Michael St. John - DTU Orbit (22/01/2018)

Michael St. John

Organisations

Section for Marine Ecology and Oceanography
23/01/2013 → 14/02/2017 Former
VIP

Section for Population Ecology and Genetics
25/02/2012 → 18/01/2013 Former
VIP

Professor, National Institute of Aquatic Resources
11/05/2011 → present
mstjo@aqua.dtu.dk
VIP

Section for Marine Living Resources
14/02/2017 → present
VIP

Publications:

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.

General information

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Bergen
Authors: Paulsen, M. L. (Intern), Riisgaard, K. (Intern), St. John, M. (Intern), Thingstad, T. F. (Ekstern), Nielsen, T. G. (Intern)
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A dark hole in our understanding of marine ecosystems and their services: Perspectives from the mesopelagic community

General information
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Authors: St. John, M. (Intern), Borja, Á. (Ekstern), Chust, G. (Ekstern), Grigorov, I. (Intern), Mariani, P. (Intern), Martin, A. P. (Ekstern), Santos, R. S. (Ekstern)
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Assessing the role of environmental factors on Baltic cod recruitment, a complex adaptive system emergent property

High export via small particles before the onset of the North Atlantic spring bloom: Small particle export before the bloom
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.
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.
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Relations
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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.

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Hamburg, Johann Heinrich von Thünen-Institute, University of Kiel
Authors: Möller, K. O. (Ekstern), Schmidt, J. O. (Ekstern), St. John, M. (Intern), Temming, A. (Ekstern), Diekmann, R. (Ekstern), Peters, J. (Ekstern), Floeter, J. (Ekstern), Sell, A. F. (Ekstern), Herrmann, J. (Ekstern), Möllmann, C. (Ekstern)
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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 pulses 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.
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.
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.
Phytoplankton dynamics in contrasting early stage North Atlantic spring blooms: composition, succession, and potential drivers

General information
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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Daniels, C. (Ekstern), Poulton, A. J. (Ekstern), Esposito, M. (Ekstern), Paulsen, M. L. (Intern), Bellerby, R. (Ekstern), St. John, M. (Intern), Martin, A. (Ekstern)
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Small-scale distribution of plankton and marine snow in the North Atlantic

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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)
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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 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 to compensate for respiratory and other losses. In this thesis, different modeling approaches are used to investigate several aspects of the biophysical 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 explicitly 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 cells 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 periods with high-light levels. 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 explicitly represented.

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- 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.
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.
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.

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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)
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 there 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.

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 there 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.

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Scopus rating (2009): SJR 2.669 SNIP 1.829
Web of Science (2009): Indexed yes
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Web of Science (2008): Indexed yes
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Building international research partnerships in the North Atlantic-Arctic region

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Scopus rating (2004): SJR 1.204 SNIP 1.468
Scopus rating (2003): SJR 1.178 SNIP 1.546
Scopus rating (2002): SJR 1.204 SNIP 1.441
Scopus rating (2001): SJR 1.244 SNIP 1.142
Scopus rating (2000): SJR 1.048 SNIP 0.952
Scopus rating (1999): SJR 1.18 SNIP 1.015
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.

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)
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 › Poster – Annual report year: 2014

Introduction to the BASIN Special Issue: State of art, past present a view to the future

General information
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

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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
Trophic role of Protozooplankton in northern marine ecosystems

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 protozooplankton 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:

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)
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.
Environmental cues and constraints affecting the seasonality of dominant calanoid copepods in brackish, coastal waters: a case study of Acartia, Temora and Eurytemora species in the south-west Baltic

Information on physiological rates and tolerances helps one gain a cause-and-effect understanding of the role that some environmental (bottom-up) factors play in regulating the seasonality and productivity of key species. We combined the results of laboratory experiments on reproductive success and field time series data on adult abundance to explore factors controlling the seasonality of Acartia spp., Eurytemora affinis and Temora longicornis, key copepods of brackish, coastal and temperate environments. Patterns in laboratory and field data were discussed using a metabolic framework that included the effects of ‘controlling’, ‘masking’ and ‘directive’ environmental factors. Over a 5-year period, changes in adult abundance within two south-west Baltic field sites (Kiel Fjord Pier, 54°19′89N, 10°09′06E, 12–21 psu, and North/Baltic Sea Canal NOK, 54°20′45N, 9°57′02E, 4–10 psu) were evaluated with respect to changes in temperature, salinity, day length and chlorophyll a concentration. Acartia spp. dominated the copepod assemblage at both sites (up to 16,764 and 21,771 females m−3 at NOK and Pier) and was 4 to 10 times more abundant than E. affinis (to 2,939 m−3 at NOK) and T. longicornis (to 1,959 m−3 at Pier), respectively. Species-specific salinity tolerance explains differences in adult abundance.
between sampling sites whereas phenological differences among species are best explained by the influence of species-specific thermal windows and prey requirements supporting survival and egg production. Multiple intrinsic and extrinsic (environmental) factors influence the production of different egg types (normal and resting), regulate life-history strategies and influence match–mismatch dynamics.

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, University of Hamburg, Leibniz Institute of Marine Sciences
Authors: Diekmann, A. B. S. (Ekstern), Clemmesen, C. (Ekstern), St. John, M. A. (Intern), Paulsen, M. (Ekstern), Peck, M. A. (Ekstern), Sommer, U. (Ekstern), Adrian, R. (Ekstern), Bauer, B. (Ekstern), Winder, M. (Ekstern)
Pages: 2399-2414
Publication date: 2012
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Marine Biology
Volume: 159
Issue number: 11
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
Marine snow, zooplankton and thin layers: indications of a trophic link from small-scale sampling with the Video Plankton Recorder

Marine aggregates of biogenic origin, known as marine snow, are considered to play a major role in the ocean’s particle flux and may represent a concentrated food source for zooplankton. However, observing the marine snow–zooplankton interaction in the field is difficult since conventional net sampling does not collect marine snow quantitatively and cannot resolve so-called thin layers in which this interaction occurs. Hence, field evidence for the importance of the marine snow–zooplankton link is scarce. Here we employed a Video Plankton Recorder (VPR) to quantify small-scale (metres) vertical distribution patterns of fragile marine snow aggregates and zooplankton in the Baltic Sea during late spring 2002. By using this non-invasive optical sampling technique we recorded a peak in copepod abundance (ca. 18 ind. l−1) associated with a pronounced thin layer (50 to 55 m) of marine snow (maximum abundance of 28 particles l−1), a feature rarely resolved. We provide indirect evidence of copepods feeding on marine snow by computing a spatial overlap index that indicated a strong positively correlated distribution pattern within the thin layer. Furthermore we recorded images of copepods attached to aggregates and demonstrating feeding behaviour, which also suggests a trophic interaction. Our observations highlight the potential significance of marine snow in marine ecosystems and its potential as a food resource for various trophic levels, from bacteria up to fish.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, University of Hamburg, Johann Heinrich von Thünen-Institute
Authors: Möller, K. O. (Ekstern), St. John, M. (Intern), Temming, A. (Ekstern), Floeter, J. (Ekstern), Sell, A. F. (Ekstern), Herrmann, J. P. (Ekstern), Möllmann, C. (Ekstern)
Pages: 57-69
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 468
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
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

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
Food availability effects on reproductive strategy: the case of Acartia tonsa (Copepoda: Calanoida)

**General information**
State: Published
Organisations: Prince William Sound Science Center, Universität Hamburg
Authors: Acheampong, E. (Ekstern), Campbell, R. (Ekstern), Diekmann, A. (Ekstern), St. John, M. (Intern)
Pages: 151-159
Publication date: 2011
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Marine Ecology - Progress Series
Volume: 428
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
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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
Temperature and light effects on photosynthesis and respiration - implications for phytoplankton survival during deep convection

General information
State: Published
Organisations: Unknown
Authors: Walter, B. (Ekstern), Peters, J. (Ekstern), van Beusekom, J. (Ekstern), St. John, M. (Intern)
Publication date: 2011
Event: Poster session presented at ICES Council Meeting 2011, Gdansk, Poland.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277069
Publication: Research - peer-review › Journal article – Annual report year: 2011

Towards an adaptive model for simulating growth of marine mesozooplankton: A macromolecular perspective

General information
State: Published
Organisations: Section for Arctic Technology, Department of Civil Engineering, Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Acheampong, E. (Ekstern), Nielsen, M. H. (Intern), Mitra, A. (Ekstern), St. John, M. (Intern)
Pages: 1-18
Publication date: 2011
Main Research Area: Technical/natural sciences
Variation in diatom biochemical composition during a simulated bloom and its effect on copepod production

The biochemical quality of phytoplankton depends in part upon nutrient availability, which has implications for the population dynamics of grazers. Here, we examined how nutrient availability influenced the growth dynamics and biochemical content of the marine diatom Thalassiosira weissflogii and how these biochemical changes impacted the vital rates of a calanoid copepod (Acartia tonsa). Changes in biochemistry (protein, carbohydrate and fatty acids) were compared in diatom cultures that simulated bloom conditions (B-algae) and those maintained in near exponential growth (E-algae) over the course of a 16-day experiment. Egg production rates (EPRs, eggs female⁻¹ day⁻¹) and the developmental success of copepodite stages of A. tonsa fed these different diets were quantified. Copepod EPR was significantly lower (reduced by half) when B-algae entered the senescent phase due to silicate limitation. In a crossover (diet switch) experiment, EPR increased when copepods fed B-algae were switched to E-algae and vice versa. Copepodites of A. tonsa developed normally and reached the adult (C6) stage when fed E-algae, but ceased development (approximately at stage C2) when reared on senescent phase B-algae. Given the importance of copepods as prey for higher trophic levels, our results highlight how nutritional changes that naturally occur during a phytoplankton bloom may influence the productivity of copepods and higher trophic levels.

General information
State: Published
Organisations: University of Hamburg
Dynamics of marine ecosystems: target species

General information
State: Published
Organisations: University of Hamburg
Authors: Gifford, D. J. (Ekstern), Harris, R. P. (Ekstern), McKinnell, S. M. (Ekstern), Peterson, W. T. (Ekstern), St. John, M. (Intern)
Number of pages: 412
Pages: 73-89
Publication date: 2010

Host publication information
Title of host publication: Marine Ecosystems and Global Change
Volume: 4
Place of publication: Oxford
Publisher: Oxford University Press
Editors: Barange, M., Field, J. G., Harris, R. P., Hofmann, E. E., Perry, R. I., Werner, F. E.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277122
Publication: Research - peer-review › Book chapter – Annual report year: 2010

End-To-End models for the analysis of marine ecosystems: Challenges, issues, and next steps

General information
State: Published
Organisations: University of Hamburg, Louisiana State University, Plymouth Marine Laboratory, Institute of Marine Research, University of Bergen
Framework of stock-recovery strategies: analyses of factors affecting success and failure

The EU FP6 UNCOVER project was aimed at producing a rational scientific basis for developing recovery strategies for some ecologically and socio-economically important fish stocks/fisheries in European seas. The immediate objectives were to identify changes experienced during stock depletion/collapses, to understand prospects for recovery, to enhance the scientific understanding of the mechanisms of recovery, and to formulate recommendations on how best to implement long-term management/recovery plans. We extended an earlier analysis conducted within the project of 13 performance criteria in relation to the recovery of more than 30 fish stocks/fisheries worldwide by multivariate exploratory analysis (canonical correspondence analysis), followed by model building [discriminant analysis (DA)] to quantify the relative importance of key performance criteria, singly or combined. Using the existing database, DA indicated that the four best additive predictors of successful recovery were "rapid reduction in fishing mortality", "environmental conditions during the recovery period", "life-history characteristics" of the target stock, and "management performance criteria". The model classified the status "recovered" and "non-recovered" assigned originally with nearly 100% accuracy.

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Hammer, C. (Ekstern), Dorrien, C. V. (Ekstern), Hopkins, C. C. E. (Ekstern), Köster, F. (Intern), Nilssen, E. M. (Ekstern), St. John, M. (Intern), Wilson, D. C. (Ekstern)
Pages: 1849-1855
Publication date: 2010
Main Research Area: Technical/natural sciences
Introduction to the Cadiz symposium on marine ecosystem mode parameterisation: Examining the state of our art

General information
State: Published
Organisations: University of Hamburg, Departamento de Ecología y Gestión Costera s/n, National Institute for Earth Science and Astronomy, IUEM, Bedford Institute of Oceanography
Authors: St. John, M. (Intern), Ruiz, J. (Ekstern), Monfray, P. (Ekstern), Grigorov, I. (Intern), Hannah, C. G. (Ekstern)
Pages: 1-5
Publication date: 2010
Main Research Area: Technical/natural sciences
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Original language: English

DOI: 10.1016/j.pocean.2010.01.001
The case for marine ecosystem models of intermediate complexity

Marine ecosystem models are reasonably proficient at simulating physically-driven features such as spring blooms. However, the demands on these models are shifting to complex biological issues such as functional diversity, and changes in ecosystems and their services such as exploited fish stocks and carbon sequestration. Current ecosystem models generally use a food web structure reduced to its bare essentials. A consequence of the simplified structure is that they are specialized to a particular time, place and ecosystem state and thereby have limited ability to evolve into a substantially different state as a result of internal dynamics or changes in external forcing. We use food web theory and the ideas from complexity theory to argue that an improved representation of the structure of marine food webs is essential for the next generation of marine ecosystem models. Here we propose that a useful guiding principle for model design is provided by earth system models of intermediate complexity; a willingness to sacrifice process detail in order to increase the number of interacting components in the system and simulate the web of feedback loops.
Trans-regional linkages in the North Eastern Atlantic: An End-to-End analysis of pelagic ecosystems

General information
State: Published
Organisations: University of Hamburg, Scottish Association for Marine Science, Institute of Marine Research, Norwegian University of Science and Technology, Bjerknes Centre for Climatological Research, University of Bergen
Pages: 1-76
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Oceanography and Marine Biology
Volume: 47
ISSN (Print): 0078-3218
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
BFI (2015): BFI-level 2
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.253 SNIP 2.492
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.318 SNIP 2.471
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.867 SNIP 1.618
Rebuilding the eastern Baltic cod stock under environmental change (Part II): Taking into account the cost of a marine protected area

General information
State: Published
Organisations: Hamburg University Centre for Marine and Atmospheric Science
Authors: Röckmann, C. (Ekstern), Tol, R. J. (Ekstern), Schneider, U. (Ekstern), St. John, M. (Intern)
Pages: 1-25
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Natural Resource Modeling
Volume: 22
ISSN (Print): 0890-8575
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 0.64 SJR 0.286 SNIP 0.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.416 SNIP 0.655 CiteScore 1.16
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.684 SNIP 0.898 CiteScore 1.23
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.49 SNIP 0.561 CiteScore 0.86
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.438 SNIP 0.805 CiteScore 0.82
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.314 SNIP 0.32 CiteScore 0.57
ISI indexed (2011): ISI indexed yes
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

Coupling ecosystem and individual-based models to simulate the influence of environmental variability on potential growth and survival of larval sprat (Sprattus sprattus L.) in the North Sea

General information
State: Published
Organisations: University of Hamburg, University of Bergen
Authors: Daewel, U. (Ekstern), Peck, M. A. (Ekstern), Kühn, W. (Ekstern), St. John, M. (Intern), Alekseeva, I. (Ekstern), Schrum, C. (Ekstern)
Pages: 333-351
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 17
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
Effects of climate and overfishing on zooplankton dynamics and ecosystem structure: regime shifts, trophic cascade, and feedback loops in a simple ecosystem

General information
State: Published
Organisations: Latvian Institute of Aquatic Ecology, Latvian Fish Resources Agency, University of Hamburg
Authors: Möllmann, C. (Ekstern), Müller-Karulis, B. (Ekstern), Kornilovs, G. (Ekstern), St. John, M. (Intern)
Pages: 302-310
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: I C E S Journal of Marine Science
Volume: 65
Issue number: 3
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
How best to include the effects of climate-driven forcing on prey fields in larval fish individual-based models

General information
State: Published
Organisations: University of Hamburg, University of Bergen
Authors: Daewel, U. (Ekstern), Peck, M. A. (Ekstern), Schrum, C. (Ekstern), St. John, M. (Intern)
Pages: 1-5
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 30
ISSN (Print): 0142-7873
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Sandeel (Ammodytes marinus) larval transport patterns in the North Sea from an individual-based hydrodynamic egg and larval model

We have calculated a time series of larval transport indices for the central and southern North Sea covering 1970-2004, using a combined three-dimensional hydrodynamic and individual-based modelling framework for studying sandeel (Ammodytes marinus) eggs, larval transport, and growth. The egg phase is modelled by a stochastic, nonlinear degree-day model describing the extended hatch period. The larval growth model is parameterized by individually back-tracking the local physical environment of larval survivors from their catch location and catch time. Using a detailed map of sandeel habitats in the North Sea, the importance of hydrography for early life stages of sandeel to their recruitment success is explored. We find that the sandeel larval transport patterns in the North Sea are relatively robust toward uncertainties in biological parameters, when mortality aspects are included. We find only weak spatiotemporal correlations between elements of the transport indices in the time series, mainly positive correlation between retention terms for the same year. The transport connectivity of sandeel habitats in the North Sea and the dynamical properties of the North Sea transport system are also analyzed, and we introduce novel a scheme to quantify direct and indirect connectivity on equal footings in terms of an interbank transit time scale.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Christensen, A. (Intern), Jensen, H. (Intern), Mosegaard, H. (Intern), St. John, M. (Intern), Schrum, C. (Ekstern)
Pages: 1498-1511
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 7
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
The effects of temperature and salinity on reproductive success of *Temora longicornis* in the Baltic Sea: a copepod coping with a tough situation

**General information**

State: Published  
Organisations: University of Hamburg  
Authors: Holste, L. (Ekstern), St. John, M. (Intern), Peck, M. A. (Ekstern)  
Pages: 527-540  
Publication date: 2008  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Marine Biology  
Volume: 156  
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
A top-down approach to modelling marine ecosystems in the context of physical-biological modelling

Coupled physical-biological models have become reasonably proficient at simulating physically-driven features such as spring blooms. However, demands for marine ecosystem models are shifting to predicting functional diversity and ecosystem change. Much work is needed to develop the ecosystem models that can deal with such questions without getting bogged down into unmanageable complexity. We argue that we need systematic ways to add complexity to ecosystem models, specifically a top-down approach that takes explicitly into account high-level rules about how ecological networks are organized. We will draw on complexity theory and food web ecology to gain insights into potential high-level rules that could be explored in developing complex marine ecosystem models. We will also look at potential avenues for the implementation of such approaches in the context of operational forecasting and illustrate them with examples from current work. We see convergence among the lower trophic levels, multispecies and theoretical food web modelling communities and, in that context, cross-fertilization of ideas needs to be encouraged.
Basin-scale Analysis, Synthesis, and INtegration

Hydrodynamic backtracking of fish larvae by individual-based modelling

Rebuilding the Eastern Baltic cod stock under environmental change - A preliminary approach using stock, environmental, and management constraints
Skill assessment of the coupled physical-biological model ECOSMO

The coupled physical-biological model ECOSMO (ECOSystem Model) is used in hindcast operational mode to study climate variability of the North Sea-Baltic Sea ecosystem. Results of the model are currently utilized in the frame of different interdisciplinary applications, studying the impact of climatic induced variability of biotic and abiotic environmental conditions on growth and survival during early life stages (egg-, larvae and juvenile phase) for a number of different key species. The success of linking physical and biological processes on different trophic levels crucially depends on the quality of models used and understanding of results from these coupling exercises require clear measures of model skills and assessment of model weaknesses for a variety of model variables on different spatial and temporal time scales. For the coupled physical-biological model ECOSMO extensive validation exercises have been performed for physical as well as biological variables. Results from these validation exercises will be presented and the skill of the model will be discussed for different variables.
Testing the implications of a permanent or seasonal marine reserve on the population dynamics of Eastern Baltic cod under varying environmental conditions

General information
State: Published
Organisations: University of Hamburg
Authors: Röckmann, C. (Ekstern), St. John, M. (Intern), Schneider, U. A. (Ekstern), Tol, R. S. J. (Ekstern)
Pages: 1-13
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 85
Issue number: 1-2
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
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
Basin-scale Analysis, Synthesis and INtegration (BASIN) of oceanographic and climate-related processes and the dynamics of plankton and fish populations in the North Atlantic Ocean

General information
State: Published
Organisations: University of Hamburg
Authors: Wiebe, P. (Ekstern), Harris, R. (Ekstern), St. John, M. (Intern), Werner, F. (Ekstern), Young, B. D. (Ekstern), Haidvogel, D. (Ekstern), Astthorsson, O. (Ekstern), Carlotti, F. (Ekstern)
Publication date: 2006

Host publication information
Title of host publication: EOS Transactions
Volume: Vol. 87, No. 36
Publisher: American Geophysical Union
Main Research Area: Technical/natural sciences
Conference: Workshop, Reykjavik, Iceland, 01/01/2005
Source: orbit
Source-ID: 277281
Publication: Research › Conference abstract in proceedings – Annual report year: 2006

Copepods coping with a tough situation temperature, salinity and calanoid vital rates in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Peck, M. (Ekstern), Holste, L. (Ekstern), Dutz, J. (Intern), St. John, M. (Intern)
Pages: 69-71
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: GLOBEC International Newsletter
Issue number: 12
Original language: English
Source: orbit
Source-ID: 281331
Development of a coupled physical-biological ecosystem model ECOSMO - Part I: Model description and validation for the North Sea

A 3-D coupled biophysical model ECOSMO (ECOSystem MOdel) has been developed. The biological module of ECOSMO is based on lower trophic level interactions between two phyto- and two zooplankton components. The dynamics of the different phytoplankton components are governed by the availability of the macronutrients nitrogen, phosphate and silicate as well as light. Zooplankton production is simulated based on the consumption of the different phytoplankton groups and detritus. The biological module is coupled to a nonlinear 3-D baroclinic model. The physical and biological modules are driven by surface forcing at temporal scale of 6 h using atmospheric re-analysis data. The model was integrated for 1984 and 1986. The simulated fields for 1984 were used to investigate the annual spatial distribution of phytoplankton and zooplankton biomass and their production in the North Sea. A detailed validation showed that the model, based on consideration of limiting processes, is able to reproduce the observed spatial and seasonal variability of the North Sea ecosystem e.g. the spring bloom, summer sub-surface production and the fall bloom. Distinct differences in regional characteristics of diatoms and flagellates could be modeled and their different roles in the seasonal cycle were resolved by ECOSMO. Moreover, the model was able to describe seasonal and regional characteristics of zooplankton biomass. In contrast to earlier models ECOSMO was able to identify frontal environments as zones of high productivity, and the simulations characterized the dynamics of different zooplankton feeding environments with special emphasis on the role of frontal production. For the second trophic level the regional increase of production in the frontal zone was found to be several times higher than for the first trophic level. (c) 2006 Elsevier B.V All rights reserved.
The 3-D coupled biophysical model ECOSMO (ECOSystern MOdel) has been applied to simulate the spatial and temporal variability of primary and secondary production and biomass in the North Sea in 1984. In order to assess the spatial and temporal dynamics of these components, statistical methods based on empirical orthogonal function analysis (EOF) are introduced to biological oceanography and ecosystem research as valuable tool to investigate spatial temporal variability. These methods are used to describe the spatial temporal characteristics of the seasonal signal of phytoplankton and zooplankton biomass and production in the North Sea. Employing these techniques made it possible to separate regional and temporal variability into the annual pattern, its temporal characteristics and some basic regional modulations of the average seasonal signal. The analysis was able to identify the modulation of average seasonal characteristics with for example earlier blooming in the south and later blooming in the northwestern North Sea. The simulated temporal development of diatom and flagellate blooms showed clear and unique temporal characteristics. The diatom bloom was characterized by a sharp peak occurring between middle of March and the end of April, with little to no diatom biomass in the second half of summer. Conversely flagellate biomass did not peak before the beginning of May and showed a relatively constant summer production and an autumn bloom. (c) 2006 Published by Elsevier B.V.
Baltic cod recruitment - the impact of climate variability on key processes
Simulating the influence of climate variability on larval fish survival: An example using sprat (Sprattus sprattus) in the southern North Sea

Within many coastal marine regions, changes in factors affecting hydrography (e.g., river input, tidal mixing, and atmospheric conditions such as solar radiation and wind) lead to spatial and temporal variability in factors impacting the transport and vital rates of fish larvae (e.g., water currents, turbulence, temperatures and prey fields). To investigate the impact of changing environmental conditions in the southern North Sea on the transport, growth and survival of larval sprat (Sprattus sprattus), we employed four inter-linked models: 1) a hydrodynamic model (HAMSOM) provided 3D fields of hydrographical properties, 2) a NPZD model prescribed local sprat prey fields (ECOSMO), 3) a Lagrangian transport model simulated temporal changes in cohort distribution, and 4) an individual-based model (IBM) depicted foraging, growth and survival of early life stages of sprat. The NPZD model (ECOSMO), which provides the spatially and temporally variable prey field, includes 3 nutrient cycles, two phytoplankton groups (diatoms, flagellates) and two classes of zooplankton (omnivorous and herbivorous). The IBM includes eggs, yolksac larvae and foraging and growth subroutines for post yolksac larvae. To estimate the influence of varying climatic conditions on vital rates of young life stages of sprat, scenario tests were performed by running the models for anomalously warm (1992) and cold (1986) years as well as within a year with average temperature conditions (1993). The simulation results were compared to in situ estimates of distribution and condition of larval sprat in the southern German Bight in 1992 and 1993.

Baltic cod recruitment - the role of physical forcing and species interactions


General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries- and Monitoring Technology, Section for Population Ecology and Genetics

Publication information
Journal: ICES C.M.
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source-ID: 226365
Fatty acid biomarkers: validation of food web and trophic markers using C-13-labelled fatty acids in juvenile sandeel (Ammodytes tobianus)

A key issue in marine science is parameterizing trophic interactions in marine food webs, thereby developing an understanding of the importance of top-down and bottom-up controls on populations of key trophic players. This study validates the utility of fatty acid food web and trophic markers using C-13-labelled fatty acids to verify the conservative incorporation of fatty acid tracers by juvenile sandeel (Ammodytes tobianus) and assess their uptake, clearance, and metabolic turnover rates. Juvenile sandeel were fed for 16 days in the laboratory on a formulated diet enriched in (13)C16:0 followed by 14 days on a formulated diet enriched in (13)C18:3(n - 3). An exponential model was employed to estimate the uptake and clearance rates of recovered labelled fatty acids as a function of growth and fatty acid metabolism. The model predicted a faster uptake of (13)C18:3(n - 3) than (13)C16:0 (0.0353 and 0.0086.day(-1), respectively), consistent with a structural role of (n - 3) polyunsaturated fatty acids in cell membranes, whereas saturated fatty acids presumably play a larger metabolic role. Clearance and metabolic rates of assimilated (13)C16:0 were estimated as 0.0572 and 0.0211.day(-1), respectively. Lack of temporal trends in nonlabelled fatty acids confirmed the conservative incorporation of labelled fatty acids by the fish.
The influence of temperature, salinity and feeding history on population characteristics of Baltic Acartia tonsa: Egg production, hatching success and cohort development

General information
State: Published
Organisations: University of Hamburg
Authors: Fiedler, L. (Ekstern), Peck, M. A. (Ekstern), St. John, M. (Intern)
Pages: 1-21
Publication date: 2004

Host publication information
Title of host publication: ICES C.M.
Volume: L:09
Main Research Area: Technical/natural sciences
Links:
Decadal variations in the stratification and circulation patterns of the North Sea; are the 90’s unusual?

Fatty acid trophic markers in the pelagic marine environment
Fish stock development in the Central Baltic Sea (1976-2000) in relation to variability in the environment

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries Advice, Section for Population Ecology and Genetics
Inter and intra annual variations in the onset of stratification and the timing and intensity of spring bloom in the Central North Sea in the 90's

General information
State: Published
Organisations: Unknown
Authors: Nielsen, M. H. (Ekstern), St. John, M. (Intern)
Pages: 384-386
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Marine Science Symposia
Volume: 219
ISSN (Print): 0906-060X
Ratings:
Modelling the influences of atmospheric forcing conditions on Baltic cod early life stages: distribution and drift

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Hinrichsen, H. (Ekstern), Böttcher, U. (Ekstern), Köster, F. (Intern), Lehmann, A. (Ekstern), St. John, M. (Intern)
Pages: 187-201
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Sea Research
Volume: 49
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
Recruitment of Baltic cod and sprat stocks: identification of critical life stages and incorporation of environmental variability into stock-recruitment relationships

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), Schnack, D. (Ekstern), St. John, M. (Intern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Möllmann, C. (Ekstern), Kraus, G. (Intern), Plikshs, M. (Ekstern), Makarchouk, A. (Ekstern), Eero, A. (Ekstern)
Pages: 129-154
Publication date: 2003
Resolving variations in the timing and intensity of the Spring Bloom in the Central North Sea during the 90's: A comparison of Remote Sensing and 2-D modelling approaches

General information
State: Published
Unusual water mass advection affected Central Baltic key species 2: Pseudocalanus and the winter inflow

General information
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Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Schmidt, J. (Ekstern), Möllmann, C. (Ekstern), Temming, A. (Ekstern), Hermann, J. (Ekstern), Floeter, J. (Ekstern), Sell, A. (Ekstern), St. John, M. (Intern)
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Resolving the impact of short-term variations in physical processes impacting on the spawning environment of eastern Baltic cod: application of a 3-D hydrodynamic model

Variations in oxygen conditions below the permanent halocline influence the ecosystem of the Baltic Sea through a number of mechanisms. In this study, we examine the effects of physical forcing on variations in the volume of deep oxygenated water suitable for reproductive success of central Baltic cod. Recent research has identified the importance of inflows of saline and oxygenated North Sea water into the Baltic Sea for the recruitment of Baltic cod. However, other processes have been suggested to modify this reproduction volume including variations in timing and volume of terrestrial runoff, variability of the solubility of oxygen due to variations in sea surface temperature as well as the influence of variations in wind stress. In order to examine the latter three mechanisms, we have performed simulations utilizing the Kiel Baltic Sea model for a period of a weak to moderate inflow of North Sea water into the Baltic, modifying wind stress, freshwater runoff and thermal inputs. The model is started from three-dimensional fields of temperature, salinity and oxygen obtained from a previous model run and forced by realistic atmospheric conditions. Results of this realistic reference run were compared to runs with modified meteorological forcing conditions and river runoff. From these simulations, it is apparent that processes other than major Baltic inflows have the potential to alter the reproduction volume of Baltic cod. Low near-surface air temperatures in the North Sea, the Skagerrak/Kattegat area and in the western Baltic influence the water mass properties (high oxygen solubility). Eastward oriented transports of these well-oxygenated highly saline water masses may have a significant positive impact on the Baltic cod reproduction volume in the Bornholm Basin. Finally, we analysed how large scale and local atmospheric forcing conditions are related to the identified major processes affecting the reproduction volume. (C) 2002 Elsevier Science B.V. All rights reserved.
Developing Baltic cod recruitment models II: Incorporation of environmental variability and species interaction

We investigate whether a process-oriented approach based on the results of field, laboratory, and modelling studies can be used to develop a stock-environment-recruitment model for Central Baltic cod (Gadus morhua). Based on exploratory statistical analysis, significant variables influencing survival of early life stages and varying systematically among spawning sites were incorporated into stock-recruitment models, first for major cod spawning sites and then combined for the entire Central Baltic. Variables identified included potential egg production by the spawning stock, abiotic conditions affecting survival of eggs, predation by clupeids on eggs, larval transport, and cannibalism. Results showed that recruitment in the most important spawning area, the Bornholm Basin, during 1976-1995 was related to egg production; however, other factors affecting survival of the eggs (oxygen conditions, predation) were also significant and when incorporated explained 69% of the variation in 0-group recruitment. In other spawning areas, variable hydrographic conditions did not allow for regular successful egg development. Hence, relatively simple models proved sufficient to predict recruitment of 0-group cod in these areas, suggesting that key biotic and abiotic processes can be successfully incorporated into recruitment models.

General information
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Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), St. John, M. (Intern), Schnack, D. (Ekstern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Plikshs, M. (Ekstern)
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Web of Science (2012): Indexed yes
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Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 1.589 SNIP 1.379
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.621 SNIP 1.236
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.354 SNIP 1.267
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.558 SNIP 1.553
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.744 SNIP 1.542
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.097 SNIP 1.622
Scopus rating (2002): SJR 1.909 SNIP 1.457
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.769 SNIP 1.46
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.5 SNIP 1.464
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.928 SNIP 1.436
Original language: English
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Publication: Research - peer-review › Journal article – Annual report year: 2001
Developing Baltic cod recruitment models I: Resolving spatial and temporal dynamics of spawning stock and recruitment for cod, herring, and sprat

The Baltic Sea comprises a heterogeneous oceanographic environment influencing the spatial and temporal potential for reproductive success of cod (Gadus morhua) and sprat (Sprattus sprattus) in the different spawning basins. Hence, to quantify stock and recruitment dynamics, it is necessary to resolve species-specific regional reproductive success in relation to size, structure, and distribution of the spawning stock. Furthermore, as species and fisheries interactions vary between areas, it is necessary to include these interactions on an area-specific basis. Therefore, area-disaggregated multispecies virtual population analyses (MSVPA) were performed for interacting species cod, herring (Clupea harengus), and sprat in the different subdivisions of the Central Baltic. The MSVPA runs revealed distinct spatial trends in population abundance, spawning biomass, recruitment, and predation-induced mortality. Results, when evaluated with respect to trends in population sizes from research surveys, were similar for the cod and sprat stocks but different for herring. Horizontal distributions from MSVPA runs and research surveys indicate that cod and sprat undergo migrations between basins during different life stages. This is an observation potentially influencing estimates for the different stock components but not affecting the overall stock sizes.

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Authors: Köster, F. (Intern), Möllmann, C. (Ekstern), Neuenfeldt, S. (Intern), St. John, M. (Intern), Plikshs, M. (Ekstern), Voss, R. (Ekstern)
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Web of Science (2011): Indexed yes
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Diatom production in the marine environment: Implications for larval fish growth and condition

To test the effects of diatom production on larval fish growth and condition, laboratory experiments were performed with larval North Sea cod reared on different algal food chains. These food chains were based on cultures of (a) the diatoms Skeletonema costatum and Thalassiosira weissflogii; (b) the dinoflagellate Heterocapsa triquetra; (c) the flagellate Rhodomonas baltica; (d) a diet composed of both Skeletonema and Heterocapsa food chains (1:1); and (e) a starvation group. These algae were fed to cultures of adult Acartia tonsa. Copepod eggs were collected, hatched, and the NI nauplii (2001(-1)) were fed to post-yolk-sac larval cod. Results indicate that larval growth rates are significantly influenced by the content of essential fatty acids of the algal food source: growth rates were positively correlated with the content of DHA (C22:6 omega 6) and negatively with EPA (C20:5 omega 3). The ratio of omega3/omega6 fatty acids in the algal source had no significant effect. The highest and lowest growth rates were observed in food chains based on H. triquetra and T. weissflogii, respectively (means for days 14-16 of 4.0 and -4.7). The mixed diatom/dinoflagellate diet resulted in intermediate growth rates and condition. Regressions of growth rates against EPA and DHA content indicated no inhibitory effect of diatom production on growth in larval cod.
Modelling thermal stratification in the North Sea: Application of a 2-D potential energy model

The spatial and temporal dynamics of the North Sea ecosystem are dependent upon vertical mixing processes which modify the availability of light and limit nutrients for phytoplankton production. In order to examine the effects of inter and intra annual variations in stratification on ecosystem dynamics we have developed and tested a potential energy model of thermal stratification based on the energy equation (for turbulence). The energy equation relates the temporal and spatial changes of turbulent kinetic energy (TKE), the production of TKE and the dissipation of TKE to the change of potential energy as water masses of different densities are mixed in the field of gravity. A constant ratio between the gain in potential energy and the production of TKE is assumed, known as the flux Richardson number. The model is comprised of 0·5m vertical layers with a temporal time step of 1 day. The model is forced with wind, dew point temperature from Ekofisk oilfield in the central North Sea, and tidal current and atmospheric radiation. The model is used to simulate the seasonal cycle of stratification in the central North Sea in the years 1988, 1989 and 1990 and is compared to density profiles in these years available from the ICES hydrographic database. We find that the model is able to simulate variations in thermal stratification including the seasonal onset and breakdown of stratification, the thermocline depth, and the effects of discrete wind and cooling events. For the years 1988–1990 we find an $R^2=0·97$ between observed and predicted upper layer temperatures. However, the model is less successful in the prediction of temperatures of the intermediate and deep
layers (R2=0.46 and 0.14) due to small deviations in thermocline depth and variations in tidal amplitude. The model was then applied to examine potential differences in stratification between the years 1990 and 1996. Simulations suggested that the development of stratification is very rapid in 1990 and that the spring of 1996 is very cold. Both of these observations having the potential to impact on the efficiency of lower trophic level coupling and production.
Testing the larval drift hypothesis in the Baltic Sea: retention versus dispersion caused by wind-driven circulation

Retention or dispersion of larvae from the spawning grounds has been identified as one of the key processes influencing recruitment success in fish stocks. To examine the potential effects of transport on recruitment, numerical simulations were performed utilizing a three-dimensional physical oceanographic model of the Baltic Sea. Cod larvae were represented as Lagrangian drifters released in the deepwater region of the Bornholm Basin, the main spawning ground for Baltic cod. Simulations were performed for the major spawning seasons of 1993 and 1994, when annual and interannual variability of meteorological forcing was large. The principal goals of the modelling exercise were first to identify the physical processes influencing the demersal distribution of the early life stages and second to describe the transport of the pelagic stages in response to variations in windstress, thereby identifying the meteorological and hydrodynamic mechanisms influencing retention and/or dispersal. The results suggest that periods of low wind, especially from northern and eastern directions, retain early life stages of cod within the deepwater region of the Bornholm Basin. Periods of higher windstress and duration from the west and south resulted in a rapid transport of larvae into shallow coastal regions. Based on the results obtained from these drift experiments and a wind data time series from the meteorological station Christiansoe a transport index has been developed, variations in annual retention/dispersal have been identified, and comparisons with variations in recruitment success are presented.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Technical University of Denmark
Authors: Hinrichsen, H. (Ekstern), St. John, M. (Intern), Aro, E. (Ekstern), Grønkjær, P. (Ekstern), Voss, R. (Ekstern)
Pages: 973-984
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Biomarkører i sild viser vandringsvejen

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Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Division of Food Chemistry, National Food Institute
Authors: Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern), St. John, M. (Intern), Cederberg, T. L. (Intern), Fromberg, A. (Intern)
Publication date: 2000
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225754
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Recruitment of Baltic cod and sprat stocks: Identification of critical life stages and incorporation of environmental variability and spatial heterogeneity into stock-recruitment relationships

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Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), Schnack, D. (Ekstern), St. John, M. (Intern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Möllmann, C. (Ekstern), Kraus, G. (Intern), Plikshs, M. (Ekstern), Makarchouk, A. (Ekstern)
Chairmans report of the ICES/GLOBEC cod and climate change backwards facing 4 workshop

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Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Danish Institute for Fisheries Research
Publication date: 1999

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Stock-recruitment relationships of Baltic cod incorporating environmental variability and spatial heterogeneity

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Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), St. John, M. (Intern), Schnack, D. (Ekstern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Plikshs, M. (Ekstern)
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Main Research Area: Technical/natural sciences

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Source: orbit
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Publication: Research › Conference article – Annual report year: 1999

Variations in the drift of larval cod (Gadus morhua L.) in the Baltic Sea: combining field observations and modelling
Coupled three-dimensional (3-D) physical oceanographic modelling and field sampling programmes were carried out in May 1988 and August 1991 to investigate the potential drift of larval cod (Gadus morhua L.) in the Bornholm Basin of the Baltic Sea. The goals were to predict the transport of cod larvae, thus aiding the identification of physical processes influencing larval retention/dispersal. Numerical simulations were performed using a 3-D eddy-resolving baroclinic model based on the Bryan-Cox-Semtner code adapted for the Baltic Sea. Within the Bornholm Basin, the model was initialized with ground truth data of physical parameters obtained on the research cruises, and all simulations were forced with actual
wind data. Outside the basin, generalized hydrographic features of the Baltic Sea were utilized by incorporation of simulated hydrographic fields from previous model runs typical for the time periods considered. Larval drift was simulated either by incorporation of passive drifters, or as the initial horizontal distribution of larvae implemented into the model. Drift model simulations of larval transport agreed relatively well with field observations. The influence of variations in the vertical distribution on a smaller scale, i.e. vertical deviations of +/- 6 m from the observed mean centre of mass, on the drift was examined, revealing no significant differences in the drift of larvae depending on their vertical distribution. The different wind forcing during the investigated time periods was linked to a retention situation in May 1988 and to a dispersal situation in August 1991. Finally, observed spatial distribution patterns of 1-group cod based on Baltic Young Fish Surveys (BYFS) were compared with their predicted transport in the larval phase and examined with respect to recruitment.
Identifying the effect of frontal regimes on condition in larval and juvenile sand lance (Ammodytes sp): Utilisation of food web specific tracer lipids

General information
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Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Møller, P. (Ekstern), St. John, M. (Intern), Lund, T. (Ekstern), Madsen, K. (Ekstern)
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Investigations of hydrographic processes influencing the distribution and production of phyto- and zooplankton in the Bornholm Basin, Baltic Sea

General information
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Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Software and GIS development
Authors: Danielsen, P. (Ekstern), St. John, M. (Intern), Heilmann, J. (Intern)
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Publication date: 1998
Main Research Area: Technical/natural sciences

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- Original language: English
- Source: orbit
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- Publication: Research › Conference article – Annual report year: 1998

Oceanographic influences on the distribution of Baltic cod, Gadus morhua, during spawning in the Bornholm Basin of the Baltic Sea
The Baltic Sea is a stratified, semi-enclosed sea typified by a low-salinity surface layer and a deep saline layer of varying volume, salinity, temperature and oxygen concentration. The relationships between these oceanographic factors and the distribution of Baltic cod are presented, utilizing results from a survey carried out during the 1995 spawning period in the Bornholm Basin, at present the main spawning area of this stock. Cod distribution, abundance and population structure were estimated from hydroacoustic and trawl data and related to hydrographic parameters as well as to bottom depth. In the central basin, cod were aggregated in an intermediate layer about 15 m thick. This area of peak abundance was defined at its upper limit by the halocline and at the lower limit by oxygen content. The majority of individuals caught in the basin centre were in spawning or pre-spawning condition with a high proportion of males to females. On the basin slopes, aggregations of cod were found near the bottom. These individuals were mainly immature and maturing stages with an increasing proportion of females to males with size. Salinity and oxygen conditions were found to be the major factors influencing the vertical and horizontal distribution of adult cod. Abundance of immature cod was also positively related to decreasing bottom depths. The effect of temperature was minor. The observed size- and sex-dependent spawning aggregation patterns, in association with habitat volume and stock size, may influence cod catchability and thereby the assessment and exploitation patterns of this stock.

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Authors: Tomkiewicz, J. (Intern), Lehmann, K. (Ekstern), St. John, M. (Intern)
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BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
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BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
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Scopus rating (2013): CiteScore 2.61
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Web of Science (2013): Indexed yes
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BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.42
ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 2
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Role of diatoms in copepod production: good, harmless or toxic?

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Authors: Jonasdottir, S. (Intern), Kiørboe, T. (Intern), Tang, K. (Ekstern), St. John, M. (Intern), Visser, A. (Intern), Saiz, E. (Ekstern), Dam, H. (Ekstern)
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Factors controlling the timing of the spring bloom in the Strait of Georgia estuary, British Columbia, Canada
We present a conceptual model to illustrate how wind events and the annual migration and grazing of the dominant copepod Neocalanus plumchrus interact and affect the development of the spring bloom. The model was supported by observations made during 1988, 1992, and 1993. For example, in 1992, an El Nino year, the annual freshet of the Fraser River and probably the spring bloom started 1 month earlier. The bloom was interrupted by a wind event in late March. A few days later, its full recovery was interrupted by the peak in zooplankton grazing, and ambient ammonium concentrations increased. In contrast, in 1988, the annual freshet started later (mid-April), and winds remained strong throughout the same period, hindering the development of the spring bloom. The spring bloom was further suppressed by large numbers of zooplankton during April, resulting in a prolonged spring bloom. These observations indicate that interannual variations in winds and the timing of the annual freshet determine the timing and duration of the spring bloom, which in turn, determine the matching of phytoplankton to zooplankton in the Strait of Georgia. The matching or mismatching bears significant implications for food availability for juvenile fish.

General information
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Food resource utilization by juvenile Baltic cod Gadus morhua: a mechanism potentially influencing recruitment success at the demersal juvenile stage?

Pelagic and demersal juvenile Baltic cod Gadus morhua L. were collected during surveys in the Bornholm Basin (Baltic Sea) in autumn 1994. Stomach contents were examined for prey composition in order to evaluate the potential importance of the pelagic and demersal habitats for recruitment success. Juvenile cod less than 40 mm fed exclusively on pelagic prey such as copepods and cladocerans. Between 40 and 50 mm the juveniles began to consume benthic prey such as mysids and amphipods; however, copepods were still the dominant food organisms. Between 50 and 70 mm the dominant prey items consumed were mysids and amphipods, with copepods comprising a minor component of the diet. Between 70 and 160 mm the juveniles' diet was composed exclusively of benthic prey with an increase in prey diversity. Mysids were slightly less important in the diet, while the abundance of polychaetes, decapods and fish increased with fish size. Amphipods remained almost constant in the diet of juveniles above 60 mm in length. These results indicate that a major change in food resource utilization started to occur at a fish length of 40 mm, with the main change taking place at approximately 50 mm, suggesting that juvenile Baltic cod make the transition to the benthic habitat at this length. This change in food preference is also reflected in the size of the prey items and the numbers of prey consumed. Pelagic juveniles consumed much smaller prey than their demersal conspecifics. Neither prey size nor prey numbers consumed by pelagic and small demersal juveniles from this study differed from prey reported to be taken by juvenile cod of corresponding size in the Atlantic and the North Sea. However, prey organisms consumed by demersal juvenile Baltic cod larger than 90 mm were much smaller, and prey numbers much higher, than those reported to be consumed by juveniles in other areas. The apparent overlap in food resource utilization among the different size groups of demersal juveniles observed in this study suggests that in years with low prey abundance, or high abundance of pelagic juveniles, strong intra-specific competition for food resources may affect the recruitment success of Baltic cod.

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Scopus rating (2014): CiteScore 2.75
Importance of wind and river discharge in influencing nutrient dynamics and phytoplankton production in summer in the central Strait of Georgia

A cruise was conducted during August 6-14, 1991 to investigate the dynamics of nutrients and phytoplankton production in the central Strait of Georgia, British Columbia, Canada, during a period when strong stratification resulted in nitrogen-limited primary productivity. High resolution vertical profiles of salinity, temperature, fluorescence and nutrients (nitrate and phosphate) were taken daily along a transect. A wind event occurred on August 7 and a rapid increase in the Fraser River discharge took place from August 8 to 14. The wind event mixed the water column and nutrients increased at the same time. Phytoplankton responded to the increase in nutrients and a bloom occurred soon after the wind event. The rapid increase in river discharge caused the entrainment of nitrate in the estuarine plume and, as a result, a subsurface maximum of chi a was developed. Our results clearly demonstrated that summer phytoplankton productivity in the central Strait of Georgia is fueled by a supply of nutrients from the nitracline through vertical mixing induced by the interaction of winds, river discharge and tidal cycles. Of these 3 factors, winds are the most variable and therefore a summer with frequent wind events could result in higher than normal productivity. The mechanism for this is that part of the nitracline was maintained above the euphotic zone due to various physical processes in spite of the strong stratification, and therefore, nutrients were frequently available for phytoplankton uptake caused by across- pycnocline mixing due to wind, river discharge and tides.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Yin, K. (Ekstern), Goldblatt, R. (Ekstern), Harrison, P. (Ekstern), St. John, M. (Intern), Clifford, P. (Ekstern), Beamish, R. (Ekstern)
Pages: 173-183
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Modeling the cod larvae drift in the Bornholm Basin in summer 1994

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Technical University of Denmark
Authors: Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), St. John, M. (Intern), Brugge, B. (Ekstern)
Pages: 1765-1784
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: Continental Shelf Research
Volume: 17
Issue number: 14
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
Scopus rating (2006): SJR 1.473 SNIP 1.445
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.922 SNIP 1.28
Scopus rating (2004): SJR 0.975 SNIP 1.246
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.285 SNIP 1.397
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.102 SNIP 1.195
Newly hatched Baltic cod Gadus morhua larvae are typically found at depths >60 m. This is a region of low light and prey availability, hence generating the hypothesis that larvae have to migrate from hatching depth to the surface layer to avoid starvation and improve their nutritional condition. To test this hypothesis, Baltic cod larvae were sampled during the spawning seasons of 1994 and 1995 with depth-resolving multiple opening/closing nets. Each larva was aged by otolith readings and its RNA/DNA ratio was determined as a measure of nutritional condition. The RNA/DNA ratios of these larvae aged 2-25 days (median 10 days) ranged from 0.4 to 6.2, corresponding to levels exhibited by starving and fast growing larvae in laboratory calibration studies (starvation, protein growth rate, $G(\pi)=-12.2\% \text{ day}^{-1}$; fast-growing larvae, $G(\pi)=14.1\% \text{ day}^{-1}$) respectively. Seventy per cent of the field caught larvae had RNA/DNA ratios between the mean values found for starving and fed laboratory larvae. Only larvae aged 8-11 days had higher mean RNA/DNA ratios above 45 m than below (t-test, $P$ ...
Partitioning of larval fish growth: The effects of age and developmental stage of larval herring on the accumulation rates of protein, triacylglycerol and otolith formation

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: St. John, M. (Intern), Mosegaard, H. (Intern), Houlihan, D. (Ekstern), Pedersen, B. (Ekstern)
Pages: 43-44
Publication date: 1997

Host publication information
Title of host publication: Ichthyoplankton Ecology
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281518
Publication: Research - peer-review › Journal article – Annual report year: 1997

Baltic cod recruitment project (CORE)

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Monitoring, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Eastern Baltic cod: Perspectives from existing data on processes affecting growth and survival of eggs and larvae

We review eastern Baltic cod literature to identify areas for future research involving egg and larval stages. Egg and larval abundances have been estimated for several decades in all of the major spawning areas. Using a subset of the available data we show that the timing of peak egg abundance in one of these areas (Bornholm Basin) varies seasonally by at least 2 mo. Trends in egg and larval abundance over time are not obvious due to differences in gear type, sampling intensity, and survey timing relative to spawning dates. Interannual differences in larval transport away from spawning areas may also contribute to variability in abundance estimates. The results of broad-scale zooplankton surveys suggest that the abundance and types of potential prey in the Baltic Sea are similar to those in other regions and perhaps suitable for moderate-to-fast larval growth. However, few systematic surveys have described food concentrations at appropriate scales for cod larvae, and the species composition of larval diets is unknown. Growth rates for Baltic cod larvae have not been measured and cannot be compared with rates in other areas or to variations in biotic and abiotic factors. Large gaps exist in our knowledge of processes affecting egg and larval growth and survival, but some promising areas of research are indicated. In particular the seasonality of spawning, deep water oxygen concentrations, predation on eggs, and larval food production require further investigation.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Fisheries- and Monitoring Technology
Authors: MacKenzie, B. (Intern), St. John, M. (Intern), Wieland, K. (Intern)
Pages: 265-281
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 134
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
Influence of salinity, oxygen and temperature on spawning aggregation and spatial distribution of Baltic cod (Gadus morhua L.)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries- and Monitoring Technology, Section for Population Ecology and Genetics
Authors: Tomkiewicz, J. (Intern), Stæhr, K. (Intern), Lehmann, K. (Ekstern), St. John, M. (Intern)
Pages: 1-10
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Lipid biomarkers: Linking the utilization of frontal plankton biomass to enhanced condition of juvenile North Sea cod

The effects of physical mixing processes on phytoplankton production in the marine environment are well established. However, the effects of these processes on growth and condition of zooplankton and larval fish are at present poorly understood. In this study, we utilized phytoplankton group-specific fatty acid content to trace the phytoplankton group and mixing regime contributing to the condition of individual juvenile North Sea cod. In order to establish a relationship between lipid tracer content and algal utilization, post yolk-sac larval North Sea cod were reared in the laboratory on food chains based on monocultures of either the diatom Skeletonema costatum or the dinoflagellate Heterocapsa triquetra (algae dominating in the mixed and stratified regions of the North Sea). In the laboratory, these algae were fed to cultures of adult Acartia tonsa, the copepod eggs were collected, hatched and the N1 nauplii from these different feeding regimes fed to post yolk-sac larval North Sea cod. Post yolk-sac larval cod required 8 d on either a Heterocapsa- or Skeletonema-based food chain before tracer Lipid signals (the ratio of the lipids 16:1 omega 7 to 16:0) in the larvae began to change from their original values to those similar to the algae at the base of their respective food chains. The cod larvae displayed a lipid tracer content similar to that of their algal food source after 13 d on their respective feeding regimes. During a cruise in May 1992 to examine the distribution of larval and juvenile North Sea cod, a subsample of 100 juvenile cod from the stratified, mixed and frontal regimes of the northeastern North Sea were examined for their content of lipid biomarkers and condition (as determined by the ratio of total lipid content to total length). Juvenile cod displaying a lipid tracer content indicating utilization of diatom-basea food webs (found in proximity to regions of frontal mixing) were observed to be in significantly better condition (p less than or equal to 0.05) than those containing a lipid signal indicative of utilization of flagellate-based food webs (found in stratified regions of the North Sea).

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: St. John, M. (Intern), Lund, T. (Ekstern)
Pages: 75-85
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 131
Issue number: 1-3
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
Oceanographic processes influencing seasonal and interannual variability in cod spawning habitat in the eastern Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Monitoring
Authors: MacKenzie, B. (Intern), St. John, M. (Intern), Plikshs, M. (Ekstern), Hinrichsen, H. (Ekstern), Wieland, K. (Intern)
Pages: C+J:4
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Oxygen in the deep basins of the Baltic Sea: The influence of winter mixing

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: St. John, M. (Intern), Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), MacKenzie, B. (Intern)
Pages: C+J:2
Publication date: 1996
Main Research Area: Technical/natural sciences

Baltic cod recruitment project

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Monitoring, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Schnack, D. (Ekstern), Köster, F. (Intern), Wieland, K. (Intern), St. John, M. (Intern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Nissling, A. (Ekstern)
Pages: J:23
Publication date: 1995
Main Research Area: Technical/natural sciences

Comparison of chlorophenyl congener and pesticide concentration in cod tissues in relation to their lipid class content

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Contents and depletion of lipids in *Calanus finmarchicus* during overwintering in the North Atlantic

**General information**
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Jonasdottir, S. (Intern), St. John, M. (Intern)
Pages: L:27
Publication date: 1995
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 226079
Publication: Research › Conference article – Annual report year: 1995

Larval drift and retention: A Baltic cod, a modelling approach

**General information**
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), St. John, M. (Intern), Brugge, B. (Ekstern)
Pages: L:28
Publication date: 1995
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
A relationship between Fraser River discharge and interannual production of Pacific salmon (Oncorhynchus spp.) and Pacific herring (Clupea pallasi) in the Strait of Georgia

We identified years of anomalously high and low discharge from the Fraser River and compared these years with indices of anomalously high and low production of Pacific salmon (Oncorhynchus spp.) and Pacific herring (Clupea pallasi). For chinook (O. tshawytscha) and coho salmon (O. kisutch), we found that brood years that went to sea in a year when the Fraser River discharge was very high compared with the previous year virtually never had an index of production that was higher than the previous year. Similarly, brood years that went to sea in a year when the Fraser River discharge was very low compared with the previous year almost never had an index of productivity that was lower than the previous year. The analysis identified a weaker association between extreme discharge anomalies and chum salmon (O. keta) production. A close association was not found between extreme discharge anomalies and pink salmon (O. gorbuscha), sockeye salmon (O. nerka), or herring production. The relationships identify a connection between annual fluctuations in river flow and production of some marine fishes and may be of use in forecasting abundance changes.
A horizontally resolving physical-biological model of nitrate concentration and primary productivity in the Strait of Georgia

Model simulations revealed that wind mixing was the dominant physical mechanism that added nitrate to the surface layer and subsequently enhanced primary productivity in the Strait of Georgia. Simulations of high Fraser River runoff showed that the enhanced stability of the water column in the vicinity of the riverine plume made wind mixing of nutrients into the surface layer more difficult. We propose that this increase in stability results in an earlier onset of the spring bloom in regions influenced by Fraser River runoff. During the summer, an increase in the buoyancy of surface water due to the freshwater plume reduces nitrate concentration in the surface layer and thereby limits primary production in the plume area. The reduced impact of wind events on nitrate fluxes is the result of a greater energy requirement to break down the more buoyant surface layer. Results indicate that during the fall, when light is again limiting and surface nitrate concentrations increase due to wind mixing by fall storms, the freshwater runoff from the Fraser River results in a more stable water column (similar to the spring situation) in the southern Strait, resulting in the potential for a fall bloom.

General information
State: Published
Organisations: University of British Columbia
Authors: St. John, M. (Intern), Marinone, S. G. (Ekstern), Stronach, J. (Ekstern), Harrison, P. J. (Ekstern), Fyfe, J. (Ekstern), Beamish, R. J. (Ekstern)
Pages: 1456-1466
Publication date: 1993
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 50
Issue number: 7
ISSN (Print): 0706-652X
Ratings:
Nutrient and plankton dynamics in the Fraser River Plume Strait of Georgia British Columbia Canada

High discharge rates from the Fraser River create a riverine plume front that moves daily and fortnightly with the tides in the Strait of Georgia. During a spring-neap tidal cycle in July 1987, a study of nutrient and plankton dynamics including vertical profiles of temperature, salinity, fluorescence, nutrients (NO₃, NH₄, PO₄, SiO₄ and urea), zooplankton, phytoplankton and bacterial biomass and primary and heterotrophic productivities was conducted at 3 stations, one situated in the riverine plume and two at the inner and outer estuarine plume. Primary productivity was highest in the outer part of the estuarine plume and lowest in the riverine plume. Bottom to surface daytime vertical zooplankton hauls revealed no differences in species composition among the 3 stations, but euphausiids were significantly more abundant in the estuarine plume, where phytoplankton abundance was also the highest. During post-neap tides, nitrate was undetectable, a subsurface chlorophyll maximum was present and productivity was high in the estuarine plume. During the post-spring tidal period, nutrient concentrations were elevated, maximum chlorophyll concentrations occurred near the surface and primary productivity increased approaching neap tides. Utilizable nitrogen sources (NO₃ + NH₄ + urea) and phosphate concentrations in the river were similar to concentrations in the riverine plume, while silicate was significantly higher in the river. Therefore, in late July, nutrient enrichment of the surface waters of the plume, resulting in high primary productivity at the plume boundaries and beyond, appears to be mainly due to entrainment as the freshwater moves over the seawater.

General information
State: Published
Organisations: Simon Fraser University, University of British Columbia
Authors: Harrison, P. (Ekstern), Clifford, P. (Ekstern), Cochlan, W. (Ekstern), Yin, K. (Ekstern), St. John, M. (Intern), Thompson, P. (Ekstern), Sibbald, M. (Ekstern), Albright, L. (Ekstern)
Pages: 291-304
Publication date: 1991
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology Progress Series
Volume: 70
Issue number: 3
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
Operational ecology: Ecosystem forecast products to enhance marine GMES applications (OPEC) (38864)
The primary goal of OPEC was to improve the quality of operational services for biogeochemical and ecological parameters and hence, improve our ability to project the future status of European marine ecosystems, by delivering a suite of error quantified indicators which describe changes in ecosystem function suitable for implementation in operational centers.

In order to advance our understanding and predictive capacities for the response of marine ecosystems to global change, OPEC employed a combination of numerical simulations, data assimilation of satellite and in situ data, observational strategy evaluation and cross-disciplinary synthesis. The MSFD takes a regional approach to the development of strategies for environmental status, identifying four main regions: NE Atlantic, Baltic, Mediterranean and Black Seas. The MSFD also identifies a number of high level descriptors of environmental status (e.g. biodiversity, commercial fish, eutrophication, food webs, and invasive species) each of which has a defined set of indicators. Using the regional approach as framework we implemented and tested a suite of indicators in each region. These descriptors along with ECVs provided a framework for the definition of new environmental applications (e.g. habitat for biodiversity, oxygen depletion/eutrophication, fisheries and marine climate change research).

A common set of descriptors with associated GES indicators and ECVs were defined across the four regions, to ensure a commonality of approach and the development of a consistent capacity across Europe. Auditable quality is essential for GMES environmental applications, and OPEC emphasized the assessment of predictability of key indicators. The R&D of the project included development of coupled end to end ecosystem models, where DTU Aqua implemented the coupling between the SMS model for higher trophic levels and HBM-ERGOM for physics and biogeochemistry.

The project had nine partners from the EU and was coordinated by Plymouth Marine Laboratory, UK. The project was funded by EU. Framework Programme 7.

National Institute of Aquatic Resources
Section for Marine Living Resources
Period: 01/01/2012 → 31/12/2014
Number of participants: 4
Research areas: Marine Living Resources & Marine Populations and Ecosystem Dynamics & Ecosystem based Marine Management
Project participant:
Vinther, Morten (Intern)
Neuenfeldt, Stefan (Intern)
St. John, Michael (Intern)
Project Manager, academic:
Christensen, Asbjørn (Intern)
Project

The role of deep convection on the dynamics of the North Atlantic phytoplankton community
National Institute of Aquatic Resources
Period: 01/01/2012 → 01/07/2015
Number of participants: 6
Phd Student:
Lindemann, Christian (Intern)
Supervisor:
Mariani, Patrizio (Intern)
Main Supervisor:
St. John, Michael (Intern)
Examiner:
MacKenzie, Brian (Intern)
Bruggeman, Jorn (Ekstern)
Martin, Adrian Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Functional biology of krill in northern marine ecosystems
National Institute of Aquatic Resources
Period: 01/05/2011 → 30/09/2014
Number of participants: 6
Phd Student:
Agersted, Mette Dalgaard (Intern)
Supervisor:
St. John, Michael (Intern)
Main Supervisor:
Nielsen, Torkel Gissel (Intern)
Examiner:
Neuenfeldt, Stefan (Intern)
Kaartvedt, Stein (Ekstern)
Schmidt, Katrin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Protozooplankton in Northern Marina Ecosystems
National Institute of Aquatic Resources
Period: 01/03/2011 → 19/12/2014
Number of participants: 6
Phd Student:
Riisgaard, Karen (Intern)
Supervisor:
St. John, Michael (Intern)
Main Supervisor:
Nielsen, Torkel Gissel (Intern)
Examiner:
Kiørboe, Thomas (Intern)
Jakobsen, Hans Henrik (Intern)
Stoecker, Diane K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD
European basin-scale analysis, synthesis and integration (EURO-BASIN) (38899)

EURO-BASIN was designed to advance our understanding on the variability, potential impacts, and feedbacks of global change and anthropogenic forcing on the structure, function and dynamics of the North Atlantic and associated shelf sea ecosystems as well as the key species influencing carbon sequestering and ecosystem functioning. Like the entire biosphere, marine ecosystems such as the North Atlantic and its associated shelf sea ecosystems can be characterized by emergent properties controlled by a dynamic network of interactions and relationships and not static entities. This system complexity is what Martin Luther King Jr. called "an inescapable network of mutuality" scientists today define as complex adaptive systems (CASs).

EURO-BASIN has represented the first attempt of creating future prognosis of marine ecosystem states sensitive to CAS dynamics using as its test case the North Atlantic. Long-term prediction of the status of these CAS systems, population dynamics of key species and hence management of marine systems requires the implementation and advancement of an ecosystem approach for the management of marine resources sensitive to CAS dynamics. What is the ecosystem approach? Unlike a single species approach, the ecosystem approach takes into account population and ecosystem responses to changes in the Earth's climate, fisheries, and interactions between them. In EURO-BASIN not only did we monitor and assess how North Atlantic marine ecosystems behaved in the past, but also predict how they will respond under possible future climate change scenarios. Hence, the results of this project have provided important recommendations for better marine resource management in the European Union.

The project had participants from 23 European universities and research institutions as well as collaborations with key institutions and Universities in the US and Canada.

The project was coordinated by DTU Aqua.

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources

Section for Marine Ecology and Oceanography
Period: 01/01/2010 → 31/12/2014
Number of participants: 12
Research areas: Marine Populations and Ecosystem Dynamics & Oceanography & Marine Living Resources
Acronym: EURO-BASIN
Number of related Ph.D. students: 4
Contact person:
Grigorov, Ivo (Intern)
Project participant:
Andersen, Ken Haste (Intern)
Jonasdottir, Sigrun (Intern)
Kiørboe, Thomas (Intern)
Koski, Marja (Intern)
Munk, Peter (Intern)
Stæhr, Karl-Johan (Intern)
Vinther, Morten (Intern)
Visser, Andre (Intern)
Project Manager, organisational:
Köster, Fritz (Intern)
MacKenzie, Brian (Intern)
Project Manager, academic:
St. John, Michael (Intern)

Relations
Activities:
40th CIESM Mediterranean Science Commission Congress: Mediterranean Science Commission, Annual Congress
Publications:
Effects of temperature and food availability on feeding and egg production of Calanus hyperboreus from Disko Bay, Western Greenland
Long-term retrospective analysis of mackerel spawning in the North Sea
Marine snow, zooplankton and thin layers: indications of a trophic link from small-scale sampling with the Video Plankton Recorder
The rise and fall of the NE Atlantic blue whiting (Micromesistius poutassou)
Spatial segregation within the spawning migration of North Eastern Atlantic mackerel (Scomber scombrus) as indicated by juvenile growth patterns
Patchy zooplankton grazing and high energy conversion efficiency: ecological implications of sandeel behavior and strategy
Population structure of Atlantic Mackerel (Scomber scombrus)
Distribution of phytoplankton functional types in high-nitrate low-chlorophyll waters in a new diagnostic ecological indicator model
Migration and fisheries of North East Atlantic mackerel (Scomber scombrus) in autumn and winter
Effects of a future warmer ocean on the coexisting copepods Calanus finmarchicus and C. glacialis in Disko Bay, Western Greenland
Pseudocollapse and rebuilding of North Sea mackerel (Scomber scombrus)
Acclimation, adaptation, traits and trade-offs in plankton functional type models – seeking clarity in terminology
A cascade of warming impacts brings bluefin tuna to Greenland waters
A resolution to the blue whiting (Micromesistius poutassou) population paradox?
Bridging the gap between marine biogeochemical and fisheries sciences; configuring the zooplankton link
Challenges in integrative approaches to modelling the marine ecosystems of the North Atlantic: Physics to fish and coasts to ocean
Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts
Distributions and seasonal abundances of krill eggs and larvae in the sub-Arctic Godthåbsfjord, SW Greenland
Effects of climate-induced habitat changes on a key zooplankton species
Gut evacuation rate and grazing impact of the krill Thysanoessa raschii and T. inermis
Identifying marine pelagic ecosystem management objectives and indicators
Interactive effects of temperature and light during deep convection: a case study on growth and condition of the diatom Thalassiosira weissflogii
Krill diversity and population structure along the sub-Arctic Godthåbsfjord, SW Greenland
Long-term changes of euphausiids in shelf and oceanic habitats southwest, south and southeast of Iceland
Physiological constrains on Sverdrup's Critical-Depth-Hypothesis: the influences of dark respiration and sinking
Size structures sensory hierarchy in ocean life
Spatially explicit estimates of stock sizes, structure and biomass of herring and blue whiting, and catch data of bluefin tuna
Trophic position of coexisting krill species: a stable isotope approach
Winter–spring transition in the subarctic Atlantic: microbial response to deep mixing and pre-bloom production
Fishing out collective memory of migratory schools

Data sharing: An open mind on open data: The move to make scientific findings transparent can be a major boon to research, but it can be tricky to embrace the change.

**Eel Egg and Larval development in Relation to Bio-Physical Characteristics and Gamete Quality**

National Institute of Aquatic Resources
Period: 01/07/2009 → 02/04/2014
Number of participants: 7
PhD Student: Sørensen, Sune Riis (Intern)
Supervisor: Bossier, Peter Georges Madeleine (Ekstern)
Munk, Peter (Intern)
Main Supervisor: Tomkiewicz, Jonna (Intern)
Examiner: St. John, Michael (Intern)
Geffen, Audrey Jacheline (Ekstern)
Vadstein, Olav (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

The coupling between the dynamics and the biology in the North Sea
In stratified waters there may be a close connection between the dynamics and the biology of the water masses. Recent research suggests that this circumstance is responsible for the fact that the North Sea is among the world’s most important with respect to the production of fish. The project aims at studying this possible close connection by considering the course of the thermal stratification in the North Sea and the abundance of cod larvae for the past 40 years.

Department of Hydrodynamics and Water Resources
National Institute of Aquatic Resources
Period: 01/10/1998 → 14/12/1999
Number of participants: 2
Project participant:
St. John, Michael (Intern)
Project Manager, organisational:
Nielsen, Morten Holtegaard (Intern)
Project