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
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Institute Management, Section for Monitoring and Data
Authors: Eero, M. (Intern), Hinrichsen, H. H. (Ekstern), Huwer, B. (Intern), Köster, F. (Intern), Mosegaard, H. (Intern), Storr-Paulsen, M. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2017

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

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, GEOMAR - Helmholtz Centre for Ocean Research
Fish egg predation by Baltic sprat and herring: do species characteristics and development stage matter?
Predation of eggs by clupeids has been identified as a major factor contributing to early life stage mortality of Baltic cod. We used data from ichthyoplankton sampling and clupeid stomach analyses to investigate whether eggs of other fish species are to a similar extent subject to predation, and how predation pressure differs between egg development stages. Cod, sprat and rockling eggs dominated in the ichthyoplankton fraction in herring and sprat diet, whereas flounder and dab eggs occurred only occasionally. In spring, cod eggs at advanced development stages were positively and sprat eggs generally negatively selected by both predators, while fish eggs were non-selectively consumed in summer. Predation is suggested to account for a large fraction of mortality of cod eggs at older stages, i.e. those eggs, which have survived the often detrimentally low oxygen concentration in and below the permanent halocline. The consumption rates of sprat eggs at all development stages relative to production rates were considerably lower compared to cod, suggesting that egg predation is of lesser importance for sprat recruitment.

General information
State: Accepted/In press
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic, Institute Management, Section for Ecosystem based Marine Management
Authors: Neumann, V. (Intern), Köster, F. (Intern), Eero, M. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Quantifying predation on Baltic cod early life stages

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

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

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

Trophic Interactions in the Baltic Sea: Predation on cod eggs by clupeids
Cod (Gadus morhua), sprat (Sprattus sprattus) and herring (Clupea harengus) are key species of the upper trophic levels in the Baltic Sea ecosystem and are strongly interlinked: The piscivore cod is the main predator on the planktovores sprat and herring, which feed, amongst others, on cod eggs. Egg predation by sprat and herring has earlier been suggested as one of the factors limiting cod recruitment success in the Baltic Sea in the 1990s. Since then, changes have taken place in cod recruitment as well as in the ecological factors potentially influencing egg predation. The overall aim of this thesis is to elucidate possible changes in predation pressure on cod early life stages in the 2000s compared to the 1990s, as well as to enhance our understanding of the processes impacting on egg predation and its implications for cod recruitment. The investigations of this thesis are based on extensive datasets on stomach contents of sprat and herring, ambient hydrographic conditions, ichthyoplankton distribution and abundance as well as predator-prey overlap as well as abundance of alternative prey (Paper I). Next, cod egg consumption by herring and sprat was quantified and compared with revised estimates from the 1990s to elucidate potential changes in predation mortality of cod eggs (Paper II). A major methodological focus in this investigation was related to resolving the spatial distribution of sprat and herring to obtain realistic estimates of predator abundances in the area overlapping with cod eggs. As a next step, predation pressure was quantified separately for egg development stages, both for cod and sprat (Paper III). Furthermore, ichthyoplankton prey selection by clupeids was investigated, with specific focus of predation on different fish egg species and development stages, to improve our understanding of the mechanisms underlying egg predation. Finally, the results on predation pressure on cod eggs were reviewed in the context of other processes acting on early life stage survival and influencing cod recruitment in the Baltic Sea (Paper IV). The results showed that diet composition of both sprat and herring groups was generally similar in the 1990s and 2000s. Although higher proportions of cod eggs occurred in the diet in the 2000s, the overall quantities of cod eggs in the diet were generally lower in the 2000s compared to the 1990s (Paper I). This suggests reduced predation on cod eggs in latter period, which was further confirmed in quantitative analyses of predation mortality on cod eggs (Paper II). The lower predation pressure on cod eggs in the 2000s compared to the 1990s was related to a combination of reduced predator abundance and lower daily rations by individual predators. Reduced predation pressure was identified as one of the factors contributing to relatively higher year-classes of cod recruitment in the 2000s (Paper IV). Predation was found to affect mainly eggs at older development stages (mainly stage III), i.e. those eggs which have survived two out of three critical development phases in the often detrimental hydrographic conditions in and below the permanent halocline (Paper III). This suggests a higher impact of predation on cod recruitment than...
formerly thought. In contrast, investigations on sprat egg mortality (Paper III) found that consumption rates of sprat eggs at all development stages relative to production rates were considerably lower compared to cod, suggesting egg predation to be of a lesser importance for sprat recruitment. The results of this thesis provide new knowledge on clupeid foraging, including identifying processes and mechanisms behind fish egg consumption in the central Baltic. Further, the thesis contributes improved methodology for quantifying cod and sprat egg predation by egg development stages. Both in combination can be considered as a major advancement in this field of research, as predation pressure on early life stages is generally extremely difficult to quantify and comparable studies are scarce. Hence, the thesis provides useful ecological and methodological input to other ecosystems and investigations, where predation on early life stages is an important factor in influencing fish recruitment.

**General information**
- State: Published
- Organisations: National Institute of Aquatic Resources, Institute Management, Section for Ecosystem based Marine Management
- Authors: Neumann, V. (Intern), Köster, F. (Intern), Eero, M. (Intern)
- Number of pages: 180
- Publication date: 2017

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

**Baltic cod recruitment – the impact of changing environmental conditions**

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

**Clupeid consumption of cod eggs: Does it affect recent recruitment of Baltic cod?**

**General information**
- State: Published
- Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Institute Management
- Authors: Neumann, V. (Intern), Schaber, M. (Ekstern), Böttcher, U. (Ekstern), Eero, M. (Intern), Köster, F. (Intern)
- Publication date: 2016
- Event: Abstract from 40th Annual Larval Fish Conference, Solomons, United States.
- Main Research Area: Technical/natural sciences
- Publication: Research › Conference abstract for conference – Annual report year: 2016

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

**General information**
- State: Published
- Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Institute Management
- Authors: Eero, M. (Intern), Casini, M. (Ekstern), Hüsey, K. (Intern), Köster, F. (Intern), MacKenzie, B. (Intern), Neuenfeldt, S. (Intern), Tomkiewicz, J. (Intern)
- Publication date: 2016
- Event: Abstract from World Fisheries Congress, Busan, Korea, Republic of.
- Main Research Area: Technical/natural sciences
- Publication: Research › Conference abstract for conference – Annual report year: 2016
Towards sustainable blue growth: Outline of the joint Baltic Sea and the North Sea research and innovation programme 2018-2023

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Aarhus University
Number of pages: 59
Publication date: 2016

Publication information
ISBN (Print): 978-952-67331-7-3
ISBN (Electronic): 978-952-67331-8-0
Original language: English
Series: BONUS Publication
Number: 15
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Publication: Research › Report – Annual report year: 2016

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

Eastern Baltic cod in distress: biological changes and challenges for stock assessment

The eastern Baltic (EB) cod (Gadus morhua) stock was depleted and overexploited for decades until the mid-2000s, when fishing mortality rapidly declined and biomass started to increase, as shown by stock assessments. These positive developments were partly assigned to effective management measures, and the EB cod was considered one of the most successful stock recoveries in recent times. In contrast to this optimistic view, the analytical stock assessment failed in 2014, leaving the present stock status unclear. Deteriorated quality of some basic input data for stock assessment in combination with changes in environmental and ecological conditions has led to an unusual situation for cod in the Baltic Sea, which poses new challenges for stock assessment and management advice. A number of adverse developments such as low nutritional condition and disappearance of larger individuals indicate that the stock is in distress. In this study, we (i) summarize the knowledge of recent changes in cod biology and ecosystem conditions, (ii) describe the subsequent challenges for stock assessment, and (iii) highlight the key questions where answers are urgently needed to understand the present stock status and provide scientifically solid support for cod management in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Institute Management, Section for Monitoring and Data, Swedish University of Agricultural Sciences, University of Skövde, International Council for the Exploration of the Sea, University of Kiel, Lund University, Johann Heinrich von Thünen-Institute
Pages: 2180-2186
Reproduction of Baltic cod, Gadus morhua (Actinopterygii: Gadiformes: Gadidae), in the Gotland Basin: Causes of annual variability

Background. The Gotland Basin spawning ground is one of three main spawning areas of Baltic cod, Gadus morhua Linnaeus, 1758. The threshold water parameters for cod development are the salinity exceeding 11‰ and the oxygen level above 2 mL·L–1. Such conditions are only present when the 11‰ isohaline is above the 2 mL·L–1 isoxygen. In such a situation, the water volume between the isolines is called the "suitable reproduction volume". When the position of the isolines is reversed, the salinity and the oxygen level of the water layer demarcated by them are below the required thresholds and as such the water is unsuitable for the cod development. We refer to it as the "unsuitable reproduction volume". The main aim of the presently reported study was to examine whether variations in suitable and unsuitable reproduction habitat estimates could explain the fluctuations in cod recruitment. Material and methods. The suitable and unsuitable reproduction volumes in the Gotland Basin were estimated based on single point observations at three oceanographic monitoring stations using the contouring software Balthypsograph. To test the spatial hydrological heterogeneity in the Gotland Basin we used 15 observations during 1969–1995 on four stations in each of two transects. The oceanographic monitoring and demersal trawl research survey data from 1974–2012 have been used in analyses. Results. The sufficient reproduction conditions in the southern Gotland Basin persisted only until 1981. In later decades the reproduction potential of the Gotland Basin has decreased. The latest major North Sea water inflows in 1993 and 2003 in the Central Gotland Basin formed the suitable reproduction volume below the layers where cod eggs are floating. A significant relation between the recruit abundance and suitable and unsuitable reproduction volumes was found only for the Southern Gotland Basin (P < 0.03). Conclusions. We demonstrated that single-point estimates sufficiently quantify the reproduction conditions in the Gotland Basin and thus can be used for estimation of the reproduction volumes. The unsuitable reproduction volume concept can be used as an ecological indicator for egg survival probability in the Gotland Basin. However, it is too premature to re-define the concept of the suitable reproduction volume because it is applicable only to the Gotland spawning ground.
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.
Floating along buoyancy levels: dispersal and survival of western Baltic fish eggs

Vertical distribution is an important feature of pelagic fish eggs and yolk sac larvae impacting their survival and dispersal, especially in heterogeneous and highly variable estuarine environments like the Baltic Sea. Egg densities determining the vertical distribution pattern were experimentally ascertained for cod (Gadus morhua), plaice (Pleuronectes platessa) and flounder (Platichthys flesus) from the western Baltic Sea. Plaice eggs floated at lower mean (± standard deviation) density range (1.0136 ± 0.0007 g cm⁻³) compared to cod (1.0146 ± 0.0009 g cm⁻³) and flounder eggs (1.0160 ± 0.0015 g cm⁻³), which floated on the highest density level. In flounder egg diameter was significantly related to egg density and in cod a weak correlation could be found between egg dry weight and density. All other relationships between female size, egg size, egg dry weight and egg density were not significant for any of the species. Available egg density data for Baltic Sea cod, plaice and flounder are summarized considering ICES subdivisions and stock management units. A hydrodynamic drift modeling approach was applied releasing drifters in the Belt Sea continuously from December to May, covering the species' spawning seasons. The model implemented experimentally derived egg density ranges and included ontogenetic egg density modifications for cod eggs, increasing egg density from a late egg development stage to first hatch. A drifter was removed from the model, i.e. considered dead, when its initially prescribed density value exceeded the density range available at the temporally resolved geographical positions along the drift trajectories. Highest survival occurred during releases in April and May but no cohorts survived if they were drifted east into the central Arkona Basin or the central Baltic Sea, irrespective of whether a major Baltic Inflow (1992/1993) or a stagnation-year (1987/1988) was simulated. The dispersal characteristics of the surviving yolk sac larvae of all three species reflected retention within the Belt Sea or northwards transport through the Great Belt into the Kattegat and partly into the Skagerrak. There was no successful transport to more eastern Baltic areas past a hypothetical line from the island of Moen (Denmark) to Kap Arkona on Rügen Island (Germany)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Petereit, C. (Ekstern), Hinrichsen, H. (Ekstern), Franke, A. (Ekstern), Köster, F. (Intern)
Pages: 131-152
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 122
ISSN (Print): 0079-6611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
An introduction to the journal is presented in which the authors discuss various reports within the issue on topics including linkages of reproductive traits and nutritional condition for gadoid stocks, their life history characteristics, and spawning behavior.
Recovery in eastern Baltic cod: is increased recruitment caused by decreased predation on early life stages?

Cod (Gadus morhua) recruitment in the eastern Baltic Sea is influenced by predation on early life stages by sprat (Sprattus sprattus) and herring (Clupea harengus), which is considered as one of the mechanisms preventing cod recovery in the 1990s. In the light of improved cod recruitment in the second half of the 2000s, new analyses of stomach content of sprat and herring were conducted, to elucidate the contribution of changes in predation pressure on cod recruitment. Comparison of stomach contents of sprat and herring in 2004–2008 with data from the 1990s showed a similar diet composition in the two periods; however, changes were found in the ichthyoplankton abundance and composition in the diet, indicating reduced predation pressure on cod eggs in the most recent period. The abundance of cod eggs in the field, availability of other prey, and horizontal and vertical overlap between predator and prey were investigated as potential factors influencing cod egg predation.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management, Section for Ecosystem based Marine Management, Thünen Institute of Sea Fisheries
Authors: Neumann, V. (Intern), Köster, F. (Intern), Schaber, M. (Ekstern), Eero, M. (Intern)
Pages: 1382-1392
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 71
Issue number: 6
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Sustainable exploitation and management of aquatic resources
DTU Aqua conducts research, provides advice, educates at university level and contributes to innovation in sustainable exploitation and management of aquatic resources. The vision of DTU Aqua is to enable ecologically and economically sustainable exploitation of aquatic resources by applying an integrated ecosystem approach which utilizes synergies in natural and technical scientific disciplines. DTU Aqua advises the Danish Ministry of Food, Agriculture and Fisheries and other public authorities, the commercial fisheries, the aquaculture industry and international commissions. DTU Aqua deals with all types of aquatic habitats – from the North Atlantic Ocean and European shelf areas to coastal areas and inner Danish waters, ecosystems in lakes and streams as well as aquaculture. European shelf seas, Danish coastal areas and freshwaters are our main working areas, but we also work on Arctic and sub-Arctic waters, in particular in the North Atlantic surrounding Greenland, and we are involved in research activities in other parts of the world. DTU Aqua’s research is divided into the following fields: Oceanography and climate focuses on understanding the interplay between physical, chemical and biological conditions in the ocean and how these factors impact the living conditions of marine organisms. Population genetics aims at gaining knowledge on how to preserve and manage biodiversity sustainably. Individual biology deals with the biology of aquatic organisms and their interaction with other organisms and with the surrounding environment. Freshwater fisheries and ecology is devoted to looking at the behaviour of particular species of fish and their interaction with the environment. Coastal ecology deals with the structure and function of the ecosystems as a habitat for fish and shellfish as well as with coastal area management. Marine ecosystems aims at understanding the mechanisms that govern the interaction between individuals, species and populations in an ecosystem enabling us to determine the stability and flexibility of the ecosystem. Marine living resources looks at the sustainable utilization of fish and shellfish stocks. Ecosystem effects expands from the ecosystem approach to fisheries management to an integrated approach where other human activities are taken into consideration. Fisheries management develops models, models and tools for predicting and evaluating the effects of management measures and regulations applied by the authorities in fisheries management. Fisheries technology focuses on the development of selective and low-impact fishing gear which can help limit unintended by-catches and minimize the impact on the marine environment. Observation Technology is concerned with research and development of systems for collecting data in support of marine research and management. Shellfish aquaculture and fisheries focuses on production potential and resilience of coastal areas in relation to shellfish aquaculture and fisheries. Aquaculture covers a wide range of biological and technological aspects from fish nutrition and growth to environmental impacts of aquaculture.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management
Authors: Neuenfeldt, S. (Intern), Köster, F. (Intern)
Publication date: 2014

Host publication information
Title of host publication: Abstract Book - DTU Sustain Conference 2014
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Main Research Area: Technical/natural sciences
Conference: DTU Sustain Conference 2014, Lyngby, Denmark, 17/12/2014 - 17/12/2014
Publication: Research › Conference abstract in proceedings – Annual report year: 2014
Linking size and age at sexual maturation to body growth, productivity and recruitment of Atlantic cod stocks spanning the North Atlantic

Sexual maturation patterns of 22 North Atlantic stocks of cod (Gadus morhua) were examined and related to geographical distribution area, ambient water temperature, growth and surplus production. Four patterns were identified, i.e. sexual maturation early in life at small size, early in life at large size, late in life at small size and lastly, late in life at large size. These maturation patterns were geographically clustered and associated with differences in growth and surplus production. Stocks maturing late in life at small size were characterised by slow growth and low surplus production (e.g. stocks in the Gulf of St. Lawrence, Labrador/Newfoundland). Stocks maturing early in life at large size exhibited high to intermediate growth and surplus production (e.g. Celtic Sea, North Sea). Stocks maturing late in life at large size had low to intermediate growth rates and surplus production (e.g. Iceland, North East Arctic), while stocks maturing early in life at small size generally showed intermediate growth and surplus production (e.g. Baltic stocks). Production of recruits per unit biomass showed a latitudinal trend, but appeared largely independent of maturation pattern, growth rate and surplus production. Recruit production of northernmost stocks was lowest and variability highest, mid-latitude stocks exhibited highest productivity and least variability, while stocks at the southern distribution range also showed low productivity. Thus, southern Gulf of St. Lawrence and eastern Scotian Shelf cod maturing late in life at small size with slow growth and low surplus production showed highest recruit production in the Western Atlantic, while the early maturing, fast growing and productive Icelandic and Faroese stocks showed the lowest recruitment production of all Eastern Atlantic stocks. This comparative analysis suggests that maturation patterns relate to growth potential and surplus production whereas annual production of recruits per unit biomass appears unrelated to average size at sexual maturation
Marine fisheries science priorities

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management
Authors: Köster, F. (Intern)
Publication date: 2013
Event: Paper presented at Meeting of Directors of Fisheries and Aquaculture Research Organisations (EFARO) of the EU, Tallinn, Estonia.
Main Research Area: Technical/natural sciences
Links:
Recruitment processes in Baltic sprat - A re-evaluation of GLOBEC Germany hypotheses

The GLOBEC Germany program (2002–2007) had the ambitious goal to resolve the processes impacting the recruitment dynamics of Baltic sprat (Sprattus sprattus L.) by examining various factors affecting early life history stages. At the start of the research program, a number of general recruitment hypotheses were formulated, i.e. focusing on (1) predation, (2) food availability, (3) physical parameters, (4) the impact of current systems, and finally (5) the importance of top-down vs bottom-up effects. The present study synthesizes the results of field sampling (2002 and 2003), laboratory experiments, and modeling studies to re-evaluate these hypotheses for the Baltic sprat stock. Recruitment success was quite different in the 2 years investigated. Despite a lower spawning stock biomass in 2003, the total number of recruits was almost 2-fold higher that year compared to 2002. The higher recruitment success in 2003 could be attributed to enhanced survival success during the post-larval/juvenile stage, a life phase that appears to be critical for recruitment dynamics. In the state of the Baltic ecosystem during the period of investigation, we consider bottom-up control (e.g. temperature, prey abundance) to be more important than top-down control (predation mortality). This ranking in importance does not vary seasonally. Prevailing water circulation patterns and the transport dynamics of larval cohorts have a strong influence on sprat recruitment success. Pronounced transport to coastal areas is detrimental for year-class strength particularly at high sprat stock sizes. A suggested mechanism is density-dependant regulation of survival via intra- and inter-specific competition for prey in coastal areas. A documented change in larval vertical migration behavior between the early 1990s and early 2000s increased the transport potential to the coast, strengthening the coupling between inter-annual differences in the magnitude and direction of wind-driven surface currents and year-to-year changes in reproductive success. However, due to the strong linkages and feed-back loops in the Baltic Sea food web, the most robust projections of the future strength of the Baltic sprat stock will need to take into account climate-driven changes in both abiotic (e.g., drift trajectories) and biotic (trophicodynamic) factors. Although our understanding of processes affecting pre-recruit (larval) growth and survival has been advanced by the integrated research conducted within the GLOBEC Germany program, key mechanisms potentially affecting life stages outside of the spawning basins remain to be explored including the dynamics of coastal habitats of juveniles and the feeding and overwintering grounds of adults.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, University of Hamburg, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Voss, R. (Ekstern), Peck, M. (Ekstern), Hinrichsen, H. (Ekstern), Clemmesen, C. (Ekstern), Baumann, H. (Ekstern), Stepputis, D. (Ekstern), Bernreuther, M. (Ekstern), Schmidt, J. (Ekstern), Temming, A. (Ekstern), Köster, F. (Intern)
Pages: 61-79
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Progress in Oceanography
Volume: 107
ISSN (Print): 0079-6611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.4 SJR 1.922 SNIP 1.278
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.703 SNIP 1.348 CiteScore 3.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.909 SNIP 1.461 CiteScore 3.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.397 SNIP 1.595 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Robustness of egg production methods as a fishery independent alternative to assess the Eastern Baltic cod stock (Gadus morhua callarias L.)

At present, several cod stocks are outside safe biological limits and are managed under recovery plans. For these stocks Total Allowable Catches (TAC’s) are generally low and quotas are accompanied by a broad variety of technical measures influencing the fishing patterns. Consequently, the input data to stock assessment models relying on catch statistics from the commercial fisheries is potentially biased and the perception of stock status may be incorrect. Egg production methods (EPM) provide a fishery independent alternative. Additionally, they provide better estimates of stock reproductive potential (SRP). Eastern Baltic cod (Gadus morhua callarias L) has severely declined throughout the 2nd half of the 1980s and 1st half of the 1990s due to climate-driven adverse hydrographic conditions and high fishing intensity. Since 2007 the stock is managed under a long-term management plan and showed signs of recovery in most recent years. Since 1986, egg surveys have been carried out regularly in the Bornholm Basin, the most important spawning area of Eastern Baltic cod since mid-1980s. In the present paper the robustness of EPM towards simplification of spawning parameters and toward reduction of the number of egg surveys is tested applying three different methods requiring different numbers of egg surveys. We applied the annual egg production method (AEPM) requiring full egg survey coverage of the spawning season to estimate cod abundances in the Bornholm Basin. In addition, the daily fecundity reduction method (DFRM) and the daily egg production method (DEPM) were tested, the latter two methods requiring only single egg surveys, but require more complex reproduction input parameters. All three methods provided a comparable result, which was also expected as many spawning parameters were derived from the same underlying data sets. In a sensitivity analysis several input parameters were varied simultaneously up to 20% in both directions. EPM were especially sensitive towards changes in proportions of mature females at age, whereas changes in the various fecundity parameters and spawning fraction were less influential. EPM results followed the large scale spawning stock trends of the Baltic International Trawl Survey index, whereas the year to year variations of the index were not captured to well. EPM yielded spawning stock sizes in the same
order of magnitude as provided by a spatially down-scaled multi-species stock assessment model

**General information**
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management
Authors: Kraus, G. (Ekstern), Hinrichsen, H. (Ekstern), Voss, R. (Ekstern), Teschner, E. (Ekstern), Tomkiewicz, J. (Intern), Köster, F. (Intern)
Pages: 75-85
Publication date: 2012
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Fisheries Research
Volume: 117
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.938 SNIP 1.142
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.022 SNIP 1.075
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.025 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.906 SNIP 1.134
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.
### Stock assessment in the BCC region

**General information**
- **State:** Published
- **Organisations:** National Institute of Aquatic Resources, Institute Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
- **Authors:** Köster, F. (Intern), Degel, H. (Intern), Rademeyer, R. (Ekstern), Kainge, P. I. (Intern), Kirchner, C. (Ekstern), Beyer, J. (Intern)
- **Publication date:** 2012
- **Event:** Abstract from Benguela Current Commission Annual Science Forum, Windhoek, Namibia.
- **Main Research Area:** Technical/natural sciences

### 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), Haslob, H. (Ekstern), Huwer, B. (Intern), Kanstinger, P. (Ekstern), Köster, F. W. (Intern), Peterheit, C. (Ekstern), Temming, A. (Ekstern), Voss, R. (Ekstern)
- **Pages:** 42-57
- **Publication date:** 2012
- **Main Research Area:** Technical/natural sciences

**Publication information**
- **Journal:** Progress in Oceanography
- **Volume:** 103
- **ISSN (Print):** 0079-6611
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.4 SJR 1.922 SNIP 1.278
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.703 SNIP 1.348 CiteScore 3.34
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.909 SNIP 1.461 CiteScore 3.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.397 SNIP 1.595 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.741 SNIP 1.794 CiteScore 4.17
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.279 SNIP 1.341 CiteScore 3.41
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.643 SNIP 1.586
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.669 SNIP 1.829
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.065 SNIP 1.422
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.859 SNIP 1.503
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.551 SNIP 1.175
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.619 SNIP 1.839
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.526 SNIP 1.571
Scopus rating (2003): SJR 2.523 SNIP 1.658
Scopus rating (2002): SJR 2.168 SNIP 1.807
Scopus rating (2001): SJR 2.389 SNIP 1.732
Scopus rating (2000): SJR 1.924 SNIP 1.245
Scopus rating (1999): SJR 2.094 SNIP 1.268
Original language: English
DOI: 10.1016/j.pocean.2012.04.013
Source: dtu
Source-ID: n:oai:DTIC-ART:elsevier/367702698::18486
Publication: Research - peer-review › Journal article – Annual report year: 2012
The state and relative importance of drivers of fish population dynamics: An indicator-based approach

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Institute Management
Authors: Eero, M. (Intern), Lindegren, M. (Intern), Köster, F. (Intern)
Pages: 248-252
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecological Indicators
Volume: 15
Issue number: 1
ISSN (Print): 1470-160X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.07 SJR 1.308 SNIP 1.756
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.481 SNIP 1.726 CiteScore 3.99
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.463 SNIP 1.996 CiteScore 3.76
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.353 SNIP 1.837 CiteScore 3.63
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.257 SNIP 1.858 CiteScore 3.42
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.21 SNIP 1.732 CiteScore 3.05
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.239 SNIP 1.603
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.047 SNIP 1.769
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.907 SNIP 1.474
Scopus rating (2007): SJR 0.774 SNIP 1.395
Scopus rating (2006): SJR 0.677 SNIP 0.958
Scopus rating (2005): SJR 0.465 SNIP 1.035
Scopus rating (2004): SJR 0.731 SNIP 1.182
Scopus rating (2003): SJR 0.465 SNIP 0.861
Scopus rating (2002): SJR 0.185 SNIP 0.762
Original language: English
DOIs:
10.1016/j.ecolind.2011.09.035
Source: orbit
Source-ID: 286994
Publication: Research - peer-review › Journal article – Annual report year: 2011
Why is the Eastern Baltic cod recovering?

