First record of the non-indigenous jellyfish *Blackfordia virginica* (Mayer, 1910) in the Baltic Sea

Marine invasions are of increasing concern for biodiversity conservation worldwide. Gelatinous macrozooplankton contain members, which have become globally invasive, for example the ctenophore *Mnemiopsis leidyi* or the hydromedusae *Blackfordia virginica*. *B. virginica* is characterised by a large salinity tolerance, with a brackish-water habitat preference, and by a metagenic life history strategy with an alternation between sexually reproducing planktonic medusae and asexually reproducing benthic polyps to complete the life cycle. In this study we analysed 8 years of ichthyoplankton survey data (2010-2017) from the Kiel Canal and 14 ichthyoplankton summer surveys in the central Baltic Sea (2008-2017). We report the first presence of *B. virginica* in northern Europe, namely from the southwestern Baltic Sea and the Kiel Canal. In the Kiel Canal, *B. virginica* was first sporadically sighted in 2014 and 2015 and has developed persistent populations since summer 2016. Changes in size-frequency distributions during summer 2016 indicate active recruitment in the Kiel Canal at salinities between 7 and 13 and temperatures > 14 °C. Close vicinity to and direct connection with the southwestern Baltic Sea, where *B. virginica* was observed during 2017, indicate that the Baltic Sea and other brackish-water habitats of Northern Europe are at risk for colonisation of this non-indigenous species. Our results highlight that monitoring activities should consider gelatinous macrozooplankton for standard assessments to allow for the detection of non-indigenous species at an early stage of their colonisation.
Effect of fish length and nutritional condition on the fecundity of distressed Atlantic cod Gadus morhua from the Baltic Sea: Potential fecundity of Baltic G. Morhua

The disappearance of larger individuals and the decrease in individual body condition suffered by Atlantic cod Gadus morhua in the eastern Baltic during the past two decades can be expected to affect the stock reproductive output. To investigate this, female G. morhua were collected during the spawning and pre-spawning period in 2015-2016. The current individual potential fecundity (FP) of eastern Baltic G. morhua was estimated and analysed in relation to total length (LT) and indices of nutritional status such as body condition (K) and hepato-somatic index (IH) using generalized linear
models. In addition, the current prevalence of atresia and its potential relation to K were investigated. Moreover, a calibration curve to estimate FP from oocyte diameter, based on the autodiametric oocyte counting method, was established for the first time for eastern Baltic G. morhua and can be used for future fecundity studies on this stock. The results showed that FP was mainly positively related to fish length, but K and IH also contributed significantly to the variation in FP. The model predicted that fish with K = 1.2 have a FP 51% higher than fish of the same LT with K = 0.8. The prevalence of fecundity regulation by atresia was 5.8%, but it was found only in fish in the pre-spawning maturity stage and with low K. Temporal changes in biological features such as the length composition and individual body condition of eastern Baltic G. morhua, should be accounted for when estimating stock reproductive potential.
Liver worm (Contracaecum osculatum) infection status in cod (Gadus morhua) along a transect from the Skagerrak to the eastern Baltic

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Thünen Institute of Baltic Sea Fisheries, University of Copenhagen, Aarhus University
Authors: Sokolova, M. (Intern), Buchmann, K. (Ekstern), Kania, P. W. (Ekstern), Huwer, B. (Intern), Krumme, U. (Ekstern), Galatius, A. (Forskerdatabase), Behrens, J. W. (Intern)
Publication date: 2018
Event: Abstract from Joint Spring Symposium 2018, Danish Society for Parasitology and Danish Society for Tropical Medicine & International Health, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review » Journal article – Annual report year: 2018

No increase in marine microplastic concentration over the last three decades - A case study from the Baltic Sea
Microplastic is considered a potential threat to marine life as it is ingested by a wide variety of species. Most studies on microplastic ingestion are short-term investigations and little is currently known about how this potential threat has developed over the last decades where global plastic production has increased exponentially. Here we present the first long-term study on microplastic in the marine environment, covering three decades from 1987 to 2015, based on a unique sample set originally collected and conserved for food web studies. We investigated the microplastic concentration in plankton samples and in digestive tracts of two economically and ecologically important planktivorous forage fish species, Atlantic herring (Clupea harengus) and European sprat (Sprattus sprattus), in the Baltic Sea, an ecosystem which is under
high anthropogenic pressure and has undergone considerable changes over the past decades. Surprisingly, neither the concentration of microplastic in the plankton samples nor in the digestive tracts changed significantly over the investigated time period. Average microplastic concentration in the plankton samples was 0.21±0.15 particles m⁻³. Of 814 fish examined, 20% contained plastic particles, of which 95% were characterized as microplastic.
Ocean current connectivity propelling the secondary spread of a marine invasive comb jelly across western Eurasia

Aim: Invasive species are of increasing global concern. Nevertheless, the mechanisms driving further distribution after the initial establishment of non-native species remain largely unresolved, especially in marine systems. Ocean currents can be a major driver governing range occupancy, but this has not been accounted for in most invasion ecology studies so far. We investigate how well initial establishment areas are interconnected to later occupancy regions to test for the potential role of ocean currents driving secondary spread dynamics in order to infer invasion corridors and the source-sink dynamics of a non-native holoplanktonic biological probe species on a continental scale.

Location: Western Eurasia.


Major taxa studied: 'Comb jelly' Mnemiopsis leidyi.

Methods: Based on 12,400 geo-referenced occurrence data, we reconstruct the invasion history of M. leidyi in western Eurasia. We model ocean currents and calculate their stability to match the temporal and spatial spread dynamics with large-scale connectivity patterns via ocean currents. Additionally, genetic markers are used to test the predicted connectivity between subpopulations.

Results: Ocean currents can explain secondary spread dynamics, matching observed range expansions and the timing of first occurrence of our holoplanktonic non-native biological probe species, leading to invasion corridors in western Eurasia. In northern Europe, regional extinctions after cold winters were followed by rapid recolonizations at a speed of up to 2,000 km per season. Source areas hosting year-round populations in highly interconnected regions can re-seed genotypes over large distances after local extinctions.

Main conclusions: Although the release of ballast water from container ships may contribute to the dispersal of non-native species, our results highlight the importance of ocean currents driving secondary spread dynamics. Highly interconnected areas hosting invasive species are crucial for secondary spread dynamics on a continental scale. Invasion risk assessments should consider large-scale connectivity patterns and the potential source regions of non-native marine species.
Changes in food web function and diversity due to non-indigenous species

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

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http://oceanrep.geomar.de/39918/1/Lehtiniemi%20et%20al%202017%20-%20BIO-C3%20D2.3%20-%20Effects%20of%20NIS%20-%20public.pdf
Publication: Research › Report chapter – Annual report year: 2017

Changes in reproductive life history and resource allocation impacting population dynamics of Baltic cod

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Monitoring and Data, Section for Ecosystem based Marine Management, Institute Management
Authors: Tomkiewicz, J. (Intern), Huwer, B. (Intern), Cordón, C. T. F. (Intern), Storr-Paulsen, M. (Intern), Eero, M. (Intern), Köster, F. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Do spatio-temporal spawning closures promote the recovery of cod in the Baltic Sea?

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

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Monitoring and Data, Section for Marine Living Resources
Authors: Storr-Paulsen, M. (Intern), Huwer, B. (Intern)
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**Micro-and macro-plastics in marine species from Nordic waters**

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Norwegian Institute for Water Research
Authors: Bråte, I. L. N. (Ekstern), Huwer, B. (Intern), Thomas, K. V. (Ekstern), Eidsvoll, D. P. (Ekstern), Halsband, C. (Ekstern), Almroth, B. C. (Ekstern), Lusher, A. (Ekstern)
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**No increase in marine microplastic concentration over the last three decades – A case study from the Baltic Sea**

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Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic, University of Copenhagen, Technical University of Denmark, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Beer, S. (Ekstern), Garm, A. (Ekstern), Huwer, B. (Intern), Dierking, J. (Ekstern), Nielsen, T. G. (Intern)
Number of pages: 1
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**Revealing the role of ocean currents for secondary invasions in a holoplanktonic species**

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Danish Shellfish Centre, Section for Marine Living Resources, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Jaspers, C. (Intern), Huwer, B. (Intern), Hinrichsen, H. (Ekstern), Biastoch, A. (Ekstern)
Publication date: 2017
Event: Abstract from ASLO Aquatic Sciences Meeting 2017, Honolulu, United States.
Spatial distribution, origin and source and sink areas of marine litter in the water column of the North Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Institute of Marine Research, Swedish University of Agricultural Sciences, Marine Scotland, Johann Heinrich von Thünen-Institute, IFREMER, Wageningen IMARES
Authors: Huwer, B. (Intern), Kloppmann, M. (Ekstern), Loots, C. (Ekstern), van Damme, C. J. G. (Ekstern), Nash, R. (Ekstern), Bland, B. (Ekstern), Ritchie, L. (Ekstern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts Sustain 2017
Article number: A-3
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017

The invasive comb jelly Mnemiopsis leidyi in Europe and in the Baltic Sea: Invasion history, distribution, phenology and ecosystem impacts

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Oceans and Arctic
Authors: Huwer, B. (Intern), Jaspers, C. (Intern)
Number of pages: 1
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Title of host publication: Book of Abstracts Sustain 2017
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Main Research Area: Technical/natural sciences
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The parasitic nematode Contracaecum osculatum (liver worm) in Baltic cod: Spatial differences in prevalence and intensity of infection

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, University of Copenhagen
Authors: Sokolova, M. (Intern), Huwer, B. (Intern), Buchmann, K. (Ekstern), Behrens, J. (Intern)
Publication date: 2017
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Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

Baltic cod recruitment – the impact of changing environmental conditions

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Leibniz Institute of Marine Sciences
Connectivity of larval cod in the transition area between North Sea and Baltic Sea and potential implications for fisheries management

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

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

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Zuo, S. (Ekstern), Huwer, B. (Intern), Bahlool, Q. (Ekstern), Al-Jubury, A. (Ekstern), Christensen, N. D. (Ekstern), Korbut, R. (Ekstern), Kania, P. (Ekstern), Buchmann, K. (Ekstern)
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Scopus rating (2017): CiteScore 1.7 SJR 0.675 SNIP 0.95
Web of Science (2017): Impact factor 1.543
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.95 SJR 0.893 SNIP 0.92
Web of Science (2016): Impact factor 1.549
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.973 SNIP 0.943 CiteScore 1.96
Web of Science (2015): Impact factor 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.895 SNIP 0.889 CiteScore 1.86
Web of Science (2014): Impact factor 1.752
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.831 SNIP 0.928 CiteScore 1.77
Web of Science (2013): Impact factor 1.586

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Copenhagen, DHI Denmark, University of Hamburg
Understanding the processes behind fish stock dynamics: Where are we?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Eero, M. (Intern), Sørensen, H. (Intern), Huwer, B. (Intern), Sørensen, S. R. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

When (How?) things go wrong: How larval drift can distort stock abundance estimates

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

Managing population mixing; genetics supported stock splitting in Atlantic cod

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

Bibliographical note
ICES C.M. 2015/I:12
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Optimal bæredygtig udnyttelse af tilgængelige torskebestande for dansk fiskeri

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Eero, M. (Intern), Hansen, J. H. (Intern), Hüussy, K. (Intern), Huwer, B. (Intern), Berg, C. W. (Intern), Mariani, P. (Intern), Mosegaard, H. (Intern), Nielsen, A. (Intern), Eg Nielsen, E. (Intern), Rindorf, A. (Intern), Ulrich, C. (Intern), Vinther, M. (Intern), Worsøe Clausen, L. (Intern)
Number of pages: 52
Publication date: 2015
Processes controlling recruitment in Baltic cod

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Leibniz Institute of Marine Sciences
Authors: Köster, F. (Intern), Huwer, B. (Intern), Hinrichsen, H. (Ekstern), Neumann, V. (Intern), Makarchouk, A. (Ekstern), Eero, M. (Intern), Hüsey, K. (Intern), Plikshs, M. (Ekstern)
Publication date: 2015
Event:
Main Research Area: Technical/natural sciences
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ICES C.M. 2015/Q:20
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A synthesis of the distribution of Mnemiopsis leidyi in European waters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, IFREMER, Alfred Wegener Institute, Aarhus University, Universite de Montpellier, Universite du Sud Toulon - Var, Institute of Biology of the Southern Seas, CSIC, Universite de La Rochelle, Thünen Institute of Sea Fisheries , University Museum of Bergen, Italian National Research Council, Alfred Wegener Institute for Polar and Marine Research, Leibniz Institute for Baltic Sea Research Warnemunde (IOW), Sorbonne Universités, Institute of Fisheries, Marine Ecology, Istanbul University, Cefas Weymouth Laboratory, Institute for Agricultural and Fisheries Research, Marine Biology and Ecology Department, Royal Netherlands Institute for Sea Research - NIOZ, Deltas, GEOMAR - Helmholtz Centre for Ocean Research Kiel, University of Gothenburg, Aix Marseille Universite, University of Southern Denmark
Publication date: 2014
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2014

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

General information
Distribution and reproduction of the Arctic ctenophore Mertensia ovum in the Baltic Sea

Species identification based on morphological characteristics has caused misidentifications and led to twisted views of abundances and roles of ctenophores. Based on extensive field studies from 2007 to 2010, the occurrence of the arctic ctenophore Mertensia ovum was genetically verified in the southern, central and northern Baltic Sea, and its egg production, distribution and abundance were studied in relation to physical factors. Genetic analyses indicate that M. ovum is by far the most abundant small ctenophore in the Baltic Sea. Specimens from a 20 yr old ctenophore collection were also genetically identified as M. ovum, contrary to their previous morphological identification as another ctenophore species, Pleurobrachia pileus. Thus, earlier reports on P. pileus in the Baltic Sea may actually refer to M. ovum. The abundance of M. ovum was regulated by both salinity and temperature, with highest abundances found in sea areas and water layers at temperatures 5.5 and oxygen levels >4 ml l-1. During summer, the highest abundances of ctenophores and their eggs were found near the halocline, while the distribution was more uniform throughout the water column during winter. Only ctenophores >3.5 mm (oral-aboral length) produced eggs in the experiments, with an average rate of 2.2 eggs ind.-1 d-1. Finally, comparison with published data from the 1980s (assuming that those data refer to M. ovum) indicates that the present-day ctenophore abundance is ~80% lower in the north and ~55% higher in the southern parts of the Baltic Sea, due to reasons yet to be established.
Population genetics of the invasive ctenophore Mnemiopsis leidyi in Europe reveal source-sink dynamics and secondary dispersal to the Mediterranean Sea

Repeated invasions of European waters by the ctenophore Mnemiopsis leidyi offer a unique opportunity to study population dynamics and dispersal in gelatinous zooplankton. Here we followed population establishment in two recently invaded areas, the North and Baltic Sea, and analysed changes in population structure during a 3-yr interval using 7 highly polymorphic microsatellites (representing 191 alleles). A second goal was to reconstruct routes of recent invasive range
expansion into the Mediterranean Sea. During the study period (2008-2010) populations in North Sea and Western Baltic Sea maintained their allelic composition with virtually unchanged levels of genetic diversity and between-population differentiation. This demonstrates that gene flow between the two regions was limited and indicates successful reproduction in both areas. In contrast, at the eastern distribution limit in the central Baltic (Bornholm Basin) the same measures fluctuated between years and genetic diversity decreased from 2008-2010. In concordance with prior ecological observations, this supports the view that here M. leidyi formed a sink population. In the area of recent range expansion (Mediterranean Sea) we observed high population differentiation for a holoplanktonic species. Among Mediterranean samples collected at sites in Spain, France and Israel pairwise differentiation was between $F_{st} = 0.04-0.16$. Despite such differentiation, Bayesian clustering and phylogeographic analysis support the hypothesis that all Mediterranean M. leidyi result from a secondary introduction originating in the Black Sea. Our study contributes to growing evidence that multiple invasions of the same species can vary in their degree of genetic diversity and demonstrates how genetic markers can help to resolve whether gelatinous plankton species form self-sustaining populations.

**General information**

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Bolte, S. (Ekstern), Fuentes, V. (Ekstern), Haslob, H. (Ekstern), Huwer, B. (Intern), Thibault-Botha, D. (Ekstern), Angel, D. (Ekstern), Galil, B. (Ekstern), Javidpour, J. (Ekstern), Moss, A. G. (Ekstern), Reusch, T. B. (Ekstern)
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
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Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Impact factor 2.619
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Web of Science (2013): Impact factor 2.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): CiteScore 2.9
Web of Science (2012): Impact factor 2.546
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.85
Web of Science (2011): Impact factor 2.711
A novel length back-calculation approach accounting for ontogenetic changes in the fish length - otolith size relationship during the early life of sprat (Sprattus sprattus)

An individual-based length back-calculation method was developed for juvenile Baltic sprat (Sprattus sprattus), accounting for ontogenetic changes in the relationship between fish length and otolith length. In sprat, metamorphosis from larvae to juveniles is characterized by the coincidence of low length growth, strong growth in body height, and maximal otolith growth. Consequently, the method identifies a point of metamorphosis for an individual as the otolith radius at maximum increment widths. By incorporating this information in our back-calculation method, estimated length growth for the early larval stage was more than 60% higher compared with the result of the biological intercept model. After minimal length growth during metamorphosis, we found the highest increase in length during the early juvenile stage. We thus located the strongest growth potential in the early juvenile stage, which is supposed to be critical in determining recruitment strength in Baltic sprat.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Guenther, C. C. (Ekstern), Temming, A. (Ekstern), Baumann, H. (Ekstern), Huwer, B. (Intern), Moellmann, C. (Ekstern), Clemmesen, C. (Ekstern), Herrmann, J. (Ekstern)
Pages: 1214-1229
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 69
Issue number: 7
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.44 SJR 1.329 SNIP 1.036
Web of Science (2017): Impact factor 2.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.388 SNIP 1.185
cellular growth, metamorphosis, ontogenetic change, Pisces Vertebrata Chordata Animalia (Animals, Chordates, Fish, Nonhuman Vertebrates, Vertebrates) - Osteichthyes [85206] Sprattus sprattus species Baltic sprat common larva, immature, 04500, Mathematical biology and statistical methods, 10515, Biophysics - Biocybernetics, 20004, Sense organs
Fiskebestandenes struktur. Fagligt baggrundsnotat til den danske implementering af EU's havstrategidirektiv

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Warnar, T. (Intern), Huwer, B. (Intern), Vinther, M. (Intern), Egekvist, J. (Intern), Sparrevohn, C. R. (Intern), Kirkegaard, E. (Intern), Dolmer, P. (Intern), Munk, P. (Intern), Sørensen, T. K. (Intern)
Number of pages: 121
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Publisher: Institut for Akvatiske Ressourcer, Danmarks Tekniske Universitet
ISBN (Electronic): 978-87-7481-158-9
Original language: Danish
Series: DTU Aqua-rapport
Number: 254-2012
Main Research Area: Technical/natural sciences
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254_2012_fiskeestandenes_struktur_baggrundsnotat_til_havstrategi.pdf
Links:
http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Publication: Commissioned › Report – Annual report year: 2012

Havforskningsskibet Dana er i Østersøen

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Storr-Paulsen, M. (Intern), Huwer, B. (Intern)
Pages: 15
Publication date: 2012

Publication information
Pages (from-to): 15
Newspaper: Fiskeritidende
Volume: 19
No.: 12
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Main Research Area: Technical/natural sciences
Publication: Communication › Newspaper article – Annual report year: 2012
Hydrographic influence on the spawning habitat suitability of western Baltic cod (Gadus morhua)

Hydrographic influence on the spawning habitat suitability of western Baltic cod (Gadus morhua) – ICES Journal of Marine Science, 69: 1736–1743. Recruitment variability of marine fish is influenced by the reproductive potential of the stock (i.e. stock characteristics and abundance) and the survival of early life stages, mediated by environmental conditions of both a physical (water temperature, salinity and oxygen conditions, ocean currents) and a biological nature (i.e. food, predators). The objective of this study is to assess the importance of variability in environmental conditions within different western Baltic cod spawning grounds for egg survival. Habitat identification was based on environmental threshold levels for egg survival and development and ambient hydrographical conditions at different times during the spawning season. The long-term resolution of environmental conditions allowing survival of western Baltic cod eggs indicates that favourable conditions predominantly occurred during the late spawning season in April/May, while minimum survival rates could be expected from January to March. Unsuitable time periods and habitats exhibiting the highest mortality rates are exclusively characterized by ambient water temperatures below the critical survival threshold. Despite the strong influence of water temperature on habitat suitability, the impact of habitat suitability on recruitment was not clearly defined, suggesting that other mechanisms regulate year class strength.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Hüsey, K. (Intern), Hinrichsen, H. (Ekstern), Huwer, B. (Intern)
Pages: 1736-1743
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 69
Issue number: 10
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Spatial management of marine resources can enhance the recovery of predators and avoid local depletion of forage fish

The eastern Baltic cod stock has recently started to recover, after two decades of severe depletion, however with unexpected side effects. The stock has not re-occupied its former wide distribution range, but remains concentrated in a limited area in the southern Baltic Sea. The biomass of forage fish, i.e., sprat and herring, is historic low in this area, which in combination with increasing cod stock results in locally high predation mortality of forage fish and cannibalism of cod. In line with low prey availability, body weight and nutritional condition of cod drastically declined. In the southern Baltic Sea, cod competes with pelagic fisheries for the limited resources of sprat and herring, while the largest biomass of these species is currently found outside the distribution range of cod. Accounting for spatial overlap between species is crucial in developing ecosystem based fisheries management to enhance the recovery of predator stocks.
Spatio-temporal variability in western Baltic cod early life stage survival mediated by egg buoyancy, hydrography and hydrodynamics

Spatio-temporal variability in western Baltic cod early life stage survival mediated by egg buoyancy, hydrography and hydrodynamics. – ICES Journal of Marine Science, 69: 1744–1752. To disentangle the effects of different drivers on recruitment variability of marine fish, a spatially and temporally explicit understanding of both the spawning stock size and the early life stage dynamics is required. The objectives of this study are to assess the transport of western Baltic cod early life stages as well as the variability in environmentally-mediated survival along drift routes in relation to both spatial (within and between different spawning areas) and temporal (interannual and seasonal) dynamics. A spatially and temporally highly-resolved biophysical model of the Baltic Sea was used to describe mortalities and survival success of eggs and yolk-sac larvae—represented by individual, virtual drifters—as predicted proportions of drifters that either died due to bottom contact or lethal temperatures, or that survived up to the end of the yolk-sac larval stage. The environmental conditions allowing survival of cod and yolk-sac larvae indicate that favourable conditions predominately occurred during the late spawning season, while minimum survival rates could be expected from January to March. The spatial analysis of different spawning areas revealed highest survival chances in the Kattegat, intermediate survival in the Great Belt, and only low survival in the Sound, Kiel Bay and Mecklenburg Bay

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Hinrichsen, H. (Ekstern), Hüssy, K. (Intern), Huwer, B. (Intern)
Pages: 1744-1752
Publication date: 2012
Main Research Area: Technical/natural sciences

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Journal: ICES Journal of Marine Science
Volume: 69
Issue number: 10
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Web of Science (2011): Impact factor 2.007
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Impact factor 1.808
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes

Original language: English

DOIs:
10.1093/icesjms/fss137
Source: dtu
Source-ID: n:oai:DTIC-ART:highwire/371422978::20300
Suitability of otolith microchemistry for stock separation of Baltic cod

Microchemical otolith analyses have been shown to provide valuable information on the life history, dispersal and stock characteristics of teleost fish. In the present study, the suitability of this technique for identifying the origin and distribution of Atlantic cod Gadus morhua L. from the Baltic Sea was examined using laser ablation-ICPMS. The capacity to distinguish individuals from different Baltic Sea stocks and from the adjacent North Sea stock based on incoporation of stock-specific elemental fingerprints along otolith growth axes was investigated. It was further tested if different origins led to spawning-site specific element concentrations in otolith cores. The results indicate that microchemical analyses of Baltic cod otoliths are applicable for differentiating individuals of different stocks. Analyses of similarities including 12 element/calcium ratios resulted in significant differences between individuals from the eastern and the western Baltic Sea and between North Sea and Baltic Sea samples. Sr/Ca, Ba/Ca, Y/Ca, Mg/Ca, Zr/Ca and Mn/Ca ratios had the strongest discriminatory power. A further separation of individuals caught in 3 different spawning grounds of the eastern Baltic, however, was not possible. Elemental compositions from the core regions of otoliths from young of the year cod caught in eastern and western Baltic Sea spawning grounds showed significant differences in Sr/Ca, Ba/Ca and Mg/Ca concentrations. Analyses of similarities again showed significant differences between these areas for juveniles. This study demonstrates the potential of otolith microchemical analyses to provide important information about the stock structure and connectivity of G. morhua in the Baltic Sea.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Heidemann, F. (Ekstern), Marohn, L. (Ekstern), Hinrichsen, H. (Ekstern), Huwer, B. (Intern), Hüussy, K. (Intern), Klügel, A. (Ekstern), Böttcher, U. (Ekstern), Hanel, R. (Ekstern)
Pages: 217-226
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 465
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Impact factor 2.619
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Web of Science (2013): Impact factor 2.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
Web of Science (2012): Impact factor 2.546
The ecophysiology of Sprattus sprattus in the Baltic and North Seas

The European sprat (Sprattus sprattus) was a main target species of the German GLOBEC program that investigated the trophodynamic structure and function of the Baltic and North Seas under the influence of physical forcing. This review summarizes literature on the ecophysiology of sprat with an emphasis on describing how environmental factors influence the life-history strategy of this small pelagic fish. Ontogenetic changes in feeding and growth, and the impacts of abiotic and biotic factors on vital rates are discussed with particular emphasis on the role of temperature as a constraint to life-history scheduling of this species in the Baltic Sea. A combination of field and laboratory data suggests that optimal thermal windows for growth and survival change during early life and are wider for eggs (5–17°C) than in young (8- to 12-mm) early feeding larvae (5–12°C). As larvae become able to successfully capture larger prey, thermal windows expand to include warmer waters. For example, 12- to 16-mm larvae can grow well at 16°C and larger, transitional-larvae and early juveniles display the highest rates of feeding and growth at ∼18–22°C. Gaps in knowledge are identified including the need for additional laboratory studies on the physiology and behavior of larvae (studies that will be particularly critical for biophysical modeling activities) and research addressing the role of overwinter survival as a factor shaping phenology and setting limits on the productivity of this species in areas located at the northern limits of its latitudinal range (such as the Baltic Sea). Based on stage- and temperature-specific mortality and growth potential of early life stages, our analysis suggests that young-of-the-year sprat would benefit from inhabiting warmer, near-shore environments rather than the deeper-water spawning grounds such as the Bornholm Basin (central Baltic Sea). Utilization of warmer, nearshore waters (or a general increase in Baltic Sea temperatures) is expected to accelerate growth rates but also enhance the possibility for density-dependent regulation of recruitment (e.g., top-down control of zooplankton resources) acting during the late-larval and juvenile stages, particularly when sprat stocks are at high levels.

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Institute Management, University of Hamburg, Leibniz Institute of Marine Sciences
Authors: Peck, M. A. (Ekstern), Baumann, H. (Ekstern), Bernreuther, M. (Ekstern), Clemmesen, C. (Ekstern), Herrmann, J. (Ekstern), Hasløb, H. (Ekstern), Huwer, B. (Intern), Kanstinger, P. (Ekstern), Köster, F. W. (Intern), Peterelt, C. (Ekstern), Temming, A. (Ekstern), Voss, R. (Ekstern)
Pages: 42-57
Climate-driven long-term trends in Baltic Sea oxygen concentrations and the potential consequences for eastern Baltic cod (Gadus morhua)

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Huwer, B. (Intern), Makarchouk, A. (Ekstern), Petereit, C. (Ekstern), Schaber, M. (Ekstern), Voss, R. (Ekstern)
Pages: 2019-2028
Publication date: 2011
Main Research Area: Technical/natural sciences

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Journal: ICES Journal of Marine Science
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Egg mortality: predation and hydrography in the central Baltic

Cod and sprat are the dominant fish species in the Baltic pelagic ecosystem, both of great economic importance and ecologically strongly interlinked. Management of both species is challenged by highly variable recruitment success. Recent studies have identified predation and hydrographic conditions during the egg phase to be of critical importance. Two years of extensive field investigations in the Bornholm Basin, central Baltic Sea, were undertaken. In 2002, a typical stagnation situation characterized by low salinity and poor oxygen conditions was investigated, and in early 2003, a major inflow of North Sea water completely changed the hydrographic conditions by increasing salinity and oxygen content, thereby altering ecological conditions. The goal was to quantify egg mortality caused by predation and hydrography, and to compare these estimates with independent estimates based on cohort analysis. Results indicated high intra-annual variability in egg mortality. Cod and sprat egg mortality responded differently to the major Baltic inflow: mortality related to hydrographic conditions increased for sprat and decreased for cod. On the other hand, predation mortality during peak spawning decreased for sprat and increased for cod.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Voss, R. (Ekstern), Hinrichsen, H. (Ekstern), Stepputtis, D. (Ekstern), Bernreuther, M. (Ekstern), Huwer, B. (Intern), Neumann, V. (Intern), Schmidt, J. (Ekstern)
Pages: 1379-1390
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: I C E S Journal of Marine Science
Volume: 68
Issue number: 7
ISSN (Print): 1054-3139
Ratings:
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Original language: English

DOI: [10.1093/icesjms/fsr061](http://dx.doi.org/10.1093/icesjms/fsr061)

Source: orbit

Source-ID: 277535

Publication: Research - peer-review › Journal article – Annual report year: 2011
Scopus rating (2007): SJR 1.497 SNIP 1.263
Scopus rating (2006): SJR 1.612 SNIP 1.429
Scopus rating (2005): SJR 1.051 SNIP 1.521
Scopus rating (2004): SJR 0.993 SNIP 1.241
Scopus rating (2003): SJR 0.799 SNIP 0.846
Scopus rating (2002): SJR 2.04 SNIP 0.967
Scopus rating (2001): SJR 1.076 SNIP 0.861
Scopus rating (2000): SJR 0.745 SNIP 0.76

Original language: English
DOIs: 10.1007/s10530-011-9936-7
Source: orbit
Source-ID: 274099
Publication: Research - peer-review › Journal article – Annual report year: 2011

The impact of hydrodynamics and hydrography on western Baltic cod early life stage survival

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Hüsey, K. (Intern), Huwer, B. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Electronic versions:
L0211.pdf
Links:
http://www.ices.dk/products/CMdocs/CM-2011/L/L0211.pdf
Source: orbit
Source-ID: 286884
Publication: Research › Paper – Annual report year: 2011

The invasive ctenophore Mnemiopsis leidyi in the central Baltic Sea: seasonal phenology and hydrographic influence on spatio-temporal distribution patterns

In the Western Baltic, the invasive ctenophore Mnemiopsis leidyi was recorded for the first time in autumn 2006. An eastward propagation of the ctenophore into the central Baltic, and thus into important spawning grounds of major Baltic fish stocks, was observed in 2007. The focus of the present study was to investigate the seasonal phenology of this introduced species and whether it is able to form a self-sustaining population in this area. Therefore, the variability of temporal and spatial distribution of M. leidyi in the Bornholm Basin was analyzed over the first 4 years following the invasion and related to ambient hydrographic parameters. Results show a clear seasonal pattern. In contrast to the majority of other native and exotic habitats, the seasonal phenology showed highest abundances in spring and autumn months and only sporadic or even no appearance during summer. Vertical distribution was mostly confined to water layers below the permanent halocline and significantly influenced by ambient temperature. Our results indicate that there is no self-sustaining population of M. leidyi in the central Baltic Sea. Instead, the species is most likely re-introduced into the Bornholm Basin every year via lateral advection from source populations in the Western Baltic. These findings are important not only to further assess the potential impact of M. leidyi on the pelagic ecosystem of the central Baltic Sea, but also for a better understanding of the mechanisms of its invasion into other marine areas

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management, Section for Monitoring
Authors: Schaber, M. (Ekstern), Haslob, H. (Ekstern), Huwer, B. (Intern), Harjes, A. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern), Storr-Paulsen, M. (Intern), Schmidt, J. (Ekstern), Voss, R. (Ekstern)
Pages: 1053-1065
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 33
Issue number: 7
ISSN (Print): 0142-7873
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.22 SJR 1.163 SNIP 0.979
Web of Science (2017): Impact factor 1.897
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.92 SJR 1.123 SNIP 0.856
Web of Science (2016): Impact factor 1.983
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.029 SNIP 0.802 CiteScore 1.77
Web of Science (2015): Impact factor 2.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.098 SNIP 1.234 CiteScore 2.24
Web of Science (2014): Impact factor 2.407
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.292 SNIP 1.101 CiteScore 2.39
Web of Science (2013): Impact factor 2.263
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.594 SNIP 1.109 CiteScore 2.43
Web of Science (2012): Impact factor 2.435
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.171 SNIP 1.049 CiteScore 1.99
Web of Science (2011): Impact factor 2.079
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.205 SNIP 0.983
Web of Science (2010): Impact factor 1.749
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.935 SNIP 1.04
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.178 SNIP 1.009
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.324 SNIP 1.218
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.197 SNIP 1.129
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.099 SNIP 1.055
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.033 SNIP 1.086
Scopus rating (2003): SJR 1.318 SNIP 1.289
The recovery of cod in the Baltic Sea, a success against all odds

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Eero, M. (Intern), Huwer, B. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Electronic versions:
AIPCE CEP Baltic cod recovery
Publication: Research - peer-review › Journal article – Annual report year: 2011

Vertical distribution and growth performance of Baltic cod larvae - Field evidence for starvation-induced recruitment regulation during the larval stage?

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management
Authors: Huwer, B. (Intern), Clemmesen, C. (Ekstern), Grønkjær, P. (Ekstern), Köster, F. (Intern)
Pages: 382-396
Publication date: 2011
Main Research Area: Technical/natural sciences
Publication information
Journal: Progress in Oceanography
Volume: 91
ISSN (Print): 0079-6611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.07 SJR 2.192 SNIP 1.547
Web of Science (2017): Impact factor 4.27
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.4 SJR 1.944 SNIP 1.287
Web of Science (2016): Impact factor 3.391
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.705 SNIP 1.367 CiteScore 3.34
Survival probability of larval sprat in response to decadal changes in diel vertical migration behavior and prey abundance in the Baltic Sea

We employed a coupled three-dimensional biophysical model to explore long-term inter- and intra-annual variability in the survival of sprat larvae in the Bornholm Basin, a major sprat spawning area in the Baltic Sea. Model scenarios incorporated observed decadal changes in larval diel vertical distribution and climate-driven abiotic and biotic environmental factors including variability in the abundance of different, key prey species (calanoid copepods) as well as
seasonal changes, long-term trends, and spatial differences in water temperature. Climate forcing affected Baltic sprat larval survival both directly (via changes in temperature) and indirectly (via changes in prey populations). By incorporating observed changes in larval diel vertical migration, decadal changes in modeled and observed survival of Baltic sprat agreed well. Higher larval survival (spawning stock biomass) was predicted in the 1990s compared to the 1980s. After changing their foraging strategy by shifting from mid-depth, low prey environment to near-surface waters, first-feeding larvae encountered much higher rates of prey encounter and almost optimal feeding conditions and had a much higher growth potential. Consequently, larvae were predicted to experience optimal conditions to ensure higher survival throughout the later larval and early juvenile stages. However, this behavioral shift also increased the susceptibility of larvae to unfavorable wind-driven surface currents, contributing to the marked increase in interannual variability in recruitment observed during the past decade.
Variability of larval Baltic sprat (Sprattus sprattus L.) otolith growth: a modeling approach combining spatially and temporally resolved biotic and abiotic environmental key variables

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Voss, R. (Ekstern), Huwer, B. (Intern), Clemmesen, C. (Ekstern)
Pages: 463-479
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 19
Issue number: 6
ISSN (Print): 1054-6006
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.86
Web of Science (2017): Impact factor 1.794
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Climate driven long-term evolution of oxygen concentration in the Baltic Sea: potential consequences for the Baltic cod stock

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Huwer, B. (Intern), Makarchouk, A. (Ekstern), Neuenfeldt, S. (Intern), Petereit, C. (Ekstern), Schaber, M. (Ekstern), Voss, R. (Ekstern)
Pages: 1-15
Publication date: 2009
Den invasive Mnemiopsis-ribbegople i østersøtorskens gydeområde

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Storr-Paulsen, M. (Intern), Huwer, B. (Intern), Warnar, T. (Intern), Bøttiger, L. (Ekstern), Madsen, C. V. (Ekstern)
Pages: 14-24
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Issue number: 62
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 242886
Publication: Research › Journal article – Annual report year: 2009

The recruitment process in Baltic cod: Spatio-temporal variation in starvation and predation during early life stages with special consideration of the invasive ctenophore Mnemiopsis leidyi

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Huwer, B. (Intern)
Publication date: 2009

Publication information
Place of publication: Aarhus and Kgs. Lyngby, Denmark
Publisher: Aarhus University, Department of Biological Sciences and: Technical University of Denmark (DTU), National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
PhD_Bastian Huwer_2009_The recruitment process in Baltic cod_WITH_COVER.pdf
Source: orbit
Source-ID: 253811
Publication: Research › Ph.D. thesis – Annual report year: 2009

Udbredelse af den invasive ribbegople Mnemiopsis leidyi i Bornholmerdybet og mulige konsekvenser for kommercielt vigtige fiskebestande

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Monitoring
Abundance, horizontal and vertical distribution of the invasive ctenophore Mnemiopsis leidyi in the central Baltic Sea, November 2007

The distribution and abundance of the invasive ctenophore Mnemiopsis leidyi in the Bornholm Basin, an important spawning ground of several fish stocks, and in adjacent areas in the central Baltic Sea was studied in November 2007. The study showed that M. leidyi were relatively small (body length 18.6 ± 7.6 mm) and they were patchily distributed over a large part of the investigated area. Specimens were found on 68 and 59% of stations sampled with a Bongo net (n=39) and an Isaac-Kidd midwater trawl (n=51), respectively. Vertically, the highest densities of M. leidyi occurred at 40 to 60 m around the halocline. Horizontally, the highest abundances were found north and west of Bornholm, but relatively high densities were also observed in the Slupsk Furrow. The mean abundance was 1.58 ± 2.12 ind. m^-2, the peak abundance was 8.92 ind. m^-2, and the average and peak population density were 0.03 ± 0.05 and 0.28 ind. m^-3, respectively. The abundances are low compared to densities recently observed in other areas of the Baltic region (e.g. Limfjorden, Åland Sea) and the estimated predation impact on zooplankton by M. leidyi was negligible in November 2007. However, because of the ctenophore’s wide distribution in the central Baltic Sea, its ability for rapid population growth, and its potential influence on fish stocks by competing for food and by preying on fish eggs and newly hatched larvae, close monitoring of the future development of M. leidyi in the Baltic Sea is strongly recommended.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice, University of Southern Denmark, Leibniz Institute of Marine Sciences
Authors: Huwer, B. (Intern), Storr-Paulsen, M. (Intern), Riisgaard, H. U. (Ekstern), Haslob, H. (Ekstern)
Pages: 113-124
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Aquatic Invasions
Volume: 3
Issue number: 2
ISSN (Print): 1818-5487
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.392 SJR 1.115 CiteScore 2.94
Web of Science (2017): Impact factor 1.976
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.065 SNIP 1.314 CiteScore 2.45
Web of Science (2016): Impact factor 2.069
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.929 SNIP 1.262 CiteScore 1.93
Web of Science (2015): Impact factor 1.955
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.659 SNIP 1.165 CiteScore 1.39
Web of Science (2014): Impact factor 1.613
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.673 SNIP 0.82 CiteScore 1.18
Changes in distribution and lengths of *Mnemiopsis leidyi* in the central Baltic Sea between fall and spring

In March 2008, we conducted a survey to investigate the distribution and abundance of the invasive ctenophore *Mnemiopsis leidyi* in the Bornholm Basin after the winter period. Compared to the situation in November 2007 the centre of the distribution had shifted towards the deeper parts of the Basin where temperatures were higher than at the surface. Furthermore, we found a decrease in average size from 18.6 mm ± 7.6 SD in November to an average of 10.5 mm ± 4.9 SD in March, which may indicate the emergence of a new generation of *M. leidyi* between the two sampling dates.

**General information**

State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Storr-Paulsen, M. (Intern), Huwer, B. (Intern)
Pages: 429-434
Publication date: 2008
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Aquatic Invasions
Volume: 3
Issue number: 4
ISSN (Print): 1818-5487
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.392 SJR 1.115 CiteScore 2.94
Web of Science (2017): Impact factor 1.976
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.065 SNIP 1.314 CiteScore 2.45
Web of Science (2016): Impact factor 2.069
Marine protected areas as a fisheries management tool for eastern Baltic cod: coupling of observational data with hydrodynamic model simulations

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Huwer, B. (Intern), Schaber, M. (Ekstern), Kraus, G. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 234016
Publication: Research - peer-review › Journal article – Annual report year: 2008

Vertical distribution and nutritional condition of Baltic cod larvae - revisited

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management
Growth, drift and survival probability of Baltic cod early life stages in relation to environmental conditions: Progress report

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Huwer, B. (Intern)
Number of pages: 45
Publication date: 2007

Publication information
Place of publication: [s.l.]
Publisher: Department of Marine Ecology, University of Aarhus and Danmarks Tekniske Universitet, Danmarks Fiskeriundersøgelser
Original language: English
Main Research Area: Technical/natural sciences

Bibliographical note
This progress report describes studies and preliminary results from the first part of the Ph.d. thesis entitled: Growth, drift and survival probability of Baltic cod early life stages in relation to environmental conditions
Source: orbit
Source-ID: 225836
Publication: Research › Report – Annual report year: 2007

Marine protected areas as a fisheries management tool in the central Baltic: An evaluation by coupling otolith microstructure analysis to a hydrodynamic model

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Huwer, B. (Intern)
Pages: 12-15
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: EUR-OCEANS Newsletter
Volume: 8
Original language: English
Links:
Source: orbit
Source-ID: 225837
Publication: Research › Journal article – Annual report year: 2007

Variability in growth rates of larval fish at frontal stations in the southern North Sea: is the "mean" all that matters?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Peck, M. (Ekstern), Kühn, W. (Ekstern), Clemmesen, C. (Ekstern), Hinrichsen, H. (Ekstern), Holtappels, M. (Ekstern), Huwer, B. (Intern), Pohlmann, T. (Ekstern)
Pages: 70-71
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Growth, drift and survival probability of cod early life stages in relation to environmental conditions

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management
Authors: Huwer, B. (Intern), Hinrichsen, H. (Ekstern), Köster, F. (Intern)
Publication date: 2006
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277537
Publication: Research › Poster – Annual report year: 2006

What has a surviving sprat (Sprattus sprattus) larva in the Baltic Sea experienced?

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Huwer, B. (Intern), Clemmesen, C. (Ekstern), Hinrichsen, H. (Ekstern), Voss, R. (Ekstern)
Publication date: 2005
Event: Abstract from 29th Annual Larval Fish Conference, Barcelona, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279281
Publication: Research › Conference abstract for conference – Annual report year: 2005

Distribution and growth of sprat (Sprattus sprattus) and sardine (Sardina pilchardus) larvae co-occurring at frontal systems in the German Bight

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Huwer, B. (Intern), Holtappels, M. (Ekstern), Clemmesen, C. (Ekstern), Mohrholz, V. (Ekstern)
Publication date: 2004
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277538
Publication: Research › Poster – Annual report year: 2004

Storm impact on clupeid larvae, their condition and their planktonic prey

General information
State: Published
Organisations: Unknown
Authors: Alheit, J. (Ekstern), Clemmesen, C. (Ekstern), Dickmann, M. (Ekstern), Drossou, A. (Ekstern), Hinrichs, R. (Ekstern), Holtappels, M. (Ekstern), Huwer, B. (Intern), Mohrholz, V. (Ekstern), Schilling, M. (Ekstern)
Projects:

**BONUS BIO-C3 Cruise (39117-DCH)**

The multidisciplinary research cruise (16-30 September 2015) was aiming to investigate the distribution, abundance, biomass, production, nutritional condition and genetic diversity of several, trophically interlinked Baltic key species, ranging from zo-, and ichthyoplankton over gelatinous organisms to adult fish, including non-indigenous species. The collected samples and data are used in the BONUS project Biodiversity changes—causes, consequences and management implications (BIO-C3), aiming to significantly advance our knowledge base towards the importance and management of the Baltic Sea biodiversity in an ecosystem perspective.

Using the contrasting environments of the Arkona, Bornholm, Gdansk and Gotland Basin, the major scientific goals of the cruise have been to resolve:

- Physiological preferences and tolerances of key meso-zooplankton species (*Pseudocalanus acuspes, Temora longicornis, Centropages hamatus* and *Acartia spp*), through controlled experiments on board with specimens caught in different areas of the central Baltic in contrasting environments, including a verification of species based on genetics,
- Abundance, distribution, nutritional condition and phenology of key zooplankton (see above) and their life stages as well as gelatinous plankton species (*Aurelia aurita, Cyanea capillata, Mertensia ovum, Mnemiopsis leidyi*) in different areas of the central Baltic, through net-sampling and deploying hydroacoustics and optics, as well as biochemical analyses,
- Individual condition, abundance and distribution of spawning herring and cod based on trawl sampling and hydroacoustics including biochemical investigations on the quality of spawning products,
- Abundance and survival of herring and cod ichthyoplankton, through net-sampling based stage specific production estimates, including age determination, nutritional condition and growth in relation to abundance, phenology and composition of zooplankton prey,
- Predation pressure on copepods and fish early life stages by herring and sprat as well as gelatinous plankton (see above) through resolving the spatial overlap between predator and prey at relevant scales as well as diet composition analyses,
- Distribution (vertical and horizontal) of sprat and herring through trawl sampling and hydroacoustics in relation to hydrography, zooplankton prey and predator (cod) abundance, with specific focus on growth, condition and survival of young of the year sprat in different areas of the central Baltic.

This project was coordinated by DTU Aqua. The project was funded by Danish Center for Marine Research.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Arctic Section
GEOMAR - Helmholtz Centre for Ocean Research Kiel
National Marine Fisheries Research Institute
University of Hamburg
Leibniz Institute for Baltic Sea Research Warnemünde (IOW)
Thünen Institute of Baltic Sea Fisheries
University of Tartu
Period: 16/09/2015 → 30/09/2015
Number of participants: 6
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology
Project participant:
Lundgren, Bo (Intern)
Project: Biodiversity changes - causes, consequences and management implications (BIO-C3) (39117)

BIO-C3 will investigate the dynamics of biodiversity in the Baltic Sea, their causes and the consequences for the function of food webs, including implications for biodiversity management policies.

Baltic biodiversity is historically dynamic responding to various drivers operating at different time and space scales. Species diversity is generally low and contains many recent immigrants and glacial relict species because of low salinity and relatively young age. Nevertheless, Baltic food webs sustain many goods and services valued by society.

We focus on functional consequences of ongoing and projected distributional and compositional changes of benthic and pelagic communities with a focus on invasive and resident key species. Using spatial and temporal projections of abiotic/biotic drivers including their interaction (climate change, eutrophication, species invasions, fisheries), we will assess how biodiversity (e.g., of species, traits, habitats) responds in time, space and along gradients of human impact and hydrography. We will investigate the potential and genetic basis for colonisation, acclimation and adaptation of species and populations to the Baltic Sea, and how compositional and adaptive changes of Baltic biodiversity affect ecosystem functions with an emphasis on trophic linkage and food web dynamics.

Results will feed into impact assessments that guide management policies including improved operationalization of status indicators, and guidelines for MPAs.

The project is coordinated by Helmholtz Centre for Ocean Research, Kiel (GEOMAR). DTU Aqua is co-coordinator.

The project is funded equally by EU, BONUS (Science for a Better Future of the Baltic Sea Region), ERA-NET.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
GEOMAR - Helmholtz Centre for Ocean Research Kiel
University of Hamburg
Stockholm University
National Marine Fisheries Research Institute
University of Tartu
Finnish Environment Institute
Klaipeda University
DHI Denmark
University of Gothenburg
Johann Heinrich von Thünen-Institute
Swedish Meteorological and Hydrological Institute
Åbo Akademi University

Period: 01/03/2014 → 28/02/2018
Number of participants: 10
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology & Population Genetics & Ecosystem based Marine Management
Project participant:
Tomkiewicz, Jonna (Intern)
MacKenzie, Brian (Intern)
Eero, Margit (Intern)
Bekkevold, Dorte (Intern)
Dutz, Jörg (Intern)
Behrens, Jane (Intern)
Huwer, Bastian (Intern)
Project Manager, organisational:
Neuenfeldt, Stefan (Intern)
Project Manager, academic:
Jaspers, Cornelia (Intern)
Project Coordinator:
Köster, Fritz (Intern)

Optimal sustainable use of cod stocks accessible for Danish fisheries (DEL-TORSK) (39147)

Optimal sustainable utilization of cod stocks that contain several biological sub-populations requires taking population structure into account in stock assessment and management. The aim of this project was to develop scientific basis for cod management decisions in the North Sea and the Baltic that takes biological units of cod and their dynamics into account.

Methodological challenges concerning advising on stocks that contain sub-populations with differences in dynamics and biological parameters are common for North Sea and the Baltic. Therefore, the project considered both seas, in terms of developing methodological basis for addressing population structure in management advice. The results were presented at ICES benchmarks for North Sea and Baltic Sea cod in 2015, and used to developing further the management basis for optimal use of cod stocks.

The project included mapping of distribution of sub-populations using genetic analyses and modelling of transport of early life stages. These results were combined with existing knowledge on cod population structure both in the Baltic and North Sea, to identify distribution areas of sub populations. This information was then incorporated in area-specific stock assessment analyses.

This project was coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 17/07/2013 → 30/04/2015
Number of participants: 8
Research areas: Ecosystem based Marine Management & Marine Populations and Ecosystem Dynamics & Population Genetics & Fish Biology & Marine Living Resources & Fisheries Management
Project participant:
Hansen, Jakob Hemmer (Intern)
Mariani, Patrizio (Intern)
Berg, Casper Willestofte (Intern)
Hüssy, Karin (Intern)
Huwer, Bastian (Intern)
Nielsen, Anders (Intern)
Eg Nielsen, Einar (Intern)
Project Coordinator:
Eero, Margit (Intern)

Study on stomach content of fish to support the assessment of good environmental status of marine food webs and the prediction of MSY after stock restoration (Open call for tenders No MARE/2012/02) (39036)

In support of policies for sustainable management strategies of living marine resources, demands for integrated ecosystem advice are growing and more extensive use of long-term management plans, which are consistent with the ecosystem approach to fisheries management, is anticipated. However, long-term management plan evaluations of fish are particularly sensitive to changes in the proportion of fish removed by natural predators (natural mortality). A prerequisite for estimating this correctly is accurate knowledge of species interactions: Who is eating whom when, where and in which quantity?
Existing stomach content data are currently used in multispecies models using historic stomach content data from before 1995. Since this period, there have been considerable changes in the predator and prey stocks of both the Baltic and the North Sea. Thus, updated information on stomach contents of the essential predators in these two areas is urgently needed.

In order to update and improve the quality and quantity of the available back ground data for the above mentioned multispecies models and management plans, the aim of this project is to
- conduct new stomach content analyses of Baltic cod to support our knowledge of the spatial and temporal stability of cod preferences
- conduct new stomach content analyses of Baltic whiting as well as grey gurnard, mackerel and hake collected in the North Sea to support our knowledge of potentially important predators for which the diet is presently poorly known or is expected to have changed significantly since the last sampling efforts
- compile historical data, which are existing in several institutes around the Baltic and North Sea, and convert them from paper or outdated electronic format into the necessary standard format
- incorporate the new as well as all appropriate historical stomach content information into the Baltic and North Sea stomach content databases

The end product will be updated stomach content databases for the Baltic and North Sea, which include all available information up to 2013. In the Baltic, the project will increase the number of stomachs available for modeling by more than 170%. In the North Sea, the project will increase the number of years where data are available for grey gurnard from 2 to 8, for mackerel from 2 to 6 and for hake from 0 to 1, hence substantially increasing the confidence in the temporal stability of the modeling results.

The databases will be made freely available to the scientific community and will form the basis for new estimates of natural mortality and improved long-term management plans in the Baltic and North Sea.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Johann Heinrich von Thünen-Institute
National Marine Fisheries Research Institute
Lund University
Institute of Food Safety Animal Health and Environment BIOR
University of Hamburg
Wageningen IMARES
Cefas Weymouth Laboratory
Period: 27/11/2012 → 27/11/2014
Number of participants: 7
Research area: Marine Populations and Ecosystem Dynamics
Project participant:
Andreasen, Heidi (Intern)
Neuenfeldt, Stefan (Intern)
Rindorf, Anna (Intern)
Storr-Paulsen, Marie (Intern)
Andersen, Niels Gerne (Intern)
Project Manager, organisational: Haslund, Ole Henrik (Intern)
Project Coordinator: Huwer, Bastian (Intern)
Project

Eastern-western Baltic cod: Improved management based on stock discrimination of eastern and western Baltic cod (Øst-Vesttorsk) (38989)

The aim of this project was to improve the management of western Baltic cod by incorporating stock identification routines in order to discriminate between eastern and western Baltic cod stocks. In recent years evidence from fishery patterns and otolith structures have indicated an increasing degree of mixing between the two cod stocks which up until 2013 were managed as two separate stocks. Changes in fishing pressure and patterns would therefore result in a risk for local depletion of the smaller western stock.
Stock identification methods were based on established approaches using genetic discrimination and otolith shape analysis, and improved by linking these methods. This method provides a tool to estimate the degree of stock mixing using the existing otolith archives. This approach documented an increase of eastern Baltic cod from 30% to > 80% in the eastern part of the western Baltic Sea management area. As a consequence of this stock mixing, a new procedure incorporating stock mixing on an annual basis was set in place in, with the aim to improve stock exploitation and reduce the risk of local depletion. The knowledge gained also influenced recent management regulations, particularly a prolongation of spawning closer of the fishery in 2016.

The project was coordinated by Centre for Environment, Fisheries & Aquaculture Science, UK. The project was funded by the Danish Ministy of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Cefas Weymouth Laboratory
Period: 27/06/2011 → 29/03/2013
Number of participants: 18
Research areas: Marine Populations and Ecosystem Dynamics & Marine Living Resources & Population Genetics & Fisheries Management
Project participant:
Hansen, Jakob Hemmer (Intern)
Huwer, Bastian (Intern)
Bastardie, Francois (Intern)
Eero, Margit (Intern)
Nielsen, J. Rasmus (Intern)
Worsøe Clausen, Lotte (Intern)
Mosegaard, Henrik (Intern)
Storr-Paulsen, Marie (Intern)
Olesen, Hans Jakob (Intern)
Kirkegaard, Eskild (Intern)
Larsen, Peter Vingaard (Intern)
Hansen, Frank Ivan (Intern)
Lundgaard, Louise Scherffenberg (Intern)
Willandsen, Maj-Britt (Intern)
de Jong, Noortje (Intern)
Mensberg, Karen-Lise Dons (Intern)
Meldrup, Dorte (Intern)
Project Coordinator:
Hüssy, Karin (Intern)

Vectors of change (VECTORS) (38907)
Marine life makes a substantial contribution to the economy and society of Europe. VECTORS aimed at elucidating the drivers, pressures and vectors that cause change in marine life, the mechanisms by which they do so, the impacts that they have on ecosystem structures and functioning, and on the economics of associated marine sectors and society. VECTORS particularly focused on causes and consequences of invasive alien species, outbreak forming species, and changes in fish distribution and productivity. New and existing knowledge and insight was synthesized and integrated to project changes in marine life, ecosystems and economies under future scenarios for adaptation and mitigation in the light of new technologies, fishing strategies and policy needs. VECTORS also evaluated current forms and mechanisms of marine governance in relation to the vectors of change. Based on its findings, VECTORS outlined solutions and tools for relevant stakeholders and policymakers during the lifetime of the project. The VECTORS consortium included a mixture of natural scientists with knowledge of socio-economic aspects, and social scientists (environmental economists, policy and governance analysts and environmental law specialists) with interests in natural system functioning.

DTU Aqua contributed to VECTORS by developing new statistical models of fish species distributions, by further developing spatially resolved bio-economic models of fishing, and by analyzing fish species richness and distribution in the north Atlantic and the general relationship between changes in fish stock abundance and distribution area. We coordinated the Baltic WP where we implemented the ATLANTIS end-to-end model and performed initial scenario testing. We also analyzed the most important drivers of fish population dynamics in the Baltic, and contributed to the study of
invasive species.

VECTORS comprised a total of 37 European Universities, research institutions and professional associations dealing with applied maritime and marine research.

The project included marine environmental scientists, fisheries scientists, conservation biologists, sociologists and economists from across the European scientific community providing expertise in marine ecosystems, management, fisheries, maritime transport, tourism and coastal development.

The project was coordinated by Plymouth Marine Laboratory, UK.

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 01/01/2011 → 31/01/2015
Number of participants: 9
Research areas: Ecosystem based Marine Management & Fisheries Management & Marine Living Resources

Contact person:
Köster, Fritz (Intern)
Project participant:
Nielsen, J. Rasmus (Intern)
Lewy, Peter (Intern)
Rindorf, Anna (Intern)
Bastardie, Francois (Intern)
Kristensen, Kasper (Intern)
Huwer, Bastian (Intern)
Project Manager, academic:
Gislason, Henrik (Intern)
Eero, Margit (Intern)

Fehmarn Belt science provision project: Fehmarn Belt fish and fisheries and related environmental investigations (38669)
Objectives and Background
The purpose of the project was to investigate main exploited fish stock and fisheries dynamics in relation to the marine environment with focus on the Fehmarn Belt area in the Western Baltic Sea, and to provide science and research based investigations and results, as well as reports and scientific peer reviewed journal papers on this. The work was associated to the scientific baseline investigations (2009-13) and impact assessment of the projection of the Fehmarn Belt Fixed Link between Denmark and Germany involving a science cooperation between DTU Aqua, Thünen-Institute and Femern Belt A/S in order to generate knowledge on potential impacts of establishment of the fixed link. Focus was on the most important commercial fisheries and fish stocks in the area (cod, herring, and sprat, but also flatfish and eels).

Tasks and Deliverables
The work covered WP0: Prospecting, planning and development of the investigations, producing outline and main contents of the science provision contract and coordination of tasks hereunder with DTU Aqua as inter-national project coordinator; WP1: Review of state-of-the-art knowledge of fish stocks and fisheries dynamics; WP2: Extension of existing, standard research surveys and linking to standard survey time series to detect potential effects on important fish stocks; WP3: Evaluation of potential integrated effects on important fish stocks and fisheries; WP4: Evaluation of potential effects of change and variability in hydrographic and environmental features and conditions on recruitment for important fish stocks (cod, herring, sprat); WP5: Evaluation of occurrences and migrations as well as separation of spring and autumn spawning herring stock components in the area.

WP1 included provision of state of the art knowledge from historical surveys and review of quality of survey indices, commercial fisheries data, and information on recruitment dynamics with emphasis on fluctuations in distribution and productivity with respect to environmental and anthropogenic drivers of change including species interactions and fisheries.

WP2 included extension of existing standard surveys in the near field area and analyses of selected historical data on fish stock and fisheries dynamics; WP3: Evaluation of potential effects of change and variability in hydrographic and environmental features and conditions on recruitment for important fish stocks (cod, herring, sprat); WP4: Evaluation of potential effects of change and variability in hydrographic and environmental features and conditions on recruitment for important fish stocks (cod, herring, sprat); WP5: Evaluation of occurrences and migrations as well as separation of spring and autumn spawning herring stock components in the area.

WP1 included provision of state of the art knowledge from historical surveys and review of quality of survey indices, commercial fisheries data, and information on recruitment dynamics with emphasis on fluctuations in distribution and productivity with respect to environmental and anthropogenic drivers of change including species interactions and fisheries.

WP 3 analyzed stock and fisheries dynamics by use of advanced scientific survey evaluation models and methods for development and extending time series with respect to variability in distribution, density and abundance patterns of relevant stocks, as well as developing advanced scientific survey evaluation models and methods for determining this.

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WP Sevaluated herring stock occurrence and migration patterns in the Baltic areas by use of genetic identity markers, otolith micro-structures and information from fisheries and research surveys in order to evaluate impact of the fixed link. The project has besides a long row of project reports produced around 30 scientific peer reviewed journal papers where DTU Aqua are first author on more than half and co-author on more than 20 of the papers. The project was coordinated by DTU Aqua. The project was funded by the 3 partners with external Funding from Femern Bælt A/S.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Johann Heinrich von Thünen-Institute

Femern A/S
Period: 01/01/2009 → 31/12/2013
Number of participants: 15
Research areas: Fisheries Management & Fish Biology & Marine Living Resources & Population Genetics

Project participant:
Worsøe Clausen, Lotte (Intern)
Bastardie, Francois (Intern)
Bekkevold, Dorte (Intern)
Huwer, Bastian (Intern)
Hüssy, Karin (Intern)
Storr-Paulsen, Marie (Intern)
Stæhr, Karl-Johan (Intern)
Sparrevohn, Claus Reedtz (Intern)
Jepsen, Niels (Intern)
Lewy, Peter (Intern)
Kristensen, Kasper (Intern)
Dutz, Jörg (Intern)
Christensen, Asbjørn (Intern)
Geitner, Kerstin (Intern)

Project Coordinator:
Nielsen, J. Rasmus (Intern)

Resolving climatic impacts on fish stocks (RECLAIM) (38109)

Climate change will impact fisheries resources and challenge managers to develop sustainable exploitation strategies. Knowledge on the impacts of climate on fisheries resources is still fragmentary.

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

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

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

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

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

Using a variety of approaches, RECLAIM will both hind cast as well as forecast the effects of climate change on the productivity and distribution of fish and shellfish stocks to formulate hypotheses and research needs to be addressed in future EU research.
The project is coordinated by IMARES, The Netherlands, and has nine partners from the EU.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Period: 01/01/2007 → 31/12/2009
Number of participants: 12
Research area: Marine Populations and Ecosystem Dynamics
Contact person:
Christensen, Asbjørn (Intern)
Project participant:
Neuenfeldt, Stefan (Intern)
MacKenzie, Brian (Intern)
Andersen, Ken Haste (Intern)
Huwer, Bastian (Intern)
Payne, Mark (Intern)
Brander, Keith (Intern)
Gürkan, Zeren (Intern)
Mosegaard, Henrik (Intern)
Geitner, Kerstin (Intern)
Jensen, Henrik (Ekstern)
Project Manager, academic:
Köster, Fritz (Intern)

Understanding the mechanisms of stock recovery (UNCOVER) (38104)
The UNCOVER project has produced a rational scientific basis for developing Long-Term Management Plans (LTMP) and recovery strategies for 11 of the ecologically and socioeconomically most important fish stocks/fisheries in the Norwegian and Barents Seas, the North Sea, the Baltic Sea and the Bay of Biscay and Iberian Peninsula.

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

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

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

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

National Institute of Aquatic Resources
Section for Marine Living Resources
Federal Research Centre for Fisheries
Marine Research Unit, Marine and Food Technological Centre
Cefas Weymouth Laboratory
University of Portsmouth
Marine Laboratory
Instituto Español de Oceanografía
Aalborg University
Christian-Albrechts-Universität zu Kiel
IFREMER
Institute of Marine Research
Sea Fisheries Institute
Nikolai M. Knipovich Polar Research Institute of Marine Fisheries and Oceanography
Nederlands Instituut voor Visserij Onderzoek b.v.
University of Aberdeen
University of Bergen
University of Hamburg
Period: 01/01/2006 → 31/12/2010
Number of participants: 14
Research areas: Marine Living Resources & Fish Biology
Contact person:
Köster, Fritz (Intern)
Project participant:
Tomkiewicz, Jonna (Intern)
Vinther, Morten (Intern)
Payne, Mark (Intern)
Munk, Peter (Intern)
Støttrup, Josianne Gatt (Intern)
Storr-Paulsen, Marie (Intern)
Eg Nielsen, Einar (Intern)
Brander, Keith (Intern)
Andersen, Ken Haste (Intern)
Huwer, Bastian (Intern)
Bastardie, Francois (Intern)
Project Manager, academic:
Neuenfeldt, Stefan (Intern)
MacKenzie, Brian (Intern)

Activities:

**ICES - International Bottom Trawl Survey Working Group - IBTSWG (External organisation)**
Period: 2015
Bastian Huwer (Participant)

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation

**ICES - International Bottom Trawl Survey Working Group - IBTSWG**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
ICES - International Bottom Trawl Survey Working Group - IBTSWG (External organisation)
Period: 2014
Bastian Huwer (Participant)
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation
ICES - International Bottom Trawl Survey Working Group - IBTSWG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on the identification of clupeoid larvae - WKIDCLUP (External organisation)
Period: 2014
Bastian Huwer (Participant)
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation
ICES - Workshop on the identification of clupeoid larvae - WKIDCLUP
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Baltic International Fish Survey Working Group - WGBIFS (External organisation)
Period: 2012 → …
Bastian Huwer (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Baltic International Fish Survey Working Group - WGBIFS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Study Group on Standards in Ichthyoplankton Surveys - SGSIPS (External organisation)
Period: 2012 → …
Bastian Huwer (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Study Group on Standards in Ichthyoplankton Surveys - SGSIPS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar