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

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

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Institute Management
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Hypoxic areas, density-dependence and food limitation drive the body condition of a heavily exploited marine fish predator

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

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Connecting the seas of Norden: Commentary

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Bergen Marine Research Cluster, Stockholm University, Åbo Academy University, Lund University, University of Oslo, University of Bergen, University of Helsinki, University of Akureyri
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Review of environmental factors influencing distributions of selected Baltic species: Report: BIO-C3 Deliverable, D1.1. EU Bonusproject BIO-C3

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

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Neuenfeldt, S. (Intern), Gårdmark, A. (Ekstern), Muller-Karulis, B. (Ekstern), Hinrichsen, H. H. (Ekstern), Möllmann, C. (Ekstern), Uusitalo, L. (Ekstern), Holmgren, N. (Ekstern), Norrström, N. (Ekstern), Large, S. (Ekstern), Tomczak, M. (Ekstern)
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Small-scale distribution of Baltic sprat: Statistical properties of school height, length and biomass imply school formation and species interaction mechanisms

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A demonstration of an integrated ecosystem assessment and advice for Baltic Sea fish stocks

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Kiel, University of Hamburg, Stockholm University, Lund University
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A metacommunity perspective on source-sink dynamics and management: the Baltic Sea as a case study
The degree to which metapopulation processes influence fish stock dynamics is a largely unresolved issue in marine science and management, especially for highly mobile species such as Atlantic cod (Gadus morhua) and herring (Clupea harengus). The Baltic Sea comprises a heterogeneous oceanographic environment that structures the spatial and temporal distribution of the dominant species cod, herring, and sprat (Sprattus sprattus). Despite local differences, the stocks are traditionally managed as homogeneous units. Here, we present a metacommunity-perspective on source–sink dynamics of Baltic Sea fish stocks by using a spatially disaggregated statistical food web model. The model is fitted to area-specific time series of multiple abiotic and biotic variables using state-space methods. Our analysis reveals pronounced net fluxes between areas, indicative of source–sink dynamics, as well as area-specific differences in species interactions (i.e., density dependence, competition, and predator–prey) and the degree of fishing and climate impact on survival and recruitment. Furthermore, model simulations show that decreasing exploitation pressure in the source area for cod (without reallocating fishing effort) produces an increase in neighboring sink habitats, but a decline of prey species in response to increased predation. Our approach provides valuable insight concerning metacommunity-structuring of marine fish and may serve as an important tool for implementing sustainable management strategies under the ecosystem approach to marine and fisheries management

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Implementing ecosystem-based fisheries management: from single-species to integrated ecosystem assessment and advice for Baltic Sea fish stocks

Theory behind ecosystem-based management (EBM) and ecosystem-based fisheries management (EBFM) is now well developed. However, the implementation of EBFM exemplified by fisheries management in Europe is still largely based on single-species assessments and ignores the wider ecosystem context and impact. The reason for the lack or slow implementation of EBM and specifically EBFM is a lack of a coherent strategy. Such a strategy is offered by recently developed integrated ecosystem assessments (IEAs), a formal synthesis tool to quantitatively analyse information on relevant natural and socio-economic factors, in relation to specified management objectives. Here, we focus on implementing the IEA approach for Baltic Sea fish stocks. We combine both tactical and strategic management aspects into a single strategy that supports the present Baltic Sea fish stock advice, conducted by the International Council for the Exploration of the Sea (ICES). We first review the state of the art in the development of IEA within the current management framework. We then outline and discuss an approach that integrates fish stock advice and IEAs for the Baltic Sea. We intentionally focus on the central Baltic Sea and its three major fish stocks cod (Gadus morhua), herring (Clupea harengus), and sprat (Sprattus sprattus), but emphasize that our approach may be applied to other parts and stocks of the Baltic, as well as other ocean areas

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Seasonal migration, vertical activity and winter temperature experience of Greenland halibut Reinhardtius hippoglossoides (Walbaum) in West Greenland waters

The deep-water flatfish Greenland halibut Reinhardtius hippoglossoides (Walbaum) is common along the West Greenland coast. In the northwestern fjords, Greenland halibut is an important socio-economic resource for the Greenland community, but due to the deep and partly ice-covered environment, very little is known about its behavior and habitat characteristics. We tagged adult Greenland halibut in the waters off Ilulissat with electronic data storage tags that collected information on depth, temperature, and time. Although clear differences between individuals in migration and vertical behavior were present, we discovered a consistent seasonal migration from the relatively shallow-water Disko Bay area into the deep waters of the Ilulissat Icefjord, where the fish resided in the winter months before returning to Disko Bay. Vertical activity was pronounced at both locations, with fish covering vertical distances of up to 100 m within 15 min. During the winter months, the fish experienced temperatures between ca. 0 and 4°C, with most experiencing temperatures of 2 to 3°C. Irrespective of year and quarter of the year, the fish experienced warmer water and a broader range of temperatures when resident in Disko Bay (mean range 2.6°C) than when resident in the ice fjord (mean range 1.4°C). Using the tagged halibut as a 'live tool,' we show that parts of the ice fjord are hundreds of meters deeper than previously thought. We also document the first seawater temperature measurements made beneath the Jakobshavn Isbræ outlet glacier, revealing a positive relationship between depth and temperature for the upper 600 m and a between-year variation in temperatures beneath the ice sheet in 2001, 2002, and 2003.
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 applying an integrated ecosystem approach which utilizes synergies in natural and technical sciences 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 for 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 methods, 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.

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Authors: Neuenfeldt, S. (Intern), Köster, F. (Intern)
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Analysing migrations of Atlantic cod Gadus morhua in the north-east Atlantic Ocean: Then, now and the future
The application of data storage tags bears the potential for a quantum leap in the research on fish migrations, because not only first-capture and recapture positions are known, but at least theoretically, the migration path during the period at large can be reconstructed. Position, however, cannot be measured directly but has to be estimated using the available data on light, temperature, pressure and salinity. The reconstructed locations based on advanced estimation techniques have been termed geolocations. Examples are discussed which illustrate the applicability of geolocations in individual path descriptions, separation of reproductively isolated populations, timing and areas of spawning, tidal transport and use of protected areas. The examples are based on archival tag data from the North Sea, the Baltic Sea, the Barents Sea and Faroese and Icelandic Waters. Besides presenting the state-of-the-art geolocations for cod Gadus morhua in the north-east Atlantic Ocean, the major aim of this review is to raise awareness of gaps in knowledge and to identify ideas for new research.

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Biological ensemble modeling to evaluate potential futures of living marine resources

Natural resource management requires approaches to understand and handle sources of uncertainty in future responses of complex systems to human activities. Here we present one such approach, the "biological ensemble modeling approach," using the Eastern Baltic cod (Gadus morhua callarias) as an example. The core of the approach is to expose an ensemble of models with different ecological assumptions to climate forcing, using multiple realizations of each climate scenario. We simulated the long-term response of cod to future fishing and climate change in seven ecological models ranging from single-species to food web models. These models were analyzed using the "biological ensemble modeling approach" by which we (1) identified a key ecological mechanism explaining the differences in simulated cod responses between models, (2) disentangled the uncertainty caused by differences in ecological model assumptions from the statistical uncertainty of future climate, and (3) identified results common for the whole model ensemble. Species interactions greatly influenced the simulated response of cod to fishing and climate, as well as the degree to which the statistical uncertainty of climate trajectories carried through to uncertainty of cod responses. Models ignoring the feedback from prey on cod showed large interannual fluctuations in cod dynamics and were more sensitive to the underlying uncertainty of climate forcing than models accounting for such stabilizing predator–prey feedbacks. Yet in all models, intense fishing prevented recovery, and climate change further decreased the cod population. Our study demonstrates how the biological ensemble modeling approach makes it possible to evaluate the relative importance of different sources of uncertainty in future species responses, as well as to seek scientific conclusions and sustainable management solutions robust to uncertainty of food web processes in the face of climate change.

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Can IBMs tell us why some cod undertake vertical (feeding) migrations into hypoxic waters?

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Identification of seasonal migration, vertical activity and thermal experience of Greenland halibut Reinhardtius hippoglossoides (Walbaum) in west Greenland waters

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Individual behaviour of Baltic cod (Gadus morhua) in relation to sex and reproductive state
Information from data storage tags (DSTs) is conventionally used to infer movement patterns or reveal characteristics (e.g. temperature or salinity) of the environment surrounding tagged fish. Here we link data derived from DSTs with the
reproductive physiology of tagged fish. Individual vertical activity of adult male and female Atlantic cod Gadus morhua L. in the Bornholm Basin was derived from DST measures and related to the individual histologically determined reproductive phase. Spawning migrations were identified by movements towards deeper and more saline waters. No difference was observed between sexes in the timing of the onset of migration and the duration of migration from feeding grounds to the spawning area. While there was no significant difference in duration of the spawning period between females and males, the histological indices suggest that females finish spawning before males. Irrespective of gender, vertical swimming activity was most pronounced during spawning, with descents towards the bottom dominating the movements. During spawning, males stayed significantly deeper than females. In conclusion, the present results suggest that initiation of spawning migration and duration of the spawning period differs between sexes, as does the level of activity during spawning events. Not all individuals followed the general pattern; a considerable number of individuals were found to spawn in shallow water in the Arkona Basin, and juvenile fish undertook the migration without spawning.

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Spawning migration and behavior of Baltic cod (Gadus morhua) based on DST-derived individual information

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Authors: Behrens, J. (Intern), Nielsen, B. (Ekstern), Hüsey, K. (Intern), Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Tomkiewicz, J. (Intern)
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Correlations between hemoglobin type and temperature preference of juvenile Atlantic cod Gadus morhua

Atlantic cod (Gadus morhua L.) exhibits polymorphic hemoglobin variants with the HbI locus showing a strong North-South geographic cline in frequency distribution of three main types (1/1, 1/2 and 2/2). This may indicate selective advantages of the different HbI types under various temperature regimes. Despite this only one study has directly examined the temperature preference of the two homozygous types, HbI-1/1 and HbI-2/2, whereas the preference of the heterozygote (HbI-1/2) has never previously been addressed.

By exposing fish to a 4–19 °C temperature gradient in an annular preference chamber we recorded the preferred temperature of wild juvenile G. morhua of all three main Hbl types originating from an area where they co-exist. HbI-2/2 G. morhua preferred significantly cooler water (8.9±0.2 °C) compared to the HbI-1/1 group (11±0.6 °C), this difference, however, not being as distinct as previously reported. There was pronounced inter-individual variation in the temperature preference of the Hbl-1/2 G. morhua ranging between 6.7 and 13.8 °C, and their overall preference (10.5±0.9 °C) did not differ significantly from either of the homozygous Hbl types.

Notably, the mean range of utilized temperature (temperature span between 1st and 3rd quartile) was very similar between all 3 Hbl types with 3.2–3.5 °C. Considering the complexity of a trait like temperature preference, there are clearly many other factors besides Hbl type that influence the thermal biology of cod, and therefore we also investigated possible associations between genotype and temperature preference for 12 variable candidate gene single nucleotide polymorphisms (SNPs) a priori expected to be related to growth and reproduction. There were, however, no significant correlations between temperature preference and any of the candidate gene SNPs indicating that none of these polymorphisms strongly associates with thermal behavior. Considering however the high-throughput genotyping methods becoming increasingly accessible there is great potential for association studies involving many more genetic markers to identify additional genetic polymorphisms that are important for temperature preference in G. morhua. In conclusion, we support the notion of a ‘warm’ (Hbl-2/2) and a ‘cold’ (Hbl-1/1) Hb type, although we suggest the difference to be more subtle than previously reported. Furthermore Hbl-1/2 G. morhua shows rather inconsistent thermoregulatory behavior. To obtain a more definitive picture of the extent to which thermal niches are realized under natural conditions field observations in areas where the 3 Hbl types co-exist should be performed.

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State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Behrens, J. W. (Intern), Gräns, A. (Ekstern), Therkildsen, N. O. (Intern), Neuenfeldt, S. (Intern), Axelsson, M. (Ekstern)
Pages: 71-77
Publication date: 2012
Main Research Area: Technical/natural sciences

Publications information
Journal: Journal of Experimental Marine Biology and Ecology
Volume: 413
ISSN (Print): 0022-0981
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.03 SJR 0.937 SNIP 0.914
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Effects of hypoxic exposure during feeding on SDA and postprandial cardiovascular physiology in the Atlantic cod, Gadus morhua

Some Atlantic cod in the Bornholm Basin undertake vertical foraging migrations into severely hypoxic bottom water. Hypoxic conditions can reduce the postprandial increase in gastrointestinal blood flow (GBF). This could subsequently postpone or reduce the postprandial increase in oxygen consumption (MO2), i.e. the SDA, leading to a disturbed digestion. Additionally, a restricted oxygen uptake could result in an oxygen debt that needs to be compensated for upon return to normoxic waters and this may also affect the ability to process the food. Long-term cardio-respiratory
measurements were made on fed G. morhua in order to understand how the cardio-respiratory system of feeding fish respond to a period of hypoxia and a subsequent return to normoxia. These were exposed to 35% water oxygen saturation for 90 minutes, equivalent to the time and oxygen level cod voluntarily endure when searching for food in the Bornholm Basin. We found that i) gastric and intestinal blood flows, cardiac output and MO2 increased after feeding, ii) gastric and intestinal blood flows were spared in hypoxia, and iii) there were no indications of an oxygen debt at the end of the hypoxic period. The magnitude and time course of the measured variables are similar to values obtained from fish not exposed to the hypoxic period. In conclusion, when cod in the field search for and ingest prey under moderate hypoxic conditions they appear to stay within safe limits of oxygen availability as we saw no indications of an oxygen debt, or negative influence on digestive capacity, when simulating field observations

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Behrens, J. (Intern), Axelsson, M. (Ekstern), Neuenfeldt, S. (Intern), Seth, H. (Ekstern)
Pages: e46227
Publication date: 2012
Main Research Area: Technical/natural sciences

**Publication information**

Journal: PLOS ONE
Volume: 7
Issue number: 9
ISSN (Print): 1932-6203
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
- ISI indexed (2011): ISI indexed no
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 2.631 SNIP 1.161
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 2.473 SNIP 0.985
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 2.323 SNIP 0.96
- Web of Science (2008): Indexed yes
Identification of potential target levels for Central Baltic Sea fishing mortalities, taking multispecies interactions into account: Extended abstract

The main biological interactions between Baltic cod, herring and sprat have been modelled in a stochastic multispecies (SMS) model. Based on this, a simple approach has been developed to quantify candidates for FMSY proxies (fishing mortality that produces the maximum sustainable yield) in a multispecies context. Multispecies FMSY is higher for cod than single-species FMSY values, due to cannibalism. The actual FMSY for herring and sprat, and cod’s influence on prey yield, depend on assumptions about density-dependent growth and spatial overlap between predator and prey. The results are ready for implementation in management, however, the multispecies aspects depend on predation data mainly from the 1980s and there is an urgent need to update the information base. The current productivity regime and spatial distribution of fish stocks in the Baltic is different from the earlier period when predation data was collected. Also, prey-to-predator feedback mechanisms should be more understood before implementation in management.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Public Sector Consultancy, Section for Population Ecology and Genetics, Section for Management Systems
Authors: Vinther, M. (Intern), Neuenfeldt, S. (Intern), Eero, M. (Intern), Casini, M. (Ekstern), Sparholt, H. (Ekstern)
Publication date: 2012
Event:
Main Research Area: Technical/natural sciences
Electronic versions: K2212.pdf
Publication: Research – Conference abstract for conference – Annual report year: 2012

Impact of climate change on fish population dynamics in the baltic sea: a dynamical downscaling investigation

Understanding how climate change, exploitation and eutrophication will affect populations and ecosystems of the Baltic Sea can be facilitated with models which realistically combine these forcings into common frameworks. Here, we evaluate sensitivity of fish recruitment and population dynamics to past and future environmental forcings provided by three ocean-biogeochemical models of the Baltic Sea. Modeled temperature explained nearly as much variability in reproductive success of sprat (Sprattus sprattus; Clupeidae) as measured temperatures during 1973-2005, and both the spawner biomass and the temperature have influenced recruitment for at least 50 years. The three Baltic Sea models estimate relatively similar developments (increases) in biomass and fishery yield during twenty-first century climate change (ca. 28 % range among models). However, this uncertainty is exceeded by the one associated with the fish population model, and by the source of global climate data used by regional models. Knowledge of processes and biases could reduce these uncertainties.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Management Systems, Section for Population Ecology and Genetics
Authors: Mackenzie, B. R. (Intern), Meier, H. E. M. (Ekstern), Lindegren, M. (Intern), Neuenfeldt, S. (Intern), Eero, M. (Intern), Blenchner, T. (Ekstern), Tomczak, M. T. (Intern), Niiranen, S. (Ekstern)
Pages: 626-636
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Ambio
Biological ensemble modelling to improve marine science and ecosystem-based management advice
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.

Is feeding under hypoxic conditions a good strategy? Insight from cardio-respiratory measurements on cod

Recovery of gastric evacuation rate in Atlantic cod Gadus morhua L. surgically implanted with a dummy telemetry device
3D mapping of cod (Baltic Sea): GIS to support spatial conservation measures

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Baltic cod cannibalism: differing consequences at stock recovery vs. decline?

Comparative analysis of marine ecosystems: workshop on predator-prey interactions

Comparative analysis of marine ecosystems: workshop on predator-prey interactions

Climate and human influences on marine ecosystems are largely manifested by changes in predator–prey interactions. It follows that ecosystem-based management of the world's oceans requires a better understanding of food web relationships. An international workshop on predator–prey interactions in marine ecosystems was held at the Oregon State University, Corvallis, OR, USA on 16–18 March 2010. The meeting brought together scientists from diverse fields of expertise including theoretical ecology, animal behaviour, fish and seabird ecology, statistics, fisheries science and ecosystem modelling. The goals of the workshop were to critically examine the methods of scaling-up predator–prey interactions from local observations to systems, the role of shifting ecological processes with scale changes, and the complexity and organizational structure in trophic interactions.
Deriving fish behaviour related patterns in fishing pressure from DST data

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Kristensen, K. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences

Bibliographical note
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Source-ID: 263930
Publication: Research - peer-review › Journal article – Annual report year: 2010

Deriving fish behaviour related patterns in fishing pressure from DST data

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Kristensen, K. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 256646
Publication: Research › Poster – Annual report year: 2010
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.

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Institute Management
Authors: Teschner, E. (Ekstern), Kraus, G. (Ekstern), Neuenfeldt, S. (Intern), Voss, R. (Ekstern), Hinrichsen, H. (Ekstern), Köster, F. (Intern)
Pages: 836-842
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Ichthyology
Volume: 26
Issue number: 6
ISSN (Print): 0175-8659
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.94
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.99
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.04
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Optimal fishery management accounting for variation in natural mortality: the Baltic sprat and herring case

Economic-ecological modelling has received increasing attention in the effort to achieve sustainable fisheries. So far, mainly single-species models have been used, which do not account for species interaction and/or climate change. However, both of these processes alter the associated natural mortality rates (M) and have the potential to strongly influence stock dynamics. Many traditional economic fishery models have been criticized by biologists, especially if results were gained by rather simple biomass models. Biological assessment models, on the other hand, rarely explicitly take into account economic considerations. To overcome these shortcomings, we have developed an age-structured, economic-ecological model that accounts for the dominant processes affecting natural mortality. With the goal of ultimately providing the most appropriate management advice for the operating fishery possible, we adopt an economic objective function (present value of resource rents) and determine optimal management. In the Baltic Sea, mortality rates of sprat and young herring are strongly influenced by adult cod stock dynamics via predation. Furthermore, both clupeid stocks show temperature-dependent stock-recruitment relationships. We simulated stock trajectories for a period of 30 years for two different natural mortality scenarios: (i) high vs. low cod abundance and associated changes in predation mortality M2 and (ii) high vs. low temperature scenarios and associated changes in the stock-recruitment function. By applying the age-structured ecological-economic model, we derive the optimal management strategy in terms of net present value of resource rents. We compare the relative importance of both processes (i.e. temperature increase via global change and variation in predation pressure via management of the cod stock) on optimal management.

Thermal niche of Atlantic cod Gadus morhua: limits, tolerance and optima

Recent studies in the marine environment have suggested that the limited phenotypic plasticity of cold-adapted species such as Atlantic cod Gadus morhua L. will cause distributions to shift toward the poles in response to rising sea temperatures. Some cod stocks are predicted to collapse, but this remains speculative because almost no information is available on the thermal tolerance of cod in its natural environment. We used electronic tags to measure the thermal experience of 384 adult Atlantic cod from 8 different stocks in the northeast Atlantic. Over 100000 d of data were collected in total. The data demonstrate that cod is an adaptable and tolerant species capable of surviving and growing in a wide range of temperate marine climates. The total thermal niche ranged from −1.5 to 19°C; this range was narrower (1 to 8°C) during the spawning season. Cod in each of the stocks studied had a thermal niche of approximately 12°C, but latitudinal differences in water temperature meant that cod in the warmer, southern regions experienced 3 times the degree days (DD; ~4000 DD yr−1) than individuals from northern regions (~1200 DD yr−1). Growth rates increased with temperature, reaching a maximum in those cod with a mean thermal history of between 8 and 10°C. Our direct observations of habitat occupation suggest that adult cod will be able to tolerate warming seas, but that climate change will affect cod populations at earlier life-history stages as well as exerting effects on cod prey species.
Time matters: post-surgical recovery of gastric evacuation rate in Atlantic cod

During the last decades, new technology has allowed collection of physiological and behavioral data from free-ranging specimen, minimizing stress and providing more reliable data than traditional methods. However, such biotelemetric methods demands surgical introduction of a foreign object into the fish, which may affect the animal, and studies dealing with the affect of surgery and implants are still scarce. A variable known to be sensitive to postsurgical and other stressors is the gastric evacuation rate (GER). GER is tightly linked to gut blood flow and in the present study we analysed how GER was affected after surgically introducing dummies of a blood-flow biotelemetry system into the abdominal cavity of Atlantic cod. Two days post surgery the cod with implants were, together with a control group, force-fed a standardized meal and the stomach contents recovered 24h later. This procedure was repeated for both groups of fish after one additional week of recovery. After two days GER was significantly lower in the group of fish with surgical implants compared to the control group, but the difference was not maintained after one additional week of recovery. We conclude that 10 days of postsurgical recovery will stabilize GER in cod. The results indicate that the presence of the implant per se did not affect GER but that the effects observed came from surgery and/or postsurgical stress. 10 days should consequently be a starting point for future studies even if longer recovery periods will probably be beneficial to the animal.
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

Biological ensemble modelling of the Eastern Baltic cod future

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Management Systems
Authors: Gårdmark, A. (Ekstern), Möllmann, C. (Ekstern), Neuenfeldt, S. (Intern), Blenckner, T. (Ekstern), Lindegren, M. (Intern), Aro, E. (Ekstern), Bastardie, F. (Intern), Heikinheimo, O. (Ekstern), Müller-Karulis, B. (Ekstern), Niiranen, S. (Ekstern), Tomczak, M. (Intern), van Leeuwen, A. (Ekstern), Wikström, A. (Ekstern)
Publication date: 2009

Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 254190
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Climate driven long-term evolution of oxygen concentration in the Baltic Sea: potential consequences for the Baltic cod stock

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

Host publication information
Title of host publication: ICES C.M.
Volume: E:06
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252261
Publication: Research › Article in proceedings – Annual report year: 2009

Cod spatial dynamics and vertical movements in European waters and implications for fishery management (CODYSSEY)
How ambient habitat traits determine seasonal and spatial distribution patterns of cod Gadus morhua L. in the central Baltic Sea

Hydroacoustic resolution of small-scale vertical distribution in Baltic cod Gadus morhua - habitat choice and limits during spawning

Hydrostratified marine ecosystems with dynamic features such as fronts or clines in salinity, temperature, or oxygen concentration challenge an individual's ability to select suitable living conditions. Ultimately, environmental heterogeneity organizes the spatial distributions of populations and hence the spatial structure of the ecosystem. Our aim here is to present a method to resolve small-scale distribution on an individual level, as needed for the behaviorally-based prediction of habitat choice and limits. We focused on the small-scale vertical distribution of cod Gadus morhua L. in the Bornholm Basin, central Baltic Sea, during spawning time in 2 years with different vertical thermohaline and oxygen stratifications. Individual cod were identified by echotracking of real-time in situ hydroacoustic distribution data. In order to resolve and identify hydrographic preferences and limits, ambient parameters including temperature, salinity, and oxygen concentration as well as expected egg-survival probability were individually allocated to each fish. The vertical distribution of hydroacoustically identified fish was compared to data simultaneously recorded by data storage tags attached to cod. The results showed a clear influence of ambient salinity and oxygen concentration on the distribution pattern and distributional limitation of cod during spawning time, and also consistency of data storage tag-derived distribution patterns with those based on individual echotracking. We therefore consider this method to be a useful tool to analyze individual behavior and its implications for the population’s spatial distribution in stratified environments.
Some Atlantic cod Gadus morhua in the Baltic Sea visit hypoxic water briefly but often

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Hinrichsen, H. (Ekstern)
Pages: 290-294
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 75
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.741 SNIP 0.882
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.951 SNIP 0.935 CiteScore 1.64
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.944 SNIP 0.934 CiteScore 1.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.049 SNIP 1.118 CiteScore 1.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.035 CiteScore 1.88
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.895 SNIP 0.946 CiteScore 1.66
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.774 SNIP 0.834
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.773 SNIP 0.891
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.883 SNIP 0.968
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.996 SNIP 1.06
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.897 SNIP 1.051
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.827 SNIP 0.898
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.945 SNIP 1.148
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.937 SNIP 1.096
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.949 SNIP 1.056
Web of Science (2002): Indexed yes
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

Using biotelemetry to investigate cardiovascular tradeoffs in cod feeding under hypoxic conditions

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Behrens, J. (Intern), Thygesen, U. H. (Intern), Neuenfeldt, S. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Bibliographical note
ICES CM 2009/B:22
Source: orbit
Source-ID: 251192
Publication: Research › Poster – Annual report year: 2009

Using individual-based stomach and data storage tag data to improve multispecies modelling: linking spatial overlap between predator-prey populations and individual functional response

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

Host publication information
Title of host publication: ICES C.M.
Volume: J:07
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences
Source: orbit
Vertical movements of Atlantic cod (Gadus morhua) in the North Sea and the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Neuenfeldt, S. (Intern), Payne, M. (Intern), Righton, D. (Ekstern), Van der Kooij, J. (Ekstern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252262
Publication: Research › Poster – Annual report year: 2009

3d pelagic habitat mapping in the Baltic Sea

General information
State: Published
Organisations: Section for Software and GIS development, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Geitner, K. (Intern), Neuenfeldt, S. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229224
Publication: Research › Conference abstract for conference – Annual report year: 2008

Atlantic cod Gadus morhua L. in the Baltic Sea visit hypoxic water briefly but often

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Andersen, K. H. (Intern), Hinrichsen, H. (Ekstern)
Publication date: 2008
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 234039
Publication: Research › Poster – Annual report year: 2008

Hvad betyder Øresund for naboområderne?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Andersen, K. H. (Intern)
Pages: 7
Publication date: 2008

Publication information
Pages (from-to): 7
Newspaper: Fiskeri Tidende
Volume: 15
No.: 7
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
3D-modelling of pelagic cod habitats in the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Software and GIS development
Authors: Neuenfeldt, S. (Intern), Geitner, K. (Intern)
Number of pages: 35
Pages: 16-17
Publication date: 2007

Host publication information
Title of host publication: BALANCE conference : Delegates notes
Place of publication: Copenhagen
Main Research Area: Technical/natural sciences
Conference: Towards marine spatial planning in the Baltic Sea Region, BALANCE Conference, 25th-26th October, Copenhagen, 01/01/2007
Source: orbit
Source-ID: 238588
Publication: Research › Article in proceedings – Annual report year: 2007

Life under pressure: Insights from electronic data-storage tags into cod swimbladder function

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: van der Koij, J. (Ekstern), Righton, D. (Ekstern), Strand, E. (Ekstern), Michalsen, K. (Ekstern), Thorsteinsson, V. (Ekstern), Svedäng, H. (Ekstern), Neat, F. (Ekstern), Neuenfeldt, S. (Intern)
Pages: 1293-1301
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: I C E S Journal of Marine Science
Volume: 64
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
Pelagic habitat mapping: A tool for area-based fisheries management in the Baltic Sea

General information
State: Published
Organisations: National Veterinary Institute, Section for Software and GIS development, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Monitoring, Institute Management, Section for Ocean Ecology and Climate, Section for Management Systems
Number of pages: 71
Publication date: 2007

Publication information
Publisher: BALANCE
Original language: English
Reconstructing migrations of individual cod (Gadus morhua L.) in the Baltic Sea by using electronic data storage tags

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Neuenfeldt, S. (Intern), Hinrichsen, H. (Ekstern), Nielsen, A. (Intern), Andersen, K. H. (Intern)
Pages: 526-535
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 16
Issue number: 6
ISSN (Print): 1054-6006
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.704 SNIP 0.987
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.139 SNIP 0.231
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Original language: English
DOIs:
10.1111/j.1365-2419.2007.00458.x
**REX på hot spots**

**General information**
- State: Published
- Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Monitoring, Section for Management Systems
- Authors: Neuenfeldt, S. (Intern), Olesen, H. J. (Intern), Karlsen, J. (Intern)
- Pages: 7
- Publication date: 2007

**Publication information**
- Pages (from-to): 7
- Newspaper: Fiskeri Tidende
- No.: 40
- Ratings:
  - ISI indexed (2013): ISI indexed no
  - ISI indexed (2012): ISI indexed no
  - ISI indexed (2011): ISI indexed no
- Main Research Area: Technical/natural sciences
- Source: orbit
- Source-ID: 226765
- Publication: Communication › Newspaper article – Annual report year: 2007

**Torskemærkninger i Øresund**

**General information**
- State: Published
- Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Management Systems, Section for Monitoring
- Authors: Neuenfeldt, S. (Intern), Karlsen, J. (Intern), Olesen, H. J. (Intern)
- Pages: 13
- Publication date: 2007

**Publication information**
- Pages (from-to): 13
- Newspaper: Fiskeri Tidende
- No.: 43
- Ratings:
  - ISI indexed (2013): ISI indexed no
  - ISI indexed (2012): ISI indexed no
  - ISI indexed (2011): ISI indexed no
- Main Research Area: Technical/natural sciences
- Source: orbit
- Source-ID: 226767
- Publication: Communication › Newspaper article – Annual report year: 2007

**Using the particle filter to geolocate Atlantic cod (Gadus morhua) in the Baltic Sea, with special emphasis on determining uncertainty**

**General information**
- State: Published
- Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
- Authors: Andersen, K. H. (Intern), Nielsen, A. (Intern), Thygesen, U. H. (Intern), Hinrichsen, H. (Ekstern), Neuenfeldt, S. (Intern)
- Pages: 618-627
- Publication date: 2007
- Main Research Area: Technical/natural sciences
Aquatic ecosystems are environmentally heterogeneous with features such as fronts or clines of temperature and salinity. This heterogeneity varies over time and is likely to cause changes in predator-prey overlaps, which will affect the diet composition of the predators. We investigated how inflows of oxygenated and saline deep water alternating with stagnation periods affect the consumption rates of the herring Clupea harengus L. and the sprat Sprattus sprattus L. by the cod Gadus morhua in the Bornholm basin of the Baltic Sea. We developed conceptual models for the effect of predator-prey overlaps on the aggregate diet of the predator population to test the hypothesis that the effects of inflows on the aggregate diet are mediated by changes in cod-clupeid overlaps. After estimating salinity and oxygen thresholds of the spatial distributions of cod and clupeids and calculating cod-clupeid overlaps from March 1958 to 2004, we applied the models relating cod-clupeid overlaps to observed numbers and masses of herring and sprat in cod stomachs. Our study indicated that (1) the ratio of consumed herring to sprat increases faster than proportionally to the ratio of cod-herring to cod-sprat overlaps, and (2) the ratio of consumed herring to sprat increases slower than proportionally to the ratio of herring to sprat in the sea. The latter is most pronounced at the low ratios of overlaps that occur during stagnation periods, which destabilise the clupeid populations, and may have contributed to the drastic increase in the sprat abundance during the late 1980s.
Geolocation of tagged Baltic Cod using the particle filter

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Andersen, K. H. (Intern), Nielsen, A. (Intern), Thygesen, U. H. (Intern), Hinrichsen, H. (Ekstern), Neuenfeldt, S. (Intern)
Pages: 1-2
Publication date: 2006

Host publication information
Title of host publication: International Council for the Exploration of the Sea
Volume: Q:05
Place of publication: Copenhagen
Publisher: I C E S
ISBN (Print): 87-7482-051-6

Series: ICES C.M. 2006/
Number: Q:05
Main Research Area: Technical/natural sciences

Bibliographical note
Extended abstract
Source: orbit
Source-ID: 284450
Publication: Research › Conference abstract in proceedings – Annual report year: 2006

Torskens hemmelige liv

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Andersen, K. H. (Intern), Neuenfeldt, S. (Intern)
A method to geolocate eastern Baltic cod by using Data Storage Tags (DSTs)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Neuenfeldt, S. (Intern), Hinrichsen, H. (Ekstern), Nielsen, A. (Intern)
Pages: 1-14
Publication date: 2004
Main Research Area: Technical/natural sciences

Three-dimensional visualization of cod spatial dynamics and vertical movements in European waters

General information
State: Published
Organisations: Section for Software and GIS development, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Geitner, K. (Intern), Neuenfeldt, S. (Intern)
Pages: 86-87
Publication date: 2004

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
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

**Oxygen and salinity characteristics of predator-prey distributional overlaps shown by predatory Baltic cod during spawning**

**General information**
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern), Beyer, J. (Intern)
Pages: 168-183
Publication date: 2003
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Fish Biology
Volume: 62
The influence of oxygen saturation on the distributional overlap of predator (cod, Gadus morhua) and prey (herring, Clupea harengus) in the Bornholm Basin of the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Neuenfeldt, S. (Intern)
Pages: 11-17
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication Information
Journal: Fisheries Oceanography
Volume: 11
Issue number: 1
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
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), Møllmann, C. (Ekstern), Neuenfeldt, S. (Intern), St. John, M. (Intern), Plikshs, M. (Ekstern), Voss, R. (Ekstern)
Pages: 1516-1533
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
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
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.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: Neuenfeldt, S. (Intern), Köster, F. (Intern)
Pages: 300-309
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
The aim of the project is to improve the knowledge and data basis for stock assessment and management for cod in the eastern Baltic Sea.

In later years, changes in growth and natural mortality of cod have presumably taken place and new knowledge on these
parameters is essential for restoring analytical stock assessment for Eastern Baltic cod that is currently lacking. Improved knowledge on cod growth and mortality is therefore a prerequisite for being able to evaluate the stock status in relation to management targets and implement management plans that are built on quantitative stock assessment.

Ecological situation in the Baltic Sea has changed in later years, which requires updated biological information. This is done in the project using different approaches, bringing together expertise of different research areas. The approaches applied include molecular-genetic analyses of cod growth, bioenergetic modelling, and analyses of monitoring data on predation and condition/growth of cod. An important component of the project is cooperation with fishing industry to support tagging experiments of Baltic cod, to obtain updated estimates of cod growth.

Finally, the project combines the new knowledge on cod that becomes available from this and other relevant projects to ensure that the assessment of stocks status and management advice is based on best available scientific information.

This project is coordinated by DTU Aqua.

The project is funded by the Ministry of Environment and Food of Denmark and the European Maritime and Fisheries Fund (EMFF).

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Danish Fishermen's Association
University of Copenhagen
Period: 15/08/2016 → 15/08/2018
Number of participants: 8
Research areas: Ecosystem based Marine Management & Fish Biology & Marine Populations and Ecosystem Dynamics & Population Genetics & Marine Living Resources & Fisheries Management
Project participant:
Storr-Paulsen, Marie (Intern)
Tomkiewicz, Jonna (Intern)
Hansen, Jakob Hemmer (Intern)
Neuenfeldt, Stefan (Intern)
Christensen, Asbjørn (Intern)
Kindt-Larsen, Lotte (Intern)
Berg, Casper Willestofte (Intern)
Project Coordinator:
Eero, Margit (Intern)
Project

Evaluation of Sustainable Exploitation of Major Baltic Fish Stocks under different Climate, Eutrophication and Fishing Pressures
National Institute of Aquatic Resources
Period: 01/07/2016 → 30/06/2019
Number of participants: 5
Phd Student:
Bossier, Sieme (Intern)
Supervisor:
Bastardie, Francois (Intern)
Christensen, Asbjørn (Intern)
Neuenfeldt, Stefan (Intern)
Main Supervisor:
Nielsen, J. Rasmus (Intern)

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

Process integration into multispecies and ecosystem models: Resulting ecological, economic and social trade offs (PRIME TRADE OFFS) (39324)
Extensive multispecies and ecosystem research has been done in the Baltic, North Sea, Barents Sea/Norwegian Sea, Bay of Biscay and the Black Sea in the past about 30 years. There has been invested substantially in the research on multispecies interactions, and ecosystem functioning.

In parallel, significant knowledge on the environmental impacts on recruitment processes, movements or migrations, and species interactions has been accumulated, but not yet consequently integrated in multispecies and ecosystem models and management concepts.

The major questions raised in PRIME TRADEOFFS are hence, (i) how the integration of environmentally-driven variability in population and ecosystem dynamics affects short- and long-term predictions of economically important fish species, and (ii) how the inclusion of environmental variability changes our perceptions of tradeoffs between utilization of different resources, including for example fuel cost due to changed resource distributions in space and effects on targeted species, as well as socio-economic efficiency.

There have been several initiatives to improve multispecies and ecosystem modelling in order to make it operational for both tactical and strategic assessment and ecosystem-based fisheries management. PRIME TRADEOFFS is the logical continuation of these initiatives and will make the concepts of multi-species maximum sustainable yield and environmental impact on biological key process such as distribution, growth and recruitment operational for ecosystem-based management of marine resources, as demanded in the Marine Strategy Framework Directive and the reformed Common Fisheries Policy.

This project is coordinated by DTU Aqua.

The project is funded the EU, COFASP, ERA-NET.

National Institute of Aquatic Resources

Section for Oceans and Arctic

IFREMER

Institute of Marine Research

AZTI Technalia

University of Hamburg

Period: 01/03/2016 → 28/02/2019

Number of participants: 4

Research areas: Marine Populations and Ecosystem Dynamics & Oceanography & Fisheries Management

Project participant:

Andersen, Niels Gerner (Intern)

Mariani, Patrizio (Intern)

Thygesen, Uffe Høgsbro (Intern)

Project Coordinator:

Neuenfeldt, Stefan (Intern)

Project A systems approach framework for coastal research and management in the Baltic (BaltCoast) (39201)

The ultimate objective of this project is a coherent and systematic management approach that encompasses multiple impacts in a spatially heterogeneous context.

In BaltCoast we tackle this complex task using the Systems Approach Framework (SAF). The SAF is an issue oriented investigation and methodology that applies a holistic perspective. It investigates and quantifies the functions of systems in order to simulate specific questions concerning their functions or policies. It comprises the process from issue identification through system analyses to policy implementation.

This Systems Approach can, hence, competently address implementation of international directives (e.g. Water Framework Directive (WFD), Marine Strategy Framework Directive (MSFD)). In BaltCoast we address multiple issues through case studies that reflect current regional management challenges and develop a generic tool for integrated system assessment.

This project is coordinated by Leibniz-Institute for Baltic Sea Research (IOW).

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

National Institute of Aquatic Resources
Biodiversity changes - causes, consequences and management implications (BIO-C3) (39117)

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

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

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

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

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

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

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
GEOMAR - Helmholtz Centre for Ocean Research Kiel
University of Hamburg
Stockholm University
National Marine Fisheries Research Institute
University of Tartu
Finnish Environment Institute
Integrating spatial processes into ecosystem models for sustainable utilization of fish resources (INSPIRE) (39118)

The BONUS INSPIRE Project conducts pilot ecosystem field surveys that help resolving the habitat requirements of different life-stages of the focal species by combined use of traditional methods and application of modern advanced analysis and modelling techniques.

The research is conducted in a matrix approach with four species specific case (cod, herring, sprat and flounder) and five research work-packages. The work packages deal with (i) habitat requirements and survival probability for different life stages, (ii) connectivity between habitat occupied in successive life stages, (iii) spatial scaling from local events to regional population dynamics, (iv) spatially explicit analytical stock assessments (including a comprehensive flatfish programme), and (v) ecosystem-based management and Marine Strategy Framework Directive indicators.

The overarching questions of the BONUS INSPIRE Project are:
- What habitat (both pelagic and benthic) conditions characterize the spatial distributions of cod, herring, sprat and flounder?
- To what extent do fishing and species interaction affect the local and basin-scale distribution of exploited stocks?
- What drives spatial connectivity and migrations of different fish species/populations?
- How does stock structure and separation of natural populations impact stock assessment outcomes?

This project is coordinated by University of Tartu, Estonia.

The project is funded by EU, BONUS (Science for a Better Future of the Baltic Sea Region), ERA-NET.
Study on stomach content of fish to support the assessment of good environmental status of marine food webs and the prediction of MSY after stock restoration (Open call for tenders No MARE/2012/02) (39036)

In support of policies for sustainable management strategies of living marine resources, demands for integrated ecosystem advice are growing and more extensive use of long-term management plans, which are consistent with the ecosystem approach to fisheries management, is anticipated. However, long-term management plan evaluations of fish are particularly sensitive to changes in the proportion of fish removed by natural predators (natural mortality). A prerequisite for estimating this correctly is accurate knowledge of species interactions: Who is eating whom when, where and in which quantity?

Existing stomach content data are currently used in multispecies models using historic stomach content data from before 1995. Since this period, there have been considerable changes in the predator and prey stocks of both the Baltic and the North Sea. Thus, updated information on stomach contents of the essential predators in these two areas is urgently needed.

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

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

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

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

Maximizing yield of fisheries while balancing ecosystem, economic and social concerns (MYFISH) (38850)
The European Common Fisheries Policy has made a commitment to direct management of fish stocks towards achieving
Maximum Sustainable Yield (MSY) by 2015 (or no later than 2020 in special cases). Attaining this goal is complicated by
lack of common agreement on the interpretation of both ‘sustainability’ and ‘yield’, and because achieving MSY for one
stock may affect the possibility of achieving MSY for other stocks and compromise ecological, environmental, economic,
or social aims.
The objective of MYFISH was to face these difficulties and provide definitions of MSY variants, evaluations of the effect on
ecosystems, economy and social aspects of attaining these variants, their social desirability and an operational framework
for their implementation.

This was achieved through cases addressing a range of fisheries in all European regional areas. The cases cover
situations ranging from data-poor to the most studied and well-understood marine ecosystems in EU waters. The
suggested implementation of MSY builds on the existing ecosystem and fisheries models in the cases, modified to perform
the maximization of the relevant yield measure operationally. Social aspects were integrated throughout the project by
active involvement of stakeholders in the definition and evaluation of MSY variants. Global experience was engaged
through associated partners and communication of results was enhanced through two major events, a dedicated
MYFISH/ICES symposium in 2015 and a targeted policy meeting in 2016. More details can be found at
www.myfishproject.eu.

The project was coordinated by DTU Aqua.
The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 01/01/2012 → 29/02/2016
Number of participants: 10
Research areas: Ecosystem based Marine Management & Fisheries Management & Marine Living Resources
Project participant:
Ulrich, Clara (Intern)
Eigaard, Ole Ritzau (Intern)
Mortensen, Lars O. (Intern)
Nielsen, J. Rasmus (Intern)
Worsøe Clausen, Lotte (Intern)
Nielsen, Anders (Intern)
von Deurs, Mikael (Intern)
Vinther, Morten (Intern)
Neuenfeldt, Stefan (Intern)
Project Manager, academic:
Rindorf, Anna (Intern)

Operational ecology: Ecosystem forecast products to enhance marine GMES applications (OPEC) (38864)
The primary goal of OPEC was to improve the quality of operational services for biogeochemical and ecological parameters and hence, improve our ability to project the future status of European marine ecosystems, by delivering a suite of error quantified indicators which describe changes in ecosystem function suitable for implementation in operational centers.
In order to advance our understanding and predictive capacities for the response of marine ecosystems to global change, OPEC employed a combination of numerical simulations, data assimilation of satellite and in situ data, observational strategy evaluation and cross-disciplinary synthesis. The MSFD takes a regional approach to the development of strategies for environmental status, identifying four main regions: NE Atlantic, Baltic, Mediterranean and Black Seas. The MSFD also identifies a number of high level descriptors of environmental status (e.g. biodiversity, commercial fish, eutrophication, food webs, and invasive species) each of which has a defined set of indicators. Using the regional approach as framework we implemented and tested a suite of indicators in each region. These descriptors along with the ECVs provided a framework for the definition of new environmental applications (e.g. habitat for biodiversity, oxygen depletion/eutrophication, fisheries and marine climate change research).
A common set of descriptors with associated GES indicators and ECVs were defined across the four regions, to ensure a commonality of approach and the development of a consistent capacity across Europe. Auditable quality is essential for GMES environmental applications, and OPEC emphasized the assessment of predictability of key indicators. The R&D of the project included development of coupled end to end ecosystem models, where DTU Aqua implemented the coupling between the SMS model for higher trophic levels and HBM-ERGOM for physics and biogeochemistry. The project had nine partners from the EU and was coordinated by Plymouth Marine Laboratory, UK. The project was funded by EU. Framework Programme 7.

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

Functional biology of krill in northern marine ecosystems
Forage fish interactions (FACTS) (38781)

Removal of a forage fish has consequences for both predators and prey of forage fish. As everything is connected, every management action has a price which goes beyond the apparent, direct effect on the target species. The fishery on forage fish can therefore not be seen in isolation, as the immediate gain in profit from the fishery has to be discounted by the lowered potential for production of large piscivorous fish. Management actions on other species also influences forage fish, i.e. conservation efforts on marine mammals or sea birds have direct consequences for the predation pressure on forage fish.

The objective of the project was to provide insight and quantitative advice on the ecosystem wide consequences of management actions directly or indirectly related to forage fish.

The two overarching questions were:
- What are the consequences of forage fish fisheries on (a) predator growth and abundance, (b) economic output of fisheries on piscivorous species, and (c) ecosystem stability and the risk for regime shifts?
- What are the consequences of changes in predator populations on forage fish populations and fisheries?

The method was a combination of ecosystem models, of process studies aimed at feeding into the models, of economic models, and of data-analysis of existing data sources.

The project covered four ecosystems in detail: Norwegian-Barents Sea, Baltic Sea, North Sea and Bay of Biscay.

FACTS brought together leading European fisheries and university institutes working on creating the tools for ecosystem based management. The active involvement of the institutes in the current management has provided a means for the results of the project to feed into management. The project furthermore included a network component which has ensured a wider dissemination of methods and results within the marine scientific community.

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
Wageningen IMARES
Cefas
Marine and Food Technological Centre
IFREMER
University of Hamburg
Institute of Marine Research
University of Southern Denmark
Christian-Albrechts-Universität zu Kiel
Finnish Game and Fisheries Research Institute
Centre National de la Recherche Scientifique
University of Copenhagen
Leibniz-Institute for Baltic Sea Research
University of St Andrews
Spanish Institute of Oceanography

Period: 01/01/2010 → 31/12/2012
Number of participants: 4
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology & Ecosystem based Marine Management

Project participant:
Andersen, Ken Haste (Intern)
Rindorf, Anna (Intern)

Project Manager, organisational:
Haslund, Ole Henrik (Intern)

Project Manager, academic:
Neuenfeldt, Stefan (Intern)

Project Monitoring and modelling vertical movements of Greenland halibut in Disko Bay (38795)
The project measured and parameterized Greenland halibut behaviour in terms of vertical movement patterns by means of data storage tags. The tags were released (and recaptured) prior to the project period under another project, so that data was available at start of the project.

Previous measurements using Data Storage tags on halibut tagged in Disko Bay have shown that the halibut undertake distinct vertical migrations of several hundred meters at a time during a few hours.

The findings in the project from analyses of the previous tagging’s gave important biological information on the seasonal migration patterns for Greenland halibut in the West Greenland Fjords; icefjords are mainly preferred as wintering habitat for the fish while the outer parts of the fjord systems are summer habitats. Further, the study showed that halibut are fast vertical swimmers most likely when chasing pelagic prey fishes.

The project was coordinated by DTU Aqua.

The project was funded by the Commission for Scientific Investigations in Greenland (KVUG).

National Institute of Aquatic Resources
Arctic Section

Greenland Institute of Natural Resources
Period: 01/01/2010 → 31/12/2013
Number of participants: 3
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology

Project participant:
Neuenfeldt, Stefan (Intern)
Behrens, Jane (Intern)

Project Manager, academic:
Boje, Jesper (Intern)

Project Advanced modelling tool for scenarios of the Baltic Sea ecosystem to support decision making (ECOSUPPORT) (38733)
The Baltic Sea is subject to several major human impacts, and three of the most important are fishing, eutrophication and climate change. Understanding and projecting how these impacts will affect the food web and its fish populations in future is therefore challenging, and requires modelling approaches which include climatic-hydrographic forcing, nutrient loading scenarios and likely fishing intensities.

ECOSUPPORT was a project whose objective was to develop an advanced modelling tool for conducting scenario simulations of how these human impacts affect the marine ecosystem and fish populations. The project coupled several different types of models so that end-to-end ecosystem models were developed which to understand how human impacts
could influence the Baltic food web and fish populations. The models to be linked included regional climate models, oceanographic-lower trophic level ecosystem models (Nutrient-Phytoplankton-Zooplankton-Detritus) and fish population models. Key project results included new scenario simulations how regionally downscaled global climate model outputs would affect the development of Baltic cod populations under scenarios of climate change and seal (predator) population growth, and under different combinations of eutrophication, exploitation and climate change. These simulations included all key elements of the foodweb via an Ecopath model which included competitive and predatory interactions between the major fish species in the Baltic. The results demonstrated the vulnerability of the cod population to successful implementation of key ecosystem management policies for the Baltic Sea, including those related to exploitation and nutrient loading. Additional model scenarios focused on the sprat population which is a key intermediary link in the Baltic foodweb as prey and predator for cod and of zooplankton. These scenarios illustrated the range of future biomass and yields under assumed ranges of climate change and natural mortality.

One of the major novelties of the project was the availability of 3 different NPZD models, which enable estimation of output uncertainties to different model parameterizations and assumptions in the lower trophic levels and physical oceanographic processes, and to compare these with uncertainties due to fish population dynamics (e.g., recruitment variability). These comparisons suggest that the biological uncertainty associated with fish population dynamics was larger than that associated with the choice of the oceanographic NPZD model.

Partners in the project are the above mentioned and five other marine research institutes around the Baltic Sea.

The project is coordinated by Swedish Meteorological and Hydrographic Institute, Sweden.

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

National Institute of Aquatic Resources
Centre for Ocean Life
Swedish Meteorological and Hydrographic Institute (SMHI)
Leibniz-Institute for Baltic Sea Research
GKSS-Research Centre
University of Gothenburg
Stockholm University

Period: 01/01/2009 → 31/12/2011
Number of participants: 4
Research areas: Oceanography & Marine Populations and Ecosystem Dynamics & Ecosystem based Marine Management

Contact person:
MacKenzie, Brian (Intern)
Project participant:
Eero, Margit (Intern)
Lindegren, Martin (Intern)
Neuenfeldt, Stefan (Intern)

Cardio-respiratory adaptations in cod feeding under hypoxic conditions (CarlsbergTorsk) (38851)

Employment of DataStorage Tags on individual Atlantic cod (Gadus morhua) in the Bornholm Basin has shown that some fish migrate towards the deeper basin centre, presumably to feed. During these voluntary dives, fish expose themselves to oxygen saturations as low as 10% and many individuals spend a third of their total time at oxygen saturation <50%. This behavior may either be a result of an optimum foraging strategy or a necessity due to limited or less accessible prey in the cod’s optimal habitats.

Feeding induces several cardio-respiratory changes to enable the animal to efficiently digest, absorb, and redistribute the nutrients. Gastrointestinal blood flow (GBF) increases profoundly to facilitate digestion and absorption of the food. However, under circumstances of low oxygen availability, regional blood flow must be altered and in unfed fish there is a redistribution of bloodaway from the gastrointestinal area. If GBF is curtailed while the fish search for and ingest prey in the hypoxic water, this may implicate impaired digestive capacity following the return to well-oxygenated waters, either by prolonging gastric evacuation time or by reducing the assimilation efficiency. Furthermore, if the fish face the limitations of a reduced metabolic scope the onset of anaerobic energy production will result in an oxygen debt which has to be paid back with subsequent return to more well-oxygenated water. Using stateof the art methods (including both ‘hardwired’ and biotelemetry equipped animals) the aim is to investigate whether (1) ingestion of prey and initiation of digestion in hypoxic water results in an oxygen debt which has to be paid back following return to more well-oxygenated water, and whether (2) GBF will be spared or curtailed under the same circumstances, and if the latter, whether this will influence the digestive processes subsequent return to normal oxygen conditions.
We found that fish after 48 hr of post-surgical recovery following surgical implantation of a dummy biotelemetry blood flow device had reduced gastric evacuation rate as compared to controls; 24-48 hrs recovery is normal standard allowed for post-surgical recovery for fish when they are 'hard-wired'. However after ten days of recovery gastric evacuation rate was comparable to that of control fish – this long recovery time is possible only when using biotelemetry systems. Furthermore, those exposed to oxygen conditions simulating the low levels in the Bornholm Basin (the Baltic Sea) into which the fish voluntarily undertake feeding migrations, we found that GBF is not negatively impacted, as long as the fish subsequently is allowed to return to more well-oxygenated waters. We thus suggest that short feeding migrations into hypoxic bottom waters is a viable strategy under conditions where food is limited in the more well-oxygenated water layers.

The project was coordinated by DTU Aqua.
The project was funded by a research stipend from the Carlsberg Foundation to Jane W. Behrens (DTU Aqua).

Influence of ecological dynamics and climate change on the marine environment in Danish waters (ECODYN) (38136)

The environment in the open Danish waters is controlled by a complex interplay between physical and biological processes, and it is therefore difficult to determine the exact cause of changes in the environment. This is also the situation for hypoxia, which is caused both by nutrients from sources ashore, by ecological dynamics of the waters, and by the flow in Kattegat and the Belts. This project examined the marine environment through three-dimensional numerical models which describe both physical and biological processes. In parallel, laboratory experiments clarified how temperature affects the biological rates at or near the sea floor. This was used to model the response of the ecosystem to the temperature increases which are expected as a result of climate change, and the future consequences for the marine environment were analyzed.

Through model simulations and oxygen measurements from ships and buoys, the biological processes leading to hypoxia were determined with the so far highest resolution in time and space; this contributed significantly to the understanding of the functioning of the ecosystem in this area.

The connection between the state of the marine environment and the abundance of fish was analyzed, focusing on the distribution and spawning regions of cod, in relation to the oxygen conditions in the inner Danish waters and in the Baltic Sea. Thereby, the project provided a description of interconnections between the ecosystem, the water flow, and the effects of a changing climate.

The project was coordinated by Department of Bioscience, Aarhus University, Denmark.
The project was funded by the Danish Council for Strategic Research.
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?

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

**Spatially-explicit management methods for North Sea cod – a Danish fishermen-science collaboration (REX, REX II, REX III) (38430, 38431, 38541)**

The REX project started in 2006 as a protest from the Danish Fishermen Association because fishers had a less pessimistic perception of the status of the cod stock in the North Sea than ICES, and they considered the agreed TAC levels far too low. In particular the fishermen considered the scientific surveys as inappropriate due to extremely low catches of large cod because of wrong gear and fishing on smooth bottom only. This seemed to call for more spatially-explicit oriented approaches and REX was born with an aim of getting closer to a common understanding of the true number of adult cod in the North Sea by focusing on communication and collaboration in developing and implementing a scientifically sound and robust survey strategy with commercial ships in a north-eastern area selected by the Danish Fishermen Association using three vessels presenting different fishing methods (flyshooter, trawler and gillnetter).

The development of the fishermen-scientists collaboration with mutual respect has increased the understanding on both sides. In particular the emphasis on defining common goals, facing and solving conflicts immediately and extending thorough collaboration from survey planning, conducting of field work to interpretation of results during workshops have contributed to bridging the communication gap.

A better understanding of cod biology has also been a focal point in these projects through the new field studies incorporating fishermen’s knowledge. This includes distribution and migration, feeding behavior and importance of Hot-Spots (e.g. ship wrecks). Electronic tags were applied to learn about migration also in the Baltic. Together with the aim of continuing to obtain better assessments of the stocks such more mechanistically oriented studies are needed to answer two apparently simple questions “Where are the cod and why?”

The REX projects have strengthened the scientific collaboration with fishermen and produced several results and types of knowledge that will influence future work on developing spatial explicit management tools. REX also represents capacity building for DTU Aqua’s interdisciplinary field research and monitoring towards the spatial dynamics of cod.

The project is coordinated by DTU Aqua.
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
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.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 01/01/2005 → 31/12/2007
Number of participants: 8
Research area: Ecosystem Based Marine Management
Project participant:
Sørensen, Thomas Kirk (Intern)
Geitner, Kerstin (Intern)
Sparrevohn, Claus Reedtz (Intern)
Hüssy, Karin (Intern)
Köster, Fritz (Intern)
Tomkiewicz, Jonna (Intern)
Neuenfeldt, Stefan (Intern)
Project Manager, organisational:
Vestergaard, Ole (Ekstern)

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 Científicas
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

Activities:

ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB (External organisation)
Period: 2015
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation
ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB (External organisation)
Period: 2014
Stefan Neuenfeldt ( Participant)
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation
ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
ICES - Working Group on Recruitment Forecasting in a Variable Environment - WGRFE (External organisation)
Period: 2014
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Degree of recognition: International

Related external organisation
ICES - Working Group on Recruitment Forecasting in a Variable Environment - WGRFE
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Baltic Fisheries Assessment Working Group - WGBFAS (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Baltic Fisheries Assessment Working Group - WGBFAS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea - WGIAB
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Study Group on Spatial Analyses for the Baltic Sea - SGSPATIAL (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Study Group on Spatial Analyses for the Baltic Sea - SGSPATIAL
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources" (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Symposium on "Forage fish interactions: Creating the tools for ecosystem based management of marine resources"
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Biodiversity Science - WGBIODIV (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Working Group on Biodiversity Science - WGBIODIV
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Fish Ecology - WGFE (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Working Group on Fish Ecology - WGFE
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Integrative, Physical-biological, and Ecosystem Modelling - WGIPEM (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Working Group on Integrative, Physical-biological, and Ecosystem Modelling - WGIPEM
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on Benchmarking Integrated Ecosystem Assessment - WKBEMIA (External organisation)
Period: 2012 → …
Stefan Neuenfeldt (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Workshop on Benchmarking Integrated Ecosystem Assessment - WKBEMIA
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar