filter pore size can have a significant impact on the outcome of spectral metrics often used to characterise CDOM such as the spectral slope (S) or the slope ratio (SR). Hence, this may complicate the combining of CDOM absorption measurements from different studies where different pore sizes were used as fine particulate material may significantly influence the spectral signature, particularly in situations where phytoplankton is the dominating source of DOM.
Strong delayed interactive effects of metal exposure and warming: latitude-dependent synergisms persist across metamorphosis

As contaminants are often more toxic at higher temperatures, predicting their impact under global warming remains a key challenge for ecological risk assessment. Ignoring delayed effects, synergistic interactions between contaminants and warming, and differences in sensitivity across species’ ranges could lead to an important underestimation of the risks. We addressed all three mechanisms by studying effects of larval exposure to zinc and warming before, during, and after metamorphosis in Ischnura elegans damselflies from high- and low-latitude populations. By integrating these mechanisms into a single study, we could identify two novel patterns. First, during exposure zinc did not affect survival, whereas it induced mild to moderate postexposure mortality in the larval stage and at metamorphosis, and very strongly reduced adult lifespan. This severe delayed effect across metamorphosis was especially remarkable in high-latitude animals, as they appeared almost insensitive to zinc during the larval stage. Second, the well-known synergism between metals and warming was manifested not only during the larval stage but also after metamorphosis, yet notably only in low-latitude damselflies. These results highlight that a more complete life-cycle approach that incorporates the possibility of delayed interactions between contaminants and warming in a geographical context is crucial for a more realistic risk assessment in a warming world.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Leuven, Nha Trang University
Authors: Debecker, S. (Ekstern), Dinh, K. V. (Intern), Stoks, R. (Ekstern)
Pages: 2409-2417
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science & Technology (Washington)
Volume: 51
Issue number: 4
ISSN (Print): 0013-936X
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 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.474 SNIP 2.334
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 3.466 SNIP 2.359
Strong delayed interactive effects of metal exposure and warming: latitude-dependent synergisms persist across metamorphosis

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University of Leuven
Authors: Debecker, S. (Ekstern), Dinh, K. V. (Intern), Stoks, R. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 128771258
Publication: Research - peer-review › Journal article – Annual report year: 2017

Succession of picophytoplankton during the spring bloom 2012 in Disko Bay (West Greenland)—an unexpectedly low abundance of green algae

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Greenland Climate Research Centre
Authors: Sørensen, N. (Ekstern), Daugbjerg, N. (Ekstern), Richardson, K. (Ekstern), Nørregaard, R. D. (Intern), Espersen, L. S. K. (Intern), Mahl, M. (Intern), Nielsen, T. G. (Intern)
Pages: 463–469
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Polar Biology
Volume: 40
Issue number: 2
ISSN (Print): 0722-4060
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 1.72 SJR 0.866 SNIP 0.761
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.985 SNIP 0.751 CiteScore 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.931 SNIP 0.81 CiteScore 1.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.109 SNIP 1.054 CiteScore 2.07
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.029 SNIP 0.891 CiteScore 1.89
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.857 SNIP 0.925 CiteScore 1.77
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.868 SNIP 0.885
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.785 SNIP 0.871
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.953 SNIP 0.877
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.976 SNIP 0.936
Scopus rating (2006): SJR 0.946 SNIP 0.958
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.851 SNIP 0.86
Scopus rating (2004): SJR 1.046 SNIP 0.957
Scopus rating (2003): SJR 0.967 SNIP 0.898
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.871 SNIP 0.848
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.85 SNIP 0.989
Scopus rating (2000): SJR 0.884 SNIP 0.92
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.101 SNIP 0.937
Original language: English
DOIs: 10.1007/s00300-016-1952-8
Source: Findit
Source-ID: 2304330891
Publication: Research - peer-review › Journal article – Annual report year: 2016

SVALGREEN: Nordisk samarbejde om forskning og højere uddannelse i Højarktis

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University Centre in Svalbard, Aarhus University, University of Copenhagen
Authors: Skov, H. (Ekstern), Christiansen, H. H. (Ekstern), Forchhammer, M. (Ekstern), Edelvang, K. (Intern), Priemé, A. (Ekstern)
Pages: 12-14
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk kemi
Volume: 98
Issue number: 8
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Temperature effects on gene expression and morphological development of European eel, Anguilla anguilla larvae

Temperature is important for optimization of rearing conditions in aquaculture, especially during the critical early life history stages of fish. Here, we experimentally investigated the impact of temperature (16, 18, 20, 22 and 24°C) on thermally induced phenotypic variability, from larval hatch to first-feeding, and the linked expression of targeted genes [heat shock proteins (hsp), growth hormone (gh) and insulin-like growth factors (igf)] associated to larval performance of European eel, Anguilla anguilla. Temperature effects on larval morphology and gene expression were investigated throughout early larval development (in real time from 0 to 18 days post hatch) and at specific developmental stages (hatch, jaw/teeth formation, and first-feeding). Results showed that hatch success, yolk utilization efficiency, survival, deformities, yolk utilization, and growth rates were all significantly affected by temperature. In real time, increasing temperature from 16 to 22°C accelerated larval development, while larval gene expression patterns (hsp70, hsp90, gh and igf-1) were delayed at cold temperatures (16°C) or accelerated at warm temperatures (20-22°C). All targeted genes (hsp70, hsp90, gh, igf-1, igf-2a, igf-2b) were differentially expressed during larval development. Moreover, expression of gh was highest at 16°C during the jaw/teeth formation, and the first-feeding developmental stages, while expression of hsp90 was highest at 22°C, suggesting thermal stress. Furthermore, 24°C was shown to be deleterious (resulting in 100% mortality), while 16°C and 22°C (~50 and 90% deformities respectively) represent the lower and upper thermal tolerance limits. In conclusion, the high survival, lowest incidence of deformities at hatch, high yolk utilization efficiency, high gh and low hsp expression, suggest 18°C as the optimal temperature for offspring of European eel. Furthermore, our results suggest that the still enigmatic early life history stages of European eel may inhabit the deeper layer of the Sargasso Sea and indicate vulnerability of this critically endangered species to increasing ocean temperature.

General information
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Section for Marine Living Resources, IFREMER, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Politis, S. N. (Intern), Mazurais, D. (Ekstern), Servili, A. (Ekstern), Zambonino-Infante, J. (Ekstern), Miest, J. J. (Ekstern), Sørensen, S. R. (Intern), Tomkiewicz, J. (Intern), Butts, I. A. E. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication information
Journal: P L o S One
Volume: 12
Issue number: 8
Article number: e0182726
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
Temperature induced variation in gene expression of thyroid hormone receptors and deiodinases of European eel (Anguilla anguilla) larvae

Thyroid hormones (THs) are key regulators of growth, development, and metabolism in vertebrates and influence early life development of fish. TH is produced in the thyroid gland (or thyroid follicles) mainly as T4 (thyroxine), which is metabolized to T3 (3,5,3'-triiodothyronine) and T2 (3,5-diiodothyronine) by deiodinase (DIO) enzymes in peripheral tissues. The action of these hormones is mostly exerted by binding to a specific nuclear thyroid hormone receptor (THR). In this study, we i) cloned and characterized thr sequences, ii) investigated the expression pattern of the different subtypes of thrs and dios, and iii) studied how temperature affects the expression of those genes in artificially produced early life history stages of European eel (Anguilla anguilla), reared in different thermal regimes (16, 18, 20 and 22°C) from hatch until first-feeding.

We identified 2 subtypes of thr (thrα and thrβ) with 2 isoforms each (thrαA, thrαB, thrβA, thrβB) and 3 subtypes of deiodinases (dio1, dio2, dio3). All thr genes identified showed high similarity to the closely related Japanese eel (Anguilla japonica). We found that all genes investigated in this study were affected by larval age (in real time or at specific developmental stages), temperature, and/or their interaction. More specifically, the warmer the temperature the earlier the expression response of a specific target gene. In real time, the expression profiles appeared very similar and only shifted with temperature. In developmental time, gene expression of all genes differed across selected developmental stages, such as at hatch, during teeth formation or at first-feeding. Thus, we demonstrate that the expression of thrs and dios show sensitivity to temperature and are involved in and during early life development of European eel.

General information
State: Accepted/In press
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Section for Marine Living Resources, IFREMER, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Politis, S. N. (Intern), Servili, A. (Ekstern), Mazurais, D. (Ekstern), Zambonino-Infante, J. (Ekstern), Miest, J. J. (Ekstern), Tomkiewicz, J. (Intern), Butts, I. A. E. (Intern)
Publication date: 2017
Temporal and spatial differences between taxonomic and trait biodiversity in a large marine ecosystem: Causes and consequences

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

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

Publication information
Journal: PLoS One
Volume: 12
Issue number: 12
Article number: e0189731
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.631 SNIP 1.161
Web of Science (2010): Indexed yes
The effect of increased loads of dissolved organic matter on estuarine microbial communities and functions

Increased river loads are projected as one of the major consequences of climate change in the northern hemisphere, leading to elevated inputs of riverine dissolved organic matter (DOM) and inorganic nutrients to coastal ecosystems. The objective of this study was to investigate the effects of elevated DOM on a coastal pelagic food web from the coastal northern Baltic Sea, in a 32-day mesocosm experiment. In particular, the study addresses the response of bacterioplankton to differences in character and composition of supplied DOM. The supplied DOM differed in stoichiometry and quality and had pronounced effects on the recipient bacterioplankton, driving compositional changes in response to DOM type. The supplied DOM additions stimulated protease activity and a release of inorganic nutrients, suggesting that DOM was actively processed. However, no difference between DOM types was detected in these functions despite different community compositions. Extensive release of re-mineralized carbon, nitrogen and phosphorus was observed during the experiment. This suggests that the nutrient access partially outweighed the negative effect of increased light attenuation by accumulating DOM. Taken together, our experimental data suggest that parts of the future elevated riverine DOM supply to the Baltic Sea will be efficiently mineralized by microbes. This will have consequences for bacterioplankton and phytoplankton community composition and function, and significantly affect nutrient biogeochemistry.
The invasive comb jelly *Mnemiopsis leidyi* in Europe and in the Baltic Sea: Invasion history, distribution, phenology and ecosystem impacts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic
Authors: Huwer, B. (Intern), Jaspers, C. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts Sustain 2017
Article number: A-11
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
*SustainAbstracts2017c.compressed_14.pdf*
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2017
The one-sample PARAFAC approach reveals molecular size distributions of fluorescent components in dissolved organic matter

Molecular size plays an important role in dissolved organic matter (DOM) biogeochemistry, but its relationship with the fluorescent fraction of DOM (FDOM) remains poorly resolved. Here high-performance size exclusion chromatography (HPSEC) was coupled to fluorescence emission-excitation (EEM) spectroscopy in full spectral (60 emission and 34 excitation wavelengths) and chromatographic resolution (<1 Hz), to enable the mathematical decomposition of fluorescence on an individual sample basis by parallel factor analysis (PARAFAC). The approach allowed cross-system comparisons of molecular size distributions for individual fluorescence components obtained from independent data sets. Spectra extracted from allochthonous DOM were highly similar. Allochthonous and autochthonous DOM shared some spectra, but included unique components. In agreement with the supramolecular assembly hypothesis, molecular size distributions of the fluorescence fractions were broad and chromatographically unresolved, possibly representing reoccurring fluorophores forming noncovalently bound assemblies of varying molecular size. Samples shared underlying fluorescence components that differed in their size distributions but not their spectral properties. Thus, in contrast to absorption measurements, bulk fluorescence is unlikely to reliably indicate the average molecular size of DOM. The one-sample approach enables robust and independent cross-site comparisons without large-scale sampling efforts and introduces new analytical opportunities for elucidating the origins and biogeochemical properties of FDOM.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Chalmers University of Technology
Authors: Wünsch, U. (Intern), Murphy, K. R. (Ekstern), Stedmon, C. (Intern)
Pages: 11900-11908
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science & Technology (Washington)
Volume: 51
Issue number: 20
ISSN (Print): 0013-936X
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 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
The role of egg cannibalism for the Calanus succession in the Disko Bay, Western Greenland

The present study is the first to describe egg cannibalism in the key Arctic copepod species Calanus finmarchicus, Calanus glacialis, and Calanus hyperboreus. Initially, a series of staining experiments evaluated the application of Neutral Red for staining Calanus eggs. The method was effective and applied in subsequent feeding experiments, where adult females were incubated in bottles with their own eggs. The results showed that all Calanus spp. ingested C. finmarchicus and C. glacialis eggs. However, consumers showed a slight preference for C. finmarchicus eggs when incubated with those of both species. The addition of phytoplankton even at high concentrations did not decrease clearance rates for eggs, suggesting that the presence of alternative food does not afford eggs any protection from cannibalism. To evaluate the potential impact of egg cannibalism on the succession of the three species, we calculated and compared field egg mortality rates with potential egg clearance rates for the Calanus complex based on rates from the experiments. Our results show that in Disko Bay cannibalism by Calanus spp., even at its highest level just before the spring bloom, could only account for about 10% of observed in situ egg mortality, and much less for most of the season.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Aarhus University
Authors: Frank-Gopolos, T. (Intern), Friis Møller, E. (Ekstern), Nielsen, T. G. (Intern)
Pages: 865–883
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 62
Issue number: 3
ISSN (Print): 0024-3590
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Transgenerational interactions between a pesticide and warming in a vector mosquito.

Climate change imposes a strong pressure on the persistence of natural populations and together with pollution it exerts a global threat to biodiversity. While many transgenerational studies have revealed the capacity of species to adapt to a temperature increase, it remains unknown if this ability may change in a polluted environment. We set up a full-factorial transgenerational experiment where Culex pipiens vector mosquitoes were reared at two temperatures (20°C vs 24°C) and, when they reached the final larval stage, exposed to one of two chlorpyrifos treatments (absent vs present). We studied effects on larval survival and age and size at metamorphosis. In both generations, warming and the pesticide reduced larval survival and accelerated development in the survivors. While warming reduced size at metamorphosis, pesticide exposure did not affect size. As expected, the effect of chlorpyrifos on mortality was stronger under warming. We could show delayed effects of parental rearing temperature on their offspring with parents reared at 24°C producing offspring with a lower survival, slower development, but a larger size at metamorphosis. For survival the effect was particularly strong in offspring that was reared at 20°C, thereby providing evidence for transgenerational acclimation resulting in poor offspring performing under thermal conditions different from their parents. Parental pesticide exposure influenced the response of the offspring to both stressors, with offspring from parents exposed to the pesticide being more susceptible to warming in terms of survival, but performing better when also exposed to the pesticide in terms of size at metamorphosis. Our results indicate some signals of transgenerational acclimation to the pesticide: offspring exposed to the pesticide did better when the parents were also exposed to the pesticide. However, when combining stressors, we could show that parental pesticide exposure increased the vulnerability to warming indicating the complexity of transgenerational acclimation. This highlights the importance of looking at the combined impact of pesticides and warming increase across generations to come to a better understanding of the impact of pesticides in a warming world.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, University of Leuven
Authors: Tran, T. (Ekstern), Dinh, K. V. (Intern), Stoks, R. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 132116833
Publication: Research › Poster – Annual report year: 2017

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
Publication: Research › Poster – Annual report year: 2017

Trophic impact of Atlantic bluefin tuna migrations in the North Sea

Large highly migratory predators can have major impacts on local marine ecosystems by reducing prey populations and leading to trophic cascades that affect the entire fish community. These trophic interactions are typically non-linear and
can alter both the migratory behaviour of the predator and the stability of the fish community. The impact of a migrating
top-predator is investigated here for Atlantic bluefin tuna in the North Sea. Bluefin tuna has been absent from the region
for half-century, but recent years have seen recovery of migrations and a return of bluefin tuna in the area. We use a size
spectrum model to analyse the trophic impact of the returning tuna on the entire fish community, under scenarios with
varying levels of tuna consumption and fishing mortality on the prey. We show that with high level of prey fishing mortality
in the North Sea, the effect of a tuna re-colonization results in only limited trophic cascades. However, high tuna
consumption or changes in fishing mortality may result in a sudden recruitment failure of small-pelagic fish due to
cascading effects on the fish community. In present-day conditions, the level of tuna consumption that triggers recruitment
failure is lower at increasing fishing mortalities on their prey, providing indications for the future sustainable management
of both small-pelagics and bluefin tuna in the area.

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Mariani, P. (Intern), Andersen, K. H. (Intern), Lindegren, M. (Intern), MacKenzie, B. (Intern)
Pages: 1552-1560
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 74
Issue number: 6
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
Trophic interactions in the Baltic Sea: Clupeid predation on cod early life stages

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Institute Management, Section for Ecosystem based Marine Management
Authors: Neumann, V. (Intern), Köster, F. (Intern), Eero, M. (Intern), Schaber, M. (Ekstern)
Publication date: 2017
Event: Abstract from ICES Annual Science Conference 2017, Fort Lauderdale, United States.
Main Research Area: Technical/natural sciences

Bibliographical note
ICES CM 2017/P:454
Publication: Research › Conference abstract for conference – Annual report year: 2017

Unraveling the size-dependent optical properties of dissolved organic matter
The size-dependent optical properties of dissolved organic matter (DOM) from four Swedish lakes were investigated using High Performance Size Exclusion Chromatography (HPSEC) in conjunction with online characterization of absorbance (240–600 nm) and fluorescence (excitation: 275 nm, emission: 300–600 nm). The molecular size of chromophoric DOM (CDOM) was consistently higher than that of fluorescent DOM (FDOM), with an average difference of 0.37 kDa. The relative abundance of FDOM vs. CDOM ranged from
0.3 to 0.7 across lakes, and increased with decreasing average molecular size. Across sites, the CDOM spectral slopes of the large molecular size fraction were highly similar while the low molecular size fraction differed and contributed to different bulk spectral slopes. Our results indicate structural congruence of high molecular size DOM across systems while lake trophic status determined the characteristics of the low size range. Furthermore, the combination of HPSEC and parallel factor analysis (HPSEC-PARAFAC2) allowed the decomposition of DOM fluorescence chromatograms. Three humic-like components and one protein-like component with broadly overlapping molecular size distributions were identified. This overlap provides further evidence for the supramolecular assembly hypothesis since fluorophores, as revealed by PARAFAC2, occur in aggregates of overlapping molecular size. Our results further suggest a link between the molecular size of these fluorophores and the associated supramolecular assemblies. This study demonstrates the potential for HPSEC and novel mathematical approaches to provide unprecedented insights into the relationship between optical and chemical properties of DOM in aquatic systems.
Using genetics to identify management units of European flounder in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Swedish University of Agricultural Sciences
Authors: Florin, A. (Ekstern), Palm, S. (Ekstern), Ustups, D. (Ekstern), Hüsey, K. (Intern), Casini, M. (Ekstern), Nissling, A. (Ekstern), Limburg, K. (Ekstern), Schade, F. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – 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
State: Published
Pages: 133-149
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Sea Research
Volume: 127
ISSN (Print): 1385-1101
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 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.115 SNIP 1.06 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.371 SNIP 1.28 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.267 SNIP 1.242
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.261 SNIP 1.071
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.289 SNIP 1.156
Scopus rating (2007): SJR 1.402 SNIP 1.179
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.325 SNIP 1.165
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.987 SNIP 0.923
Scopus rating (2004): SJR 0.932 SNIP 0.957
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.146
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.059 SNIP 0.926
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.131 SNIP 0.954
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.127 SNIP 1.021
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.182 SNIP 1.014
Original language: English
Ocean circulation, Lagrangian approach, Variability, Marine protected areas, Renewable energy, Wind park, Model intercomparison, Ensemble
DOIs:
Water mass characteristics and associated fauna of a recently discovered Lophelia pertusa (Scleractinia: Anthozoa) reef in Greenlandic waters

The first living sample of Lophelia pertusa from Greenlandic waters was inadvertently collected at 60.3675°, −48.45528°, entangled together with other corals to a seawater sampler and property sensor (CTD) package. We collected in situ photographs taken at two sites in the same area in order to determine whether a reef was present. We identified reef-like structures formed by living and dead L. pertusa at 886–932 m depth on a steep slope. We assembled and analyzed hydrographic data to characterize the reef environment in order to facilitate future localization of other reefs and predictions of the impacts of climate change. We showed that the reef was located in a layer of modified Atlantic Water of relatively stable bottom temperature (4.1–5.0 °C) and salinity (34.90–34.98) with density slightly higher (27.62–27.71 kg m⁻³) than that reported for the occurrence of reefs in the northeast Atlantic, and in an area with exceptionally and persistently high currents of >15 cm s⁻¹ at 1000 m. The intermediate-depth salinity maximum was found in the depth range where the corals were found. We discovered signals of consistent vertical and horizontal transports at 700–900 m over the reef area. Although this area is not directly influenced by intermediate and deep convection in the Labrador Sea, the seasonal evolution of near-bottom temperature, salinity and density for the 700–900 m depth range revealed strong seasonal patterns with both temperature and salinity reducing to their annual minimal values at the end of March and staying low for 1 month with an indication of a second minimum in June, 3 months later. The occurrence and temporal extent of these minima likely arose through a combination of local convection from the surface and advection of cooled and freshened waters at depth from the Irminger Sea. A diversified associated fauna was described; the short list of species compiled from our limited sample comprised species common in the area, as well as rare species, species new to Greenland, and species new to science.

General information

State: Published
Organisations: Arctic Section, National Institute of Aquatic Resources, Section for Oceans and Arctic, Bedford Institute of Oceanography, University of Copenhagen
Authors: Kenchington, E. (Ekstern), Yashayaev, I. (Ekstern), Tendal, O. S. (Ekstern), Jørgensbye, H. (Intern)
Pages: 321–337
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Polar Biology
Volume: 40
Issue number: 2
ISSN (Print): 0722-4060
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 1.72 SJR 0.866 SNIP 0.761
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.985 SNIP 0.751 CiteScore 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.931 SNIP 0.81 CiteScore 1.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.109 SNIP 1.054 CiteScore 2.07
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.029 SNIP 0.891 CiteScore 1.89
When in life does density dependence occur in fish populations?
Will salinity hinder the ongoing northward dispersal of the invasive round goby into the oceanic North Sea?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Behrens, J. (Intern), van Deurs, M. (Intern), Christensen, E. A. F. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
SustainAbstracts2017c.compressed_6.pdf
Publication: Research - peer-review » Journal article – Annual report year: 2016
Zooplankton in a global perspective: Will climate change favor a more gelatinous marine food web?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Jaspers, C. (Intern)
Publication date: 2017
Event: Abstract from Aarhus University Marine Ecology Seminar Series, Aarhus, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

1.500 mærkede torsk skal give bedre bestandsvurdering

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Monitoring and Data, Danish Fishermen's Producers' Organization
Authors: Hüssy, K. (Intern), Olesen, H. J. (Intern), Hansen, K. K. (Ekstern), Lund, H. S. (Ekstern)
Pages: 11
Publication date: 2016

Aborrer og gedder i brakvand - betydningen af ferskvandsområder for gydning

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Freshwater Fisheries Ecology, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Jacobsen, L. (Intern), Berg, S. (Intern), Skov, C. (Intern), Nielsen, J. (Intern), Aarestrup, K. (Intern), Jepsen, N. (Intern), Christensen, E. A. F. (Intern), Skovrind, M. (Ekstern), Højrup, L. B. (Ekstern)
Publication date: 2016
Event: Poster session presented at Dansk Ferskvandsymposium 2016, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

Abundance of specific mRNA transcripts impacts hatching success in European eel, Anguilla anguilla L.
MaternalmRNA governs earlyembryonic development in fish and variation in abundance of maternal transcripts may contribute to variation in embryonic survival and hatch success in European eel, Anguilla anguilla. Previous studies have shown that quantities of the maternal gene products β-tubulin, insulin-like growth factor 2 (igf2), nucleoelmin (nmp2), prohibitin 2 (phpb2), phosphatidylinositol glycan biosynthesis class F protein 5 (pigf5), and carnitine O-palmitoyltransferase liver isoform-like 1 (cpt1) are associated with embryonic developmental competence in other teleosts. Here, the relations between relative mRNA abundance of these genes in eggs and/or embryos and egg quality, was studied and analyzed. We compared egg quality of the two groups: i) batches with hatching and ii) batches with no hatching. Results showed no significant differences in relative mRNA abundance between the hatch and no hatching groups for any of the selected genes at 0, 2.5, and 5 HPF. However, at 30 HPF the hatch group showed significantly higher abundance of cpt1a, cpt1b, β-tubulin, php2, and pigf5 transcripts than the no hatch group. Therefore, these results indicate that up-regulation of the transcription of these genes in European eel after the mid-blastula transition, may be needed to sustain embryonic development and hatching success

General information
State: Published
A carbon budget for the Amundsen Sea Polynya, Antarctica: Estimating net community production and export in a highly productive polar ecosystem

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Rutgers University, University of Colorado, Columbia University, Georgia Institute of Technology, Bangor University, Stanford University, University of Georgia, University of Copenhagen, Uppsala University, Institute of Marine Science (CSIC), Florida Atlantic University
Authors: Yager, P. L. (Ekstern), Sherrell, R. M. (Ekstern), Stammerjohn, S. E. (Ekstern), Ducklow, H. W. (Ekstern), Ingall, E. D. (Ekstern), Wilson, S. E. (Ekstern), Lowry, K. E. (Ekstern), Williams, C. M. (Ekstern), Riemann, L. (Ekstern), Bertilsson, S. (Ekstern), Alderkamp, A. C. (Ekstern), Dinasquet, J. (Ekstern), Logares, R. (Ekstern), Mu, L. (Ekstern), Newstead, R. G. (Ekstern), Post, A. (Ekstern), Swalethorp, R. (Intern), van Dijken, G. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

A comparative review of fisheries management experiences in the European Union and in other countries worldwide: Iceland, Australia, and New Zealand

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, IFREMER, University of Copenhagen, AZTI-Tecnalia, National University of Ireland, Thünen Institute of Sea Fisheries, University of Iceland, University of Portsmouth, Aalborg University, Universite de Bretagne Occidentale, Fishery and Aquaculture Research Organisation, Hellenic Centre for Marine Research, CSIRO Ocean and Atmospheres
Authors: Marchal, P. (Ekstern), Andersen, J. L. (Ekstern), Aranda, M. (Ekstern), Gotli, M. (Ekstern), Guyader, O. (Ekstern), Haraldsson, G. (Ekstern), Hatcher, A. (Ekstern), Héglund, T. J. (Ekstern), Le Floch, P. (Ekstern), Macher, C. (Ekstern), Malvarosa, L. (Ekstern), Maravelias, C. D. (Ekstern), Mardle, S. (Ekstern), Murillas, A. J. (Ekstern), Nielsen, J. R. (Intern), Sabatella, R. (Ekstern), Smith, A. D. M. (Ekstern), Stokes, K. (Ekstern), Theegersen, T. T. (Intern), Ulrich, C. (Intern)
Pages: 803-824
Publication date: 2016
Main Research Area: Technical/natural sciences
**Publication information**
Journal: Fish and Fisheries  
Volume: 17  
Issue number: 3  
ISSN (Print): 1467-2960

**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  
- Web of Science (2016): Indexed yes  
- Scopus rating (2016): CiteScore 7.7 SJR 3.606 SNIP 3.245  
- Web of Science (2016): Indexed yes  
- BFI (2015): BFI-level 2  
- Scopus rating (2015): SJR 3.668 SNIP 3.034 CiteScore 7.05  
- Web of Science (2015): Indexed yes  
- BFI (2014): BFI-level 2  
- Scopus rating (2014): SJR 3.462 SNIP 3.327 CiteScore 7.13  
- Web of Science (2014): Indexed yes  
- BFI (2013): BFI-level 2  
- Scopus rating (2013): SJR 3.488 SNIP 3.12 CiteScore 6.19  
- ISI indexed (2013): ISI indexed yes  
- BFI (2012): BFI-level 2  
- Scopus rating (2012): SJR 3.565 SNIP 2.852 CiteScore 6.14  
- ISI indexed (2012): ISI indexed yes  
- BFI (2011): BFI-level 2  
- Scopus rating (2011): SJR 4.025 SNIP 2.854 CiteScore 6.2  
- ISI indexed (2011): ISI indexed yes  
- BFI (2010): BFI-level 2  
- Scopus rating (2010): SJR 3.456 SNIP 2.434  
- Web of Science (2010): Indexed yes  
- BFI (2009): BFI-level 2  
- Scopus rating (2009): SJR 2.617 SNIP 2.61  
- BFI (2008): BFI-level 2  
- Scopus rating (2008): SJR 2.714 SNIP 2.712  
- Web of Science (2008): Indexed yes  
- Scopus rating (2007): SJR 2.887 SNIP 2.786  
- Scopus rating (2006): SJR 2.869 SNIP 3.161  
- Scopus rating (2005): SJR 2.394 SNIP 2.519  
- Scopus rating (2004): SJR 1.883 SNIP 1.483  
- Scopus rating (2003): SJR 1.33 SNIP 1.463  
- Scopus rating (2002): SJR 0.776 SNIP 0.821  
- Web of Science (2002): Indexed yes  
- Web of Science (2001): Indexed yes  
- Original language: English  
- DOIs: 10.1111/faf.12147

**A dark hole in our understanding of marine ecosystems and their services: Perspectives from the mesopelagic community**

**General information**
State: Published  
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Research Secretariat, Centre for Ocean Life, AZTI-Tecnalia, National Oceanography Centre, University of the Azores
Adult lifetime reproductive value in fish depends on size and fecundity type

In a stable population, the adult lifetime reproductive value must be balanced against early life survival. Although delaying maturity may increase fecundity, it also reduces survival. Larger size at maturity therefore not only allows for higher fecundity, but requires it. Using simple arguments from life history, we derive a direct proportionality relationship between the adult lifetime reproductive value and weight at maturation and find that this relationship is consistent with empirical evidence from 28 stocks and species of bony fish from temperate–boreal environments. However, the expected proportionality falls off if mortality increases to include fishing. Furthermore, we find that the fecundity type (determinate or indeterminate) affects the predicted adult reproductive value, which is significantly (10-fold) higher for an indeterminate spawner than for a determinate spawner of the same weight. These differences may relate to trade-offs in the adult life history traits and (or) to seasonality in the spawning environment, with subsequent consequences for early life stage survivorship.
A mere fluke: can parasites help predators limit fish invasions?
An important step towards accurate estimation of diet composition and consumption rates for the harbor porpoise (Phocoena phocoena)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Flink, H. (Ekstern), Behrens, J. (Intern), Svensson, A. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Publication information
Journal: Marine Mammal Science
Volume: 32
Issue number: 4
ISSN (Print): 0824-0469
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 1.87 SJR 1.008 SNIP 0.978
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.055 SNIP 0.972 CiteScore 1.73
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.987 SNIP 1.093 CiteScore 1.83
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.193 SNIP 1.206 CiteScore 1.78
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.029 SNIP 1.106 CiteScore 1.9
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.891 SNIP 1.002 CiteScore 1.59
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.776 SNIP 0.876
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.94 SNIP 0.919
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.97 SNIP 1.084
Scopus rating (2007): SJR 1.025 SNIP 0.999
Scopus rating (2006): SJR 0.892 SNIP 1.104
Scopus rating (2005): SJR 0.799 SNIP 1.002
Anoxia-mediated release of dissolved organic matter from Baltic coastal sediments stimulate further hypoxia

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Reader, H. (Intern), Stedmon, C. (Intern), Kowalczuk, P. (Ekstern), Magnusson, Å. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

An porewater dissolved organic matter lend insight into the role of the coastal filter over time?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Reader, H. (Intern), Stedmon, C. (Intern)
Publication date: 2016
Event: Poster session presented at ECSA 56 Coastal systems in transition, Bremen, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2017

Aquaculture and feeding ecology: Feeding behaviour in turbot larvae

The period of first feeding, characterized by the shift from internal (yolk-sac) to external food sources, is considered particularly critical for the survival of marine fish, but the underlying causes are still unknown. The larval stage, characterized by high mortality rates, is particularly challenging for larval rearing. After the start of exogenous feeding, another intense and likely critical period of change occurs in the early life stages of fish. This stage is the metamorphosis, during which the larvae transform organs and body morphology to become juveniles. Compared to other teleosts, larvae of flatfishes undergo a particularly evident and dramatic metamorphosis, because flatfishes completely reprogram their body to move from the pelagic habitat, in the water column, to the benthic habitat, on the sea floor. Due to the complex morphological and physiological changes, in aquaculture metamorphosis in flatfish species is often unsuccessful, resulting in different types of abnormal development.

The objective of this thesis was to analyse the feeding behaviour of the flatfish species turbot (Psetta maxima L.) larvae during the two crucial life periods, 1) first feeding and 2) metamorphosis. To analyse whether these two periods are critical for the correct development and survival of turbot, feeding behaviours of larvae during the period of first feeding and during the first stages of metamorphosis was studied using video recordings. This provided qualitative and quantitative descriptions of behavioural parameters, including modal action patterns (e.g. Pause, S-shape, and Attack), attack rate, capture success rate, and swimming speeds of predator and prey. The feeding behaviour of turbot larvae could also be influenced by prey swimming behaviours. To test the effect of two common types of copepod swimming behaviours, turbot larvae were exposed to two species of copepod nauplii. The results presented in this thesis indicate that neither the period of first feeding nor the period of transition from an upright to a tilted swimming position seem to be critical for turbot larvae. First feeding and metamorphosis rather represent periods of adjustments to new morphological and physiological conditions, such as the depletion of yolk-sac during first feeding, and the migration of one eye when metamorphosis starts. Moreover, the behaviour of prey appears to have limited or no influence on larval turbot capture success.

This thesis is part of a large international project aimed at improving the rearing techniques of high value fish species larvae fed with calanoid copepods, their natural prey, to achieve high levels of survival and quality. In fact, fish aquaculture is becoming increasingly important as source of food. However, several bottlenecks during the larval stage still affect its production efficiency. The larvae of turbot were chosen as a model species because turbot is a highly prized flatfish.
species, which is particularly difficult to rear.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Roskilde University
Authors: Bruno, E. (Intern), Støttrup, J. G. (Intern), Hansen, B. W. (Ekstern), Munk, P. (Intern)
Number of pages: 109
Publication date: 2016

**Publication information**
Publisher: Technical University of Denmark. National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2016

**Assessing the role of environmental factors on Baltic cod recruitment, a complex adaptive system emergent property**

**General information**
State: Published
Organisations: Section for Marine Ecology and Oceanography, National Institute of Aquatic Resources, Centre for Ocean Life, Institute of Oceanology of the Polish Academy of Sciences
Authors: Krekoukiotis, D. (Intern), Palacz, A. P. (Intern), St John, M. A. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Frontiers in Marine Science
Volume: 3
Article number: 126
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Electronic versions:
Publishers version
DOIs:
10.3389/fmars.2016.00126
Source: FindIt
Source-ID: 2306800861
Publication: Research - peer-review › Journal article – Annual report year: 2016

**A trait database for marine copepods**

**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), Kierboe, T. (Intern)
Publication date: 2016

**Publication information**
Original language: English
Main Research Area: Technical/natural sciences
DOIs:
Ballastvand – Værktøj til afgrænsning af “Same Risk Area”

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Living Resources
Authors: Hansen, F. T. (Intern), Christensen, A. (Intern)
Number of pages: 20
Publication date: 2016

Publication information
Publisher: Institut for Akvatiske Ressourcer, Danmarks Tekniske Universitet
ISBN (Electronic): 978-87-7481-235-7
Original language: Danish
Series: DTU Aqua-rapport
Number: 317-2016
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Publication: Research › Report – Annual report year: 2017

Baltic cod recruitment – the impact of changing environmental conditions

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and
Oceanography, Section for Ecosystem based Marine Management, Leibniz Institute of Marine Sciences
Authors: Köster, F. (Intern), Huwer, B. (Intern), Hinrichsen, H. (Ekstern), Neumann, V. (Intern), Makarchouk, A. (Ekstern),
Eero, M. (Intern), von Dewitz, B. (Ekstern), Tomkiewicz, J. (Intern), Hüssy, K. (Intern), Plikshs, M. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2016

Calanus finmarchicus egg production at its northern border
How the distribution of Calanus finmarchicus and its potential northward expansion will be affected by climate changes
depends on the mechanisms and processes constraining their reproduction, recruitment and survival. Here we present
measurements of C. finmarchicus egg production rates during the spring bloom in 2008, 2010 and 2011 in Disko Bay,
West Greenland and validate four independently derived metabolic models to predict egg production rates. The spring
bloom in 2008 was short and intense and supported lower cumulated specific egg production of C. finmarchicus than the
longer blooms with lower peak biomass in 2011 and 2012. The models predicted different timing of initialization and
development of egg production rates based on phytoplankton biomass and temperature and model performance varied
from ‘poor’ to ‘very good’. Phytoplankton biomass controlled the changes in egg production rates during the spring in
Disko Bay, while the low temperature in the Bay explained why the egg production rate here is much lower than at more
southerly localities despite high food concentrations. This study suggests that
an increase in magnitude of the Arctic phytoplankton spring bloom will not result in increased copepod egg production,
whereas a longer bloom and increasing temperatures will

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of
Southern Denmark, Greenland Climate Research Centre, Aarhus University
Authors: Møller, E. F. (Ekstern), Bohr, M. (Ekstern), Kjellerup, S. (Intern), Maar, M. (Ekstern), Mehl, M. (Intern),
Swalethorp, R. (Intern), Nielsen, T. G. (Intern)
Pages: 1206-1214
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 38
Issue number: 5
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.158 SNIP 1.045 CiteScore 1.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.186 SNIP 0.98
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.922 SNIP 1.046
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.174 SNIP 1.037
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.31 SNIP 1.225
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.19 SNIP 1.118
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.116 SNIP 1.068
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.035 SNIP 1.101
Scopus rating (2003): SJR 1.315 SNIP 1.299
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.239 SNIP 1.068
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.234 SNIP 1
Web of Science (2001): Indexed yes
Carbon export by vertically migrating zooplankton: Optimal vertical migration and carbon export

Through diel vertical migration (DVM), zooplankton add an active transport to the otherwise passive sinking of detrital material that constitutes the biological pump. This active transport has proven difficult to quantify. We present a model that estimates both the temporal and depth characteristic of optimal DVM behavior based on a trade-off between feeding opportunity and predation risk; factors that vary with latitude, time of year, and the size of the migrating animal. This behavioral component, coupled to a nutrient-phytoplankton-zooplankton (NPZ) productivity model provides estimates of the active transport of carbon by different size fractions of the migrating zooplankton population as function of time and space. The approach is motivated by the difficulty in incorporating behavioral aspects of carbon transport into large scale carbon budgets of the world’s oceans. The results show that despite their lower abundance, large zooplankton (length circa 1–2 mm) migrate deeper and transport approximately twice as much carbon as do the smaller zooplankton (length circa 0.2–0.3 mm). In mid-latitudes (∼30°N to ∼45°N), where pronounced spring blooms are observed, up to 20% more carbon is transported than at either equatorial or boreal latitudes. We estimate that the amount of carbon transported below the mixed layer by migrating zooplankton in the North Atlantic Ocean constitutes 27% (16–30%) of the total export flux associated with the biological pump in that region.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Hansen, A. N. (Intern), Visser, A. W. (Intern)
Pages: 701-710
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 61
Issue number: 2
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Challenging ICES age estimation protocols: lessons learned from the eastern Baltic cod stock

Over the recent decades, the International Council for the Exploration of the Sea (ICES) has set guidelines for best practise quality control of age estimation procedures. The applicability of these guidelines is assessed by reviewing the ageing issues of eastern Baltic cod (EBC) as a case study. Since the implementation of an age-based assessment of EBC in the beginning of the 1970s, the assessment has been hampered by the quality of the age composition data, in recent years to a degree that age-based assessment is no longer used. The reason for the age reading problems is the low visual contrast between growth zones in the otoliths which seems to be the result of complex interactions of the hydrography in the Baltic Sea with the cod’s biology and behaviour. Over the last 40 years, various expert groups have struggled to document and improve the agreement of age estimation between national otolith readers, standardize methods and age estimations through repeated exchanges and reference collections as well as an internationally agreed manual. Despite these initiatives the precision of the age estimations based on traditional ageing did not improve, with significant bias persisting between and within readers. Additionally, a wide range of alternative methods for deriving the age information necessary for stock assessment and for validation of the true age have been tested. However, these methods did not produce unbiased age estimates over the entire size and age range of the EBC stock. An age-validation is urgently needed. Deviations from the ICES guidelines identified are as follows: (i) the lack of rigorous quality control, particularly the auditing of national trends in age precision over the years using a reference collection and (ii) the implementation of an age error matrix in the stock assessment.
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
Pages: 217-241
Publication date: 2016
Conference: International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark, 26/08/2013 - 26/08/2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Annual Review of Marine Science
Volume: 8
Issue number: 3
ISSN (Print): 1941-1405
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 12.76 SJR 6.382 SNIP 4.101
Web of Science (2016): Indexed yes
Scopus rating (2014): SJR 8.073 SNIP 5.529 CiteScore 14.2
Scopus rating (2013): SJR 10.485 SNIP 5.585 CiteScore 16.42
Scopus rating (2012): SJR 9.805 SNIP 6.475 CiteScore 16.95
Scopus rating (2010): SJR 10.409 SNIP 5.716
Original language: English
Electronic versions:
Postprint
DOIs:
10.1146/annurev-marine-122414-034144
Publication: Research - peer-review › Journal article – Annual report year: 2016

Characterization and fate of dissolved organic matter in the Lena Delta Region, Siberia

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Alfred-Wegener-Institute für Polar und Meeresforschung, Russian Academy of Sciences
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Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

Clupeid consumption of cod eggs: Does it affect recent recruitment of Baltic cod?
Composition of seminal plasma and ovarian fluid in Ide Leuciscus idus and Northern pike Esox lucius

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of South Bohemia, University of Warmia and Mazury
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Pages: 960-969
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Reproduction in Domestic Animals
Volume: 51
Issue number: 6
ISSN (Print): 1439-0531
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.38 SJR 0.551 SNIP 0.924
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.639 SNIP 0.999 CiteScore 1.39
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.695 SNIP 0.916 CiteScore 1.55
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.66 SNIP 0.937 CiteScore 1.23
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.621 SNIP 1.207 CiteScore 1.57
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.776 SNIP 0.978 CiteScore 1.26
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.661 SNIP 0.856
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.648 SNIP 0.898
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.633 SNIP 0.859
Scopus rating (2007): SJR 0.551 SNIP 0.878
Scopus rating (2006): SJR 0.632 SNIP 0.946
Scopus rating (2005): SJR 0.683 SNIP 0.995
Scopus rating (2004): SJR 0.542 SNIP 1.01
Scopus rating (2003): SJR 0.255 SNIP 0.596
Connectivity of larval cod in the transition area between North Sea and Baltic Sea and potential implications for fisheries management

Connectivity of pelagic, early life stages via transport by ocean currents may affect survival chances of offspring, recruitment success, and mixing of stocks across management units. Based on drift model studies, transport patterns of particles representing exogenously feeding cod larvae in the transition area between North Sea and Baltic were investigated to (i) determine long-term trends and variability in advective transport of larvae from spawning grounds to juvenile nursery areas, (ii) estimate the degree of exchange between different management areas, and (iii) compare the results with spatial distributions of juvenile cod. The transport of particles showed considerable intra- and interannual variability, but also some general patterns of retention within and dispersion to different management areas. Good spatial overlap of particle end positions, representing potential juvenile settlement areas, with observed distributions of juveniles in bottom trawl surveys suggests that the drift simulations provide reasonable estimates of early life stage connectivity between cod populations in the investigated areas. High exchange rates of particles between management areas of up to ca. 70% suggest that cod populations in the investigated areas are demographically correlated. Results are discussed in relation to their relevance for stock structure, fish stock assessment, and management.
Copepod life strategy and population viability in response to prey timing and temperature: Testing a new model across latitude, time, and the size spectrum

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Strathclyde University, NOAA, Aarhus University
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Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 3
Article number: 225
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Coupling bacterioplankton populations and environment to community function in coastal temperate waters

Bacterioplankton play a key role in marine waters facilitating processes important for carbon cycling. However, the influence of specific bacterial populations and environmental conditions on bacterioplankton community performance remains unclear. The aim of the present study was to identify drivers of bacterioplankton community functions, taking into account the variability in community composition and environmental conditions over seasons, in two contrasting coastal systems. A Least Absolute Shrinkage and Selection Operator (LASSO) analysis of the biological and chemical data obtained from surface waters over a full year indicated that specific bacterial populations were linked to measured functions. Namely, Synechococcus (Cyanobacteria) was strongly correlated with protease activity. Both function and community composition showed seasonal variation. However, the pattern of substrate utilization capacity could not be directly linked to the community dynamics. The overall importance of dissolved organic matter (DOM) parameters in the LASSO models indicate that bacterioplankton respond to the present substrate landscape, with a particular importance of nitrogenous DOM. The identification of common drivers of bacterioplankton community functions in two different systems indicates that the drivers may be of broader relevance in coastal temperate waters.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Aarhus University
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Deciphering the structure of the West Greenland marine food web using stable isotopes (δ13C, δ15N)

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Monitoring and Data, Environment Canada, Aarhus University, Greenland Climate Research Centre, Kalundborg Municipality, Greenland Institute of Natural Resources
Authors: Linnebjerg, J. F. (Forskerdatabase), Hobson, K. A. (Ekstern), Fort, J. (Ekstern), Nielsen, T. G. (Intern), Møller, P. (Ekstern), Wieland, K. (Intern), Born, E. W. (Ekstern), Rigét, F. F. (Ekstern), Mosbech, A. (Forskerdatabase)
Publication date: 2016
Main Research Area: Technical/natural sciences
Development of a broodstock diet to improve developmental competence of embryos in European eel, Anguilla anguilla

We examined the effect of dietary arachidonic acid (ARA) and eicosapentaenoic acid (EPA) on the production of embryos and hatched larvae in the European eel, Anguilla anguilla. Two diets with high and intermediate levels of ARA and low and intermediate levels of EPA (Feed 1: ARA 1.9%, EPA 4.2%; Feed 2: ARA 1.2%, EPA 5.1% of total fatty acids) were tested against a commercial diet (DE: ARA: 0.5%, EPA: 8.2% of total fatty acids). After 24 weeks of feeding, ARA levels in the muscles and ovaries increased to 0.9% and 1.3% of total fatty acids, respectively, in Feed 1 and were significantly higher than in Feed 2 and DE. Female broodstock was not fed during hormonal treatment to induce vitellogenesis and ovulation. EPA levels in females fed the test diets decreased in the both muscle and ovary and were significantly lower in eggs from females fed Feed 1. The highest percentage of stripped females, producing viable eggs and larvae, were those females fed the highest dietary ARA levels (Feed 1). The level of lipid peroxidation products in eggs was similar among treatment, indicating that the lowest dietary levels of vitamin C and vitamin E were sufficient. In the unfertilized eggs, ARA levels were also highest (1.1% of total fatty acids) in the diet with highest ARA levels (Feed 1).
Dietary evidence of mesopelagic and pelagic foraging by Atlantic bluefin tuna (Thunnus thynnus L.) during autumn migrations to the Iceland Basin

Atlantic bluefin tuna (ABFT; Thunnus thynnus) is a large highly mobile predator fish species in the North Atlantic Ocean and Mediterranean Sea. Knowledge of its trophic role in marine food webs in summer feeding areas is presently based on recent (1980–2010s) sampling in the Bay of Biscay, Gulfs of Maine and St. Lawrence, and from historical (1950–1960s) sampling in the Norwegian-North Sea-Kattegat. No study has yet investigated the diets of ABFT in Icelandic waters, where it supported an experimental fishery during 1996–2005, nor in any region north of the Bay of Biscay since the 1960s. However, north Atlantic temperatures and fish species distributions, including some ABFT prey species (e.g., mackerel) have been changing in the 2000s. New knowledge of ABFT diets in previously understudied parts of the species range will be useful for understanding factors affecting the trophic role, migration behavior, and bioenergetics of ABFT. Here, we report the dietary composition of ABFT during autumn migrations to the Iceland Basin south of the continental shelf of Iceland. A total of 36 prey species or higher taxa were observed in 421 stomach samples: 17 teleost fishes, 4 squid, 1 octopus, 12 crustaceans, and 2 other invertebrate species. The most important prey species were European flying squid (Todarodes sagittatus) (%N = 16.70, %W = 48.89; %FO = 87.65), barracudinas (Paralepididae) (%N = 14.05, %W = 28.59, %FO = 76.48), and gonate squid (Gonatus sp.) (%N = 9.17, %W = 7.85, %FO = 75.06). Prey sizes were highly variable relative to ABFT sizes indicating highly opportunistic feeding on diverse sizes. The presence of a large proportion of mesopelagic species in the diet indicates feeding in the mesopelagic layer and extensive dive behavior. These results give new baseline knowledge for future comparison with anticipated oceanographic-biological changes in the region in the coming decades and can be used to help parameterize new models of ABFT migration behavior and trophic role

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Marine Research Institute
Authors: Olafsdottir, D. (Ekstern), MacKenzie, B. (Intern), Chosson-P, V. (Ekstern), Ingimundardottir, T. (Ekstern)
Number of pages: 23
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Drivers of fluorescent dissolved organic matter in the global epipelagic ocean

Fluorescent dissolved organic matter (FDOM) in open surface waters (< 200 m) of the Atlantic, Pacific, and Indian oceans was analysed by excitation-emission matrix (EEM) spectroscopy and parallel factor analysis (PARAFAC). A four-component PARAFAC model was fit to the EEMs, which included two humic- (C1 and C2) and two amino acid-like (C3 and C4) components previously identified in ocean waters. Generalized additive models (GAMs) were used to explore the environmental factors that drive the global distribution of these PARAFAC components. The explained variance for the humic-like components was substantially larger (> 70%) than for the amino acid-like components (< 35%). The environmental variables exhibiting the largest effect on the global distribution of C1 and C2 were apparent oxygen utilisation followed by chlorophyll a. Positive non-linear relationships between both predictor variables and the two humic-like PARAFAC components suggest that their distribution are biologically controlled. Compared with the dark ocean (> 200 m), the relationships of C1 and C2 with AOU indicate a higher C1/AOU and C2/AOU ratios of the humic-like substances in the dark ocean than in the surface ocean where a net effect of photobleaching is also detected. C3 (tryptophan-like) and C4 (tyrosine-like) variability was mostly dictated by salinity (S), by means of positive non-linear relationships, suggesting a
primary physical control of their distributions at the global surface ocean scale that could be related to the changing evaporation-precipitation regime. Remarkably, bacterial biomass (BB) only contributed to explain a minor part of the variability of C1 and C4.
Early life of an inshore population of West Greenlandic cod Gadus morhua: spatial and temporal aspects of growth and survival

Understanding the processes that affect fish larval survival and recruitment is a fundamental tenant of fisheries science. Small, isolated fjords are ideal study systems for elucidating early life history processes, as population dynamics are well traced in these partially closed systems. We examined the distribution, growth and mortality of eggs and larvae of a fjord population of cod during a 5 mo field campaign in the fjord Kapisigdlit, West Greenland. Cod mainly spawned early in the season in the innermost shallow region of the fjord. Egg survival was generally high in the fjord. The high survival may have been driven by relatively high temperature and/or low predation in the inner region. Early in the season, the distribution of eggs and young larvae was mostly restricted to the spawning area. Later in the season, larger larvae had become more evenly distributed in the fjord. This shift in distribution was observed after the seasonal pulse in freshwater outflow following the ice break-up in Kapisigdlit River. There was a positive correlation between the amount of food in a larval stomach and growth, and larval growth was greater in the outer fjord where prey availability was higher. The timing between spawning and freshwater input may be essential for survival and recruitment, this ensuring low dispersal of eggs and younger stages and high dispersal of older, actively feeding stages. Therefore, cod in this area could be vulnerable to future climate change affecting the timing and magnitude of freshwater outflow, by changes in precipitation, temperature or prey availability.
Early life of key fish species, capelin Mallotus villosus and Atlantic cod Gadus morhua, in West Greenland

Research involving the processes governing early life of fishes is important for understanding recruitment to the adult population. The forcing factors, like oceanographic processes and the associated plankton communities, impact the distribution and transport of fish larvae and determine their growth conditions, survival and recruitment to the adult stock. The temporal and spatial overlap of fish larvae and their prey is essential for their feeding, growth and survival. Investigations of the prey size spectra in fish larvae made possible to observe inter-specific prey competition and gain knowledge on the role in the food web. The changes in environmental factors between subarctic and Arctic areas along the west coast of Greenland provide a unique study frame. Here, the period of high primary productivity is short and limited by seasonal changes in light, consequently prey availability for the fish larvae during the summer. The duration of the productive season is of great importance for the early life of fish. The present thesis investigates the diets of capelin and cod in the subarctic Kapisigdlit, as well as the feeding of non-commercial larval fish in the entire Godthåbsfjord system. Furthermore, growth and feeding of capelin were compared between the two distant localities, Kapisigdlit Fjord and Disko Bay.

In Kapisigdlit Fjord, the zooplankton community structure was dominated by rotifers and harpacticoid copepod. These organisms appeared too small as prey for cod larvae, where they were feeding on prey sizes of about 5% of their own size (Paper I) and consequently the prey preference spectra covered calanoid nauplii, cladocerans and calanoid copepodites with increasing larval size.

In the Godthåbsfjord system and Fyllas Bank area, 4 hydrographic zones were defined; in each zone distinct zooplankton and ichthyoplankton assemblages were observed (Paper II). Calanus spp are mainly found off Godthåbsfjord, while the
smaller copepods are found in the inner fjord. Cladocerans and rotifers were mainly found in Kapisigdlit Fjord, where the key fish species capelin and cod spawn. Sixteen larval fish species were found in the area, and 3 main assemblages were identified according to their similarities, which are related to the hydrographic zones. Fish larvae may benefit from the estuarine circulation to distribute themselves from the spawning areas through the Godthåbsfjord. The diet of the larval fish species varied markedly along the fjord. Prey size preferences of fish larvae were positively correlated to their mouth sizes. American plaice and sandeel were probably do not compete for food with other fish species since these, contrary to other species, had high preference for microplankton. Capelin larvae from Kapisigdlit Fjord and Disko Bay emerged from the spawning sites when the sea surface temperature reached 6°C, this temperature was reached 1 month later in the northern locality though (Paper III). Their highest pelagic abundances were found when the sea surface temperature reached 8°C. Larval growth rate differed between the two localities, larvae growing faster in the northern Disko Bay than in Kapisigdlit Fjord.

Apparently, the later emergence of larvae in the northern locality was compensated by a higher growth rate, so the capelin larvae would reach the appropriate larval stage and size for overwintering. With respect to diet of capelin larvae, the feeding incidence was found to be greater than 50% and we found a broader spectra of prey taxa than seen in other investigations (Paper IV). The dominating prey items in both localities are: numerically, the rotifers and cyclopoid copepodites, and harpacticoid nauplii in Kapisigdlit only; while in terms of biomass, calanoid nauplii and cyclopoid copepodites dominated in both localities. The prey size spectra calculations show some feeding on microplankton, invertebrate eggs and rotifers for the smaller larvae, but the main organisms of preference – and of importance as biomass consumed – were calanoid nauplii and cyclopoid copepodites.

The findings indicate that capelin and cod larvae were not competing for food as their prey size spectra do not overlap. While cod is preying on larger organisms as they develop, the increase in maximally preferred prey size showed a slower increase during growth of the capelin larvae. Cyclopoid copepodites are food source for both capelin and cod, and there might be some competition for this item, however this plankton group is very abundant in the west coast of Greenland. However, the competition for food seems to be greater between cod and other fish larvae. With capelin, competition with other fish larvae seems to be minor. The increase in water temperatures in west of Greenland may impact the capelin stocks. When larval emergence is linked to temperature, and the initiation of productive cycles is linked to the break-up of ice cover and the subsequent irradiance increase in the water column, climatic changes in Arctic regions could lead to a mismatch between larval emergence and optimal conditions for their feeding and growth. Thus it would be feasible to investigate the capelin stock genetic characteristics in these areas, to evaluate the potential impact generated by the global warming because of the importance of the capelin for the food web in the west coast of Greenland.

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

**Publication Information**
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2016

Ecosystem indicators in the context of fisheries management: example of cod in the Baltic Sea

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Institute Management
Authors: Eero, M. (Intern), Casini, M. (Ekstern), Hüssy, K. (Intern), Köster, F. (Intern), MacKenzie, B. (Intern), Neuenfeldt, S. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2016

**Event**: Abstract from World Fisheries Congress, Busan, Korea, Republic of.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Effect of arctic sea-ice melt on inherent optical properties and vertical distribution of solar radiant heating - possible feedbacks on ice melt

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian Polar Institute
Effects of an Arctic under-ice phytoplankton bloom on bio-optical properties of surface waters during the Norwegian Young Sea Ice Cruise (N-ICE2015)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Bergen, Norwegian Polar Institute, University of Manitoba, Alfred Wegener Institute for Polar and Marine Research
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

Effects of oil spill responses on key Arctic zooplankton species
The copepod Calanus glacialis is a key species in the Arctic ecosystem. Increased shipping and oil and gas activities in the Arctic increase the risk of an oil spill. It is therefore important to study the potential consequences of an oil spill on this key species in the Arctic marine ecosystems. As a part of a large joint industry initiative (www.arcticresponsetechnology.org) a first of its kind mesocosm experiment was executed in an Arctic fjord of the Island of Svalbard. Effects of natural attenuation of the oil, in-situ burning and chemical dispersion were studied on grazing, egg production and hatching of the Arctic copepod Calanus glacialis. Eight mesocosms with open top and bottom were deployed in the sea ice in Van Mijenfjorden, Svalbard, in February 2015. Two replicates were used for all treatments. After application, surface ice was allowed to re-establish. Water was collected from the top 2 cm water column in March and just before sea ice break up in May, and was used in two 14-day incubation experiments with C. glacialis collected in Isfjorden. Copepods were fed during the experiment and eggs and pellets were quantified daily. Egg hatching was determined in the beginning and end of the experiment. There was no significant effect of the oil spill treatments on average cumulated specific pellet production or egg hatching success. However in May, the average cumulated specific egg production was significantly higher in the dispersed oil treatment compared to the control from day 2 (+ 169 %) until the end of the experiment (+ 41 %)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Centre for Ocean Life, UiT The Arctic University of Norway, University Centre in Svalbard, COWI A/S
Authors: Toxværd, K. U. (Intern), Hansen, P. H. (Intern), Köhler, E. (Intern), Pancic, M. (Intern), Hatlebakk, M. (Ekstern), Eide, H. O. (Ekstern), Søreide, J. E. (Ekstern), Nielsen, T. G. (Intern), Hjorth, M. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2017
Effects of oil spill responses on key Arctic zooplankton species

Increased shipping and oil and gas activities in the Arctic increase the risk of an oil spill. Oil compounds can have toxic impact on Arctic marine ecosystems, but impacts from response technologies on ice associated ecology have not been studied extensively. The copepod Calanus glacialis is a key species in the Arctic marine ecosystem. It plays a central role in energy transfer between primary producers and higher trophic levels of the Arctic food chain. It is therefore relevant to study potential consequences of an oil spill on this ecological important species. As a part of a large joint industry initiative (www.arcticresponsetechnology.org) a first of its kind mesocosm experiment was executed in an Arctic fjord of the Island of Svalbard. Effects of natural attenuation of the oil, in-situ burning and chemical dispersion were studied on grazing, egg production and hatching of the Arctic copepod Calanus glacialis. Eight mesocosms with open top and bottom were deployed in the sea ice in Van Mijenfjorden, Svalbard, in February 2015. Two replicates were used for all treatments. After application, surface ice was allowed to re-establish. Water was collected from the top 2 cm water column in March and just before sea ice break up in May, and was used in two 14-day incubation experiments with C. glacialis collected in Isfjorden. Copepods were fed during the experiment and eggs and pellets were quantified daily. Egg hatching was determined in the beginning and end of the experiment. There was no significant effect of the oil spill treatments on average cumulated specific pellet production or egg hatching success. However in May, the average cumulated specific egg production was significantly higher in the oil-dispersant mixture treatment compared to the control from day 2 (+ 169 %) until the end of the experiment (+ 41 %). To correlate observed effects and toxicity, and to examine potential pollutant transfer, the chemical content of incubation water, exposed females and produced eggs was further analysed for chemical residue. These results will be presented on the SETAC 2016 conference

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Centre for Ocean Life, University Centre in Svalbard, UiT The Arctic University of Norway
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Publication date: 2016
Event: Poster session presented at 7th SETAC World Congress, Orlando, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2017

Effects of salinity and sea salt type on egg activation, fertilization, buoyancy and early embryology of European eel, Anguilla anguilla

Improper activation and swelling of in vitro produced eggs of European eel, Anguilla anguilla, has been shown to negatively affect embryonic development and hatching. We investigated this phenomenon by examining the effects of salinity and sea salt type on egg dimensions, cell cleavage patterns and egg buoyancy. Egg diameter after activation, using natural seawater adjusted to different salinities, varied among female eels, but no consistent pattern emerged. Activation salinities between 30–40 practical salinity unit (psu) produced higher quality eggs and generally larger egg diameters. Chorion diameters reached maximal values of 1642 ± 8 μm at 35 psu. A positive relationship was found between egg neutral buoyancy and activation salinity. Nine salt types were investigated as activation and incubation media. Five of these types induced a substantial perivitelline space (PVS), leading to large egg sizes, while the remaining four salt types resulted in smaller eggs. All salt types except NaCl treatments led to high fertilization rates and had no effect on fertilization success as well as egg neutral buoyancies at 7 h post-fertilization. The study points to the importance of considering ionic composition of the media when rearing fish eggs and further studies are encouraged

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Sørensen, S. R. (Intern), Butts, I. (Intern), Munk, P. (Intern), Tomkiewicz, J. (Intern)
Pages: 121-138
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
Journal: Zygote
Volume: 24
Issue number: 1
ISSN (Print): 0967-1994
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
The Baltic Sea is the world's largest area suffering from eutrophication-driven hypoxia. Low oxygen levels are threatening its biodiversity and ecosystem functioning. The main causes for eutrophication-driven hypoxia are high nutrient loadings and global warming. Wastewater treatment plants (WWTP) contribute to eutrophication as they are important sources of nitrogen to coastal areas. Here, we evaluated the effects of wastewater treatment plant effluent inputs on Baltic Sea planktonic communities in four experiments. We tested for effects of effluent inputs on chlorophyll a content, bacterial community composition, and metabolic rates: gross primary production (GPP), net community production (NCP), community respiration (CR) and bacterial production (BP). Nitrogen-rich dissolved organic matter (DOM) inputs from effluents increased bacterial production and decreased primary production and community respiration. Nutrient amendments and seasonally variable environmental conditions lead to lower alpha-diversity and shifts in bacterial community composition (e.g. increased abundance of a few cyanobacterial populations in the summer experiment), concomitant with changes in metabolic rates. An increase in BP and decrease in CR could be caused by high lability of the DOM that can support secondary bacterial production, without an increase in respiration. Increases in bacterial production and simultaneous decreases of primary production lead to more carbon being consumed in the microbial loop, and may shift the ecosystem towards heterotrophy.
Enhancing organic matter removal in desalination pretreatment systems by application of dissolved air flotation
Membrane fouling in reverse osmosis (RO) systems caused by organic matter (OM) remains a significant operational issue during desalination. Dissolved air flotation (DAF) has recently received attention as a pre-treatment option for seawater OM removal; however, only a limited number of studies have been undertaken. This may be because it is difficult to characterise OM in seawater due to the high salt content and low carbon concentration. In this study, DAF pre-treatment experiments were conducted using a model seawater solution, and real seawater and brackish water samples. DAF performance was determined via conventional water quality parameters as well as fluorescence excitation-emission matrix (FEEM) spectroscopy and liquid chromatography with organic carbon detection (LC-OCD). Biopolymers and humic substances were the major organic fractions removed between 38 and 84% and 20-61% depending on the sample, respectively. The optimal normalised coagulant dose (Fe3+ to DOC ratio) was observed to be 0.5-4 at pH5.5 increasing to 4-12 at pH7.5. At pH5.5, the optimum coagulant dose increased with increasing humic character of the feed water. Overall, the OM removal efficiency by DAF observed in this study was higher than reported for other membrane-based processes; a combination of DAF and biofiltration is likely to be complementary.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of New South Wales
Authors: Shutova, Y. (Ekstern), Karna, B. L. (Ekstern), Hambly, A. C. (Intern), Lau, B. (Ekstern), Henderson, R. K. (Ekstern), Le-Clech, P. (Ekstern)
Pages: 12-21
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Desalination
Volume: 383
ISSN (Print): 0011-9164
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 5.82 SJR 1.808 SNIP 1.911
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.522 SNIP 1.868 CiteScore 4.83
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.86 SNIP 2.257 CiteScore 4.65
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.733 SNIP 2.17 CiteScore 4.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.517 SNIP 1.506 CiteScore 2.97
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.109 SNIP 1.276 CiteScore 2.93
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.897 SNIP 1.076
Environmental DNA from seawater samples correlate with trawl catches of Subarctic, deepwater fishes

Remote polar and deepwater fish faunas are under pressure from ongoing climate change and increasing fishing effort. However, these fish communities are difficult to monitor for logistic and financial reasons. Currently, monitoring of marine fishes largely relies on invasive techniques such as bottom trawling, and on official reporting of global catches, which can be unreliable. Thus, there is need for alternative and non-invasive techniques for qualitative and quantitative oceanic fish surveys. Here we report environmental DNA (eDNA) metabarcoding of seawater samples from continental slope depths in Southwest Greenland. We collected seawater samples at depths of 188-918 m and compared seawater eDNA to catch data from trawling. We used Illumina sequencing of PCR products to demonstrate that eDNA reads show equivalence to fishing catch data obtained from trawling. Twenty-six families were found with both trawling and eDNA, while three families were found only with eDNA and two families were found only with trawling. Key commercial fish species for Greenland were the most abundant species in both eDNA reads and biomass catch, and interpolation of eDNA abundances between sampling sites showed good correspondence with catch sizes. Environmental DNA sequence reads from the fish assemblages correlated with biomass and abundance data obtained from trawling. Interestingly, the Greenland shark (Somniosus microcephalus) showed high abundance of eDNA reads despite only a single specimen being caught, demonstrating the relevance of the eDNA approach for large species that can probably avoid bottom trawls in most cases. Quantitative detection of marine fish using eDNA remains to be tested further to ascertain whether this technique is able to yield credible results for routine application in fisheries. Nevertheless, our study demonstrates that eDNA reads can be used as a qualitative and quantitative proxy for marine fish assemblages in deepwater oceanic habitats. This relates directly to applied fisheries as well as to monitoring effects of ongoing climate change on marine biodiversity especially in polar ecosystems.

General information
State: Published
Organisations: Section for Ecosystem based Marine Management, National Institute of Aquatic Resources, Arctic Section
Authors: Thomsen, P. F. (Ekstern), Møller, P. R. (Ekstern), Sigsgaard, E. E. (Ekstern), Knudsen, S. W. (Ekstern), Jørgensen, O. A. (Intern), Willerslev, E. (Ekstern), Mahon, A. R. (ed.) (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Estimation of by catch in the commercial fishery for Greenland halibut at West Greenland based on survey data

The by catch in the commercial fishery for Greenland halibut in NAFO Div. 1CD was estimated based on information from ground fish surveys conducted by Greenland Institute of Natural Resources in the same area as the commercial fishery. The survey is conducted with a trawl with 30 mm in the cod end while the minimum mesh size in the cod end in the commercial trawls is 140 mm and the survey catches are converted to potential
commercial by catches. The conversion is based on a number of assumptions and the results should be considered as indicative. The total by-catch in weight is estimated to be 13% of the total catch of Greenland halibut. Macrourus berglax is the most abundant by catch species and constituted 3.2% of the weight of Greenland halibut followed by Antiomora rostrata (2.7%), Alepocephalus agassizzi (2.0%) and Hydrodorus affinis (1.2%). None of the remaining species constituted more than 1% of the weight of the Greenland halibut catches. The impact of the fishery for Greenland halibut in Div. 1CD on the stocks of the bycatch species seems, however, to be limited. The by-catch in Div. 0B is at the same level as in Div. 1CD.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section
Authors: Jørgensen, O. A. (Intern)
Number of pages: 8
Publication date: 2016
Main Research Area: Technical/natural sciences

Evaluation of otolith shape as a tool for stock discrimination in marine fishes using Baltic Sea cod as a case study
In the Western Baltic Sea two genetically distinct cod stocks "Eastern Baltic cod" and "Western Baltic cod" occur with considerable mixing of stocks. In this study we evaluated the applicability of otolith shape analysis for classification of individuals caught in the mixed stock cod fishery, using SNP (singlenucleotide polymorphism) based genetic assignment of otolith shape baselines. We further developed a management aimed approach for mixed stock assignment by robust stochastic baseline selection and posterior bias correction by individual reassignment of the least likely classifications into the alternate stock. Classification criteria selected by Monte Carlo runs of Linear Discriminant Analysis were captured by otolith area and 20 Elliptic Fourier Descriptors of primarily low frequency harmonics. Classification success was considerably lower when using a baseline of spawning individuals only, compared to the better spatial coverage of a combined baseline also including genotyped individuals from the mixed stock area. Furthermore, the inclusion of genotyped individuals balanced the baseline size composition and to a large extent removed a strong size related bias in classification success. These results demonstrate the interplay of environmental, ontogenetic and genetic influences on otolith shape, which complicates the application of otolith shape for stock discrimination in mixed-stock scenarios. Rigours genetic validation and further studies on the temporal dynamics of shape formation are necessary.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Section for Ecosystem based Marine Management
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Pages: 210-218
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 174
ISSN (Print): 0165-7836
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 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
Evolution determines how global warming and pesticide exposure will shape predator-prey interactions with vector mosquitoes

How evolution may mitigate the effects of global warming and pesticide exposure on predator-prey interactions is directly relevant for vector control. Using a space-for-time substitution approach, we addressed how 4°C warming and exposure to the pesticide endosulfan shape the predation on Culex pipiens mosquitoes by damselfly predators from replicated low- and high-latitude populations.
Although warming was only lethal for the mosquitoes, it reduced predation rates on these prey. Possibly, under warming escape speeds of the mosquitoes increased more than the attack efficiency of the predators. Endosulfan imposed mortality and induced behavioral changes (including increased filtering and thrashing and a positional shift away from the bottom) in mosquito larvae. Although the pesticide was only lethal for the mosquitoes, it reduced predation rates by the low-latitude predators. This can be explained by the combination of the evolution of a faster life history and associated higher vulnerabilities to the pesticide (in terms of growth rate and lowered foraging activity) in the low-latitude predators and pesticide-induced survival selection in the mosquitoes. Our results suggest that predation rates on mosquitoes at the high latitude will be reduced under warming unless predators evolve toward the current low-latitude phenotype or low-latitude predators move poleward.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Leuven, Nha Trang University
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Pages: 818-830
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Evolutionary Applications (Online)
Volume: 9
Issue number: 6
ISSN (Print): 1752-4563
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 4.96 SJR 2.299 SNIP 1.478
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.666 SNIP 1.392 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.356 SNIP 1.402 CiteScore 4.23
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.478 SNIP 1.432 CiteScore 4.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.185 SNIP 1.179 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 2.427 SNIP 1.216 CiteScore 4.5
Scopus rating (2010): SJR 1.633 SNIP 1.014
Scopus rating (2009): SJR 1.241 SNIP 0.87
Original language: English
Electronic versions:
Publishers version
DOIs: 10.1111/eva.12390
Source: PublicationPreSubmission
Source-ID: 124122592
Publication: Research - peer-review › Journal article – Annual report year: 2016
Experimental insights into the importance of aquatic bacterial community composition to the degradation of dissolved organic matter

Bacteria play a central role in the cycling of carbon, yet our understanding of the relationship between the taxonomic composition and the degradation of dissolved organic matter (DOM) is still poor. In this experimental study, we were able to demonstrate a direct link between community composition and ecosystem functioning in that differently structured aquatic bacterial communities differed in their degradation of terrestrially derived DOM. Although the same amount of carbon was processed, both the temporal pattern of degradation and the compounds degraded differed among communities. We, moreover, uncovered that low-molecular-weight carbon was available to all communities for utilisation, whereas the ability to degrade carbon of greater molecular weight was a trait less widely distributed. Finally, whereas the degradation of either low- or high-molecular-weight carbon was not restricted to a single phylogenetic clade, our results illustrate that bacterial taxa of similar phylogenetic classification differed substantially in their association with the degradation of DOM compounds. Applying techniques that capture the diversity and complexity of both bacterial communities and DOM, our study provides new insight into how the structure of bacterial communities may affect processes of biogeochemical significance.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Lund University, Uppsala University, University of Copenhagen, KTH - Royal Institute of Technology, Swedish University of Agricultural Sciences
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Pages: 533-545
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: ISME Journal
Volume: 10
Issue number: 3
ISSN (Print): 1751-7362
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 8.91 SJR 4.771 SNIP 2.188
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.087 SNIP 2.363 CiteScore 9.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 5.056 SNIP 2.181 CiteScore 8.42
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.71 SNIP 2.175 CiteScore 8.62
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.673 SNIP 2.07 CiteScore 8.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.536 SNIP 1.777 CiteScore 6.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.245 SNIP 1.626
Exposure to a heat wave under food limitation makes an agricultural insecticide lethal: a mechanistic laboratory experiment

Extreme temperatures and exposure to agricultural pesticides are becoming more frequent and intense under global change. Their combination may be especially problematic when animals suffer food limitation. We exposed Coenagrion puella damselfly larvae to a simulated heat wave combined with food limitation and subsequently to a widespread agricultural pesticide (chlorpyrifos) in an indoor laboratory experiment designed to obtain mechanistic insights in the direct effects of these stressors in isolation and when combined. The heat wave reduced immune function (activity of phenoloxidase, PO) and metabolic rate (activity of the electron transport system, ETS). Starvation had both immediate and delayed negative sublethal effects on growth rate and physiology (reductions in Hsp70 levels, total fat content, and activity levels of PO and ETS). Exposure to chlorpyrifos negatively affected all response variables. While the immediate effects of the heat wave were subtle, our results indicate the importance of delayed effects in shaping the total fitness impact of a heat wave when followed by pesticide exposure. Firstly, the combination of delayed negative effects of the heat wave and starvation, and the immediate negative effect of chlorpyrifos considerably (71%) reduced larval growth rate. Secondly and more strikingly, chlorpyrifos only caused considerable (ca. 48%) mortality in larvae that were previously exposed to the combination of the heat wave and starvation. This strong delayed synergism for mortality could be explained by the cumulative metabolic depression caused by each of these stressors. Further studies with increased realism are needed to evaluate the consequences of the here-identified delayed synergisms at the level of populations and communities. This is especially important as this synergism provides a novel explanation for the poorly understood potential of heat waves and of sublethal pesticide concentrations to cause mass mortality.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Leuven, KU Leuven, Nha Trang University
Authors: Dinh, K. V. (Intern), Janssens, L. (Ekstern), Stoks, R. (Ekstern)
Pages: 3361-3372
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Change Biology
Volume: 22
Issue number: 10
ISSN (Print): 1354-1013
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 8.75 SJR 4.768 SNIP 2.615
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 5.239 SNIP 2.585 CiteScore 8.48
Web of Science (2015): Indexed yes
Extreme temperature and oil contamination shape the relative abundance of copepod species in the Arctic

The retreat of sea ice in the Arctic under global warming is predicted to intensify oil exploitation and shipping activities in this region, posing the risk of oil contamination. Knowledge on how Arctic secondary producers deal with the combined effects of global warming, particularly the extreme temperature and oil exposure is limited. To address this, we exposed females of two copepods species Calanus glacialis and C. finmarchicus to pyrene at three temperatures: 2, 6 and 10°C. Both species co-exist in the Disko Bay, Greenland, but only C. glacialis is a true Arctic specialist while C. finmarchicus is of north Atlantic origin. Pyrene is one of the most toxic components of crude oil to marine copepods. The temperatures of 2, 6 and 10°C represent the mean sea water temperature, the 4°C increase in mean temperature by 2100 as predicted by IPCC scenario RCP8.5 (2013) and the extreme sea water temperature, respectively, in Disko Bay. Four-degree temperature increase did not have an effect on grazing rate and survival of both species. However, the extreme temperature (10°C) increased the grazing rate and mortality of C. glacialis, but not in C. finmarchicus. Exposure to high pyrene strongly reduced survival and grazing rate in both species and this pattern was independent of temperatures.
Notably, exposure to high pyrene resulted in than 70% of mortality in C. finmarchicus that was two times higher than the mortality observed for C. glacialis. These results suggest that extreme temperature under global warming and oil pollution may drastically change the relative abundance of pelagic copepod community by changing the species-specific vulnerability to extreme temperature and oil exposure.
Down-regulation of fecundity through oocyte resorption was assessed in Baltic Sea turbot Scophthalmus maximus at three locations in the period from late vitellogenesis in April to spawning during June to July. The mean±s.d. total length of the sampled fish was 32.7±3.1 cm and mean±s.d. age was 6.2±1.5 years. Measurements of atresia were performed using the ‘profile method’ with the intensity of atresia adjusted according to the ‘dissectormethod’ (10.6% adjustment; coefficient of determination was 0.675 between methods). Both prevalence (portion of fish with atresia) and intensity (calculated as the average proportion of atretic cells in fish displaying atresia) of atresia were low in prespawning fish, but high from onset of spawning throughout the spawning period. Atretic oocytes categorized as in early alpha and in late alpha state occurred irrespective of maturity stage from late prespawning individuals up to late spawning fish, showing that oocytes may become atretic throughout the spawning period. Observed prevalence of atresia throughout the spawning period was almost 40% with an intensity of c. 20%. This indicates extensive down-regulation, i.e. considerably lower realized (number of eggs spawned) v. potential fecundity (number of developing oocytes), suggesting significant variability in reproductive potential. The extent of fecundity regulation in relation to fish condition (Fulton’s condition factor) is discussed, suggesting an association between levels of atresia and fish condition.
First-feeding by European eel larvae: A step towards closing the life cycle in captivity

First evidence of first-feeding European eel larvae that have been reared in captivity•Up to 50% of larvae ingested a diet composed of concentrated rotifer paste, with or without natural feeding stimulants•Documentation of a significant increase in feeding success under higher light intensities•Results move us a step closer towards understanding an undisclosed phase in the European eel life cycle

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Butts, I. (Intern), Sørensen, S. R. (Intern), Politis, S. N. (Intern), Tomkiewicz, J. (Intern)
Pages: 451-458
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
Journal: Aquaculture
Volume: 464
ISSN (Print): 0044-8486
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 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
First production of larvae using cryopreserved sperm: Effects of preservation temperature and cryopreservation on European eel sperm fertilization capacity

Sperm cryopreservation is a useful tool in captive fish reproduction management, that is to synchronize gamete production, especially in the case of species as the European eel, where the time of female spawning readiness is unpredictable. Several protocols to cryopreserve sperm of this species have been described, but until recently fertilization trials were not feasible. This study evaluated the effect of cold storage of diluted sperm prior to fertilizations and tested whether a previously defined protocol for European eel sperm cryopreservation can be successfully applied in fertilization trials to produce viable offspring. In our experiment, the sperm motility was evaluated after the extraction and the best samples were selected and pooled. Until stripping of eggs and fertilization, diluted sperm samples were maintained at either 4 or 20°C, or cryopreserved, following existing protocols. Fertilization of two egg batches was attempted. Diluted sperm caused a similar percentage of fertilized eggs and a similar number of embryos and larvae, independently of storage temperature (4 or 20°C). The cryopreserved sperm resulted in a lower percentage of fertilized eggs, but embryos developed and a few larvae (‘cryolarvae’) were obtained 55 h after fertilization in one of the two egg batches. This result evidences that the tested cryopreservation protocol is applicable for eel reproduction management, although improvements will be required to enhance fertilization success.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Universidad Politecnica de Valencia, Billund Aquakulturservice A/S
Fiskere kan være med til at aldersbestemme torsk

General information
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
Source-ID: 126631149
Publication: Research › Conference abstract for conference – Annual report year: 2016

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

Functional biology of sympatric krill species
Here we compare the functional biology of the sympatric krill species, Meganyctiphanes norvegica and Thysanoessa inermis. For M. norvegica, we investigated functional responses on diatoms and copepods, together with prey size spectra on plankton ,400 mm and copepods in the size range 500–3220 mm. For T. inermis, only prey size spectrum on plankton ,400 mm were investigated. The prey size ranges of both species include organisms ,400 mm, and they consequently graze on several trophic levels. However, T. inermis feeds on cells ,10 mm equivalent spherical diameter (ESD), whereas M. norvegica only feed on cells .10 mm. Meganyctiphanes norvegica show maximum predation on 800–1600 mm sized copepods, corresponding to a predator:prey size ratio of 17.0±2.2. Functional response experiments with M. norvegica follow a Holling type III functional response, both when feeding on diatoms and copepods, but with an order of magnitude higher ingestion rate on the copepod prey. The two functional groups, M. norvegica and Thysanoessa spp., overlap in prey size spectra. However, there are differences in their ability to exploit different prey classes. Here, we present clearance rates of both krill species on natural plankton illustrating the two species’ wide particle range spectra

General information
Functional characterisation of eel dopamine D2 receptors and involvement in the direct inhibition of pituitary gonadotrophins

In various vertebrate species, dopamine (DA) exerts an inhibitory action on reproduction. In the European eel, DA plays a pivotal role in the inhibitory control of gonadotroph function and the blockade of puberty. In vivo studies have suggested that this effect is mediated by receptors pharmacologically related to the D2 family. In the European eel, two distinct D2 receptor (D2-R) paralogous genes have been identified (D2A-R and D2B-R) and both were shown to be expressed in the pituitary. We investigated the potential role of each parologue in the control of gonadotroph function in this species. Eel recombinant D2A-R or D2B-R were expressed in HEK 293 cells, with a universal Gα subunit, and receptor activation was followed by inositol phosphate production. Recombinant D2-Rs exhibited a comparable affinity for DA, although they had differential affinities for mammalian D2-R agonists and antagonists, supporting subtle structure/activity differences. Furthermore, using eel pituitary cell primary cultures, the expression by gonadotroph cells of both native eel D2-R paralogues was examined by in situ hybridisation of D2A-R or D2B-R transcripts, coupled with immunofluorescence of luteinising hormone (LH)β or follicle-stimulating (FSH)β. LH and to a lesser extent, FSH cells expressed both D2-R transcripts but with a clear predominance of D2B-R. Notably, D2B-R transcripts were detected for the majority of LH cells. Accordingly, using these cultures, we showed that DA potently inhibited basal and testosterone-stimulated LHβ expression and less potently basal and activin-stimulated FSHβ expression. We also tested some D2-R antagonists, aiming to select the most adequate one to be used in innovative protocols for induction of eel sexual maturation. We identified eticlopride as the most potent inhibitor of DA action on basal and stimulated LH expression in vitro. Our data suggest a differential functionalisation of the duplicated receptor genes and demonstrate that mainly D2B-R is involved in the dopaminergic inhibitory control of eel gonadotroph function.
Temperature increase associated with global climate change can be expected to directly influence the spawning success of fish species, with implications for abundance and distribution. We conducted a meta-analysis to investigate and compare responses of development time, cumulative degree-days and survival of fish eggs from 32 populations of 17 species in the North Atlantic to different temperatures in order to determine potential consequences of global warming for these species. The response of development time exhibited a similar decreasing trend with respect to temperature across species. The similar slopes of regression lines relating ln-transformed development time and temperature indicate similar sensitivity to temperature changes. Across-species differences were mainly driven by intercept values, indicating up to 8-fold differences in development time at given temperature. There was an overall decrease, across species, in an index of thermal requirement (cumulative degree-days) for egg development with increasing temperature. Within an empirically derived optimal thermal range for egg survival, the thermal requirement was more variable in species adapted to cold waters compared to species adapted to warmer waters. Moreover, the sensitivity of survival of eggs from different species to increases in temperature differed, reflecting a pattern of sensitivity along a stenotherm-eurytherm gradient of vulnerability to temperature among species. The results quantify physiological effects of temperature on the eggs, and we propose that such effects are major factors leading to a close correspondence between the physiological optimal temperature for survival and observed temperature at spawning sites. Temperature during egg development appears to be a key evolutionary force affecting spawning time and location.
Glacial meltwater influences on plankton community structure and the importance of top-down control (of primary production) in a NE Greenland fjord

Freshwater runoff from the Greenland Ice Sheet (GIS) can be an important driver influencing plankton community structure in Greenland fjords. In the present study, we describe physical, taxonomic and functional differences in the plankton community in Young Sound, a NE Greenland fjord, from the inner fjord close to the GIS towards the coastal region in late summer. The fjord is influenced by runoff from land-terminating glaciers that separated the surface layer from cold underlying waters. The highest chlorophyll a concentration (74.9% of the total copepod biomass at all stations, and their grazing impact was the highest among the copepod groups. Copepod grazing impact on the phytoplankton standing stock, however, was exceeded by microzooplankton grazing, investigated by dilution experiments, with the highest grazing impact on the phytoplankton standing stock of 63% d⁻¹ in the inner part of the fjord. In spite of high phytoplankton instantaneous growth rates at the innermost fjord station, proto-zooplankton was capable of controlling the phytoplankton production. The study showed functional differences within the system and provides indications of how dynamic the coastal ecosystem of Greenland can be.
Scopus rating (2002): SJR 0.694 SNIP 1.25
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.038 SNIP 1.259
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.033 SNIP 1.39
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.662 SNIP 1.245
Original language: English
Oceanography, Aquatic Science, Glacial meltwater runoff, Grazing, High Arctic fjord, Phytoplankton growth, Zooplankton, Calanus, Copepoda, Microcalanus, Pseudocalanus
DOIs:
10.1016/j.ecss.2016.08.026
Source: FindIt
Source-ID: 2347681340
Publication: Research - peer-review › Journal article – Annual report year: 2016

Global patterns in the feeding ecology of large marine fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: van Denderen, P. D. (Intern), Lindegren, M. (Intern), MacKenzie, B. (Intern), Watson, R. A. (Ekstern), Andersen, K. H. (Intern)
Publication date: 2016
Event: Poster session presented at Gordon research conference and seminar: “Unifying ecology across scales”, Biddeford, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

Habitat suitability of the Atlantic bluefin tuna by size class: An ecological niche approach

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, European Commission - Joint Research Center, IFREMER, Fisheries and Oceans Canada, AZTI-Tecnalia, Institute of Oceanography and Fisheries, World Wide Fund for Nature (WWF), Instituto Nacional de Pesca, Institute of Marine Biological Resources and Inland Waters, Instituto Español de Oceanografía, Università degli Studi di Bari Aldo Moro, Istanbul University, University of Athens, Ege University, National Oceanographic and Atmospheric Administration, Universidade dos Açores, Università degli studi di Cagliari
Pages: 30-46
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Progress in Oceanography
Volume: 142
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
Has eutrophication promoted forage fish production in the Baltic Sea?
Reducing anthropogenic nutrient inputs is a major policy goal for restoring good environmental status of coastal marine ecosystems. However, it is unclear to what extent reducing nutrients would also lower fish production and fisheries yields. Empirical examples of changes in nutrient loads and concurrent fish production can provide useful insights to this question. In this paper, we investigate to what extent a multi-fold increase in nutrient loads from the 1950s to 1980s enhanced forage fish production in the Baltic Sea. We use monitoring data on fish stock dynamics covering the period of the nutrient increase, combined with nutrient concentrations from a 3-dimensional coupled physical-biogeochemical ocean model. The results suggest that nutrient enrichment enhanced the biomass level of forage fish by up to 50 % in some
years and areas due to increased body weight of fish. However, the trends in fish biomasses were generally decoupled from changes in nutrient concentrations.

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Swedish Meteorological and Hydrological Institute

Authors: Eero, M. (Intern), Andersson, H. C. (Ekstern), Almroth-Rosell, E. (Ekstern), MacKenzie, B. (Intern)

Publication date: 2016

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Ambio

Volume: 45

Issue number: 6

ISSN (Print): 0044-7447

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 3.19 SJR 1.221 SNIP 1.194
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.114 SNIP 1.089 CiteScore 2.6
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.23 SNIP 1.308 CiteScore 2.71
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.203 SNIP 1.278 CiteScore 2.56
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.953 SNIP 0.907 CiteScore 1.88
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.845 SNIP 0.897 CiteScore 1.65
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.176 SNIP 1.323
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.189 SNIP 1.082
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.871 SNIP 1.055
- Scopus rating (2007): SJR 0.786 SNIP 1.091
- Scopus rating (2006): SJR 0.965 SNIP 1.115
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.732 SNIP 1.064
- Scopus rating (2004): SJR 0.834 SNIP 1.094
- Scopus rating (2003): SJR 0.833 SNIP 1.055
- Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.819 SNIP 1.156
- Scopus rating (2001): SJR 1 SNIP 1.402
- Web of Science (2001): Indexed yes
High export via small particles before the onset of the North Atlantic spring bloom: Small particle export before the bloom

Sinking organic matter in the North Atlantic Ocean transfers 1-3 Gt carbon yr⁻¹ from the surface ocean to the interior. The majority of this exported material is thought to be in form of large, rapidly sinking particles that aggregate during or after the spring phytoplankton bloom. However, recent work has suggested that intermittent water column stratification resulting in the termination of deep convection can isolate phytoplankton from the euphotic zone, leading to export of small particles. We present depth profiles of large (>0.1 mm equivalent spherical diameter, ESD) and small (300 m depth, leading to deep mixing of particles as deep as 600 m. Subsequent restratification could trap these particles at depth and lead to high particle fluxes at depth without the need for aggregation ("mixed-layer pump"). Overall, we suggest that prebloom fluxes to the mesopelagic are significant, and the role of small sinking particles requires careful consideration.

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, National Oceanography Centre, University of Bergen, University of Hamburg

Authors: Giering, S. L. C. (Ekstern), Sanders, R. (Ekstern), Martin, A. P. (Ekstern), Lindemann, C. (Ekstern), Möller, K. O. (Ekstern), Daniels, C. J. (Ekstern), Mayor, D. J. (Ekstern), St. John, M. (Intern)

Pages: 6929–6945

Publication date: 2016

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Geophysical Research: Oceans

Volume: 121

Issue number: 9

ISSN (Print): 2169-9275

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 3.36 SJR 1.996 SNIP 1.313

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 2.288 SNIP 1.362 CiteScore 3.39

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 2.324 SNIP 1.349 CiteScore 3.27

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 2.357 SNIP 1.44 CiteScore 3.38

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 2.365 SNIP 1.35 CiteScore 2.93

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 2
Host size-dependent anisakid infection in Baltic cod Gadus morhua associated with differential food preferences

A significant increase in the infection level of Baltic cod Gadus morhua with the anisakid nematode larvae Contracaecum osculatum and Pseudoterranova decipiens has been recorded during recent years due to the expanding local population of grey seals Halichoerus grypus, which act as final hosts for these parasites. Here, we report from an investigation of 368 cod (total length [TL] 6-49 cm; caught in ICES Subdivision 25) that the infection level of juvenile cod (TL 6-30 cm) with larvae of C. osculatum and P. decipiens is absent or very low, whereas it increases drastically in larger cod (TL 31-48 cm). A third nematode Hysterothylacium aduncum was rarely found. The study indicates that the prey animals for large cod act as transport hosts for the parasite larvae. Analyses of stomach contents of cod caught in the same area (2007-2014) showed that small benthic organisms (including polychaetes Harmothoe sarsi) are preferred food items by small cod, the isopod Saduria entomon is taken by all size classes, and sprat Sprattus sprattus are common prey items for cod larger than 30 cm. Parasitological investigations (microscopic and molecular analyses) of H. sarsi (100 specimens) and S. entomon (40 specimens) did not reveal infection in these invertebrates, but 11.6% of sprat (265 specimens examined) was shown to be infected with 1-8 C. osculatum third stage larvae per fish. Analyses of sprat stomach contents confirmed that copepods and cladocerans are the main food items of sprat. These observations suggest that the C. osculatum life cycle in the Baltic Sea includes grey seals as final hosts, sprat as the first transport host and cod as second transport host. It may be speculated that sprat obtain infection by feeding on copepods and/or cladocerans, which could serve as the first intermediate hosts. One cannot exclude the possibility that the size-dependent C. osculatum infection of cod may...
contribute (indirectly or directly) to the differential mortality of larger cod (>38 cm) compared to smaller cod (}
Hypoxic areas, density-dependence and food limitation drive the body condition of a heavily exploited marine fish predator

Investigating the factors regulating fish condition is crucial in ecology and the management of exploited fish populations. The body condition of cod (Gadus morhua) in the Baltic Sea has dramatically decreased during the past two decades, with large implications for the fishery relying on this resource. Here, we statistically investigated the potential drivers of the Baltic cod condition during the past 40 years using newly compiled fishery-independent biological data and hydrological observations. We evidenced a combination of different factors operating before and after the ecological regime shift that occurred in the Baltic Sea in the early 1990s. The changes in cod condition related to feeding opportunities, driven either by density-dependence or food limitation, along the whole period investigated and to the fivefold increase in the extent of hypoxic areas in the most recent 20 years. Hypoxic areas can act on cod condition through different mechanisms related directly to species physiology, or indirectly to behaviour and trophic interactions. Our analyses found statistical evidence for an effect of the hypoxia-induced habitat compression on cod condition possibly operating via crowding and density-dependent processes. These results furnish novel insights into the population dynamics of Baltic Sea cod that can aid the management of this currently threatened population.
ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Cefas, University of Queensland, University of Adelaide, Swedish University of Agricultural Sciences, Marine Institute, Trinity College Dublin, University of Padova, Italian National Institute for Environmental Protection and Research, University of Leuven, Princeton University, Flanders Marine Institute, University of Cape Town
Pages: 1386-1403
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
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
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
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
Immediate and delayed interactions of global warming and contaminants on aquatic invertebrates

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Dinh, K. V. (Intern)
Publication date: 2016
Event: Abstract from Annual Meeting of the British Ecological Society, Liverpool, United Kingdom.
Main Research Area: Technical/natural sciences

Bibliographical note
Invited talk
Publication: Research › Conference abstract for conference – Annual report year: 2016

Interactive effects of dietary composition and hormonal treatment on reproductive development of cultured female European eel, Anguilla anguilla

Farmed female eels were fed two experimental diets with similar proximate composition but different n-3 polyunsaturated fatty acid (PUFA) levels. Both diets had similar levels of arachidonic acid (ARA), while levels of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in one diet were approximately 4.5 and 2.6 times higher compared to the other diet, respectively. After the feeding period, each diet group was divided into two and each half received one of two hormonal treatments using salmon pituitary extract (SPE) for 13 weeks: i) a constant hormone dose of 18.75mg SPE/kg initial body weight (BW) and ii) a variable hormone dosage that increased from 12.5mg SPE/kg initial BW to 25mg SPE/kg initial BW. Results showed a significant interaction between diets and hormonal treatments on gonadosomatic index (GSI), indicating that the effect of broodstock diets on ovarian development depends on both nutritional status and hormonal regime. Females fed with higher levels of n-3 series PUFAs and stimulated with the constant hormonal treatment reached higher GSIs than those receiving the variable hormonal treatment. However, when females were fed lower levels of n-3 series PUFAs there was no difference in the effect of hormonal treatments on GSI. We also found that, independent of hormonal treatment, the diet with higher levels of n-3 series PUFAs led to the most advanced stages of oocyte development, such as germinal vesicle migration. Concentration of sex steroids (E2, T, and 11-KT) in the plasma did not differ between diets and hormonal treatments, but was significantly correlated with ovarian developmental stage. In conclusion, increasing dietary levels of n-3 PUFAs seemed to promote oocyte growth, leading to a more rapid progression of ovarian development in European eel subjected to hormonal treatment.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Norwegian University of Science and Technology, Nofima AS
Authors: da Silva, F. (Intern), Støttrup, J. G. (Intern), Kjørsvik, E. (Ekstern), Tveiten, H. (Ekstern), Tomkiewicz, J. (Intern)
Pages: 17-26
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Langt fremme med produktion af åleyngel i Hirtshals

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tomkiewicz, J. (Intern)
Pages: 6-8
Larval drift and settling of Greenland halibut (R. hippoglossoides Walbaum) in Northwest Atlantic with special focus on Greenlandic waters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section
Authors: Stenberg, C. (Ekstern), Ribergaard, M. H. (Ekstern), Boje, J. (Intern), Sundby, S. (Ekstern)
Number of pages: 32
Publication date: 2016

Publication information
Publisher: Danish Meteorological Institute
Original language: English
Series: DMI Report
Number: 16-21
ISSN: 1399-1388
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Links:
http://www.dmi.dk/dmi/DMIRep16-21
Publication: Research › Report – Annual report year: 2016

Larval fish ecology - adaptations and physical linkages

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Munk, P. (Intern)
Publication date: 2016

Publication information
Place of publication: Charlottenlund
Publisher: DTU aqua. National Institute of Aquatic Resources
ISBN (Print): 978-87-7481-227-2
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Doctoral thesis – Annual report year: 2016

Links between the circulation and distribution of dissolved organic matter in the White Sea, Arctic Ocean
The White Sea is a semi-enclosed Arctic marginal sea receiving a significant loading of freshwater (225-231 km3 yr-1 equalling an annual runoff yield of 2.5 m) and dissolved organic matter (DOM) from river run-off. We report discharge weighed values of stable oxygen isotope ratios (δ18O) of -14.0‰ in Northern Dvina river for the period 10 May-12 October 2012. We found a significant linear relationship between salinity (S) and δ18O (δ18O=-17.66±0.58+0.52±0.02×S; R²=0.96, N=162), which indicates a dominant contribution of river water to the freshwater budget and little influence of sea ice formation or melt. No apparent brine additions from sea-ice formation is evident in the White Sea deep waters as seen from a joint analysis of temperature (T), S, δ18O and aCDOM(350) data, confirming previous suggestions about strong tidal induced vertical mixing in winter being the likely source of the deep waters. We investigated properties and
distribution of colored dissolved organic matter (CDOM) and dissolved organic carbon (DOC) in the White Sea basin and coastal areas in summer. We found contrasting DOM properties in the inflowing Barents Sea waters and White Sea waters influenced by terrestrial runoff. Values of absorption by CDOM at 350 nm (aCDOM(350)) and DOC (exceeding 10 m-1 and 550 μmol l-1, respectively) in surface waters of the White Sea basin are higher compared to other river-influenced coastal Arctic domains. Linear relationship between S and CDOM absorption, and S and DOC (DOC=959.21±52.99-25.80±1.79×S; R2=0.85; N=154) concentrations suggests conservative mixing of DOM in the White Sea. The strongest linear correlation between CDOM absorption and DOC was found in the ultraviolet (DOC=56.31±2.76+9.13±0.15×aCDOM(254); R2=0.99; N=155), which provides an easy and robust tool to trace DOC using CDOM absorption measurements as well as remote sensing algorithms. Deviations from this linear relationship in surface waters likely indicate contribution from different rivers along the coast of the White Sea. Characteristics of CDOM further indicate that there is limited removal or change in the DOM pool before it exits to the Barents Sea.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian Polar Institute, Tallinn University, Arctic and Antarctic Research Institute, Polish Academy of Sciences, Knipovich Polar Research Institute of Marine Fisheries and Oceanography
Authors: Pavlov, A. K. (Ekstern), Stedmon, C. A. (Intern), Semushin, A. V. (Ekstern), Martma, T. (Ekstern), Ivanov, B. V. (Ekstern), Kowalczuk, P. (Ekstern), Granskog, M. A. (Ekstern)
Pages: 1-13
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Continental Shelf Research
Volume: 119
ISSN (Print): 0278-4343
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 2.27 SJR 1.051 SNIP 1.15
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.002 SNIP 1.117 CiteScore 2.07
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.109 SNIP 1.218 CiteScore 2.08
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.21 SNIP 1.448 CiteScore 2.28
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.137 SNIP 1.207 CiteScore 2.02
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.409 SNIP 1.438 CiteScore 2.31
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.352 SNIP 1.312
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.305 SNIP 1.307
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.176 SNIP 1.33
- Scopus rating (2007): SJR 1.376 SNIP 1.56
Linking water treatment practices and fish welfare

Peracetic acids can be used as sanitizers to control water quality in aquaculture systems. As an alternative to formalin, chloramine-T or copper sulphate, PAA has strong anti-microbial effects, degrades quickly and is relatively safe to use. Its mode of action and associated rapid decay can make optimizing treatment protocols a challenge. Continuous low-dose applications seem to be a promising solution. In this preliminary study behavioral response was used to assess potential correlations with PAA dosage. A behavioral change or response is not necessarily an indication of compromised welfare. Supportive enzymatic, biochemical and physiological biomarkers can be used along with gill and epidermal histological measures to evaluate the effects on water treatment regimens. The ultimate goal is to define the therapeutic window where fish welfare is not compromised. PAA is among the few disinfectants approved for organic aquaculture.

Low larval densities in northern populations reinforce range expansion by a Mediterranean damselfly

1. Contemporary climate change triggers a poleward range shift in many species. A growing number of studies document evolutionary changes in traits accelerating range expansion (such as growth rate and dispersal-related traits). In contrast, the direct impact of decreasing conspecific densities towards the very edge of the expansion front has been neglected. Density effects may, however, have a profound direct impact on traits involved in range expansion and influence range dynamics. 2. In this study, we contrast the effects of high conspecific larval density typical for established populations and low larval density typical for newly founded populations at the edge of the expansion front on a set of larval traits that may affect the range dynamics in the poleward moving
damselfly Coenagrion scitulum. We therefore ran an outdoor mesocosm experiment with a low- and high-density treatment close to the species' northern expansion front. Density effects on survival, growth rate and body size are scored both during the pre-winter growth period and during the subsequent winter period. Additionally, foraging activity was scored at the end of the pre-winter period and body condition [size-corrected body mass, fat content and activity of phenoloxidase (PO)] was scored at the end of the winter period. 3. The low-density treatment had strong direct positive effects on survival, growth rate and body size of larvae before winter indicating relaxed competition. Lower foraging activity at the low-density treatment indicated higher food availability at low conspecific densities. Interestingly, the initial density treatment had stronger effect than densities experienced at the time of quantification on survival during the pre-freezing winter period and body condition estimates at the end of the experiment, indicating also delayed effects of the initial density treatment. Survival throughout a freezing period indicated extreme winter conditions are not likely a limiting factor in the range expansion of this Mediterranean species. 4. The increased survival and individual growth rates (through causing shifts in voltinism) at low conspecific density will translate in increased population growth rates. Furthermore, nutritional advantages at low conspecific density may increase investment in dispersal ability. Together, these direct and delayed density-dependent effects that gradually increase towards the expansion front are expected to accelerate range expansion.

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Leuven, Ghent University

Authors: Therry, L. (Ekstern), Swaegers, J. (Ekstern), Dinh, K. V. (Intern), Bonte, D. (Ekstern), Stoks, R. (Ekstern)

Pages: 1430-1441

Publication date: 2016

Main Research Area: Technical/natural sciences

**Publication information**

Journal: Freshwater Biology

Volume: 61

Issue number: 9

ISSN (Print): 0046-5070

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 3.36 SJR 1.568 SNIP 1.41

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 1.537 SNIP 1.371 CiteScore 2.95

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 1.487 SNIP 1.473 CiteScore 3.03

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 2.045 SNIP 1.9 CiteScore 4.02

ISI indexed (2013): ISI indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 2.075 SNIP 1.755 CiteScore 3.76

ISI indexed (2012): ISI indexed yes

BFI (2011): BFI-level 2

Scopus rating (2011): SJR 1.927 SNIP 1.628 CiteScore 3.33

ISI indexed (2011): ISI indexed yes

BFI (2010): BFI-level 2

Scopus rating (2010): SJR 1.736 SNIP 1.525

BFI (2009): BFI-level 2

Scopus rating (2009): SJR 1.734 SNIP 1.514

Web of Science (2009): Indexed yes

BFI (2008): BFI-level 2

Scopus rating (2008): SJR 1.618 SNIP 1.502

Web of Science (2008): Indexed yes
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

Marine ecosystem connectivity mediated by migrant–resident interactions and the concomitant cross-system flux of lipids

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Centre for Ocean Life, National Food Institute, Research Group for Bioactives – Analysis and Application, Section for Marine Ecology and Oceanography, Lund University, University of Bergen
Pages: 4076-4087
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecology and Evolution
Volume: 6
Microplastic exposure studies should be environmentally realistic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Lenz, R. (Intern), Enders, K. (Intern), Nielsen, T. G. (Intern)
Pages: E4121 - E4122
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Proceedings of the National Academy of Sciences
Volume: 113
Issue number: 29
Article number: 201606615
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
Migration, distribution and population (stock) structure of shallow-water hake (Merluccius capensis) in the Benguela Current Large Marine Ecosystem inferred using a geostatistical population model

Shallow-water hake (Merluccius capensis) is of considerable ecological and economic importance in the Benguela Current Large Marine Ecosystem in South Africa and Namibia. Optimal management of the resource is currently constrained by the limited understanding of migration patterns and population (stock) structure. We combined data from multiple demersal trawl surveys from the entire distribution area to estimate growth rate, mortality and spatial and temporal patterns of M. capensis. Analyses were conducted using the geostatistical model GeoPop. The complexity of the model and the amount of data required a new level of soft- and hardware performance. This was achieved by utilizing Template Model Builder and high-end computational hardware (Amazon Elastic Compute Cloud, EC2). The data and the model enabled us to follow the distribution and infer movements of M. capensis from the recruitment/nursery areas, through the juvenile phase and the adults' migration to the spawning areas outside/upstream of the nursery areas. This revealed some previously unknown migration patterns and indicated natal homing and the existence of three primary population components in the region, namely the Walvis (central and northern Namibia), the Orange (Southern Namibia-Northern SA) and the Agulhas (Southern part of SA) components. Our results also indicated substantial regional differences in mortality. We recommend that fisheries assessment, advice and management take consideration of these aspects of the distribution and population (stock) structure of M. capensis in the Benguela Current Large Marine Ecosystem.

General information
State: Published
Organisations: Section for Marine Living Resources, National Institute of Aquatic Resources, Section for Monitoring and Data, Section for Marine Ecology and Oceanography, Benguela Current Commission, Ministry of Fisheries and Marine Resources, Institute of Marine Research, Department for Agriculture, Forestry and Fisheries, Rhodes University
Pages: 156-167
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 179
ISSN (Print): 0165-7836
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 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Modelling gastric evacuation in gadoids feeding on crustaceans

A mechanistic, prey surface-dependent model was expanded to describe the course and rate of gastric evacuation in predatory fishes feeding on crustacean prey with robust exoskeletons. This was accomplished by adding a layer of higher resistance to the digestive processes outside the inner softer parts of a prey cylinder abstraction and splitting up the prey evacuation into two stages: an initial stage where the exoskeleton is cracked and a second where the prey remains are digested and evacuated. The model was parameterized for crustaceans with different levels of armour fed to Atlantic cod Gadus morhua or whiting Merlangius merlangus and recovered from the stomachs at different post-prandial times. The prey species were krill Meganyctiphanes norvegica; shrimps and prawns Crangon crangon, Pandalus borealis, Pandalus montagui and Eualus macilentus; crabs Liocarcinus depurator and Chionoecetes opilio. In accordance with the apparent intraspecific isometric relationship between exoskeleton mass and total body mass, the model described stage duration and rate of evacuation of the crustacean prey independently of meal and prey sizes. The duration of the first stage increased (0-33 h) and the evacuation rate of both stages decreased (by a half) with increasing level of the crustacean armament in terms of chitin and ash. A common, interspecific parameterization of the model within each of the categories krill, shrimp and crab can probably be used if the contents of chitin and ash are similar among prey species per prey category. The model offers a simple way for estimating evacuation rates from stomach content data in order to obtain food consumption rates of wild fishes, provided that information about digestion stage of crustacean prey is available. © 2016 The Fisheries Society of the British Isle
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Fish Biology
Volume: 88
Issue number: 5
ISSN (Print): 0022-1112

**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 1.57 SJR 0.741 SNIP 0.882
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.895 SNIP 0.946 CiteScore 1.66
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.774 SNIP 0.834
  Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.773 SNIP 0.891
  Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 0.883 SNIP 0.968
  Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.996 SNIP 1.06
  Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.897 SNIP 1.051
  Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.827 SNIP 0.898
  Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 0.945 SNIP 1.148
  Web of Science (2004): Indexed yes
- Scopus rating (2003): SJR 0.937 SNIP 1.096
  Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.949 SNIP 1.056
  Web of Science (2002): Indexed yes
- Scopus rating (2001): SJR 0.874 SNIP 1.1
Multidisciplinary perspectives on the history of human interactions with life in the ocean

There is an essentially circular interaction between the human social system and the marine ecosystem. The Oceans Past V Conference "Multidisciplinary perspectives on the history of human interactions with life in the ocean" held in Tallinn, Estonia, in May 2015 was an opportunity for the presentation and discussion of papers on a diverse array of topics that examined this socio-ecological system from a historical perspective. Here we provide background to the disciplines participating in the conference and to the conference itself. We summarize the conference papers that appear in this special volume of the ICES JMS and highlight issues which arose during general discussion. We make two conclusions. First, to have greater impact and ensure more efficient use of knowledge gained from marine historical ecology (MHE) and marine environmental history (MEH) in ecosystem-based management and related policy development, practitioners need to work more routinely with population and ecological modellers and statisticians. This will allow greater processing of the available historical data to derive ecologically meaningful properties that can then be used to assess the ecological impact of long-term changes of affected species and define appropriate and realistic management targets. Second, increased multi-and trans-disciplinary effort is required to better understand the relative importance of different human demographic, technological, economic, and cultural drivers on the patterns, intensities and trajectories of human activities affecting marine ecosystems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, NIWA, University of Tartu
Authors: MacDiarmid, A. (Ekstern), MacKenzie, B. (Intern), Ojaveer, H. (Ekstern)
Pages: 1382-1385
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
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
New records of sabellids and serpulids (Polychaeta: Sabellidae, Serpulidae) from the Tropical Eastern Pacific

Sabellids and serpulids are two well represented families in the polychaete fauna of the Tropical Eastern Pacific, with 31 and 34 species respectively; however, most records come from the Gulf of California or the western coast of Baja California Peninsula. Only a few records are from localities in the large expanse of the central and southern Mexican Pacific. Thus, sabellids and serpulids were collected from several shallow water habitats along the coast of Mexican Pacific, such as coastal lagoons, coral reefs, rocky shores and from man-made structures as marinas, piers and ships of several harbors; additionally, specimens from national collections were revised. More than 8,400 specimens of sabellids and serpulids from the states of Baja California, Baja California Sur, Sonora, Sinaloa, Michoacan, Guerrero, Oaxaca and Chiapas, and some specimens from Panama and Peru were examined. In the present work we record new localities of four sabellids and 24 serpulids. One sabellid, Branchiomma bairdi, is an exotic/invasive species in Oaxaca, Sinaloa and Baja California Sur, while four species of serpulids are exotic and/or cryptogenic species: Ficopomatus uschakovi, Hydroides dirampha, H. elegans and H. sanctaecrucis. Additionally, the geographical range has been extended for five species: the sabellids Pseudobranchiomma punctata from Oahu, Hawaii to La Paz Bay, and Parasabella pallida from California to Puerto Escondido, Baja California Sur; and for three serpulids, Hydroides inermis from the Galapagos Islands to Agua Blanca, Oaxaca, H. gairacensis from Panama to Puerto Angel, Oaxaca, and H. panamensis from Panama to Huatulco, Oaxaca and Faro de Bucerias, Michoacan. Hydroides cf. amri, previously recorded as H. brachyacantha from Oahu, Hawaii, is more similar to H. amri from Australia. The number of sabellids recorded for the Tropical Eastern Pacific increased to 33, the serpulid species to 35.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Ciudad Universitaria, Universidad Autonoma de Nuevo Leon, Universidad Nacional Mayor de San Marcos
Authors: Rolando Bastida-Zavala, J. (Ekstern), Rodriguez Buelna, A. S. (Intern), Angel De Leon-Gonzalez, J. (Ekstern), Andrea Camacho-Cruz, K. (Ekstern), Carmona, I. (Ekstern)
Pages: 401-457
Publication date: 2016
Main Research Area: Technical/natural sciences
Ocean warming expands habitat of a rich natural resource and benefits a national economy

Geographic redistribution of living natural resources changes access and thereby harvesting opportunities between countries. Internationally shared fish resources can be sensitive to shifts in the marine environment and this may have great impact on the economies of countries and regions that rely most heavily on fisheries to provide employment and food supply. Here we present a climate change-related biotic expansion of a rich natural resource with substantial economic consequences, namely the appearance of northeast Atlantic mackerel (Scomber scombrus) in Greenlandic waters. In recent years, the summer temperature has reached record highs in the Irminger Current, and this development has expanded the available and realized mackerel habitat in time and space. Observations in the Irminger Current in east Greenland in 2011 of this temperature-sensitive epipelagic fish were the first records so far northwest in the Atlantic. This change in migration pattern was followed by a rapid development of a large-scale fishery of substantial importance for the national economy of Greenland (23% of Greenland’s export value of all goods in 2014). A pelagic trawl survey was conducted in mid-summer 2014 and the results showed that the bulk of similar to 1 million Mg (=t) of mackerel in the Irminger Current in southeast Greenland were located in the relatively warm (>8.5 degrees C) surface layer. Mackerel was also observed in southwest Greenland. Finally, 15 CMIP5 Earth System Model projections of future marine climate were used to evaluate the epipelagic environment in Greenland. These projections for moderate and high CO2 emission
scenarios (representative concentration pathways [RCP] 4.5 and 8.5) suggest how the available mackerel habitat may expand further in space and time. Overall, our results indicate that, if the stock remains large, productive, and continues its current migration pattern, then climate change has provided Greenland with a new unique opportunity for commercial exploitation. However, positive cases like this should not be cherry-picked and misused as arguments against timely and effective mitigation of climate change.

**General information**

**State:** Published

**Organisations:** Section for Marine Living Resources, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Greenland Institute of Natural Resources, Institute of Marine Research, Marine Research Institute, Greenland Institute of Natural Resources

**Authors:** Jansen, T. (Intern), Post, S. L. (Intern), Kristiansen, T. (Ekstern), Oskarsson, G. J. (Ekstern), Boje, J. (Intern), MacKenzie, B. R. (Intern), Broberg, M. (Ekstern), Siegstad, H. (Ekstern)

**Pages:** 2021-2032

**Publication date:** 2016

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

**Publication information**

**Journal:** Ecological Applications

**Volume:** 26

**Issue number:** 7

**ISSN (Print):** 1051-0761

**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 4.4 SJR 2.265 SNIP 1.576
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 2.76 SNIP 1.759 CiteScore 4.63
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.593 SNIP 1.842 CiteScore 4.59
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 2.676 SNIP 1.863 CiteScore 4.77
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 2.965 SNIP 1.937 CiteScore 4.55
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 3.286 SNIP 1.975 CiteScore 4.86
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 2.784 SNIP 1.675
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 2.664 SNIP 1.759
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 2.869 SNIP 1.749
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 2.805 SNIP 1.876
- Scopus rating (2006): SJR 3.065 SNIP 2.06
- Scopus rating (2005): SJR 2.819 SNIP 1.966
Ontogeny and growth of early life stages of captive-bred European eel

Captive breeding of European eel, Anguilla anguilla is challenged by the complex hormonal control of Anguillid eel reproduction and the distinctive ontogeny of the leptocephalus larvae that are unique to the Elopomorph superorder. Recent experimental research has succeeded in the production of viable eggs and larvae of European eel, providing the basis for studies on early life stages of this species in captivity. In this study, we describe and illustrate morphological characteristics of eggs, embryos, and larvae from fertilization to termination of the yolk sac stage and provide a comparison with additional commercially important eel species. Furthermore, we model growth during the critical first phase in larval ontogeny, i.e. the yolk sac stage, and test for maternal effects. The eggs of A. anguilla typically have numerous oil droplets that coalesce into a single large oil droplet, while the zygote forms a large perivitelline space, reaching an egg diameter of 1.45 ± 0.12 mm at 3.0 to 3.5 h post fertilization. Embryonic development from fertilization to larval hatch lasted ~46–48 h at 20 °C with the larvae emerging in a relatively undeveloped stage with a protuberant yolk sac. During the period of yolk and oil absorption, the larvae undertook significant changes in head and body morphology. At the completion of yolk sac absorption, the largely transparent larvae had a set of protruding teeth, pigmented eyes and tail, and a simple alimentary tract. Larvae appeared capable of feeding at ~12 days post hatch at 20 °C, and were able to survive another ~10 days without feeding. Larval length approached and asymptotic maximum of 6.8mma round day 10 in non-fed larvae. Larval batches from different maternal origins varied in yolk sac size and the extent of yolk sac resources influenced larval size at the end of the yolk sac stage. The ontogenetic description presented here fills a gap in knowledge about the yet undiscovered early life stages of native European eel, which can provide a framework of reference for the development of hatchery technology. Such progress is urgently needed for a self-sustained aquaculture of this high-value and critically endangered species. Statement of relevance: European eel is a high-value species in aquaculture, however, production is presently hampered by reliance on wild caught fry. Captive production of glass eels will reopen markets in Europe and Asia, benefiting European eel producers. The results presented here document recent progress within assisted reproduction and larval culture of this species in aquaculture and aid establishing hatchery technology of this species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Billund Aquakulturservice A/S, Danish Aquaculture Organisation
Authors: Sørensen, S. R. (Intern), Tomkiewicz, J. (Intern), Munk, P. (Intern), Butts, I. A. (Intern), Nielsen, A. (Intern), Lauesen, P. (Ekstern), Graver, C. (Ekstern)
Pages: 50-61
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 456
ISSN (Print): 0044-8486
Ratings:
BFI (2018): BFI-level 2
Persistent shift of Calanus spp. in the south-western Norwegian Sea since 2003, linked to ocean climate

The south-western Norwegian Sea is characterized by an inflow of warm and saline Atlantic water from the southwest and cold and less saline East Icelandic Water (EIW), of Arctic origin, from the northwest. These two water masses meet and form the Iceland-Faroe Front (IFF). In this region, the copepod Calanus finmarchicus plays a key role in the pelagic ecosystem. Time-series of C. finmarchicus and Calanus hyperboreus in May and September, extending back to the early 1990s, were studied in relation to phytoplankton bloom dynamics and hydrography. The main reproductive period of C. finmarchicus started consistently earlier south of the IFF, resulting in different life cycles and stage compositions in the two water masses. In 2003, a sudden shift occurred north of the IFF, resulting in a similar phenology pattern to south of the IFF. Before this, only one generation of C. finmarchicus was produced in the Arctic water, but the earlier reproduction enabled the species to produce two generations after 2003. Simultaneously, C. hyperboreus, an expatriate in the EIW, largely disappeared. Food availability is unlikely the reason for the phenological differences observed across the front, as the typical pattern of the phytoplankton spring bloom showed an earlier onset north of the IFF. Temperature and salinity peaked at record high values in 2003 and 2004, and therefore possible links to oceanography are discussed. The dominant role of Calanus spp. and the potential linkages to water mass exchanges may herald strong effects on the ecosystem and pelagic fish in this subpolar Atlantic region under expected climate change.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Faroe Marine Research Institute
Authors: Kristiansen, I. (Ekstern), Gaard, E. (Ekstern), Hátún, H. (Ekstern), Jonasdottir, S. (Intern), Ferreira, A. S. (Intern)
Pages: 1319-1329
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
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
Plankton community composition and vertical migration during polar night in Kongsfjorden

The polar night in the Arctic is characterized by up to six months of darkness, low temperatures and limited food availability. Biological data on species composition and abundance during this period are scarce due to the logistical challenges posed when sampling these regions. Here, we characterize the plankton community composition during the polar night using water samplers and zooplankton net samples (50, 64, 200, 1500 lm), supplemented by acoustics (ADCPs, 300 kHz), to address a previously unresolved question—which species of zooplankton perform diel vertical migration during the polar night? The protist community (smallest plankton fraction) was mainly represented by ciliates (Strombidiida). In the larger zooplankton fractions (50, 64, 200 lm) the species composition was represented primarily by copepod nauplii and small copepods (e.g., Microcalanus spp., Pseudocalanus spp. and Oithona similis). In the largest zooplankton fraction ([1500 lm), the euphausiid, Thysanoessa inermis, was the most abundant species followed by the chaetognath Parasagitta elegans. Classical DVM was not observed throughout the darkest parts of the polar night (November–mid-January), although, subtle vertical migration patterns were detected in the acoustic data. With the occurrence of a more distinct day–night cycle (i.e., end of January), acoustical DVM signals were observed, paralleled by a classical DVM pattern in February in the largest fractions of zooplankton net samples. We suggest that Thysanoessa spp. are main responsible for the acoustical migration patterns throughout the polar night, although, chaetognaths and copepods may be co-responsible.
Quantum yields of natural organic matter and organic compounds: Implications for the fluorescence-based interpretation of organic matter composition

Rapid adaptation to oil exposure in the cosmopolitan copepod Acartia tonsa

Recent trends in the abundance of plaice Pleuronectes platessa and cod Gadus morhua in shallow coastal waters of the Northeastern Atlantic continental shelf – a review
water remains open. Fundamental differences exist in the suggested causes of the trends in different geographical areas. High fishing pressure together with low local recruitment apparently prevents the recovery of overexploited plaice and cod stocks in the Skagerrak/Kattegat. In contrast, the responses of juveniles and adult fish to increasing seawater temperature are the main hypotheses for changes in distribution and abundance of both fish species in the North Sea/Bay of Biscay. However, temperature alone cannot explain the observed decline of fish in coastal areas, and the causes may be more complex, involving nutrient loading, primary productivity or food availability, although at present, knowledge of these factors is insufficient.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Copenhagen, DHI Denmark, University of Hamburg
Number of pages: 129
Publication date: 2016

Publication information
Original language: English
Main Research Area: Technical/natural sciences

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

Publication information
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

Same-Risk-Area Assessment Model (SRAAM) User's manual

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Living Resources
Authors: Hansen, F. T. (Intern), Christensen, A. (Intern)
Number of pages: 42
Publication date: 2016

Publication information
Publisher: National Institute of Aquatic Resources, DTU Aqua. Technical University of Denmark
ISBN (Electronic): 978-87-7481-234-0
Original language: English
Series: DTU Aqua report
Number: 318-2016
Scaling laws in phytoplankton nutrient uptake affinity

Nutrient uptake affinity affects the competitive ability of microbial organisms at low nutrient concentrations. From the theory of diffusion limitation it follows that uptake affinity scales linearly with the cell radius. This is in conflict with some observations suggesting that uptake affinity scales to a quantity that is closer to the square of the radius, i.e. to cell surface area. We show that this apparent conflict can be resolved by nutrient uptake theory. Pure diffusion limitation assumes that the cell is a perfect sink which means that it is able to absorb all encountered nutrients instantaneously. Here we provide empirical evidence that the perfect sink strategy is not common in phytoplankton. Although small cells are indeed favored by a large surface to volume ratio, we show that they are punished by higher relative investment cost in order to fully benefit from the larger surface to volume ratio. We show that there are two reasons for this. First, because the small cells need a higher transporter density in order to maximize their affinity, and second because the relative cost of a transporter is higher for a small than for a large cell. We suggest that this might explain why observed uptake affinities do not scale linearly with the cell radius.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, University of Bergen
Authors: Lindemann, C. (Intern), Fiksen, Ø. (Ekstern), Andersen, K. H. (Intern), Aksnes, D. L. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 3
Article number: 26
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Phytoplankton, Size, nutrient uptake, Allometric scaling, Molecular diffusion
Electronic versions:
Lindemann_2016_Scaling_laws.pdf
DOIs:
10.3389/fmars.2016.00026
Source: FindIt
Source-ID: 2302894577
Publication: Research - peer-review › Journal article – Annual report year: 2016

Sediment extracted organic matter fluorescence: an archive of organic matter flux and origins?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Lund University
Authors: Stedmon, C. (Intern), Funkey, C. (Ekstern), Conley, D. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Selection for high reproduction rates during establishment of non-indigenous species: A case study of a successful marine invader

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Jaspers, C. (Intern), Marty, L. (Intern), Kiørboe, T. (Intern)
Publication date: 2016
Event: Abstract from International Jellyfish Blooms Symposium, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

Slave to the rhythm: Can seasonal signals in otolith microchemistry be used as a tool for age estimation?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Hüssy, K. (Intern), Heidemann, F. (Ekstern), Hinrichsen, H. (Ekstern), Marohn, L. (Ekstern), Gröger, J. (Ekstern), Limburg, K. E. (Ekstern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Slave to the rhythm: seasonal signals in otolith microchemistry reveal age of eastern Baltic cod (Gadus morhua)
Annual growth zones in cod otoliths from the eastern Baltic stock are less discrete than in other cod stocks leading to biased age reading, which recently led to a failure of age-based assessment in the eastern Baltic cod stock. In this study, we explored the applicability of minor and trace element patterns in cod otoliths for age determination. By first identifying elements of interest in a stock without ageing problems, western Baltic cod, we then tested their applicability on another stock without ageing problems, North Sea cod, and finally applied this knowledge to estimate age of eastern Baltic cod. In western Baltic cod, matching patterns with respect to occurrence of minima and maxima in both otolith opacity and element concentrations were found for Cu, Zn, and Rb, and inverse patterns with Mg and Mn. No match was found for Pb, Ba, and Sr. In the test stock, the North Sea cod, the same patterns in Cu, Zn, Rb, and Mg, and Mn signals occurred. All eastern Baltic cod with low visual contrast between growth zones exhibited clearly defined synchronous cycles in Cu, Zn, Rb and Pb. Using a combined finite differencing method and structural break models approach, the statistical significance of the local profile minima were identified, based on which their age could be estimated. Despite extensive environmental differences between the three areas examined, the element concentrations of Cu, Zn, and Rb were strongly correlated in all individuals with similar correlations in all three areas, suggesting that the incorporation mechanisms are the same for these elements and independent of environmental concentrations.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Thünen Institute of Fisheries Ecology, GEOMAR - Helmholtz Centre for Ocean Research Kiel, University of Kiel
Authors: Hüssy, K. (Intern), Gröger, J. (Ekstern), Heidemann, F. (Ekstern), Hinrichsen, H. (Ekstern), Marohn, L. (Ekstern)
Pages: 1019-1032
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: ICES Journal of Marine Science
Volume: 73
Issue number: 4
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
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 - peer-review › Journal article – Annual report year: 2015
Spatio-temporal trends in stock mixing of eastern and western Baltic cod in the Arkona Basin and the implications for recruitment

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Hüssy, K. (Intern), Hinrichsen, H. (Ekstern), Eero, M. (Intern), Mosegaard, H. (Intern), Hansen, J. H. (Intern), Lehmann, A. (Ekstern), Lundgaard, L. S. (Intern)
Pages: 293-303
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 73
Issue number: 2
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
Web of Science (2004): Indexed yes
Spawning areas of eastern Baltic cod revisited: Using hydrodynamic modelling to reveal spawning habitat suitability, egg survival probability, and connectivity patterns

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Uppsala University, Institute of Food Safety, Animal Health and Environment, Swedish University of Agricultural Sciences, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), Petereit, C. (Ekstern), Nissling, A. (Ekstern), Ustups, D. (Ekstern), Bergström, U. (Ekstern), Hüsy, K. (Intern)
Pages: 13-25
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 143
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
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
Species composition and diversity of fish larvae in the Subtropical Convergence Zone of the Sargasso Sea from morphology and DNA barcoding

Specific regions of otherwise oligotrophic oceans seem to attract fish spawning and sustain significant abundances of fish larvae. The Sargasso Sea in the North Atlantic subtropical gyre is known as the spawning area of the Atlantic eels, but numerous other fish species also spawn in the area. In order to evaluate spatial variability of larval fish in the region, we examined species diversity, composition and abundances at eight stations in the Subtropical Convergence Zone (STCZ) using morphological identification and DNA barcoding. From a total of approximately 3500 specimens collected, at least 154 species from 50 families could be identified. The family Myctophidae had the highest species richness, with at least 32 species represented. The myctophids Lepidophanes gaussi, Bolinichthys indicus, Notolychnus valdiviae and Ceratoscopelus warmingii were the four most abundant species. Other common species included the three eels: Nemichthys scolopaceus, Ariosoma balearicum and Anguilla anguilla. Larval fish species composition differed substantially between the relatively closely spaced stations on either side of prominent hydrographic fronts in the study area, presumably because of the strong environmental gradients. Common eel species were concentrated between the fronts whereas common myctophids were of highest abundance at the outer edges of the fronts. The abundances of most species were generally enhanced in the vicinity of the fronts. The use of combined morphological and DNA-barcoding identification methods facilitated species identification, and we could document substantially higher levels and a larger degree of spatial variability in species diversity of fish larvae than previously shown for oligotrophic ocean areas.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Ayala, D. J. (Intern), Munk, P. (Intern), Riemann, L. (Ekstern)
Pages: 85-104
Publication date: 2016
Main Research Area: Technical/natural sciences
Species interactions in the western Baltic Sea: With focus on the ecological role of whiting

The food web of the upper trophic levels in marine ecosystems is often complex, encompassing multiple biological interactions. One species may serve as prey, predator and competitor at the same time, and the interactions are likely to change with the ontogenetic development from juvenile to adult. Disentangling food web dynamics is important for both ecologists and conservationists involved with management. Multispecies assessment models and ecosystem-based trophic models are becoming increasingly used as tools to investigate and assess biological interactions and predation impacts of key species in the food web. Furthermore, the models can be used to evaluate effects of anthropogenic activities such as fishing, eutrophication and pollution from land-based activities and shipping. Despite the growing awareness of the strength of these models to describe food web dynamics and ecosystem functioning, implementation of the models in
strategic management advice for commercially important fish stocks and protected marine mammals is not common practice. This is due to the lack of sufficient information about species interactions including knowledge about the diet, food intake and growth dynamics. This thesis investigates the ecological role of whiting in the western Baltic Sea. The ecosystem is more brackish than for example the North Sea and the species diversity of the upper trophic levels is lower and the food web simpler. The main piscivorous fish species are whiting and cod, while herring and sprat are the predominant forage fishes. The growth dynamics and feeding ecology of whiting in the western Baltic Sea has not previously been investigated, despite the fact that it is an important species both in the commercial fishery and in the food web of the North Sea. Due to differences in hydrography, species diversity and fishing pressure, the ecological role of whiting in the Baltic Sea is likely to differ considerably from that of its conspecific in the North Sea. The western Baltic Sea also provides a habitat for protected marine mammals, including the harbour porpoise, the grey seal and the harbour seal, which potentially prey on and compete for food with whiting. Here, the growth dynamics and feeding ecology of whiting in the western Baltic Sea is investigated and discussed in an ecosystem context. Furthermore, the diet of the harbour porpoise is examined and the interactions between whiting, cod and porpoises are discussed. Describing the fish population dynamics and biological interactions of the main species at the higher trophic levels in the western Baltic Sea is an important step towards a broader regional understanding of the ecosystem dynamics. The information can be used to inform single species and multispecies assessment models for fish and ecosystem-based trophic models, and, thus, potentially improve management advice for fish stocks and protected marine mammals in the western Baltic Sea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Nielsen, J. R. (Intern), Gislason, H. (Intern), Andersen, N. G. (Intern)
Number of pages: 180
Publication date: 2016

Publication information
Publisher: DTU aqua. National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences

State of the Earth’s Oceans
The oceans cover 70% of the Earth’s surface and are an essential part of the whole earth system. The oceans have a fundamental role in controlling our climate, are an important buffer for atmospheric CO₂ and are one of the most important sources of protein and lipids exploited for human consumption. In spite of their importance for climate, and exploitation our knowledge of the oceans is less than our knowledge of space. Satellite remote sensing over last 20 years has been revolutionary for marine research as it revealed the intricate patterns of the marine environment, its currents, blooms, hot spots, upwelling zones and more. Many crucially important processes do take place at the ocean surface, such as heat flux, deep water formation, primary production. However, over and above covering the 70% of the earth’s surface the Ocean is 3-Dimensional and includes over 90% of the habitable space on this planet out of the detection of satellite or other airborne sensing.
There is a need to develop observational platforms and systems that can detect processes in the deep oceans. During the last 10 years a major international effort has been on underwater ocean observation technology. Argo floats and gliders have revealed the oceans heat storage and shown that 93% of the heat associated with global warming has gone into the oceans since the industrial revolution. Undulating video plankton recorders give us information of patchiness under the ocean surfaces, green laser cameras detect organisms in murky waters of the coastal zones and new generation of sensors give us the opportunity to sniff out DNA. At DTU, we are tantalizingly close to the forefront of this innovation, innovation that is crucial for our sustainable exploitation of the world’s oceans.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Jonasdottir, S. (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-3
Publication: Research - peer-review  Conference abstract for conference – Annual report year: 2016
The compositional change of Fluorescent Dissolved Organic Matter across Fram Strait assessed with use of a multi-channel in situ fluorometer

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian Polar Institute
Authors: Raczkowska, A. (Ekstern), Kowalczyk, P. (Ekstern), Sagan, S. (Ekstern), Zabłocka, M. (Ekstern), Pavlov (Ekstern), Gransko, M. A. (Ekstern), Stedmon, C. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2016

The diet of whiting Merlangius merlangus in the western Baltic Sea

The diet of whiting Merlangius merlangus in the western Baltic Sea was investigated and compared to the diet in the southern North Sea. Clupeids were important prey in both areas, but especially in the western Baltic Sea where they constituted up to 90% of the diet of larger individuals. Gobies, brown shrimps and polychaetes were the main prey of juveniles in the western Baltic Sea, while a wider range of species were consumed in the North Sea. The shift to piscivory occurred at smaller sizes in the western Baltic Sea and the fish prey consumed was proportionately larger than in the southern North Sea. Estimates of prey abundance and food intake of M. merlangus are required to evaluate its predatory significance in the western Baltic Sea, but its diet suggests that it could be just as significant a fish predator here as in the southern North Sea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Gislason, H. (Intern), Andersen, N. G. (Intern), Lewy, P. (Intern), Nielsen, J. R. (Intern)
Pages: 1965-1988
Publication date: 2016
Main Research Area: Technical/natural sciences
The effect of Pseudo-nitzschia seriata on grazing and fecundity of Calanus finmarchicus and Calanus glacialis

This study investigates whether feeding on the domoic acid (DA)-producing diatom Pseudo-nitzschia seriata affects the faecal pellet (FP) production (proxy for grazing) and fecundity of Calanus finmarchicus and Calanus glacialis. Female copepods were fed a saturating concentration of food (400 mg C L$^{-1}$) in two combinations (i) natural phytoplankton spiked with 50% P. seriata and (ii) only the non-toxic phytoplankton community. The copepods ingested DA, as illustrated by DA accumulation in their FPs, and transferred a share of DA to their eggs and body tissue. DA was mainly excreted through FPs in both species. Compared with C. finmarchicus, C. glacialis accumulated substantially more DA in its body tissue. For both species, egg production and hatching success were unaffected by grazing on the toxic diatom. This suggests that feeding on DA-containing P. seriata does not affect copepod fecundity, despite increasing DA concentrations of P. seriata during the experiment.

General information
State: Published
Authors: Miesner, A. K. (Intern), Lundholm, N. (Forskerdatabase), Krock, B. (Ekstern), Nielsen, T. G. (Intern)
Pages: 564-574
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Plankton Research
Volume: 38
Issue number: 3
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
The influence of feeding behaviour on growth of Atlantic cod (Gadus morhua, Linnaeus, 1758) in the North Sea

The objective of this study was to resolve key mechanisms driving individual growth patterns of Atlantic cod (Gadus morhua). Growth dynamics were analysed by linking growth patterns with stomach content composition and environmental temperature. Samples were collected in August/September of the years 2009, 2010 and 2011 in the north-eastern part of the central North Sea. Prey selection was assessed by identification of individual prey items in the stomach content to species. Ten feeding groups were identified consisting of individuals with one prey type dominating their stomach contents (≥75% by mass), of which six were used for growth analyses: “Sandeel”, “Clupeids”, “Norway pout”, “Flatfishes”, “Crustaceans” and “Brittle stars”. For each group, growth patterns were estimated based on measures of otolith growth increments. The stomach contents showed that cod as a species are opportunistic in their prey selection, but at the same time indicated that the total, broad feeding niche width of the population is dominated by individual diet specialization and that many individuals temporally show a preference for a particular prey type. The contribution of invertebrates and particularly crustaceans decreased with increasing cod size, whereas that of fish and predominantly herring increased. Prey type had a significant effect on growth, while temperature had no effect. Slowest growth was observed in the cod group preying on sandeel, while cod preying on Norway pout showed the fastest growth. No significant difference was observed between groups preying on brittle stars, crustaceans, flatfishes and herring. Growth in the year before capture did however not differ between any of these groups. Across sampling years, growth chronology patterns were similar but not significantly influenced by temperature.
The migration game in habitat network: the case of tuna

Long-distance migration is a widespread process evolved independently in several animal groups in terrestrial and marine ecosystems. Many factors contribute to the migration process and of primary importance are intra-specific competition and seasonality in the resource distribution. Adaptive migration in direction of increasing fitness should lead to the ideal free distribution (IFD) which is the evolutionary stable strategy of the habitat selection game. We introduce a migration game which focuses on migrating dynamics leading to the IFD for age-structured
populations and in time varying habitats, where dispersal is costly. The model predicts migration dynamics between these habitats and the corresponding population distribution. When applied to Atlantic bluefin tunas, it predicts their biomass is located in the spawning areas which have also the largest diversity in the age-structure. Distant feeding areas are occupied on a seasonal base and often by larger individuals, in agreement with empirical observations. Moreover, we show that only a selected number of migratory routes emerge as those effectively used by tunas.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Biology Centre CAS, IRD, Unité de Recherche Ecosystèmes Marins Exploités
Authors: Mariani, P. (Intern), Krivan, V. (Ekstern), MacKenzie, B. (Intern), Mullon, C. (Ekstern)
Pages: 219-232
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Theoretical Ecology
Volume: 9
Issue number: 2
ISSN (Print): 1874-1738

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): SJR 1.124 SNIP 0.764 CiteScore 1.81
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.223 SNIP 0.764 CiteScore 1.71
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.468 SNIP 0.981 CiteScore 1.86
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.456 SNIP 0.914 CiteScore 2.2
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.647 SNIP 1.067 CiteScore 2.4
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.341 SNIP 0.696 CiteScore 1.74
- ISI indexed (2011): ISI indexed no
- Scopus rating (2010): SJR 1.162 SNIP 0.929
- Web of Science (2010): Indexed yes
- Scopus rating (2009): SJR 0.993 SNIP 0.68

Original language: English
Structured population, Ideal free distribution, Game theory, Habitat selection, Bluefin tuna

**DOIs:**
- 10.1007/s12080-015-0290-8

Publication: Research - peer-review › Journal article – Annual report year: 2015

**Three nuclear and two membrane estrogen receptors in basal teleosts, Anguilla sp.: Identification, evolutionary history and differential expression regulation**

Estrogens interact with classical intracellular nuclear receptors (ESR), and with G-coupled membrane receptors (GPER). In the eel, we identified three nuclear (ESR1, ESR2a, ESR2b) and two membrane (GPERa, GPERb) estrogen receptors. Duplicated ESR2 and GPER were also retrieved in most extant teleosts. Phylogeny and synteny analyses suggest that they result from teleost whole genome duplication (3R). In contrast to conserved 3R-duplicated ESR2 and GPER, one of
3R-duplicated ESR1 has been lost shortly after teleost emergence. Quantitative PCRs revealed that the five receptors are all widely expressed in the eel, but with differential patterns of tissue expression and regulation. ESR1 only is consistently up-regulated in vivo in female eel BPG-liver axis during induced sexual maturation, and also up-regulated in vitro by estradiol in eel hepatocyte primary cultures. This first comparative study of the five teleost estradiol receptors provides bases for future investigations on differential roles that may have contributed to the conservation of multiple estrogen receptors.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Sorbonne Universités
Authors: Lafont, A. G. (Ekstern), Rousseau, K. (Ekstern), Tomkiewicz, J. (Intern), Dufour, S. (Ekstern)
Pages: 177-191
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: General and Comparative Endocrinology
Volume: 235
ISSN (Print): 0016-6480
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 2.55 SJR 1.056 SNIP 0.924
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.269 SNIP 0.943 CiteScore 2.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.109 SNIP 0.951 CiteScore 2.51
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.192 SNIP 1.242 CiteScore 2.96
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.062 SNIP 1.183 CiteScore 3.02
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.262 SNIP 1.117 CiteScore 3.07
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.05 SNIP 0.978
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.095 SNIP 0.948
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.925 SNIP 1.03
Scopus rating (2007): SJR 0.85 SNIP 0.947
Scopus rating (2006): SJR 0.858 SNIP 1.07
Scopus rating (2005): SJR 0.978 SNIP 1.007
Scopus rating (2004): SJR 0.637 SNIP 0.835
Scopus rating (2003): SJR 0.676 SNIP 1.079
Scopus rating (2002): SJR 0.779 SNIP 0.925
Scopus rating (2001): SJR 0.806 SNIP 1.004
Scopus rating (2000): SJR 0.806 SNIP 0.961
Trends in marine climate change research in the Nordic region since the first IPCC report

Oceans are exposed to anthropogenic climate change shifting marine systems toward potential instabilities. The physical, biological and social implications of such shifts can be assessed within individual scientific disciplines, but can only be fully understood by combining knowledge and expertise across disciplines. For climate change related problems these research directions have been well-established since the publication of the first IPCC report in 1990, however it is not well-documented to what extent these directions are reflected in published research. Focusing on the Nordic region, we evaluated the development of climate change related marine science by quantifying trends in number of publications, disciplinarity, and scientific focus of 1362 research articles published between 1990 and 2011. Our analysis showed a faster increase in publications within climate change related marine science than in general marine science indicating a growing prioritisation of research with a climate change focus. The composition of scientific disciplines producing climate change related publications, which initially was dominated by physical sciences, shifted toward a distribution with almost even representation of physical and biological sciences with social sciences constituting a minor constant proportion. These trends suggest that the predominantly model-based directions of the IPCC have favoured the more quantitatively oriented natural sciences rather than the qualitative traditions of social sciences. In addition, despite being an often declared prerequisite to successful climate science, we found surprisingly limited progress in implementing interdisciplinary research indicating that further initiatives nurturing scientific interactions are required.
Ultrasonographic predictors of response of European eels (Anguilla anguilla) to hormonal treatment for induction of ovarian development

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Müller, A. V. (Ekstern), McEvoy, F. (Ekstern), Tomkiewicz, J. (Intern), Politis, S. N. (Intern), Amigo, J. (Ekstern)
Pages: 478-486
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: American Journal of Veterinary Research
Volume: 77
Issue number: 5
ISSN (Print): 0002-9645
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
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
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
Understanding the processes behind fish stock dynamics: Where are we?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem Based Marine Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Eero, M. (Intern), Sørensen, H. (Intern), Huwer, B. (Intern), Sørensen, S. R. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences

Using fluorescent dissolved organic matter to trace and distinguish the origin of Arctic surface waters

Climate change affects the Arctic with regards to permafrost thaw, sea-ice melt, alterations to the freshwater budget and increased export of terrestrial material to the Arctic Ocean. The Fram and Davis Straits represent the major gateways connecting the Arctic and Atlantic. Oceanographic surveys were performed in the Fram and Davis Straits, and on the east Greenland Shelf (EGS), in late summer 2012/2013. Meteoric (f(mw)), sea-ice melt, Atlantic and Pacific water fractions were determined and the fluorescence properties of dissolved organic matter (FDOM) were characterized. In Fram Strait and EGS, a robust correlation between visible wavelength fluorescence and f(mw) was apparent, suggesting it as a reliable tracer of polar waters. However, a pattern was observed which linked the organic matter characteristics to the origin of polar waters. At depth in Davis Strait, visible wavelength FDOM was correlated to apparent oxygen utilization (AOU) and traced deep-water DOM turnover. In surface waters FDOM characteristics could distinguish between surface waters from eastern (Atlantic + modified polar waters) and western (Canada-basin polar waters) Arctic sectors. The findings highlight the potential of designing in situ multi-channel DOM fluorometers to trace the freshwater origins and decipher water mass mixing dynamics in the region without laborious samples analyses.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Norwegian Polar Institute, Fisheries and Oceans Canada
Authors: Gonçalves-Araújo, R. (Ekstern), Granskog, M. A. (Ekstern), Bracher, A. (Ekstern), Azetsu-Scott, K. (Ekstern), Dodd, P. A. (Ekstern), Stedmon, C. A. (Intern)
Pages: 1-12
Publication date: 2016
Main Research Area: Technical/natural sciences
UTOFIA: Time-of-Flight camera for underwater applications

Today’s ever increasing proliferation of information, real-time data feeds and overwhelming sensor coverage, can often make the world feel small and constrained. However, the oceans and seas contain some of the world’s most unexplored and uncharted regions, and hold valuable physical and informational resources for the planet’s population. As well as the obvious mineral wealth, knowledge regarding the health and well-being of the underwater environment will become critical information over the coming years. Understanding and monitoring fish stocks, mapping the sea floor and assessing the health of the ecosystem, whilst noting the impact of human activity are becoming an increasing concern for both public and commercial bodies. UTOFIA is a H2020 project (633098) is undertaking the development, testing and commercialization of a new, compact and cost-efficient concept for underwater range-gated imaging system. It will offer a compact and cost-effective underwater imaging system for turbid environments. Using range-gated imaging, the system will extend the imaging range by factor 2 to 3 over conventional video systems. At the same time, the system will provide video-rate 3D information. This will fill the current gap between short-range, high-resolution conventional video and long-range low-resolution sonar systems. UTOFIA offers a new modus operandi for the main targeted domains of application: marine life monitoring, harbour and ocean litter detection, fisheries and aquaculture stock assessment, and seabed mapping. Progress in UTOFIA has been rapid, and we present here a summary of results from deployments of prototypes in observing marine organisms – as a demonstration of the application of the system in monitoring underwater habitats, stock assessment and for use in offshore fish farms.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Visser, A. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
Variability and connectivity of plaice populations from the Eastern North Sea to the Baltic Sea, part II. Biological evidence of population mixing

A multi-disciplinary study was conducted to clarify stock identity and connectivity patterns in the populations of European plaice (Pleuronectes platessa) in the Skagerrak-Kattegat transition area between the Eastern North Sea and the Baltic Sea. Five independent biological studies were carried out in parallel. Genetic markers suggested the existence of different genetic populations in the transition area. Growth backcalculation with otoliths resulted in significant although limited differences in growth rates between North Sea and Skagerrak, indicating weak differentiation or important mixing. Hydrogeographical drift modelling suggested that some North Sea juveniles could settle along the coast line of the Skagerrak and the Kattegat. Tagging data suggested that both juveniles and adult fish from the North Sea perform feeding migrations into Skagerrak in summer/autumn. Finally, survey data suggested that Skagerrak also belongs to the area distribution of North Sea plaice. The outcomes of the individual studies were then combined into an overall synthesis. The existence of some resident components was evidenced, but it was also demonstrated that North Sea plaice migrate for feeding into Skagerrak and might constitute a large share of the catches in this area. The mixing of different populations within a management area has implications for stock assessment and management. Choice must be made to either lump or split the populations, and the feasibility and constraints of both options are discussed. The outcomes of this work have directly influenced the management decisions in 2015.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, BGI-Shenzhen
Authors: Ulrich, C. (Intern), Hansen, J. H. (Intern), Boje, J. (Intern), Christensen, A. (Intern), Hüsey, K. (Intern), Sun, H. (Ekstern), Worsøe Clausen, L. (Intern)
Pages: 13-23
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Sea Research
Volume: 120
ISSN (Print): 1385-1101
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 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.115 SNIP 1.06 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.371 SNIP 1.28 CiteScore 2.5
When (How?) things go wrong: How larval drift can distort stock abundance estimates

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Johann Heinrich von Thünen-Institute
Authors: Kloppmann, M. (Ekstern), van Damme, C. (Ekstern), Nash, R. (Ekstern), Huwer, B. (Intern), Loots, C. (Ekstern)
Publication date: 2016
Event: Poster session presented at 40th Annual Larval Fish Conference, Solomons, United States.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2016

Abundance, size and polymer composition of marine microplastics ≥10μm in the Atlantic Ocean and their modelled vertical distribution
We studied abundance, size and polymer type of microplastic down to 10 μm along a transect from the European Coast to the North Atlantic Subtropical Gyre (NASG) using an underway intake filtration technique and Raman micro-spectrometry. Concentrations ranged from 13 to 501 items m− 3. Highest concentrations were observed at the European coast, decreasing towards mid-Atlantic waters but elevated in the western NASG. We observed highest numbers among particles in the 10–20 μm size fraction, whereas the total volume was highest in the 50–80 μm range. Based on a numerical model size-dependent depth profiles of polyethylene microspheres in a range from 10–1000 μm were calculated and show a strong dispersal throughout the surface mixed layer for sizes smaller than 200 μm. From model and field study results we conclude that small microplastic is ubiquitously distributed over the ocean surface layer and has a lower residence time than larger plastic debris in this compartment.
Acclimation, adaptation, traits and trade-offs in plankton functional type models – seeking clarity in terminology

We propose definitions in terminology to enhance ongoing collaborations between biologists and modellers on plankton ecology. Organism “functional type” should refer to commonality in ecology not biogeochemistry; the latter is largely an emergent property of the former, while alignment with ecology is also consistent with usage in terrestrial science. Adaptation should be confined, as in genetics, to consideration of species inter-generational change; most so-called “adaptive” plankton models are thus acclimative, modifying vital rates in response to stimuli. Trait trade-off approaches should ideally only be considered for describing intra-generational interactions; in applications between generations, and certainly between unrelated species, such concepts should be avoided. We suggest that systems biology approaches, through to complex adaptive/acclimative systems modelling, with explicit modelling of feedback processes (which we suggest should define “mechanistic” models), would provide realistic and flexible bases upon which to develop descriptions of functional type models.
A century of research on the larval distributions of the Atlantic eels: a re-examination of the data: Larval distributions of the Atlantic eels

The spawning areas of the Atlantic freshwater eels were discovered about a century ago by the Danish scientist Johannes Schmidt who after years of searching found newly hatched larvae of the European eel, Anguilla anguilla, and the American eel, Anguilla rostrata, in the southern Sargasso Sea. The discovery showed that anguillid eels migrate thousands of kilometers to offshore spawning areas for reproduction, and that their larvae, called leptocephali, are transported equally long distances by ocean currents to their continental recruitment areas. The spawning sites were found to be related to oceanographic conditions several decades later by German and American surveys from 1979 to 1989 and by a Danish survey in 2007 and a German survey in 2011. All these later surveys showed that spawning occurred within a restricted latitudinal range, between temperature fronts within the Subtropical Convergence Zone of the Sargasso Sea. New data and re-examinations of Schmidt's data confirmed his original conclusions about the two species having some overlap in spawning areas. Although there have been additional collections of leptocephali in various parts of the North Atlantic, and both otolith research and transport modelling studies have subsequently been carried out, there is still a range of unresolved questions about the routes of larval transport and durations of migration. This paper reviews the history and basic findings of surveys for anguillid leptocephali in the North Atlantic and analyses a new comprehensive database that
includes 22612 A. anguilla and 9634 A. rostrata leptocephali, which provides a detailed view of the spatial and temporal distributions and size of the larvae across the Atlantic basin and in the Mediterranean Sea. The differences in distributions, maximum sizes, and growth rates of the two species of larvae are likely linked to the contrasting migration distances to their recruitment areas on each side of the basin. Anguilla rostrata leptocephali originate from a more western spawning area, grow faster, and metamorphose at smaller sizes of

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Tokyo, IFREMER, Fisheries and Oceans Canada, Thünen Institute of Fisheries Ecology, University of Maine
Authors: Miller, M. J. (Ekstern), Bonhommeau, S. (Ekstern), Munk, P. (Intern), Castonguay, M. (Ekstern), Hanel, R. (Ekstern), McCleave, J. D. (Ekstern)
Pages: 1035-1064
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Biological Reviews
Volume: 90
Issue number: 4
ISSN (Print): 1464-7931
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 7.94 SJR 4.345 SNIP 3.251
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.417 SNIP 3.716 CiteScore 10.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.032 SNIP 3.828 CiteScore 9.82
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 5.783 SNIP 4.135 CiteScore 11.08
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.928 SNIP 3.666 CiteScore 9.47
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 4.568 SNIP 2.959 CiteScore 8.14
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 4.338 SNIP 3.299
BFI (2009): BFI-level 2
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 5.267 SNIP 3.868
Scopus rating (2006): SJR 3.598 SNIP 2.974
Scopus rating (2005): SJR 3.194 SNIP 2.455
Scopus rating (2004): SJR 3.244 SNIP 3.241
Scopus rating (2003): SJR 4.008 SNIP 3.029
Scopus rating (2001): SJR 3.661 SNIP 3.259
A critical assessment of visual identification of marine microplastic using Raman spectroscopy for analysis improvement

Identification and characterisation of microplastic (MP) is a necessary step to evaluate their concentrations, chemical composition and interactions with biota. MP ≥10 μm diameter filtered from below the sea surface in the European and subtropical North Atlantic were simultaneously identified by visual microscopy and Raman micro-spectroscopy. Visually identified particles below 100 μm had a significantly lower percentage confirmed by Raman than larger ones indicating that visual identification alone is inappropriate for studies on small microplastics. Sixty-eight percent of visually counted MP (n = 1279) were spectroscopically confirmed being plastic. The percentage varied with type, colour and size of the MP. Fibres had a higher success rate (75%) than particles (64%). We tested Raman micro-spectroscopy applicability for MP identification with respect to varying chemical composition (additives), degradation state and organic matter coating. Partially UV-degraded postconsumer plastics provided identifiable Raman spectra for polymers most common among marine MP, i.e. polyethylene and polypropylene.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Micro- and Nanotechnology, Technical University of Denmark
Authors: Lenz, R. (Intern), Enders, K. (Intern), Stedmon, C. (Intern), Mackenzie, D. M. (Intern), Nielsen, T. G. (Intern)
Pages: 82-91
Publication date: 2015
Main Research Area: Technical/natural sciences

Publications information
Journal: Marine Pollution Bulletin
Volume: 100
Issue number: 1
ISSN (Print): 0025-326X
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 3.46 SJR 1.302 SNIP 1.331
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.245 SNIP 1.277 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.304 SNIP 1.425 CiteScore 3.04
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.208 SNIP 1.546 CiteScore 2.89
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.241 SNIP 1.377 CiteScore 2.64
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Adult and offspring size in the ocean over 17 orders of magnitude follows two life history strategies
Explaining variability in offspring vs. adult size among groups is a necessary step to determine the evolutionary and environmental constraints shaping variability in life history strategies. This is of particular interest for life in the ocean where a diversity of offspring development strategies is observed along with variability in physical and biological forcing factors in space and time. We compiled adult and offspring size for 407 pelagic marine species covering more than 17 orders of magnitude in body mass including Cephalopoda, Cnidaria, Crustaceans, Ctenophora, Elasmobranchii, Mammalia, Sagittoidea, and Teleost. We find marine life following one of two distinct strategies, with offspring size being either proportional to adult size (e.g., Crustaceans, Elasmobranchii, and Mammalia) or invariant with adult size (e.g., Cephalopoda, Cnidaria, Sagittoidea, Teleosts, and possibly Ctenophora). We discuss where these two strategies occur and how these patterns (along with the relative size of the offspring) may be shaped by physical and biological constraints in the organism’s environment. This adaptive environment along with the evolutionary history of the different groups shape observed life history strategies and possible group-specific responses to changing environmental conditions (e.g., production and distribution).

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Ocean Ecology and Climate, Section for Ecosystem based Marine Management
Authors: Neuheimer, A. (Intern), Hartvig, M. (Intern), Heuschele, J. (Intern), Hylander, S. (Intern), Kærboe, T. (Intern), Olsson, K. H. (Intern), Sainmont, J. (Intern), Andersen, K. H. (Intern)
Pages: 3303–3311
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecology
Volume: 96
Issue number: 12
ISSN (Print): 0012-9658
Advective loss of overwintering Calanus finmarchicus from the Faroe-Shetland Channel

The flow of deep water from the Norwegian Sea to the North Atlantic via the Faroe-Shetland Channel is one of the critical bottlenecks in the meridional overturn circulation. It is also a flow that potentially carries with it a large number of the overwintering copepod, Calanus finmarchicus, a regionally important secondary producer. Using a high resolution
hydrodynamic model, MIKE 3 FM, we simulate the overflow of deep water and estimate the associated loss rate of C. finmarchicus as a function of the water depth strata within which they reside. We estimate a net advective loss from the Norwegian Sea population of 80 +/- 10 kt carbon bound in lipids of C finmarchicus biomass per year, a number that constitutes about 50% of the total overwintering population. Estimates of water mass characteristics and particle tracking suggest that the fate of individuals transported in the overflowing water is to be entrained into warmer waters of the North Atlantic Basin, a habitat that appears to be unsuitable for successful overwintering. (C) 2015 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Rullyanto, A. (Intern), Jonasdottir, S. H. (Intern), Visser, A. W. (Intern)
Pages: 76-82
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Volume: 98
ISSN (Print): 0967-0637
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 2.76 SJR 1.45 SNIP 1.119
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.369 SNIP 1.174 CiteScore 2.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.557 SNIP 1.279 CiteScore 2.67
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.077 SNIP 1.314 CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.024 SNIP 1.165 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.916 SNIP 1.164 CiteScore 2.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.865 SNIP 1.202
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.734 SNIP 1.305
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.505 SNIP 1.109
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.694 SNIP 1.144
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.91 SNIP 1.222
Web of Science (2006): Indexed yes
A model of extracellular enzymes in free-living microbes: Which strategy pays off?

An initial modeling approach was applied to analyze how a single, nonmotile, free-living, heterotrophic bacterial cell may optimize the deployment of its extracellular enzymes. Free-living cells live in a dilute and complex substrate field, and to gain enough substrate, their extracellular enzymes must be utilized efficiently. The model revealed that surface-attached and free enzymes generate unique enzyme and substrate fields, and each deployment strategy has distinctive advantages. For a solitary cell, surface-attached enzymes are suggested to be the most cost-efficient strategy. This strategy entails potential substrates being reduced to very low concentrations. Free enzymes, on the other hand, generate a radically different substrate field, which suggests significant benefits for the strategy if free cells engage in social foraging or experience high substrate concentrations. Swimming has a slight positive effect for the attached-enzyme strategy, while the effect is negative for the free-enzyme strategy. The results of this study suggest that specific dissolved organic compounds in the ocean likely persist below a threshold concentration impervious to biological utilization. This could help explain the persistence and apparent refractory state of oceanic dissolved organic matter (DOM). Microbial extracellular enzyme strategies, therefore, have important implications for larger-scale processes, such as shaping the role of DOM in ocean carbon sequestration.
A MSFD complementary approach for the assessment of pressures, knowledge and data gaps in Southern European Seas: The PERSEUS experience

PERSEUS project aims to identify the most relevant pressures exerted on the ecosystems of the Southern European Seas (SES), highlighting knowledge and data gaps that endanger the achievement of SES Good Environmental Status (GES) as mandated by the Marine Strategy Framework Directive (MSFD). A complementary approach has been adopted, by a meta-analysis of existing literature on pressure/impact/knowledge gaps summarized in tables related to the MSFD descriptors, discriminating open waters from coastal areas. A comparative assessment of the Initial Assessments (IAs) for five SES countries has been also independently performed. The comparison between meta-analysis results and IAs shows similarities for coastal areas only. Major knowledge gaps have been detected for the biodiversity, marine food web, marine litter and underwater noise descriptors. The meta-analysis also allowed the identification of additional research themes targeting research topics that are requested to the achievement of GES.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Pages: 28-39
Publication date: 2015
Main Research Area: Technical/natural sciences
An approach to estimate the freshwater contribution from glacial melt and precipitation in East Greenland shelf waters using colored dissolved organic matter (CDOM)

Changes in the supply and storage of freshwater in the Arctic Ocean and its subsequent export to the North Atlantic can potentially influence ocean circulation and climate. In order to understand how the Arctic freshwater budget is changing and the potential impacts, it is important to develop and refine empirical approaches for tracing freshwater contributions. This in turn can help develop and validate model simulations. Arctic rivers are an important source of freshwater and stable oxygen isotope measurements are used to separate contributions from meteoric water (river, glacial, and precipitation) and sea ice melt. We develop this approach further and investigate the use of an additional tracer, colored dissolved organic matter (CDOM), which is largely specific to freshwater originating from Arctic rivers. A robust relationship between the freshwater contribution from meteoric water and CDOM is derived from 4 years of measurements in Fram Strait (2009-2012), combined with measurements from the East Greenland shelf and Dijmpha Sound (NE Greenland). Results confirm a high contribution of riverine CDOM in Arctic halocline waters with salinities >31.5 and indicate the importance of shelf processes (riverine input and sea ice formation), while previously, these waters where thought to be derived from open sea processes (cooling and sea ice formation) in the northern Barents and Kara Seas. In Greenlandic coastal waters the meteoric water contribution is influenced by Greenland ice sheet meltwater and deviations from the CDOM-meteoric water relationships found are applied to quantify meltwater contribution along the East Greenland shelf waters (0-13%)
An effective algorithm for approximating adaptive behavior in seasonal environments

Behavior affects most aspects of ecological processes and rates, and yet modeling frameworks which efficiently predict and incorporate behavioral responses into ecosystem models remain elusive. Behavioral algorithms based on life-time optimization, adaptive dynamics or game theory are unsuited for large global models because of their high computational demand. We compare an easily integrated, computationally efficient behavioral algorithm known as Gilliam's rule against the solution from a life-history optimization. The approximation takes into account only the current conditions to optimize behavior; the so-called "myopic approximation", "short sighted", or "static optimization". We explore the performance of the myopic approximation with diel vertical migration (DVM) as an example of a daily routine, a behavior with seasonal dependence that trades off predation risk with foraging opportunities in aquatic environments. The myopic approximation proves to be a robust replacement for the life-history optimization, deviating only up to 25% in regions of strong seasonality. The myopic approximation has additional advantages in that it can readily accommodate density dependence and inter-annual variations, aspects that can only be accessed in dynamic programming approaches with escalating computational costs. Furthermore, the explanatory power of the myopic approximation is notably higher than when behavior is not implemented, highlighting the importance for adaptive DVM behavior in ecological models where techniques such as dynamic programming are simply too computational demanding to be implemented.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Department of Applied Mathematics and Computer Science, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Bergen
A new compact, cost-efficient concept for underwater range-gated imaging: the UTOFIA project

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, AZTI-Tecnalia
Authors: Quincoces, I. (Ekstern), Galparsoro, I. (Ekstern), Bald, J. (Ekstern), Gabina, G. (Ekstern), Visser, A. (Intern), Mariani, P. (Intern), Jonasdottir, S. (Intern)
Number of pages: 1
Publication date: 2015
Event: Poster session presented at ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions: Publishers_version

A new look at ocean carbon remineralization for estimating deepwater sequestration

The "biological carbon pump" causes carbon sequestration in deep waters by downward transfer of organic matter, mostly as particles. This mechanism depends to a great extent on the uptake of CO2 by marine plankton in surface waters and subsequent sinking of particulate organic carbon (POC) through the water column. Most of the sinking POC is remineralized during its downward transit, and modest changes in remineralization have substantial feedback on atmospheric CO2 concentrations, but little is known about global variability in remineralization. Here we assess this variability based on modern underwater particle imaging combined with field POC flux data and discuss the potential sources of variations. We show a significant relationship between remineralization and the size structure of the phytoplankton assemblage. We obtain the first regionalized estimates of remineralization in biogeochemical provinces, where these estimates range between -50 and +100% of the commonly used globally uniform remineralization value. We apply the regionalized values to satellite-derived estimates of upper ocean POC export to calculate regionalized and ocean-wide deep carbon fluxes and sequestration. The resulting value of global ocean carbon sequestration at 2000m is 0.33PgCyr-1, and 0.72PgCyr-1 at the depth of the top of the permanent pycnocline, which is up to 3 times higher than the value resulting from the commonly used approach based on uniform remineralization and constant sequestration depth. These results stress that variable remineralization and sequestration depth should be used to model ocean carbon sequestration and feedback on the atmosphere.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Sorbonne Universités, National Oceanography Centre
Authors: Guidi, L. (Ekstern), Legendre, L. (Ekstern), Reygondeau, G. (Intern), Uitz, J. (Ekstern), Stemmann, L. (Ekstern), Henson, S. (Ekstern)
Pages: 1044-1059
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Global Biogeochemical Cycles
Volume: 29
Issue number: 7
ISSN (Print): 0886-6236
Ratings:
An integrated end-to-end modeling framework for testing ecosystem-wide effects of human-induced pressures in the Baltic Sea

We present an integrated end-to-end modeling framework that enables whole-of ecosystem climate, eutrophication, and spatial management scenario exploration in the Baltic Sea. The framework is built around the Baltic implementation of the spatially-explicit end-to-end ATLANTIS model, linked to the high-resolution coupled physical-biological model HBM-ERGOM and the fisheries bio-economic FishRent model. We investigate ecosystem-wide responses to changes in human-induced pressures by simulating several eutrophication scenarios that are relevant to existing Baltic Sea management plans (e.g. EU BSAP, EU CFP). We further present the structure and calibration of the Baltic ATLANTIS model and the operational linkage to the other models. Using the results of eutrophication scenarios, and focusing on the relative changes in fish and fishery production, we discuss the robustness of the model linking with respect to the underlying assumptions, strengths and weaknesses of individual models. Furthermore, we describe how to possibly
expand the framework to account for spatial impacts and economic consequences, for instance by linking to the individual-vessel based DISPLACE modeling approach. We conclude that the proposed model integration and management scenario evaluation scheme lays the foundations for developing a robust framework for management strategy evaluation that is of strategic importance to stakeholders from around the Baltic Sea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Monitoring and Data, Technical University of Denmark, Aarhus University, University of Southern Denmark, CSIRO Ocean and Atmospheres, University of Copenhagen
Authors: Palacz, A. (Intern), Nielsen, J. R. (Intern), Christensen, A. (Intern), Hoff, A. (Ekstern), Frost, H. (Ekstern), Gislasen, H. (Intern), Maar, M. (Ekstern), Bastardie, F. (Intern), Geitner, K. (Intern), Hasler, B. (Ekstern), Ravn-Jonsen, L. (Ekstern), Hutniczak, B. (Forskerdatabase), Fulton, E. A. (Ekstern)
Number of pages: 2
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Additional files:
Publishers version

Bibliographical note
ICES CM 2015/M:12
Publication: Research › Conference abstract for conference – Annual report year: 2015

Anoxia-mediated release of dissolved organic matter from sediments in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Reader, H. (Intern), Stedmon, C. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

A time for every season: seasonal cycles of plankton and fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern)
Number of pages: 180
Publication date: 2015

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

Biogeographic changes in fish diversity driven by changes in climate and exploitation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Bryndum, K. M. (Intern), Christensen, A. (Intern), She, J. (Ekstern), Richardson, K. (Ekstern), MacKenzie, B. (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:
Biogeography of key mesozooplankton species in the North Atlantic, by manual counting methods, and egg production of *Calanus finmarchicus*

Here we present a new, pan-Atlantic compilation of data on key mesozooplankton species, including the possibly most important copepod, *Calanus finmarchicus*. Distributional data of ten representative zooplankton taxa, from recent (2000–2009) Continuous Plankton Recorder data, are presented, along with basin-scale data of the phytoplankton colour index. Then we present a compilation of data on *C. finmarchicus* including observations of abundance, demography, egg production and female size with accompanying data on temperature and chlorophyll. This is a contribution by Canadian, European and US scientists and their institutions. http://doi.pangaea.de/10.1594/PANGAEA.820732, http://doi.pangaea.de/10.1594/PANGAEA.824423, http://doi.pangaea.de/10.1594/PANGAEA.828393.
Blue mussel (*Mytilus edulis*) growth at various salinity regimes determined by a Dynamic Energy Budget model

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Danish Shellfish Centre, Section for Marine Ecology and Oceanography, Aarhus University, Orbicon
Authors: Saurel, C. (Intern), Maar, M. (Ekstern), Landes, A. (Intern), Dolmer, P. (Ekstern), Petersen, J. K. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Changes in the composition and bioavailability of dissolved organic matter during sea ice formation

The Arctic Ocean receives a large amount of terrestrial dissolved organic matter (DOM) from rivers and more than half of this is removed during its passage through the Arctic Ocean. Terrestrial DOM is generally believed to have a low bioavailability and recent studies point to physicochemical processes such as sea ice formation as the source of the significant DOM removal in the Arctic Ocean. We present the results of a mesocosm experiment designed to investigate how sea ice formation affects DOM composition and bioavailability. We measured the change in different fluorescent dissolved organic matter (FDOM) fractions in sea ice, brines (contained in small pores between the ice crystals), and the underlying seawater during a 14 d experiment. Two series of mesocosms were used: one with seawater alone and one with seawater enriched with humic-rich river water. Abiotic processes increased the humic-like FDOM signal in the seawater below the ice during the initial ice formation. Humic-like FDOM fractions with a marine signal were preferentially retained in sea ice (relative to salinity), whereas humic-like FDOM with a terrestrial signal behaved more conservatively with respect to salinity. Amino acid-like FDOM and an unknown FDOM component, only previously found in Antarctic brines, were associated with biological activity and possibly extracellular polymeric substances in sea ice. An additional long-term (226-228 d) bioassay experiment with seawater collected from the mesocosm experiment revealed that 11%+/-2% of the bulk dissolved organic carbon (DOC) was bioavailable. However, 16%+/-12% of DOC expelled from the ice into the seawater below was bioavailable and the bioavailability of DOC in brine was even higher at 45%. DOM is highly susceptible to physicochemical changes during sea ice formation, leading to modifications in composition and increased bioavailability, which can in part explain terrestrial DOC removal in the Arctic Ocean.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Bangor University, Finnish Environment Institute
Authors: Jørgensen, L. (Intern), Stedmon, C. A. (Intern), Kaartokallio, H. (Ekstern), Middelboe, M. (Ekstern), Thomas, D. N. (Ekstern)
Pages: 817-830
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Limnology and Oceanography
Volume: 60
Issue number: 3
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
- Web of Science (2015): Indexed yes
Changes in the freshwater inventory of the Young Sound-Tyrolean fjord system (NE Greenland): evidence from 10 years of Greenland Ecosystem Monitoring

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Aarhus University, Greenland Institute of Natural Resources
Changes in the freshwater inventory of Young Sound-Tyroler fjord system (NE Greenland): Evidence from 10 years of Greenland Ecosystem Monitoring

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, ClimateLab, Greenland Climate Research Centre, Aarhus University
Authors: Stedmon, C. (Intern), Sejr, M. (Ekstern), Bendtsen, J. (Ekstern), Dalsgaard, T. (Ekstern), Juul Pedersen, T. (Ekstern), Mortensen, J. (Ekstern), Rysgaard, S. (Ekstern)
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Place of publication: Lyngby
Publisher: Technical University of Denmark (DTU)
Article number: S-1
Main Research Area: Technical/natural sciences
Conference: DTU Sustain Conference 2015, Lyngby, Denmark, 17/12/2015 - 17/12/2015
Electronic versions: S1_DTU_Sustain_2015.pdf
Publication: Research › peer-review › Conference abstract in proceedings – Annual report year: 2015

Characterising organic matter in recirculating aquaculture systems with fluorescence EEM spectroscopy

The potential of recirculating aquaculture systems (RAS) in the aquaculture industry is increasingly being acknowledged. Along with intensified application, the need to better characterise and understand the accumulated dissolved organic matter (DOM) within these systems increases. Mature RASs, stocked with rainbow trout and operated at steady state at four feed loadings, were analysed by dissolved organic carbon (DOC) analysis and fluorescence excitation-emission matrix (EEM) spectroscopy. The fluorescence dataset was then decomposed by PARAFAC analysis using the drEEM toolbox. This revealed that the fluorescence character of the RAS water could be represented by five components, of which four have previously been identified in fresh water, coastal marine water, wetlands and drinking water. The fluorescence components as well as the DOC showed positive correlations with feed loading, however there was considerable variation between the five fluorescence components with respect to the degree of accumulation with feed loading. The five components were found to originate from three sources: the feed; the influent tap water (groundwater); and processes related to the fish and the water treatment system. This paper details the first application of fluorescence EEM spectroscopy to assess DOM in RAS, and highlights the potential applications of this technique within future RAS management strategies

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Environmental Engineering, Section for Aquaculture
Authors: Hambly, A. (Intern), Arvin, E. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern), Seredynska-Sobecka, B. (Intern), Stedmon, C. (Intern)
Pages: 112-120
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Water Research
Volume: 83
ISSN (Print): 0043-1354
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
Concentrations of sunscreens and antioxidant pigments in Arctic Calanus spp. in relation to ice cover, ultraviolet radiation, and the phytoplankton spring bloom: MAAs and astaxanthin in copepods

Arctic zooplankton ascend to shallow depths during spring to graze on the yearly occurring phytoplankton bloom. However, in surface waters they are exposed to detrimental ultraviolet radiation (UVR) levels. Here, we quantified concentrations of substances known to have UVR-protective functions, namely mycosporine-like amino acids (MAAs) and the carotenoid astaxanthin, from March to May in Calanus finmarchicus, Calanus glacialis and Calanus hyperboreus. Ice cover was 100% in the beginning of March, started to break up during April and was gone by the end of May. UVR-exposure in the water column was tightly linked to the ice conditions and water UVR-transparency was up to 6 m (depth where 1% radiation remains). Concentrations of MAAs in C. finmarchicus and C. glacialis increased sharply during ice break-up and peaked concurrently with maximum chlorophyll a (Chl a) levels. MAA-concentrations in C. hyperboreus increased later in accordance with its later arrival to the surface. The concentration of astaxanthin increased in all three species over time but there was no synchrony with ice conditions or the phytoplankton bloom. Even though only the upper 6 m of the water column was affected by UV-radiation, MAAs in the copepods were tightly correlated to the UV-threat. Hence, changes in ice cover are projected to have a large impact on the UVR-exposure of zooplankton emphasizing the importance of the timing of zooplankton ascent from deep waters in relation to the phytoplankton bloom and the ice break-up.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Stockholm University, University of Innsbruck, Greenland Institute of Natural Resources, Linnaeus University
Authors: Hylander, S. (Ekstern), Kiørboe, T. (Intern), Snoeijs, P. (Ekstern), Sommaruga, R. (Ekstern), Nielsen, T. G. (Intern)
Pages: 2197-2206
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 60
Issue number: 6
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.374 SNIP 1.445 CiteScore 3.59
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Connecting the seas of Norden: Commentary

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Bergen Marine Research Cluster, Stockholm University, Åbo Academy University, Lund University, University of Oslo, University of Bergen, University of Helsinki, University of Akureyri
Authors: Paasche, Ø. (Ekstern), Österblom, H. (Ekstern), Neuenfeldt, S. (Intern), Bonsdorff, E. (Ekstern), Brander, K. (Intern), Conley, D. (Ekstern), Durant, J. (Ekstern), Eikeset, A. (Ekstern), Goksøyr, A. (Ekstern), Jónsson, S. (Ekstern), Kjesbu, O. S. (Ekstern), Kuparinen, A. (Ekstern), Stenseth, N. (Ekstern)
Pages: 89-92
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature Climate Change
Volume: 5
Issue number: 2
ISSN (Print): 1758-678X
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
Connectivity, growth and survival in a spatially structured fish population, which is currently managed as seven separate stock units

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Nielsen, K. E. (Intern), Azour, F. (Intern), Bekkevold, D. (Intern), Christensen, A. (Intern), Hüssy, K. (Intern), Lundgaard, L. S. (Intern), Mosegaard, H. (Intern), Møller, P. R. (Ekstern), Deurs, M. V. (Intern)
Publication date: 2015
Event: 
Main Research Area: Technical/natural sciences
Electronic versions:

**Bibliographical note**

ICES C.M. 2015/A:36

Contrasting optical properties of surface waters across the Fram Strait and its potential biological implications

Underwater light regime is controlled by distribution and optical properties of colored dissolved organic matter (CDOM) and particulate matter. The Fram Strait is a region where two contrasting water masses are found. Polar water in the East Greenland Current (EGC) and Atlantic water in the West Spitsbergen Current (WSC) differ with regards to temperature, salinity and optical properties. We present data on absorption properties of CDOM and particles across the Fram Strait (along 79° N), comparing Polar and Atlantic surface waters in September 2009 and 2010. CDOM absorption of Polar water in the EGC was significantly higher (more than 3-fold) compared to Atlantic water in the WSC, with values of absorption coefficient, $a_{\text{CDOM}}(350)$, m$^{-1}$ of 0.565±0.100 (in 2009) and 0.458±0.117 (in 2010), and 0.138±0.036 (in 2009) and 0.153±0.039 (in 2010), respectively. An opposite pattern was observed for particle absorption with higher absorption found in the eastern part of the Fram Strait. Average values of particle absorption ($a_{\text{P}}(440)$, m$^{-1}$) were 0.016±0.013 (in 2009) and 0.014±0.011 (in 2010), and 0.047±0.012 (in 2009) and 0.016±0.014 (in 2010), respectively for Polar and Atlantic water. Thus absorption of light in eastern part of the Fram Strait is dominated by particles - predominantly phytoplankton, and the absorption of light in the western part of the strait is dominated by CDOM, with predominantly terrigenous origin. As a result the balance between the importance of CDOM and particulates to the total absorption budget in the upper 0-10m shifts across Fram Strait. Under water spectral irradiance profiles were generated using ECOLIGHT 5.4.1 and the results indicate that the shift in composition between dissolved and particulate material does not influence substantially the penetration of photosynthetic active radiation (PAR, 400-700nm), but does result in notable differences in ultraviolet (UV) light penetration, with higher attenuation in the EGC. Future changes in the Arctic Ocean system will likely affect EGC through diminishing sea-ice cover and potentially increasing CDOM export due to increase in river runoff into the Arctic Ocean. Role of attenuation of light by CDOM in determining underwater light regime will become more important, with a potential for future increase in marine productivity in the area of EGC due to elevated PAR and lowered UV light exposures.
Controlling factors in fish early life history and how they combine to influence trophic links across the North Atlantic Ocean.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Hawaii
Authors: Neuheimer, A. (Intern), Payne, M. (Intern), MacKenzie, B. (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:
Publishers version

Bibliographical note
ICES CM 2015/S:06
Publication: Research › Conference abstract for conference – Annual report year: 2015

Copepod carcasses as microbial hot spots for pelagic denitrification
Copepods are exposed to a high non-predatory mortality and their decomposing carcasses act as microniches with intensified microbial activity. Sinking carcasses could thereby represent anoxic microenvironments sustaining anaerobic microbial pathways in otherwise oxic water columns. Using non-invasive O2 imaging, we document that carcasses of Calanus finmarchicus had an anoxic interior even at fully airsaturated ambient O2 level. The extent of anoxia gradually expanded with decreasing ambient O2 levels. Concurrent microbial sampling showed the expression of nitrite reductase genes (nirS) in all investigated carcass samples and thereby documented the potential for microbial denitrification in carcasses. The nirS gene was occasionally expressed in live copepods, but not as consistently as in carcasses. Incubations of sinking carcasses in 15NO2 3 amended seawater demonstrated denitrification, of which on average 34%-617% (n=28) was sustained by nitrification. However, the activity was highly variable and was strongly dependent on the ambient O2 levels. While denitrification was present even at air-saturation (302 lmol L-1), the average carcass specific activity increased several orders of magnitude to 1 nmol d-1 at 20% air-saturation (55 lmol O2 L-1) at an ambient temperature of 78C. Sinking carcasses of C. inmarchicus therefore represent hotspots of pelagic denitrification, but the quantitative importance as a sink for bioavailable nitrogen is strongly dependent on the ambient O2 level. The importance of carcass associated denitrification could be highly significant in O2 depleted environments such as Oxygen Minimum Zones (OMZ).

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Southern Denmark, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, College of William and Mary, Greenland Climate Research Centre, Greenland Institute of Natural Resources
Authors: Glud, R. N. (Ekstern), Grossart, H. (Ekstern), Larsen, M. (Ekstern), Tang, K. W. (Ekstern), Arendt, K. E. (Ekstern), Rysgaard, S. (Ekstern), Thamdrup, B. (Ekstern), Nielsen, T. G. (Intern)
Pages: 2026-2036
Publication date: 2015
Publication information
Journal: Limnology and Oceanography
Volume: 60
Issue number: 6
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.374 SNIP 1.445 CiteScore 3.59
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.38 SNIP 1.425
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.329 SNIP 1.682
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.381 SNIP 1.615
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.361 SNIP 1.682
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.38 SNIP 1.641
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.302 SNIP 1.697
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.463 SNIP 1.778
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.685 SNIP 2.004
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.605 SNIP 1.798
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.91 SNIP 1.892
Web of Science (2001): Indexed yes
Coupling ecosystems exposure to nitrogen and species sensitivity to hypoxia: modelling marine eutrophication in LCIA

Characterisation modelling in Life Cycle Impact Assessment (LCIA) quantifies impacts of anthropogenic emissions by applying substance-specific impact potentials, or Characterisation Factors (CF), to the amount of substances emitted. Nitrogen (N) emissions from human activities enrich coastal marine ecosystems and promote planktonic growth that may lead to marine eutrophication impacts. Excessive algal biomass and dissolved oxygen (DO) depletion typify the ecosystem response to the nutrient input. The present novel method couples a mechanistic model of coastal biological processes that determines the ecosystem response (exposure) to anthropogenic N enrichment (exposure Factor, XF [kgO2·kgN-1]) with the sensitivity of species exposed to oxygen-depleted waters (Effect Factor, EF [(PAF)·m3·kgO2-1], expressed as a Potentially Affected Fraction (PAF) of species). Thus, the coupled indicator (XF*EF, [(PAF)·m3·kgN-1]) represents the potential impact on benthic and demersal marine species caused by N inputs. Preliminary results range from 2 (PAF)·m3·kgN-1 (Central Arctic Ocean) to 94 (PAF)·m3·kgN-1 (Baltic Sea). Comparative contributions per country or watersheds can also be obtained. Further adding environmental fate modelling of N emissions completes the CF for eutrophying emissions making it a useful contribution for sustainability assessment of human activities, as applied in Life Cycle Assessment (LCA).

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Cosme, N. M. D. (Intern), Koski, M. (Intern), Hauschild, M. Z. (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:
Extended abstract

Dangerous relations in the Arctic marine food web: Interactions between toxin producing Pseudo-nitzschia diatoms and Calanus copepodes

Diatoms of the genus Pseudo-nitzschia produce domoic acid (DA), a toxin that is vectored in the marine food web, thus causing serious problems for marine organisms and humans. In spite of this, knowledge of interactions between grazing zooplankton and diatoms is restricted. In this study, we examined the interactions between Calanus copepodes and toxin producing Pseudo-nitzschia. The copepodes were fed with different concentrations of toxic P. seriata and a strain of P. obtusa that previously was tested to be non-toxic. The ingestion rates did not differ among the diets (P. seriata, P. obtusa, a mixture of both species), and they accumulated 6%–16% of ingested DA (up to 420 μg per dry weight copepodite). When P. seriata was exposed to the copepodes, either through physical contact with the grazers or separated by a membrane, the toxicity of P. seriata increased (up to 3300%) suggesting the response to be chemically mediated. The induced response was also triggered when copepodes grazed on another diatom, supporting the hypothesis that the cues originate from the copepodite. Neither pH nor nutrient concentrations explained the induced DA production. Unexpectedly, P. obtusa also produced DA when exposed to grazing copepodes, thus representing the second reported toxic polar diatom.
More than 70% of the earth surface is covered by the ocean. The ocean is not static; it is in constant motion at many scales and circulates waters in coastal regions, the open seas and across ocean basins. The flow not only occurs in the surface of the ocean, as we can see in the form of waves or tides, but also deep beneath the surface, where deep-water currents circulate waters throughout the world’s oceans.

In certain very-localized regions, the flow of the deep-water has to travel over a sill in a narrow submarine channel. This overflow process mixes the deep water with overlying waters, creating new water masses with distinct temperature, salinity and density characteristics. The change of water mass characteristics not only affects the local environment, but also far distant regions. The Faroe Bank Channel, which is located in the southern part of Faroe Islands, is one of the most important overflow regions in the world. It connects two huge ocean basins, the North Atlantic Ocean and the Nordic Seas, and the water mass produced there is an important ingredient of North Atlantic Deep Water, a water mass that found very nearly everywhere in the deep basins of the world’s oceans.
In this thesis, I use a high-resolution hydrodynamic model to study in detail the physics of deep-water overflows. Such models are a powerful research tool that can be used to study phenomena that are otherwise difficult to observe, and, when properly calibrated, can be used to predict how circulation may change under different circumstances. The focus is on the Faroe Bank Channel, a relatively small region, which has a significant impact on the global ocean circulation and marine organisms that live in its environment.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, DHI Denmark
Authors: Rullyanto, A. (Intern), Visser, A. (Intern), Petersen, O. S. (Ekstern), Sørensen, J. V. (Ekstern)
Number of pages: 86
Publication date: 2015

**Publication information**
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2015

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**Di-(2-ethylhexyl)-phthalate disrupts pituitary and testicular hormonal functions to reduce sperm quality in mature goldfish**

Di-(2-ethylhexyl) phthalate (DEHP) interferes with male reproductive endocrine system in mammals, however its effects on fish reproduction are largely unknown. We evaluated sperm quality and investigated reproductive endocrine system in mature goldfish (Carassius auratus) exposed to nominal 1, 10, and 100μg/L DEHP. To examine DEHP estrogenic activity, one group of goldfish was exposed to 17β-estradiol (5μg/L E2) for comparison. Following 30d of exposure, sperm production was decreased and suppressed in DEHP and E2 treated goldfish, respectively. Sperm motility and velocity were decreased in goldfish exposed to 100 and 10μg/L DEHP at 15s post-sperm activation, respectively. Compared to control, 11-ketotestosterone (11-KT) levels were decreased at 10 and 1μg/L DEHP at day 15 and 30, respectively. In E2 treated goldfish, 11-KT levels were decreased compared to control during the period of exposure. E2 levels were increased in goldfish exposed to E2, but remained unchanged in DEHP treated goldfish during the period of exposure. StAR mRNA levels encoding regulator of cholesterol transfer to steroidogenesis were decreased in DEHP and E2 treated goldfish following 15 and 30d of exposure, respectively. Luteinizing hormone (LH) levels were decreased in DEHP and E2 treated goldfish following 15 and 30d of exposure, respectively. In DEHP treated goldfish, gnrh3, kiss1 and its receptor (gpr54) mRNA levels did not change during the experimental period. In E2 treated goldfish, gnrh3 mRNA levels were decreased at day 7, but kiss1 and gpr54 mRNA levels were increased at day 30 of exposure. The mRNA levels of genes encoding testicular LH and androgen receptors remained unchanged in DEHP and E2 treated goldfish. In contrast to E2 treated goldfish, vitellogenin production was not induced in DEHP treated goldfish and mRNA levels of genes with products mediating estrogenic effects remained unchanged or decreased. In conclusion, DEHP interferes with testis and pituitary hormonal functions to reduce sperm quality in goldfish and does not exhibit estrogenic activity.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of South Bohemia, University of Agriculture in Kraków, University of Lorraine, Polytechnic University of Marche
Authors: Golshan, M. (Ekstern), Hatef, A. (Ekstern), Socha, M. (Ekstern), Milla, S. (Ekstern), Butts, I. (Intern), Carnevali, O. (Ekstern), Rodina, M. (Ekstern), Sokolowska-Mikołajczyk, M. (Ekstern), Fontaine, P. (Ekstern), Linhart, O. (Ekstern), Alavi, S. (Ekstern)
Pages: 16-26
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Aquatic Toxicology
Volume: 163
ISSN (Print): 0166-445X
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.38 SJR 1.612 SNIP 1.393
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.666 SNIP 1.175 CiteScore 3.79
Digesting in hypoxia: impact on gastric evacuation rate and postprandial metabolism (SDA) of Atlantic cod, Gadus morhua

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Ministere des Peches et des Oceans
Authors: Chabot, D. (Ekstern), Behrens, J. (Intern), Andersen, N. G. (Intern)
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Electronic versions:

10.1016/j.aquatox.2015.03.017

Publication: Research - peer-review › Journal article – Annual report year: 2015
The larval krill community (Thysanoessa spp.) was investigated along the sub-Arctic Godthåbsfjord, SW Greenland, in June 2010. In addition, the progress of krill development from egg to furcilia was studied from March to August 2010 in a fjord branching off the Godthåbsfjord. Krill spawned from late April until early May, with a second spawning event in early July. Spawning took place in the warmer, innermost part of the fjord, correlated with phytoplankton blooms. Naupliar abundance peaked immediately after spawning, and naupliar stage duration was 3 d. Sequences of the calyptopis and furcilia stages lasted 22 and 63 d, respectively. The growth rate from metanauplius to calyptopis was 0.12 d⁻¹, while the growth rate across all developmental stages was 0.05 d⁻¹. Mortality rates were calculated as 25% from eggs to nauplii, 48% from eggs to calyptopis and 83% from eggs to furcilia. During development, the larvae were dispersed from the shallow, warmer hatching area in the inner part of the fjord by tidal currents and runoff from land. The study showed that developmental stages of krill are a key group in Greenland coastal waters, one which should be considered in future studies of the pelagic food web.
Duplicated leptin receptors in two species of eel bring new insights into the evolution of the leptin system in vertebrates

Since its discovery in mammals as a key-hormone in reproduction and metabolism, leptin has been identified in an increasing number of tetrapods and teleosts. Tetrapods possess only one leptin gene, while most teleosts possess two leptin genes, as a result of the teleost third whole genome duplication event (3R). Leptin acts through a specific receptor (LEPR). In the European and Japanese eels, we identified two leptin genes, and for the first time in vertebrates, two LEPR genes. Synteny analyses indicated that eel LEPRa and LEPRb result from teleost 3R. LEPRb seems to have been lost in the teleost lineage shortly after the elopomorph divergence. Quantitative PCRs revealed a wide distribution of leptins and LEPRs in the European eels. This might be related to the remarkable adaptation of silver eel metabolism to long-term fasting throughout the reproductive oceanic migration. In contrast, sexual maturation induced differential increases in the expression of leptins and LEPRs in the BPG-liver axis. Leptin2 was strikingly upregulated in the liver, the central organ of the reproductive metabolic challenge in teleosts. LEPRs were differentially regulated during sexual maturation, which may have contributed to the conservation of the duplicated LEPRs in this species. This suggests an ancient and positive role of the leptin system in the vertebrate reproductive function. This study brings new insights on the evolutionary history of the leptin system in vertebrates. Among extant vertebrates, the eel represents a unique case of duplicated leptins and leptin receptors as a result of 3R.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Museum National d'Histoire Naturelle, Leiden University
Authors: Morini, M. (Ekstern), Pasquier, J. (Ekstern), van den Thillart, G. (Ekstern), Tomkiewicz, J. (Intern), Rousseau, K. (Ekstern), Dufour, S. (Ekstern), Lafont, A. (Ekstern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS ONE
Volume: 10
Issue number: 5
Article number: e0126008
ISSN (Print): 1932-6203
Ratings:
Early development of *Calanus glacialis* and *C. finmarchicus*

Egg and nauplii development of co-existing populations of *Calanus glacialis* and *C. finmarchicus* from Disko Bay, western Greenland, were measured in the laboratory with and without addition of food. Egg hatching rate was measured at 5 temperatures from 0-10 °C and the fit to a Beléhrádek equation was highly significant ($r^2 > 0.99$). There was little difference between hatching and development rates of the two species; however, the egg hatching rate at low temperatures was faster than predicted from measurements made in other areas. Also nauplii development times at 0 °C were similar, with *C. glacialis* and *C. finmarchicus* reaching nauplii stage six after 44 and 48 days, respectively. The laboratory reared nauplii could be separated accurately to species by stage and length alone. However separation by size was not possible for the in situ community of nauplii where the influence of food and temperature made the size distribution more variable.
Eastern Baltic cod in distress: biological changes and challenges for stock assessment
The eastern Baltic (EB) cod (Gadus morhua) stock was depleted and overexploited for decades until the mid-2000s, when fishing mortality rapidly declined and biomass started to increase, as shown by stock assessments. These positive developments were partly assigned to effective management measures, and the EB cod was considered one of the most successful stock recoveries in recent times. In contrast to this optimistic view, the analytical stock assessment failed in 2014, leaving the present stock status unclear. Deteriorated quality of some basic input data for stock assessment in combination with changes in environmental and ecological conditions has led to an unusual situation for cod in the Baltic Sea, which poses new challenges for stock assessment and management advice. A number of adverse developments such as low nutritional condition and disappearance of larger individuals indicate that the stock is in distress. In this study, we (i) summarize the knowledge of recent changes in cod biology and ecosystem conditions, (ii) describe the subsequent challenges for stock assessment, and (iii) highlight the key questions where answers are urgently needed to understand the present stock status and provide scientifically solid support for cod management in the Baltic Sea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Institute Management, Section for Monitoring and Data, Swedish University of Agricultural Sciences, University of Skövde, International Council for the Exploration of the Sea, University of Kiel, Lund University, Johann Heinrich von Thünen-Institute
Pages: 2180-2186
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 72
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
Effect of acidification on an Arctic phytoplankton community from Disko Bay, West Greenland

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Roskilde University, University of Copenhagen, Greenland Institute of Natural Resources
Authors: Thoisen, C. (Ekstern), Riisgaard, K. (Intern), Lundholm, N. (Ekstern), Nielsen, T. G. (Intern), Hansen, P. J. (Ekstern)
Pages: 21-34
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 520
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Effect of sea-ice melt on inherent optical properties and vertical distribution of solar radiant heating in Arctic surface waters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian Polar Institute, Polish Academy of Sciences
Authors: Granskog, M. A. (Ekstern), Pavlov, A. K. (Ekstern), Sagan, S. (Ekstern), Kowalczik, P. (Ekstern), Raczkowska, A. (Ekstern), Stedmon, C. A. (Intern)
Pages: 7028-7039
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
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<td>Web of Science (2003):</td>
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<td>Scopus rating (2000):</td>
<td>SJR 2.729 SNIP 1.489</td>
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Effects of climate-induced habitat changes on a key zooplankton species

Impacts of climate change on marine ecosystems have become increasingly apparent during the past decades. In consequence, it is necessary to study how these alterations can affect the habitat and population dynamics of key organisms. Here we used a video plankton recorder (VPR) to investigate the effect of climate-induced habitat changes on the copepod Pseudocalanus acuspes, a key species in the Baltic Sea. The VPR allowed the observation of reproducing copepod females, identified by attached egg sacs, usually lost during traditional net sampling. We compared the small-scale distribution of our target species during non-inflow and inflow periods. Our study showed a large increase in the availability of suitable habitat after the inflow event due to improved oxygen and salinity conditions. Furthermore, increased copepod abundance and a deeper and wider vertical distribution was apparent. Applying a new approach to estimate in situ egg production rates from VPR-derived images revealed no changes. However, we observed increased offspring survival with improved hydrographic conditions pointing toward the importance of salinity and oxygen for the population dynamics of Baltic P. acuspes. Our observations illustrate the strong impact that climate change can have on the habitat of key marine ecosystem species, important for overall ecosystem dynamics.
Effects of pre-incubation of eggs in fresh water and varying sperm concentration on fertilization rate in sterlet sturgeon, *Acipenser ruthenus*

Standardization of fertilization protocols for sterlet *Acipenser ruthenus* is crucial for improving reproductive techniques and for conservation purposes. Our objectives were to determine the number of sperm (tested 430,000:1, 43,000:1, 430:1 sperm to egg) required to fertilize eggs and explore how pre-incubation of eggs in freshwater for 0. min, 0.5. min, 1. min, and 10. min interacts with different sperm ratios. Fertilization success ranged from 29.7% at 430:1 to 84.2% at 430,000:1. Pre-incubation time had no effect on fertilization success at 430,000:1 and 43,000:1 sperm to egg ratios, while it was significant at the 430:1 and 430:1 ratios. The use of adequate experimental suboptimal sperm to egg ratio revealed a positive effect of pre-incubation time, such that at the 430:1 ratio, 0.5. min pre-incubation increased the fertilization rate than 10. min. At 0. min pre-incubation the proportion of fertilized eggs increased at the 430,000:1 ratio, while at 1. min fertilization increased at the 430:1 ratio. At the 10. min pre-incubation time, fertilization increased at the 43,000:1 ratio. Moreover, at the 0.5. min pre-incubation time, the 43,000:1 ratio increased the fertilization rate than the 430:1 ratio. Generally, for 430:1 ratio, the fertilization rate is lower than in control. Transmission electron microscopy showed that pre-incubation of eggs in water for <10. min does not trigger a cortical reaction or the formation of a perivitelline space. Results suggest that with a low sperm to egg ratio 0.5 to 1. min pre-incubation of eggs in freshwater prior to fertilization
can enhance fertilization rate of sterlet
Elevating the predatory effect: Sensory-scanning foraging strategy by the lobate ctenophore Mnemiopsis leidyi

The influential predatory role of the lobate comb jellyfish Mnemiopsis leidyi has largely been attributed to the generation of a hydrodynamically silent feeding current to entrain and initiate high encounter rates with prey. However, for high encounter rates to translate to high ingestion rates, M. leidyi must effectively capture the entrained prey. To investigate the capture mechanisms, we recorded and quantified, using three-dimensional videography, the outcome of encounter events with slow swimming Artemia prey. The auricles, which produce the feeding current of M. leidyi, were the primary encounter structures, first contacting 59% of the prey in the feeding current. Upon detection, the auricles manipulated the Artemia to initiate captures on the tentillae, which are coated with sticky cells (colloblasts). Using this mechanism of sensory-scanning to capture prey entrained in the feeding current, M. leidyi uses a similar foraging strategy to that of feeding-current foraging copepods. As such, M. leidyi has a higher capture efficiency than do medusae, contributing to the greater predatory effect of M. leidyi in both its endemic and invasive ecosystems.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Marine Biological Laboratory, Providence College, University of California at Berkeley, University of Texas, University of Oregon, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Colin, S. P. (Ekstern), MacPherson, R. (Ekstern), Gemmell, B. (Ekstern), Costello, J. H. (Ekstern), Sutherland, K. (Ekstern), Jaspers, C. (Intern)
Pages: 100-109
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 60
Issue number: 1
ISSN (Print): 0024-3590
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 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.374 SNIP 1.445 CiteScore 3.59
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.38 SNIP 1.425
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Elevating the predatory effect: Sensory-scanning foraging strategy by the lobate ctenophore Mnemiopsis leidyi

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Collin, S. P. (Ekstern), MacPherson, R. (Ekstern), Gemmell, B. (Ekstern), Costello, J. (Ekstern), Sutherland, K. (Ekstern), Jaspers, C. (Intern)
Publication date: 2015
Event: Abstract from ASLO Aquatic Sciences Meeting 2015, Granada, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

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
Publication: Research › Conference abstract for conference – Annual report year: 2016
Establishment of blue mussel beds to enhance fish habitats

Human activity has impacted many coastal fjords causing degeneration of the structure and function of the fish habitats. In Nørrefjord, Denmark, local fishermen complained of declining fish catches which could be attributed to eutrophication and extraction of sediments over several decades. This study aimed to establish blue mussel beds (Mytilus edulis) to increase structural complexity and increase the abundance of fish and epifauna in Nørrefjord. It was expected that the mussels would improve water transparency and increase the depth range and coverage of eelgrass (Zostera marina). New methods for mussel production and -bed construction were investigated in collaboration with local volunteer fishermen. The effect of the artificial mussel beds was most evident on a small scale. Video observations directly at the beds (Impact area) demonstrated increased biodiversity and a three times higher abundance of mesopredator fish compared to the Control area. Water clarity and eelgrass coverage were unchanged. Two methods for establishing mussel beds were tested. A total of 44 tons of blue mussels were produced and established in beds over an area of 121,000 m². Production of blue mussels directly on hemp sacs hanging on long-lines was the most effective method. This new method is potentially a useful management tool to improve fish habitats.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Shellfish Centre, Section for Marine Ecology and Oceanography, University of Southern Denmark, Nordshell IS, Aarhus University
Authors: Kristensen, L. D. (Intern), Stenberg, C. (Intern), Støttrup, J. (Intern), Poulsen, L. K. (Intern), Christensen, H. T. (Intern), Dolmer, P. (Intern), Landes, A. (Intern), Røjbek, M. (Intern), Thorsen, S. (Ekstern), Deurs, M. A. V. (Ekstern), Grønkjær, P. (Ekstern)
Pages: 783-796
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Applied Ecology and Environmental Research
Volume: 13
Issue number: 3
ISSN (Print): 1589-1623
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): SJR 0.291 SNIP 0.676 CiteScore 0.78
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.221 SNIP 0.462 CiteScore 0.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.309 SNIP 0.86 CiteScore 0.76
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.296 SNIP 0.75 CiteScore 0.81
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.428 SNIP 0.658 CiteScore 0.74
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.297 SNIP 0.562 CiteScore 0.57
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.393 SNIP 0.993
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.299 SNIP 0.657
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.317 SNIP 0.866
Scopus rating (2007): SJR 0.204 SNIP 0.641
Et hav fuld af mikroplastik

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Institute Management
Authors: Enders, K. (Intern), Lenz, R. (Intern), Sørensen, T. K. (Intern), Reeh, L. (Intern), Nielsen, T. G. (Intern)
Pages: 8-13
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aktuel Naturvidenskab
Issue number: 2
ISSN (Print): 1399-2309
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish

Relations
Press / Media items:
Forskere på jagt efter plast i fiskene vi spiser
Publication: Communication › Journal article – Annual report year: 2015

Evaluation of integrated ecological-economic models – Review and challenges for implementation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, National Oceanographic and Atmospheric Administration, IFREMER, Thünen Institute of Sea Fisheries, Commonwealth Scientific and Industrial Research Organisation, University of Vigo, AZTI-Tecnalia, Agrocampus Ouest, Wageningen IMARES, Spanish National Research Council, National Marine Fisheries Research Institute, Cefas, University of Southern Denmark, Swiss Federal Institute for Aquatic Science and Technology, Swiss Federal Institute of Aquatic Science and Technology, Swedish Agency for Marine and Water Management, University of Kiel, University of Copenhagen, Johann Heinrich von Thünen-Institute, Stockholm University, Lund University
Number of pages: 3
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers_version
Exposure factors for marine eutrophication impacts assessment based on a mechanistic biological model

Emissions of nitrogen (N) from anthropogenic sources enrich marine waters and promote planktonic growth. This newly synthesised organic carbon is eventually exported to benthic waters where aerobic respiration by heterotrophic bacteria results in the consumption of dissolved oxygen (DO). This pathway is typical of marine eutrophication. A model is proposed to mechanistically estimate the response of coastal marine ecosystems to N inputs. It addresses the biological processes of nutrient-limited primary production (PP), metazoan consumption, and bacterial degradation, in four distinct sinking routes from primary (cell aggregates) and secondary producers (faecal pellets, carcasses, and active vertical transport). Carbon export production (PE) and ecosystems eXposure Factors (XF), which represents a nitrogen-to-oxygen 'conversion' potential, were estimated at a spatial resolution of 66 large marine ecosystem (LME), five climate zones, and site-generic. The XFs obtained range from 0.45 (Central Arctic Ocean) to 15.9kgO2kgN⁻¹ (Baltic Sea). While LME resolution is recommended, aggregated PE or XF per climate zone can be adopted, but not global aggregation due to high variability. The XF is essential to estimate a marine eutrophication impacts indicator in Life Cycle Impact Assessment (LCIA) of anthropogenic-N emissions. Every relevant process was modelled and the uncertainty of the driving parameters considered low suggesting valid applicability in characterisation modelling in LCIA.
Fecundity regulation in relation to habitat utilisation of two sympatric flounder (Platichthys flesus) populations in the brackish water Baltic Sea

Two populations of flounder (Platichthys flesus) with different life history traits inhabit the brackish water Baltic Sea. Both types share feeding areas in coastal waters during summer-autumn but utilise different habitats for spawning in spring, namely offshore spawning with pelagic eggs and coastal spawning with demersal eggs respectively. Fecundity regulation by atresia was assessed as prevalence (portion of fish with atresia) and intensity (calculated as the average intensity of atresia in these fish) during the reproductive cycle following start of gonad development in the autumn up to spawning in spring, and evaluated in relation to fish condition (Fulton's condition factor reflecting energy reserves of the fish) and feeding incidence of the respective population. Peaking in winter (December–February), fecundity regulation was significantly higher for coastal spawning flounder than for flounder spawning offshore. For coastal spawners, the prevalence was 45–90% with an intensity of 6.4–9.3% vs. 0–25% and an intensity of 2.1–3.4% for offshore spawners during winter. Further, fecundity regulation ceased prior to spawning for offshore spawners but continued for coastal spawners. For coastal spawners, the prevalence was 12–29% and an intensity of 2.5–6.1% during spawning. The change in fish condition was strongly related to feeding incidence and differed between populations. As feeding ceased, condition of offshore spawners decreased during winter up to spawning, whereas condition of coastal spawners decreased during autumn but was maintained as feeding started again prior to spawning. Thus, habitat utilisation according to spawning strategy affects the timing of fecundity down-regulation reflecting availability of resources, namely limited food resources in deep areas and higher availability in coastal areas. Offshore spawning flounder display characteristics typical for a capital spawner with ceasing of feeding and oocyte down-regulation well before spawning whereas coastal spawning flounder can be characterised as intermediate between a capital and income spawner with feeding prior to and during spawning along with continuous fecundity-regulation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Uppsala University

Institute of Marine Research
Female ovarian abnormalities and reproductive failure of autumn-spawning herring (Clupea harengus membras) in the Baltic Sea

Fecundity and reproductive potential are important factors to be considered in evaluating trajectories and demographic predictions of fish populations. Therefore, characterizing the nature and quantifying the extent of any reproductive failure should be considered in fisheries studies. Here, we describe morphological changes in developed ovaries of autumn-spawning herring (Clupea harengus membras) caught in the northern Baltic Sea and evaluate the magnitude of this phenomenon during 3 consecutive years. Visibly, abnormal ovaries were histologically characterized by irregular-shaped oocytes in a vitellogenic or final maturation stage with coagulative necrosis and liquefaction of the yolk sphere, degraded follicle membranes, and fibrinous adhesion among oocytes. Such degeneration is presumed to cause complete infertility in the fish. The frequency of fish with abnormal ovaries varied annually between 10 and 15% among all females sampled. However, specific sampling events showed up to 90% females with abnormal gonads. The specific cause of this abnormality remains unknown; however, prevalence was associated with unfavourable environmental conditions encountered before spawning. Thus, ovarian abnormality was positively related to water temperatures, with the highest level found at ≥15°C and negatively related to the frequency of strong winds. The frequency of occurrence of abnormal gonads decreased with the progression of spawning from August to October. The observed abnormality and associated spawning failure will negatively affect the realized fecundity of autumn herring in the Baltic Sea and may act as a limiting factor for recovery of the stock, which has experienced profound depression during the last three decades.
Fisheries oceanography of northern pelagic fish species

People are familiar with marine fish species and the great variety of different species that are available in the market, such as herring, cod and sole. What may not be well known is that every individual fish goes through a long, risky journey during its life before reaching maturity. Most of the marine fish species are important prey for larger predators, such as larger fish in the ocean, marine mammals, birds and humans. Every individual female fish can produce many thousands to millions of eggs every year during the spawning season. The eggs (usually less than 2 mm in diameter) that live free in the environment, and depending on species, eggs either drift/float in the water or are attached to the bottom close to each other. The larvae that hatch from the eggs grow in size continuously until they reach a certain size and become adults. The first few weeks of its life are the riskiest and most of the eggs and larvae become prey for other organisms living in the sea or perish due to unfavorable conditions, for example high or low temperature or salinity. Those that survive to adulthood will participate with the rest of the population to the reproductive process, called spawning which takes place every year. The period of time that spawning takes place depends on the environmental conditions that each species has adapted to during the life of the species.

Here, I have found that temperature is a significant factor that strongly affects egg development and survival. There are large differences in the temperature range that maximizes survival among different species, but the sensitivity of egg development rate in a degree of temperature increase is similar among the 32 species and populations I analysed. I also found that adults spawn at temperature conditions that are generally close to the egg preferences, indicating that the egg stage is critical to the population abundance.

Two significant factors that regulate the time of spawning are the temperature at which the eggs and larvae can survive best and the availability of food for larvae. In general, at higher latitudes (northern North Atlantic) the optimal conditions are found during a narrower period and at lower latitudes (southern North Atlantic) the optimal conditions last longer. Temperature is also one of the factors that gives the signal to adults that the time to spawn has come. Another finding of my study is that species that have longer spawning seasons, at lower latitudes, are able to produce 10 times more eggs during their life time than species than have a limited spawning season. This may reflect the more un-predictable environmental conditions at lower latitudes. People are also familiar with the words "climate change" and "warming of the oceans". There is already evidence in the scientific community that the temperature in the surface water (0-75m depth) of the North Atlantic has been increasing by 0.11 oC per decade since the 1970s. This will lead to a significant cumulative increase in the next few decades, with many consequences for marine organisms. One of the impacts will be the time that species start to spawn, and there is already evidence for earlier spawning in some North Sea fish species. A change like that may likely have a chain reaction, affecting larval stages and whether they will live in environments with high food availability. Warming temperature may also result in changes in the geographical distributions of species. If the environment becomes too warm at the areas that species live now, they may move to northern or deeper waters. This will leave space for other species, now living southern to move north. As a result the composition of the communities in the oceans will probably change. In my thesis, I also evaluated how expected climate change could affect the timing, location and success of spawning by herring in the North
Sea. This species is an important species for the food-web and has an important commercial value for countries bordering the North Sea. I first developed a model that could describe the most important environmental conditions that determine herring spawning areas and times in the North Sea, and then used these model with future temperatures estimated by climate change models to estimate where and when spawning might occur in future. I found that egg survival will generally remain high but that spawning times and locations will likely change. These changes could affect herring ecology (e.g., survival rates), if the larvae experience substantially different levels of food or predators than at present, and subsequently the North Sea herring populations. However, there can be differences in the sensitivity of some species to temperature changes, which for some will be greater compared to others. From the global perspective, humans will likely see the effects of climate change in the oceans by reduced availability of the species they consume now and increased availability of new species. In addition, there will likely be economic impacts on the local fishing communities. How species respond to climate change is a field of research that receives great attention because the responses will affect the management of fisheries

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tsoukali, S. (Intern), MacKenzie, B. (Intern), Visser, A. (Intern)
Number of pages: 132
Publication date: 2015

Fluorescence quantum yields of natural organic matter and organic compounds: Implications for the fluorescence-based interpretation of organic matter composition
Absorbance and fluorescence spectroscopy are economical tools for tracing the supply, turnover and fate of dissolved organic matter (DOM). The colored and fluorescent fractions of DOM (CDOM and FDOM, respectively) are linked by the apparent fluorescence quantum yield (AQY) of DOM, which reflects the likelihood that chromophores emit fluorescence after absorbing light. Compared to the number of studies investigating CDOM and FDOM, few studies have systematically investigated AQY spectra for DOM, and linked them to fluorescence quantum yields (Φ) of organic compounds. To offer a standardized approach, a MATLAB toolbox for the determination of apparent quantum yields of DOM (aquaDOM), featuring two calculation approaches, was developed and used to derive AQYs for samples from the Norwegian Sea. Φ of the organic compounds varied between 0.00079 and 0.35, whereas the average AQY for DOM samples at 350 nm was 0.011 ± 0.003. The AQY at 350 nm increased with depth, while the AQY at 250 nm showed no trend. Laboratory tests indicated that Φ of compound mixtures are additive and represent an intermediate of the constituents. Additionally, the presence of non-fluorescent chromophores greatly suppressed calculated AQYs. Similar trends in the DOM AQY at 350 nm were observed in natural samples. We therefore hypothesize that fluorescence AQYs can indicate changes in the relative abundances of CDOM and FDOM. Additionally, the optical properties of 15 potential DOM constituents were determined and compared to more than 200 modeled spectra (PARAFAC components) in the OpenFluor database. Apparent matches, based on spectral similarity, were subsequently evaluated using molar fluorescence and absorbance. Five organic compounds were potential matches with PARAFAC components from 16 studies; however, the ability to confirm matches was limited due to multiple compounds exhibiting very similar spectra. This reiterates the fact that spectral similarity alone is insufficient evidence of the presence of particular compounds, and additional evidence is required.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Chalmers University of Technology
Authors: Wünsch, U. (Intern), Murphy, K. R. (Ekstern), Stedmon, C. (Intern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 2
Article number: 98
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
From Fresh to Marine Waters: Characterization and Fate of Dissolved Organic Matter in the Lena River Delta Region, Siberia

Connectivity between the terrestrial and marine environment in the Arctic is changing as a result of climate change, influencing both freshwater budgets and the supply of carbon to the sea. This study characterizes the optical properties of dissolved organic matter (DOM) within the Lena Delta region and evaluates the behavior of DOM across the fresh water-marine gradient. Six fluorescent components (four humic-like; one marine humic-like; one protein-like) were identified by Parallel Factor Analysis (PARAFAC) with a clear dominance of allochthonous humic-like signals. Colored DOM (CDOM) and dissolved organic carbon (DOC) were highly correlated and had their distribution coupled with hydrographical conditions. Higher DOM concentration and degree of humification were associated with the low salinity waters of the Lena River. Values decreased towards the higher salinity Laptev Sea shelf waters. Results demonstrate different responses of DOM mixing in relation to the vertical structure of the water column, as reflecting the hydrographical dynamics in the region. Two mixing curves for DOM were apparent. In surface waters above the pycnocline there was a sharper decrease in DOM concentration in relation to salinity indicating removal. In the bottom water layer the DOM decrease within salinity was less. We propose there is a removal of DOM occurring primarily at the surface layer, which is likely driven by photodegradation and flocculation.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Alfred Wegener Institute for Polar and Marine Research, University of Bremen, Russian Academy of Sciences
Authors: Gonçalves-Araujo, R. (Ekstern), Stedmon, C. (Intern), Heim, B. (Ekstern), Dubinenkov, I. (Ekstern), Kraberg, A. (Ekstern), Moiseev, D. (Ekstern), Bracher, A. (Ekstern)
Number of pages: 13
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 2
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Arctic, DOC, PARAFAC, CDOM, Hydrography, Optical Indicies, FDOM, Laptev Sea
Electronic versions:
fmars_02_00108.pdf
DOIs:
10.3389/fmars.2015.00108
Source: FindIt
Source-ID: 2289822232
Publication: Research - peer-review › Journal article – Annual report year: 2015
From genes to ecosystems: spatial heterogeneity and temporal dynamics of the Baltic Sea

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Hüssy, K. (Intern), Dierking, J. (Ekstern), Laikre, L. (Ekstern)
Number of pages: 3
Publication date: 2015
Event: Paper presented at ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers_version

**Bibliographical note**
ICES Theme session Q
Publication: Research › Paper – Annual report year: 2015

From nitrogen enrichment to oxygen depletion: a mechanistic model of coastal marine ecosystems response

Nitrogen (N) emissions from anthropogenic sources may enrich coastal waters and lead to marine eutrophication impacts. Processes describing N-limited primary production (PP), zooplankton grazing, and bacterial respiration of sinking organic carbon, were modelled to quantify the potential dissolved oxygen (DO) consumption as a function of N input. Such indicator is the basis for an eXposure Factor (XF) applied in Life Cycle Impact Assessment (LCIA) to estimate impacts from N enrichment. The Large Marine Ecosystems (LME) biogeographical classification system was adopted to address the spatial variation of the modelled parameters and to characterise spatially differentiated N-emissions. Preliminary XF results range from 0.5 kgO2·kgN-1 in the Central Arctic Ocean to 16 kgO2·kgN-1 in the Baltic Sea, out of a total of 66 LME-dependent XFs. All the relevant processes were included in a mechanistic model and the uncertainty of the driving parameters is considered low. The presented XF estimation method contributes with a central component for site-dependent characterization factors (CFs) for marine eutrophication, to be coupled with environmental fate of N emissions and effects of oxygen depletion on biota.

**General information**
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Cosme, N. M. D. (Intern), Koski, M. (Intern), Hauschild, M. Z. (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:

**Abstract**

**Bibliographical note**
ICES CM 2015/R:24

**Relations**
Activities:
ICES Annual Science Conference 2015
Source: PublicationPreSubmission
Source-ID: 117922751
Publication: Research › Conference abstract for conference – Annual report year: 2015

Functional responses of North Atlantic fish eggs to increasing temperature

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Tsoukali, S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern)
Number of pages: 2
Publication date: 2015
GOFORIT: IntelliGent Oceanographically – based short-term fishery FORecasting applicaTions

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Authors: MacKenzie, B. (Intern), Ak, O. (Ekstern), Astthorsson, O. (Ekstern), Gislason, A. (Ekstern), Jonasdottir, S. (Intern), Radu, G. (Ekstern), Salihoglu, B. (Ekstern), Timofte, F. (Forskerdatabase), Deurs, M. V. (Intern)
Publication date: 2015

Growth and respiration in blue mussels (Mytilus spp.) from different salinity regimes

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Danish Shellfish Centre, Orbicon, NIRAS A/S, University of Copenhagen
Authors: Landes, A. (Intern), Dolmer, P. (Ekstern), Poulsen, L. K. (Ekstern), Petersen, J. K. (Intern), Vismann, B. (Ekstern)
Pages: 373-382
Publication date: 2015
Growth potential of blue mussels (M. edulis) exposed to different salinities evaluated by a Dynamic Energy Budget model

For blue mussels, Mytilus edulis, one major constraint in the Baltic Sea is the low salinities that reduce the efficiency of mussel production. However, the effects of living in low and variable salinity regimes are rarely considered in models describing mussel growth. The aim of the present study was to incorporate the effects of low salinity into an eco-physiological model of blue mussels and to identify areas suitable for mussel production. A Dynamic Energy Budget (DEB) model was modified with respect to i) the morphological parameters (DW/WW-ratio, shape factor), ii) change in ingestion rate and iii) metabolic costs due to osmoregulation in different salinity environments. The modified DEB model was validated with experimental data from different locations in the Western Baltic Sea (including the Limfjorden) with salinities varying from 8.5 to 29.9 psu. The identified areas suitable for mussel production in the Baltic Sea are located in the Little Belt area, the Great Belt, the southern Kattegat and the Limfjorden according to the prevailing salinity regimes. The new model can be used for supporting site selection of new mussel nutrient extraction cultures in the Baltic Sea that suffers from high eutrophication symptoms or as part of integrated multi-trophic aquaculture production. The model can also be used to predict the effects of salinity changes on mussel populations e.g. in climate change studies.
Gut evacuation rate and grazing impact of the krill Thysanoessa raschii and T. inermis

Gut evacuation rates and ingestion rates were measured for the krill Thysanoessa raschii and T. inermis in Godthåbsfjord, SW Greenland. Combined with biomass of the krill community, the grazing potential on phytoplankton along the fjord was estimated. Gut evacuation rates were 3.9 and 2.3 h⁻¹ for T. raschii and T. inermis, respectively. Ingestion rates were 12.2 ± 7.5 μg C mg C⁻¹ day⁻¹ (n = 4) for T. inermis and 4.9 ± 3.2 μg C mg C⁻¹ day⁻¹ (n = 4) for T. raschii, corresponding to...
daily rations of 1.2 and 0.5 % body carbon day$^{-1}$. Clearance experiments conducted in parallel to the gut evacuation experiment gave similar results for ingestion rates and daily rations. Krill biomass was highest in the central part of the fjord's length, with T. raschii dominating. Community grazing rates from krill and copepods were comparable; however, their combined impact was low, estimated as <1 % of phytoplankton standing stock being removed per day during this late spring study.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Greenland Institute of Natural Resources, Technical University of Denmark

Authors: Teglhus, F. W. (Ekstern), Agersted, M. D. (Intern), Arendt, K. E. (Ekstern), Nielsen, T. G. (Intern)

Pages: 169-180
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Marine Biology
Volume: 162
Issue number: 1
ISSN (Print): 0025-3162
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 2.41 SJR 1.198 SNIP 0.993
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.315 SNIP 0.932 CiteScore 2.21
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.204 SNIP 1.041 CiteScore 2.32
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.272 SNIP 1.064 CiteScore 2.4
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.306 SNIP 1.107 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.145 SNIP 1.073 CiteScore 2.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.235 SNIP 1.069
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.178 SNIP 1.052
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.236 SNIP 1.022
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.348 SNIP 1.21
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.195 SNIP 1.09
Har du fået skældt din biolog ud i dag?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Beyer, J. (Intern)
Pages: 12
Publication date: 2015

Publication information
Pages (from-to): 12
Newspaper: Fiskeritidende
Volume: 22
No.: 23
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2015

Has human-induced eutrophication promoted fish production in the Baltic Sea?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Eero, M. (Intern), Andersson, H. (Ekstern), Rosel, E. A. (Ekstern), MacKenzie, B. (Intern)
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Links:

Bibliographical note
Heterogeneous distribution of plankton within the mixed layer and its implications for bloom formation in tropical seas

Intensive sampling at the coastal waters of the central Red Sea during a period of thermal stratification, prior to the main seasonal bloom during winter, showed that vertical patches of prokaryotes and microplankton developed and persisted for several days within the apparently density uniform upper layer. These vertical structures were most likely the result of in situ growth and mortality (e.g., grazing) rather than physical or behavioural aggregation. Simulating a mixing event by adding nutrient-rich deep water abruptly triggered dense phytoplankton blooms in the nutrient-poor environment of the upper layer. These findings suggest that vertical structures within the mixed layer provide critical seeding stocks that can rapidly exploit nutrient influx during mixing, leading to winter bloom formation.
Horizontal and vertical dynamics of zooplankton and larval fish communities during mid-summer in Disko Bay, West Greenland

Disko Bay is a highly productive inlet at the border between high- and low-arctic sectors of west Greenland. The physical/chemical conditions in the bay have changed during recent decades, specifically during an inflow event in 1996–1997 that led to increased deep-water temperatures. To further understand the consequences of physical changes to the plankton community in the bay, we examine findings from a field study on mesozooplankton and fish larvae in the areas of Disko Bay and Disko Bank carried out in 1997. We sampled 31 stations over 5 days along four transects and assessed horizontal and vertical distribution patterns, community composition and plankton trophodynamics. Plankton abundance was enhanced near-coast and across the pycnocline, and communities differed between regions. Polar cod (Boreogadus saida) and the sandeel (Ammodytes sp.) were among the abundant fish larvae. Productivity/growth estimates of key species of copepods and fish larvae showed no apparent relationship to food availability; they reached weight specific values of ~6% day^{-1} for copepods and ~14% day^{-1} for fish larvae. Overall, we found a rich and dynamic plankton community, strongly influenced by the complex hydrography of the area. Thus, changes in physical characteristics of the bay could threaten the resilience of its ecosystem.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Roskilde University
Authors: Munk, P. (Intern), Nielsen, T. G. (Intern), Hansen, B. W. (Ekstern)
Pages: 554-570
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 37
Issue number: 3
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.158 SNIP 1.045 CiteScore 1.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.186 SNIP 0.98
In order for European eel aquaculture to be sustainable, the life cycle should be completed in captivity. Development of broodstock diets may improve the species’ reproductive success in captivity, through the production of high-quality gametes. Here, our aim was to evaluate the influence of dietary regime on muscle composition, and liver lipids prior to induced maturation, and the resulting sperm composition and performance. To accomplish this fish were reared on three “enhanced” diets and one commercial diet, each with different levels of fatty acids, arachidonic acid (ARA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Neutral lipids from the muscle and liver incorporated the majority of the fatty acid profile, while phospholipids incorporated only certain fatty acids. Diet had an effect on the majority of sperm fatty acids, on the total volume of extractable milt, and on the percentage of motile sperm. Here, our results suggest that the total volume of extractable milt is a DHA-dependent process, as we found the diets with the highest DHA levels induced the most milt while the diet with the lowest DHA level induced the least amount of milt. The diet with the highest level of ARA induced medium milt volumes but had the highest sperm motility. EPA also seems important for sperm quality parameters since diets with higher EPA percentages had a higher volume of milt and higher sperm motility. In conclusion, dietary fatty acids had an influence on fatty acids in the tissues of male eel and this impacted sperm performance.
The development of pH during the spring bloom in 2011 and 2012 was investigated in Disko Bay, West Greenland. During the spring phytoplankton bloom pH reached 8.5 at the peak of the bloom. Subsequently, the pH decreased to 7.5.
Microcosm experiments were conducted on natural assemblages sampled at the initiation of the spring bloom each year and manipulated to cover pH levels in the range of 8.0-9.5 to test the immediate tolerance of Arctic protist plankton to elevated pH under nutrient-limiting (2011) and nutrient-rich conditions (2012). The most pronounced effect of elevated pH was found for heterotrophic protists, whereas phytoplankton proved more robust. Two out of three heterotrophic protist species were significantly affected if pH increased above 8.5, and all heterotrophic protists had disappeared at pH 9.5. Based on Chl a measurements from the two sets of experiments, phytoplankton community growth was significantly reduced at pH 9.5 during nutrient-rich conditions, while pH had little impact on nutrient-limited phytoplankton growth. The results were supported by cell counts that revealed that phytoplankton growth during nutrient-rich conditions was significantly reduced from an average of 0.49 d⁻¹ at pH 8.0 to an average of 0.27 d⁻¹ at pH 9.5. In comparison, only one out of four tested phytoplankton species were significantly affected by elevated pH under nutrient-limited conditions. Sudden pH fluctuations, such as those occurring during phytoplankton blooms, will most likely favour pH-tolerant species, such as diatoms.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Riisgaard, K. (Intern), Nielsen, T. G. (Intern), Hansen, P. J. (Ekstern)
Pages: 63-75
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 530
ISSN (Print): 0171-8630
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
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.85
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
Impact of ice cover and freshwater discharge on the pelagic food web

Mass loss from the Greenland Ice Sheet (GrIS) quadrupled over the past two decades owing to increased surface melt and the widespread retreat and speedup of marine-terminating glaciers. These physical changes have sparked interest in Greenland’s glacial fjords - the conduits between the large-scale ocean and the ice sheet - for two reasons. First, it is plausible that a sizable portion of the observed glacier acceleration and retreat was triggered by increased submarine melting of the glaciers’ margins. Second, the melt water from Greenland must transit through the fjord before reaching Greenland’s continental shelves - where it can impact the ocean circulation and the downstream marine ecosystems. Using data collected from several Greenland fjord/glacier systems we show that the freshwater discharge in these coastal waters is mediated by a complex interplay of atmospheric forcing, subglacial processes, as well as both shelf and fjord dynamics. In these strongly stratified waters dominated by relatively cold, fresh Polar Waters overlying warm, salty Atlantic Waters, the discharge of surface and submarine melt at depth can result in subsurface intrusions of a third water mass. These glacially modified waters ultimately govern the freshwater export both at the surface and at depth. Ocean circulation within the fjords, which results from the interplay between buoyancy-driven (i.e. driven by glacial inputs) and shelf-driven flows (a consequence of gradients between fjord and continental shelf waters), in turn regulates this export by controlling melt processes as well as the residence time of glacially modified waters in these systems. While freshwater input into surface waters can fundamentally impact the marine ecosystem via changes in water column stratification and the biochemistry of surface waters, a better understanding of variability within these systems is needed to constrain the consequences of GrIS mass loss on the coastal ocean.

Induction of domoic acid production in the toxic diatom Pseudo-nitzschia seriata by calanoid copepods

The toxic diatom Pseudo-nitzschia seriata was exposed directly and indirectly (separated by a membrane) to copepods, Calanus hyperboreus and C. finmarchicus, to evaluate the effects of the copepods on domoic acid production and chain formation in P. seriata. The toxicity of P. seriata increased in the presence of the copepods. This response was chemically mediated without physical contact between the organisms suggesting that it was induced by potential waterborne cues from the copepods or changes in water chemistry. Domoic acid production may be related to defense against grazing in P. seriata although it was not shown in the present study. To evaluate if the induction of domoic acid production was mediated by the chemical cues from damaged P. seriata cells, live P. seriata cells were exposed to a P. seriata cell homogenate, but no effect was observed. Chain formation in P. seriata was affected only when in direct contact with the copepods. This study suggests that the presence of zooplankton may be one of the factors affecting the toxicity of Pseudo-nitzschia blooms in the field.
Interactions of gelatinous zooplankton within marine food webs

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, GEOMAR - Helmholtz Centre for Ocean Research Kiel, National Oceanographic and Atmospheric Administration, Universidad de Oviedo
Authors: Jaspers, C. (Intern), Acuña, J. L. (Ekstern), Brodeur, R. D. (Ekstern)
Pages: 985-988
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 37
Issue number: 5
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.158 SNIP 1.045 CiteScore 1.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.186 SNIP 0.98
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.922 SNIP 1.046
Interactive effects of temperature and light during deep convection: a case study on growth and condition of the diatom *Thalassiosira weissflogii*

Aim of this study was to expose phytoplankton to growth conditions simulating deep winter convection in the North Atlantic and thereby to assess changes in physiology enabling their survival. Growth rate, biochemical composition, and photosynthetic activity of the diatom *Thalassiosira weissflogii* were determined under two different light scenarios over a temperature range of 5–15°C to simulate conditions experienced by cells during winter deep convection. These metrics were examined under a low light scenario (20 mmol m⁻² s⁻¹, 12/12 h light/dark), and compared with a scenario of short light pulses of a higher light intensity (120 mmol m⁻² s⁻¹, 2/22 h light/dark). Both experimental light conditions offered the same daily light dose. No growth was observed at temperatures below 8°C. Above 8°C, growth rates were significantly higher under low light conditions compared with those of short pulsed light exposures, indicating a higher efficiency of light utilization. This could be related to (i) a higher content of Chl a per cell in the lowlight trial and/or (ii) a more efficient transfer of light energy into growth as indicated by constantly low carbohydrate levels. In contrast, pulsed intense light led to an accumulation of carbohydrates, which were catabolized during the longer dark period for maintaining metabolism. Light curves measured via Chl a fluorescence indicated low light assimilation for the algae exposed to short pulsed light. We postulate that our trial with short light pluses did not provide sufficient light to reach full light saturation. In general, photosynthesis was more strongly affected by temperature under pulsed light than under low light conditions. Our results indicate that model estimates of primary production in relation to deep convection, which are based on average low light conditions, not considering vertical transportation of algae will lead to an overestimation of in situ primary production.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg
Authors: Walter, B. (Ekstern), Peters, J. (Ekstern), van Beusekom, J. E. E. (Ekstern), St. John, M. (Intern)
Pages: 2061-2071
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: ICES Journal of Marine Science
Volume: 72
Invasion rate and population characteristics of the invasive round goby Neogobius melanostomus: effects of density and invasion history

Round goby Neogobius melanostomus is currently one of the most wide-ranging invasive fish species in Europe and North America. The present study demonstrates how the distribution of round goby has expanded from 2008 to 2013 at a rate of
about 30 km yr⁻¹ along the Danish coastline in the western Baltic Sea. Further analyses showed that fish from an established high-density round goby population were slow-growing and displayed poorer condition (weight at age and hepatosomatic index) compared to fish sampled from recently invaded locations (i.e. at the forefront of the distribution range). The established population revealed a broad age distribution and a 1:1 gender ratio, while fish from a recently invaded site were primarily of intermediate ages with a male-biased gender ratio. Otolith analyses suggested that the oldest individuals from the recently invaded area experienced superior growth conditions only in the most recent years, suggesting immigration into the area as adults. Our results suggest that intraspecific competition for food may cause continued dispersal of the species and that population demographics likely relate to invasion history.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Azour, F. (Intern), Deurs, M. V. (Intern), Behrens, J. (Intern), Carl, H. (Ekstern), Hüsey, K. (Intern), Greisen, K. (Ekstern), Ebert, R. (Ekstern), Møller, P. R. (Ekstern)
Pages: 41-52
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: Aquatic Biology
Volume: 24
ISSN (Print): 1864-7782
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): SJR 0.847 SNIP 0.895 CiteScore 1.82
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.767 SNIP 0.713 CiteScore 1.41
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.681 SNIP 0.678 CiteScore 1.44
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.641 SNIP 0.618 CiteScore 1.34
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.814 SNIP 0.813 CiteScore 1.7
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.844 SNIP 0.848 CiteScore 1.79
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.899 SNIP 0.666
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.631 SNIP 0.483
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.461 SNIP 0.54
Original language: English
Electronic versions:
Publishers' version
Invasion success - looking at a key trait

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Jaspers, C. (Intern)
Publication date: 2015
Event: Poster session presented at Excellence cluster Future Ocean Retreat 2015, Neumünster, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2015

Kan den invasive sortmundede kutling sprede sig til Skagerrak og Nordsøen?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Behrens, J. (Intern)
Publication date: 2015

Publication information
Source/Publisher: Fiskepleje.dk
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Internet publication – Annual report year: 2015

Korttidsprognoser for kortlivede industrifisk under MSY – forvaltning af tobis i Nordsøen

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Deurs, M. V. (Intern), Christensen, A. (Intern), Bekkevold, D. (Intern), Lynam, C. (Ekstern), Nielsen, K. E. (Intern), Azour, F. (Intern), Lundgaard, L. S. (Intern), Hüsy, K. (Intern), Mosgaard, H. (Intern), Worsøe Clausen, L. (Intern)
Publication date: 2015

Publication information
Original language: Danish
Main Research Area: Technical/natural sciences
Bibliographical note
Slutrapport for EFF projekt J.nr. 33010-13-k-0280
Publication: Research › Report – Annual report year: 2015

Kulstof i havet - en tynd kop te?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, University of Copenhagen
Authors: Traving, S. J. (Ekstern), Stedmon, C. (Intern), Riemann, L. (Ekstern), Thygesen, U. H. (Intern)
Pages: 14-18
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication information
Journal: Aktuel naturvidenskab
Issue number: 5
Light impacts embryonic and early larval development of the European eel, Anguilla anguilla

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Politis, S. N. (Intern), Butts, I. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2015
Event: Abstract from Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences

Lights and shadows of the feeding ecology of the small copepod Oithona

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institut de Ciències del Mar-CSIC, James Cook University
Authors: Zamora-Terol, S. (Ekstern), Nielsen, T. G. (Intern), McKinnon, A. (Ekstern), Saiz, E. (Ekstern)
Publication date: 2015
Event: Abstract from ASLO Aquatic Sciences Meeting 2015, Granada, Spain.
Main Research Area: Technical/natural sciences

Management of fishery: Importance of fish food web dynamics in coupling of multispecies and bio-economic fisheries management evaluation models

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Nielsen, J. R. (Intern), Gislason, H. (Intern), Andersen, N. G. (Intern), Vinther, M. (Intern), Bastardie, F. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Managing population mixing; genetics supported stock splitting in Atlantic cod

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Authors: Hansen, J. H. (Intern), Hüssy, K. (Intern), Huwer, B. (Intern), Mosegaard, H. (Intern), Eero, M. (Intern)
Publication date: 2015
Event:
Main Research Area: Technical/natural sciences

Bibliographical note
ICES C.M. 2015/I:12
Publication: Research › Conference abstract for conference – Annual report year: 2015
Marine Microplastics - Method development for detection of plastic particles from sea water

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Lenz, R. (Intern), Enders, K. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Mass and UV-visible spectral fingerprints of dissolved organic matter: sources and reactivity

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Lund University
Authors: Reader, H. (Intern), Stedmon, C. (Intern), Nielsen, N. J. (Ekstern), Kritzberg, E. (Ekstern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Frontiers in Marine Science
Volume: 2
Issue number: 88
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 0.173 SNIP 0.109
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.145 SNIP 0.05
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Electronic versions:
Publishers_version
DOIs:
10.3389/fmars.2015.00088
Publication: Research - peer-review › Journal article – Annual report year: 2015

Meso- and macro-zooplankton community structure of the Amundsen Sea Polynya, Antarctica (Summer 2010–2011)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Arizona State University, Columbia University, University of Georgia, Bangor University, University of Gothenburg
Authors: Wilson , S. E. (Ekstern), Swalethorp, R. (Intern), Kjellerup, S. (Intern), Wolverton , M. A. (Ekstern), Ducklow , H. W. (Ekstern), Yager , P. L. (Ekstern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Elementa
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2016): Indexed yes
Microbially-Mediated Fluorescent Organic Matter Transformations in the Deep Ocean: Do the Chemical Precursors Matter?

The refractory nature of marine dissolved organic matter (DOM) increases while it travels from surface waters to the deep ocean. This resistant fraction is in part composed of fluorescent humic-like material, which is relatively difficult to metabolize by deep water prokaryotes, and it can also be generated by microbial activity. It has been recently argued that microbial production of new fluorescent DOM (FDOM) requires the presence of humic precursors in the surrounding environment. In order to experimentally test how the chemical quality of the available organic compounds influences the production of new FDOM, three experiments were performed with bathypelagic Atlantic waters. Microbial communities were incubated in three treatments which differed in the quality of the organic compounds added: i) glucose and acetate; ii) glucose, acetate, essential amino acids and humic acids; and iii) humic acids alone. The response of the prokaryotes and the production of FDOM were simultaneously monitored. Prokaryotic abundance was highest in treatments where labile compounds were added. The rate of humic-like fluorescence production scaled to prokaryotic abundance varied depending on the quality of the additions. The precursor compounds affected the generation of new humic-like FDOM, and the cell-specific production of this material was higher in the incubations amended with humic precursors. Furthermore, we observed that the protein-like fluorescence decreased only when fresh amino acids were added. These findings contribute to the understanding of FDOM variability in deep waters and provide valuable information for studies where fluorescent compounds are used in order to track water masses and/or microbial processes.

Microplastics: Occurrence, effects and sources of releases to the environment in Denmark

This report contains a review of existing knowledge on issues related to contamination by micro-plastic with a focus on the use and release of micro-plastics in Denmark and the occurrence of micro-plastics in the surrounding waters.

Micro-plastic defined as small plastic pieces of 1µm to 5 mm.
Micro Plastics are detected in organisms at all levels of the marine food chain as well as in water and sediment.

There are potentially three types of adverse effects of the micro-plastic: (1) physical effects related to the intake, (2) toxic response by the release of hazardous substances in the plastic and, (3) toxic reaction to the pollutants which are adsorbed to micro plastic. These effects are shown in laboratory experiments but not proven to occur in the environment.

Although the majority of the micro plastics in the waste water end up in the sewage sludge, wastewater treatment plants are important potential sources of emission of the micro-plastics in the ocean.

The most important sources of release of micro-plastics to the environment are tires, paints, road markings, textiles, etc. The report estimates that only minor significance to micro plastic used directly in certain products (for example, in cosmetics or for use in blowing agents).

General information
State: Published
Organisations: Department of Environmental Engineering, Environmental Chemistry, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, COWI A/S, Swedish Environmental Research Institute, Technical University of Denmark
Authors: Lassen, C. (Ekstern), Hansen, S. F. (Intern), Magnusson, K. (Ekstern), Hartmann, N. B. (Intern), Rehne Jensen, P. (Ekstern), Nielsen, T. G. (Intern), Brinch, A. (Ekstern)
Number of pages: 206
Publication date: 2015

Publication information
Place of publication: Copenhagen K
Publisher: Danish Environmental Protection Agency
ISBN (Electronic): 978-87-93352-80-3
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Lassen_et_al._2015.pdf
Links:
http://mst.dk/service/publikationer/publikationsarkiv/2015/nov/rapport-om-mikroplast

Bibliographical note
Environmental project No. 1793, 2015

Relations
Press / Media items:
Forskere på jagt efter plast i fiskene vi spiser
Source: PublicationPreSubmission
Source-ID: 118137742
Publication: Commissioned - peer-review › Report – Annual report year: 2015

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
Modelling emergent trophic strategies in plankton

Plankton are typically divided into phytoplankton and zooplankton in marine ecosystem models. Yet, most protists in the photic zone engage in some degree of phagotrophy, and it has been suggested that trophic strategy is really a continuum between pure phototrophs (phytoplankton) and pure phagotrophs ( unicellular zooplankton). Such a continuum of trophic strategies is well represented by trait-based modelling techniques. A key model ingredient is the size of individual cells, as size constrains affinities for nutrient uptake, photosynthesis and active encounter with other cells. We outline a general trait-based model of a unicellular planktonic organism where size is a central trait and where nutrient uptake, photosynthesis and phagotrophy are determined by investments into these functions and by the physical constraints imposed by organism size. This framework provides simple predictions of how trophic strategy correlates with size.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Copenhagen, University of Bergen
Authors: Andersen, K. H. (Intern), Aksnes, D. L. (Ekstern), Berge, T. (Ekstern), Fiksen, Ø. (Ekstern), Visser, A. (Intern)
Pages: 862-868
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 37
Issue number: 5
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.158 SNIP 1.045 CiteScore 1.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.186 SNIP 0.98
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.922 SNIP 1.046
Web of Science (2009): Indexed yes
Monitoring RAS organic matter by fluorescence EEM spectroscopy

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Environmental Engineering, Section for Aquaculture
Authors: Hambly, A. (Intern), Arvin, E. (Intern), Pedersen, L. (Intern), Pedersen, P. B. (Intern), Stedmon, C. (Intern)
Pages: 25
Publication date: 2015

Host publication information
Title of host publication: 3rd NordicRAS Workshop on Recirculating Aquaculture Systems Molde, Norway, 30 September - 1 October 2015: Book of Abstracts
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Editor: Dalsgaard, A. T.

Series: DTU Aqua Report
Number: 301-2015
ISSN: 1395-8216
Main Research Area: Technical/natural sciences
Electronic versions:

MSC certification of plaice fisheries in area IIIa: Basic investigations and development of a management plan

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Hansen, J. H. (Intern), Ulrich, C. (Intern), Boje, J. (Intern), Christensen, A. (Intern), Degel, H. (Intern), Hüssy, K. (Intern), Worsøe Clausen, L. (Intern)
Number of pages: 52
Musculoskeletal anatomy and feeding performance of pre-feeding engyodontic larvae of the European eel (Anguilla anguilla)

Being part of the elopomorph group of fishes, Anguillidae species show a leptocephalus larval stage. However, due to largely unknown spawning locations and habitats of their earliest life stages, as well as their transparency, these Anguilla larvae are rarely encountered in nature. Therefore, information regarding the early life history of these larvae, including their exogenous feeding strategy and feeding performance, is rather scarce. To better understand the structural basis and functional performance of larval feeding in captivity, the functional morphology of the cranial musculoskeletal system in pre- and first-feeding engyodontic leptocephali of the European eel (Anguilla anguilla) was studied. A 3D reconstruction of the feeding apparatus (head of the leptocephali <1mm) was used to visualize and describe the musculoskeletal changes throughout these stages. To analyze the ontogenetic changes in the functionality of the feeding apparatus towards the active feeding phase, 3D data of joints, levers and muscles derived from the reconstructions were used to estimate bite and joint reaction forces (JRFs). Observing a maximum estimated bite force of about 65μN (and corresponding JRFs of 260μN), it can be hypothesized that leptocephalus larvae are functionally constrained to feed only on soft food particles. Additionally, potential prey items are size delimited, based on the theoretically estimated average gape of these larvae of about 100μm. This hypothesis appears to be in line with recent observations of a diet consisting of small and/or gelatinous prey items (Hydrozoa, Thaliacea, Ctenophora, Polycystenia) found in the guts of euryodontic leptocephalus larvae.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Ghent University, Billund Aquaculture Service Aps
Authors: Bouilliart, M. (Ekstern), Tomkiewicz, J. (Intern), Lauesen, P. (Ekstern), De Kegel, B. (Ekstern), Adriaens, D. (Ekstern)
Pages: 325-340
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Anatomy
Volume: 227
Issue number: 3
ISSN (Print): 0021-8782
Ratings:
BFI (2018): BFI-level 1
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): SJR 1.022 SNIP 1.049 CiteScore 2.18
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.057 SNIP 1.144 CiteScore 2.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.98 SNIP 1.229 CiteScore 2.14
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.179 SNIP 1.117 CiteScore 2.56
Naupliar and Metanaupliar development of Thysanoessa raschii (Malacostraca, Euphausiacea) from Godthåbsfjord, Greenland, with a reinstatement of the ancestral status of the free-living Nauplius in Malacostracan evolution

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Akther, H. (Intern), Agersted, M. D. (Intern), Olesen, J. (Ekstern)
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: P L o S One
Volume: 10
Issue number: 12
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
No barrier to emergence of bathyal king crabs on the Antarctic shelf

Significance For tens of millions of years, cold conditions have excluded shell-crushing fish and crustaceans from the continental shelf surrounding Antarctica. Rapid warming is now allowing predatory crustaceans to return. Our study of the continental slope off the western Antarctic Peninsula showed that abundant, predatory king crabs comprise a reproductively viable population at 841- to 2,266-m depth. Depth profiles of temperature, salinity, habitat structure, food availability, and predators indicate that there are no barriers to prevent king crabs from moving upward onto the outer shelf at 400–550 m. A cold-water barrier above 200 m could be breached within the next few decades. Emergence of king crabs on the shelf could have catastrophic consequences for the unique seafloor communities of Antarctica.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Florida Institute of Technology, University of Alabama, Woods Hole Oceanographic Institution, University of Gothenburg, University of Southampton
Authors: Aronson, R. B. (Ekstern), Smith, K. E. (Ekstern), Vos, S. C. (Ekstern), McClintock, J. B. (Ekstern), Amsler, M. O. (Ekstern), Moksnes, P. (Ekstern), Ellis, D. S. (Ekstern), Kaeli, J. (Ekstern), Singh, H. (Ekstern), Bailey, J. W. (Ekstern), Schiferl, J. C. (Ekstern), van Woesik, R. (Ekstern), Martin, M. A. (Ekstern), Steffel, B. V. (Ekstern), Deal, M. E. (Ekstern), Lazarus, S. M. (Ekstern), Havenhand, J. N. (Ekstern), Swalethorp, R. (Intern), Kjellerup, S. (Intern), Thatje, S. (Ekstern)
Pages: 12997-13002
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Proceedings of the National Academy of Sciences
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</table>
Ny forståelse for ålens tidlige opvækst i Sargassohavet

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Munk, P. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2015

Oceanic boundary conditions for Jakobshavn Glacier Part I. Variability and renewal of Ilulissat Icefjord waters, 2001-2014

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, New York University, Greenland Institute of Natural Resources
Authors: Gladish, C. V. (Ekstern), Holland, D. M. (Ekstern), Rosing-Asvid, A. (Ekstern), Behrens, J. (Intern), Boje, J. (Intern)
Pages: 3-32
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Physical Oceanography
Volume: 45
Issue number: 1
ISSN (Print): 0022-3670
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): SJR 2.76 SNIP 1.379 CiteScore 3.22
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.646 SNIP 1.413 CiteScore 3.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.568 SNIP 1.394 CiteScore 2.89
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.756 SNIP 1.554 CiteScore 3.26
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.216 SNIP 1.555 CiteScore 2.75
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Oceanography and the base of the pelagic food web in the southern Indian Ocean

Processes governing productivity at the base of the pelagic food web of the southern Indian Ocean are influenced primarily by physical–chemical conditions with implications for the structure and function of the entire pelagic food web. Here, we report observations along a great circle transect from Cape Town, South Africa, to Broome in north western Australia. Primary production was tightly linked to water column stability and nutrient availability, with high productivity (1144 mg C m⁻² day⁻¹) in the sub-tropical convergence zone, and falling off by an order of magnitude in the sub-tropical gyre and tropical waters off northwest Australia. Primary production was largely confined to the GF/F fraction (GF/F .75% of total production and usually much higher) and the photosynthetic parameters showed adaptation to the prevailing light levels. Bacterial production ranged from 19 to 155 mg C m⁻² day⁻¹. No relationships were found between bacterial production and primary production or phytoplankton biomass and bacterial production seem more related to the state of the phytoplankton community as high bacterial production was observed in a post-bloom situation. The average BP:PP ratio was 31% (range 3.5–71%)
Økologiske konsekvenser af høj pH på marine copepoder

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Roskilde University, University of Copenhagen
Authors: Hansen, B. W. (Ekstern), Hansen, P. J. (Ekstern), Nielsen, T. G. (Intern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Ontogeny of the immune response during early life history of European eel and its temperature dependence

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Miest, J. (Ekstern), Politis, S. N. (Intern), Adamek, M. (Ekstern), Butts, I. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2015
Event: Poster session presented at Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences

Optimal bæredygtig udnyttelse af tilgængelige torskbestande for dansk fiskeri

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Number of pages: 52
Publication date: 2015

Oxygen minimum zone induced rapid temporal fluctuations of Eastern Baltic cod genetic diversity

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Johann Heinrich von Thünen-Institute, Leibniz Institute of Marine Sciences
Authors: Dierking, J. (Ekstern), von Dewitz, B. (Ekstern), Elsbernd, L. (Ekstern), Schultz, H. (Ekstern), Bracamonte, S. (Ekstern), Hüsey, K. (Intern), Hansen, J. H. (Intern), Krumme, U. (Ekstern), Oeberst, R. (Ekstern), Hinrichsen, H. (Ekstern), Reusch, T. (Ekstern)
Publication date: 2015
Event:
Bibliographical note
ICES C.M. 2015/Q:22

Parasit påvirker torskens hjerterytmer

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Behrens, J. (Intern), Buchmann, K. (Ekstern)
Pages: 32-35
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information
Journal: Aktuel naturvidenskab
Physiological constrains on Sverdrup's Critical-Depth-Hypothesis: the influences of dark respiration and sinking

Discussions on the controls initiating the onset of the phytoplankton spring bloom in particular in the North Atlantic have since Sverdrup been dominated by the role of physical and biological drivers. Undoubtedly, these drivers play an important role in phytoplankton dynamics and thus the onset of the spring bloom. However, they neglect the cells ability to modify vital rates in response to changes in the external environment. In this study, we use a non-hydrostatic convection model coupled to an Individual-Based-Model to simulate changes phytoplankton cells during the transition from winter conditions as driven by convective mixing, and the onset of thermal stratification resulting in the spring bloom. The comparison between a simulation using a standard fixed rate approach in line with the original Sverdrup hypothesis and a simulation parameterized to include variable respiration and sinking rates showed that the latter approach was able to capture the observed phytoplankton concentration during deep convective mixing, the timing and magnitude of the spring bloom aswell as simulating realistic physiological rates. In contrast, the model employing fixed rate parameterizations could only replicate field observations when employing unrealistic parameter values. These results highlight the necessity to consider not only the physical and biological external controls determining phytoplankton dynamics but also the cells ability to modify critical physiological rates in response to external constraints. Understanding these adaptive qualities will be of increasing importance in the future as species assemblages and physical controls change with changing climate.
Phytoplankton dynamics in contrasting early stage North Atlantic spring blooms: composition, succession, and potential drivers

The spring bloom is a key annual event in the phenology of pelagic ecosystems, making a major contribution to the oceanic biological carbon pump through the production and export of organic carbon. However, there is little consensus as to the main drivers of spring bloom formation, exacerbated by a lack of in situ observations of the phytoplankton community composition and its evolution during this critical period. We investigated the dynamics of the phytoplankton community structure at two contrasting sites in the Iceland and Norwegian Basins during the early stage (25 March–25 April) of the 2012 North Atlantic spring bloom. The plankton composition and characteristics of the initial stages of the bloom were markedly different between the two basins. The Iceland Basin (ICB) appeared well mixed to > 400 m, yet surface chlorophyll a (0.27–2.2 mg m⁻³) and primary production (0.06–0.66 mmol C m⁻³ d⁻¹) were elevated in the upper 100 m. Although the Norwegian Basin (NWB) had a persistently shallower mixed layer (< 100 m), chlorophyll a (0.58–0.93 mg m⁻³) and primary production (0.08–0.15 mmol C m⁻³ d⁻¹) remained lower than in the ICB, with picoplankton (> 2 μm) dominating chlorophyll a biomass. The ICB phytoplankton composition appeared primarily driven by the physicochemical environment, with periodic events of increased mixing restricting further increases in biomass. In contrast, the NWB phytoplankton community was potentially limited by physicochemical and/or biological factors such as grazing. Diatoms dominated the ICB, with the genus Chaetoceros (1–166 cells mL⁻¹) being succeeded by Pseudo-nitzschia (0.2–210 cells mL⁻¹). However, large diatoms (> 10 μm) were virtually absent (< 0.5 cells mL⁻¹) from the NWB, with only small nanosized (< 5 μm) diatoms present (101–600 cells mL⁻¹). We suggest micro-zooplankton grazing, potentially coupled with the lack of a seed population of bloom forming diatoms, was restricting diatom growth in the NWB, and that large diatoms may be absent in NWB spring blooms. Despite both phytoplankton communities being in the early stages of bloom formation, different physicochemical and biological factors controlled bloom formation at the two sites. If these differences in phytoplankton composition persist, the subsequent spring blooms are likely to be significantly different in terms of biogeochemistry and trophic interactions throughout the growth season, with important implications for carbon cycling and organic matter export.

General information
State: Published
Phytoplankton dynamics in contrasting early stage North Atlantic spring blooms: composition, succession, and potential drivers
Predicting future shifts in herring spawning habitat in the North Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Danish Meteorological Institute
Authors: Tsoukali, S. (Intern), Christensen, A. (Intern), Tian, T. (Ekstern), Visser, A. (Intern), MacKenzie, B. (Intern)
Number of pages: 2
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Predicting spectral and PAR light attenuation in Greenlandic coastal waters

The spectral quality and penetration of light are key parameters controlling the productivity of Greenlandic fjords. Solar elevation and sea ice play an important role, but during the increasing ice free period and summer months in particular, light is also regulated by water constituents. We present models for spectral and PAR (photosynthetically active radiation) attenuation in two contrasting Greenlandic fjords, Godthåbsfjord (SW Greenland) and Young Sound (NE Greenland). The fjords differ in the character and concentrations of optically active components present: dissolved organic material (CDOM), phytoplankton pigments and inorganic particles. These differences are due in part to hydrography and to the sources of meltwater: respectively, fjord-terminating and land-terminating glaciers. We present a model to explain the variation in spectral and PAR irradiance in terms of the variation in optically active components. The ability of our model to predict irradiance is compared with that of 2 existing models.

Processes controlling recruitment in Baltic cod

Growing evidence has shown a profound modification of plankton communities of the North East Atlantic and adjacent seas over the past decades. This drastic change has been attributed to a modification of the environmental conditions that regulate the dynamics and the spatial distribution of ectothermic species in the ocean. Recently, several studies have highlighted modifications of the regional climate station L4 (50° 15.00’N, 4° 13.02’W) in the Western English Channel. We here focus on the modification of the plankton community by studying the long-term, annual and seasonal changes of five zooplankton groups and eight copepod genera. We detail the main composition and the phenology of the plankton communities during four climatic periods identified at the L4 station: 1988-1994, 1995-2000, 2001-2007 and 2008-2012. Our results show that long-term environmental changes underlined by Molinero et al. (2013) drive a profound restructuration of the plankton community modifying the phenology and the dominance of key planktonic groups including fish larvae. Consequently, the slow but deep modifications detected in the plankton community highlight a climate driven ecosystem shift in the Western English Channel.
Reaching out: Communicating the Danish Eel Expedition 2014

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Reeh, L. (Intern), Christoffersen, M. (Intern), Sørensen, S. R. (Intern), Nielsen, T. G. (Intern), Munk, P. (Intern)
Publication date: 2015
Event: Poster session presented at 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Communication › Poster – Annual report year: 2015

Recent decrease in DOC concentrations in Arctic lakes of southwest Greenland: Decreasing DOC in Arctic lakes

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Maine, North Carolina State University, Loughborough University
Authors: Saros, J. E. (Ekstern), Osburn, C. L. (Ekstern), Northington, R. M. (Ekstern), Birkel, S. D. (Ekstern), Auger, J. D. (Ekstern), Stedmon, C. A. (Intern), Anderson, N. J. (Ekstern)
Pages: 6703-6709
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication information
Journal: Geophysical Research Letters
Volume: 42
Issue number: 16
ISSN (Print): 0094-8276
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 4.35 SJR 2.91 SNIP 1.499
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.324 SNIP 1.496 CiteScore 4.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 3.315 SNIP 1.532 CiteScore 4.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.461 SNIP 1.704 CiteScore 4.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 3.317 SNIP 1.579 CiteScore 3.82
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 3.113 SNIP 1.56 CiteScore 3.79
ISI indexed (2011): ISI indexed yes
Receptivity of winter flounder larvae to artificial diet from the yolk-sac stage to metamorphosis

In the period from 4 days post-hatching to metamorphosis, winter flounder that were naïve to artificial feed were exposed to an artificial diet and allowed to forage for 8 min. The presence or absence of artificial diet in the gut was used as an indicator of acceptance. The relationship between diet acceptance and age was found to be a dome-shaped function (incidence of ingested food = −0.0233 day² + 1.101 day − 4.9428, r² = 0.85). Here, our analysis suggests that winter flounder should be exposed to artificial diets by 26 days post-hatch at 10 °C, after this time receptivity declines. This age corresponds to larvae that are in the flexion developmental stage and have a standard length between 5.95 and 6.23 mm.
Reproduction rates under variable food conditions and starvation in Mnemiopsis leidyi: significance for the invasion success of a ctenophore

The ctenophore Mnemiopsis leidyi is characterized by high growth rates and a large reproductive capacity. However, reproductive dynamics are not yet well understood. Here, we present laboratory data on food-dependent egg production in M. leidyi and egg hatching time and success. Further, we report on the reproduction of laboratory-reared and field-caught animals during starvation. Our results show that the half-saturation zooplankton prey concentration for egg production is reached at food levels of 12–23 µgC L⁻¹, which is below the average summer food concentration encountered in invaded areas of northern Europe. Furthermore, starved animals continue to produce eggs for up to 12 days after cessation of feeding with high overall hatching success of 65–90%. These life history traits allow M. leidyi to thrive and reproduce in
environments with varying food conditions and give it a competitive advantage under unfavourable conditions. This may explain why recurrent population blooms are observed and sustained in localized areas in invaded northern Europe, where water exchange is limited and zooplankton food resources are quickly depleted by M. leidyi. We suggest that these reproductive life history traits are key to its invasion success.
Resilience to temperature and pH changes in a future climate change scenario in six strains of the polar diatom *Fragilariopsis cylindrus*

Abstract. The effects of ocean acidification and increased temperature on physiology of six strains of the polar diatom *Fragilariopsis cylindrus* from Greenland were investigated. Experiments were performed under manipulated pH levels (8.0, 7.7, 7.4, and 7.1) and different temperatures (1, 5, and 8°C) to simulate changes from present to plausible future levels. Each of the 12 scenarios was run for 7 days, and a significant interaction between temperature and pH on growth was detected. By combining increased temperature and acidification, the two factors counterbalanced each other, and therefore no effect on the growth rates was found. However, the growth rates increased with elevated temperatures by 20–50% depending on the strain. In addition, a general negative effect of increasing acidification on growth was observed. At pH 7.7 and 7.4, the growth response varied considerably among strains. However, a more uniform response was detected at pH 7.1 with most of the strains exhibiting reduced growth rates by 20–37% compared to pH 8.0. It should be emphasized that a significant interaction between temperature and pH was found, meaning that the combination of the two parameters affected growth differently than when considering one at a time. Based on these results, we anticipate that the polar diatom *F. cylindrus* will be unaffected by changes in temperature and pH within the range expected by the end of the century. In each simulated scenario, the variation in growth rates among the strains was larger than the variation observed due to the whole range of changes in either pH or temperature. Climate change may therefore not affect the species as such, but may lead to changes in the population structure of the species, with the strains exhibiting high phenotypic plasticity, in terms of temperature and pH tolerance towards future conditions, dominating the population.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Pancic, M. (Intern), Hansen, P. J. (Ekstern), Tammilehto, A. (Ekstern), Lundholm, N. (Ekstern)
Pages: 4235-4244
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Biogeosciences
Volume: 12
Issue number: 14
ISSN (Print): 1726-4170
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 4.25 SJR 2.328 SNIP 1.305
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
RevFisk – et projekt som kvantificerer stenrevs betydning for fisk

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Aarhus University, DHI Denmark
Publication date: 2015
Event: Poster session presented at 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Publication: Research › Poster – Annual report year: 2015
RevFisk – et projekt som kvantificerer stenrevs (et lavtliggende stenrev i den fotiske zone og et dybere liggende stenrev i den afotiske zone) betydning for fisk

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Aarhus University, DHI Denmark
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Review of environmental factors influencing distributions of selected Baltic species: Report: BIO-C3 Deliverable, D1.1 . EU Bonusproject BIO-C3

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Danish Shellfish Centre, University of Hamburg, Leibniz Institute of Marine Sciences, University of Tartu
Number of pages: 75
Publication date: 2015

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
DOI:
10.3289/BIO-C3_D1.1
Links:
http://oceanrep.geomar.de/31919/
Publication: Research › Report – Annual report year: 2016

Salinity tolerance and correlated physiology of the invasive round goby Neogobius melanostomus

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Authors: Behrens, J. (Intern), Deurs, M. V. (Intern), Christensen, E. A. F. (Intern)
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Links:
http://www.ices.dk/sites/pub/ASCExtendedAbstracts/Shared%20Documents/Q%20From%20genes%20to%20ecosystems.%20Spatial%20heterogeneity%20and%20temporal%20dynamics%20of%20the%20Baltic%20Sea%20Co-sponsored%20by%20BONUS%29/Q2715.pdf (Link to full text)

Bibliographical note
Seasonal copepod lipid pump promotes carbon sequestration in the deep North Atlantic

Significance Every autumn across the North Atlantic, large numbers of zooplankton copepods migrate from the surface waters into the ocean's interior to hibernate at depths of 600–1,400 m. Through this migration, they actively transport lipid carbon to below the permanent thermocline, where it is metabolized at a rate comparable to the carbon delivered by sinking detritus. This “lipid pump” has not been included in previous estimates of the deep-ocean carbon sequestration, which are based on either measurements of sinking fluxes of detritus, or estimates of new primary production. Unlike other components of the biological pump, the lipid pump does not strip the surface ocean of nutrients, and decouples carbon sequestration from nutrient replenishment, a process we term the “lipid shunt.”

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, University of Strathclyde
Authors: Jonasdottir, S. (Intern), Visser, A. (Intern), Richardson, K. (Ekstern), Heath, M. R. (Ekstern)
Pages: 12122-12126
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication: Communication › Internet publication – Annual report year: 2015

Source/Publisher: shz.de
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Internet publication – Annual report year: 2015

Schwarzmundgrundel und Meerwalnuss: Neubürger in Nord- und Ostsee: Die Globalisierung macht vor der Meeressumwelt nicht halt: Auf lange Sicht wird die Artenvielfalt darunter leiden

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Reusch, T. B. (Ekstern), Jaspers, C. (Intern)
Publication date: 2015

Publication information
Source/Publisher: shz.de
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Internet publication – Annual report year: 2015

Schwarzmundgrundel und Meerwalnuss: Neubürger in Nord- und Ostsee: Die Globalisierung macht vor der Meeressumwelt nicht halt: Auf lange Sicht wird die Artenvielfalt darunter leiden

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Reusch, T. B. (Ekstern), Jaspers, C. (Intern)
Publication date: 2015

Publication information
Source/Publisher: shz.de
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Internet publication – Annual report year: 2015

Seasonal copepod lipid pump promotes carbon sequestration in the deep North Atlantic

Significance Every autumn across the North Atlantic, large numbers of zooplankton copepods migrate from the surface waters into the ocean's interior to hibernate at depths of 600–1,400 m. Through this migration, they actively transport lipid carbon to below the permanent thermocline, where it is metabolized at a rate comparable to the carbon delivered by sinking detritus. This “lipid pump” has not been included in previous estimates of the deep-ocean carbon sequestration, which are based on either measurements of sinking fluxes of detritus, or estimates of new primary production. Unlike other components of the biological pump, the lipid pump does not strip the surface ocean of nutrients, and decouples carbon sequestration from nutrient replenishment, a process we term the “lipid shunt.”

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, University of Strathclyde
Authors: Jonasdottir, S. (Intern), Visser, A. (Intern), Richardson, K. (Ekstern), Heath, M. R. (Ekstern)
Pages: 12122-12126
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication: Communication › Internet publication – Annual report year: 2015

Source/Publisher: shz.de
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Internet publication – Annual report year: 2015
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
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 6.769 SNIP 2.529
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 6.913 SNIP 2.544
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 6.899 SNIP 2.445
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 6.766 SNIP 2.441
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 6.734 SNIP 2.434
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 6.784 SNIP 2.551
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 7.026 SNIP 2.622
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 7.018 SNIP 2.501
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 7.183 SNIP 2.471
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 7.192 SNIP 2.463
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 7.731 SNIP 2.475
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 8.271 SNIP 2.446

Original language: English
Biological Sciences, Physical Sciences, Environmental Sciences-BS, Earth, Atmospheric, and Planetary Sciences
Seasonal variation in population dynamics of Calanus finmarchicus in the south western Norwegian Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Faroe Marine Research Institute
Authors: Kristiansen, I. (Ekstern), Gaard, E. (Ekstern), Hatun, H. (Ekstern), Jonasdottir, S. (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:
Publishers_version

Bibliographical note
ICES CM 2015/S:18
Publication: Research › Conference abstract for conference – Annual report year: 2015

Short-term prediction and harvest control rules for Baltic cod (Gadus morhua): A generic method to include state of the art knowledge on environmental uncertainty and its consequences – would it make a difference for advice?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Neuenfeldt, S. (Intern), Gårdmark, A. (Ekstern), Muller-Karulis, B. (Ekstern), Hinrichsen, H. H. (Ekstern), Möllmann, C. (Ekstern), Uusitalo, L. (Ekstern), Holmgren, N. (Ekstern), Norrström, N. (Ekstern), Large, S. (Ekstern), Tomczak, M. (Ekstern)
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:
Publishers_version

Bibliographical note
ICES CM 2015/B:13
Publication: Research › Conference abstract for conference – Annual report year: 2015

Size structure, not metabolic scaling rules, determines fisheries reference points
Impact assessments of fishing on a stock require parameterization of vital rates: growth, mortality and recruitment. For 'data-poor' stocks, vital rates may be estimated from empirical size-based relationships or from life-history invariants. However, a theoretical framework to synthesize these empirical relations is lacking. Here, we combine life-history invariants, metabolic scaling and size-spectrum theory to develop a general size- and trait-based theory for demography and recruitment of exploited fish stocks. Important concepts are physiological or metabolic scaled mortalities and flux of individuals or their biomass to size. The theory is based on classic metabolic relations at the individual level and uses asymptotic size W∞ as a trait. The theory predicts fundamental similarities and differences between small and large species in vital rates and response to fishing. The central result is that larger species have a higher egg production per recruit than small species. This means that density dependence is stronger for large than for small species and has the consequence that fisheries reference points that incorporate recruitment do not obey metabolic scaling rules. This result implies that even though small species have a higher productivity than large species their resilience towards fishing is lower than expected from metabolic scaling rules. Further, we show that the fishing mortality leading to maximum yield per recruit is an ill-suited reference point. The theory can be used to generalize the impact of fishing across species and for making demographic and evolutionary impact assessments of fishing, particularly in data-poor situations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Size structures sensory hierarchy in ocean life

Life in the ocean is shaped by the trade-off between a need to encounter other organisms for feeding or mating, and to avoid encounters with predators. Avoiding or achieving encounters necessitates an efficient means of collecting the maximum possible information from the surroundings through the use of remote sensing. In this study, we explore how sensing mode and range depend on body size. We reveal a hierarchy of sensing modes (chemosensing, mechanosensing, vision, hearing, and echolocation) where body size determines the available battery of sensing modes and where larger body size means a longer sensing range. The size-dependent hierarchy and the transitions between primary sensory modes are explained on the grounds of limiting factors set by physiology and the physical laws governing signal generation, transmission and reception. We characterize the governing mechanisms and theoretically predict the body size limits for various sensory modes, which align very well with size ranges found in literature. The treatise of all ocean life, from unicellular organisms to whales, demonstrates how body size determines available sensing modes, and thereby acts as a major structuring factor of aquatic life.
Small-scale distribution of Baltic sprat: Statistical properties of school height, length and biomass imply school formation and species interaction mechanisms

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg
Authors: Neuenfeldt, S. (Intern), Gloes, D. (Ekstern), Möller, K. O. (Ekstern), Möllmann, C. (Ekstern)
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/Q:33
Publication: Research › Conference abstract for conference – Annual report year: 2015

Small-scale distribution of plankton and marine snow in the North Atlantic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg
Authors: Möller, K. O. (Ekstern), St. John, M. (Intern), Christiansen, B. (Ekstern), Möllmann, C. (Ekstern)
Number of pages: 1
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Some like it hot - Calanus in Disko Bay
The ongoing temperature increase in the Arctic affects the succession patterns in the marine pelagic ecosystem. Reduction and earlier breakup of sea ice changes the initiation of the spring bloom. Along the Greenland coast three species of Calanus dominate the zooplankton; C. hyperboreus, C. glacialis and C. finmarchicus. C. hyperboreus and C. glacialis are large lipid rich Arctic species, whereas C. finmarchicus is a smaller North Atlantic species. During the last two decades we have investigated the Calanus community in the Disko Bay, western Greenland. Calanus are impacted by the environmental changes, directly through their physiological rates as egg production, development, growth, and metabolic cost and indirectly via the environment through changes in ice cover, salinity, and food availability. The Calanus species have different lifecycles and show different responses to increasing temperatures. The aim of this talk is to discuss possible effects of climate change on coexisting Calanus species. Our result from in situ and laboratory studies illustrates that Calanus in Disko Bay are well adapted to Arctic conditions with unpredictable pulses of food. All three species continue reproduction when starved. Pre-feeding history of C. glacialis and C. finmarchicus are important to the starvation response as it affects gonad maturation. Only C. finmarchicus that have previously fed will continue egg production during starvation, unlike C. glacialis that sustain egg production without food. This advantage however diminishes with increasing temperature. At temperatures above 5 °C both starved and fed C. finmarchicus can produce egg at a rate similar to C. glacialis. The reproduction by the winter spawner C. hyperboreus seemed to be endogenously controlled, as neither food nor temperature affect reproductive output. The eggs of C. hyperboreus develop relatively fast at low temperature, and nauplii can survive long periods of starvation.

Spatially explicit estimates of stock sizes, structure and biomass of herring and blue whiting, and catch data of bluefin tuna
The North Atlantic is a productive marine region which has supported important commercial fisheries for centuries. Many of these fisheries have exploited the pelagic species, including herring, blue whiting and tuna. Here we present data on the distribution of herring and blue whiting based on the international ecosystem survey in the Nordic Seas (IESNS), the bottom trawl survey in the Bay of Biscay and Celtic Sea (EVHOE) and the pelagic survey in the Bay of Biscay (PELGAS). We also present catch data on bluefin tuna, which has been depleted for decades but historically used to be a key predator on the other pelagic stocks during summer. The results show that there were substantial changes in the herring and blue whiting distribution during the 1990s and early 2000s. The earliest bluefin tuna catches noted were in 1907. The catches in the Norwegian Sea area peaked in the 1950s and there have been very small catches since the 1980s. The reported catches in the Mediterranean, on the other hand, peaked in the late 1990s and subsequently had a strong reduction.
Structuring of zooplankton and fish larvae assemblages in a freshwater-influenced Greeniandic fjord- Influence from hydrography and prey availability

The recent increase in temperature and freshwater runoff in the Arctic will influence the functioning of the plankton ecosystem and hence the life of the fish larvae residing in these areas. Here, we studied the strength of physical–biological linkages and the adaptability of individual larval fish species to changing hydrographical and feeding environments in a sub-Arctic area in Greenland. The study was carried out along a transect covering a wide range of physical conditions from the deep ocean to the icecap in the Godtha˚bsfjord on the south-western Greenland coast. Along the transect, we identified a series of distinct zooplankton and larval fish assemblages which showed linkage to water mass characteristics, to the presence of frontal structures and to availability of preferred prey. Spawning site location and water circulation was also likely to influence distributional patterns of the individual larval fish species.
Larvae were feeding on a variety of prey taxa and sizes; some larval species were generalists, while others were more specialized or fed on alternative prey taxa. Differences in feeding strategies might have the consequence that the species will be differently affected by changes in the plankton community. Accordingly, fish larvae that have a greater feeding flexibility and that are more adaptable to environmental variability may cope better with climate related changes.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Swalethorp, R. (Intern), Malanski, E. (Intern), Munk, P. (Intern), Agersted, M. D. (Intern), Nielsen, T. G. (Intern)
Pages: 102-119
Publication date: 2015
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Plankton Research
Volume: 37
Issue number: 1
ISSN (Print): 0142-7873
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 1.92 SJR 1.098 SNIP 0.848
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.557 SNIP 1.101 CiteScore 2.43
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.158 SNIP 1.045 CiteScore 1.99
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.186 SNIP 0.98
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.922 SNIP 1.046
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 1.174 SNIP 1.037
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.31 SNIP 1.225
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 1.19 SNIP 1.118
Struktur og aktivitet af det mikrobielle samfund gennem den isfrie periode i en højarktisk fjord (Young Sund, NØ Grønland)

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Aarhus University, University of Bergen
Authors: Paulsen, M. L. (Ekstern), Stedmon, C. (Intern), Nielsen, S. E. B. (Intern), Middelboe, M. (Ekstern), Møller, E. F. (Ekstern), Larsen, A. (Ekstern), Sejr, M. (Ekstern)
Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Sustainable development of the Nephrops fishery in the Kattegat-Skagerrak region

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Management Systems, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Institute Management, Swedish University of Agricultural Sciences, Institute of Marine Research, Danish Fishermen's Producers' Organization, Aalborg University
Number of pages: 23
Publication date: 2015
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.
The Baltic ATLANTIS model: Implementing a holistic framework to evaluate ecosystem wide responses to changes in climate and anthropogenic forcing

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Monitoring and Data, Centre for Ocean Life, Aarhus University
Authors: Palacz, A. (Intern), Nielsen, J. R. (Intern), Christensen, A. (Intern), Gislason, H. (Intern), Bastardie, F. (Intern), Geitner, K. (Intern), Maar, M. (Ekstern), Lindegren, M. (Intern), Hufnagl, M. (Intern), Fulton, E. (Ekstern)
Number of pages: 1
Publication date: 2015
Event: Poster session presented at 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Links:
http://www.marine-vectors.eu/Core_pages/The_Baltic_ATLANTIS_model_a_holistic_framework_to

The effect of temperature and body size on metabolic scope of activity in juvenile Atlantic cod Gadus morhua L.
Changes in ambient temperature affect the physiology and metabolism and thus the distribution of fish. In this study we used intermittent flow respirometry to determine the effect of temperature (2, 5, 10, 15 and 20 °C) and wet body mass (BM) (~30–460 g) on standard metabolic rate (SMR, mg O2 h⁻¹), maximum metabolic rate (MMR, mg O2 h⁻¹) and metabolic scope (MS, mg O2 h⁻¹) of juvenile Atlantic cod. SMR increased with BM irrespectively of temperature, resulting in an average scaling exponent of 0.87 (0.82–0.92). Q10 values were 1.8–2.1 at temperatures between 5 and 15 °C but higher (2.6–4.3) between 2 and 5 °C and lower (1.6–1.4) between 15 and 20 °C in 200 and 450 g cod. MMR increased with temperature in the smallest cod (50 g) but in the larger cod MMR plateaued between 10, 15 and 20 °C. This resulted in a negative correlation between the optimal temperature for MS (Topt) and BM. Topt being respectively 14.5, 11.8 and 10.9 °C in a 50, 200 and 450 g cod. Irrespective of BM cold water temperatures resulted in a reduction (30–35%) of MS whereas the reduction of MS at warm temperatures was only evident for larger fish (200 and 450 g), caused by plateauing of MMR at 10 °C and above. Warm temperatures thus seem favourable for smaller (50 g) juvenile cod, but not for larger conspecifics (200 and 450 g)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Tirsgaard, B. (Ekstern), Behrens, J. (Intern), Steffensen, J. F. (Ekstern)
Pages: 89-94
Publication date: 2015
Main Research Area: Technical/natural sciences
Publication information
Journal: Comparative Biochemistry and Physiology. Part A: Molecular & Integrative Physiology
Volume: 179
ISSN (Print): 1095-6433
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 2.16 SJR 0.794 SNIP 0.879
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.917 SNIP 0.915 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.983 SNIP 0.94 CiteScore 2.18
Web of Science (2014): Indexed yes
The effects of inbreeding on sperm quality traits in captive-bred lake trout, Salvelinus namaycush (Walbaum, 1972)

The effects of inbreeding in both captive and wild-caught species and populations have been reported to affect a wide variety of life history traits. Recently, the effects of inbreeding on reproductive traits such as sperm quality have become a subject of particular interest for conservation biology, evolutionary ecology, and management of captive populations. This study investigated the effects of inbreeding on sperm quality in a captive population of experimentally inbred and outbred lake trout, Salvelinus namaycush. It was found for moderately to highly inbred males (males with half-sib and full-sib parents, respectively), that sperm quality traits (velocity, motility, linearity, longevity, spermatocrit and morphology) showed no apparent inbreeding depression. The apparent lack of inbreeding effects on sperm quality traits may be due to several factors including (i) no inbreeding depression in the studied population, due to purging, low levels of inbreeding or lack of detection at the gametic level, or (ii) relaxed selective pressures due to benign hatchery conditions. The present study provides significant insight into the effects of inbreeding on sperm quality in a captive-bred salmonid population, and has important implications for hatchery rehabilitation programs for this species.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Trent University, University of Windsor
Authors: Johnson, K. (Ekstern), Butts, I. A. E. (Intern), Smith, J. L. (Ekstern), Wilson, C. C. (Ekstern), Pitcher, T. E. (Ekstern)
Pages: 62-70
Publication date: 2015
Main Research Area: Technical/natural sciences
The influence of glacial melt water on bio-optical properties in two contrasting Greenlandic fjords

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Aarhus University, Greenland Institute of National Resources
Authors: Murray, C. (Ekstern), Markager, S. (Ekstern), Stedmon, C. A. (Intern), Juul-Pedersen, T. (Ekstern), Sejr, M. K. (Ekstern), Bruhn, A. (Ekstern)
Pages: 72-83
Publication date: 2015
Main Research Area: Technical/natural sciences
Fjords, Greenland, light attenuation, suspended particulate matter, dissolved organic matter, melt water
The invasive comb-jelly Mnemiopsis leidyi in northern Europe: Transport, origin and local extinction and re-invasion of sub-populations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Danish Shellfish Centre, Leibniz Institute of Marine Sciences
Authors: Jaspers, C. (Intern), Hinrichsen, H. (Ekstern), Møller, L. F. (Intern)
Publication date: 2015
Event: Abstract from ASLO Aquatic Sciences Meeting 2015, Granada, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

The optical properties of DOM in the ocean

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Stedmon, C. (Intern), Nelson, N. (Ekstern)
Number of pages: 712
Pages: 481-508
Publication date: 2015

Host publication information
Title of host publication: Biogeochemistry of Marine Dissolved Organic Matter
Publisher: Elsevier
Editors: Hansell, D., Carlson, C.
Edition: 2.
ISBN (Print): 9780124059405
ISBN (Electronic): 9780124071537
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Book chapter – Annual report year: 2015

Thermal effects on early life history stages of European eel Anguilla anguilla

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Politis, S. N. (Intern), Miest, J. (Ekstern), Adamek, M. (Ekstern), Servili, A. (Ekstern), Mazurais, D. (Ekstern), Zambonino, J. (Ekstern), Tomkiewicz, J. (Intern), Butts, I. (Intern)
Publication date: 2015
Event: Abstract from Aquaculture Europe 2015, Rotterdam, Netherlands.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

The role of deep convection on the dynamics of the North Atlantic phytoplankton community
In recent years observations of a significant winter phytoplankton stock and blooms in the absence of stratification have challenged the classical picture of phytoplankton dynamics in the North Atlantic. To explain phytoplankton winter survival, it has been suggested that deep convection can sustain low primary production by frequently returning plankton cells to the euphotic zone. For this mechanism to work the convective vertical velocities have to superimpose the sinking rate of phytoplankton cells and cell photosynthesis has to compensate for respiratory and other losses. In this thesis different modeling approaches are used to investigate several aspects of the bio-physical interplay between deep convection and phytoplankton growth. Simple water column models for phytoplankton have suggested that phytoplankton cannot grow in highly turbulent deep mixed layers, conditions typical for deep convective regimes. To investigate this discrepancy between observations and model studies, a modeling approach commonly used in population models was applied to a spatial grid, where the advective flow was explicit represented. The result shows that indeed phytoplankton can persist in highly turbulent deep waters and suggests that it is the
convective overturning within the mixed layer, that enables cell to thrive under these conditions.

To investigate the role of acclimation during winter and during the onset of the spring bloom, an adaptive Individual-Based-Model (IBM) was developed, allowing to test the phyto-convection hypothesis in relation to individual physiological rates. The model in-cooperates an adaptive parameterization for respiration and a mechanistic sinking model, both of which have been suggested as important contributors to phytoplankton losses during the winter. While cell sinking was found to be only of lesser importance, respiration had a large impact on phytoplankton survival during during winter and especially during the onset of stratification. In difference to the non-hydrostatic model coupled to the IBM, ecosystem models are hydrostatic and are therefore not able to capture convective motion as such. Due to the coupling of deep convection and phytoplankton winter survival in the north Atlantic this can lead to an underestimation of winter phytoplankton biomass. As a first step to improve the winter phytoplankton representation, a simple parameterization assuming average mixed layer light levels throughout the whole mixed layer, was implemented into an ecosystem model and validated with a on-hydrostatic convection model. The new parameterization improved the model fit to observational data substantially. The increased standing stock during winter led to higher carbon export, in particular during the onset of thermal stratification in spring. The finding of this thesis have important implication for our understanding of carbon sequestration during winter and for the role of the North Atlantic as a carbon sink, in particular in a scenario of climate change.
Twenty five years of invasion: management of the round goby Neogobius melanostomus in the Baltic Sea

The round goby, Neogobius melanostomus (Pallas, 1814), is one of the most invasive non-indigenous species in the Baltic Sea. It dominates coastal fisheries in some localities and is frequently found in offshore pelagic catches. This paper identifies management issues and suggests actions to be considered for post-invasion management. Priority should be given to the establishment of a coordinated pan-Baltic monitoring programme and associated data storage and exchange, as well as the compilation of landing statistics of the round goby in commercial and recreational fisheries. While eradication is unrealistic, population control that leads to minimising the risk of transfer to yet uncolonised areas in the Baltic Sea and adjacent waterbodies is feasible. This should comprise the requirement that the species be landed in commercial fishery bycatch, the management of ships’ ballast water and sediments, and hull fouling of inland and sea-going vessels, including recreational boats. Extensive involvement of stakeholders is crucial at all phases of the management process.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Israel Oceanographic and Limnological Research, Baltic Sea Advisory Council, Swedish University of Agricultural Sciences, Finnish Environment Institute, University of Tartu
Zooplankton are the link connecting primary producers to higher trophic levels, and knowing their distribution and community is important for predicting the distribution of predator species, like fish, seabirds, and marine mammals. However, data from open Arctic oceans are still scarce. In autumn, tens of millions of the planktivorous little auks (Alle alle) (about 75% of the world’s population) and millions of thick-billed murres (Uria lomvia) pass through the Baffin Bay. To investigate their potential food sources, we investigated the spatial and vertical distribution of zooplankton and small fishes in the upper 500 m of southern Baffin Bay in September 2009. The zooplankton community was dominated by copepods (55% of abundance in the upper 500 m), primarily of the genus Calanus. Other important zooplankton taxa included Limacina helicina, Chaetognatha, and Cirripedia nauplii. On the Greenland Shelf, most Calanus were late copepodite stages and most were found at the depths of >200 m, suggesting they were in diapause. On the Canadian Shelf, there were relatively more Calanus in the near-surface layers, which were probably still actively feeding and which were available to visual predators such as seabirds and fish. The acoustic survey showed the highest density of polar cod Boreogadus saida in the upper 50 m on the western part of the Greenland Shelf. A particularly high biomass of both zooplankton and polar cod was found in the central part of the basin in association with a local relatively shallow area.
What are the major global threats and impacts in marine environments? Investigating the contours of a shared perception among marine scientists from the bottom-up

Marine scientists broadly agree on which major processes influence the sustainability of marine environments worldwide. Recent studies argue that such shared perceptions crucially shape scientific agendas and are subject to a confirmation bias. Based on these findings a more explicit engagement with scientists' (shared) perceptions of global change in marine environments is called for. This paper takes stock of the shared understanding in marine science of the most pertinent, worldwide threats and impacts that currently affect marine environments. Using results from an email survey among leading academics in marine science this article explores if a shared research agenda in relation to global change in marine environments exists. The analysis demonstrates that marine scientists across disciplines are largely in agreement on some common features of global marine change. Nevertheless, the analysis also highlights where natural and social scientists diverge in their assessment. The article ends discussing what these findings imply for further improvement of interdisciplinary marine science

General information
Winter−spring transition in the subarctic Atlantic: microbial response to deep mixing and pre-bloom production

In temperate, subpolar and polar marine systems, the classical perception is that diatoms initiate the spring bloom and thereby mark the beginning of the productive season. Contrary to this view, we document an active microbial food web dominated by pico- and nanoplankton prior to the diatom bloom, a period with excess nutrients and deep convection of the water column. During repeated visits to stations in the deep Iceland and Norwegian basins and the shallow Shetland Shelf (26 March to 29 April 2012), we investigated the succession and dynamics of photo-synthetic and heterotrophic microorganisms. We observed that the early phytoplankton production was followed by a decrease in the carbon:nitrogen ratio of the dissolved organic matter in the deep mixed stations, an increase in heterotrophic prokaryote (bacteria) abundance and activity (indicated by the high nucleic acid:low nucleic acid bacteria ratio), and an increase in abundance and size of heterotrophic protists. The major chl a contribution in the early winter−spring transition was found in the fraction <10 μm, i.e. dominated by pico- and small nanophytoplankton. The relative abundance of picophytoplankton decreased towards the end of the cruise at all stations despite nutrient-replete conditions and increasing day length. This decrease is hypothesised to be the result of top-down control by the fast-growing population of heterotrophic protists. As a result, the subsequent succession and nutrient depletion can be left to larger phytoplankton resistant to small grazers. Further, we observed that large phytoplankton (chl a > 50 μm) were stimulated by deep mixing later in the period, while picophytoplankton were unaffected by mixing; both physical and biological reasons for this development are discussed herein.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University Museum of Bergen, University of Bergen
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Pages: 49-69
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Aquatic Microbial Ecology
Volume: 76
Issue number: 1
ISSN (Print): 0948-3055
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): SJR 0.805 SNIP 0.567 CiteScore 1.77
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.124 SNIP 0.768 CiteScore 2.21
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.893 SNIP 0.699 CiteScore 1.88
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.021 SNIP 0.844 CiteScore 2.16
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.389 SNIP 0.921 CiteScore 2.49
ISI indexed (2012): ISI indexed yes
Zooplankton vertical migration in the polar night – Is migration more "random" than diel during the darkest period of winter?

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Akvaplan-niva AS, University Centre in Svalbard
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Publication date: 2015
Event: Abstract from 18. Danske Havforskermøde, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

Abundance of broad bacterial Taxa in the Sargasso Sea explained by environmental conditions but not water mass
To explore the potential linkage between distribution of marine bacterioplankton groups, environmental conditions, and water mass, we investigated the factors determining the abundance of bacterial taxa across the hydrographically complex Subtropical Convergence Zone in the Sargasso Sea. Based on information from 16S rRNA gene clone libraries from various locations and two depths, abundances of the predominant taxa (eubacteria, Archaea, Alphaproteobacteria, Gammaproteobacteria, Bacteroidetes, and the Roseobacter, SAR11, and SAR86 clades) were quantified by real-time PCR. In addition, the abundances of Synechococcus, Prochlorococcus, and picoalgae were determined by flow cytometry.
Linear multiple-regression models determining the relative effects of eight environmental variables and of water mass explained 35 to 86% of the variation in abundance of the quantified taxa, even though only one to three variables were significantly related to any particular taxon’s abundance. Most of the variation in abundance was explained by depth and chlorophyll a. The predominant phototrophs, Prochlorococcus and picoalgae, were negatively correlated with phosphate, whereas eubacteria, heterotrophic bacteria, and SAR86 were negatively correlated with nitrite. Water mass showed limited importance for explaining the abundance of the taxonomical groups (significant only for Roseobacter, explaining 14% of the variation). The results suggest the potential for predicting the abundance of broad bacterioplankton groups throughout the Sargasso Sea using only a few environmental parameters.
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), Hoyer, 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 - peer-review › Journal article – 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.
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 demonstration of an integrated ecosystem assessment and advice for Baltic Sea fish stocks

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, University of Kiel, University of Hamburg, Stockholm University, Lund University
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.324 SNIP 1.349 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.357 SNIP 1.44 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.365 SNIP 1.35 CiteScore 2.93
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.239 SNIP 1.301 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.449 SNIP 1.324
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.347 SNIP 1.359
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.101 SNIP 1.296
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.054 SNIP 1.26
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.166 SNIP 1.351
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.159 SNIP 1.228
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.232 SNIP 1.376
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.116 SNIP 1.455
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.269 SNIP 1.581
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.66 SNIP 1.524
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.729 SNIP 1.489
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.901 SNIP 1.532
Original language: English
DOIs: 10.1002/2014JC010323
A metacommunity perspective on source-sink dynamics and management: the Baltic Sea as a case study
The degree to which metapopulation processes influence fish stock dynamics is a largely unresolved issue in marine science and management, especially for highly mobile species such as Atlantic cod (Gadus morhua) and herring (Clupea harengus). The Baltic Sea comprises a heterogeneous oceanographic environment that structures the spatial and temporal distribution of the dominant species cod, herring, and sprat (Sprattus sprattus). Despite local differences, the stocks are traditionally managed as homogeneous units. Here, we present a metacommunity-perspective on source–sink dynamics of Baltic Sea fish stocks by using a spatially disaggregated statistical food web model. The model is fitted to area-specific time series of multiple abiotic and biotic variables using state-space methods. Our analysis reveals pronounced net fluxes between areas, indicative of source–sink dynamics, as well as area-specific differences in species interactions (i.e., density dependence, competition, and predator–prey) and the degree of fishing and climate impact on survival and recruitment. Furthermore, model simulations show that decreasing exploitation pressure in the source area for cod (without reallocating fishing effort) produces an increase in neighboring sink habitats, but a decline of prey species in response to increased predation. Our approach provides valuable insight concerning metacommunity-structuring of marine fish and may serve as an important tool for implementing sustainable management strategies under the ecosystem approach to marine and fisheries management.

Read More: http://www.esajournals.org/doi/abs/10.1890/13-0566.1

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Swedish University of Agricultural Sciences
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Pages: 1820-1832
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecological Applications
Volume: 24
Issue number: 7
ISSN (Print): 1051-0761
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 4.4 SJR 2.265 SNIP 1.576
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.76 SNIP 1.759 CiteScore 4.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.593 SNIP 1.842 CiteScore 4.59
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.676 SNIP 1.863 CiteScore 4.77
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.965 SNIP 1.937 CiteScore 4.55
A model for the description of feeding regulation by mesozooplankton under different conditions of temperature and prey nutritional status

Ecosystem modelling studies that consider mesozooplankton feeding regulation have primarily focused on the impact of prey nutritional status and temperature separately, despite experimental evidence for strong links between these two factors. Here, we propose a method based on optimal feeding behaviour of individual mesozooplankton that can be used to derive acclimative food ingestion, assimilation, and respiration under different temperature and food conditions. In the model, animals first evaluate the nutritional value of prey organisms based on their temperature-specific demand for energy and structural biochemical substances. They then regulate their feeding behaviour as well as metabolic physiology in order to satisfy their specific biochemical requirements for maintenance and growth. The approach is applicable to all heterotrophic plankton. In the example presented here the model has been configured to simulate egg production by the calanoid copepod Acartia tonsa. The model realistically reproduces the observed rates for egg production, as well as carbon (C) and nitrogen (N) gross growth efficiencies of egg production by Acartia in response to changes in both algal C:N-ratio and temperature. Results suggest that enhanced temperature accelerates respiratory consumption of the N assimilated by mesozooplankton, and thus decreases the rates for reproduction at higher temperatures. They also show that the optimum temperature for maximum egg production increases with algal C:N-ratio. These findings support and extend conclusions previously obtained for mesozooplankton and indicate that ocean warming could alter the role of Acartia spp. in planktonic food webs. © 2013 Elsevier B.V.
Analysis of self-overlap reveals trade-offs in plankton swimming trajectories

Movement is a fundamental behaviour of organisms that not only brings about beneficial encounters with resources and mates, but also at the same time exposes the organism to dangerous encounters with predators. The movement patterns adopted by organisms should reflect a balance between these contrasting processes. This trade-off can be hypothesized as being evident in the behaviour of plankton, which inhabit a dilute three-dimensional environment with few refuges or orienting landmarks. We present an analysis of the swimming path geometries based on a volumetric Monte Carlo sampling approach, which is particularly adept at revealing such trade-offs by measuring the self-overlap of the trajectories. Application of this method to experimentally measured trajectories reveals that swimming patterns in copepods are shaped to efficiently explore volumes at small scales, while achieving a large overlap at larger scales. Regularities in the observed trajectories make the transition between these two regimes always sharper than in randomized trajectories or as predicted by randomwalk theory. Thus, real trajectories present a stronger separation between exploration for food and exposure to predators. The specific scale and features of this transition depend on species, gender and local environmental conditions, pointing at adaptation to state and stage-dependent evolutionary trade-offs. © 2014 The Author(s) Published by the Royal Society. All rights reserved.
Annual and spatial variability in endo- and ectoparasite infections of North Sea cod (Gadus morhua Linnaeus, 1758) larvae, post-larvae and juveniles.

A parasitological investigation was performed on a total of 5380 Atlantic cod larvae, post-larvae and small juveniles sampled from the North Sea during a period of five years. The copepod Caligus elongatus (Von Nordmann, 1832) and the nematode Hysterodrilus aduncum (Rudolphi, 1802) were found at a relatively high prevalence of infection (4.6% and 5.2%, respectively). The infection by both parasites showed annual and spatial variability. C. elongatus showed a higher prevalence in 1992 compared to the following years, whereas the prevalence of H. aduncum increased from 1992 to 2001. We observed a relation between parasite distribution and parameters such as latitude and water depth. Adult digeneans (Lecithaster gibbosus and Derogenes varicus) and larval cestodes were also found with lower infection rates. Since changes of infection levels coincided with increasing North Sea water temperature in the studied period, it is hypothesized that temperature may affect parasite population levels. However, it is likely that other environmental factors may contribute to the observed variations. Absence of infection intensities higher than one nematode per fish in small larvae and post-larvae suggests that host survival may be affected by a high infection pressure. The relatively high levels of infection in the younger stages of cod, and the annual/spatial variability of these infections should be considered in the understanding of the early life dynamics of the species.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, University of Tromsø
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Pages: 284-293
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information

Journal: Acta Parasitologica
Volume: 59
Issue number: 2
ISSN (Print): 1230-2821
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): SJR 0.532 SNIP 0.721 CiteScore 1.24
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.6 SNIP 0.831 CiteScore 1.18
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.452 SNIP 0.778 CiteScore 0.9
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.497 SNIP 0.816 CiteScore 1.05
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.506 SNIP 0.923 CiteScore 1.12
 ISI indexed (2012): ISI indexed yes
 BFI (2011): BFI-level 1
 Scopus rating (2011): SJR 0.591 SNIP 0.696 CiteScore 0.89
 ISI indexed (2011): ISI indexed yes
 BFI (2010): BFI-level 1
 Scopus rating (2010): SJR 0.596 SNIP 0.656
 Web of Science (2010): Indexed yes
 BFI (2009): BFI-level 1
 Scopus rating (2009): SJR 0.594 SNIP 0.734
 BFI (2008): BFI-level 1
 Scopus rating (2008): SJR 0.515 SNIP 0.873
 Scopus rating (2007): SJR 0.487 SNIP 0.706
 Scopus rating (2006): SJR 0.406 SNIP 0.653
 Scopus rating (2005): SJR 0.312 SNIP 0.546
 Scopus rating (2004): SJR 0.326 SNIP 0.604
 Scopus rating (2003): SJR 0.276 SNIP 0.594
 Scopus rating (2002): SJR 0.445 SNIP 0.651
 Scopus rating (2001): SJR 0.347 SNIP 0.623
 Scopus rating (2000): SJR 0.392 SNIP 0.517
 Scopus rating (1999): SJR 0.224 SNIP 0.521
 Original language: English
 HASH(0x4daf908), Atlantic cod, North Sea, Hysterothylacium aduncum, Caligus elongatus, growth, temperature, latitude
 DOIs:
 10.2478/s11686-014-0244-0
 Source: FindIt
 Source-ID: 267329597
 Publication: Research - peer-review › Journal article – Annual report year: 2014

Are Leptocephali assemblages confined by oceanographic features? – Investigating distributional patterns across the subtropical convergence zone of the Sargasso Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
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Publication date: 2014
Event: Abstract from Annual Larval Fish Conference, , Quebec, Canada.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2015

A seasonal diary of phytoplankton in the North Atlantic
In recent years new biological and physical controls have been suggested to drive phytoplankton bloom dynamics in the North Atlantic. A better understanding of the mechanisms driving primary production has potentially important implications for the understanding of the biological carbon pump, as it has for prediction of the system in climate change scenarios. However, the scientific discussion regarding this topic has generally failed to integrate the different drivers into a coherent picture, often rendering the proposed mechanisms exclusive to each other. We feel that the suggested mechanisms are not mutually exclusive, but rather complementary. Thus, moving beyond the “single mechanism” point of view, here we present an integrated conceptual model of the physical and biological controls on phytoplankton dynamics in the North Atlantic. Further we believe that the acclimation of physiological rates can play an important role in mediating phytoplankton dynamics. Thus, this view emphasizes the occurrence of multiple controls and relates their variations in impact to climate change

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Lindemann, C. (Intern), St. John, M. (Intern)
A synthesis of the distribution of Mnemiopsis leidyi in European waters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, IFREMER, Alfred Wegener Institute, Aarhus University, Université Montpellier, University of Toulon, Institute of Biology of the Southern Seas, CSIC, Université de La Rochelle, Thünen Institute of Sea Fisheries, University Museum of Bergen, National Research Council of Italy, Alfred Wegener Institute for Polar and Marine Research, Leibniz-Institute for Baltic Sea Research, Sorbonne Universités, Institute of Fisheries, Marine Ecology, Istanbul University, Cefas, Institute for Agricultural and Fisheries Research, Marine Biology and Ecology Department, Royal Netherlands Institute for Sea Research - NIOZ, Deltares, GEOMAR - Helmholtz Centre for Ocean Research Kiel, University of Gothenburg, Aix Marseille Université, University of Southern Denmark
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2014

Biogeography of key mesozooplankton species in the North Atlantic, by manual counting methods, and egg production of Calanus finmarchicus

Here we present a new, pan-Atlantic compilation of data on key mesozooplankton species, including the possibly most important copepod, Calanus finmarchicus. Distributional data of ten representative zooplankton taxa, from recent (2000–2009) Continuous Plankton Recorder data, are presented, along with basin-scale data of the phytoplankton colour index. Then we present a compilation of data on C. finmarchicus including observations of abundance, demography, egg production and female size with accompanying data on temperature and chlorophyll. This is a contribution by Canadian, European and US scientists and their institutions. http://doi.pangaea.de/10.1594/PANGAEA.820732, http://doi.pangaea.de/10.1594/PANGAEA.824423, http://doi.pangaea.de/10.1594/PANGAEA.828393.
Bridging the gap between marine biogeochemical and fisheries sciences; configuring the zooplankton link

Exploring climate and anthropogenic impacts on marine ecosystems requires an understanding of how trophic components interact. However, integrative end-to-end ecosystem studies (experimental and/or modelling) are rare. Experimental investigations often concentrate on a particular group or individual species within a trophic level, while tropho-dynamic field studies typically employ either a bottom-up approach concentrating on the phytoplankton community or a top-down approach concentrating on the fish community. Likewise the emphasis within modelling studies is usually placed upon phytoplankton-dominated biogeochemistry or on aspects of fisheries regulation. In consequence the roles of zooplankton communities (protists and metazoans) linking phytoplankton and fish communities are typically under-represented if not (especially in
fisheries models) ignored. Where represented in ecosystem models, zooplankton are usually incorporated in an extremely simplistic fashion, using empirical descriptions merging various interacting physiological functions governing zooplankton growth and development, and thence ignoring physiological feedback mechanisms. Here we demonstrate, within a modelled plankton food-web system, how trophic dynamics are sensitive to small changes in parameter values describing zooplankton vital rates and thus the importance of using appropriate zooplankton descriptors. Through a comprehensive review, we reveal the mismatch between empirical understanding and modelling activities identifying important issues that warrant further experimental and modelling investigation. These include: food selectivity, kinetics of prey consumption and interactions with assimilation and growth, form of voided material, mortality rates at different age-stages relative to prior nutrient history. In particular there is a need for dynamic data series in which predator and prey of known nutrient history are studied interacting under varied pH and temperature regimes.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Aarhus University, Centre for Sustainable Aquatic Research, Instituto Español de Oceanografía, Akvaplan-niva AS, Sir Alister Hardy Foundation for Ocean Science (SAHFOS), Institut de Ciències del Mar-CSIC, University of Hamburg, Marine Research Institute, Dalhousie University, Plymouth Marine Laboratory
Pages: 176-199
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Progress in Oceanography
Volume: 129
Issue number: Part B
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
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
Bridging the gap between marine biogeochemical and fisheries sciences; configuring the zooplankton link

Building international research partnerships in the North Atlantic-Arctic region

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Woods Hole Oceanographic Institution, Old Dominion University
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Pages: 317
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: E O S
Volume: 95
Issue number: 35
ISSN (Print): 0096-3941
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.529 SNIP 0.557 CiteScore 0.64
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.408 SNIP 0.522 CiteScore 0.49
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.423 SNIP 0.648 CiteScore 0.6
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.613 SNIP 1.108 CiteScore 0.69
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Capital versus income breeding in a seasonal environment

The allocation of resources between growth, storage, and reproduction is a key trade-off in the life-history strategies of organisms. A central dichotomy is between capital breeders and income breeders. Capital breeders build reserves that allow them to spawn at a later time independently of food availability, while income breeders allocate ingested food directly to reproduction. Motivated by copepod studies, we use an analytical model to compare the fitness of income with capital breeding in a deterministic seasonal environment. We analyze how the fitness of breeding strategies depend on feeding season duration and size at maturity. Small capital breeders perform better in short feeding seasons but fall behind larger individuals when the length of the feeding season increases. Income breeding favors smaller individuals as their short generation time allows for multiple generations within a year and thereby achieve a high annual growth rate, outcompeting capital breeders in long feeding seasons. Therefore, we expect to find a dominance of small income breeders in temperate waters, while large capital breeders should dominate high latitudes where the spring is short and intense. This pattern is evident in nature, particularly in organisms with a generation time of a year or less.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Akvaplan-niva AS
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Pages: 466-476
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: American Naturalist
Volume: 184
Issue number: 4
ISSN (Print): 0003-0147
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Challenges in integrative approaches to modelling the marine ecosystems of the North Atlantic: Physics to fish and coasts to ocean

It has long been recognised that there are strong interactions and feedbacks between climate, upper ocean biogeochemistry and marine food webs, and also that food web structure and phytoplankton community distribution are important determinants of variability in carbon production and export from the euphotic zone. Numerical models provide a vital tool to explore these interactions, given their capability to investigate multiple connected components of the system and the sensitivity to multiple drivers, including potential future conditions. A major driver for ecosystem model development is the demand for quantitative tools to support ecosystem-based management initiatives. The purpose of this paper is to review approaches to the modelling of marine ecosystems with a focus on the North Atlantic Ocean and its adjacent shelf seas, and to highlight the challenges they face and suggest ways forward. We consider the state of the art in simulating oceans and shelf sea physics, planktonic and higher trophic level ecosystems, and look towards building an integrative approach with these existing tools. We note how the different approaches have evolved historically and that many of the previous obstacles to harmonisation may no longer be present. We illustrate this with examples from the ongoing and planned modelling effort in the Integrative Modelling Work Package of the EURO-BASIN programme.
General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Plymouth Marine Laboratory, Institute of Marine Research, MEMMS, Technopôle Brest Iroise, Institute of Marine Sciences, National Oceanography Centre
Pages: 285-313
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 129
Issue number: Part B
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
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
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.065 SNIP 1.422
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.859 SNIP 1.503
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.551 SNIP 1.175
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.619 SNIP 1.839
Characteristics of juvenile survivors reveal spatio-temporal differences in early life stage survival of Baltic cod

The spatio-temporal origin of surviving juvenile Baltic cod Gadus morhua was investigated by coupling age information from otolith microstructure analysis and hydrodynamic modeling, which allowed backtracking of drift routes in time and space. The suitability of hydrodynamic modeling for drift simulations of early life stages of Baltic cod up to the pelagic juvenile stage was validated by comparing model simulations with the catch distribution from a survey targeting pelagic juveniles, and mortality rates and hatch date distributions of pelagic and demersal juveniles were estimated. Hatch dates and hatch locations of juvenile survivors showed distinct patterns which did not agree well with the abundance and spatial distribution of eggs, suggesting marked spatio-temporal differences in larval survival. The good agreement of the spatio-temporal origin of survivors from this field investigation with previous modeling studies on the survival chances of early-stage larvae and with general spatio-temporal patterns of larval prey availability suggests that differences in survival are related to food availability during the early larval stage. Results are discussed in relation to the recruitment process of Baltic cod, in particular with respect to the critical period and match-mismatch hypotheses, and to possible implications for the placement of a Marine Protected Area which was established to ensure undisturbed spawning of Baltic cod.
Chemometric analysis of organic matter fluorescence

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of New South Wales, University of Copenhagen
Authors: Murphy, K. (Ekstern), Stedmon, C. (Intern), Bro, R. (Ekstern)
Number of pages: 418
Pages: 339-375
Publication date: 2014

Host publication information
Title of host publication: Aquatic organic matter fluorescence
Publisher: Cambridge University Press
Editors: Coble, P., Lead, J., Baker, A., Reynolds, D., Spencer, R. G.
ISBN (Print): 9780521764612
Chapter: 10

Series: Cambridge Environmental Chemistry Series
ISSN: 1359-0243
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Book chapter – Annual report year: 2014
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 biomass 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
Volume: 129
Issue number: Part B
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
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
Comparative impacts of temperature and trade-offs on egg ecology of north Atlantic pelagic fish species

The early life history stages of fish are considered the most vulnerable and can be strongly affected by environmental variability, leading to population fluctuations. Temperature has a major role on development and mortality rates, with consequences for recruitment and overall stock productivity. We collated development and survival data from publications on laboratory egg incubation experiments to investigate and compare the development, daily mortality and survival of fish eggs from pelagic species in the north Atlantic at different temperatures, and to investigate whether trade-offs exist between these traits at the population and species level and between habitat types (pelagic and demersal). While differing in magnitude, the response of these traits exhibited similar trends with respect to temperature, regardless of species, population or habitat type. A trade-off appears between rapid development and high mortality or slow development and low mortality, resulting in similar survivorship percentages across species. These results quantify physiological effects of temperature on the eggs and are a major factor in yielding a close correspondence between the physiological optimum temperature for survivorship and observed temperature at spawning sites. Temperature during egg development may be a key evolutionary force affecting spawning time and location.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tsoukali, S. (Intern), MacKenzie, B. (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
Defining Mediterranean and Black Sea biogeochemical subprovinces and synthetic ocean indicators using mesoscale oceanographic features

The Mediterranean and Black Seas are semi-enclosed basins characterized by high environmental variability and growing anthropogenic pressure. This has led to an increasing need for a bioregionalization of the oceanic environment at local and regional scales that can be used for managerial applications as a geographical reference. We aim to identify biogeochemical subprovinces within this domain, and develop synthetic indices of the key oceanographic dynamics of each subprovince to quantify baselines from which to assess variability and change. To do this, we compile a data set of 101 months (2002-2010) of a variety of both "classical" (i.e., sea surface temperature, surface chlorophyll-a, and bathymetry) and "mesoscale" (i.e., eddy kinetic energy, finite-size Lyapunov exponents, and surface frontal gradients) ocean features that we use to characterize the surface ocean variability. We employ a k-means clustering algorithm to objectively define biogeochemical subprovinces based on classical features, and, for the first time, on mesoscale features, and on a combination of both classical and mesoscale features. Principal components analysis is then performed on the oceanographic variables to define integrative indices to monitor the environmental changes within each resultant subprovince at monthly resolutions. Using both the classical and mesoscale features, we find five biogeochemical subprovinces for the Mediterranean and Black Seas. Interestingly, the use of mesoscale variables contributes highly in the delineation of the open ocean. The first axis of the principal component analysis is explained primarily by classical ocean features and the second axis is explained by mesoscale features. Biogeochemical subprovinces identified by the present study can be useful within the European management framework as an objective geographical framework of the Mediterranean and Black Seas, and the synthetic ocean indicators developed here can be used to monitor variability and long-term change.
Deliverable 6.6 Report on the role winter convection in controlling the basin-scale C budget
Description of *Pyramimonas diskoicola* sp. nov. and the importance of the flagellate *Pyramimonas* (Prasinophyceae) in Greenland sea ice during the winter–spring transition

*Pyramimonas Schmarda* is a genus of unicellular green flagellates, recorded in marine water and sea ice samples. *Pyramimonas* is within the prey size range of the most important protozoan grazers in Disko Bay, West Greenland, where this study took place. Despite the potential ecological importance, little is known about the occurrence of the genus. The aim of this study was to explore the biomass of *Pyramimonas* in developing stages of sea ice and in the water column. *Pyramimonas* colonized the early stages of sea ice, and the highest percent of *Pyramimonas* biomass was found in grease ice. The biomass of *Pyramimonas* was more than a magnitude higher within sea ice compared to the surface water. The results illustrate that *Pyramimonas* from the ice is an important contributor to the plankton community prior to the spring bloom. An undescribed species, *Pyramimonas diskoicola* sp. nov., was found. Based on morphology and ultrastructure, combined with molecular phylogeny inferred from the small-subunit SSU rDNA and the large-subunit chloroplast-encoded *rbcL*, the species was placed in subgenus *Vestigifera*. The cells possessed four flagella, measured 8.3 ± 2.6 lm in length and 5.1 ± 0.8 lm in width, and were characterized by an uplifted quadrant in the center of the box scales, not seen at any other *Pyramimonas* species. The phylogenetic analyses indicated *P. diskoicola* to be closely related to other polar sea ice species of *Pyramimonas*.
Distribuição e abundância do ictioplancton na região do Porto do Pecém, estado do Ceará: Distribution and abundance of ichthyoplankton in the Pecém harbor region, Ceará State

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Universidade Federal do Rio Grande
Authors: Mota, É. M. T. (Ekstern), Totufo, T. M. D. C. (Ekstern), Garcia, T. M. (Ekstern), Malanski, E. (Intern), Campos, C. C. (Ekstern)
Pages: 38-44
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Arquivos de Ciencias do Mar
Volume: 47
Issue number: 1
ISSN (Print): 0374-5686
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2014): Indexed yes
Original language: English
Publication: Research - peer-review › Journal article – Annual report year: 2015

DNA Sampling of Mnemiopsis leidyi for genotyping of populations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Jaspers, C. (Intern), Reusch, T. (Ekstern)
Pages: 76-79
Publication date: 2014

Host publication information
Title of host publication: Report of the Joint CIESM/ICES Workshop on Mnemiopsis Science (JWMS)
Series: I C E S Council Meeting
Volume: SSGHIE
Number: 14
ISSN: 1015-4744
Main Research Area: Technical/natural sciences
Publication: Research › Report chapter – Annual report year: 2015

Does the 'snot' of the oceans matter? Engaging with the public on gelatinous zooplankton. Lessons learned from The Danish Eel Expedition 2014

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Authors: Reeh, L. (Intern), Jaspers, C. (Intern), Sørensen, S. R. (Intern), Christoffersen, M. (Intern), Nielsen, T. G. (Intern), Munk, P. (Intern)
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Ecosystem-based management objectives for the North Sea: riding the forage fish rollercoaster
The North Sea provides a useful model for considering forage fish (FF) within ecosystem-based management as it has a complex assemblage of FF species. This paper is designed to encourage further debate and dialogue between stakeholders about management objectives. Changing the management of fisheries on FF will have economic consequences for all fleets in the North Sea. The predators that are vulnerable to the depletion of FF are Sandwich terns, great skua and common guillemots, and to a lesser extent, marine mammals. Comparative evaluations of management
strategies are required to consider whether maintaining the reserves of prey biomass or a more integral approach of monitoring mortality rates across the trophic system is more robust under the ecosystem approach. In terms of trophic energy transfer, stability, and resilience of the ecosystem, FF should be considered as both a sized-based pool of biomass and as species components of the system by managers and modellers. Policy developers should not consider the knowledge base robust enough to embark on major projects of ecosystem engineering. Management plans appear able to maintain sustainable exploitation in the short term. Changes in the productivity of FF populations are inevitable so management should remain responsive and adaptive.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Wageningen IMARES, University of St Andrews, Cefas, WorldFish, University of Hamburg, University of Copenhagen, University of Kiel
Authors: Dickey-Collas, M. (Ekstern), Engelhard, G. H. (Ekstern), Rindorf, A. (Intern), Raab, K. (Ekstern), Smout, S. (Ekstern), Aarts, G. (Ekstern), Deurs, M. V. (Intern), Brunel, T. (Ekstern), Hoff, A. (Ekstern), Lauerburg, R. A. (Ekstern), Garthe, S. (Ekstern), Andersen, K. H. (Intern), Scott, F. (Ekstern), Kooten, T. V. (Ekstern), Beare, D. (Ekstern), Peck, M. A. (Ekstern)
Pages: 128-142
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 1
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
Web of Science (2016): Indexed yes
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
**Eels in culture, fisheries and science in Denmark**

**General information**

*State:* Published

*Organisations:* National Institute of Aquatic Resources, Secretariat for Management and Communication, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Freshwater Fisheries Ecology, Section for Marine Living Resources, Section for Administration and Service, Danish Eel Farmers Association


*Pages:* 41-61

*Publication date:* 2014

**Host publication information**

*Title of host publication:* Eels and humans

*Place of publication:* Tokyo

*Publisher:* Springer

*Editors:* Tsukamoto, K., Kuroki, M.

*ISBN (Print):* 978-4-431-54528-6

*Chapter:* 3

*Series:* Humanity and the Sea

*ISSN:* 2213-607X

*Main Research Area:* Technical/natural sciences

*DOIs:* 10.1007/978-4-431-54529-3_3

*Publication:* Research - peer-review › Book chapter – Annual report year: 2013

**Effects of dietary fatty acids on the production and quality of eggs and larvae of Atlantic cod (Gadus morhua L.)**

Cultivated Atlantic cod (Gadus morhua) entering their first year of gamete maturation were fed diets with different levels of arachidonic acid (ARA) and eicosapentaenoic acid (EPA) for 6.5 months prior to commencement of spawning. Gravid females were stripped three times: at the beginning, peak and end of spawning. Lipid composition and egg and larval quality of 34 family crosses were investigated. Results indicated that ARA uptake into eggs from broodstock diet was highly efficient achieving proportions of ARA up to 84% higher in eggs than in the diet. EPA was 42–76% higher, and DHA was 155–173% higher in eggs than in diets. Cod fed the diet with the lowest EPA/ARA ratio had the greatest egg production. Eggs from fish on a diet with high ARA level had significantly higher fertilization and hatching success than those fed low levels of ARA. This diet produced on average 71 viable eggs g 1 female compared with 32.5 and 4 eggs in diet B and C, respectively. Furthermore, larval survival until 8 days posthatch was higher in diets with lower ARA levels. The combined results showed that ARA dietary supplementation and low EPA/ARA ratio yielded a greater number of viable larvae kg 1 female

**General information**

*State:* Published

*Organisations:* National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, National Food Institute, Division of Industrial Food Research, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Fisheries and Oceans Canada

*Authors:* Røjbek, M. (Intern), Støttrup, J. (Intern), Jacobsen, C. (Intern), Tomkiewicz, J. (Intern), Nielsen, A. (Intern), Trippel, E. (Ekstern)

*Pages:* 654-666
Effects of reproduction on growth and survival in Atlantic cod, Gadus morhua, assessed by comparison to triploids

Despite increasing interest in optimal life history theory and the associated physiological, ecological and evolutionary processes, little information exists on gonad-soma tradeoffs and longevity of individuals over long time periods. We examined somatic and survival costs of reproduction in captive iteroparous, batch-spawning Atlantic cod (Gadus morhua), utilizing diploids and triploids, knowing that triploid females invest little to no energy into gametogenesis. Based on annual specific growth rate, there was no evidence for a somatic cost of reproduction at ages 2 (virgin year) and 4. years, but there was at age 3. years. At age 2. years, low investment in reproduction likely accounted for the lack of a somatic cost of reproduction, whereas at age 4 the absence was associated with heightened growth post-spawning enabling mature fish to catch up to immature fish. At age 3, compensatory growth during post-spawning was below that of immature fish. Survival represented a significant component of the cost of reproduction. Laboratory experiments examining the cost of reproduction have traditionally focused on shorter time periods, commonly spanning several months, whereas ours spanned nearly four years. Although previously done for bivalves, to our knowledge, this is the first time the cost of reproduction has been evaluated using triploid fish as a comparator.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Fisheries and Oceans Canada, University of New Brunswick
Authors: Trippel, E. A. (Ekstern), Butts, I. (Intern), Babin, A. (Ekstern), Neil, S. R. (Ekstern), Feindel, N. J. (Ekstern), Benfey, T. J. (Ekstern)
Pages: 35-43
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Experimental Marine Biology and Ecology
Volume: 451
ISSN (Print): 0022-0981
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 2.03 SJR 0.937 SNIP 0.914
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.043 SNIP 0.823 CiteScore 1.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.145 SNIP 1.045 CiteScore 2.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.294 SNIP 1.08 CiteScore 2.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.186 SNIP 1.021 CiteScore 2.27
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.067 SNIP 1.007 CiteScore 2.14
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.239 SNIP 1.017
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.299 SNIP 1.208
Estimating spatio-temporal dynamics of size-structured populations
Spatial distributions of structured populations are usually estimated by fitting
abundance surfaces for each stage and at each point of time separately, ignoring correlations that emerge from growth of
individuals. Here, we present a statistical model that combines spatio-temporal correlations with simple stock dynamics, to
estimate simultaneously how size distributions and spatial distributions develop in time. We demonstrate the method for a
cod population sampled by trawl surveys. Particular attention is paid to correlation between
size classes within each trawl haul due to clustering of individuals with similar size. The model estimates growth, mortality
and reproduction, after which any aspect of size-structure, spatio-temporal population dynamics, as well as the sampling
process can be probed. This is illustrated by two applications: 1) tracking the spatial movements of a single cohort through
time, 2) predicting the risk of by-catch of undersize individuals. The method demonstrates that it is possible to combine
stock assessment and spatio-temporal dynamics, however at
a high computational cost. The model can be extended by increasing its ecological fidelity, although computational
feasibility eventually becomes limiting

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, National
Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Kristensen, K. (Intern), Thygesen, U. H. (Intern), Andersen, K. H. (Intern), Beyer, J. E. (Intern)
Pages: 326-336
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 71
Issue number: 2
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
European eel as experimental model I: Assisted reproduction technology and standardized fertilization methods for mass production of viable embryos and larvae

General information
Evaluation of integrated ecological-economic models - What are they used for?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tomkiewicz, J. (Intern)
Publication date: 2014
Event: Abstract from DAFINET and Targetfish FP7 Workshop –Fish models in Research, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Examining the interactions of growth, climate and recruitment of boarfish (Capros aper) for a better understanding of the recent population expansion

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Lund University
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Explaining life history variation in a changing climate across a species' range

Timing of reproduction greatly influences offspring success and resulting population production. Explaining and predicting species’ dynamics necessitates disentangling the intrinsic (genotypic) and extrinsic (climatic) factors controlling reproductive timing. Here we explore temporal and spatial changes in spawning time for 21 populations of Atlantic cod (Gadus morhua) across the species' range (40 degrees to 80 degrees N). We estimate spawning time using a physiologically relevant metric that includes information on fish thermal history (degree-days, DD). First, we estimate spawning DD among years (within populations) to show how recent changes in spawning time can be explained by local changes in temperature. Second, we employ spawning DD to identify temperature-independent trends in spawning time among populations that are consistent with parallel adaptive evolution and the evolutionary history of the species. Finally, we use our results to estimate spawning time under future climate regimes, and discuss the implications for cod ecology across the species' range.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Neuheimer, A. B. (Intern), MacKenzie, B. R. (Intern)
ECOLOGY, COD GADUS-MORHUA, HADDOCK MELANOGRAMMUS-AEGLEFINUS, SIZE-AT-AGE, EXPLOITED MARINE FISH, GROWING DEGREE-DAY, ATLANTIC COD, SEXUAL-MATURATION, COUNTERGRADIENT VARIATION, ADAPTIVE EVOLUTION, WARMING WATERS, Atlantic cod, climate change, evolutionary biology, Gadus morhua, macroecology, North Atlantic Ocean, phenology, temperature
Explaining variation in life history timing across a species range: Effects of climate on spawning time in an exploited marine fish

The capacity of a species to tolerate and/or adapt to environmental conditions will shape its response to future climate change including climate extremes. Of the many life-history processes affected by climate change, timing of reproduction greatly influences offspring success and resulting population production. Here we explore temporal and spatial changes in spawning time for Atlantic cod (Gadus morhua) across the species’ range (4 to 80°N). We estimate spawning time using a physiologically relevant metric that includes information on fish thermal history (degree days, DD). First, we estimate spawning DD among years (within populations) to show recent changes in spawning time can be explained by local changes in temperature. Second, we employ spawning DD to identify temperature independent trends in spawning time among populations that are consistent with the evolutionary history of the species. Combined, these results shed light on the adaptive capacity of the species in the face of changing climate. We use our results to estimate expected spawning time under future climate regimes, and discuss the implications for codeology and management across the species’ range, and in the greater ecosystem.

Feeding opportunities and growth of larval cod (Gadus morhua) in a Greenlandic fjord

Feeding opportunities of larval and juvenile cod (Gadus morhua) in a Greenlandic fjord: temporal and spatial linkages between cod and their preferred prey

Feeding of fish depends on a spatial and temporal match with prey, and since larval and juvenile feeding can be highly selective, their preferences for given prey sizes and taxa should be considered when quantifying the actual availability of potential prey. We investigated the diet and prey preferences of the early-life stages of Atlantic cod (Gadus morhua) to quantify the availability of prey during a spring-summer season in a West Greenlandic fjord. We hypothesized that abundances of larval and juvenile cod at size were synchronized to optimal availability of preferred prey in space and time. The present analysis is based on nine cruises each covering 5 stations visited between 24 May and 5 August 2010 comparing zooplankton abundance, cod gut content and distribution patterns. Cod 4–25 mm in length preferred prey of about 5 % of their own length. During ontogeny, their preferences changed from calanoid nauplii towards Pseudocalanus spp. and Calanus spp. copepodites. The larvae/juvenile had an exceptionally high dietary contribution from cladocerans, which were highly preferred by cod larger than 9 mm, while the abundant Metridia longa and the non-calanoid copepods contributed less. These findings stress the importance of focusing on abundance of preferred prey when assessing the actual prey availability to young fish. We found a spatio-temporal overlap between cod and their preferred prey, and observations suggest that advection of both zooplankton and cod contributed to this overlap. Hence, the larval feeding opportunities might be sensitive to climate-related changes affecting the circulation patterns in this fjord.
Fishing out collective memory of migratory schools

Animals form groups for many reasons but there are costs and benefit associated with group formation. One of the benefits is collective memory. In groups on the move, social interactions play a crucial role in the cohesion and the ability to make consensus decisions. When migrating from spawning to feeding areas fish schools need to retain a collective memory of the destination site over thousand of kilometers and changes in group formation or individual preference can produce sudden changes in migration pathways. We propose a modelling framework, based on stochastic adaptive networks, that can reproduce this collective behaviour. We assume that three factors control group formation and school migration behaviour: the intensity of social interaction, the relative number of informed individuals and the preference that each individual has for the particular migration area. We treat these factors independently and relate the individuals’ preferences to the experience and memory for certain migration sites. We demonstrate that removal of knowledgable individuals or alteration of individual preference can produce rapid changes in group formation and collective behavior. For example, intensive fishing targeting the migratory species and also their preferred prey can reduce both terms to a point at which migration to the destination sites is suddenly stopped. The conceptual approaches represented by our modelling framework may therefore be able to explain large-scale changes in fish migration and spatial distribution.
Fish larvae at fronts: Horizontal and vertical distributions of gadoid fish larvae across a frontal zone at the Norwegian Trench

The reproduction and early life history of many fish species are linked to the physical and biological characteristics of fronts. In order to ascertain linkages between frontal physics and fish larvae, we investigated distributional differences among gadoid fish larvae comparing these to both horizontal and vertical variability in hydrography and abundances of potential copepod prey. The investigation was carried out at a frontal zone along the Norwegian Trench in the northern North Sea, and was based on a series of cross-bathymetric sampling transects. Tows with a large ring net and an opening-closing net were used for describing fish larval horizontal and vertical distributions, while a submersible pump was used for describing vertical distributions of copepods. Hydrographic profiles and current velocity measurements were used to outline variability in temperature, salinity and current structure. Measurements demonstrated a distinct bottom front at the southern slope of the Trench with deepening isopycnals and high chlorophyll a concentrations. Abundances of both gadoid fish larvae and copepods peaked in vicinity of the front around mid-depth, and findings point to an inter-connection between the vertical and horizontal distributions of each species. However, the three-dimensional pattern of distribution differed significantly among species of larvae and species of copepods. The study underlines the complexity of bio-physical interrelationships in the frontal zone, and indicates that the zone encompasses specific ecological niches to which each species of fish larvae is adapted.
Forage fish interactions: A symposium on creating the tools for ecosystem-based management of marine resources

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Pages: 1-4
Publication date: 2014
Main Research Area: Technical/natural sciences
Forage fish, their fisheries, and their predators: who drives whom?
The North Sea has a diverse forage fish assemblage, including herring, targeted for human consumption; sandeel, sprat, and Norway pout, exploited by industrial fisheries; and some sardine and anchovy, supporting small-scale fisheries. All show large abundance fluctuations, impacting on fisheries and predators. We review field, laboratory, and modelling
studies to investigate the drivers of this complex system of forage fish. Climate clearly influences forage fish productivity; however, any single-species considerations of the influence of climate might fail if strong interactions between forage fish exist, as in the North Sea. Sandeel appears to be the most important prey forage fish. Seabirds are most dependent on forage fish, due to specialized diet and distributional constraints (breeding colonies). Other than fisheries, key predators of forage fish are a few piscivorous fish species including saithe, whiting, mackerel, and horse-mackerel, exploited in turn by fisheries; seabirds and seals have a more modest impact. Size-based foodweb modelling suggests that reducing fishing mortality may not necessarily lead to larger stocks of piscivorous fish, especially if their early life stages compete with forage fish for zooplankton resources. In complex systems, changes in the impact of fisheries on forage fish may have potentially complex (and perhaps unanticipated) consequences on other commercially and/or ecologically important species.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Cefas, University of Hamburg, University of St Andrews, Wageningen IMARES, University of Kiel
Authors: Engelhard, G. H. (Ekstern), Peck, M. A. (Ekstern), Rindorf, A. (Intern), Smout, S. (Ekstern), Deurs, M. V. (Intern), Raab, K. (Ekstern), Andersen, K. H. (Intern), Garthe, S. (Ekstern), Lauerburg, R. A. (Ekstern), Scott, F. (Ekstern), Brunel, T. (Ekstern), Aarts, G. (Ekstern), Kooten, T. V. (Ekstern), Dickey-Collas, M. (Ekstern)
Pages: 90-104
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information

Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 1
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
From fish to phytoplankton

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: 2014
Event: Abstract from NorMER Annual Meeting 2014, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication information
Volume: 107
ISSN (Print): 0967-0645
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 2.35 SJR 1.335 SNIP 0.962
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.327 SNIP 1.063 CiteScore 2.5
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.735 SNIP 1.092 CiteScore 2.68
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.221 SNIP 1.32 CiteScore 3.06

Fronts, fish, and predators

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Rhode Island, University of Washington, National Oceanographic and Atmospheric Administration, University of St Andrews, Universidade dos Açores, Stony Brook University, University of Maryland, University of Tokyo, Pelagic Research Group LLC, Turnpenny Horsfield Associates, Chinese Academy of Sciences
Authors: Belkin, I. M. (Ekstern), Hunt, G. L. (Ekstern), Hazen, E. L. (Ekstern), Zamon, J. E. (Ekstern), Schick, R. S. (Ekstern), Prieto, R. (Ekstern), Brodziak, J. (Ekstern), Teo, S. L. (Ekstern), Thorne, L. (Ekstern), Bailey, H. (Ekstern), Itoh, S. (Ekstern), Munk, P. (Intern), Musyl, M. K. (Ekstern), Willis, J. K. (Ekstern), Zhang, W. (Ekstern)
Pages: 1-2
Publication date: 2014
Main Research Area: Technical/natural sciences
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.84 SNIP 1.152 CiteScore 2.59
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.843 SNIP 1.098 CiteScore 2.6
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.905 SNIP 1.098
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.763 SNIP 1.114
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.432 SNIP 1.03
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.561 SNIP 1.052
Scopus rating (2006): SJR 1.745 SNIP 1.021
Scopus rating (2005): SJR 2.099 SNIP 1.106
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.919 SNIP 1.102
Scopus rating (2003): SJR 2.42 SNIP 1.01
Scopus rating (2002): SJR 2.271 SNIP 1.336
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.642 SNIP 1.348
Scopus rating (2000): SJR 2.97 SNIP 1.242
Scopus rating (1999): SJR 3.364 SNIP 1.351
Original language: English
DOIs:
10.1016/j.dsr2.2014.07.009
Source: FindIt
Source-ID: 269468761
Publication: Research - peer-review › Journal article – Annual report year: 2014

**Functional biology and ecological role of krill in Northern marine ecosystems**

Krill is an understudied key group of zooplankton, which transfers energy through the food web by linking lower and higher trophic levels. Furthermore, krill play an important role in the biological pump by transporting carbon out of the euphotic zone to depth by diel vertical migration (DVM) and by production of fast sinking carbon-rich faecal pellets. Hence, the large schools of krill greatly influence the pelagic food web and the flux of organic matter in the sea. However, knowledge of the distribution and feeding biology in krill from northern areas is scarce, although of importance to get a better understanding of the marine ecosystems and food webs. This thesis aimed to gain more knowledge of krill in northern hemisphere and to study their trophic position and grazing impact in a sub-Arctic fjord. The project investigated i) species and population composition of krill in the area of Godthåbsfjord, SW Greenland, ii) trophic position and feeding rates of krill on different groups of plankton, and iii) in situ grazing impacts. The approach was a combination of field studies and controlled laboratory experiments. We found four krill species to coexist in Godthåbsfjord; Meganyctiphanes norvegica, Thysanoessa longicaudata, T. inermis and T. raschii. Species distribution was related to the oceanographic regimes, and different species dominated outside vs. inside the fjord. Temperature had an effect on the maturation of the krill. In regions with warmer temperatures, maturation occurred at an earlier life stage, than in regions with colder temperatures. Results from stable isotope analyses and feeding experiments show that there is an overlap in the diet of the species and that they are able to exploit several trophic levels. Trophic positions are related to available prey. However, the size of the krill seemed to be the key factor determining the trophic position of a species, where the largest species had the highest trophic position. The species were feeding on the same food items, which could lead to competition for food. However, there is a difference between the two functional groups, represented by M. norvegica and Thysanoessa spp., where the former feed on large copepods, whereas the latter feed on smaller cells such as flagellates. This difference in feeding could reduce interspecific competition if food is scarce, and thereby make coexistence possible. The in situ grazing impact in early summer was estimated for the two dominating species within the fjord, T. inermis and T. raschii. The krill grazed < 1% of the phytoplankton standing stock in Godthåbsfjord, and therefore did not control the phytoplankton community at this time of year. Yet, the grazing impact was similar to the copepods', which are normally assumed to be the main grazers in
marine ecosystems. This suggests that krill could be and are - in the case of Godthåbsfjord - important grazers that deserve more attention in future monitoring and research programs.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Agersted, M. D. (Intern), Nielsen, T. G. (Intern), St. John, M. (Intern)
Number of pages: 153
Publication date: 2014

**Publication information**
Place of publication: Charlottenlund
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: 2014

Gelatinous zooplankton on a global perspective: interactions with fisheries and consequences for socio-economics

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Jaspers, C. (Intern), Brodeur, R. D. (Ekstern), Acuña, J. L. (Ekstern)
Number of pages: 1
Publication date: 2014
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers Brewers version

**Bibliographical note**
ICES Theme session A
Publication: Research › Paper – Annual report year: 2014

Genome- and transcriptome-assisted development of nuclear insertion/deletion markers for Calanus species (Copepoda: Calanoida) identification

Copepods of the genus Calanus are key zooplankton species in temperate to arctic marine ecosystems. Despite their ecological importance, species identification remains challenging. Furthermore, the recent report of hybrids among Calanus species highlights the need for diagnostic nuclear markers to efficiently identify parental species and hybrids. Using next-generation sequencing analysis of both the genome and transcriptome from two sibling species, Calanus finmarchicus and Calanus glacialis, we developed a panel of 12 nuclear insertion/deletion markers. All the markers showed species-specific amplicon length. Furthermore, most of the markers were successfully amplified in other Calanus species, allowing the molecular identification of Calanus helgolandicus, Calanus hyperboreus and Calanus marshallae.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Nordland, Plymouth Marine Laboratory, Sir Alister Hardy Foundation for Ocean Sciences, Aarhus University, University of Connecticut
Authors: Smolina, I. (Ekstern), Kollias, S. (Ekstern), Poortvliet, M. (Ekstern), Nielsen, T. G. (Intern), Lindeque, P. (Ekstern), Castellani, C. (Ekstern), Møller, E. (Ekstern), Blanco-Bercial, L. (Ekstern), Hoarau, G. (Ekstern)
Pages: 1072-1079
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Molecular Ecology Resources
Volume: 14
Issue number: 5
ISSN (Print): 1755-098X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Havforskningsskibet Dana er netop vendt hjem fra Østersøen

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Storr-Paulsen, M. (Intern), Huwer, B. (Intern)
Pages: 9
Publication date: 2014

Publication information
Pages (from-to): 9
Newspaper: Fiskeritidende
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)
Publication date: 2014
Event: Abstract from Johan Hjort Symposium, Bergen, Norway.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

How does prey quality affect life-history traits under different temperature regimes?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Holt, R. (Ekstern), Deurs, M. V. (Intern), Andersen, N. G. (Intern), Nielsen, J. R. (Intern), Jørgensen, C. (Ekstern)
Publication date: 2014
Event: Abstract from 11th International Congress on the Biology of Fish, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

ICES and PICES strategies for coordinating research on the impacts of climate change on marine ecosystems
The social, economic, and ecological consequences of projected climate change on fish and fisheries are issues of global concern. In 2012, the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES) established a Strategic Initiative on Climate Change Effects on Marine Ecosystems (SICCME) to synthesize and to promote innovative, credible, and objective science-based advice on the impacts of climate change on marine ecosystems in the Northern Hemisphere. SICCME takes advantage of the unique and complementary strengths of the two organizations to develop a research initiative that focuses on their shared interests. A phased implementation will ensure that SICCME will be responsive to a rapidly evolving research area while delivering ongoing syntheses of existing knowledge, thereby advancing new science and methodologies and communicating new insights at each phase.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Pukyong National University, Plymouth Marine Laboratory, National Oceanographic and Atmospheric Administration
Authors: Kim, S. (Ekstern), Hollowed, A. B. (Ekstern), Barange, M. (Ekstern), MacKenzie, B. (Intern)
Pages: 160-167
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Oceanography
Volume: 27
Issue number: 4
ISSN (Print): 1042-8275
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): SJR 1.729 SNIP 1.164 CiteScore 2.4
Ichthyodinium identified in the eggs of European eel (Anguilla anguilla) spawned in captivity

A presumed parasitic protozoan was found in the eggs of European eel obtained from an experiment on captive breeding of eel, Anguilla anguilla, based on silver eels from a freshwater lake in the northern part of Denmark. Gross morphology of the organism was comparable to that of early stages of Ichthyodinium, a syndinian dinoflagellate parasite found in pelagic eggs of various marine fish species. Sequences of genes coding for small subunit ribosomal RNA confirmed that the organism was an Ichthyodinium species, and molecular phylogenetic analysis demonstrated the presence of two Ichthyodinium genotypes: one occurring in the Atlantic Ocean and adjacent coastal waters and one in the Pacific Ocean area. The inclusion of several GenBank-derived environmental gene sequences, from the Caribbean Sea, revealed to represent Ichthyodinium, suggesting that this parasite genus is ubiquitous in the World's oceans.
Implementing ecosystem-based fisheries management: from single-species to integrated ecosystem assessment and advice for Baltic Sea fish stocks

Theory behind ecosystem-based management (EBM) and ecosystem-based fisheries management (EBFM) is now well developed. However, the implementation of EBFM exemplified by fisheries management in Europe is still largely based on single-species assessments and ignores the wider ecosystem context and impact. The reason for the lack or slow
implementation of EBM and specifically EBFM is a lack of a coherent strategy. Such a strategy is offered by recently developed integrated ecosystem assessments (IEAs), a formal synthesis tool to quantitatively analyse information on relevant natural and socio-economic factors, in relation to specified management objectives. Here, we focus on implementing the IEA approach for Baltic Sea fish stocks. We combine both tactical and strategic management aspects into a single strategy that supports the present Baltic Sea fish stock advice, conducted by the International Council for the Exploration of the Sea (ICES). We first review the state of the art in the development of IEA within the current management framework. We then outline and discuss an approach that integrates fish stock advice and IEAs for the Baltic Sea. We intentionally focus on the central Baltic Sea and its three major fish stocks cod (Gadus morhua), herring (Clupea harengus), and sprat (Sprattus sprattus), but emphasize that our approach may be applied to other parts and stocks of the Baltic, as well as other ocean areas.
Implications of stock recovery for a neighbouring management unit: experience from the Baltic cod

Cod in the Baltic Sea is assessed and managed as two separate stocks, i.e. eastern and western Baltic cod. The eastern Baltic cod has recently started to recover after several decades of severe depletion. In the present study, we suggest that the recovery of the eastern Baltic cod population has also substantially increased cod abundance in a specific area of the adjacent western Baltic management unit. This is investigated through long time-series of spatially resolved stock assessment data supplemented by genetic analyses of origin of the cod currently found in the transition area between the two populations. Due to immigrating cod from the east, there are currently large spatial differences in cod abundance and mean weight in the western Baltic management unit that raise new management concerns. First, the high abundance of cod of eastern origin found in the western Baltic management unit can mask the relatively poor state of the western Baltic cod population. Second, the current fishing mortality estimates for the entire western Baltic management unit, used as basis for fisheries management, are difficult to interpret as these are highly influenced by mixing of biological populations and the spatial distribution of fisheries.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Eero, M. (Intern), Hansen, J. H. (Intern), Hüsey, K. (Intern)
Pages: 1458-1466
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 6
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
Importance of deep mixing for initiating the North Atlantic spring bloom

The phytoplankton spring bloom is one of the most important recurrent events in the sup-polar part of the Atlantic Ocean. The classical idea is that the bloom is controlled by nutrients and light, but recent observations challenge this hypothesis. During repeated visits to stations in the deep Icelandic and the Norwegian Basins and the shallow Shetland Shelf (26 March to 1 May 2012), we investigated the succession and growth dynamics of microscopic grazers prior to the bloom. We demonstrate that deep mixing of the water column play an important role for predator-prey interactions and that a released grazing pressure could initiate the bloom.

Importance of food web dynamics in coupling of multispecies models and bio-economic fisheries management evaluation models

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Nielsen, J. R. (Intern), Gislason, H. (Intern), Andersen, N. G. (Intern), Vinther, M. (Intern), Bastardie, F. (Intern)

Improving biophysical rearing conditions during early life stages of European eel

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Sørensen, S. R. (Intern)
Publication date: 2014
Event: Abstract from DAFINET and Targetfish FP7 Workshop –Fish models in Research, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Influences of deep convection on the inocculum of the phytoplankton spring bloom in the North Atlantic

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Lindemann, C. (Intern), St. John, M. (Intern), Backhaus, J. (Ekstern)
Publication date: 2014
Event: Poster session presented at ASLO Ocean Sciences Meeting, Honolulu, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

Introduction to the BASIN Special Issue: State of art, past present a view to the future

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Research Secretariat, Plymouth Marine Laboratory, AZTI-Tecnalia, Institute of Marine Research, IFREMER, National Oceanography Centre, Swansea University, Woods Hole Oceanographic Institution, Old Dominion University
Authors: St. John, M. (Intern), Barange, M. (Ekstern), Benway, H. (Ekstern), Flynn, K. J. (Ekstern), Holt, J. (Ekstern), Merino, G. (Ekstern), Martin, A. (Ekstern), Mitra, A. (Ekstern), Melle, W. (Ekstern), Sanders, R. (Ekstern), Trenkel, V. (Ekstern), Grigorov, I. (Intern), Hoffman, E. (Ekstern)
Pages: 171-175
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Progress in Oceanography
Volume: 129 B
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
Krill community composition and grazing biology in a sub-Arctic Greenlandic fjord

Several studies have described the role of copepods in Arctic marine food webs. However, knowledge about larger zooplankton organisms like krill are very limited. Krill is an important food source for many marine animals and they are potentially a significant contributor to the vertical flux of organic material, i.e. the biological pump. Our aim is to improve the understanding and knowledge about the role of krill in a sub-Arctic fjord. During multiple cruises in the Godthåbsfjord, Southwest Greenland, krill abundance, distribution and grazing biology have been investigated through field and laboratory experiments. In situ gut fluorescence experiments have been conducted to estimate gut evacuation and ingestion rates of the dominating species Thysanoessa raschii and T. inermis. Furthermore, the functional biology of T. raschii on the diatom Thalassiosira weissflogii has been examined. The present novel knowledge about krill abundance and grazing biology will provide the basis for a discussion of the role of krill in the pelagic food web of the sub-Arctic Godthåbsfjord.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Greenland Institute of Natural Resources
Authors: Teglhus, F. W. (Ekstern), Agersted, M. D. (Intern), Arendt, K. E. (Ekstern), Nielsen, T. G. (Intern)
Publication date: 2014
Event: Abstract from ESSAS Annual Science Meeting, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Kunstig befrugtning og babyboom i ålens verden

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tomkiewicz, J. (Intern), Sørensen, S. R. (Intern)
Publication date: 2014
Event: Abstract from Dansk Selskab for Marinbiologi, Fyraftensmøde, København, Denmark.
Main Research Area: Technical/natural sciences

KYSTFISK I. Kortlægning af de kystnære fiskebestandes udvikling på basis af fiskernes egne observationer i perioden fra 1980’erne til 2013

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Støttrup, J. (Intern), Lund, H. S. (Ekstern), Kindt-Larsen, L. (Intern), Egekvist, J. (Intern), Munk, P. (Intern), Stenberg, C. (Intern)
Number of pages: 45
Publication date: 2014

KYSTFISK I. Udviklingen i kystnære fiskebestande. Slutrapport

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Monitoring and Data
Authors: Støttrup, J. (Intern), Lund, H. S. (Ekstern), Munk, P. (Intern), Dutz, J. (Intern), Kindt-Larsen, L. (Intern), Egekvist, J. (Intern), Stenberg, C. (Intern), Nielsen, T. G. (Intern)
Number of pages: 21
Publication date: 2014
Larval production and survival during the early larval stage in European eel

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Billund Aquaculture Service Aps, Danish Aquaculture Organisation
Authors: Tomkiewicz, J. (Intern), Butts, I. (Intern), Sørensen, S. R. (Intern), Politis, S. N. (Intern), Lauesen, P. (Ekstern), Krüger-Johnsen, M. (Intern), Graver, C. (Ekstern)
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2014

Light impacts embryonic and early larval development of the European eel, Anguilla anguilla
Little is known about the natural ecology of European eel during early life history. We extend our understandings on the ecology of this species by studying how early life stages perform under various light regimes. We assessed the effects of intensity, photoperiod (12:12 and 24:0 h light/dark) and spectral composition on embryonic survival, hatch success, larval morphology and survival at 5 days post-hatch. Treatments consisted of low intensity white (full spectrum, 2.2 μmol m-2 s-1), blue (~470 nm, 0.7 μmol m-2 s-1), green (~530 nm, 0.4 μmol m-2 s-1), red (~690 nm, 0.2 μmol m-2 s-1) and high intensity white (full spectrum, 10.5 μmol m-2 s-1), blue (~470 nm, 3.9 μmol m-2 s-1), green (~530 nm, 1.5 μmol m-2 s-1), and red light (~690 nm, 1.1 μmol m-2 s-1). Additionally, offspring were reared in continuous darkness (0:24 h light/dark). Results showed that light critically influenced early life stages. In particular, for the 12:12 h photoperiod, embryonic survival, until 26 h post-fertilization was significantly higher when reared under low (62 ± 13%) than those reared under high intensity light (42 ± 13%). Furthermore, embryos reared in low light had a higher hatch success (16 ± 7%) than those in high intensity light (12 ± 7%). Larval yolk-sac area was significantly affected by photoperiod and body area was significantly affected by the interaction between intensity × photoperiod. The highest incidence of deformities (75%) occurred when embryos were reared in high intensity white light under a 24:0 h light/dark photoperiod. Larval survival was significantly affected by light regime, such that larvae reared in low light intensity had higher survival (20 ± 8%) than those reared in high intensity (11 ± 8%), larvae reared in the 12:12 h photoperiod had higher survival (19 ± 8%) than those reared in the 24:0 h light/dark photoperiod (13 ± 8%), and larvae reared in red light (22 ± 8%) had higher survival than those reared in green (14 ± 8%) or white light (11 ± 8%). Under continuous darkness, development and survival of offspring was as high as the best intensity-photoperiod-spectral composition regime. For all early life history traits, a strong maternal effect was evident, such that offspring of ‘poorer’ quality showed lower adaptability to extrinsic factors than offspring of higher quality. Together, these findings suggest a preference for no or low light during embryogenesis and no or 12:12 h low red light during the pre-leptocephalus stage.
Links between implementation of Water Framework Directive and changes in plaice distribution along the Danish west coast

General information
State: Published
Live discrimination of Calanus glacialis and C. finmarchicus females: can we trust phenological differences?

Two key players in the Arctic and subarctic marine ecosystem are the calanoid copepods, Calanus finmarchicus and C. glacialis. Although morphologically very similar, these sibling species have different life cycles and roles in the Arctic pelagic marine ecosystem. Considering that the distribution of C. glacialis corresponds to Arctic water masses and C. finmarchicus to Atlantic water masses, the species are frequently used as climate indicators. Consequently, correct identification of the two species is essential if we want to understand climate-impacted changes on Calanus-dominated marine ecosystems such as the Arctic. Here, we present a novel morphological character (redness) to distinguish live females of C. glacialis and C. finmarchicus and compare it to morphological (prosome length) and genetic identification.

The characters are tested on 300 live females of C. glacialis and C. finmarchicus from Disko Bay, western Greenland. Our analysis confirms that length cannot be used as a stand-alone criterion for separation. The results based on the new morphological character were verified genetically using a single mitochondrial marker (16S) and nuclear loci (six microsatellites and 12 InDels). The pigmentation criterion was also used on individuals (n = 89) from Young Sound fjord, northeast Greenland to determine whether the technique was viable in different geographical locations. Genetic markers based on mitochondrial and nuclear loci were corroborative in their identification of individuals and revealed no hybrids. Molecular identification confirmed that live females of the two species from Greenlandic waters, both East and West, can easily be separated by the red pigmentation of the antenna and somites of C. glacialis in contrast to the pale opaque antenna and somites of C. finmarchicus, confirming that the pigmentation criterion is valid for separation of the two species.
Long-term changes of euphausiids in shelf and oceanic habitats southwest, south and southeast of Iceland

Generalized additive models (GAMs) were used to test the hypothesis that changes in physical and biological environmental conditions affected by current climatic warming would negatively impact the euphausiid populations in the North Atlantic. Two zooplankton time series were used, one collected by the Marine Research Institute (MRI) on a transect south of Iceland during spring (1990–2011) and the other by the Continuous Plankton Recorder (CPR) survey (1958–2007) in the oceanic waters south of Iceland covering all months. Due to limitations of the sampling gears used, the results mainly reflect the variations of the early stages of euphausiids. On a spatial scale, results reveal a general decline of euphausiid abundance from the east coast of Greenland to the Faroe Islands. On a temporal scale, euphausiid numbers decreased in most CPR areas from 1958 to 2007. Conversely, an increase was observed in numbers of larvae during spring 1990–2011 for the shelf south of Iceland. Single variable-based GAMs indicated that phytoplankton biomass was generally the main environmental factor regulating euphausiid abundance. Multiple variable-based GAMs showed that phytoplankton biomass was the strongest predictor of euphausiid abundance in the west, whereas in the east temperature appears to be most important. In addition, the onset of the spring bloom also affected the long-term changes in euphausiid abundance. For the oceanic areas, it is concluded that a weakened temporal synchrony between the development of young euphausiids and the phytoplankton bloom influenced by recent climate warming may have led to the observed decrease in euphausiid populations.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Marine Research Institute, Sir Alister Hardy Foundation for Ocean Science (SAHFOS), University of Iceland
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Marine microplastics - Method development for detection of plastic particles from sea water down to 10 μm

During the past few years and especially in 2014, plastic pollution has gained a lot of media attention and public awareness is rising. Management plans and policies start to adopt strategies for mitigating effects and reducing entry of marine litter and beached plastic. Strangled seals or plastic ingesting seabirds are perceived easily by the broad public through emotionally charged photographs and personal experiences on beaches all around the globe. Monitoring programs, beach clean-ups, source elimination, and societal changes such as local bans of single-use plastic bags or outphasing of microbeads in personal care products are being talked of frequently. All together, this increases the acceptance of allocation of public resources on environmental programs. In contrast it is hard to draw someones attention to possible effects of microplastics on community structures of organisms on the bottom of the food web, whose existence and importance we are rarely aware of. There are chances for severe impacts in plastic accumulating ocean gyres which are of oligotrophic nature and consequently low food availability. So far the concentrations, biological impact and the fate of disintegrating plastics in the marine environment are still not enough understood, especially with perspective on the ecosystem as a whole. Zooplankton, free-floating animals that often live of single-celled algae, form the link between primary production and higher trophic level organisms, including commercially important fish species and therefore human food resources. Microplastic, either as degradation product from plastic litter or directly introduced as microfibres, microbeads or plastic resin pellets, have been found by many studies down to sizes of a few micrometres, which is in the food size range of most zooplankter. The physical and chemical harm from ingestion can not be quantified yet, and also data on distribution of particles smaller than 300 μm is sparse. The handling and analysis of those small microplastics is still difficult and no working standard methods are in place. Here we show our ongoing work on a sample set from a cross Atlantic transect to estimate the concentration of microplastic from 10 μm and larger based on visual identification supported by Raman microspectrometry.

Mechanisms behind the metabolic flexibility of an invasive comb jelly

Mnemiopsis leidyi is an invasive comb jelly which has successfully established itself in European seas. The species is known to produce spectacular blooms yet it is holoplanktonic and not much is known about its population dynamics in between. One way to gain insight on how M. leidyi might survive between blooms and how it can bloom so fast is to study how the metabolism of this species actually responds to environmental changes in food and temperature over its different life-stages. To this end we combined modelling and data analysis to study the energy budget of M. leidyi over its full life-cycle using Dynamic Energy Budget (DEB) theory and literature data.
An analysis of data obtained at temperatures ranging from 8 to 30 °C suggests that the optimum thermal tolerance range of M. leidyi is higher than 12 °C. Furthermore M. leidyi seems to undergo a so-called metabolic acceleration after hatching. Intriguingly, the onset of the acceleration appears to be delayed and the data do not yet exist which allows determining what actually triggers it. It is hypothesised that this delay confers a lot of metabolic flexibility by controlling generation time. We compared the DEB model parameters for this species with those of another holoplanktonic gelatinous zooplankton species (Pelagia noctiluca). After accounting for differences in water content, the comparison shows just how fundamentally different the two energy allocation strategies are. P. noctiluca has an extremely high reserve capacity, low turnover times of reserve compounds and high resistance to shrinking. M. leidyi adopts the opposite strategy: it has a low reserve capacity, high turnover rates of reserve compounds and fast shrinking.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Vrije Universiteit Amsterdam, Aix Marseille Universite, University of Porto, Royal Netherlands Institute for Sea Research - NIOZ
Authors: Augustine, S. (Intern), Jaspers, C. (Intern), Kooijman, S. A. L. (Ekstern), Carlotti, F. (Ekstern), Poggiale, J. (Ekstern), Freitas, V. (Ekstern), Veer, H. V. D. (Ekstern), Walraven, L. V. (Ekstern)
Pages: 156-165
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Sea Research
Volume: 94
ISSN (Print): 1385-1101
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 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.115 SNIP 1.06 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.371 SNIP 1.28 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.267 SNIP 1.242
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.261 SNIP 1.071
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.289 SNIP 1.156
Scopus rating (2007): SJR 1.402 SNIP 1.179
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.325 SNIP 1.165
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.987 SNIP 0.923
Scopus rating (2004): SJR 0.932 SNIP 0.957
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.146
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.059 SNIP 0.926
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.131 SNIP 0.954
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.127 SNIP 1.021
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.182 SNIP 1.014
Original language: English
DOIs:
10.1016/j.seares.2014.09.005

Publication: Research - peer-review › Journal article – Annual report year: 2014

Meso and macro-zooplankton community structure of the Amundsen Sea Polynya, Antarctica

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Bangor University, Columbia University, University of Georgia
Authors: Wilson, S. E. (Ekstern), Swalethorp, R. (Intern), Kjellerup, S. (Intern), Ducklow, H. W. (Ekstern), Yager, P. L. (Ekstern)
Publication date: 2014
Event: Poster session presented at Ocean Science Meeting 2014, Honolulu, United States.
Main Research Area: Technical/natural sciences

Microbial interference and potential control in culture of European eel (Anguilla anguilla) embryos and larvae

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Bangor University, Columbia University, University of Georgia
Authors: Sørensen, S. R. (Intern), Skov, P. V. (Intern), Lauesen, P. (Ekstern), Tomkiewicz, J. (Intern), Bossier, P. (Ekstern), Schryver, D. (Ekstern)
Pages: 1-8
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication Information
Journal: Aquaculture
Volume: 426-427
ISSN (Print): 0044-8486
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 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Mnemiopsis leidyi in the Baltic Sea region: Origin, transport and seasonality

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, GEOMAR - Helmholtz Centre for Ocean Research Kiel, University of Gothenburg
Authors: Jaspers, C. (Intern), Møller, L. F. (Ekstern), Hinrichsen, H. (Ekstern)

DOI: 10.1016/j.aquaculture.2014.01.011
Publication: Research - peer-review › Journal article – Annual report year: 2014
Muscle development in European eel Anguilla anguilla yolk sac larvae and effects of egg incubation temperature

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian University of Science and Technology
Authors: Kjørsvik, E. (Ekstern), Wold, P. A. (Ekstern), Bardal, T. (Ekstern), Davidsen, M. (Ekstern), da Silva, F. (Intern), Tomkiewicz, J. (Intern), Sørensen, S. R. (Intern)
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2014

North Atlantic Ecosystems, the role of climate and anthropogenic forcing on their structure and function

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Research Secretariat, Plymouth Marine Laboratory, AZTI-Tecnalia, Institute of Marine Research, IFREMER, National Oceanography Centre, Swansea University, Woods Hole Oceanographic Institution, Old Dominion University
Pages: 171-324
Publication date: 2014
Main Research Area: Technical/natural sciences
On the way to successful European eel larval rearing: Impact of biophysical conditions and gamete quality

The European eel is a widely distributed fish species of economic and cultural importance. It inhabits both coastal and freshwater systems, and is targeted by fisheries and treasured as food item. Although eels are reared in aquaculture, this industry relies solely of wild-caught juvenile glass eels that arrive to the European coasts after a 6000 km journey from the Sargasso Sea, where they were hatched. The adolescent eels start their long migration from the European continent back to their spawning area in the Sargasso Sea in late autumn as sliver eels. As long as the eels are within the European continent, they are in an immature stage, and they do not start migration and maturation until the silvering stage. This stage is however tightly controlled by brain and pituitary hormones, preventing maturation of gonads remote from their natural breeding area. This hormonal inhibition of maturation is the main reason why it is difficult to reproduce European eel in captivity. Although, attempted since 1930ies, utilizing maturational hormones primarily from other fish species, we only recently succeeded in refining reproduction protocols that enable rich quantities of viable gametes from this species. In view of these obstacles, the last decade’s research has shown substantial progress. This PhD has contributed to this progress through new knowledge and development of procedures for successful egg activation and fertilization as well as incubation and larvae culture. My PhD work addressed biophysical determinants fundamental to producing healthy eggs and larvae. One of my aims was to improve methods and results of in vitro fertilization. This research included characterisation of sperm density, “optimal” sperm to egg ratios and gamete mixing. Eel gametes are activated by salt water and incubated in a marine aquatic environment. In this regard, my aim was to identify suited salinities and seawater sources, supporting a good embryonic development. Embryonic development lasts two days from fertilization to hatch. During this time, as well as in early larval stages, mortality is high. Here, my aim was to assess effects of temperature and microbial interference during incubation and larval rearing on order to reduce this mortality in cultures. The results have provided valuable new insights, contributing to progress of in vitro fertilization methods.
and reduced mortality in egg and larval culture. Our fertilisation procedures initially applied spermatoctrit as for sperm quantification technique to standardise sperm:egg ratio. Although being a practical method, it featured moderate precision. Spectrophotometry in contrast, showed high precision in addition to being a fast and practical and subsequently supported experiments that identified optimal sperm:egg ratio. Egg activation and swelling are among the processes often seen to fail in experiments. Activation salinity was found to be a determinant of egg fertilisation, buoyancy, and egg size although egg size effects differed among individual females. Fertilization percent was typically high in the range 30 and 40 ppt, while rate of un-activated and dead eggs rose in higher salinities. Egg swelling could be optimized using certain artificial salt types and impeded using others. During egg incubation, microbial interference was found to be a major obstacle for hatch, rather caused by microbial activity than presence. Larval mortality was highly dependent on whether antimicrobial conditions were bacteriostatic of bactericidal. This calls for future technology and microbial management, e.g. by matured water integrated in RAS technology. The results obtained through these studies have added to Danish progress within artificial reproduction in European eel by improved fertilization protocols and identification of important parameters during the early life stages. Such progress has led to present focus on eel larval culture and feeding, which has brought attention to eel as a potential “new species” in aquaculture.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Sørensen, S. R. (Intern), Tomkiewicz, J. (Intern), Munk, P. (Intern), Bossier, P. (Ekstern)
Number of pages: 100
Publication date: 2014

Physical and bacterial controls on inorganic nutrients and dissolved organic carbon during a sea ice growth and decay experiment
We investigated how physical incorporation, brine dynamics and bacterial activity regulate the distribution of inorganic nutrients and dissolved organic carbon (DOC) in artificial sea ice during a 19-day experiment that included periods of both ice growth and decay. The experiment was performed using two series of mesocosms: the first consisted of seawater and the second consisted of seawater enriched with humic-rich river water. We grew ice by freezing the water at an air temperature of −14°C for 14 days after which ice decay was induced by increasing the air temperature to −1°C. Using the ice temperatures and bulk ice salinities, we derived the brine volume fractions, brine salinities and Rayleigh numbers. The temporal evolution of these physical parameters indicates that there was two main stages in the brine dynamics: bottom convection during ice growth, and brine stratification during ice decay. The major findings are: (1) the incorporation of dissolved compounds (nitrate, nitrite, ammonium, phosphate, silicate, and DOC) into the sea ice was not conservative (relative to salinity) during ice growth. Brine convection clearly influenced the incorporation of the dissolved compounds, since the non-conservative behavior of the dissolved compounds was particularly pronounced in the absence of brine convection. (2) Bacterial activity further regulated nutrient availability in the ice: ammonium and nitrite accumulated as a result of remineralization processes, although bacterial production was too low to induce major changes in DOC concentrations. (3) Different forms of DOC have different properties and hence incorporation efficiencies. In particular, the terrestrially-derived DOC from the river water was less efficiently incorporated into sea ice than the DOC in the seawater. Therefore the main factors regulating the distribution of the dissolved compounds within sea ice are clearly a complex interaction of brine dynamics, biological activity and in the case of dissolved organic matter, the physico-chemical properties of the dissolved constituents themselves.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Hüsey, K. (Intern)
Publication date: 2014
Event: Abstract from 5th International Otolith Symposium, Mallorca, Spain.
Main Research Area: Technical/natural sciences
Links:

Otolith microchemistry: A useful tool for age validation?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Hüsey, K. (Intern)
Publication date: 2014
Event: Abstract from 5th International Otolith Symposium, Mallorca, Spain.
Main Research Area: Technical/natural sciences
Links:

Physical and bacterial controls on inorganic nutrients and dissolved organic carbon during a sea ice growth and decay experiment
We investigated how physical incorporation, brine dynamics and bacterial activity regulate the distribution of inorganic nutrients and dissolved organic carbon (DOC) in artificial sea ice during a 19-day experiment that included periods of both ice growth and decay. The experiment was performed using two series of mesocosms: the first consisted of seawater and the second consisted of seawater enriched with humic-rich river water. We grew ice by freezing the water at an air temperature of −14°C for 14 days after which ice decay was induced by increasing the air temperature to −1°C. Using the ice temperatures and bulk ice salinities, we derived the brine volume fractions, brine salinities and Rayleigh numbers. The temporal evolution of these physical parameters indicates that there was two main stages in the brine dynamics: bottom convection during ice growth, and brine stratification during ice decay. The major findings are: (1) the incorporation of dissolved compounds (nitrate, nitrite, ammonium, phosphate, silicate, and DOC) into the sea ice was not conservative (relative to salinity) during ice growth. Brine convection clearly influenced the incorporation of the dissolved compounds, since the non-conservative behavior of the dissolved compounds was particularly pronounced in the absence of brine convection. (2) Bacterial activity further regulated nutrient availability in the ice: ammonium and nitrite accumulated as a result of remineralization processes, although bacterial production was too low to induce major changes in DOC concentrations. (3) Different forms of DOC have different properties and hence incorporation efficiencies. In particular, the terrestrially-derived DOC from the river water was less efficiently incorporated into sea ice than the DOC in the seawater. Therefore the main factors regulating the distribution of the dissolved compounds within sea ice are clearly a complex interaction of brine dynamics, biological activity and in the case of dissolved organic matter, the physico-chemical properties of the dissolved constituents themselves.
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 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), Counillon, 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 - peer-review › Journal article – Annual report year: 2014
Population dynamic of high latitude copepods - with emphasis on Metridia longa

High latitude ecosystems are shaped by seasonality in light, ranging from complete darkness in winter to midnight sun in summer, influencing both temperature and primary production. Copepods are important grazers on phytoplankton in marine systems and occupy a central role in the marine food-web, linking smaller and larger organisms. Research of copepod communities in the Arctic has traditionally focused on larger taxa present in the surface layers. Consequently, little is known about reproduction strategies and population dynamics of smaller copepods located deeper in the water column. The aim of this thesis was to identify the dominant copepod species in an open ocean system covering different water masses in Baffin Bay and Davis Strait, as well as a sub-Arctic fjord during spring and summer. Both investigations were conducted using fine meshed nets, sampling of deeper water masses and including diurnal and nocturnal sampling. The seasonal fjord study further identified different life strategies with respect to seasonal adaptations in reproduction and migration patterns. In contrast to the general assumption that large calanoid copepods dominate high latitude ecosystems, we find that smaller species numerically dominated the copepod community in the fjord. The contribution of the smaller species was less pronounced in Baffin Bay. However, even in this region, smaller species dominated in the part of the study area when the large Calanus species had left the surface layer to overwinter at depth. The large calanoid Metridia longa dominated the biomass in the fjord during spring and represented a significant part of the biomass in Baffin Bay and Davis Strait. Metridia longa exhibited a pronounced diel vertical migration, avoiding the upper 150 meters of the water column during day. Thus, sampling only the upper water column during the day-as is a usual procedure-would underestimate this potential key species. Reproduction patterns of the large calanoids suggested lifecycles adapted to the seasonal and episodic food availability, and consequently had a pulsed reproduction. In contrast, small copepod species were less dependent on the spring phytoplankton bloom, and their reproduction and population dynamics were less pulsed. Likewise, a large proportion of Oithona similis was ovigerous from March to August. Reproduction of Microsetella norvegica, another of the small key species in the fjord, was more restricted and indicated a life-history strategy that combines the advantages of eggcarrying with inter-clutch duration independent of hatching time. Our findings stress the need for sampling with small meshed nets, sampling deeper in the water column, and sampling both diurnally and nocturnally to target the entire copepod community. We speculate that the complexity of the copepod community will increase in a warmer climate, as smaller species will profit more than the larger species from increased water temperatures.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Kjellerup, S. (Intern), Nielsen, T. G. (Intern), Kørboe, T. (Intern)
Number of pages: 207
Publication date: 2014

Publications Information
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2014

Population dynamics and life history strategies of the dominant copepods in a sub-arctic Greenlandic fjord

Investigations of the Arctic and Sub-Arctic pelagic food web have previously focused on the copepod genus Calanus, as they often dominate the mesozooplankton community and serve as a lipid rich food source for higher trophic levels. However, if night samples are considered a different food web might emerges with the omnivorous copepod Metridia spp. in a major role. Biology of Metridia is practically unknown but deviates from Calanus e.g. Metridia does not hibernate but stays active yearlong benefiting from being omnivore. In the present study abundance, depth distribution, and egg and pellet production of two Calanus species and Metridia longa was monitored weekly from March-August. M. longa performed diel vertical migration of up to 200 meters and was the dominating larger copepod species. Weekly lipid measurements of M. longa showed a similar buildup of lipids during late summer as the 20 hibernating Calanus. M. longa might thereby also have a central role in the lipid rich food chain which is a distinct feature for Arctic and Sub-Arctic ecosystems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Kjellerup, S. (Intern), Nielsen, T. G. (Intern)
Publication date: 2014
Event: Abstract from ESSAS Annual Science Meeting, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Population dynamics and production of the small copepod Oithona spp. in a subarctic fjord of West Greenland

The small cyclopoid copepod Oithona is widely occurring in polar areas; however, knowledge of its biology and ecology is very limited. Here, we investigate the population dynamics, vertical distribution, and reproductive characteristics of Oithona spp. from late winter to summer, in a subarctic fjord of West Greenland. During winter–early spring, the abundance of Oithona spp. was low (1.8 ± 1.03 ind. m⁻²) and the population was mainly composed of late copepodites and adults, whereas in summer, abundance peaked and younger stages dominated (1.1 ± 1.06 ind. m⁻²). In general, all stages of Oithona spp. remained in the upper 100 m, with nauplii exhibiting a shallower distribution. Although no general seasonal migration was found, a deeper distribution of the adult females in winter was observed. The mean clutch size of Oithona spp. varied from 16 to 30 eggs per female, peaking in summer. Egg production rates (EPR) were low in winter–early spring (0.13 ± 0.03 eggs female⁻¹ day⁻¹) and reached maximum values in summer (1.6 ± 0.45 eggs female⁻¹ day⁻¹). EPR of Oithona spp. showed a significantly positive relationship with both temperature and protozooplankton biomass, and the development of the population seemed to be appreciably affected by temperature. Oithona spp. remained active throughout the study, stressing the key importance of these small copepods in high-latitude ecosystems, especially in periods when larger copepods are not present in the surface layer.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Zamora-Terol, S. (Ekstern), Kjellerup, S. (Intern), Swalethorp, R. (Intern), Saiz, E. (Ekstern)
Pages: 953-965
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Polar Biology
Volume: 37
Issue number: 7
ISSN (Print): 0722-4060
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 1.72 SJR 0.866 SNIP 0.761
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.985 SNIP 0.751 CiteScore 1.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.931 SNIP 0.81 CiteScore 1.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.109 SNIP 1.054 CiteScore 2.07
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.029 SNIP 0.891 CiteScore 1.89
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.857 SNIP 0.925 CiteScore 1.77
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Prey or predator – expanding the food web role of sandeel (Ammodytes marinus)

We report an unexpected observation of lesser sandeel Ammodytes marinus foraging on juveniles and late larval stages of the same species. This recording sheds new light on the cannibalistic and piscivorous capacity of forage fish and raises a number of questions about the role of forage fish in marine food webs. In 2012 and 2013 the stomachs of 748 sandeels from 36 different commercial sandeel hauls in the central North Sea were opened. 9% of these stomachs contained late stage sandeel larvae. In order to better understand the cannibalistic nature of sandeels, we made a detailed analysis of another 450 sandeels from a single haul with a high frequency of apparent cannibals. One-third of the stomachs contained a minimum of one young sandeel (mean length 2.7 cm; max. length 4.9 cm), 10 percent contained 5 or more, and one stomach contained 18. Analyses of sample DNA confirmed that predator and prey were conspecifics. Larger specimens were more likely to be cannibals. However, among cannibals the specific sandeel larvae consumption was independent of cannibal size. We argue that this piscivorous cannibalistic behaviour may not only be a key factor in explaining recruitment fluctuations in North Sea sandeel stocks, but it may also add a new element to the complexity of energy flow in marine food chains.
Processing of humic-rich riverine dissolved organic matter by estuarine bacteria: effects of predegradation and inorganic nutrients

The bioavailability of predegraded dissolved organic matter (DOM) from a humic-rich, boreal river to estuarine bacteria from the Baltic Sea was studied in 39-day bioassays. The river waters had been exposed to various degrees of bacterial degradation by storing them between 0 and 465 days in dark prior to the bioassay. The resulting predegraded DOM was inoculated with estuarine bacteria and the subsequent changes in DOM quantity and quality measured. During the incubations, dissolved organic carbon (DOC) and oxygen concentrations decreased, indicating heterotrophic activity. Coloured DOM was degraded less than DOC, indicating a selective utilization of DOM, and humic-like fluorescence components increased during the incubations. The amount of DOC degraded was not affected by the length of DOM predegradation. The percentage of bioavailable DOC (%BDOC) was higher in experiment units with added inorganic nitrogen and phosphorus than without addition (on average 13.5 % and 9.0, respectively), but had no effect on the degradation of fresh, non-predegraded, DOC (%BDOC 12.0 %). Bacterial growth efficiency (BGE) was highest (65 ± 2 %) in the units with fresh DOM, and lowest in units with predegraded DOM and no added inorganic nutrients (11 ± 4 %). The addition of inorganic nutrients increased the BGE of predegraded DOM units by an average of 28 ± 4 %. There was no significant effect on BGE by length of predegradation after the initial drop (<3 months). This study suggests that both the length of predegradation and the inorganic nutrient status in the receiving estuary has consequences to carbon cycling and will determine the amount of terrestrial-derived DOC being ultimately assimilated into marine food webs.
Production and transformation of dissolved neutral sugars and amino acids by bacteria in seawater

Dissolved organic matter (DOM) in the ocean consists of a heterogeneous mixture of molecules, most of which are of unknown origin. Neutral sugars and amino acids are among the few recognizable biomolecules in DOM, and the molecular composition of these biomolecules is shaped primarily by biological production and degradation processes. This study provides insight into the bioavailability of biomolecules as well as the chemical composition of DOM produced by bacteria. The molecular compositions of combined neutral sugars and amino acids were investigated in DOM produced by bacteria and in DOM remaining after 32 days of bacterial degradation. Results from bioassay incubations with natural seawater (sampled from water masses originating from the surface waters of the Arctic Ocean and the North Atlantic Ocean) and artificial seawater indicate that the molecular compositions following bacterial degradation are not strongly influenced by the initial substrate or bacterial community. The molecular composition of neutral sugars released by bacteria was characterized by a high glucose content (47 mol %) and heterogeneous contributions from other neutral sugars (3–14 mol %). DOM remaining after bacterial degradation was characterized by a high galactose content (33 mol %), followed by glucose (22 mol %) and the remaining neutral sugars (7–11 mol %). The ratio of D-amino acids to L-amino acids increased during the experiments as a response to bacterial degradation, and after 32 days, the D/L ratios of aspartic acid, glutamic acid, serine and alanine reached around 0.79, 0.32, 0.30 and 0.51 in all treatments, respectively. The striking similarity in neutral sugar and amino acid compositions between natural (representing marine semi-labile and refractory DOM) and artificial (representing bacterially produced DOM) seawater samples, suggests that microbes transform bioavailable neutral sugars and amino acids into a common, more persistent form.
Quallen trüben den Badespaß

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Jaspers, C. (Intern)
Pages: 13
Publication date: 2014

Publication information
Pages (from-to): 13
Newspaper: Kieler Nachrichten
Main Research Area: Technical/natural sciences
Links:
Publication: Communication › Newspaper article – Annual report year: 2015

Radiocarbon dating of fluvial organic matter reveals land-use impacts in boreal peatlands
This study measured the effects of land use on organic matter released to surface waters in a boreal peat catchment using radiocarbon dating of particulate and dissolved organic carbon (POC and DOC), DOC concentration, stable carbon and nitrogen isotope composition, and optical measurements. Undisturbed sites invariably released modern DOC and POC (}

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Helsinki, Bangor University, Finnish Environment Institute
Authors: Hulatt, C. J. (Ekstern), Kaartokallio, H. (Ekstern), Oinonen, M. (Ekstern), Sonninen, E. (Ekstern), Stedmon, C. A. (Intern), Thomas, D. N. (Ekstern)
Pages: 12543-12551
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Science and Technology
Volume: 48
Issue number: 21
ISSN (Print): 0013-936X
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 6.26 SJR 2.538 SNIP 1.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.584 SNIP 1.828 CiteScore 5.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.777 SNIP 2.017 CiteScore 5.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.956 SNIP 2.103 CiteScore 5.52
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.146 SNIP 2.056 CiteScore 5.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.178 SNIP 1.953 CiteScore 5.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.964 SNIP 1.729
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.835 SNIP 1.803
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.943 SNIP 1.942
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.8 SNIP 1.927
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.541 SNIP 1.901
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.604 SNIP 2.014
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.863 SNIP 2.046
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.545 SNIP 2.071
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.353 SNIP 1.953
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.419 SNIP 1.977
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.474 SNIP 2.334
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 3.466 SNIP 2.359

Original language: English

DOIs:
Recovery in eastern Baltic cod: is increased recruitment caused by decreased predation on early life stages?

Cod (Gadus morhua) recruitment in the eastern Baltic Sea is influenced by predation on early life stages by sprat (Sprattus sprattus) and herring (Clupea harengus), which is considered as one of the mechanisms preventing cod recovery in the 1990s. In the light of improved cod recruitment in the second half of the 2000s, new analyses of stomach content of sprat and herring were conducted, to elucidate the contribution of changes in predation pressure on cod recruitment. Comparison of stomach contents of sprat and herring in 2004–2008 with data from the 1990s showed a similar diet composition in the two periods; however, changes were found in the ichthyoplankton abundance and composition in the diet, indicating reduced predation pressure on cod eggs in the most recent period. The abundance of cod eggs in the field, availability of other prey, and horizontal and vertical overlap between predator and prey were investigated as potential factors influencing cod egg predation.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management, Section for Ecosystem based Marine Management, Thünen Institute of Sea Fisheries
Authors: Neumann, V. (Intern), Köster, F. (Intern), Schaber, M. (Ekstern), Eero, M. (Intern)
Pages: 1382-1392
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 6
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
Web of Science (2016): Indexed yes
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
To examine the potential influence of terrestrially derived DOM on the Baltic Sea, a year-long study of dissolved organic matter (DOM) was performed in three river catchments in Sweden. One catchment drains into the Bothnian Sea, while two southern catchments drain into the Baltic proper. Dissolved organic carbon (DOC) concentrations were positively correlated with discharge from forested catchments over the year. While the overall concentrations of DOC were several times higher in the southern two catchments, higher discharge in the northern catchment resulted in the annual loadings of DOC being on the same order of magnitude for all three catchments. Biological oxygen demand (BOD) was used as a proxy for the lability of carbon in the system. The range of BOD values was similar for all three catchments, however, the ratio of BOD to DOC (an indication of the labile fraction) in Ume river was four times higher than in the southern two catchments. Total annual BOD loading to the Baltic Sea was twice as high in the northern catchment than in the two southern catchments. Lower winter temperatures and preservation of organic matter in the northern catchment combined with an intense spring flood help to explain the higher concentrations of labile carbon in the northern catchment. Lower lability of DOM as well as higher colour in the southern catchments suggest that wetlands (i.e. peat bogs) may be the dominant source of DOM in these catchments, particularly in periods of low flow. With climate change expected to increase precipitation events and temperatures across the region, the supply and quality of DOM delivered to the Baltic Sea can also be expected to change. Our results indicate that DOM supply to the Baltic Sea from boreal rivers will be more stable throughout the year, and potentially have a lower bioavailability.
Seasonal migration, vertical activity and winter temperature experience of Greenland halibut Reinhardtius hippoglossoides (Walbaum) in West Greenland waters

The deep-water flatfish Greenland halibut Reinhardtius hippoglossoides (Walbaum) is common along the West Greenland coast. In the northwestern fjords, Greenland halibut is an important socio-economic resource for the Greenland community, but due to the deep and partly ice-covered environment, very little is known about its behavior and habitat characteristics. We tagged adult Greenland halibut in the waters off Ilulissat with electronic data storage tags that collected information on depth, temperature, and time. Although clear differences between individuals in migration and vertical behavior were present, we discovered a consistent seasonal migration from the relatively shallow-water Disko Bay area into the deep waters of the Ilulissat Icefjord, where the fish resided in the winter months before returning to Disko Bay. Vertical activity was pronounced at both locations, with fish covering vertical distances of up to 100 m within 15 min. During the winter months, the fish experienced temperatures between ca. 0 and 4°C, with most experiencing temperatures of 2 to 3°C. Irrespective of year and quarter of the year, the fish experienced warmer water and a broader range of temperatures when resident in Disko Bay (mean range 2.6°C) than when resident in the ice fjord (mean range 1.4°C). Using the tagged halibut as a ‘live tool,’ we show that parts of the ice fjord are hundreds of meters deeper than previously thought. We also document the first seawater temperature measurements made beneath the Jakobshavn Isbræ outlet glacier, revealing a positive relationship between depth and temperature for the upper 600 m and a between-year variation in temperatures beneath the ice sheet in 2001, 2002, and 2003

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Danish Pelagic Producers Organisation
Authors: Boje, J. (Intern), Neuenfeldt, S. (Intern), Sparrevohn, C. R. (Ekstern), Eigaard, O. R. (Intern), Behrens, J. (Intern)
Pages: 211-222
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 508
ISSN (Print): 0171-8630
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 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
ISI indexed (2012): ISI indexed yes
Size-based predictions of food web patterns

We employ size-based theoretical arguments to derive simple analytic predictions of ecological patterns and properties of natural communities: size-spectrum exponent, maximum trophic level, and susceptibility to invasive species. The predictions are brought about by assuming that an infinite number of species are continuously distributed on a size-trait axis. It is, however, an open question whether such predictions are valid for a food web with a finite number of species embedded in a network structure. We address this question by comparing the size-based predictions to results from dynamic food web simulations with varying species richness. To this end, we develop a new size- and trait-based food web model that can be simplified into an analytically solvable size-based model. We confirm existing solutions for the size distribution and derive novel predictions for maximum trophic level and invasion resistance. Our results show that the predicted size-spectrum exponent is borne out in the simulated food webs even with few species, albeit with a systematic bias. The predicted maximum trophic level turns out to be an upper limit since simulated food webs may have a lower number of trophic levels, especially for low species richness, due to structural constraints. The size-based model possesses an evolutionary stable state and is therefore un-invadable. In contrast, the food web simulations show that all communities, irrespective of number of species, are equally open to invasions. We use these results to discuss the validity of size-based predictions in the light of the structural constraints imposed by food webs.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Institute of Aquatic Resources, Centre for Ocean Life, Scientific Computing, Section for Marine Ecology and Oceanography
Authors: Zhang, L. (Intern), Hartvig, M. (Intern), Knudsen, K. (Intern), Andersen, K. H. (Intern)
Pages: 23-33
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Theoretical Ecology
Volume: 7
ISSN (Print): 1874-1738
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
Standardization of fertilization protocols for the European eel, Anguilla anguilla

Standardization of artificial fertilization protocols for the European eel, Anguilla anguilla, is a prerequisite for optimizing the use of available gametes in hatchery facilities and for conserving sperm from high quality males, which is either cryopreserved or in living gene banks. The objectives of this research were to provide a rapid, accurate and precise method to quantify sperm density by examining the relationship between sperm density and absorbance by use of a spectrophotometer, determine the optimal number of sperm required to fertilize eggs in a controlled setting, and explore how long eggs are receptive to fertilization post-stripping. Mean sperm density and absorbance at 350nm were 1.54e+10±4.95e+9 sperm/mL and 1.91±0.22 nm, respectively. Regression analysis demonstrated a highly significant positive relationship between sperm density and absorbance using a spectrophotometer at 350nm (R2=0.94, p<0.001, y=2.273e+10x-2.805e+10); significant but slightly weaker relationships were also detected at 400, 500, and 600nm (R2≤0.93, p<0.001). Fertilization success using sperm to egg ratios ranging from 1.3e+3 to 1.0e+6 sperm per egg increased from 37.5 to 68.1%, respectively. Sperm to egg ratio had a significant effect on fertilization success (p<0.0001), where fertilization success increased from 1.3e+3 to 2.5e+4 sperm per egg; adding greater than 2.5e+4 sperm per egg had no significant effect. Furthermore, the duration of time post-stripping had a significant effect on egg fertilization success (p<0.0001), such that between 0 and 10min post-stripping 57.4 to 78.2% of the eggs were fertilized while at 15min post-stripping a significant decrease in fertilization success was detected (47.5%). For all statistical models, the female variance component was significant for fertilization success (p<0.0001) and explained ≤84% of the models variance. In conclusion, European eel eggs should be fertilized within 10min post-stripping using 2.5e+4 sperm per egg. Together, these findings will contribute to the development of European eel breeding technology and further our understanding on sperm biology and reproductive biology in fishes.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Windsor
Authors: Butts, I. (Intern), Sørensen, S. R. (Intern), Politis, S. N. (Intern), Pitcher, T. (Ekstern), Tomkiewicz, J. (Intern)
Pages: 9-13
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquaculture
Volume: 426-427
ISSN (Print): 0044-8486
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 2.75 SJR 1.101 SNIP 1.524
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.103 SNIP 1.254 CiteScore 2.12
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.002 SNIP 1.34 CiteScore 2.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.136 SNIP 1.3 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.212 SNIP 1.487 CiteScore 2.32
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.294 SNIP 1.542 CiteScore 2.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.151 SNIP 1.394
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.941 SNIP 1.263
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.909 SNIP 1.173
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.019 SNIP 1.318
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.008 SNIP 1.689
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.915 SNIP 1.236
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.016 SNIP 1.627
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.121 SNIP 1.926
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.992 SNIP 1.418
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.049 SNIP 1.317
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.908 SNIP 1.113
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.049 SNIP 1.251

Original language: English

DOIs:
Strategies for success: Copepods in a seasonal world

Amongst the zooplankton community, copepods display complex and diverse life history strategies, which could explain their wide success in the world ocean. Specifically, in temperate and high latitude ecosystems, copepods are subject to "boom and bust" conditions where annual cycles are punctuated by a short, productive spring blooms, but with relatively little food and harsh conditions for the rest of the year. Due to their world-wide dominance in biomass, and their importance in the food webs, copepods are fairly well studied. However, the success of their complex life-history strategies remain open scientific questions, in particular, how these are attuned to environmental conditions, and how these may be compromised by climate change. Due to their ability to concentrate lipids in their small bodies, copepods are indeed of great ecological significance as they are an important link between phytoplankton production and higher trophic levels such as fish, seabirds and marine mammals. Their most striking life-history trait includes multiple moulting from egg to adult stages (energetically costly but allowing them to have the most ecient shape to swim relative to their size in water), overwintering at great depth and plastic behaviors such as switching between feeding modes and daily vertical migration allowing them to quickly adapt to local conditions. Some of their life history traits also vary widely amongst species, including how resources are allocated to reproduction and size at maturity. This thesis covers two of these life-history traits: diel vertical migration and the allocation of resource to reproduction.

Diel vertical migration (DVM) strategies arise from a trade-off between feeding and predation risk { both of which tend to be maximized in the surface ocean. The latter is modulated on a day night cycle as the eciency of visual predators varies with ambient light. An ecient strategy is thus to migrate vertically, feeding at the surface at night, and taking refuge at depth during the day. The rst part of this thesis treats DVM with some observations and models. A rst study, made from a video plankton recorder in the West coast of Greenland, shows the wide range of migration patterns adopted in the zooplankton community but also within the Calanus copepods taxa (chapter 2). A second study shows the emergence of the DVM strategy in a game theory approach, not only of the organism, but also their predator (chapter 3). In addition to controlling trophic transfer in marine ecosystems, DVM also plays a potential role in biogeochemistry of the worlds oceans. A simple modeling method taking behavior into account in large models is therefore needed, as ocean system model are already computationally intensive. The third study investigates how well a simple (myopic) optimization of DVM compares with life-history optimization using dynamic programming (chapter 4). The myopic optimizations shows surprisingly accurate predictive power over a large range of parameter space.

Inspired by the copepods Calanus nmarinus and C. hyperboreus, an individual based model is used to study the success of their reproduction strategy as a function of the feeding season duration. The rst of these two species is close to an income breeder, relying only on the incoming food supply, while the latter is a capital breeder, storing reserves to spawn at a time not directly dictated by food availability. Although from the same genus, their size at maturity and their distributions die dramatically. Including behavior and energetic allocation, we thus investigate the eect of the resource allocation trait to reproduction coupled with the most suited maturity size as a function of the feeding season duration (chapter 5). Capital breeding favors large maturity size and is successful in short blooms, while the income breeders are favored in long blooms and benet from small size. As the output tness curve functions seem fairly standard, the model is simplified to an analytical approach that is used to investigate the same problem and gives similar results. The closed solutions are then used to explore the parameter space and the resulting pattern is shown to be robust (chapter 6). This thesis therefore focuses on two main aspects of the life-history of copepods: diel vertical migration and reproduction strategy. The results may be generalized and applied to other species living in a seasonal environment.
Temperature and oxygen as determining factors in post-stress recovery profiles of Norwegian lobster Nephrops norvegicus

General information
State: Published

Host publication information
Title of host publication: Abstract Book - DTU Sustain Conference 2014
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Main Research Area: Technical/natural sciences
Conference: DTU Sustain Conference 2014, Lyngby, Denmark, 17/12/2014 - 17/12/2014
Publication: Research › Conference abstract in proceedings – Annual report year: 2014

Temperature and oxygen as determining factors in post-stress recovery profiles of Norwegian lobster Nephrops norvegicus

General information
State: Published
Temperature, paternity and asynchronous hatching influence early developmental characteristics of larval Atlantic cod, Gadus morhua

Offspring, especially during early development, are influenced by both intrinsic properties endowed to them by their parents, extrinsic environmental factors as well as the interplay between genes and the environment. We investigated the effects of paternity (P), temperature (T), and asynchronous hatching on larval traits of cod, Gadus morhua from the Atlantic Ocean and the Baltic Sea. Daily cohorts of 4 half-sib families of Atlantic larvae and 5 half-sib families of Baltic larvae were incubated and hatched at 5 temperatures (Atlantic 2.0-10.0°C, Baltic 6.5-12.5°C) and imaged for notochord length (LN), yolk-sac area (AY), and deformities. Larvae hatching on a given day were incubated at the same temperature and sampled at 4 days post-hatch (DPH) for growth, yolk utilization rate (YUR) and efficiency (YUE). The mean±SE duration of the hatching window decreased with increasing temperature in both Atlantic (5.4±0.1 to 2.6±0.3 days from 2.0 to 10.0°C) and Baltic larvae (6.2±0.4 to 5.0±0.6 days from 6.5 to 12.5°C) and LN increased and AY decreased for every subsequent day of hatch. Deformities increased with increasing T and P × T explained 52.3 and 26.8% of the variance for Atlantic and Baltic larvae, respectively. In Baltic larvae, size at peak hatch tended to decrease with increasing T and P × T explained 34.6% of the variance. In Atlantic larvae, growth, YUR and YUE were influenced by T while P alone explained 26.0% of the variance in YUE and up to 66.4% of variance in morphological traits at 4 DPH. Asynchronous hatching significantly affected larval growth, YUR, and YUE with P explaining 37.1% of the variance in growth for Atlantic larvae. Temperature and asynchronous hatching interacted to produce larvae that were generally longer and had smaller AY if they were incubated at colder temperatures or if they hatched at the end of the hatching period at a specific temperature. Differences in larval morphometrics among temperatures for early hatching larvae decreased or even reversed for later hatching larvae. In light of anticipated global climate change, the present study on cod provides further insight in understanding the genotype-based variability and the adaptive potential to an ecologically changing environment.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Alfred Wegener Institute, University of Hamburg, Fisheries and Oceans Canada
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Pages: 70-79
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Experimental Marine Biology and Ecology
Volume: 459
ISSN (Print): 0022-0981
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 2.03 SJR 0.937 SNIP 0.914
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.043 SNIP 0.823 CiteScore 1.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.145 SNIP 1.045 CiteScore 2.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.294 SNIP 1.08 CiteScore 2.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
The Baltic ATLANTIS model: Implementing a holistic framework to evaluate ecosystem wide responses to changes in climate and anthropogenic forcing

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Monitoring and Data, Centre for Ocean Life, Aarhus University
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Number of pages: 1
Publication date: 2014
Event: Poster session presented at EU-FP7-VECTORS Symposium, La Grande Motte, France.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2014
The Baltic cod: A case study for testing stock discrimination based on otolith shape analysis in a mixed stock fishery

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Section for Ecosystem based Marine Management
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Publication date: 2014
Event: Abstract from 5th International Otolith Symposium, Mallorca, Spain.
Main Research Area: Technical/natural sciences
Links:

The Biological carbon pump in the North Atlantic
Mediated principally by the sinking of organic rich particles from the upper ocean, the Biological Carbon Pump (BCP) is a significant component of the global carbon cycle. It transfers roughly 11 Gt C yr⁻¹ into the ocean’s interior and maintains atmospheric carbon dioxide at significantly lower levels than would be the case if it did not exist. More specifically, export by the BCP in the North Atlantic is ~0.55–1.94 Gt C yr⁻¹. A rich set of observations suggests that a complex set of processes drives this export. However, significant uncertainties exist regarding the BCP in the North Atlantic, including both the magnitude of the downward flux and the ecological, chemical and physical processes by which it is sustained and controlled. Our lack of detailed mechanistic understanding has also hindered modelling attempts to quantify and predict changes to the BCP. In this paper, we assess current knowledge concerning the BCP in the North Atlantic in order to identify priorities for future research, as well as suggesting how they might be addressed

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Université de Bretagne Occidentale, Institute of Marine Sciences, Norwegian Institute for Water Research, National Oceanography Centre
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Pages: 200-218
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 129 B
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
Web of Science (2016): Indexed yes
Scopus rating (2016): CiteScore 3.4 SJR 1.922 SNIP 1.278
BFI (2015): BFI-level 2
Web of Science (2015): Indexed yes
Scopus rating (2015): SJR 1.703 SNIP 1.348 CiteScore 3.34
BFI (2014): BFI-level 2
Web of Science (2014): Indexed yes
Scopus rating (2014): SJR 1.909 SNIP 1.461 CiteScore 3.65
BFI (2013): BFI-level 2
Web of Science (2013): Indexed yes
Scopus rating (2013): SJR 2.397 SNIP 1.595 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.741 SNIP 1.794 CiteScore 4.17
Balanced harvesting, where species or individuals are exploited in accordance with their productivity, has been proposed as a way to minimize the effects of fishing on marine fish communities and ecosystems. This calls for a thorough examination of the consequences balanced harvesting has on fish community structure and yield. We use a size- and trait-based model that resolves individual interactions through competition and predation to compare balanced harvesting with traditional selective harvesting, which protects juvenile fish from fishing. Four different exploitation patterns, generated by combining selective or unselective harvesting with balanced or unbalanced fishing, are compared. We find that unselective balanced fishing, where individuals are exploited in proportion to their productivity, produces a slightly larger total maximum sustainable yield than the other exploitation patterns and, for a given yield, the least change in the relative biomass composition of the fish community. Because fishing reduces competition, predation and cannibalism within the community, the total maximum sustainable yield is achieved at high exploitation rates. The yield from unselective balanced fishing is dominated by small individuals, whereas selective fishing produces a much higher proportion of large individuals in the yield. Although unselective balanced fishing is predicted to produce the highest total maximum sustainable yield and the lowest impact on trophic structure, it is effectively a fishery predominantly targeting small forage fish.
The influence of winter convection on primary production: A parameterisation using a hydrostatic three-dimensional biogeochemical model

In the recent past observational and modelling studies have shown that the vertical displacement of water parcels, and therefore, phytoplankton particles in regions of deep-reaching convection plays a key role in late winter/early spring primary production. The underlying mechanism describes how convection cells capture living phytoplankton cells and recurrently expose them to sunlight. This study presents a parameterisation called ‘phytoconvection’ which focuses on the influence of convection on primary production. This parameterisation was implemented into a three-dimensional physical–biogeochemical model and applied to the Northwestern European Continental Shelf and areas of the adjacent Northeast Atlantic. The simulation was compared to a ‘conventional’ parameterisation with respect to its influence on phytoplankton concentrations during the annual cycle and its effect on the carbon cycle. The simulation using the new parameterisation showed good agreement with observation data recorded during winter, whereas the reference simulation did not capture the observed phytoplankton concentrations. The new parameterisation had a strong influence on the carbon export through the sinking of particulate organic carbon. The carbon export during late winter/early spring significantly exceeded the export of the reference run. Furthermore, a non-hydrostatic convection model was used to evaluate the major assumption of the presented parameterisation which implies the matching of the mixed layer depth with the convective mixing depth. The applied mixed layer depth criterion principally overestimates the actual convective mixing depth. However, the results showed that this assumption is reasonable during late winter, while indicating a mismatch during spring.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg
Authors: Grosse, F. (Ekstern), Lindemann, C. (Intern), Pätch, J. (Ekstern), Backhaus, J. O. (Ekstern)
Pages: 138-152
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Marine Systems
Volume: 147
ISSN (Print): 0924-7963
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): SJR 1.403 SNIP 1.282 CiteScore 2.61
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.093 SNIP 1.033 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.231 SNIP 1.494 CiteScore 2.69
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.609 SNIP 1.457 CiteScore 2.99
ISI indexed (2013): ISI indexed yes
The parasitic copepod *Lernaeocera branchialis* negatively affects cardiorespiratory function in Atlantic cod (*Gadus morhua*)

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Gothenburg, University of Copenhagen
Authors: Behrens, J. (Intern), Seth, H. (Ekstern), Axelsson, M. (Ekstern), Buchmann, K. (Ekstern)
Publication date: 2014
Event: Abstract from DAFINET and Targetfish FP7 Workshop -Fish models in Research, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2014

The parasitic copepod *Lernaeocera branchialis* negatively affects cardiorespiratory function in *Gadus morhua*. The parasitic copepod *Lernaeocera branchialis* had a negative effect on cardiorespiratory function in Atlantic cod *Gadus morhua* such that it caused pronounced cardiac dysfunction with irregular rhythm and reduced stroke amplitude compared with uninfected fish. In addition, parasite infection depressed the postprandial cardiac output and oxygen consumption.
The recent population expansion of boarfish, Capros aper (Linnaeus, 1758): Interactions of climate, growth and recruitment

The objectives of this study were to evaluate whether temperature changes in the Northeast Atlantic influence the growth and recruitment dynamics of boarfish, Capros aper. Two geographically separate areas were examined, 'north' at the northern distribution range west of Ireland and 'south' on the main fishing grounds south of Ireland. No significant differences in length-at-age were observed between the two areas. Interannual otolith growth patterns were similar between the two areas with distinct years of faster and slower growth. In the 'north', no significant relationship between adult growth and temperature was observed, while growth in the 'south' was positively related to temperature up to approximately 16°C growth rates were suppressed in the years with temperatures above that. Recruitment showed a positive correlation with adult growth the previous year for the Spanish recruitment index only, suggesting spatial connectivity between the Celtic Sea and the Bay of Biscay. The age distributions were similar in both areas and despite the boarfish's longevity of >30 years, are dominated by the age classes corresponding to the years with high recruitment, suggesting that increased recruitment is responsible for the observed stock expansion.
Toxic diatoms in the Arctic marine food web

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen, Alfred-Wegener-Institut für Polar-und Meeresforschung
Authors: Hardardottir, S. (Ekstern), Pancic, M. (Intern), Tammilehto, A. (Ekstern), Krock, B. (Ekstern), Nielsen, T. G. (Intern), Lundholm, N. (Ekstern)
Publication date: 2014
Event:
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Applied Ichthyology
Volume: 2014
Issue number: 1
ISSN (Print): 1742-6596
Ratings:
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs: 10.1111/jai.12412

Tracing the long-term microbial production of recalcitrant fluorescent dissolved organic matter in seawater

The majority of dissolved organic matter (DOM) in the ocean is resistant to microbial degradation, yet its formation remains poorly understood. The fluorescent fraction of DOM can be used to trace the formation of recalcitrant DOM (RDOM). A long-term (> 1 year) experiment revealed 27–52% removal of dissolved organic carbon and a nonlinear increase in RDOM fluorescence associated with microbial turnover of semilabile DOM. This fluorescence was also produced using glucose as the only initial carbon source, suggesting that degradation of prokaryote remnants contributes to RDOM. Our results indicate that the formation of a fluorescent RDOM component depends on the bioavailability of the substrate: the less labile, the larger the production of fluorescent RDOM relative to organic carbon remineralized. The anticipated increase in microbial carbon demand due to ocean warming can potentially force microbes to degrade less labile substrates, thereby increasing RDOM production and stimulating ocean carbon storage

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Norwegian Polar Institute, University of Copenhagen
Authors: Jørgensen, L. (Intern), Stedmon, C. A. (Intern), Granskog, M. A. (Ekstern), Middelboe, M. (Ekstern)
Pages: 2481-2488
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication information
Journal: Geophysical Research Letters
Volume: 41
Issue number: 7
ISSN (Print): 0094-8276
Ratings:
Trophic position of coexisting krill species: a stable isotope approach

Four krill species with overlapping functional biology coexist in Greenland waters. Here, we used stable isotopes to investigate and discuss their trophic role and mode of coexistence. Bulk carbon (δ13C) and nitrogen (δ15N) stable isotope analyses of Thysanoessa longicaudata, T. inermis, T. raschii and Meganyctiphanes norvegica sampled in June 2010 in the Godthåbsfjord, SW Greenland revealed new insight into their trophic roles and positions. There was a general positive correlation between body length and trophic position. The largest species M. norvegica had the highest trophic position (TP = 2.8 ± 0.2) indicating carnivory, while T. inermis (TP = 2.4 ± 0.3) had a more omnivorous diet. In turn, T. longicaudata and T. raschii (TP = 2.2 ± 0.2) were herbivorous. Along the fjord, nutrient and plankton composition affected trophic position. Thysanoessa longicaudata was more omnivorous offshore than inshore where it had the same trophic position as the baseline primary consumer Calanus spp.. Similarly, T. raschii and T. inermis had higher trophic positions in the mouth of the fjord compared to the inner fjord. Regardless of spatial variations in potential food and the overlap in diet, typical of opportunistic species, body size appears as the key factor determining the role and position of krill in the food web.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Instituto Español de Oceanografía
Authors: Agersted, M. D. (Intern), Bode, A. (Ekstern), Nielsen, T. G. (Intern)
Pages: 139-151
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 516
ISSN (Print): 0171-8630
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 2.4
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 2
  Scopus rating (2015): CiteScore 2.56
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): CiteScore 2.75
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): CiteScore 2.79
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 2
  Scopus rating (2012): CiteScore 2.9
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 2
  Scopus rating (2011): CiteScore 2.85
  ISI indexed (2011): ISI indexed yes
  Web of Science (2011): Indexed yes
  BFI (2010): BFI-level 2
Plankton succession was investigated in the subarctic Godthåbsfjord, Western Greenland, from March to August 2010. The trophic role of protozooplankton (ciliates and heterotrophic dinoflagellates) was evaluated with emphasis on their seasonal succession and as prey for the copepod community. The integrated protozooplankton biomass ranged between 0.1 and 4.0 g C m$^{-2}$, and was dominated by ciliates. Over the 6 mo study period, maximum potential ingestion rates of the protozooplankton biomass ranged from 0.02 to 1.2 g C m$^{-2}$ d$^{-1}$, corresponding to 30 to 194% of primary production d$^{-1}$ or 0.5 to 37% of phytoplankton biomass d$^{-1}$. The highest copepod biomass (24 g C m$^{-2}$) occurred in spring, with Metridia longa alone contributing up to 92% of the biomass. A grazing experiment with M. longa feeding on a natural plankton assemblage confirmed that this species cleared cells in the size range 10 to 60 μm with an average clearance rate of 2.4 ml μg C$^{-1}$ d$^{-1}$. The copepod community, dominated by the genera Calanus, Metridia, Pseudocalanus, Oithona, Microsetella and Triconia/Oncaea, accounted for 72 to 93% of the copepod biomass in the spring. After the large calanoid copepod species left the surface layer, the protozooplankton increased numerically and were the most important grazers for some weeks until a late summer copepod community, dominated by cyclopoids Oithona spp., controlled the protist community.

Our study indicated that protozooplankton succession is regulated by copepod grazing during most of the season, and that these protists provide an essential source of nutrition for the copepod populations.
Protozooplankton are the major grazers on phytoplankton in the global ocean, but many questions related to their trophic role remain unanswered in particular for northern marine ecosystems. In the present thesis, protozooplankton communities were evaluated with special emphasis on factors, such as elevated temperature, water column stratification, pH and copepod predation, regulating their biomass, growth- and grazing rates. In addition, it was investigated what role protozooplankton have for the phytoplankton bloom dynamics at present and in a predicted warmer future. The studies were done through a combination of field observations and experiments conducted at four localities within the sub-Arctic and Arctic waters. The Ph.D. thesis is based on 6 scientific papers (Paper I-VI) dispersed on these four localities:

1) In the high Arctic North East Water Polynya, heterotrophic dinoflagellates and ciliates doubled their growth rates when the temperature was increased from -1.7 to 5 °C. Despite this, most protozooplankton were found in association with the highest phytoplankton concentration: i.e. in the marginal ice zones where the temperature was below the freezing point (Paper I).

2) In waters between Iceland and Norway, succession and population dynamics of autotrophic and heterotrophic microbes including protozooplankton were followed prior to the spring bloom in relation to deep ocean convection. A decrease in abundance of small sized phytoplankton relative to larger diatoms was explained by a strong top-down control by protozooplankton. The data further suggests that deep ocean convection control the protozooplankton community prior to the bloom, which may induce or accelerate the onset of the phytoplankton spring bloom (Paper II & III).

3) In the Arctic Disko Bay, pH was documented to increase from 7.5 to 8.5 due to CO₂ uptake from phytoplankton as the
bloom developed. Microcosm experiments demonstrated that most protists were unaffected by the seasonal changes in pH, even during the massive phytoplankton spring bloom (Paper IV).

4) In a sub-Arctic fjord, field data indicated that the protozooplankton succession was regulated by copepod grazing during most of the productive season and that the protozooplankton provide an essential food source for the copepod populations. In addition the protozooplankton >20 µm were significantly herbivores on the small sized phytoplankton grazing. The importance of protozooplankton as grazers increased over a transect going from open-ocean to the inner part of the fjord (Paper V & VI).

In conclusion, protozooplankton contributed significantly to the area-specific biomass at all investigated sub-Arctic and Arctic localities with a tendency towards high protozooplankton concentrations in the upper water column of stratified waters. Future climate changes are expected to increase water column stratification which will lead to reduced phytoplankton size and increase the importance of protozooplankton as grazers that are especially suited for consuming small cells. This will shift the relative importance of larger metazoan grazers (e.g. copepods) towards protozooplankton.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Riisgaard, K. (Intern), Nielsen, T. G. (Intern), St. John, M. (Intern)
Number of pages: 169
Publication date: 2014

Electronic versions:

Warming impacts on fish species composition in the Kattegat-Belt Sea
Sea temperatures have been rising in the waters near Denmark during the past 1-2 decades and are expected to affect marine populations, species, communities and foodwebs. Here we investigate whether and how the species richness and composition of the marine fish community in the Kattegat and Belt Sea have been influenced by these changes. We hypothesize that the recent warming has led to an increase in species richness of the local community and that this increase is due to immigration of species from warmer areas. We use spring and fall survey data collected by DTU Aqua during the years 1994-2013 and bottom temperature data (observed and model outputs from a regional physical oceanographic model) to test these ideas. Species richness has increased significantly during the time period in both seasons of the year, and the increases were significantly correlated with bottom temperatures. Analysis of the southern range limits of all species captured in the surveys shows that the mean southern latitudinal limit of the fish community has been decreasing and is also correlated with bottom temperatures; these patterns are consistent with immigration of fish from southerly zoogeographic regions. Warm-adapted species also increased their distributional area (i.e., probability of occurrence) in the sampling region and some cold-adapted species became rarer and more narrowly distributed. Similar results were generally obtained using both observed and modelled temperature data. The changes reported in this study contribute to a growing documentation of how climate variability and changes are affecting marine communities and biodiversity.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Bryndum, K. M. (Ekstern), MacKenzie, B. (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

Where have all the coast fish gone?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Section for Monitoring and Data
Authors: Stættrup, J. (Intern), Munk, P. (Intern), Lund, S. (Ekstern), Kindt-Larsen, L. (Intern), Dutz, J. (Intern), Egekvist, J. (Intern)
Publication date: 2014
Analysing migrations of Atlantic cod Gadus morhua in the north-east Atlantic Ocean: Then, now and the future

The application of data storage tags bears the potential for a quantum leap in the research on fish migrations, because not only first-capture and recapture positions are known, but at least theoretically, the migration path during the period at large can be reconstructed. Position, however, cannot be measured directly but has to be estimated using the available data on light, temperature, pressure and salinity. The reconstructed locations based on advanced estimation techniques have been termed geolocations. Examples are discussed which illustrate the applicability of geolocations in individual path descriptions, separation of reproductively isolated populations, timing and areas of spawning, tidal transport and use of protected areas. The examples are based on archival tag data from the North Sea, the Baltic Sea, the Barents Sea and Faroese and Icelandic Waters. Besides presenting the state-of-the-art geolocations for cod Gadus morhua in the north-east Atlantic Ocean, the major aim of this review is to raise awareness of gaps in knowledge and to identify ideas for new research.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Department of Applied Mathematics and Computer Science, Centre for Ocean Life, Cefas, Marine Scotland, Havsmiljöinstitutet, Institute of Marine Research, Faroe Marine Research Institute, Marine Research Institute

Authors: Neuenfeldt, S. (Intern), Righton, D. (Ekstern), Neat, F. (Ekstern), Wright, P. (Forskerdatabase), Svedäng, H. (Ekstern), Michalsen, K. (Ekstern), Subbey, S. (Ekstern), Steingrund, P. (Ekstern), Thorsteinsson, V. (Ekstern), Pampoulie, C. (Ekstern), Andersen, K. H. (Intern), Pedersen, M. W. (Intern), Metcalfe, J. (Ekstern)

Pages: 741-763
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 82
Issue number: 3
ISSN (Print): 0022-1112

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 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.895 SNIP 0.946 CiteScore 1.66
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
A reliable method for ageing of whiting (Merlangius merlangus) for use in stock assessment and management

Accurate age estimation is important for stock assessment and management. The importance of reliable ageing is emphasized by the impending analytical assessment of whiting (Merlangius merlangus) in the Baltic Sea. Whiting is a top predator in the western Baltic Sea, where it is fished commercially although less extensively compared to the North Sea. Although the species is considered one of the most difficult gadoids to age, few efforts have been made to shed light on the ageing problems. The aim of the present study was to identify and validate the 1st winter ring and to examine the visibility of the subsequent winter rings. Microstructure analysis was used to confirm the 1st winter ring. Additionally, otolith growth trajectories were obtained, confirming the allometric growth as seen in many fish species. The method for ageing of whole otoliths presented in this study can be directly implemented in future ageing of whiting otoliths from the Baltic Sea – and potentially also adjacent areas where the conspecifics have similar growth rates

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Hüssy, K. (Intern)
Pages: 825-832
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Ichthyology
Volume: 29
ISSN (Print): 0175-8659
Ratings:
BFI (2018): BFI-level 1
A review on broodstock nutrition of marine pelagic spawners: the curious case of the freshwater eels (Anguilla spp.)
To sustain eel aquaculture, development of reproduction in captivity is vital. The aim of this review is to assess our current knowledge on the nutrition of broodstock eels in order to improve the quality of broodstock under farming conditions, drawing information from wild adult eels and other marine pelagic spawners. Freshwater eels spawn marine pelagic eggs with an oil droplet (type II), and with a large perivitelline space. Compared with other marine fish eggs, eel eggs are at the extreme end of the spectrum in terms of egg composition, even within this type II group. Eel eggs contain a large amount of total lipids, and a shortage of neutral lipids has been implied a cause for reduced survival of larvae. Eel eggs have higher ARA but lower EPA and DHA levels than in other fish. Too high levels of ARA negatively affected reproduction in the Japanese eel, although high levels of 18:2n-6 in the eggs of farmed eels were not detrimental. The total free amino acid amount and profile of eel eggs appears much different from other marine pelagic spawners. Nutritional intervention to influence egg composition seems feasible, but responsiveness of farmed eels to induced maturation might also require environmental manipulation. The challenge remains to succeed in raising European eel broodstock with formulated feeds and to enable the procurement of viable eggs and larvae, once adequate protocols for induced maturation have been developed.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, National Food Institute, Division of Industrial Food Research, Section for Marine Ecology and Oceanography, National Institute of
Biochemical, histological and molecular study of digestive tract development in European eel larvae (Anguilla anguilla) prior to exogenous feeding

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, IFREMER, Norwegian University of Science and Technology
Authors: Mazurais, D. (Ekstern), Kjørsvik, E. (Ekstern), World, P. (Ekstern), Politis, S. N. (Intern), Cahu, C. (Ekstern), Tomkiewicz, J. (Intern), Zambonino-Infante, J. (Ekstern)
Publication date: 2013
Event: Poster session presented at Aquaculture Europe 13, Trondheim, Norway.
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version

Bibliographical note
Best Poster Award

Biological ensemble modeling to evaluate potential futures of living marine resources
Natural resource management requires approaches to understand and handle sources of uncertainty in future responses of complex systems to human activities. Here we present one such approach, the "biological ensemble modeling approach," using the Eastern Baltic cod (Gadus morhua callarias) as an example. The core of the approach is to expose an ensemble of models with different ecological assumptions to climate forcing, using multiple realizations of each climate scenario. We simulated the long-term response of cod to future fishing and climate change in seven ecological models ranging from single-species to food web models. These models were analyzed using the "biological ensemble modeling approach" by which we (1) identified a key ecological mechanism explaining the differences in simulated cod responses between models, (2) disentangled the uncertainty caused by differences in ecological model assumptions from the statistical uncertainty of future climate, and (3) identified results common for the whole model ensemble. Species interactions greatly influenced the simulated response of cod to fishing and climate, as well as the degree to which the statistical uncertainty of climate trajectories carried through to uncertainty of cod responses. Models ignoring the feedback from prey on cod showed large interannual fluctuations in cod dynamics and were more sensitive to the underlying uncertainty of climate forcing than models accounting for such stabilizing predator–prey feedbacks. Yet in all models, intense fishing prevented recovery, and climate change further decreased the cod population. Our study demonstrates how the biological ensemble modeling approach makes it possible to evaluate the relative importance of different sources of uncertainty in future species responses, as well as to seek scientific conclusions and sustainable management solutions robust to uncertainty of food web processes in the face of climate change

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Finnish Game and Fisheries Research Institute, Lund University, Stockholm University, University of Hamburg
Authors: Gårdmark, A. (Ekstern), Lindegren, M. (Intern), Neuenfeldt, S. (Intern), Blenckner, T. (Ekstern), Heikinheimo, O. (Ekstern), Müller-Karulis, B. (Ekstern), Niiranen, S. (Ekstern), Tomczak, M. T. (Ekstern), Aaro, E. (Ekstern), Möllmann, C. (Ekstern)
Pages: 742-754
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: Ecological Applications
Volume: 23
Issue number: 4
ISSN (Print): 1051-0761
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Can IBMs tell us why some cod undertake vertical (feeding) migrations into hypoxic waters?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Authors: Behrens, J. W. (Intern), Neuenfeldt, S. (Intern), Deurs, M. V. (Intern)

DOI: 10.1890/12-0267.1
Links: http://www.esajournals.org/doi/abs/10.1890/12-0267.1
Publication: Research - peer-review > Journal article – Annual report year: 2013
Cannibalism of Lesser sandeels (Ammodytes marinus) in the North Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Ayala, D. J. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

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 37th Annual Larval Fish Conference, Miami, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Cod recovery as a new challenge for fisheries management: experience from the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Institute Management
Authors: Eero, M. (Intern), Hüsey, K. (Intern), Mosegaard, H. (Intern), Hansen, J. H. (Intern), Bastardie, F. (Intern), Köster, F. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Coexistence of structured populations with size-based prey selection

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Hartvig, M. (Intern), Andersen, K. H. (Intern)
Pages: 24-33
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Theoretical Population Biology
Volume: 89
ISSN (Print): 0040-5809
Ratings:
Comparing ecosystem models as fisheries management tools: a case study in the California current

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Jacobsen, N. S. (Intern), Koehn, L. (Ekstern), Hodgson, E. (Ekstern), Andersen, K. H. (Intern), Essington, T. (Ekstern)
Publication date: 2013
Event: Abstract from International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Comparison of broodstock lipid stores in farmed and wild European eel (Anguilla anguilla) in link with reproductive performance

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Corraze, G. (Ekstern), Støttrup, J. (Intern), Larroquet, L. (Ekstern), Tomkiewicz, J. (Intern), Kaushik, S. (Ekstern)
Publication date: 2013
Event: Poster session presented at Aquaculture Europe 13, Trondheim, Norway.
Main Research Area: Technical/natural sciences
Links: https://www.was.org/easonline/AbstractDetail.aspx?i=2067
Publication: Research › Poster – Annual report year: 2014

Development of a broodstock diet to improve embryonic development competence in female European eel Anguilla anguilla

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, National Food Institute, Division of Industrial Food Research
Authors: Støttrup, J. (Intern), Tomkiewicz, J. (Intern), Jacobsen, C. (Intern), Krüger-Johnsen, M. (Intern), Holst, L. (Ekstern), Lauesen, P. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Links: https://www.was.org/easonline/Mobile/Paper.aspx?i=2048
Publication: Research › Paper – Annual report year: 2014

Development of techniques and technology for embryonic and larval rearing of the European eel

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Butts, I. (Intern), Sørensen, S. R. (Intern), Politis, S. N. (Intern), Lauesen, P. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2013
Event: Poster session presented at Larvi 2013, Ghent, Belgium.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

Distribution and reproduction of the Arctic ctenophore Mertensia ovum in the Baltic Sea
Species identification based on morphological characteristics has caused misidentifications and led to twisted views of abundances and roles of ctenophores. Based on extensive field studies from 2007 to 2010, the occurrence of the arctic ctenophore Mertensia ovum was genetically verified in the southern, central and northern Baltic Sea, and its egg production, distribution and abundance were studied in relation to physical factors. Genetic analyses indicate that M. ovum is by far the most abundant small ctenophore in the Baltic Sea. Specimens from a 20 yr old ctenophore collection were also genetically identified as M. ovum, contrary to their previous morphological identification as another ctenophore species, Pleurobrachia pileus. Thus, earlier reports on P. pileus in the Baltic Sea may actually refer to M. ovum. The abundance of M. ovum was regulated by both salinity and temperature, with highest abundances found in sea areas and water layers at temperatures 5.5 and oxygen levels >4 ml l^-1. During summer, the highest abundances of ctenophores and their eggs were found near the halocline, while the distribution was more uniform throughout the water column during winter. Only ctenophores >3.5 mm (oral-aboral length) produced eggs in the experiments, with an average rate of 2.2 eggs ind^-1 d^-1. Finally, comparison with published data from the 1980s (assuming that those data refer to M. ovum) indicates that the present-day ctenophore abundance is ~80% lower in the north and ~55% higher in the southern parts of the Baltic Sea, due to reasons yet to be established

General information
Distribution of phytoplankton functional types in high-nitrate low-chlorophyll waters in a new diagnostic ecological indicator model

Modeling and monitoring plankton functional types (PFTs) is challenged by insufficient amount of field measurements to ground-truth both plankton models and bio-optical algorithms. In this study, we combine remote sensing data and a dynamic plankton model to simulate an ecologically-sound spatial and temporal distribution of phyto-PFTs. We apply an innovative ecological indicator approach to modeling PFTs, and focus on resolving the question of diatom-coccolithophore co-existence in the subpolar high-nitrate and low-chlorophyll regions. We choose an artificial neural network as our modeling framework because it has the potential to interpret complex nonlinear interactions governing complex adaptive
systems, of which marine ecosystems are a prime example. Using ecological indicators that fulfill the criteria of measurability, sensitivity and specificity, we demonstrate that our diagnostic model correctly interprets some basic ecological rules similar to ones emerging from dynamic models. Our time series highlight a dynamic phyto-PFT community composition in all high latitude areas, and indicate seasonal co-existence of diatoms and coccolithophores. This observation, though consistent with in situ and remote sensing measurements, was so far not captured by state-of-the-art dynamic models which struggle to resolve this "paradox of the plankton". We conclude that an ecological indicator approach is useful for ecological modeling of phytoplankton and potentially higher trophic levels. Finally, we speculate that it could serve as a powerful tool in advancing ecosystem-based management of marine resources.
Distribution of plankton functional types in response to changes in their ecological niches

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Palacz, A. (Intern)
Publication date: 2013
Event: Abstract from International Workshop on Trait-based approaches to Ocean Life, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Does whiting play a central role in the food web of the western Baltic Sea?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Ross, S. D. (Intern), Nielsen, J. R. (Intern), Gislason, H. (Intern), Andersen, N. G. (Intern)
Publication date: 2013
Event: Abstract from ICES Annual Science Conference 2013, Reykjavik, Iceland.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Editorial on writing equations and mathematical expressions: Some basic principles

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Andersen, N. G. (Intern), Craig, J. (Ekstern)
Pages: 1771-1772
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 82
Issue number: 6
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Effect of preservation temperature and cryopreservation on European eel sperm fertilization capacity. First production of larvae using cryopreserved sperm

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Asturiano, J. (Ekstern), Sørensen, S. R. (Intern), Pérez, L. (Ekstern), Lauesen, P. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2013
Event: Poster session presented at 4th International Workshop on Biology of Fish Gametes, Faro, Portugal.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

Emerging asymmetric interactions between forage and predator fisheries impose management trade-offs
A size and trait-based marine community model was used to investigate interactions, with potential implications for yields, when a fishery targeting forage fish species (whose main adult diet is zooplankton) co-occurs with a fishery targeting larger-sized predator species. Predicted effects on the size structure of the fish community, growth and recruitment of fishes, and yield from the fisheries were used to identify management trade-offs among the different fisheries. Results showed that moderate fishing on forage fishes imposed only small effects on predator fisheries, whereas predator fisheries could enhance yield from forage fisheries under some circumstances

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Marine Institute, Queen's University Belfast
Authors: Houle, J. (Ekstern), Andersen, K. H. (Intern), Farnsworth, K. (Ekstern), Reid, D. (Ekstern)
Pages: 890-904
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Fish Biology
Volume: 83
Issue number: 4
ISSN (Print): 0022-1112
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 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
En revision af traditionelle koncepter i fiskeriet. Er balanceret fiskeri en mulig forvaltningsstrategi?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Authors: Jacobsen, N. S. (Intern), Andersen, K. H. (Intern), Gislason, H. (Intern)
Publication date: 2013
Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2013

Evaluation of methods to determine sperm density for the european eel, anguilla anguilla

European eel, Anguilla anguilla, is a target species for future captive breeding, yet best methodology to estimate sperm density for application in in vitro fertilization is not established. Thus, our objectives were to evaluate methods to estimate European eel sperm density including spermatocrit, computer-assisted sperm analysis (CASA) and flow cytometry (FCM), using Neubauer Improved haemocytometer as benchmark. Initially, relationships between spermatocrit, haemocytometer counts and sperm motility were analysed, as well as the effect of sperm dilution on haemocytometer counts. Furthermore, accuracy and precision of spermatocrit, applying a range of G-forces, were tested and the best G-force used in method comparisons. We found no effect of dilution on haemocytometer sperm density estimates, whereas motility associated positively with haemocytometer counts, but not with spermatocrit. Results from all techniques, spermatocrit, CASA and FCM, showed significant positive correlations with haemocytometer counts. The best correlation between spermatocrit and haemocytometer counts was obtained at 6000 × g (r = 0.68). Of two CASA variants, one or three photographic fields (CASA-1 and CASA-2), CASA-2 showed a very high accuracy to haemocytometer counts (r = 0.93), but low precision
FCM was tested with and without microfluorospheres (FCM-1 and FCM-2), and relationships to haemocytometer counts were highly accurate (FCM-1: \( r = 0.94 \); FCM-2: \( r = 0.88 \)) and precise (CV: FCM-1 = 2.5; FCM-2 = 2.7%). Overall, CASA-2 and FCM-1 feature reliable methods for quantification of European eel sperm, but FCM-1 has a clear advantage featuring highest precision and accuracy. Together, these results provide a useful basis for gamete management in fertilization protocols.
Evaluation of methods to determine sperm density for the European eel, Anguilla anguilla

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Sørensen, S. R. (Intern), Gallego, V. (Ekstern), Pérez, L. (Ekstern), Butts, I. (Intern), Tomkiewicz, J. (Intern), Asturiano, J. (Ekstern)
Publication date: 2013
Event: Poster session presented at 4th International Workshop on Biology of Fish Gametes, Faro, Portugal.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

Excess post hypoxic oxygen consumption in Atlantic cod (Gadus morhua)
Atlantic cod Gadus morhua experienced oxygen deficit (DO2) when exposed to oxygen levels below their critical level (c. 73% of pcrit) and subsequent excess post-hypoxic oxygen consumption (CEPHO) upon return to normoxic conditions, indicative of an oxygen debt. The mean±s.e. CEPHO:DO2 was 6·9±1·5, suggesting that resorting to anaerobic energy production in severe hypoxia is energetically expensive

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Plambech, M. (Intern), Deurs, M. V. (Intern), Steffensen, J. (Ekstern), Tirsgaard, B. (Ekstern), Behrens, J. (Intern)
Pages: 396-403
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 83
Issue number: 2
ISSN (Print): 0022-1112
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 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Feeding season duration and the relative success of capital and income spawning copepods

In high latitude environments, two closely related Calanus copepods have developed opposite reproduction strategies to cope with the strongly seasonal fluctuation. Calanus finmarchicus copepods breeds relying on the available food (income breeder), while Calanus hyperboreus copepods spawn prior to the spring bloom, using only its reserves accumulated the previous year (capital breeder). The success of these two strategies is related to the length of the spring bloom, the only source of nutrients for these copepods. We use an individual based model to approach the question of income versus capital breeders in a highly seasonal environment, and find that the capital breeders have a higher fitness during short spring bloom while the income breeder has an improved performance over long productive seasons.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Sainmont, J. (Intern), Varpe, Ø. (Ekstern), Andersen, K. H. (Intern), Visser, A. (Intern)
Publication date: 2013
Event: Abstract from ASLO 2013 Aquatic Sciences Meeting, New Orleans, United States.
Main Research Area: Technical/natural sciences
Publication: Research – Conference abstract for conference – Annual report year: 2013
Food for thought: Overconfidence in model projections
There is considerable public and political interest in the state of marine ecosystems and fisheries, but the reliability of some recent projections has been called into question. New information about declining fish stocks, loss of biodiversity, climate impacts, and management failure is frequently reported in the major news media, based on publications in prominent scientific journals. Public and political awareness of the generally negative changes taking place in marine ecosystems is welcome, especially if it results in effective remedial action, but the scientific basis for such action must be reliable and uncertainties arising from models and data shortcomings must be presented fully and transparently. Scientific journals play an important role and should require more detailed analysis and presentation of uncertainties.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Brander, K. (Intern), Neuheimer, A. (Intern), Andersen, K. H. (Intern), Hartvig, M. (Intern)
Pages: 1065-1068
Publication date: 2013
Main Research Area: Technical/natural sciences
Forage fish quality: seasonal lipid dynamics of herring (Clupea harengus L.) and sprat (Sprattus sprattus L.) in the Baltic Sea

This study investigates lipid content and fatty acid composition of two important forage fish, sprat (Sprattus sprattus) and herring (Clupea harengus) in the Baltic Sea ecosystem. Seasonal variation in lipids was studied during three periods following the annual reproductive cycle considering potential differences relating to fish size, sex, and reproductive status. The isopod Saduria entomon, being at times an important prey for predatory fish, was included for comparison. In both sprat and herring, lipid content and absolute contents of essential polyunsaturated fatty acids (PUFAs) varied seasonally with high levels towards the end of the annual zooplankton production cycle, succeeded by a decline. Lipid content and fatty acid composition differed significantly between sprat and herring. Sprat lipid content was higher than herring, increasing with fish size and characterized by large proportions of monounsaturated fatty acids. Herring lipid content was related to the reproductive cycle and proportions of PUFAs were high compared with sprat. Levels of essential PUFAs were high in S. entomon compared with clupeids rendering it a valuable alternative prey species in the Baltic Sea ecosystem. The lipid dynamics of forage fish and benthos, combined with changes in availability and abundance, will affect growth and reproduction of their predators.
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 - peer-review › Journal article – Annual report year: 2013

Haemoglobin genotypes in cod (Gadus morhua L): their geographic distribution and physiological significance

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Norwegian University of Science and Technology, University of Copenhagen
Authors: Ross, S. D. (Intern), Behrens, J. W. (Intern), Brander, K. (Intern), Methling, C. (Ekstern), Mork, J. (Ekstern)
Pages: 158-168
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2014
How important is whiting in the western Baltic Sea ecosystem?

General information
State: Published
Identification of seasonal migration, vertical activity and thermal experience of Greenland halibut Reinhardtius hippoglossoides (Walbaum) in west Greenland waters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources
Authors: Behrens, J. W. (Intern), Neuenfeldt, S. (Intern), Sparrevohn, C. R. (Intern), Eigaard, O. R. (Intern), Boje, J. (Intern)
Publication date: 2013
Event: Poster session presented at Society of Experimental Biology, Annual Main Meeting, Valencia, Spain.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2013

Importance of Protozooplankton in a future warmer arctic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Arctic Section
Authors: Nielsen, T. G. (Intern), Risgaard, K. (Intern), Swalethorp, R. (Intern), Kjellerup, S. (Intern), Ryggaard, S. (Ekstern)
Publication date: 2013
Event: Abstract from ASLO 2013 Aquatic Sciences Meeting, New Orleans, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Improved management based on stock identification of eastern and western Baltic cod

The objective of this project was to establish an empirically founded knowledge base for the sustainable exploitation of the western Baltic cod stock by including the complex stock structure and migration patterns.
Stock mapping: Extensive immigration of “Eastern” cod into the Arkona Basin (SD 24) within the “Western” cod’s management unit was documented using high-powered genetic tools. The majority (91%) of all spawning fish caught in SD 24 in 2011 were “Eastern” cod and only 9% were from the “Western” stock. The results suggest that the stock structure in the Arkona Basin is highly influenced by mixing of genetically separate stocks.
Trends in mixing: Since the 1980’s where cod in SD 24 consisted primarily of “Western” type, the proportion of “Eastern” cod has increased, particularly since 2005. Throughout that period, the immigration of “Eastern” cod into SD 24 consisted primarily of adult, older fish. The changes in biological characteristics (mean size at age, condition and maturity) observed in that area since 2005 are thus a direct consequence of the extensive immigration of “Eastern” cod. As no seasonal signals in stock mixing were observed, the immigration is not associated with a change in “Eastern” cod’s spawning behaviour.
Management: The stock mixing proportions were successfully implemented in DTU Aqua’s modeling framework for management scenarios. “Eastern” immigrants into SD 24 lead the management procedure to advice for higher TACs that enhance the pressure on the fishing mortality level in SD 22. The fishing mortality level in SD 22 in this situation will need to be lowered i.e. by allocating more effort and catch from SD 22 to SD 24. Higher landings are expected if effort is redirected/re-allocated to SD 24, profiting from the “Eastern” immigrants. By lowering the fishing mortality in SD 22, the SSB in SD 22 is also preserved, which is assumed to be the main source of recruits for the whole “western” stock (i.e. SD 22 + SD 24). In conclusion: Within the frame of this project we showed that substantial immigration “Eastern” cod into SD 24 has occurred and that these stock dynamics should be incorporated in evaluations of future management plans.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources
Authors: Hüsey, K. (Intern), Bastardie, F. (Intern), Eero, M. (Intern), Hansen, J. H. (Intern), Mosegaard, H. (Intern), Nielsen, J. R. (Intern)
Number of pages: 61
Publication date: 2013
Individual behaviour of Baltic cod (Gadus morhua) in relation to sex and reproductive state

Information from data storage tags (DSTs) is conventionally used to infer movement patterns or reveal characteristics (e.g. temperature or salinity) of the environment surrounding tagged fish. Here we link data derived from DSTs with the reproductive physiology of tagged fish. Individual vertical activity of adult male and female Atlantic cod Gadus morhua L. in the Bornholm Basin was derived from DST measures and related to the individual histologically determined reproductive phase. Spawning migrations were identified by movements towards deeper and more saline waters. No difference was observed between sexes in the timing of the onset of migration and the duration of migration from feeding grounds to the spawning area. While there was no significant difference in duration of the spawning period between females and males, the histological indices suggest that females finish spawning before males. Irrespective of gender, vertical swimming activity was most pronounced during spawning, with descents towards the bottom dominating the movements. During spawning, males stayed significantly deeper than females. In conclusion, the present results suggest that initiation of spawning migration and duration of the spawning period differs between sexes, as does the level of activity during spawning events. Not all individuals followed the general pattern; a considerable number of individuals were found to spawn in shallow water in the Arkona Basin, and juvenile fish undertook the migration without spawning.
Influences of deep convection on phytoplankton winter dynamics

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Lindemann, C. (Intern), St. John, M. (Intern), Backhaus, J. (Ekstern)
Publication date: 2013
Event: Poster session presented at 45th international liege colloquium on ocean dynamics, Liège, Belgium.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

Konkurrerer krill om føden?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Agersted, M. D. (Intern), Nielsen, T. G. (Intern)
Publication date: 2013
Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Marine climate change research in Nordic regions: recent trends and current state

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Publication date: 2013
Event: Poster session presented at ICES Annual Science Conference 2013, Reykjavik, Iceland.
Main Research Area: Technical/natural sciences
Source: dtu
Source-ID: u:9868
Publication: Research › Poster – Annual report year: 2013

Microbial interference and potential control in the production of European eel Anguilla anguilla larvae

General information
State: Published
Microbial interference with hatch and survival of European eel larvae

Recent research has significantly improved our knowledge and capabilities in the field of in vitro production of yolk sac larvae from European eel (Anguilla anguilla). Female broodstock European eels are matured by weekly administration of pituitary extract and male eels with hCG (human chorionic gonadotropin), which afford gametes for in vitro fertilization studies. The maturing process may lead to mass hatchings of up to ½ million larvae of which some survive the entire yolk sac phase. However, the rearing of larvae suffers from high larval mortalities, and water quality might be a crucial factor for larval survival in rearing systems. By applying antibiotic treatment as a research tool, it was possible to determine the extent of microbial interference in the production of high numbers of good quality larvae. By controlling microbiota during egg and larval incubation, the egg hatching success and larval longevity more than doubled. Using scanning electron microscopic analysis it was observed that microbe inhibiting treatments reduced bacterial colonization of the eggs surface, which possibly cause reduced gas and ionic exchange across chorionic membrane.

These results suggest that future eel larviculture should not only focus on optimizing physical incubation conditions, but certainly also on the control over microbial interference.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Billund Aquaculture Service Aps, Ghent University
Authors: Sørensen, S. R. (Intern), Lauesen (Ekstern), Tomkiewicz, J. (Intern), de Schryver, P. (Ekstern)
Number of pages: 1
Publication date: 2013
Event: Abstract from DAFINET Workshop : Diagnosis and Control of Fish Diseases, Frederiksberg, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Pages_from_DAFINET_April_2013_Abstracts_2.pdf
Links:
http://www.dafinet.dk/DAFINET/Abstract_books_files/DAFINET%20April%202013%20Abstracts.pdf
Publication: Research › Conference abstract for conference – Annual report year: 2013

Novel insight from Mnemiopsis ecophysiological data using a coherent framework

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Billund Aquaculture Service Aps, Ghent University
Authors: Augustine, S. (Intern), Jaspers, C. (Intern), Kooijman, S. A. (Ekstern), Freitas, V. (Ekstern), Walraven, L. V. (Ekstern), Veer, H. V. D. (Ekstern), Poggiale, J. (Ekstern), Carlotti, F. (Ekstern)
Number of pages: 1
Publication date: 2013
Event: Abstract from Dynamic Energy Budget (DEB) symposium , Island of Texel, Netherlands.
Main Research Area: Technical/natural sciences
Electronic versions:
Conference abstract
Publication: Research › Conference abstract for conference – Annual report year: 2013

Oogenesis, fecundity and condition of Baltic herring (Clupea harengus L.): A stereological study

Herring (Clupea harengus) is a capital breeder that stores energy reserves in muscle tissue. Individual potential fecundity relies on the size and weight of female fish. Poor condition during the maturation process can lead to a heavy down-regulation of fecundity through atresia and, in the extreme, cause skipped spawning. Herring in the Central Baltic Sea exist in a variable environment where food availability fluctuates substantially. Compared to other herring populations their
condition is generally poor. In the present study, the oocyte dynamics and fecundity in relation to the condition of Central Baltic herring was investigated. A modern stereological method, the physical fractionator, was used to quantify the number of oocytes in previtellogenic (PG), cortical alveoli (CA) as well as successive vitellogenic (VT1 and VT2) stages in central Baltic herring during ovarian maturation. The potential fecundity, i.e. the number of VT2 oocytes, was low compared to other Atlantic stocks but the relative potential fecundity was higher. The latter decreased by 71% when comparing early-maturing individuals with CA oocytes and late-maturing individuals with VT2 oocytes, suggesting a substantial down-regulation of fecundity. Although determined as spring spawners by otolith hatch type, 15% of the randomly sampled females were characterized by oocytes in CA stage in the prespawning period, indicating skipped spawning. The condition of these females was poor, which might have resulted in skipped spawning. Ovary weight was a good predictor of potential fecundity within maturing stages of females. Combined with estimates of skipped spawning, this ovary weight could be used to estimate egg production thereby improving Central Baltic herring stock-recruitment models.
Optimal foraging and diel vertical migration in a life history model

Zooplankton such as copepods are known to perform diel vertical migration, avoiding the food rich surface during bright hours to avoid visual predator when they are most dangerous, and returning to the surface to feed at night. The resolution of this foraging behaviour requires fine time scale in the model, unsuited for life history modeling. We propose a method based on optimal foraging theory to take into account the emergent feeding rates as a function of the copepod metabolic cost, latitude, time and predation. We predict that copepods will balance their growth rate and mortality, playing a safe strategy when food is plentiful, but taking greater risks at low food concentrations. We apply these concepts to high latitude ecosystems where there is a strong seasonal variation in both food availability and day length. Specifically, during the summer, the midnight sun will force the animals to take more risk and maintain some feeding at the surface to cover their nutritional needs, compensate for predation mortality and sustain their growth.

Paternal effects on early life history traits in Northwest Atlantic cod, Gadus morhua

It is important to understand parental effects on early life history of fish as manifested, for example, in individual fitness of offspring. Immediately after fertilization, parental contributions (both genetic and non-genetic) to embryos will affect larval ontogeny, physiology, morphology and survival. In marine fish, rates of natural mortality are highest during early life and are negatively correlated with rates of growth and body size. In these early life stages (eggs, larvae, young juveniles) subtle differences in mortality can cause large differences in recruitment and year-class success. Therefore, it is particularly critical to understand factors that contribute to variability in mortality during early life. This study focuses on evaluating the potential influence of paternity on rates of mortality and development in eggs and larvae of Northwest Atlantic cod, Gadus morhua. To accomplish this 12 males and two females were crossed using a full-factorial breeding...
design. Paternity had a strong influence on fertilization success, hatching success, cumulative embryonic mortality, larval standard length, eye diameter, yolk-sac area, and cumulative larval mortality. Female 1 showed an overall 'weaker' performance of offspring than Female 2, indicating that deviations can stem from differences in female quality. Nevertheless, paternal contributions to embryonic and larval development were still evident despite differences in female quality, showing that sire effects on offspring are undeniable and can serve as important sources of variation during early life stages in fishes. Overall, these findings have implications for furthering the understanding of recruitment variability and can be used to optimize reproductive output for the aquaculture industry. In addition, the data suggests that the choice of mate during spawning can play a large role in offspring fitness.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg, Fisheries and Oceans Canada
Authors: Kroll, M. (Ekstern), Peck, M. (Ekstern), Butts, I. A. (Intern), Trippel, E. (Ekstern)
Pages: 623-629
Publication date: 2013
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Applied Ichthyology
Volume: 29
Issue number: 3
ISSN (Print): 0175-8659
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 0.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.99
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs: 10.1111/jai.12161
Population dynamics and life strategy of the copepod Metridia longa in a Greenlandic fjord

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Ecology and Oceanography
Authors: Kjellerup, S. (Intern), Swalethorp, R. (Intern), Nielsen, T. G. (Intern)
Publication date: 2013
Event: Abstract from ASLO 2013 Aquatic Sciences Meeting, New Orleans, United States.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Population genetics of the invasive ctenophore Mnemiopsis leidyi in Europe reveal source-sink dynamics and secondary dispersal to the Mediterranean Sea

Repeated invasions of European waters by the ctenophore Mnemiopsis leidyi offer a unique opportunity to study population dynamics and dispersal in gelatinous zooplankton. Here we followed population establishment in two recently invaded areas, the North and Baltic Sea, and analysed changes in population structure during a 3-yr interval using 7 highly polymorphic microsatellites (representing 191 alleles). A second goal was to reconstruct routes of recent invasive range expansion into the Mediterranean Sea. During the study period (2008-2010) populations in North Sea and Western Baltic Sea maintained their allelic composition with virtually unchanged levels of genetic diversity and between-population differentiation. This demonstrates that gene flow between the two regions was limited and indicates successful reproduction in both areas. In contrast, at the eastern distribution limit in the central Baltic (Bornholm Basin) the same measures fluctuated between years and genetic diversity decreased from 2008-2010. In concordance with prior ecological observations, this supports the view that here M. leidyi formed a sink population. In the area of recent range expansion (Mediterranean Sea) we observed high population differentiation for a holoplanktonic species. Among Mediterranean samples collected at sites in Spain, France and Israel pairwise differentiation was between Fst = 0.04-0.16. Despite such differentiation, Bayesian clustering and phylogeographic analysis support the hypothesis that all Mediterranean M. leidyi result from a secondary introduction originating in the Black Sea. Our study contributes to growing evidence that multiple invasions of the same species can vary in their degree of genetic diversity and demonstrates how genetic markers can help to resolve whether gelatinous plankton species form self-sustaining populations.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Bolte, S. (Ekstern), Fuentes, V. (Ekstern), Haslob, H. (Ekstern), Huwer, B. (Intern), Thibault-Botha, D. (Ekstern), Angel, D. (Ekstern), Galil, B. (Ekstern), Javidpour, J. (Ekstern), Moss, A. G. (Ekstern), Reusch, T. B. (Ekstern)
Pages: 25-36
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: Marine Ecology - Progress Series
Volume: 485
ISSN (Print): 0171-8630
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 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Prey exoskeletons influence the course of gastric evacuation in Atlantic cod Gadus morhua

This study examined the effects of prey exoskeleton characteristics on gastric evacuation patterns in Atlantic cod Gadus morhua. Three distinct stages were highlighted in the gastric evacuation of crustacean prey characterized by a robust exoskeleton. The experiments confirmed that the three shrimp species, Pandalus borealis, Pandalus montagui and Eualus macilentus, and the crab Chionoecetes opilio, were evacuated from the stomach at different rates. The duration of all stages increased with increasing ash (and carbonate) content of the fresh prey. Thickness, chemical composition and morphology of the prey exoskeleton all affected gastric evacuation: duration of initial delay, overall evacuation rate and a decreased evacuation rate at the end of the process. The power exponential function (PEF), with its shape parameter, described the course of evacuation for these prey types well, especially the initial delay. The PEF does not, however, allow describing evacuation by the current stomach content mass independent of meal size, which limits its usefulness in estimating consumption rates of wild G. morhua. To predict and describe gastric evacuation of prey with a robust exoskeleton, it is therefore suggested that the square-root function be expanded with an initial lag phase, coupled to the mechanistically based cylinder model of gastric evacuation.
Reproduction of European eel and larval culture: state of the art

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Centre for Ocean Life
Authors: Tomkiewicz, J. (Intern), Støttrup, J. (Intern), Corraze, G. (Ekstern), Kausik, S. (Ekstern), Holst, L. (Ekstern), McEvoy, F. (Ekstern), Dufour, S. (Ekstern), Lafont, A. (Ekstern), Asturiano, J. (Ekstern), Sørensen, S. R. (Intern), Tveiten, H. (Ekstern), De Schryver, P. (Ekstern), Butts, I. (Intern), Munk, P. (Intern), Zambonino-Infante, J. (Ekstern), Politis, S. N. (Intern), Krüger-Johnsen, M. (Intern), Lauesen, P. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Links:
https://www.was.org/easonline/Mobile/Paper.aspx?i=2052
Publication: Research › Paper – Annual report year: 2014

Size-based estimation of the status of fish stocks: simulation analysis and comparison with age-based estimations

Estimation of the status of fish stocks is important for sustainable management. Data limitations and data quality hinder this task. The commonly used age-based approaches require information about individual age, which is costly and relatively inaccurate. In contrast, the size of organisms is linked to physiology more directly than is age, and can be measured easier with less cost. In this work we used a single-species size-based model to estimate the fishing mortality (F) and the status of the stock, quantified by the ratio F/Fmsy between actual fishing mortality and the fishing mortality which leads to the maximum sustainable yield. A simulation analysis was done to investigate the sensitivity of the estimation and its improvement when stock specific life history information is available. To evaluate our approach with real observations, data-rich fish stocks, like the North Sea cod, were investigated and our estimations were compared to the ICES advice. Only size-specific catch data were used, in order to emulate data limited situations. The simulation analysis reveals that the status of the stock, i.e. F/Fmsy, is estimated more accurately than the fishing mortality F itself. Specific knowledge of the natural mortality improves the estimation more than having information about all other life history parameters. Our approach gives, at least qualitatively, an estimated stock status which is similar to the results of an age-based assessment. Since our approach only uses size-based catch data, it is a suitable tool for data-limited situations

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Authors: Kokkalis, A. (Intern), Thygesen, U. H. (Intern), Nielsen, A. (Intern), Andersen, K. H. (Intern)
Publication date: 2013
Event: Abstract from ICES Annual Science Conference 2013, Reykjavik, Iceland.
Main Research Area: Technical/natural sciences
Bibliographical note
ICES ASC 2013 extended abstract - ICES CM H:16
Source: dtu
Source-ID: u:9830
Publication: Research › Conference abstract for conference – Annual report year: 2013

Spawning migration and behavior of Baltic cod (Gadus morhua) based on DST-derived individual information

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Behrens, J. (Intern), Nielsen, B. (Ekstern), Hüssy, K. (Intern), Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Tomkiewicz, J. (Intern)
Publication date: 2013
Statistical aspects of fish stock assessment

Fish stock assessments are conducted for two main purposes: 1) To estimate past and present fish abundances and their commercial exploitation rates. 2) To predict the consequences of different management strategies in order to ensure a sustainable fishery in the future.

This thesis concerns statistical aspects of fish stocks assessment, which includes topics such as time series analysis, generalized additive models (GAMs), and non-linear state-space/mixed models capable of handling missing data and a high number of latent states and parameters. The aim is to improve the existing methods for stock assessment by application of state-of-the-art statistical methodology. The main contributions are presented in the form of six research papers.

The major part of the thesis deals with age-structured assessment models, which is the most common approach. Conversion from length to age distributions in the catches is a necessary step in age-based stock assessment models. For this purpose, GAMs and continuation ratio logits are combined to model the probability of age as a smooth function of length and spatial coordinates, which constitutes an improvement over traditional methods based on area-stratification. GAMs and delta-distributions are applied for the calculation of indices of abundance from trawl survey data, and different error structures for these are investigated.

Two extensions to the state-space approach to age-structured stock assessment modelling are presented. The first extension introduces multivariate error distributions on survey catch-at-age data. The second extension is an integrated assessment model for overlapping sub-stocks subject to joint exploitation in the area of overlap. Estimation and inference is carried out using maximum likelihood.

Finally, a biomass dynamic model based on stochastic differential equations is presented. This work extends the classical approaches to biomass modelling by incorporating observation errors on the catches, and allowing for missing and non-equidistant samples in time.

Stereology as a tool to assess reproduction strategy and fecundity of teleost fishes: Integrated studies in Central Baltic herring (Clupea harengus L.)

In fish stock assessment, spawning stock biomass (SSB) is used as an index of stock reproductive potential (SRP), and proportionality is assumed between SSB and recruitment, i.e. offspring production. SSB is calculated as the sum of biomass proportions of sexually mature individuals per age group. However, evidence that SSB is not a reliable SRP indicator has accumulated over the past decades. The SSB estimation does not consider individual differences in fecundity, skipped spawning, timing of spawning or differences in reproductive traits between sexes, which may all fluctuate significantly, influenced by individual physiological condition. The Central Baltic herring has experienced a radical decline in SSB over the past decades. This is mainly due to overfishing. However, significant changes in Baltic Sea saltinity and temperature have also altered herring prey composition and abundance, while reduction in the number of cod has caused sprat numbers and thereby food competition to increase. Together, this has resulted in a significant drop in Central Baltic herring physiological condition. The influence which this lowered condition may have on herring SRP, in terms of increased down-regulation and thereby lowered fecundity, skipped spawning and timing of spawning, has not been investigated and is not considered in assessment of the stock.
The objective of the study was two-fold. Firstly, improve methods for quantification of oocyte recruitment dynamics by adapting and applying modern stereological methods to assess fecundity and reproductive strategies. The strength of the stereological method being that, in combination with conventional histological analysis, quantification of all oocyte categories is possible, as well as registration of qualitative characteristics relating to spawning history of individuals, and further that statistical evaluation of estimates and method is possible. Secondly, apply the stereological methods to fill in gaps in knowledge about Baltic Sea herring reproductive strategy under current environmental conditions, including oocyte recruitment pattern, fecundity determination and down-regulation, skipped spawning and spawning fidelity, and to understand how factors like condition may influence individual decision making and fitness regarding these reproductive traits. The stereological methods applied in this project constituted a powerful set of tools for quantification of oocyte dynamics in fish and were successfully implemented in herring ovaries for quantification of both oocyte numbers and sizes as well as total volume fraction of atretic oocytes, introducing a negligible error to the total variance of estimates. The histological nature of the stereological methods facilitated a ready validation of maturity data, distinguishing first time spawners from repeat spawners, as well as a ready recognition of ongoing oocyte recruitment in early maturity stages, early stage atresia, POFs and residual eggs. Analyzing a sample of females all collected during a short time frame in March 2008 covering various stages of maturation progression, we saw that oocyte recruitment followed the characteristic pattern of an iteroparous total spawner with determinate fecundity and group synchronous oocyte development. However, a significant fecundity down-regulation was apparent, which followed a three-step mechanism, resulting in low potential fecundity, but high relative potential fecundity compared to other herring stocks. Individual maturation progression revealed a substantial number of specimens with early developing ovaries, thereby being skipped or delayed spawners in accordance to the spring spawning season. Individual condition generally did not appear to influence fecundity regulation, but showed a strong correlation with degree of maturation progression, skipped or delayed spawners having significantly poorer condition than specimens expected to spawn during the spring spawning season. Results further indicated, that spawning occurs throughout the year in the Central Baltic herring population and that spawning time appears to be independent of individual hatch type, but rather relying on especially condition, but also size and age. Bioenergetic modeling showed that an individual condition factor threshold may control timing of spawning. These results may all influence Central Baltic herring SRP General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Bucholtz, R. H. (Intern), Tomkiewicz, J. (Intern)
Number of pages: 139
Publication date: 2013

Publication information
Place of publication: Charlottenlund
Publisher: National Institute of Aquatic Resources, Technical University of Denmark
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Ph.D. thesis – Annual report year: 2014

Techniques for rearing European eel during early life history
General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Billund Aquakulturservice A/S
Authors: Butts, I. (Intern), Serensen, S. R. (Intern), Politis, S. N. (Intern), Lauesen, P. (Ekstern), Tomkiewicz, J. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Links: https://www.was.org/easonline/Mobile/Paper.aspx?i=2037
Publication: Research › Paper – Annual report year: 2014

Towards an adaptive evolutionary and ecological trait-based model
General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Lindemann, C. (Intern), Palacz, A. (Intern), Prowe, F. (Intern)
Trait-based plankton trophic interactions and community composition in a global ocean ecosystem model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Prowe, F. (Intern), Andersen, K. H. (Intern), Kiørboe, T. (Intern), Visser, A. (Intern)
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
Publication: Research › Poster – Annual report year: 2013

Udvikling af effektivt og skånsomt redskab til tobisfiskeri på Dogger Banke

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources
Authors: Behrens, J. (Intern), Dinesen, G. E. (Intern), Tørring, P. (Ekstern), Eigaard, O. R. (Intern), Pedersen, E. M. (Intern), Stage, B. (Intern), Sørensen, T. K. (Intern), Mosegaard, H. (Intern)
Publication date: 2013
Event: Abstract from 17. Danske havforskermøde, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Zooplankton feeding traits and community composition in a global ecosystem model

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography
Authors: Prowe, F. (Intern), Andersen, K. H. (Intern), Kiørboe, T. (Intern), Visser, A. (Intern)
Publication date: 2013
Event: Abstract from International Liège Colloquium, Liège, Belgium.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013

Diversity of fish larvae communities across the subtropical convergence zone of the Sargasso Sea: a zoogeographical analysis combining morphological and genetic identification techniques

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Growth of cod larvae in a West Greenlandic fjord – effect of location on larval development in a subarctic population

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Ecology and Oceanography
Authors: Swalethorp, R. (Intern), Munk, P. (Intern), Nielsen, T. G. (Intern)
Publication date: 2012
Event: Abstract from Annual Larval Fish Conference, Os, Norway.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Reproduction of European eel: towards a self-sustained aquaculture (PRO-EEL)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Centre for Ocean Life, National Food Institute, Division of Industrial Food Research
Publication date: 2012
Event: Abstract from World Fisheries Congress, Edinburgh, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Spatial and temporal variability in nutrients and carbon uptake during 2004 and 2005 in the eastern equatorial Pacific Ocean

The eastern equatorial Pacific plays a great role in the global carbon budget due to its enhanced biological productivity linked to the equatorial upwelling. However, as confirmed by the Equatorial Biocomplexity cruises in 2004 and 2005, nutrient upwelling supply varies strongly, partly due to the tropical instability waves (TIWs). The aim of this study was to examine patterns of spatial and temporal variability in the biological uptake of NO3, Si(OH)(4) and carbon in this region, and to evaluate the role of biological and physical interactions controlling this variability over seasonal and intraseasonal time scales. Here, high resolution Pacific ROMS-CoSiNE (Regional Ocean Modeling System-Carbon, Silicon, Nitrogen Ecosystem) model results were evaluated with in situ and remote sensing data. The results of model-data comparison revealed a good agreement in domain-average hydrographic and biological rate estimates, and patterns of spatio-temporal variability in primary productivity. We confirmed that TIWs have the potential to enhance phytoplankton biomass through an increased supply of nutrients and elevated local and instantaneous phytoplankton nutrient uptake as opposed to only advecting biomass. Furthermore, we concluded that initial biological conditions (e.g., zooplankton biomass) may play an important additional constraint on biological responses, in particular of large phytoplankton such as diatoms, to TIW-induced perturbations in the physical and biogeochemical fields and fluxes. In order to fully resolve the complexity of biological and physical interactions in the eastern equatorial Pacific, we recommended improving CoSiNE and other models by introducing more phytoplankton groups, variable Redfield and carbon to chlorophyll ratios, as well as resolving the Fe-Si co-limitation of phytoplankton growth.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Maine
Authors: Palacz, A. P. (Intern), Chai, F. (Ekstern)
Pages: 4369-4383
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Biogeosciences
Volume: 9

Electronic versions:
Palacz.pdf

DOIs:
Spatial patterns in the distribution and early life characteristics of North Sea cod - Influence from environmental factors and climate change

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Marine Ecology and Oceanography
Authors: Höffle, H. (Intern), Munk, P. (Intern), MacKenzie, B. (Intern)
Number of pages: 171
Publication date: 2012

Publication information
Place of publication: Charlottenlund
Publisher: Technical University of Denmark, National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Phd_thesis_Hannes_Hoffle.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2012

State-space models for bio-loggers: A methodological road map
Ecologists have an unprecedented array of bio-logging technologies available to conduct in situ studies of horizontal and vertical movement patterns of marine animals. These tracking data provide key information about foraging, migratory, and other behaviours that can be linked with bio-physical datasets to understand physiological and ecological influences on habitat selection. In most cases, however, the behavioural context is not directly observable and therefore, must be inferred. Animal movement data are complex in structure, entailing a need for stochastic analysis methods. The recent development of state-space modelling approaches for animal movement data provides statistical rigor for inferring hidden behavioural states, relating these states to bio-physical data, and ultimately for predicting the potential impacts of climate change. Despite the widespread utility, and current popularity, of state-space models for analysis of animal tracking data, these tools are not simple and require considerable care in their use. Here we develop a methodological “road map” for ecologists by reviewing currently available state-space implementations. We discuss appropriate use of state-space methods for location and/or behavioural state estimation from different tracking data types. Finally, we outline key areas where the methodology is advancing, and where it needs further development

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Section for Population Ecology and Genetics
Authors: Jonsen, I. (Ekstern), Basson, M. (Ekstern), Bestley, S. (Ekstern), Bravington, M. (Ekstern), Patterson, T. (Ekstern), Pedersen, M. W. (Intern), Thomson, R. (Ekstern), Thygesen, U. H. (Intern), Wotherspoon, S. (Ekstern)
Pages: 34-46
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Volume: 88-89
ISSN (Print): 0967-0645
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 2.35 SJR 1.335 SNIP 0.962
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.327 SNIP 1.063 CiteScore 2.5
Stock assessment in the BCC region

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Degel, H. (Intern), Rademeyer, R. (Ekstern), Kainge, P. I. (Intern), Kirchner, C. (Ekstern), Beyer, J. (Intern)
Main Research Area: Technical/natural sciences
Publication: Research – peer-review → Journal article – 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
The early life of a West Greenlandic inshore cod population (Gadus morhua)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Arctic Section, Section for Marine Ecology and Oceanography
Authors: Swalethorp, R. (Intern), Munk, P. (Intern), Nielsen, T. G. (Intern)
Publication date: 2012
Event: Poster session presented at Arctic Scientific Partnership annual meeting, Winnipeg, Canada.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2012

The ups and downs of winter phytoplankton in the North Atlantic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg
Authors: Lindemann, C. (Intern), St. John, M. (Intern), Backhaus, J. O. (Ekstern)
Pages: 48
Publication date: 2012

Host publication information
Title of host publication: Recent Impulses to Marine Science and Technology : Between space and seafloor - aqua vita est
Place of publication: Hamburg
Publisher: German Society for Marine Research
Editors: Wiedling, J., Einsporn, M. H.
Main Research Area: Technical/natural sciences
Conference: YOUMARES 3, Lübeck, Germany, 12/09/2012 - 12/09/2012
Source: PublicationPreSubmission
Source-ID: 97704920
Publication: Research › Conference abstract in proceedings – Annual report year: 2014

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.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Introducing state-space stock assessment (SAM), split species issues and spatial modelling

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Kainge, P. I. (Intern), Beyer, J. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Electronic versions:
BCC Annual Forum 2011 Koester et al ECOFISH WP1 final [Compatibility Mode]
Linking size and age of attaining sexual maturation to growth and stock productivity in Atlantic cod stocks

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Tomkiewicz, J. (Intern), Trippel, E. (Ekstern)
Publication date: 2011
Event: Abstract from Fish reproduction and Fisheries, Vigo, Spain.
Main Research Area: Technical/natural sciences

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

The recovery of cod in the Baltic Sea, a success against all odds

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Eero, M. (Intern), Huwer, B. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Electronic versions:
AIPCE CEP Baltic cod recovery
Publication: Research › Paper – Annual report year: 2011

Baltic cod cannibalism: Differing consequences at stock recovery versus the historic situation of cod decline?

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Neuenfeldt, S. (Intern), Köster, F. (Intern)
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
Links:
http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multiannual_management_plan_for_the_cod_stocks_in_the_Baltic_Sea
Publication: Research › Conference abstract for conference – Annual report year: 2009

Effects of different temperatures and food conditions on the production of Calanus finmarchicus and C. glacialis before, during and after the spring bloom in Disko Bay, West Greenland
Expected rate of fisheries-induced evolution is slow

Commercial fisheries exert high mortalities on the stocks they exploit and the consequent selection pressure leads to fisheries induced evolution of growth rate, size at maturation, and reproductive output. Productivity and yields may decline as a result, but little is known about the rate at which such changes are likely to occur. Fisheries-induced evolution of exploited populations has recently become a subject of concern for policy makers, fisheries managers, and the general public, with prominent calls for mitigating management action. We make a general evolutionary impact assessment of fisheries by calculating the expected rate of fisheries induced evolution and the consequent changes in yield. Rates of evolution are expected to be on the order of 0.1–0.4 % per year. Resulting relative changes in fisheries yield are less than 0.5 % per year. These rates are much lower than published values based on experiments and analysis of population time series and we explain why published values may have overestimated the rates. Dealing with evolutionary effects of fishing is less urgent than reducing the direct detrimental effects of overfishing on exploited stocks and on their marine ecosystems.

Indirect effects of recovery strategies

For a higher organism to grow another organism has to die. This obvious and fundamental relationship means that if one species group increases in abundance, the prey species will suffer increased mortality. On the other hand, the predators of said species will have a more abundant food supply. Size-based models of fish communities indicate that these relationships have lawful dynamics that continue to be expressed, even when individual species become rarer - as predators or as prey. An ecosystem based management recovery strategy of a given species or group of species should therefore not be seen in isolation, but the expected consequences for the rest of the ecosystem must be analyzed. We use a general size- and trait-based model to calculate the ecosystem effects of fishing and recovery. We present a general analysis of a recovery strategies targeting either large fishes (consumer fishery), small fishes (forage fish fishery), or the ecosystem as a whole. We calculate expected recovery time and demonstrate indirect effects on prey, predators and beyond, and provide some insight into the relative difficulty of selective rebuilding of populations of large or small fish.

Seasonal lipid dynamics of herring and sprat in the Baltic Sea and possible implications for cod reproduction

The Baltic Sea experienced a regime shift in the 1980ies with major changes in food web dynamics. These ecosystem alterations were related to climatic driven changes in hydrographic conditions affecting phyto- and zooplankton assemblage and hence the food availability for clupeids. Sprat abundance increased dramatically in the early 1990ies. The changes in plankton communities in combination with increased competition resulted in declined condition of clupeids. Polyunsaturated fatty acids originate from phytoplankton and are transmitted through the food web. The present study investigates if the seasonal variation in lipid composition of herring and sprat reflects the changes in plankton. Fish were sampled five times over a year and the lipid composition of different size groups were analyzed. Significant seasonal
variation in average lipid content in sprat was found: 14.00% in November, 11.26% in January, 7.47% in March and 9.60% in June. The lipid content inherring also varied within season but was lower than sprat: 7.42% in November, 6.71% in January and 4.70% in March. The seasonal lipid dynamic was reflected in variation of specific fatty acids. Clupeids are the major prey of Baltic cod so deficiencies of essential fatty acids could be a limiting factor for cod reproduction.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, National Food Institute, Division of Industrial Food Research, Institute Management
Authors: Røjbek, M. (Intern), Tomkiewicz, J. (Intern), Støttrup, J. (Intern), Jacobsen, C. (Intern), Köster, F. (Intern)
Publication date: 2009
Event: Poster session presented at ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2009

Spatial and temporal variation in Baltic sprat (Sprattus sprattus balticus S.) batch fecundity
Over the last decade the size of the Baltic sprat spawning stock declined from a record high of over 1.7 million tonnes in 1996 to 910.000 tonnes in 2008. From the perspective of stock recovery it is of central interest how reproductive parameters have changed over this period of strongly changing stock size. Batch fecundity of Baltic sprat (Sprattus sprattus balticus S.) during peak spawning time was investigated in relation to fish length and weight applying the hydrated oocyte method. A series of ten years was established covering important spawning areas in the Central Baltic Sea, i.e., the Bornholm Basin, the Gdansk Deep and for some years the Gotland Basin. Analysis of Covariance (ANCOVA) showed significant differences in batch fecundity of Baltic sprat between areas and years. To detect possible causes for this variation in batch fecundity, environmental factors such as water temperature, salinity, oxygen content as well as fish and stock size were tested as explanatory variables. The data obtained in this investigation were used to develop a predictive model of Baltic sprat batch fecundity. Coupling these results with existing ichthyoplankton survey and stock structure data will allow applying the daily egg production method.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Leibniz Institute of Marine Sciences, Johann Heinrich von Thünen-Institute
Authors: Haslob, H. (Ekstern), Tomkiewicz, J. (Intern), Hinrichsen, H. (Ekstern), Kraus, G. (Ekstern)
Publication date: 2009
Event: Poster session presented at ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2009

UNCOVER: Fish Stock Recovery Strategies – Lessons learned in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management, Johann Heinrich von Thünen-Institute, AquaMarine Advisers, Aalborg University
Authors: Hammer, C. (Ekstern), Dorrien, C. V. (Ekstern), Hopkins, C. C. (Ekstern), Köster, F. (Intern), Neuenfeldt, S. (Intern), St. John, M. (Intern), Wilson, D. C. (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
Links: http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multi-annual_management_plan_for_the_cod_stocks_in_the_Baltic_Sea
Publication: Research › Conference abstract for conference – Annual report year: 2009

Klimaændringer og mulige effekter på dyre- og plantelivet i danske farvande

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, DHI Denmark, Aarhus University, University of Copenhagen
Authors: Gustavson, K. (ed.) (Ekstern), Buch, E. (Ekstern), Dahl, K. (Forskerdatabase), Middelboe, A. L. (Forskerdatabase), Borum, J. (Forskerdatabase), MacKenzie, B. (Intern), Visser, A. (Intern), Clausen, P. (Ekstern),