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Public Sector Consultancy
Authors: Eero, M. (Intern), Köster, F. (Intern), Vinther, M. (Intern)
Pages: 235-240
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Policy
Volume: 36
Issue number: 1
ISSN (Print): 0308-597X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.7 SJR 1.335 SNIP 1.182
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.591 SNIP 1.397 CiteScore 3.07
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.438 SNIP 1.56 CiteScore 3.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.472 SNIP 1.635 CiteScore 2.71
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.339 SNIP 1.495 CiteScore 2.54
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 1.263 CiteScore 2.07
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.289 SNIP 1.483
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.947 SNIP 1.142
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.838 SNIP 1.417
Scopus rating (2007): SJR 0.927 SNIP 1.377
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.961 SNIP 2.043
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.84 SNIP 1.229
Scopus rating (2004): SJR 0.793 SNIP 1.116
Scopus rating (2003): SJR 0.506 SNIP 1.11
Externally driven mortality of cod early life stages in the central Baltic: hydrography vs. predation

Cod (Gadus morhua L.) recruitment success in the central Baltic Sea is influenced by various abiotic and biotic factors, which include ambient salinity and oxygen conditions as well as predation pressure on early life stages by planktivore clupeids, such as sprat (Sprattus sprattus) and herring (Clupea harengus). After a period of very low recruitment and stock size during the 1990s–early 2000s, the eastern Baltic cod stock exhibits signs of recovery, at least partly owing to several stronger year classes formed in recent years. In this paper we investigate whether or not changes in predation pressure by clupeids on the early life stages of cod could have enhanced cod recruitment in recent years. The analyses are based on a large dataset of stomach content of clupeids, cod egg abundances from ichthyoplankton surveys, and hydrographic measurements. We investigate temporal and spatial variability in predation pressure on cod eggs, both within and between years, and relate this to variability in hydrographic conditions. Preliminary results indicate lower predation pressure on cod eggs in the recent period compared with some earlier years.

Grey seal predation on forage fish in the Baltic Sea

The mean annual growth rate of grey seal stock in the Baltic has been on average 7.5% annually during the last decade. In 2010, a total of approximately 23 100 grey seals were counted. The increase in stock size was highest in the northern areas and the predation pressure of grey seals on clupeoids has increased accordingly. The diet of grey seal in the Baltic consists of ca. 20 fish species. The most abundant prey items in the Baltic proper are Baltic herring, sprat, and cod, and in the Bothnian Sea and Bothnian Bay Baltic herring, Coregonus sp., Baltic salmon, and sea trout. An adult seal consumes on average round 4.5 kg fish per day, of which 55% are clupeoids in the Baltic Main basin and 70% in the Bothnian Sea and Bothnian Bay. According to acoustic estimates, predator–prey distribution patterns, migration patterns, and multispecies analysis (SMS), the predation effect of grey seals on Baltic herring and sprat stocks is still at a very low level. Hence, with present grey seal stock sizes, the impact of seal predation can be ignored in whole Baltic-scale herring and sprat stock management considerations. Locally, however, grey seal–fishery interactions play an important role and should be taken into account in future spatial planning and ecosystem management.
Introducing state-space stock assessment (SAM), split species issues and spatial modelling

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Kainge, P. I. (Intern), Beyer, J. (Intern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Electronic versions:
BCC Annual Forum 2011 Koester et al ECOFISH WP1 final [Compatibility Mode]
Links:

Linking size and age of attaining sexual maturation to growth and stock productivity in Atlantic cod stocks

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Section for Marine Ecology and Oceanography
Authors: Köster, F. (Intern), Tomkiewicz, J. (Intern), Trippel, E. (Ekstern)
Publication date: 2011
Event: Abstract from Fish reproduction and Fisheries, Vigo, Spain.
Main Research Area: Technical/natural sciences

Multi-decadal responses of a cod (Gadus morhua) population to human-induced trophic changes, fishing, and climate

Understanding how human impacts have interacted with natural variability to affect populations and ecosystems is required for sustainable management and conservation. The Baltic Sea is one of the few large marine ecosystems worldwide where the relative contribution of several key forcings to changes in fish populations can be analyzed with empirical data. In this study we investigate how climate variability and multiple human impacts (fishing, marine mammal hunting, eutrophication) have affected multi-decadal scale dynamics of cod in the Baltic Sea during the 20th century. We document significant climate-driven variations in cod recruitment production at multi-annual timescales, which had major impacts on population dynamics and the yields to commercial fisheries. We also quantify the roles of marine mammal predation, eutrophication, and exploitation on the development of the cod population using simulation analyses, and show how the intensity of these forcings differed over time. In the early decades of the 20th century, marine mammal predation and eutrophication were the main limiting factors; exploitation of cod was still relatively low. During the 1940s and subsequent decades, exploitation increased and became a dominant forcing on the population. Eutrophication had a relatively minor positive influence on cod biomass until the 1980s. The largest increase in cod biomass occurred during the late 1970s, following a long period of hydrographically related above-average cod productivity coupled to a temporary reduction in fishing pressure. The Baltic cod example demonstrates how combinations of different forcings can have synergistic effects and consequently dramatic impacts on population dynamics. Our results highlight the potential and limitations of human manipulations to influence predator species and show that sustainable management can only be achieved by considering both anthropogenic and naturally varying processes in a common framework.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Institute Management, Section for Population Ecology and Genetics
Authors: Eero, M. (Intern), MacKenzie, B. (Intern), Köster, F. (Intern), Gislason, H. (Intern)
Pages: 214-226
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Ecological Applications
Volume: 21
Spatio-temporal overlap of the alien invasive ctenophore Mnemiopsis leidyi and ichthyoplankton in the Bornholm Basin (Baltic Sea)

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Monitoring, Institute Management
Authors: Schaber, M. (Ekstern), Haslob, H. (Ekstern), Huwer, B. (Intern), Harjes, A. (Ekstern), Hinrichsen, H. (Ekstern), Størn-Paulsen, M. (Intern), Schmidt, J. (Ekstern), Voss, R. (Ekstern), Neumann, V. (Intern), Köster, F. (Intern)
Pages: 2647-2660
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Biological Invasions
Volume: 13
Issue number: 12
ISSN (Print): 1387-3547
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.294 SNIP 1.193 CiteScore 2.71
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.444 SNIP 1.19 CiteScore 2.58
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.416 SNIP 1.402 CiteScore 2.78
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.553 SNIP 1.29 CiteScore 2.9
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.523 SNIP 1.335 CiteScore 2.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.652 SNIP 1.363 CiteScore 3
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.665 SNIP 1.526
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.865 SNIP 1.597
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.59 SNIP 1.478
Scopus rating (2007): SJR 1.481 SNIP 1.268
Scopus rating (2006): SJR 1.607 SNIP 1.445
Scopus rating (2005): SJR 1.035 SNIP 1.516
Scopus rating (2004): SJR 0.957 SNIP 1.199
Scopus rating (2003): SJR 0.803 SNIP 0.857
Scopus rating (2002): SJR 1.336 SNIP 0.994
Scopus rating (2001): SJR 1.081 SNIP 0.884
Scopus rating (2000): SJR 0.745 SNIP 0.764
Original language: English
DOI: 10.1007/s10530-011-9936-7
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.
The recovery of cod in the Baltic Sea, a success against all odds

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

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
Baltic cod cannibalism: differing consequences at stock recovery vs. decline?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Institute Management
Authors: Neuenfeldt, S. (Intern), Aro, E. (Ekstern), Köster, F. (Intern)
Number of pages: 3
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
http://www.ices.dk/products/CMdocs/CM-2010/C/C0810.pdf

Bibliographical note
Extended abstract
Source: orbit
Source-ID: 267554
Publication: Research › Conference abstract for conference – Annual report year: 2010

CAVIAR: Climate variability of the Baltic Sea area

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Lehmann, A. (Ekstern), Getzlaff, K. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern)
Number of pages: 6
Publication date: 2010
Main Research Area: Technical/natural sciences
Electronic versions:
S0110.pdf
Links:
Source: orbit
Source-ID: 267545
Publication: Research › Paper – Annual report year: 2010

Framework of stock-recovery strategies: analyses of factors affecting success and failure

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

**General information**

State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and
Genetics
Authors: Hammer, C. (Ekstern), Dorrien, C. V. (Ekstern), Hopkins, C. C. E. (Ekstern), Köster, F. (Intern), Nilssen, E. M.
(Ekstern), St. John, M. (Intern), Wilson, D. C. (Ekstern)
Pages: 1849-1855
Publication date: 2010
Main Research Area: Technical/natural sciences

**Publication information**

Journal: ICES Journal of Marine Science
Volume: 67
Issue number: 9
ISSN (Print): 1054-3139
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.63
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 2.18
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 2.62
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 2.46
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 2.35
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 2.32
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Web of Science (2008): Indexed yes
- Web of Science (2007): Indexed yes
- Web of Science (2006): Indexed yes
- Web of Science (2005): Indexed yes
Impact of hypoxia on consumption of Baltic cod in a multispecies stock assessment context

The Baltic Sea is characterised by a heterogeneous oceanographic environment. The deep water layers forming the habitat of Baltic cod (Gadus morhua callarias L.) are subjected to frequently occurring pronounced anoxic conditions. Adverse oxygen conditions result in physiological stress for organisms living under these conditions. For cod e.g. a direct relationship between oxygen availability and food intake with a decreasing ingestion rate at hypoxia could be revealed. In the present study, the effects of oxygen deficiency on consumption rates were investigated and how these translate to stock size estimates in multi-species models. Based on results from laboratory experiments, a model was fitted to evacuation rates at different oxygen levels and integrated into the existing consumption model for Baltic cod. Individual mean oxygen corrected consumption rates were 0.1–10.9% lower than the uncorrected ones. At the currently low predator stock size, however, the effect of oxygen-reduced consumption on the total amount of eaten prey biomass and thus predation mortalities was only marginal. But should successful management lead to higher cod stock sizes in the future, then total predation mortalities will greatly increase and thus improved precision of these estimates would be valuable for the assessment of prey stocks.
Influence of lipids and fatty acid composition on Baltic cod (Gadus morhua L.) maturation and timing of spawning

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Aquatic Lipids and Oxidation, Institute Management
Authors: Tomkiewicz, J. (Intern), Støttrup, J. (Intern), Jacobsen, C. (Intern), Røjbek, M. (Intern), Köster, F. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Electronic versions:
ICES CM 2009 C10.pdf
Links:
http://www.ices.dk/products/cmdocsindex.asp

Bibliographical note
Extended abstract
Source: orbit
Source-ID: 256650
Publication: Research › Conference abstract for conference – Annual report year: 2010

Marine resources management in the face of change: from ecosystem science to ecosystem-based management

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Institute Management
Authors: Barange, M. (Ekstern), O.Boyle, R. (Ekstern), Cochrane, K. L. (Ekstern), Fogarty, M. J. (Ekstern), Jarre, A. (Intern), Kell, L. T. (Ekstern), Köster, F. (Intern), King, J. R. (Ekstern), de Moor, C. L. (Ekstern), Reed, K. (Ekstern), Sinclair, M. (Ekstern), Yatsu, A. (Ekstern)
Pages: 253-287
Publication date: 2010

Host publication information
Title of host publication: Marine ecosystems and global change
Volume: 9
Place of publication: Oxford
Publisher: Oxford University Press
Editors: Barange, M., Field, J., Harris, R., Hofmann, E., Perry, R., Werner, C.
ISSN (Print): 978-0-19-955802-5
Main Research Area: Technical/natural sciences
The EFARO perspective on providing science for policy

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management
Authors: Köster, F. (Intern)
Publication date: 2010
Event: Abstract from 20th Meeting of Directors of Fisheries and Aquaculture Research Organisations (EFARO) of the EU, Palma de Mallorca, Spain.
Main Research Area: Technical/natural sciences
Links:
http://www.efaro.eu/default.asp?ZNT=S0T1O-1P89
Publication: Research › Conference abstract for conference – Annual report year: 2010

An ecosystem-based framework for tracking performance of fish stocks and related forcings using fuzzy-logic approach

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Institute Management
Authors: Eero, M. (Intern), Jarre, A. (Intern), Ojaveer, H. (Ekstern), Tomczak, M. (Intern), Lindegren, M. (Intern), Köster, F. (Intern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Links:
http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multi-annual_management_plan_for_the_cod_stocks_in_the_Baltic_Sea
Source: orbit
Source-ID: 284726
Publication: Research › Conference abstract for conference – Annual report year: 2009

Baltic cod cannibalism: Differing consequences at stock recovery versus the historic situation of cod decline?

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Neuenfeldt, S. (Intern), Köster, F. (Intern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Links:
http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multi-annual_management_plan_for_the_cod_stocks_in_the_Baltic_Sea
Publication: Research › Conference abstract for conference – Annual report year: 2009

Current trends in the assessment and management of stocks

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Environmental effects on recruitment and implications for biological reference points of Eastern Baltic cod (Gadus morhua)

The decline of the Eastern Baltic cod (Gadus morhua) stock from highest to lowest stock levels on record throughout the 1980s and early 1990s was caused by a combination of recruitment failure and increasing fishing pressure at declining stock sizes. The processes driving the reproductive success are largely understood, but the consequences of these changes for fisheries management are far less evident. This includes doubts about the adequacy of the biological reference points presently used to advise on the stock status, and the need of their revision given that environmental changes have affected stock productivity. Long-term projections suggest that under adverse environmental conditions for reproduction, harvesting at fishing mortality determined as precautionary may not lead to a recovery of the stock to a biomass level considered precautionary. Thus, a revision of either the limit fishing mortality or the limit biomass reference point is indicated. However, an accepted methodology to determine these reference points in situations of changing stock productivity or system carrying capacity does not exist. Environmental conditions affecting recruitment matter not only for...
the determination of limit reference points, but according to long-term simulations also for target fishing mortalities, being central parts of harvest control rules in several management plans.

**General information**

**State:** Published

**Organisations:** Institute Management, National Institute of Aquatic Resources, Section for Fisheries Advice, Section for Population- and Ecosystem Dynamics, Section for Management Systems

**Authors:** Köster, F. (Intern), Vinther, M. (Intern), MacKenzie, B. (Intern), Eero, M. (Intern), Plikshs, M. (Ekstern)

**Pages:** 205-220

**Publication date:** 2009

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

**Publication information**

**Journal:** Journal of Northwest Atlantic Fishery Science

**Volume:** 41

**ISSN (Print):** 0250-6408

**Ratings:**

- **BFI (2018):** BFI-level 1
- **Web of Science (2018):** Indexed yes
- **BFI (2017):** BFI-level 1
- **BFI (2016):** BFI-level 1
- **Scopus rating (2016):** SJR 0.317 SNIP 0.442 CiteScore 0.83
- **BFI (2015):** BFI-level 1
- **Scopus rating (2015):** SJR 0.831 SNIP 1.67 CiteScore 1.33
- **Web of Science (2015):** Indexed yes
- **BFI (2014):** BFI-level 1
- **Scopus rating (2014):** SJR 0.448 SNIP 0.634 CiteScore 0.91
- **BFI (2013):** BFI-level 1
- **Scopus rating (2013):** SJR 0.246 SNIP 0.566 CiteScore 0.75
- **ISI indexed (2013):** ISI indexed no
- **BFI (2012):** BFI-level 1
- **Scopus rating (2012):** SJR 0.199 SNIP 0.423 CiteScore 0.33
- **ISI indexed (2012):** ISI indexed no
- **Web of Science (2012):** Indexed yes
- **BFI (2011):** BFI-level 1
- **Scopus rating (2011):** SJR 0.646 SNIP 0.816 CiteScore 2.24
- **ISI indexed (2011):** ISI indexed no
- **Web of Science (2011):** Indexed yes
- **BFI (2010):** BFI-level 1
- **Scopus rating (2010):** SJR 0.81 SNIP 0.747
- **Web of Science (2010):** Indexed yes
- **BFI (2009):** BFI-level 1
- **Scopus rating (2009):** SJR 0.609 SNIP 0.467
- **Web of Science (2009):** Indexed yes
- **Scopus rating (2008):** SJR 0.515 SNIP 0.514
- **Web of Science (2008):** Indexed yes
- **Scopus rating (2007):** SJR 0.656 SNIP 0.568
- **Scopus rating (2006):** SJR 0.791 SNIP 0.722
- **Scopus rating (2005):** SJR 0.676 SNIP 0.843
- **Scopus rating (2004):** SJR 0.345 SNIP 0.314
- **Web of Science (2004):** Indexed yes
- **Scopus rating (2003):** SJR 0.519 SNIP 0.337
- **Web of Science (2003):** Indexed yes
- **Scopus rating (2002):** SJR 0.602 SNIP 0.206
- **Web of Science (2002):** Indexed yes
- **Scopus rating (2001):** SJR 0.384 SNIP 0.376
Identifying eastern Baltic cod nursery grounds using hydrodynamic modelling: knowledge for the design of Marine Protected Areas

Knowledge of the spatial and temporal distribution of juvenile cod is essential to closing the life cycle in population dynamic models, and it is a prerequisite for the design of Marine Protected Areas (MPAs) aiming at the protection of juveniles. In this study, we use a hydrodynamic model to examine the spatial distribution of eastern Baltic cod larvae and early juveniles. The transport patterns of the larvae spawned at the three major spawning grounds in the central Baltic Sea were investigated by drift model simulations for the period 1979–2004. We analysed potential habitats for their suitability for juvenile settlement, i.e. the change from pelagic to demersal life. The results revealed a clear dependence of the probability for successful settling on wind-induced drift of larval cod, which is controlled by the local atmospheric conditions over the Baltic Sea. Furthermore, we found evidence that the final destinations of juvenile cod drift routes are affected by decadal climate variability. Application of the methodology to MPA design is discussed, e.g. identifying the overlap of areas with a high probability of successful juvenile cod settlement and regions of high fishing effort in small-meshed fisheries targeting sprat and herring.
Reflection on the CFP reform

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management
Authors: Köster, F. (Intern)
Publication date: 2009
Event: Abstract from 19th Meeting of Directors of Fisheries and Aquaculture Research Organisations (EFARO) of the EU, Gothenburg, Sweden.
Main Research Area: Technical/natural sciences
Links:
http://www.efaro.eu/default.asp?ZNT=S0T1O-1P75
Publication: Research - peer-review › Journal article – Annual report year: 2009

Seasonal lipid dynamics of herring and sprat in the Baltic Sea and possible implications for cod reproduction

The Baltic Sea experienced a regime shift in the 1980ies with major changes in food webodynamics. These ecosystem alterations were related to climatic driven changes in hydrographic conditions affecting phyto- and zooplankton assemblage and hence the food availability for clupeids. Sprat abundance increased dramatically in the early 1990ies. The changes in plankton communities in combination with increased competition resulted in declined condition of clupeids. Polyunsaturated fatty acids originate from phytoplankton and are transmitted through the food web. The present study investigates if the seasonal variation in lipid composition of herring and sprat reflects the changes in plankton. Fish were sampled five times over a year and the lipid composition of different size groups was analyzed. Significant seasonal variation in average lipid content in sprat was found: 14.00% in November, 11.26% in January, 7.47% in March and 9.60% in June. The lipid content in herring also varied within season but was lower than sprat: 7.42% in November, 6.71% in January and 4.70% in March. The seasonal lipid dynamic was reflected in variation of specific fatty acids. Clupeids are the major prey of Baltic cod so deficiencies of essential fatty acids could be a limiting factor for cod reproduction

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, National Food Institute, Division of Industrial Food Research, Institute Management
Authors: Rejbek, M. (Intern), Tomkiewicz, J. (Intern), Stettrup, J. (Intern), Jacobsen, C. (Intern), Köster, F. (Intern)
Publication date: 2009
Event: Poster session presented at ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Poster – Annual report year: 2009

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
Authors: Huwer, B. (Intern), Storr-Paulsen, M. (Intern), Schaber, M. (Ekstern), Haslob, H. (Ekstern), Harjes, A. (Ekstern), Hinrichsen, H. (Ekstern), Voss, R. (Ekstern), Köster, F. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 279280
Publication: Research › Conference abstract for conference – Annual report year: 2009

UNCOVER: Fish Stock Recovery Strategies – Lessons learned in the Baltic Sea

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Institute Management, Johann Heinrich von Thünen-Institute, AquaMarine Advisers, Aalborg University
Authors: Hammer, C. (Ekstern), Dorrien, C. V. (Ekstern), Hopkins, C. C. (Ekstern), Köster, F. (Intern), Neuenfeldt, S. (Intern), St. John, M. (Intern), Wilson, D. C. (Ekstern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Links:
http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multi-annual_management_plan_for_the COD_stocks_in_the_Baltic_Sea
Publication: Research › Conference abstract for conference – Annual report year: 2009

Yes, we can – the successful recovery of the Baltic sprat stock

General information
State: Published
Organisations: National Institute of Aquatic Resources, Institute Management, Christian-Albrechts-Universität zu Kiel, Institute for Hydrobiology and Fisheries Science, Johann Heinrich von Thünen-Institute, Leibniz Institute of Marine Sciences
Authors: Voss, R. (Ekstern), Köster, F. (Intern), Schmidt, J. O. (Ekstern), Peck, M. A. (Ekstern), Möllmann, C. (Ekstern), Kraus, G. (Ekstern), Stepputtis, D. (Ekstern), Hinrichsen, H. (Ekstern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Links:
http://www.academia.edu/3478438/Stock-based_vs._fleet-based_evaluation_of_the_multi-annual_management_plan_for_the_COD_stocks_in_the_Baltic_Sea
Publication: Research › Conference abstract for conference – Annual report year: 2009

CAVIAR: Climate variability of the Baltic Sea area

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Getziaff, K. (Ekstern), Voss, R. (Ekstern), Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), Köster, F. (Intern)
Publication date: 2008
Climate related marine ecosystem changes

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Number of pages: 473
Pages: 309-377
Publication date: 2008

Host publication information
Title of host publication: Assessment of Climate Change for the Baltic Sea Basin
Publisher: Springer
Editors: Bodungen, B., Storch, H.
Series: Regional climate studies
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 237013
Publication: Research - peer-review › Book chapter – Annual report year: 2008

Fish

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Möllmann, C. (Ekstern), Köster, F. (Intern)
Number of pages: 473
Pages: 334-341
Publication date: 2008

Host publication information
Title of host publication: Assessment of Climate Change for the Baltic Sea Basin
Volume: 5.8
Publisher: Springer
Editor: Storch, H.
Series: Regional climate studies
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 226514
Publication: Research - peer-review › Book chapter – Annual report year: 2008

FishFrame 5.0: A web based datawarehouse application for management, access and integration of fisheries and stock assessment data

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Monitoring, Institute Management
Fish stock development under hydrographic and hydrochemical aspects - the history of Baltic Sea fisheries and its management

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Number of pages: 712
Pages: 543-582
Publication date: 2008

Host publication information
Title of host publication: State and Evolution of the Baltic Sea 1952 – 2005
Volume: Chapter 18
Publisher: Wiley
Editors: Feistel, R., Nausch, G., Wasmund, N.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 278037
Publication: Research - peer-review › Book chapter – Annual report year: 2008

Incorporating environmental variability in stock assessment: predicting recruitment, spawner biomass and landings of sprat (Sprattus sprattus) in the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Horbowy, J. (Ekstern), Köster, F. (Intern)
Pages: 1334-1341
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 7
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Process-based model for direct and indirect effects of hydrographic conditions on Central Baltic (Gadus morhua) cod egg mortality

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Andersen, K. H. (Intern), Möllmann, C. (Ekstern), Köster, F. (Intern)
Pages: 84-88
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 17
Issue number: 2
ISSN (Print): 1054-6006
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.704 SNIP 0.987
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.139 SNIP 0.231
Web of Science (2003): Indexed yes
Reconstructing historical stock development of Atlantic cod (Gadus morhua) in the eastern Baltic Sea before the beginning of intensive exploitation

The landings of Atlantic cod (Gadus morhua) in the eastern Baltic Sea in the early decades of the 20th century were below 50 thousand tonnes and therefore lower than in recent years at very low stock size. These low landings have largely contributed to a perception that the stock size was also low before the 1950s. In this investigation, we demonstrate that cod spawning stock biomass in the years 1925-1944 fluctuated in a similar range as in the periods from the 1950s to the mid-1970s and from the late 1980s onwards and was in most of these years at least twice as high as at present. Fishing mortality before the 1940s was below 0.2, but reached moderate levels during the Second World War. The stock size before the war may be considered as a reference level of biomass at low fishing impact, providing important information for the management of fisheries and the Baltic ecosystem.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Institute Management, Section for Population- and Ecosystem Dynamics
Authors: Eero, M. (Intern), Köster, F. (Intern), MacKenzie, B. (Intern)
Pages: 2728-2741
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 12
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Seasonal prevalence and intensity of follicular atresia in Baltic cod Gadus morhua callarias L

In the present study, 307 ovaries of eastern Baltic cod Gadus morhua callarias sampled during the prespawning and spawning season 2000 were analysed histologically to estimate the seasonal prevalence and intensity of atresia. The number of atretic oocytes per ovary was estimated using a combination of the physical disector method and volume fraction (Delesse principle). Atretic oocytes were observed in 32% of the ovaries. Prevalence of atresia was independent of female size, but increased significantly with declining female condition from prespawning and through the spawning stages. The relative intensity of atresia, i.e. number of atretic oocytes in relation to normally developed vitellogenic oocytes, was low amounting to 1.4% on average. Similar to prevalence, relative intensity of atresia differed significantly between maturity stages and increased with decreasing female condition. The population egg loss due to atresia amounted to 4.6% indicating that Baltic cod was performing close to maximum productivity, i.e. potential egg production. (c) 2008 The Authors Journal compilation (c) 2008 The Fisheries Society of the British Isles.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Kraus, G. (Intern), Tomkiewicz, J. (Intern), Diekmann, R. (Ekstern), Köster, F. (Intern)
Pages: 831-847
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 72
Issue number: 4
ISSN (Print): 0022-1112
Ratings:
The Eastern Baltic cod stock in the 20th century: Resolving impacts of fishing, human-induced trophic changes and climate

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Eero, M. (Intern), MacKenzie, B. (Intern), Köster, F. (Intern), Gislason, H. (Intern)
Pages: 1-22
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication Information
Journal: ICES Council Meeting
Volume: J:08
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 226303
Publication: Research › 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
Authors: Huwer, B. (Intern), Clemmesen, C. (Ekstern), Grønkjær, P. (Ekstern), Köster, F. (Intern)
Publication date: 2008
Event: Poster session presented at 32nd Annual Larval Fish Conference, Kiel, Germany.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229303
Publication: Research › Conference article – Annual report year: 2008

Developing an integrated view on the Baltic Sea ecosystem: The EUR-OCEANS Baltic system study

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Management Systems
Authors: Köster, F. (Intern), Turner, D. (Ekstern), Omstedt, A. (Ekstern), Möllmann, C. (Ekstern), Gislason, H. (Intern), Autio, R. (Ekstern), Olsson, A. (Ekstern), Diekmann, R. (Intern)
Pages: 90-92
Publication date: 2007

Host publication information
Title of host publication: Fifth study conference on BALTEX, Kuressaare, Saaremaa, Estonia, 4-8 June 2007: Conference proceedings
Editor: Isemer, H.
Series: Publication / International BALTEX Secretariat
Number: 38
Eastern Baltic cod (Gadus morhua callarias) stock dynamics: extending the analytical assessment back to the mid-1940s

**General information**
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Eero, M. (Intern), Köster, F. (Intern), Plikshs, M. (Ekstern), Thurow, F. (Ekstern)
Pages: 1257-1271
Publication date: 2007
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICES Journal of Marine Science
Volume: 64
Issue number: 6
ISSN (Print): 1054-3139
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.63
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 2.18
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 2.62
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 2.46
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 2.35
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 2.32
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Web of Science (2008): Indexed yes
- Web of Science (2007): Indexed yes
- Web of Science (2006): Indexed yes
Impact of 21st century climate change on the Baltic Sea fish community and fisheries

The Baltic Sea is a large brackish semi-closed sea whose species-poor fish community supports important commercial and recreational fisheries. Both the fish species and the fisheries are strongly affected by climate variations. These climatic effects and the underlying mechanisms are briefly reviewed. We then use recent regional-scale climate-ocean modelling results to consider how climate change during this century will affect the fish community of the Baltic and fisheries management. Expected climate changes in northern Europe will likely affect both the temperature and salinity of the Baltic, causing it to become warmer and fresher. As an estuarine ecosystem with large horizontal and vertical salinity gradients, biodiversity will be particularly sensitive to changes in salinity which can be expected as a consequence of altered precipitation patterns. Marine-tolerant species will be disadvantaged and their distributions will partially contract from the Baltic Sea; habitats of freshwater species will likely expand. Although some new species can be expected to immigrate because of an expected increase in sea temperature, only a few of these species will be able to successfully colonize the Baltic because of its low salinity. Fishing fleets which presently target marine species (e.g., cod, herring, sprat, plaice, sole) in the Baltic will likely have to relocate to more marine areas or switch to other species which tolerate decreasing salinities. Fishery management thresholds that trigger reductions in fishing quotas or fishery closures to conserve local populations (e.g., cod, salmon) will have to be reassessed as the ecological basis on which existing thresholds have been established changes, and new thresholds will have to be developed for immigrant species. The Baltic situation illustrates some of the uncertainties and complexities associated with forecasting how fish populations, communities and industries dependent on an estuarine ecosystem might respond to future climate change.
Impact of 21st century climate change on the Baltic Sea fish community and fisheries

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Gislason, H. (Intern), Möllmann, C. (Ekstern), Köster, F. (Intern)
Pages: 1-41
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Incorporating environmental variability in stock assessment - predicting recruitment, spawner biomass and landings of sprat in the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Horbowy, J. (Ekstern), Köster, F. (Intern)
Pages: 1-16
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Volume: R:11
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Links:
Source: orbit
Source-ID: 226521
Publication: Research › Conference article – Annual report year: 2007

Invading Mnemiopsis leidyi as a potential threat to Baltic fish

The occurrence of the ctenophore Mnemiopsis leidyi as a new invasive species in the Baltic Sea and the potential consequences for fish stock recruitment was investigated in spring 2007. The study focused on the Bornholm Basin, which serves as the major spawning ground for cod and sprat, the commercially most important fish stocks in the Baltic. The distribution pattern of M. leidyi revealed a substantial overlap with cod eggs. The observed predation of M. leidyi on eggs has the potential to alter the recruitment success of cod, which is the top predator in the system and, thus, to change the Baltic food-web structure.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Haslob, H. (Ekstern), Clemmesen, C. (Ekstern), Schaber, M. (Ekstern), Hinrichsen, H. (Ekstern), Schmidt, J. (Ekstern), Voss, R. (Ekstern), Kraus, G. (Intern), Köster, F. (Intern)
Pages: 303-306
Publication date: 2007
Pelagic habitat mapping: A tool for area-based fisheries management in the Baltic Sea
Spatial and temporal heterogeneity of the cod spawning environment in the Bornholm Basin, Baltic Sea

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Institute Management, Section for Population- and Ecosystem Dynamics
Authors: Hinrichsen, H. (Ekstern), Voss, R. (Ekstern), Wieland, K. (Intern), Köster, F. (Intern), Andersen, K. H. (Intern), Margonski, P. (Ekstern)
Pages: 245-254
Publication date: 2007
Main Research Area: Technical/natural sciences
Dorsch in der Ostsee

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Köster, F. (Intern)
Pages: 334-345
Publication date: 2006

Host publication information
Title of host publication: Fazination Meeresforschung: Ein ökologisches Lesebuch
Place of publication: Bremen
Publisher: Hauschild
Editors: Hempel, G., Hempel, I., Schiel, S.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226369
Publication: Research › Book chapter – Annual report year: 2006

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
Event: Poster session presented at EUR-OCEANS Annual Meeting, Barcelona, Spain,
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277537
Publication: Research › Poster – Annual report year: 2006
Recruitment variability in Baltic Sea sprat (Sprattus sprattus) is tightly coupled to temperature and transport patterns affecting the larval and early juvenile stages

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Baumann, H. (Ekstern), Hinrichsen, H. (Ekstern), Malzahn, A. (Ekstern), Möllmann, C. (Ekstern), Köster, F. (Intern), Temming, A. (Ekstern)
Pages: 2191-2201
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 63
Issue number: 10
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.589 SNIP 1.379
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.621 SNIP 1.236
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.354 SNIP 1.267
Torsken og klimaforandringer

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern)
Publication date: 2006
Event: Poster session presented at CONWOY Conference on Vand og Vejr om 100 år, Roskilde, Denmark.
Main Research Area: Technical/natural sciences

Bibliographical note
Poster
Source: orbit
Source-ID: 226539
Publication: Research › Poster – Annual report year: 2006

Baltic

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Möllmann, C. (Ekstern), Tomkiewicz, J. (Intern), MacKenzie, B. (Intern)
Pages: 19-32
Publication date: 2005

Host publication information
Title of host publication: Spawning and life history information for North Atlantic cod stocks
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Editor: Brander, K.
ISBN (Print): 87-7482-034-6

Series: ICES cooperative research report
Number: 274
Main Research Area: Technical/natural sciences
Links:
http://www.ices.dk/pubs/crr/crr274/crr274.pdf
Source: orbit
Source-ID: 226363
Publication: Research › Book chapter – Annual report year: 2005
Climate, zooplankton, and pelagic fish growth in the central Baltic Sea

Oceanographic conditions in the brackish central Baltic Sea are strongly linked to atmospheric forcing and the unusual period of persistently strong westerlies that, since the late 1980s, have resulted in an increase in average water temperatures and decreasing salinity. These changes in temperature and salinity resulted in a change in the dominance of the mesozooplankton community from Pseudocalanus sp. to Temora longicornis and Acartia spp. Similar to the copepod community, the central Baltic fish community shifted from cod (Gadus morhua), dominant during the 1980s, to sprat (Sprattus sprattus), dominant during the 1990s. Further, the commercially important pelagic fish species herring (Clupea harengus) and sprat exhibited reductions in growth. Using Principal Component and Correlation Analyses we investigated the temporal variability in the importance of the food supply as well as competition on condition of central Baltic pelagic fish species. Our results indicate that herring condition results from a combined effect of changes in the food environment and increased competition with sprat, while sprat condition appeared to be primarily determined by intra-specific competition.

General information

State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Kornilovs, G. (Ekstern), Fetter, M. (Ekstern), Köster, F. (Intern)
Pages: 1270-1280
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information

Journal: ICES Journal of Marine Science
Volume: 62
Issue number: 7
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Maternal and paternal influences on early life history traits and processes of Baltic cod Gadus morhua

**General information**
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Trippel, E. (Ekstern), Kraus, G. (Intern), Köster, F. (Intern)
Pages: 259-267
Publication date: 2005
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Marine Ecology - Progress Series
Volume: 303
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Timing of Baltic cod spawning and spawner demography

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Tomkiewicz, J. (Intern), Kraus, G. (Intern), Köster, F. (Intern)
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2005/
Volume: Q:23
Original language: English
Source: orbit
Source-ID: 227703
Publication: Research - peer-review › Journal article – Annual report year: 2005

A new retention index for the Central Baltic Sea: long-term hydrodynamic modelling used to improve Baltic sprat recruitment models

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Baumann, H. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern), Temming, A. (Ekstern)
Pages: 11-12
Publication date: 2004
Main Research Area: Technical/natural sciences
A new retention index for the central Baltic Sea: long-term hydrodynamic modelling used to improve Baltic sprat, Sprattus sprattus, recruitment models

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Baumann, H. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern), Temming, A. (Ekstern)
Pages: 1-19
Publication date: 2004
Main Research Area: Technical/natural sciences

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

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries- and Monitoring Technology, Section for Population Ecology and Genetics
Pages: 1-41
Publication date: 2004
Main Research Area: Technical/natural sciences

Distribution of herring and sprat in the Baltic Sea in relation to physical features

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Stepputtis, D. (Ekstern), Böttcher, U. (Ekstern), Götte, E. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern)
Publication date: 2004
Estimating Baltic sprat (Sprattus sprattus balticus S.) population sizes from egg production

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Kraus, G. (Intern), Köster, F. (Intern)
Pages: 313-329
Publication date: 2004
Main Research Area: Technical/natural sciences
Feeding ecology of central Baltic Sea herring (Clupea harengus) and sprat (Sprattus sprattus)

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Kornilovs, G. (Ekstern), Fetter, M. (Ekstern), Köster, F. (Intern)
Pages: 1563-1581
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 65
Issue number: 6
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
Fish predation control of key copepod species in the Bornholm Basin

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Temming, A. (Ekstern), Hirche, H. (Ekstern), Stepputtis, D. (Ekstern), Bernreuther, M. (Ekstern), Köster, F. (Intern)
Pages: 15-17
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: GLOBEC International Newsletter
Fish predation control of key copepod species in the Bornholm Basin

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Temming, A. (Ekstern), Hirche, H. (Ekstern), Stepputtis, D. (Ekstern), Bernreuther, M. (Ekstern), Köster, F. (Intern)
Pages: 1-28
Publication date: 2004
Main Research Area: Technical/natural sciences

Fish production and climate: Sprat in the Baltic Sea
Processes controlling the production of new fish (recruitment) are poorly understood and therefore challenge population ecologists and resource managers. Sprat in the Baltic Sea is no exception: recruitment varies widely between years and is virtually independent of the biomass of mature sprat. Sprat is a key prey and predator species in the Baltic ecosystem and is commercially exploited (1.86 X 10(8) kg/yr since 1974). The population and fishery must therefore be managed sustainably and if necessary accommodate environmental effects on population dynamics. We demonstrate using 45 years of data that recruitment depends on temperature conditions during the months when sprat gonads, eggs, and larvae are developing. We also show that recruitment can be predicted before adults spawn (and fully 15 months earlier than using present technology) by using linkages between recruitment, large-scale climate variability (North Atlantic Oscillation), Baltic Sea ice coverage, and water temperature. These relationships increase our understanding of sprat population dynamics and enable a desirable integration of fisheries ecology and management with climatology and oceanography.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern)
Pages: 784-794
Publication date: 2004
Main Research Area: Technical/natural sciences

Fish production and climate: Sprat in the Baltic Sea
Processes controlling the production of new fish (recruitment) are poorly understood and therefore challenge population ecologists and resource managers. Sprat in the Baltic Sea is no exception: recruitment varies widely between years and is virtually independent of the biomass of mature sprat. Sprat is a key prey and predator species in the Baltic ecosystem and is commercially exploited (1.86 X 10(8) kg/yr since 1974). The population and fishery must therefore be managed sustainably and if necessary accommodate environmental effects on population dynamics. We demonstrate using 45 years of data that recruitment depends on temperature conditions during the months when sprat gonads, eggs, and larvae are developing. We also show that recruitment can be predicted before adults spawn (and fully 15 months earlier than using present technology) by using linkages between recruitment, large-scale climate variability (North Atlantic Oscillation), Baltic Sea ice coverage, and water temperature. These relationships increase our understanding of sprat population dynamics and enable a desirable integration of fisheries ecology and management with climatology and oceanography.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern)
Pages: 784-794
Publication date: 2004
Main Research Area: Technical/natural sciences

Fish production and climate: Sprat in the Baltic Sea
Processes controlling the production of new fish (recruitment) are poorly understood and therefore challenge population ecologists and resource managers. Sprat in the Baltic Sea is no exception: recruitment varies widely between years and is virtually independent of the biomass of mature sprat. Sprat is a key prey and predator species in the Baltic ecosystem and is commercially exploited (1.86 X 10(8) kg/yr since 1974). The population and fishery must therefore be managed sustainably and if necessary accommodate environmental effects on population dynamics. We demonstrate using 45 years of data that recruitment depends on temperature conditions during the months when sprat gonads, eggs, and larvae are developing. We also show that recruitment can be predicted before adults spawn (and fully 15 months earlier than using present technology) by using linkages between recruitment, large-scale climate variability (North Atlantic Oscillation), Baltic Sea ice coverage, and water temperature. These relationships increase our understanding of sprat population dynamics and enable a desirable integration of fisheries ecology and management with climatology and oceanography.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern)
Pages: 784-794
Publication date: 2004
Main Research Area: Technical/natural sciences

Fish production and climate: Sprat in the Baltic Sea
Processes controlling the production of new fish (recruitment) are poorly understood and therefore challenge population ecologists and resource managers. Sprat in the Baltic Sea is no exception: recruitment varies widely between years and is virtually independent of the biomass of mature sprat. Sprat is a key prey and predator species in the Baltic ecosystem and is commercially exploited (1.86 X 10(8) kg/yr since 1974). The population and fishery must therefore be managed sustainably and if necessary accommodate environmental effects on population dynamics. We demonstrate using 45 years of data that recruitment depends on temperature conditions during the months when sprat gonads, eggs, and larvae are developing. We also show that recruitment can be predicted before adults spawn (and fully 15 months earlier than using present technology) by using linkages between recruitment, large-scale climate variability (North Atlantic Oscillation), Baltic Sea ice coverage, and water temperature. These relationships increase our understanding of sprat population dynamics and enable a desirable integration of fisheries ecology and management with climatology and oceanography.
Herring and sprat growth changes in the central Baltic Sea

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Kornilovs, G. (Ekstern), Fetter, M. (Ekstern), Köster, F. (Intern)
Pages: 1-25
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2004/
Volume: L:27
Original language: English
Source: orbit

Comparing the feeding habits of co-occurring sprat (Sprattus sprattus) and cod (Gadus morhua) larvae in the Bornholm Basin, Baltic Sea

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Voss, R. (Ekstern), Köster, F. (Intern), Dickmann, M. (Ekstern)
Pages: 97-111
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 63
Issue number: 1
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Developing alternative indices of reproductive potential for use in fisheries management: Case studies for stocks spanning an information gradient

There is accumulating evidence to suggest that spawning stock biomass (SSB) may not be directly proportional to reproductive potential. The wide-ranging implications of this conclusion necessitate that it be tested for as many stocks as possible. Undertaking such tests is complicated by the fact that fish stocks vary in the amount and type of information that is available to estimate reproductive potential. In this review, nine stocks illustrate the range of approaches that are being taken to developing alternative indices of reproductive potential from existing data resources. Three stocks had sufficient data to reconstruct a time series of total egg production (TEP), whereas, the remaining stocks were limited to estimating proxies for stock reproductive potential. For some of the case studies the alternative indices explained a higher amount of recruitment variation than did SSB. Other case studies provided evidence that characteristics of the spawning stock, e.g. age diversity and female-only SSB, influence recruitment in ways that are not properly accounted for by using SSB as the sole index of reproductive potential. This is further evidence that the assumption of proportionality between SSB and TEP is invalid. The data-rich stocks showed the relationship between SSB and TEP to be variable and characterized by distinct time trends. This variability will impact the ability of biomass-based reference points to conserve reproductive potential. Consequently, management protocols should be adapted to incorporate the detailed information on reproductive potential that is increasingly becoming available rather than being restricted to approaches that have been designed for data-poor situations.
Environmental indices in fish stock assessment and management procedures: State of the art in pelagic fish stocks: report of the 2nd meeting of the SPACC/IOC Study Group on "Use of environmental indices in the management of pelagic fish populations" (9-11 November 2002, Paris, France)

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Köster, F. (Intern), Barange, M. (Ekstern), Barange, M. (ed.) (Ekstern)
Number of pages: 19
Publication date: 2003

Publication information
Publisher: [s.n.]
Original language: English
Series: Globec special contribution
Number: 6
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226370
Publication: Research › Report – Annual report year: 2003

Environmental indices in the assessment of Baltic sprat and herring: Report of the 2nd meeting of the SPACC/IOC Study Group on "Use of environmental indices in the management of pelagic fish populations" (9-11 November 2002, Paris, France)

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Köster, F. (Intern), Möllmann, C. (Ekstern), Barange, M. (ed.) (Ekstern)
Number of pages: 39
Publication date: 2003

Publication information
Publisher: [s.n.]
Original language: English
Series: Globec special contribution
Number: 6
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226371
Publication: Research › Report – Annual report year: 2003

Fish stock development in the Central Baltic Sea (1976-2000) in relation to variability in the environment

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries Advice, Section for Population Ecology and Genetics
Authors: Köster, F. (Intern), Möllmann, C. (Ekstern), Neuenfeldt, S. (Intern), Vinther, M. (Intern), St. John, M. (Intern), Tomkiewicz, J. (Intern), Voss, R. (Ekstern), Hinrichsen, H. (Ekstern), Kraus, G. (Intern), Schnack, D. (Ekstern)
Pages: 294-306
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Marine Science Symposia
Interannual variability in population dynamics of calanoid copepods in the Central Baltic Sea

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Köster, F. (Intern), Kornilovs, G. (Ekstern), Sidrevics, L. (Ekstern)
Pages: 220-230
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Marine Science Symposia
Volume: 219
ISSN (Print): 0906-060X
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.32
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
Web of Science (2010): Indexed yes
Web of Science (2009): Indexed yes
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
Source: orbit
Source-ID: 226372
Publication: Research - peer-review › Journal article – Annual report year: 2003
Modelling the influences of atmospheric forcing conditions on Baltic cod early life stages: distribution and drift

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

Publication information
Journal: Journal of Sea Research
Volume: 49
ISSN (Print): 1385-1101
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
Recruitment of Baltic cod and sprat stocks: identification of critical life stages and incorporation of environmental variability into stock-recruitment relationships

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), Schnack, D. (Ekstern), St. John, M. (Intern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Möllmann, C. (Ekstern), Kraus, G. (Intern), Plikshs, M. (Ekstern), Makarchouk, A. (Ekstern), Eero, A. (Ekstern)
Pages: 129-154
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientia Marina
Volume: 67
Issue number: 1
ISSN (Print): 0214-8358
Ratings:
Scientific knowledge on biological processes potentially useful in fish stock predictions

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Köster, F. (Intern), Schnack, D. (Ekstern), Möllmann, C. (Ekstern)
Pages: 101-107
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientia Marina
Volume: 67
The marine copepod, *Pseudocalanus elongatus*, as a mediator between climate variability and fisheries in the Central Baltic Sea

**General information**
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Kornilovs, G. (Ekstern), Fetter, M. (Ekstern), Köster, F. (Intern), Hinrichsen, H. (Ekstern)
Pages: 360-368
Publication date: 2003
Main Research Area: Technical/natural sciences
Biodiversity and species-environment relationships of the demersal fish assemblage at the Great Meteor Seamount (subtropical NE Atlantic), sampled by different trawls

Quantitative data collected with different bottom trawls at the Great Meteor Seamount (subtropical NE Atlantic, 30°N; 28.5°W) in 1967, 1970, and 1998 are compared. Bootstrap estimates of total catch per unit effort increased from 6.96 and 10.8 ind. m\(^{-1}\) h\(^{-1}\) in 1967 and 1970, respectively, to 583.98 ind. m\(^{-1}\) h\(^{-1}\) in 1998. Gear effects and an effect of gear over time accounted for 47.1% and 20% of species variability. Further significant factors were time of day and habitat, while season was not significant. A total of 43 species was collected. Including supplementary species information, a grand total of 46 species was found associated with the Great Meteor Seamount. Diversity was higher in 1967 and 1970 (Shannon's diversity: \(H^'=2.5\) and 1.6) than in 1998 (\(H^'=0.9\)). Species-environment relationships
are discussed in terms of a sound-scattering layer-interception hypothesis, i.e. utilisation of prey from a diurnally moving sound-scattering layer for the bentho-pelagic community. This is probably augmented by concentration effects in a circular current around the seamount (Taylor-column). Long-term changes are discussed with respect to a decrease in biodiversity due to considerable increases in Macroramphosus scolopax and Capros aper. In 1998, the increase of abundance of Trachurus picturatus and the respective decreases for genuine benthic species were likely to have been caused by a change of gear.

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Fock, H. (Ekstern), Uiblein, F. (Ekstern), Köster, F. (Intern), von Westernhagen, H. (Ekstern)
Pages: 185-199
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Biology
Volume: 141
Issue number: 1
ISSN (Print): 0025-3162
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41 SJR 1.198 SNIP 0.993
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.315 SNIP 0.932 CiteScore 2.21
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.204 SNIP 1.041 CiteScore 2.32
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.272 SNIP 1.064 CiteScore 2.4
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.306 SNIP 1.107 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.145 SNIP 1.073 CiteScore 2.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.235 SNIP 1.069
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.178 SNIP 1.052
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.236 SNIP 1.022
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.348 SNIP 1.21
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.195 SNIP 1.09
Biophysical modelling of larval Baltic cod (Gadus morhua) survival and growth

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Hinrichsen, H. (Ekstern), Möllmann, C. (Ekstern), Voss, R. (Ekstern), Köster, F. (Intern), Kornilovs, G. (Ekstern)
Pages: 1858-1873
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 59
Issue number: 12
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Egg production of Baltic cod in relation to variable sex ratio, maturity and fecundity

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Kraus, G. (Intern), Tomkiewicz, J. (Intern), Köster, F. (Intern)
Pages: 1908-1920
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 59
Issue number: 12
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Long-term trends in abundance of cladocerans in the Central Baltic Sea

Long-term dynamics (1960-1997) of the cladoceran species Bosmina coregoni maritima, Evadne nordmanni and Podon spp. are described for the Gdansk Deep and the Gotland Basin (Central Baltic Sea). By using correlation analyses on seasonal time-series, the influence of temperature and salinity on the abundance of cladoceran species was investigated. A clear affinity to higher temperature was found for B. coregoni maritima in summer as well as for E. nordmanni and Podon spp. in spring. In addition to temperature, association tests with salinity revealed besides species-specific preferences, regional and temporal differences. Contrary to B. coregoni maritima, both other species were positively
associated to salinity in summer and autumn in the Gdansk Deep. In the Gotland Basin only E. nordmanni was positively correlated to salinity in autumn. Differences in the response to hydrographic variables are possibly stage specific, i.e. between resting eggs and adults, or due to a different adaptation to the abiotic environment

**General information**

State: Published  
Organisations: Institute Management, National Institute of Aquatic Resources  
Authors: Möllmann, C. (Ekstern), Köster, F. (Intern), Kornilovs, G. (Ekstern), Sidrevics, L. (Ekstern)  
Publication date: 2002  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Marine Biology  
Volume: 141  
Issue number: 2  
ISSN (Print): 0025-3162  
Ratings:  
BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 2.41 SJR 1.198 SNIP 0.993  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 1.315 SNIP 0.932 CiteScore 2.21  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 1.204 SNIP 1.041 CiteScore 2.32  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 1.272 SNIP 1.064 CiteScore 2.4  
ISI indexed (2013): ISI indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 1.306 SNIP 1.107 CiteScore 2.43  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 1.145 SNIP 1.073 CiteScore 2.22  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.235 SNIP 1.069  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.178 SNIP 1.052  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 2  
Scopus rating (2008): SJR 1.236 SNIP 1.022  
Web of Science (2008): Indexed yes  
Scopus rating (2007): SJR 1.348 SNIP 1.21  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.195 SNIP 1.09  
Web of Science (2006): Indexed yes  
Scopus rating (2005): SJR 1.253 SNIP 1.198  
Web of Science (2005): Indexed yes
Population dynamics of calanoid copepods and the implications of their predation by clupeid fish in the Central Baltic Sea

Population dynamics of major Baltic calanoid copepod species in the Gotland Basin during the last two decades were characterized by a decline of Pseudocalanus elongatus associated with declining salinities, and an increase of Temora longicornis and Acartia spp., potentially due to warmer conditions. Additionally, this study investigated the effect of predation by the major planktivorous fish species herring (Clupea harengus) and sprat (Sprattus sprattus) for the period 1977-1996 in the Gotland Basin (Central Baltic Sea). Examination of consumption by these fish species in relation to copepod production estimates showed a switch by herring from consuming mainly CV/VI of P. elongatus and T. longicornis, to preying on CII of the latter copepod. This switch was potentially due to increased competition with the drastically increased sprat stock since the late 1980s. Further, an increased predation pressure by sprat on CV/CFI of both copepod species in spring resulted in higher copepod mortality rates. In consequence, based on these results we suggest that the increase in the sprat stock since the late 1980s contributed to a decline of P. elongatus, and additionally prevented an even more pronounced temperature-driven increase in the T. longicornis stock, as was observed for Acartia spp., which was not significantly consumed.

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources
Authors: Möllmann, C. (Ekstern), Köster, F. (Intern)
Pages: 959-977
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Plankton Research
Volume: 24
Issue number: 10
ISSN (Print): 0142-7873
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.92 SJR 1.098 SNIP 0.848
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.025 SNIP 0.796 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.095 SNIP 1.255 CiteScore 2.24
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.289 SNIP 1.109 CiteScore 2.39
Resolving the impact of short-term variations in physical processes impacting on the spawning environment of eastern Baltic cod: application of a 3-D hydrodynamic model

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

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

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), St. John, M. (Intern), Schnack, D. (Ekstern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Plikshs, M. (Ekstern)
Pages: 1534-1556
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 58
Issue number: 8
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Developing Baltic cod recruitment models I: Resolving spatial and temporal dynamics of spawning stock and recruitment for cod, herring, and sprat.

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

General information

State: Published

Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Population Ecology and Genetics

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

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

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management, Section for Management Systems, Technical University of Denmark
Authors: St John, M. A. (Ekstern), Mosegaard, H. (Intern), Hinrichsen, H. (Ekstern), Grønkjær, P. (Ekstern), Köster, F. (Intern), Hüssy, K. (Intern), Nielsen, J. R. (Intern)
Pages: 1-25
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 227509
Publication: Research - peer-review › Journal article – Annual report year: 2001

Recruitment of Baltic cod and sprat stocks: Identification of critical life stages and incorporation of environmental variability and spatial heterogeneity into stock-recruitment relationships

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), Schnack, D. (Ekstern), St. John, M. (Intern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Möllmann, C. (Ekstern), Kraus, G. (Intern), Plikshs, M. (Ekstern), Makarchouk, A. (Ekstern)

Trophodynamic control on recruitment success in Baltic cod: the influence of cannibalism

Cod is the top piscivore predator in the Baltic Sea ecosystem. Based on stomach content data from 62427 cod collected during 1977-1994 and food consumption rates, cannibalism in the Eastern and Western Baltic cod stocks has been quantified using multispecies virtual population analysis. In the Eastern Baltic stock, depending on model assumptions, an average of 25-38% of the 0-group and 11-17% of the 1-group were removed by predation by adults. Thus, between age 0 and age 2 a year class may lose on average about 31% and 44% of the initial number as a result of cannibalism. Cannibalism is lower in the Western Baltic. On average, 19% of the 0-group and 9% of the 1-group are consumed per year, i.e. 24% of the initial cohort is eaten before reaching age 2. Predation was most intense in 1978-1984, a period with high juvenile abundance and large adult stock sizes in both areas. Subsequently, stock, recruitment, and cannibalism declined steadily until the early 1990s and then increased again. Problems identified in relation to data compilation and estimation procedure are discussed with respect to their impact on estimates of cannibalism and stock-recruitment relationships. (C) 2000 International Council for the Exploration of the Sea.
Baltic cod reproduction in the Gotland Basin: annual variability and possible causes

**General information**
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Plikshs, M. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern), Tomkiewicz, J. (Intern), Berzins, V. (Ekstern)
Pages: 1-26
Publication date: 1999
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICES CM 1999/
Volume: Y:31
Original language: English
Source: orbit
Source-ID: 227140
Publication: Research - peer-review › Journal article – Annual report year: 2000

Does spatial match-mismatch of spawning and environmental conditions and recruitment in Baltic cod?

**General information**
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Plikshs, M. (Ekstern), Köster, F. (Intern), Hinrichsen, H. (Ekstern)
Pages: 1-12
Publication date: 1999
Stock-recruitment relationships of Baltic cod incorporating environmental variability and spatial heterogeneity

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Authors: Köster, F. (Intern), Hinrichsen, H. (Ekstern), St. John, M. (Intern), Schnack, D. (Ekstern), MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Plikshs, M. (Ekstern)
Pages: 1-20
Publication date: 1999
Main Research Area: Technical/natural sciences

Summary of environmental conditions relevant to cod and sprat biology in the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern), Hinrichsen, H. (Ekstern)
Number of pages: 26
Publication date: 1999

Quantifying and disaggregating the spawner effect: Incorporating stock structure, spatial distribution and female influences into estimates of annual population egg production

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Köster, F. (Intern), Nissling, A. (Ekstern)
Pages: 1-23
Publication date: 1998
Main Research Area: Technical/natural sciences
Size and visibility of Baltic cod eggs with reference to size-selective and stage-dependent predation mortality

Size of Baltic cod eggs from incubation experiments and from field samples was determined by microscopic analysis. Results from plankton samples were compared with corresponding size distributions of cod eggs found in herring stomachs. The influence of fixation on size of different developmental stages was studied. Live eggs from incubation experiments were also sized repeatedly throughout the developmental period with an optical plankton counter (OPC) based on light attenuation measurements as this was assumed to be more closely related to the visibility of the eggs for potential predators than egg diameter as obtained by microscopic analysis. Preservation in formaldehyde solution caused a small reduction in egg diameter (2.2%) whereby no differences between the developmental stages were detected. Egg size decreased slightly during incubation (6.9%) while the OPC measurements revealed a substantial increase in light attenuation during egg development (42.2%). In the field, a general decrease in egg size with increasing depth was observed while no change between the developmental stages was detectable. The mean size of eggs ingested by herring was slightly lower than in the water column which was most pronounced for the late stages containing a well-developed embryo. The frequency of eggs in an advanced stage of development was considerably higher in the stomachs than in corresponding plankton samples. Therefore, it is suggested that the selection of further developed egg stages by predatory fish in the central Baltic Sea, i.e. herring and sprat, is due to an increase of visibility during egg development in relation to growth and pigmentation of the embryo. Thus it is likely that egg mortality due to predation is stage-dependent rather than strictly size-selective.
Baltic cod recruitment project

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

Publication information
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
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 zoo-, 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.
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.
Externally driven mortality of Eastern Baltic cod early life stages: Impact of predation and hydrography

National Institute of Aquatic Resources
Period: 01/02/2011 → 30/08/2017
Number of participants: 6
Phd Student:
Neumann, Viola (Intern)
Supervisor:
Eero, Margit (Intern)
Main Supervisor:
Köster, Fritz (Intern)
Examiner:
MacKenzie, Brian (Intern)
Grønkjær, Peter (Ekstern)
Kraus, Gerd (Intern)

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

Development of ecological sustainable fisheries practices in the Benguela Current Large Marine Ecosystem (EcoFish) (38847)
EcoFish promotes the ecosystem approach to fisheries (EAF) and is conducted in the Benguela Current Large Marine Ecosystem (BCLME), encompassing fish stocks from Angola, Namibia and South Africa.

The objectives are:
1. Adaptation of state-of-art assessments methods and Marine Protected Areas (MPA) planning tools
2. Validation or modification of current assessment practices based on spatially explicit analyses
3. Incorporation of stakeholders’ knowledge in data collection and analysis
4. Strengthening of regional capacity to apply the developed assessment tools on a regular basis.

The project represents a paradigm shift compared to DTU Aqua 20 years of FAO/Danida courses in the 80’s and 90’s, where fish stock assessment was taught in 85 countries by using comparative simple techniques. In contrast EcoFish applies advance stock assessment methodology based on open access, web-based state space (SAM) and geostatistical (GeoPop) tools. Thus the capacity building involved also includes a focus on DTU Aqua because of similar ongoing challenges in the Nordic seas, and two DTU Aqua PhD projects are integrated in EcoFish.

Focus in Ecofish is on hake, horse mackerel and sardinella, coordination to important donor projects in the area such as the Norwegian climate project NansClim and EAF-Nansen is ensured through the leadership of Benguela Current Commission. There are potential synergies to several EU projects (FP6 IMAGE, FP7 MEECE and FP7 FACTS) as well as national projects such as Sunfish (Description of the life cycle and recruitment of cod) and REX/RESOURCE (fishermen-science collaboration on cod in the North Sea). The potential database for BCLME is unique and EcoFish offers the possibility for developing a master example to be used as a generic tool in African Large Marine Ecosystems as well as the large lakes.

The project is coordinated by Benguela Current Commission, Namibia.

The project is funded by EuropeAid.

National Institute of Aquatic Resources
Section for Marine Living Resources
Benguela Current Commission
Institute National Investigacao Pescas
National Marine Information and Research Centre
Marine and Coastal Management
University of Cape Town
University of Stellenbosch

Period: 01/01/2011 → 31/12/2015
Number of participants: 4
Research areas: Marine Living Resources & Marine Population and Ecosystem Dynamics

Project participant:
Wieland, Kai (Intern)
Jansen, Teunis (Intern)

Project Manager, organisational:
Köster, Fritz (Intern)

Project Manager, academic:
Beyer, Jan (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)

European basin-scale analysis, synthesis and integration (EURO-BASIN) (38899)

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

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

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

The project was coordinated by DTU Aqua.

The project was funded by EU, Framework Programme 7.

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

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

Marine snow, zooplankton and thin layers: indications of a trophic link from small-scale sampling with the Video Plankton Recorder

Bridging the gap between marine biogeochemical and fisheries sciences; configuring the zooplankton link

Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts

Population structure of Atlantic Mackerel (Scomber scombrus)

Press / Media items:

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

Project

Towards an integrated marine and maritime science community (MARCOM+) (38881)

The Aberdeen plus interest group joined forces with the Venice Platform group to take further steps in integrating the marine, maritime and coastal research sectors in Europe. The goal is to establish a sustainable and long-lasting partnership forum (European Marine and Maritime Science and Technology Forum), based on shared interests and shared leadership, and to test it on regional seas and pan-European basis. The process will contribute to developing interactions between partners (the research community, industry, regional authorities, civil society and other stakeholders) starting from regional scales to broader issues shared with EU-neighboring countries.

In the project DTU Aqua is representing the European Fisheries and Aquaculture Organization (EFARO).

The project is coordinated by International Council for the Exploration of the Sea (ICES).

National Institute of Aquatic Resources

Research Secretariat

International Council for the Exploration of the Sea

Coastal and Marine Union

European Council for Maritime Applied R&D Association (representing the Waterborne Technology Platform)

Marine Board – European Science Foundation

European Aquaculture Technology and Innovation Platform

Hellenic Centre for Marine Research

Royal Netherlands Academy of Arts and Sciences (representing the European Network of Marine Research Institutes and Stations MARS)

Community of European Shipyards Associations

Mediterranean Science Commission

Period: 01/01/2010 → 15/04/2012

Number of participants: 2

Research area: Ecosystem Based Marine Management

Project participant:

Köster, Fritz (Intern)

Lisbjerg, Dennis (Intern)

Project

Building scenarios for marine ecosystems under anthropogenic and natural forcings (EurOceans Consortium) (38779)

The aim of the EUR-OCEANS Consortium was to favor joint initiatives between key Research Performing Organizations (RPOs) and Research Funding Organizations (RFOs) across Europe, to help the community make significant jumps in marine sciences during the next decades. This was implemented by organizing and sponsoring activities with a clear focus on relevant marine science "hot topics" leading to wider European (FP8, JPI) projects. These activities included Gordon-like conferences, flagship programs, foresight workshops and public outreach. The focus of the Consortium was on the impact of climate/global change on marine ecosystems, and the construction of scenarios relevant to the emerging International Platform on Biodiversity and Ecosystem Services (iPBes).

A number of activities were funded in EUROCEANS with major impacts in term of new scientific publications, international training networks and other EU and Nationally funded projects. The EUROCEANS Consortium merged with similar initiatives in other marine research fields (i.e., MARBEF+ and Marine Genomics) to establish first a Consortium for a
Collective Support Action under the FP7 program (called EUROMARINE) and then the integrated European Marine Network: EUROMARINE covering research topics from genes to ecosystems under changing oceans.

The Consortium had over 25 European universities and research institutions covering all of Europe and a broad spectrum of marine ecology disciplines.

The project was coordinated by Institut de Recherche pour le Développement, France.

The project was self-funded.

National Institute of Aquatic Resources

Section for Marine Ecology and Oceanography
Period: 01/01/2009 → 31/12/2012
Number of participants: 2
Research area: Oceanography
Contact person:
Mariani, Patrizio (Intern)
Project participant:
Köster, Fritz (Intern)

Marine ecosystem evolution in a changing environment (MEECE) (38131)

In order to advance our understanding and the predictive capacities necessary to resolve how marine ecosystems will respond to global change MEECE employed a combination of data synthesis, numerical simulation and targeted experimentation to further our knowledge of how marine ecosystems will respond to combinations of these climate change and anthropogenic drivers.

A key objective of MEECE was to advance model coupling across trophic levels and create concepts and infrastructure to enable end-to-end modeling, from physics to fish, which has empirically been difficult due to different space and time scales involved, as well as relative emphasis of statistical and mechanistic aspects. Finally MEECE integrated modeling advancements with fishery management perspectives.

The project was coordinated by Plymouth Marine Laboratory, UK, and had 21 partners from the EU.

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources

Section for Marine Living Resources
Period: 01/01/2008 → 15/10/2012
Number of participants: 11
Research areas: Marine Living Resources & Marine Populations and Ecosystem Dynamics & Fisheries Management
Acronym: MEECE
Contact person:
Christensen, Asbjørn (Intern)
Project participant:
Vinther, Morten (Intern)
Neuenfeldt, Stefan (Intern)
MacKenzie, Brian (Intern)
Nielsen, J. Rasmus (Intern)
Eero, Margit (Intern)
Andersen, Ken Haste (Intern)
Bastardie, Francois (Intern)
Neumann, Viola (Intern)
Grigorov, Ivo (Intern)
Project Manager, academic:
Köster, Fritz (Intern)

Relations
Publications:
Should “Citizen Scientists” play with climate & ecosystem models?
Project
Resolving climatic impacts on fish stocks (RECLAIM) (38109)
Climate change will impact fisheries resources and challenge managers to develop sustainable exploitation strategies. Knowledge on the impacts of climate on fisheries resources is still fragmentary.

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

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

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

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

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

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

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

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

Indicators for fisheries management in Europe (IMAGE) (38225)
The Common Fisheries Policy (CFP) requires the progressive implementation of an ecosystem-based approach to fisheries management (EBFM). To implement effective management, it is essential to develop a framework that allows for the evaluation of different management strategies based on indicators. Indicators can support the decision making process by (i) describing the pressures affecting the ecosystem, the state of the ecosystem and the response of managers, (ii) tracking progress towards meeting management objectives and (iii) communicating trends in complex impacts and management processes to a non-specialist audience. The aim of this project was to develop an indicator-based operational framework that can support ecosystem-based management, and also show how this can be applied to test and evaluate different management strategies or sampling programs.
The principal objectives of IMAGE were:-To develop an operational framework of candidate indicators (ecological, economic, social) that can support ecosystem-based fisheries management at the regional and pan-European scale-To elaborate these indicators in comprehensive dashboards (e.g. current values, trends, reference levels)-To develop methodology to integrate this information into tools supporting the decision-making process-To develop a framework that can evaluate management strategies based on indicators-To advise on how indicators can be used to support EBFM in selected regional case studies based on the RAC areas.

The project consisted of a conceptual phase where the operational framework was designed. This was followed by a phase of methodology development, an implementation phase consisting of regional case studies linked to the RACs and finally a pan-European evaluation and synthesis of the projects results. The results of this project contribute to the development of an effective EBFM in the context of the CFP, while also contributing to the applied science needed to support the emerging European Marine Strategy and Maritime Policy.

The project was coordinated by Institute for Marine Resources and Ecosystem Studies (IMARES), The Netherlands.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
IFREMER
Aalborg University
COISPA Tecnologia & Ricerca

University of Tartu
Period: 01/01/2006 → 31/12/2009
Number of participants: 11
Research area: Ecosystem Based Marine Management
Contact person:
Nielsen, J. Rasmus (Intern)
Köster, Fritz (Intern)
Project participant:
Jarre, Astrid (Intern)
Bastardie, Francois (Intern)
Andersen, Ken Haste (Intern)
Serensen, Thomas Kirk (Intern)
Mosegaard, Henrik (Intern)
Thomsen, Kirsten (Intern)
Tomczak, Maciej (Ekstern)
Jacobsen, Jonathan Broch (Ekstern)
Project Manager, academic:
Eero, Margit (Intern)
Project

**Understanding the mechanisms of stock recovery (UNCOVER) (38104)**

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

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

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

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

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

National Institute of Aquatic Resources
Section for Marine Living Resources
Bundesforschungsanstalt für Fischerei
Marine Research Unit, Marine and Food Technological Centre
Cefas
University of Portsmouth
Marine Laboratory
Instituto Español de Oceanografía
Aalborg University
Leibniz Institut für Meereswissenschaften, Universität Kiel
IFREMER
Institute of Marine Research
Sea Fisheries Institute
Knipovich Polar Research Institute of Marine Fisheries and Oceanography
Nederlands Instituut voor Visserij Onderzoek b.v.
University of Aberdeen
University of Bergen
University of Hamburg
Period: 01/01/2006 → 31/12/2010
Number of participants: 14
Research areas: Marine Living Resources & Fish Biology
Contact person:
Köster, Fritz (Intern)
Project participant:
Tomkiewicz, Jonna (Intern)
Vinther, Morten (Intern)
Payne, Mark (Intern)
Munk, Peter (Intern)
Stettrup, 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)
**Baltic Sea management: Nature conservation and sustainable development of the ecosystem through spatial planning (BALANCE) (38432)**

BALANCE aimed to develop transnational marine spatial planning tools and an agreed template for marine management planning and decision-making. It was based on four transnational pilot areas demonstrating the economical and environmental value of habitat maps and marine spatial planning (exemplified through two zoning plans). The tools and zoning plans integrated biological, geological and oceanographic data with local knowledge from stakeholders. A "blue corridor" concept was developed and promoted, i.e. between protected sites adding spatial development dimensions to the implementation of EU Directives. As a part of this work it was assessed if the Baltic marine Natura 2000 network is ecologically coherent and adequately represents and protects a continuum of habitats. A communication strategy was developed for stakeholder involvement to ensure that objectives and decisions address local stakeholders’ needs.

Spatial planning tools included Baltic Sea marine landscapes presented in GIS maps, a holistic approach to marine habitat mapping integrating data on benthic, pelagic and fish habitats in four transnational pilot areas, development of habitat models for areas with little biological information, templates for zoning plans in two pilot areas, including planning guidelines and criteria to evaluate management success, meta-database for Baltic Sea marine data, outlining data formats, techniques and data availability for use by stakeholders in future planning, development of agreed protocols for habitat mapping based on intercalibration of existing national protocols, ensuring compatible data for future transnational mapping.

DTU Aqua was mainly involved in habitat modelling (coastal and pelagic fish habitats) and in development of marine spatial planning and management frameworks.

In addition to DTU Aqua, 23 partners were involved in the BALANCE project, i.e. representing governmental and non-governmental organizations and research institutes from the entire Baltic region in the fields of biology/ecology, fisheries and geology.

The project was coordinated by DTU Aqua.

**Critical interactions between species and their implications for a precautionary fisheries management in a variable environment – a modeling approach (BECAUSE) (38613)**

Across Europe, the population of predatory fish has fallen dramatically in recent years. This has reduced the predation rate and the prey species has remained fairly stable. Therefore the balance between predators and prey species has been radically changed. No accurate scientific picture of the exact interactions between these species and their effects on non-commercial top predators is available. To maintain biodiversity and make recovery plans more effective, such an understanding is vital.

The sustainable management of European fisheries requires an adaptive approach that takes into account the long term dynamics of the entire marine ecosystem so as to protect the biodiversity of our seas. BECAUSE investigated the interaction between predator and prey, and the shifts in their relative populations and looked into how fishing affects the balance of the marine food chain. The interactions targeted for investigation included sandeel/predator fish, predators and prey of cod, and hake/prey fish.

Contributions to the policy development aimed at integrating a sustainable ecosystem approach into the EU’s Common
Fisheries Policy (CFP) thereby helping the EU to meet its global fishing commitments and underwrite the sustainability of ecosystem services. Multi-species fisheries assessment were improved and enhanced policy and management measures to replenish fish stocks and ensure high yields were proposed.

The was coordinated by Universität Hamburg, Germany.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Universität Hamburg
Marine and Food Technological Centre
Cefas
Finnish Game and Fisheries Research Institute
Marine Scotland
Marine Research Institute
Leibniz Institute of Marine Sciences
IFREMER
Consejo Superior de Investigaciones Cientificas
Institute of Marine Research
National Centre for Marine Research
Sea Fisheries Institute
Sapienza University of Rome
University of St Andrews
Latvian Fish Resources Agency
Instituto Español de Oceanografía
Period: 01/01/2004 → 31/12/2007
Number of participants: 6
Research area: Marine Living Resources
Contact person:
Köster, Fritz (Intern)
Project participant:
Tomkiewicz, Jonna (Intern)
Neuenfeldt, Stefan (Intern)
Rindorf, Anna (Intern)
Christensen, Asbjørn (Intern)
Project Manager, organisational:
Vinther, Morten (Intern)
Project

European advisory system evaluation (EASE) (2194)
The overall objective was to set up the basis for more appropriate data collection and analysis programs in order to support existing and emerging fishery management issues. The present data and advisory structures have developed by a process of evolution and involve considerable commitment of human and financial resources. In general these resources are in short supply and may be declining. It is no longer clear whether present systems can be maintained or whether they are appropriate for emerging issues, notably those relating to a more holistic approach to fishery management.

The first objective of the concerted action was to understand the current balance between resources devoted to data collection and value of these data in the provision of advice. This required the evaluation of the range of advice requested on fishery management and the data needs to perform the science to support it. Of particular importance is the basic fisheries data on catch composition according to species, size or age and commercial catch per unit of effort (CPUE) according to fleet since these are used in almost all analyses. However other types of necessary data have also been included, e.g. research vessel CPUE, stock structure according to size or age, weight and maturity at age.

The second objective was to quantify the quality of the scientific outputs derived from the data inputs. Since much advice is qualitative and relies on expert judgement, this objective was focussed to quantifying the reliability of routine annual
stock assessments upon which advice is formulated.

The third objective was to identify alternative uses of data and alternative analytical methods which could support present fishery management needs as well as those which could address new and emerging issues, such as multi-annual decision rules and mixed fisheries issues.

The fourth and final objective was to analyse ways of re-deploying existing resources in order to support a modern fishery management system. With focus on where data collection should be improved and rationalisation of the deployment of current resources to improve efficiency scope for re-deployment of resources to address emerging management advisory needs, such requirements of effort management systems and the implementation of the ecosystem approach to fisheries management.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Swedish National Board of Fisheries
Institute of Marine Research
Netherlands Institute for Fisheries Research
Cefas
Marine Scotland Science
Marine Institute
IFREMER
Ecole Nationale Supérieure Agronomique
Instituto Español de Oceanografía
Instituto Português de Investigação das Pescas e do Mar
Bundesforschungsanstalt für Fischerei
Finnish Game and Fisheries Research Institute
Marine Research Institute
Fisheries Research Station
Period: 01/01/2002 → 31/12/2006
Number of participants: 2
Research area: Fisheries Management
Contact person:
Köster, Fritz (Intern)
Nielsen, J. Rasmus (Intern)

Project

**Environmental and Fisheries Influences on Fish Stock Recruitment in the Baltic Sea (STORE)**

The objectives of the research project are to:

1. Determine stock-recruitment relationships for Baltic cod and sprat in relation to key environmental factors influencing the production of viable spawn and the survival of early life history stages.

2. Improve short-term predictions of stock development by integrating recruitment estimates based on the present status of the stock and its biotic and abiotic environment.

3. Develop predictive recruitment models for medium- to long-term forecasts of stock development under different environmental and fishery scenarios.

4. Estimate biological management reference points, critical stock limits and target spawning stock sizes based on stock-recruitment relationships and stock development simulation models, and considering the precautionary approach for fisheries management.

National Institute of Aquatic Resources
Institute of Marine Sciences, Kiel
Finnish Game and Fisheries Research Institute
Gotland University College
Baltic Sea Research Institute

Federal Research Centre for Fisheries, Institute for Baltic Sea Fishery
Period: 01/01/1999 → 30/06/2002
Number of participants: 1
Project participant: Köster, Fritz (Intern)
Documents:
Final STORE Project Report
Final STORE Project Report - Tables and figures

Activities:

ICES - Bureau meeting - BUREAU (External organisation)
Period: 2012 → …
Fritz Köster (Participant)
National Institute of Aquatic Resources
Institute Management
Degree of recognition: International

Related external organisation

ICES - Bureau meeting - BUREAU
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Bureau Meeting (External organisation)
Period: 2012 → …
Fritz Köster (Participant)
National Institute of Aquatic Resources
Institute Management
Degree of recognition: International

Related external organisation

ICES - Council Meeting (External organisation)
Period: 2012 → …
Fritz Köster (Participant)
National Institute of Aquatic Resources
Institute Management
Degree of recognition: International

Related external organisation

ICES - Council Meeting
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar