Do spatio-temporal spawning closures promote the recovery 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 Living Resources, Institute Management, Section for Monitoring and Data
Authors: Eero, M. (Intern), Hinrichsen, H. H. (Ekstern), Huwer, B. (Intern), Köster, F. (Intern), Mosegaard, H. (Intern), Storr-Paulsen, M. (Intern)
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Challenging ICES age estimation protocols: lessons learned from the eastern Baltic cod stock
Over the recent decades, the International Council for the Exploration of the Sea (ICES) has set guidelines for best practise quality control of age estimation procedures. The applicability of these guidelines is assessed by reviewing the ageing issues of eastern Baltic cod (EBC) as a case study. Since the implementation of an age-based assessment of EBC in the beginning of the 1970s, the assessment has been hampered by the quality of the age composition data, in recent years to a degree that age-based assessment is no longer used. The reason for the age reading problems is the low visual contrast between growth zones in the otoliths which seems to be the result of complex interactions of the hydrography in the Baltic Sea with the cod’s biology and behaviour. Over the last 40 years, various expert groups have struggled to document and improve the agreement of age estimation between national otolith readers, standardize methods and age estimations through repeated exchanges and reference collections as well as an internationally agreed manual. Despite these initiatives the precision of the age estimations based on traditional ageing did not improve, with significant bias persisting between and within readers. Additionally, a wide range of alternative methods for deriving the age information necessary for stock assessment and for validation of the true age have been tested. However, these methods did not produce unbiased age estimates over the entire size and age range of the EBC.
stock. An age-validation is urgently needed. Deviations from the ICES guidelines identified are as follows: (i) the lack of rigorous quality control, particularly the auditing of national trends in age precision over the years using a reference collection and (ii) the implementation of an age error matrix in the stock assessment.

**General information**

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, National Marine Fisheries Research Institute, Institute of Food Safety, Animal Health and Environment, Thünen Institute of Baltic Sea Fisheries, Swedish University of Agricultural Sciences
Authors: Hüussy, K. (Intern), Radtke, K. (Ekstern), Plikshs, M. (Ekstern), Oeberst, R. (Ekstern), Baranova, T. (Ekstern), Krumme, U. (Ekstern), Sjöberg, R. (Ekstern), Walther, Y. (Ekstern), Mosegaard, H. (Intern)
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**Publication information**

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Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
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Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
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Evaluation of otolith shape as a tool for stock discrimination in marine fishes using Baltic Sea cod as a case study

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

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Section for Ecosystem based Marine Management
Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern), Albertsen, C. M. (Intern), Eg Nielsen, E. (Intern), Hansen, J. H. (Intern), Eero, M. (Intern)
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Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Spatio-temporal trends in stock mixing of eastern and western Baltic cod in the Arkona Basin and the implications for recruitment

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources, GEOMAR - Helmholtz Centre for Ocean Research Kiel
Authors: Hüssy, K. (Intern), Hinrichsen, H. (Ekstern), Eero, M. (Intern), Mosegaard, H. (Intern), Hansen, J. H. (Intern), Lehmann, A. (Ekstern), Lundgaard, L. S. (Intern)
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Connectivity, growth and survival in a spatially structured fish population, which is currently managed as seven separate stock units

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Nielsen, K. E. (Intern), Azour, F. (Intern), Bekkevold, D. (Intern), Christensen, A. (Intern), Hüsey, K. (Intern), Lundgaard, L. S. (Intern), Mosegaard, H. (Intern), Møller, P. R. (Ekstern), Deurs, M. V. (Intern)
Effect of spatial differences in growth on distribution of seasonally co-occurring herring Clupea harengus stocks
The mechanisms most likely to determine the distribution of the two major herring Clupea harengus stocks in their common early summer feeding ground in the eastern North Sea, Skagerrak and Kattegat were investigated through analysis of acoustic survey data from six consecutive years. No change was detected in biomass of North Sea autumn spawning C. harengus (NSAS) over time, whereas the biomass of western Baltic spring spawning C. harengus (WBSS) declined severely. Analyses of centre of abundance by stock showed no change in NSAS distribution, whereas the WBSS changed to a more western distribution over time. Contrary to previous perception of the juvenile migration, NSAS were found to leave the study area at the age between 1 and 2 years and WBSS 1 year olds were encountered in the Skagerrak. The estimated parameters of von Bertalanffy growth equations showed marked differences between areas with fish in the eastern part of the area having the lowest size at age at all ages. Further, their growth conditions appeared to deteriorate progressively over the period studied. Both NSAS and WBSS showed the highest condition in the North Sea and Skagerrak while condition was substantially lower in age Kattegat. The westward movement of spring spawners over time suggests that growth rate and possibly density of conspecifics influence the migration pattern and distribution of C. harengus in the area. In contrast, there was no evidence to suggest that distribution was constant over time within stocks or that distribution reflected size-dependent limitations on migration distance.
Korttidsprognoser for kortlivede industrifisk under MSY – forvaltning af tobis i Nordsøen

General information
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Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography
Authors: Deurs, M. V. (Intern), Christensen, A. (Intern), Bekkevold, D. (Intern), Lynam, C. (Ekstern), Nielsen, K. E. (Intern), Azour, F. (Intern), Lundgaard, L. S. (Intern), Hüssy, K. (Intern), Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern)
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Slutrapport for EFF projekt J.nr. 33010-13-k-0280
Publication: Research › Report – Annual report year: 2015
Long-term effects of an offshore wind farm in the North Sea on fish communities

Long-term effects of the Horns Rev 1 offshore wind farm (OWF) on fish abundance, diversity and spatial distribution were studied. This OWF is situated on the Horns Reef sand bank in the North Sea. Surveys were conducted in September 2001, before the OWF was established in 2002, and again in September 2009, 7 yr post-establishment. The sampling surveys used a multi-mesh-size gillnet. The 3 most abundant species in the surveys were whiting Merlangius merlangus, dab Limanda limanda and sandeels Ammodytidae spp. Overall fish abundance increased slightly in the area where the OWF was established but declined in the control area 6 km away. None of the key fish species or functional fish groups showed signs of negative long-term effects due to the OWF. Whiting and the fish group associated with rocky habitats showed different distributions relative to the distance to the artificial reef structures introduced by the turbines. Rocky habitat fishes were most abundant close to the turbines while whiting was most abundant away from them. Species diversity was significantly higher close to the turbines. Overall, these results indicate that the artificial reef structures were large enough to attract fish species with a preference for rocky habitats, but not large enough to have adverse negative effects on species inhabiting the original sand bottom between the turbines.

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, FishStats, Orbicon
Authors: Stenberg, C. (Intern), Støttrup, J. (Intern), Deurs, M. V. (Intern), Berg, C. W. (Intern), Dinesen, G. E. (Intern), Mosegaard, H. (Intern), Grome, T. (Intern), Leonhard, S. (Ekstern)
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Web of Science (2015): Indexed yes
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Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
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Scopus rating (2011): CiteScore 2.85
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Managing population mixing; genetics supported stock splitting in Atlantic cod

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Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Authors: Hansen, J. H. (Intern), Hüssy, K. (Intern), Huwer, B. (Intern), Mosegaard, H. (Intern), Eero, M. (Intern)
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Optimal bæredygtig udnyttelse af tilgængelige torskebestande for dansk fiskeri

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Eero, M. (Intern), Hansen, J. H. (Intern), Hüssy, K. (Intern), Huwer, B. (Intern), Berg, C. W. (Intern), Mariani, P. (Intern), Mosegaard, H. (Intern), Nielsen, A. (Intern), Eg Nielsen, E. (Intern), Rindorf, A. (Intern), Ulrich, C. (Intern), Vinther, M. (Intern), Worsøe Clausen, L. (Intern)
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Stock mixing of eastern and western Baltic cod in SD 24

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Section for Ecosystem based Marine Management
Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern), Albertsen, C. M. (Intern), Hansen, J. H. (Intern), Eero, M. (Intern)
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Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Exploring the multidimensional nature of stock structure: a case study on herring dynamics in a transition area

Fish are not just fish. Differences within marine fish species in terms of morphology, behaviour, life history and certainly also genetic differentiation have been shown for an impressive number of species, including herring (Clupea harengus). These differences persist despite marine fish usually occupy areas without much environmental structuring and extensive mixing between populations occur. Many species of marine fishes have the capacity of dispersing over vast geographical areas, either passively by drifting eggs and larvae following ocean currents, or actively by migration of juveniles and adults, however, even for highly migratory species, significant population structure have been documented. Thus population structures are maintained despite extensive mixing of populations across vast distances; however the structuring factors are not easily disentangled. The factors behind this structure of populations have in some cases been referred to as spatial distance between populations, when the distribution of the species is larger than the dispersal range of individuals. Also oceanographic processes and the topography of the ocean floor have been linked to population structure in a number of species, yet few studies have tested specifically for relationships between environmental parameters of adaptive significance and population structuring in marine migratory fish, and even fewer have examined evidence of local adaptation. The relative roles of migratory behaviour and local differences in environmentally induced selective pressures in effecting such structure remain elusive. Maintaining population structures is of vital importance for the resilience of fish populations to changes in the environment and their exploitation. The preservation of intraspecific population integrity is a prerequisite for maintaining population and life history diversity which in turn affect the performance of individual species in providing important ecosystem services. In this PhD thesis, I explore the population complexity of the herring stock called the Western Baltic Spring Spawning herring; localized in the transition area between the North Sea and the Baltic. I analyse which herring populations that are available to a mixed herring fishery in the area and their spatial and temporal occurrence. I explore the potential structuring factors causing the population diversity in the area and discuss the mechanisms behind these structuring factors. The results in this present thesis contribute to the understanding of the dynamics of the herring populations in the mixed pool of herring in the transition area between the North Sea and the Baltic. I identify several genetically different herring populations which are available for a fishery; their occurrence is structured by divergent migration strategies driven primarily by growth potential and the persistence of a genetic population differentiation is linked to the environmental heterogeneity in terms of salinity facilitating homing to spawning site. Such insight will aid a sustainable aggregated management of a fishery on a mixed herring stock. It will facilitate protecting the weaker populations from over harvesting in a mixed fishery and thus maintain the diversity and in turn the resilience of the stock to a fishery.

Prey or predator – expanding the food web role of sandeel (Ammodytes marinus)

We report an unexpected observation of lesser sandeel Ammodytes marinus foraging on juveniles and late larval stages of the same species. This recording sheds new light on the cannibalistic and piscivorous capacity of forage fish and raises a number of questions about the role of forage fish in marine food webs. In 2012 and 2013 the stomachs of 748 sandeels from 36 different commercial sandeel hauls in the central North Sea were opened. 9% of these stomachs contained late stage sandeel larvae. In order to better understand the cannibalistic nature of sandeels, we made a detailed analysis of another 450 sandeels from a single haul with a high frequency of apparent cannibals. One-third of the stomachs contained a minimum of one young sandeel (mean length 2.7 cm; max. length 4.9 cm), 10 percent contained 5 or more, and one stomach contained 18. Analyses of sample DNA confirmed that predator and prey were conspecifics. Larger specimens were more likely to be cannibals. However, among cannibals the specific sandeel larvae consumption was independent of cannibal size. We argue that this piscivorous cannibalistic behaviour may not only be a key factor in explaining recruitment fluctuations in North Sea sandeel stocks, but it may also add a new element to the complexity of energy flow in marine food chains.
Statistical analysis of population assignment for fisheries management employing otolith characteristics

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Authors: Mosegaard, H. (Intern)
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The Baltic cod: A case study for testing stock discrimination based on otolith shape analysis in a mixed stock fishery

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Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern), Hansen, J. H. (Intern), Eero, M. (Intern)
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Trading yield against precautionarity and the need for stability in the fishing sector

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Authors: Deurs, M. V. (Intern), Rindorf, A. (Intern), Vinther, M. (Intern), Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern)
Publication date: 2014
Main Research Area: Technical/natural sciences

Cod recovery as a new challenge for fisheries management: experience from the Baltic Sea

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Section for Marine Living Resources, Institute Management
Authors: Eero, M. (Intern), Hüssy, K. (Intern), Mosegaard, H. (Intern), Hansen, J. H. (Intern), Bastardie, F. (Intern), Köster, F. (Intern)
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2013
Improved management based on stock identification of eastern and western Baltic cod

The objective of this project was to establish an empirically founded knowledge base for the sustainable exploitation of the western Baltic cod stock by including the complex stock structure and migration patterns.

Stock mapping: Extensive immigration of “Eastern” cod into the Arkona Basin (SD 24) within the “Western” cod’s management unit was documented using high-powered genetic tools. The majority (91%) of all spawning fish caught in SD 24 in 2011 were “Eastern” cod and only 9% were from the “Western” stock. The results suggest that the stock structure in the Arkona Basin is highly influenced by mixing of genetically separate stocks.

Trends in mixing: Since the 1980’s where cod in SD 24 consisted primarily of “Western” type, the proportion of “Eastern” cod has increased, particularly since 2005. Throughout that period, the immigration of “Eastern” cod into SD 24 consisted primarily of adult, older fish. The changes in biological characteristics (mean size at age, condition and maturity) observed in that area since 2005 are thus a direct consequence of the extensive immigration of “Eastern” cod. As no seasonal signals in stock mixing were observed, the immigration is not associated with a change in “Eastern” cod’s spawning behaviour.

Management: The stock mixing proportions were successfully implemented in DTU Aqua’s modeling framework for management scenarios. “Eastern” immigrants into SD 24 lead the management procedure to advice for higher TACs that enhance the pressure on the fishing mortality level in SD 22. The fishing mortality level in SD 22 in this situation will need to be lowered i.e. by allocating more effort and catch from SD 22 to SD 24. Higher landings are expected if effort is re-directed/re-allocated to SD 24, profiting from the “Eastern” immigrants. By lowering the fishing mortality in SD 22, the SSB in SD 22 is also preserved, which is assumed to be the main source of recruits for the whole “western” stock (i.e. SD 22 + SD 24). In conclusion: Within the frame of this project we showed that substantial immigration “Eastern” cod into SD 24 has occurred and that these stock dynamics should be incorporated in evaluations of future management plans.
been suggested to close parts of the sandeel fishery in the North Sea out of concern for other species feeding on sandeel and/or spawning in the sandeel habitats. The economic effects of such closures have been assessed using BEMCOM. The results indicate that the model yields reliable estimates of the effect of MPAs, and can thus be a valuable tool when deciding where to locate MPA.
Recruitment decline in North Sea herring is accompanied by reduced larval growth rates

The stock of North Sea autumn spawning herring (Clupea harengus L.) has shown an unprecedented sequence of ten years of sharply reduced recruitment, in spite of a high spawning biomass. Recent work has identified this below-expected recruitment as being determined during the larval phase; however, the underlying mechanism remains elusive. In this study we analysed archived larval samples captured before and after the onset of the reduced survival to test the hypothesis of a concurrent change in the larval growth rate. Individual larval growth rates, averaged over the 21 days prior to capture, were estimated for two hundred larvae from four different years using a model-based analysis of the otolith ring-widths. Hydrographic-backtracking models complemented the otolith analysis by reconstructing the environmental history and spawning origin of each larva. A significant reduction in net larval growth rate of 8%, concurrent with the reduced larval survival and recruitment, was identified: after correcting for the effect of other explanatory variables (e.g. temperature changes), the gross reduction was found to be 12%. This reduction is most probably due to changes in either the amount or quality of available food. The study demonstrates the potential in coupling of two different techniques, the otolith microstructure analysis and the hydrographic modelling, for affording new insights into fish early-life history. Finally, the study provides a novel indication of the association between reduced growth and larvae survival, thereby narrowing the range of potential mechanisms underlying the observed reduction in the recruitment of North Sea autumn spawning herring.
Spatio-temporal dynamics of growth and survival of Lesser Sandeel early life-stages in the North Sea: Predictions from a coupled individual-based and hydrodynamic-biogeochemical model

Accounting for the individual variability and regional variations are important when predicting recruitment in fish species. Spatially explicit descriptions for recruitment in sandeels are necessary and sandeel growth and survival depend locally on zooplankton prey. We investigate the responses of larval and early juvenile Lesser Sandeel (Ammodytes marinus) in the North Sea to local feeding conditions by an adapted version of a generic bioenergetic individual-based model for larval fish describing growth and survival. Prey encounter and physiological processes are described explicitly in the model, which allows analyzing the influence of prey on the growth and survival of sandeel. The model is coupled to a hydrodynamic-biogeochemical model with physical and prey fields and implemented in temporal and three-dimensional spatial settings. Zooplankton biomass simulated by the biogeochemical model is validated by Continuous Plankton Recorder survey time series data. Spatio-temporal dynamics of the sandeel cohorts are simulated by the integrated model framework for the period 2004-2006 and five major area divisions of suitable sandeel habitats in the North Sea. This allows obtaining insight into the influence of temperature variation and zooplankton availability on the growth and survival. To determine areas promising for recruitment, area divisions are compared and optimal time of hatching for higher survival to recruitment due to match-mismatch with prey is determined by comparing different hatching times. The effect of vertical diel migration behavior of sandeel on the model outcomes is also examined. Vertical migration of sandeel results in increased feeding ability and growth and decreased starvation mortality of individuals. Results show that areas of German Bight and Southern Bight with high zooplankton production support high growth of sandeel. Most sandeel survive to settling in the Dogger Bank area that has large retention on average and still productive in zooplankton. Hatching at the optimal time of March/February with matching zooplankton peak concentrations enhances the growth and survival. Growth correlates positively with the observed temperature trend. Survival correlates negatively with temperature and prominently, when the hatching is in winter. © 2012 Elsevier B.V.
A bioenergetic approach to model and reconstruct individual life traits from fish otoliths

Otoliths are biocalcified bodies connected to the sensory system in the inner ears of fish. Their layered, biorhythm-following formation provides individual records of the age, the individual history, and the natural environment of extinct and living fish species. Such data are critical for ecosystem and fisheries monitoring. They often lack validation, however, and the poor understanding of biomineralization mechanisms has led to striking examples of misinterpretations and subsequent erroneous conclusions in fish ecology and fisheries management. From the characterization of the physico-chemical characteristics of fish otoliths, we present a numerical model of otolith biomineralization. Based on a general bioenergetic theory, it disentangles the complex interplay between metabolic and temperature effects on biomineralization. This model resolves controversial issues and explains poorly understood observations of otolith formation. It represents a unique simulation tool to improve otolith interpretation and applications, and, beyond, to address the effects of both climate change and ocean acidification on other biomineralizing organisms such as corals and bivalves.

Growth and survival of larval and early juvenile lesser sandeel in patchy prey field in the North Sea: An examination using individual-based modelling

Disentangling physical–biological interaction processes during early life-stages of fish is crucial for the understanding of fish stock recruitment. Among many individual and environmental aspects affecting mortality during the early life-stages of fish, encountering food at greater than average concentrations is regarded important for survival. Intense aggregations of zooplankton in near-surface waters provide these conditions for larval fish. Simulation studies by individual-based modeling can help understanding of the mechanisms for survival during early life-stages. In this study, we examined how growth and survival of larvae and early juveniles of Lesser Sandeel (Ammodytes marinus) in the North Sea are influenced by availability and patchiness of the planktonic prey by adapting and applying a generic bioenergetic individual-based model for larval fish. Input food conditions were generated by modeling copepod size spectra dynamics and patchiness based on particle count transects and Continuous Plankton Recorder time series data. The study analyzes the effects of larval hatching time, presence of zooplankton patchiness and within patch abundance on growth and survival of sandeel early life-stages in the North Sea. Simulations of patchiness related starvation mortality are able to explain observed patterns of variation in sandeel growth. Reduced prey densities within patches decrease growth and survival rate of larvae and match–mismatch affect growth and survival of larvae with different hatch time due to plankton seasonality. Of general scientific and environmental management interest, the results indicate a steep threshold concentration critical for survival at around 0.04–0.05 no. zooplankton/mL.
Individual-based model, Growth and survival, Lesser Sandeel, Patchiness, Size spectra, Continuous Plankton Recorder

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High-resolution stock discrimination of Atlantic herring (Clupea harengus) based on otolith shape, microstructure, and genetic markers

One of the most rapidly developing applications of otolith research is shape analysis, often used for population discrimination as well as for species identification. Otolith shape is influenced by the environment through physiology, but also shows consistent and temporally stable differences between populations, which suggest genetic control as well. Thus otolith shape serves as a population marker, suitable for individual assignment. Here we use otolith morphological characteristics (otolith shape and larval otolith microstructure) combined with genetic markers to discriminate between different populations of Atlantic herring (Clupea harengus) in the western Baltic and adjacent waters. We analyse a baseline (spawning individuals from several populations validated by genetic markers) for separation of adult herring (2+) based on otolith shape and juveniles using genetically validated otolith shape characteristics as separation parameters. Otolith shape was found to clearly discriminate between individuals at all ages from different spawning populations. The identified distances between populations based on otolith shape matched previously obtained genetic distances and were, when combined with the otolith microstructure, able to discriminate between populations that are spatially different but spawning in the same season.

General information
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- Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics
- Authors: Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern), Bekkevold, D. (Intern)
- Publication date: 2012
- Event:
- Main Research Area: Technical/natural sciences
- Publication: Research › Conference abstract for conference – Annual report year: 2012

Modelling the mixing of herring stocks between the Baltic and the North Sea from otolith data

Herring catches in the western Baltic, Kattegat and Skagerrak consist of a mixture of stocks, mainly North Sea autumn spawners (NSAS) and western Baltic spring spawners (WBSS), which is managed through a single TAC. Catches of these two stocks are split using otolith microstructures from Danish and Swedish commercial landings and surveys samples for the purpose of stock assessment. But the split estimates from sampling data are highly variable and noisy. Better understanding of the migration and exploitation patterns involved could therefore potentially improve the stock assessment as well as provide solutions to the complex management of this mix. The stock-specific seasonal trends in distribution of the two main stocks from otolith data were analysed using a generalized linear mixed model (GLMM) of stock composition. The results show a clear seasonal and age-related pattern and are consistent with existing ideas about the migration patterns of WBSS and NSAS within Division IIIa and adjacent waters. This work therefore provides the foundation for the development of a more rational management of the herring stocks in this area.

General information
- State: Published
- Authors: Ulrich, C. (Intern), Post, S. L. (Ekstern), Worsøe Clausen, L. (Intern), Berg, C. W. (Intern), Deurs, M. V. (Intern), Mosegaard, H. (Intern), Payne, M. (Intern)
- Number of pages: 20
- Publication date: 2012
- Event:
- Main Research Area: Technical/natural sciences
- Electronic versions: J0212.pdf
- Publication: Research › Paper – Annual report year: 2012

Offshore windfarms and their impact on fish abundance and community structure

Deployment of offshore windfarms (OWF) is rapidly expanding. A before–after control impact (BACI) approach was used to study the impact of one of the world’s largest offshore windfarms (Horns Rev Offshore Windfarm) on fish assemblages and species diversity. Fish were generally more abundant in the control than the impact area before the establishment of the OWF. Eight years later fish abundance was similar in both the impact and control area but the abundance of one of the most frequently occurring species, whiting, was much lower compared to 2001. However, the changes in whiting reflected the general trend of the whiting population in the North Sea. The introduction of hard bottom resulted in higher species diversity close to each turbine with a clear spatial (horizontal) distribution. New reef fish such as goldsinny wrasse (Ctenolabrus rupestris), viviparous eelpout (Zoarces viviparus), and lumpsucker (Cyclopterus lumpus), established themselves on the introduced reef area. In contrast very few gobies were caught near or at the OWF, presumably owing to the highly
turbulent hydrographical conditions in the OWF. We suggest that the lack of this common prey fish is the main reason for the absence of larger predatory fish species.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Population Ecology and Genetics, Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Stenberg, C. (Intern), Dinesen, G. E. (Intern), Deurs, M. V. (Intern), Berg, C. W. (Intern), Mosegaard, H. (Intern), Leonhard, S. (Ekstern), Groome, T. (Ekstern), Støttrup, J. (Intern)
Number of pages: 18
Publication date: 2012
Event:
Main Research Area: Technical/natural sciences
Electronic versions:
O0912.pdf
Links:
Publication: Research › Paper – Annual report year: 2012

Precautionary sandeel fishery in Natura 2000 areas on the Dogger Bank (North Sea): a way to comply with MSFD implementation?

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Management Systems, Section for Coastal Ecology
Authors: Behrens, J. (Intern), Tørring, P. (Ekstern), Eigaard, O. R. (Intern), Dinesen, G. E. (Intern), Pedersen, E. M. (Intern), Sørensen, T. K. (Intern), Mosegaard, H. (Intern)
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication: Research › Paper – Annual report year: 2012

Short-term and long-term effects of an offshore wind farm on three species of sandeel and their sand habitat

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Coastal Ecology, Section for Monitoring
Authors: Deurs, M. V. (Intern), Grome, T. (Ekstern), Kaspersen, M. (Ekstern), Jensen, H. (Ekstern), Stenberg, C. (Intern), Sørensen, T. K. (Intern), Støttrup, J. (Intern), Warnar, T. (Intern), Mosegaard, H. (Intern)
Pages: 169-180
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Marine Ecology - Progress Series
Volume: 458
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
The Gordian knot: managing herring (Clupea harengus) bridging across populations, fishery units, management areas, and politics

The management of western Baltic spring spawning (WBSS) herring is challenged by the highly complex stock structure with a temporal and geographical distribution leading to conflicting interests among different stakeholder groups. The stock is exploited in the Baltic Sea (Subdivisions 22–24) and the North Sea (Division IIIa) by various EU—and in the latter case also non-EU—fishing fleets. For the two separate management areas, TACs are set at different times in the yearly TACsetting process by the EU and negotiating counties, which often result in conflicts over quota allocations among different management units. The WBSS herring stock spawns in the western Baltic Sea and migrates into the Kattegat and Skagerrak areas, where it mixes with North Sea autumn spawning (NSAS) herring. Recent development of otolith shape analysis has enabled a high-resolution separation of herring stocks in these waters, giving a more detailed picture of the actual stock mixing potentially undermining the current assumption of only three population components. We discuss how a higher resolution of spawning components may facilitate the estimation of local population-related productivity, and how this in turn may be applied in an advanced future management of several populations within one management unit.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Department of Informatics and Mathematical Modeling, Mathematical Statistics, Section for Management Systems
Authors: Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern), Berg, C. W. (Intern), Ulrich, C. (Intern)
Effect of the Horns Rev 1 Offshore Wind Farm on Fish Communities. Follow-up Seven Years after Construction: Follow-up Seven Years after Construction

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Mathematical Statistics, Department of Informatics and Mathematical Modeling
Number of pages: 96
Publication date: 2011

Inferring the location and scale of mixing between habitat areas of lesser sandeel through information from the fishery

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Jensen, H. (Ekstern), Rindorf, A. (Intern), Wright, P. J. (Ekstern), Mosegaard, H. (Intern)
Pages: 43-51
Publication date: 2011
Main Research Area: Technical/natural sciences
Shedding light on fish otolith biomineralization using a bioenergetic approach

Otoliths are biocalcified bodies connected to the sensory system in the inner ears of fish. Their layered, biorhythm-following formation provides individual records of the age, the individual history and the natural environment of extinct and living fish species. Such data are critical for ecosystem and fisheries monitoring. They however often lack validation and the poor understanding of biomineralization mechanisms has led to striking examples of misinterpretations and subsequent erroneous conclusions in fish ecology and fisheries management. Here we develop and validate a numerical model of otolith biomineralization. Based on a general bioenergetic theory, it disentangles the complex interplay between metabolic and temperature effects on biomineralization. This model resolves controversial issues and explains poorly understood observations of otolith formation. It represents a unique simulation tool to improve otolith interpretation and applications, and, beyond, to address the effects of both climate change and ocean acidification on other biomineralizing organisms such as corals and bivalves

General information

State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Fablet, R. (Ekstern), Pecquerie, L. (Ekstern), de Pontual, H. (Ekstern), Høie, H. (Ekstern), Millner, R. (Ekstern), Mosegaard, H. (Intern), Sebastiaan, A. (Ekstern), Kooijman, S. (Ekstern)
Pages: art. no. e27055
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information

Journal: PLoS ONE
Volume: 6
Growth and survival of larval and early juvenile lesser sandeel in patchy prey field in the North Sea: An examination using individual-based modelling

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Gürkan, Z. (Intern), Christensen, A. (Intern), Deurs, M. V. (Intern), Mosegaard, H. (Intern)
Publication date: 2010
Modelling the spatio-temporal dynamics in growth and survival of larval cod and sandeel in the North Sea by using individual-based models integrated with spatially explicit three-dimensional hydrodynamic and biogeochemical models

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Gürkan, Z. (Intern), Christensen, A. (Intern), Mosegaard, H. (Intern)
Pages: 249-250
Publication date: 2010

Host publication information
Title of host publication: ICES Annual Science Conference : 20-24 September 2010
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 267838
Publication: Research › Conference abstract in proceedings – Annual report year: 2010

Overwintering strategy of sandeel ecotypes from an energy/predation trade-off perspective

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Deurs, M. V. (Intern), Christensen, A. (Intern), Frisk, C. (Intern), Mosegaard, H. (Intern)
Pages: 201-214
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Issue number: 416
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
The effect of patchiness in prey on the growth of larval lesser sandeel in the North Sea: An examination using Individual-Based Modelling

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Gürkan, Z. (Intern), Christensen, A. (Intern), Mosegaard, H. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 253081
Publication: Research - peer-review › Journal article – Annual report year: 2010

The life-cycle of sandeel - adaptations to a seasonal environment, from the perspective of a forage fish

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, University of Copenhagen
Authors: Deurs, M. V. (Intern), Steffensen, J. F. (Eksterm), Mosegaard, H. (Intern)
Publication date: 2010

Publication information
Place of publication: Copenhagen
Publisher: Copenhagen University
Original language: English
Main Research Area: Technical/natural sciences
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.
Adaptive foraging behaviour and the role of the overwintering strategy

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Deurs, M. V. (Intern), Christensen, A. (Intern), Frisk, C. (Intern), Mosegaard, H. (Intern)
Number of pages: 25
Pages: 1-25
Publication date: 2009

Host publication information
Title of host publication: ICES C.M.
Volume: H:05
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252348
Publication: Research › Article in proceedings – Annual report year: 2009

Automated Fish Ageing (AFISA)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Mahe, K. (Ekstern), Ogor, A. (Ekstern), Hüsey, K. (Intern), Christensen, A. (Intern), Mosegaard, H. (Intern), Warnes, S. (Ekstern), De Pontual, H. (Ekstern), Harbitz, A. (Ekstern), Gudmundsson, E. (Ekstern), Thordarson, G. (Ekstern), Parisi, V. (Ekstern), Cotano, A. (Ekstern), Carbini, S. (Ekstern)
Publication date: 2009

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

Bibliographical note
(AFISA, proj. nr. 2243). FP6 project, Specifically targeted research project of innovation project - Reference no 044132
Cod spatial dynamics and vertical movements in European waters and implications for fishery management (CODYSSEY)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Righton, D. (Ekstern), Metcalfe, J. (Ekstern), McCloggrie, P. (Ekstern), Hetherington, S. (Ekstern), Mills, C. (Ekstern), Kooij, J. V. D. (Ekstern), Michalsen, K. (Ekstern), Fernø, A. (Ekstern), Huse, G. (Ekstern), Ádlandsvik, B. (Ekstern), Subbey, S. (Ekstern), Quayle, V. (Ekstern), Aldridge, J. (Ekstern), Little, A. (Ekstern), Heffernan, O. (Ekstern), Neuenfeldt, S. (Intern), Mosegaard, H. (Intern), Beyer, J. (Intern), Andersen, N. G. (Intern), Andersen, K. H. (Intern), Worsøe Clausen, L. (Intern), Hüsy, K. (Intern), Nielsen, B. (Intern), Wright, P. (Ekstern), Neat, F. (Ekstern), Gibb, I. (Ekstern), Gibb, F. (Ekstern), Zuur, A. (Ekstern), Thorsteinsson, V. (Ekstern), Valdimarsson, H. (Ekstern), Palsson, O. (Ekstern), Sæmundsson, K. (Ekstern), Strand, E. (Ekstern), Hinrichsen, H. (Ekstern), Kraus, G. (Ekstern), Lehmann, A. (Ekstern), Schaber, M. (Ekstern), Steingrund, P. (Ekstern), Svedang, H. (Ekstern), Jonsson, P. (Ekstern)
Publication date: 2009

Finding the signal in the noise: objective data-selection criteria improve the assessment of western Baltic spring-spawning herring

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Payne, M. (Intern), Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern)
Pages: 1673-1680
Publication date: 2009
Main Research Area: Technical/natural sciences
Impending collapse of bluefin tuna in the northeast Atlantic and Mediterranean

The abundance of bluefin tuna, Thunnus thynnus, in the east Atlantic and Mediterranean has declined in recent decades. The International Commission for the Conservation of Atlantic Tunas (ICCAT), the regional bluefin tuna management authority, has developed a plan to promote recovery by 2022, while still permitting fishing to continue during the period 2008-2010. Here we predict that the adult population in 2011 will likely be 75% lower relative to 2005 and that quotas in some intervening years will allow the fishery to capture legally all of the adult fish. Population demographics (proportion of older fish and repeat spawners in population) indicate that buffering capacity against years of poor reproduction has been reduced. This population is at risk of collapse (90% decline in adult biomass within three generations, the criterion used by the IUCN for defining populations as Critically Endangered), even under the currently agreed recovery plan, unless new conservation measures are implemented in the next few years.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: MacKenzie, B. (Intern), Mosegaard, H. (Intern), Rosenberg, A. A. (Ekstern)
Pages: 26-35
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: Conservation Letters
Volume: 2
Issue number: 1
ISSN (Print): 1755-263X
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Individual-based modeling of growth and survival of Atlantic cod and lesser sandeel larval and juvenile stages

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Gürkan, Z. (Intern), Christensen, A. (Intern), Mosegaard, H. (Intern)
Number of pages: 264
Publication date: 2009

Host publication information
Title of host publication: ICES Annual Science Conference
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences

Bibliographical note
ICES C.M. 2009/T:04
Source: orbit
Source-ID: 256654
Publication: Research › Conference abstract in proceedings – Annual report year: 2009

Individual based modeling of growth and survival of Atlantic cod (Gadus morhua) and lesser sandeel (Ammodites marinus) larval stages

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Gürkan, Z. (Intern), Christensen, A. (Intern), Mosegaard, H. (Intern)
Publication date: 2009
Event: Poster session presented at Beyond Kyoto Addressing the Challenges of Climate Change, 5-7 March, Aarhus, Denmark,
Main Research Area: Technical/natural sciences
Spatially resolved fish population analysis for designing MPAs: influence on inside and neighbouring habitats

The sandeel population analysis model (SPAM) is presented as a simulation tool for exploring the efficiency of Marine Protected Areas (MPAs) for sandeel stocks. SPAM simulates spatially resolved sandeel population distributions, based on a high-resolution map of all fishery-established sandbank habitats for settled sandeels, combined with a life-cycle model for survival, growth, and reproduction, and a three-dimensional hydrodynamic model for describing larval transport between the network of habitats. SPAM couples stock dynamics to ecosystem and anthropogenic forcing via well-defined drivers. The SPAM framework was tested using ICES statistical rectangle 37F2 as an MPA, and the impact on sandeel populations within the MPA and neighbouring habitats was investigated. Increased larval spillover compensated for lost catches inside the MPA. The temporal and spatial scales of stock response to MPAs demonstrated that ecosystem self-regulation must be included when modelling the efficiency of MPAs, and for lesser sandeel, that self-regulation partially counteracts the benefits of a fishing sanctuary. The use of realistic habitat connectivity is critical for both qualitative and quantitative MPA assessment. The results confirm that the stock levels are more sensitive to changes in life conditions of larval stages than later parts of the life cycle.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Christensen, A. (Intern), Mosegaard, H. (Intern), Jensen, H. (Intern)
Pages: 56-63
Publication date: 2009
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 66
Issue number: 1
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Using data storage tags to link otolith macrostructure in Baltic cod Gadus morhua with environmental conditions

We examined otolith opacity of Baltic cod in relation to environmental conditions in order to evaluate the formation mechanisms of seasonal patterns used in age determination. Adult fish were tagged with data storage tags (DSTs) and a permanent mark was induced in the otoliths by injection of a strontium chloride solution. Based on environmental conditions experienced, fish were classified into different behavioural types: non-reproducing 'non-spawner', and 'spawner' undertaking spawning migrations. Otolith opacity, an indicator of otolith and fish somatic growth and condition, was examined in relation to these environmental drivers. Temperature was the only environmental variable with a significant effect, overlaying a strong size-related effect. The temperature effect was not uniform across behavioural types and spawning periods. Opacity showed a negative correlation with temperature as expected—but in non-spawning fish only. In spawners, the general trend was a decrease in opacity from pre- to post spawning. A significant—but positive—temperature effect was only found in the pre-spawning period. The negative effects during and following spawning were not significant. In spawners, this decoupling leads to an otolith structure with stronger contrasts and more abrupt changes, while in non-spawners, opacity changes more smoothly. The trigger for this decoupling seems to be an interaction between temperature exposure and seasonal variations in food availability and may serve as a tool to identify the occurrence and repetitiveness of spawning in Baltic cod.
Using otolith microstructure to infer age of adult Eastern Baltic cod (Gadus morhua L.)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern)
Publication date: 2009
Event: Abstract from 4. International Symposium on Fish Otolith Research & Application, Monterrey, California, USA, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229402
Publication: Research - peer-review › Journal article – Annual report year: 2009

Estimating population age structure using otolith morphometrics: a test with known-age Atlantic cod (Gadus morhua) individuals

Traditional age reading is a rather subjective method that lacks true reproducibility, producing ageing error that propagates up to stock assessment. One alternative is represented by the use of otolith morphometrics as a predictor of age. An important issue with such a method is that it requires known-age fish individuals. Here we used known-age Atlantic cod (Gadus morhua) from the Faroe Bank and Faroe Plateau stocks. Cod populations usually show quite large variation in growth rates and otolith shape. We showed that including otolith morphometrics into ageing processes has the potential to make ageing objective, accurate, and fast. Calibration analysis indicated that a known-age sample from the same population and environment is needed to obtain robust calibration; using a sample from a different stock more than doubles the error rate, even in the case of genetically highly related populations. The intercalibration method was successful but generalization from one stock to another remains problematic. The development of an otolith growth model is needed for generalization if an operational method for different populations is required in the future.
Restricted fish feeding reduces cod otolith opacity

The purpose of this work was to examine the effect of reduced feeding and constant temperature on cod otolith opacity. Three groups of juvenile cod were given restricted food rations at different times for 4 months, resulting in depressed somatic growth. Otolith opacity was measured on pictures of the otolith sections. The otolith carbonate deposited during the experimental period was generally opaque compared to the more translucent otolith material deposited prior to and after the experimental period, when the fish were kept in a pond and in sea-cages at higher temperatures. Large variations in otolith opacity were found between individual fish both within groups and between groups. In two of the three groups significantly more translucent otolith material was deposited in response to reduced feeding. Our results show that variations in feeding and hence fish growth resulted in variation in otolith opacity, but the effect was minor compared to that of variations in ambient temperature. The combined influence of these effects, which both act on fish metabolism, are most likely controlling the seasonal opacity changes observed in wild fish. Our results help explain the variations seen in fish at constant temperatures.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Høie, H. (Ekstern), Folkvord, A. (Ekstern), Mosegaard, H. (Intern), Li, L. (Ekstern), Worsøe Clausen, L. (Intern), Norberg, B. (Ekstern), Geffen, A. (Ekstern)
Pages: 138-143
Publication date: 2008
Main Research Area: Technical/natural sciences
Sandeel (Ammodytes marinus) larval transport patterns in the North Sea from an individual-based hydrodynamic egg and larval model

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

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Marine Scotland
Authors: Worsøe Clausen, L. (Intern), Bekkevold, D. (Intern), Hatfield, E. (Ekstern), Mosegaard, H. (Intern)

Original language: English
DOIs:
10.1139/F08-073
Source: orbit
Source-ID: 225107
Publication: Research - peer-review › Journal article – Annual report year: 2008
Divergent origins of sympatric herring population components determined using genetic mixture analysis

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Bekkevold, D. (Intern), Worsøe Clausen, L. (Intern), Mariani, S. (Ekstern), André, C. (Ekstern), Christensen, T. (Ekstern), Mosegaard, H. (Intern)
Pages: 187-196
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 337
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
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
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Et flerårigt grundlag for dansk industrifiskeri: Biologisk vurdering af ressourcegrundlaget og analyse af forvaltningsmodeller

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries Advice, Section for Management Systems, Section for Monitoring
Authors: Kirkegaard, E. (Intern), Jensen, H. (Intern), Mosegaard, H. (Intern), Vinther, M. (Intern), Payne, M. (Intern), Nielsen, J. R. (Intern), Dalskov, J. (Intern)
Number of pages: 63
Publication date: 2007

Hydrodynamic backtracking of fish larvae by individual-based modelling

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Christensen, A. (Intern), Daewel, U. (Ekstern), Jensen, H. (Intern), Mosegaard, H. (Intern), St. John, M. (Intern), Schrum, C. (Ekstern)
Pages: 221-232
Publication date: 2007
Main Research Area: Technical/natural sciences
Using otoolith and body shape analysis to distinguish herring stocks to the west of the British Isles

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hatfield, E. (Ekstern), Mosegaard, H. (Intern), Jansen, S. (Ekstern), Schlickeisen, J. (Ekstern), Zimmermann, C. (Ekstern)
Publication date: 2007

Host publication information
Title of host publication: ICES Council Meeting
Publisher: International Council for the Exploration of the Sea
Series: ICES CM 2007/
Number: L:12
Main Research Area: Technical/natural sciences
Biocomplexity in a highly migratory pelagic marine fish, Atlantic herring

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Ruzzante, D. (Ekstern), Mariani, S. (Ekstern), Bekkevold, D. (Intern), André, C. (Ekstern), Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern), Dahlgren, T. (Ekstern), Hutchinson, W. (Ekstern), Hatfield, E. (Ekstern), Torstensen, E. (Ekstern), Brigham, J. (Ekstern), Simmonds, E. (Ekstern), Laikre, L. (Ekstern), Larsson, L. (Ekstern), Stet, R. (Ekstern), Ryman, N. (Ekstern), Carvalho, G. (Ekstern)
Pages: 1459-1464
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Royal Society of London. Proceedings B. Biological Sciences
Volume: 273
Issue number: 1593
ISSN (Print): 0962-8452
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.89 SJR 2.541 SNIP 1.474
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.948 SNIP 1.535 CiteScore 4.08
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.916 SNIP 1.673 CiteScore 4.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.091 SNIP 1.762 CiteScore 5.08
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.947 SNIP 1.881 CiteScore 4.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.234 SNIP 1.789 CiteScore 5.02
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.894 SNIP 1.61
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.581 SNIP 1.389
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.364 SNIP 1.372
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.475 SNIP 1.447
Scopus rating (2006): SJR 2.925 SNIP 1.713
Web of Science (2006): Indexed yes
Considerations of population structuring in Atlantic herring, Clupea harengus L. assessment and management in the North Sea, Skagerrak, Kattegat and western Baltic

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Hatfield, E. (Ekstern), Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern), Bekkevold, D. (Intern), Mariani, S. (Ekstern), Hutchinson, W. (Ekstern), Carvalho, G. (Ekstern), Ruzzante, D. (Ekstern), Ryman, N. (Ekstern), André, C. (Ekstern), Dahlgren, T. (Ekstern), Torstensen, E. (Ekstern), Simmonds, E. (Ekstern)
Pages: 245
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication Information
Journal: Journal of Fish Biology
Volume: 69
Issue number: Suppl. C
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
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
Onset of maturity and cohort composition at spawning of Baltic sprat Sprattus sprattus on the basis of otolith macrostructure analysis

Data on catch per unit effort (CPUE) from the Danish commercial fishery showed dense aggregations of sprat Sprattus sprattus born in 1997 in the main spawning area of the Baltic Sea during May 1999. After the analysis of their otolith macrostructure, these fish were found to have a shorter distance to the beginning of the first winter zone compared to fish from the same cohort caught in other months. At the same time, the number of fish with large otoliths at the period of winter zone formation tended to decrease or even disappear. The otolith size at winter zone formation (O-W) was found to be a good predictor of sprat total length (L-T) and mass (M) in age group 0 years. Changes in the otolith size distribution over time were related to variations in cohort composition depending on the L-T and M attained during the juvenile stage. Examination of the gonads suggested two life history patterns: 1) individuals achieving a larger L-T and M during the first growing season may contribute at age 1 years to the spawning stock and the fishery, whereas 2) individuals attaining smaller L-T and M contribute in larger amounts to both the spawning stock and the fishery later, when they are at age 2 years. Moreover, changes in the relationship between O-W and L-T and M were related to differences in growth trajectories for sprat born during the same spawning season. Smaller sprat as group 0 years continued growing during the second growing season delaying maturity compared to larger individuals from the same cohort.
The impact of temperature change on fisheries production

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Brander, K. (Intern), Mosegaard, H. (Intern)
Number of pages: 129
Publication date: 2006

Host publication information
Title of host publication: Comparative Biochemistry and Physiology Part A Molecular & Integrative Physiology
Volume: 143(4), Suppl S
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 283952
Publication date: 2006

Variation in the abundance of sandeels Ammodytes marinus off the southeast Scotland: an evaluation of area-closure fisheries management and stock abundance assessment methods

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Greenstreet, S. (Ekstern), Armstrong, E. (Ekstern), Mosegaard, H. (Intern), Jensen, H. (Intern), Gibb, I. (Ekstern), Fraser, H. (Ekstern), Scott, B. (Ekstern), Holland, G. (Ekstern), Sharples, J. (Ekstern)
Pages: 1530-1550
Publication date: 2006

Publication information
Journal: ICES Journal of Marine Science
Volume: 63
Issue number: 8
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
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
A cooperative effort to exchange age reading experience and protocols between European fish institutes

In Europe, research to improve age estimation methods is often limited to small-scale studies and thus it has been difficult to integrate innovations into routine protocols. There has even been a lack of pilot scale studies and implementation of control mechanisms in the age reading process. This was recognised and addressed by European Fish Ageing Network (EFAN; 1997-2000). EFAN was established as an active, independent and informal network for exchange of ideas and experience for improving age estimation. For the first time, age reading problems were addressed on a common platform across Europe. EFAN improved awareness and sensitivity towards the quality of age reading, however, this did not always deliver changes in the routine age reading processes. The present project, Towards Accreditation and Certification of Age Determination of Aquatic Resources (TACADAR); 2002-2006 aims to submit a quality assurance manual including an evaluation of the legal aspects and implications to the European Union (EU). Through the network of excellence, TACADAR will strengthen the competitive position of European institutions involved in fish ageing through institutional synergy and international co-operation. (c) 2005 Elsevier B.V. All rights reserved

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Swedish National Board of Fisheries
Authors: Appelberg, M. (Ekstern), Formigo, N. (Ekstern), Geffen, A. (Ekstern), Hammer, C. (Ekstern), McCurdy, W. (Ekstern), Modin, J. (Ekstern), Moksness, E. (Ekstern), Mosegaard, H. (Intern), Morales-Nin, B. (Ekstern), Tro adec, H. (Ekstern), Wright, P. (Ekstern)
Pages: 167-173
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Application and validation of otolith microstructure as stock identifier in mixed Atlantic herring (Clupea harengus) stocks in the North Sea and Western Baltic

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Worsøe Clausen, L. (Intern), Bekkevold, D. (Intern), Hatfield, E. M. C. (Ekstern), Mosegaard, H. (Intern)
Pages: 1-16
Publication date: 2005
Main Research Area: Technical/natural sciences

Environmental correlates of population differentiation in Atlantic herring

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Bekkevold, D. (Intern), André, C. (Ekstern), Dahlgren, T. G. (Ekstern), Worsøe Clausen, L. (Intern), Torstensen, E. (Ekstern), Mosegaard, H. (Intern), Carvalho, G. (Ekstern), Christensen, T. B. (Ekstern), Ruzzante, D. E. (Ekstern)
Pages: 2656-2668
Publication date: 2005
Main Research Area: Technical/natural sciences
Mixing of populations of year class twinning in Norwegian spring spawning herring?

**General information**
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Husebø, Å. (Ekstern), Slotte, A. (Ekstern), Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern)
Pages: 763-772
Publication date: 2005
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Marine and Freshwater Research
Volume: 56
Issue number: 5
ISSN (Print): 1323-1650
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.711 SNIP 0.763
Atlantic cod (Gadus morhua) growth and otolith accretion characteristics modelled in a bioenergetics context

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern)
Pages: 1021-1031
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 61
Issue number: 6
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.589 SNIP 1.379
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.621 SNIP 1.236
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.354 SNIP 1.267
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.558 SNIP 1.553
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.744 SNIP 1.542
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.097 SNIP 1.622
Scopus rating (2002): SJR 1.909 SNIP 1.457
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.769 SNIP 1.46
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.5 SNIP 1.464
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.928 SNIP 1.436
Original language: English
Source: orbit
Source-ID: 225856
Publication: Research - peer-review › Journal article – Annual report year: 2004
Effect of age and temperature on amino acid composition and the content of different protein types of juvenile cod (Gadus morhua L.) otoliths

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Hüssy, K. (Intern), Mosegaard, H. (Intern), Jessen, F. (Intern)
Pages: 1012-1020
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 61
Issue number: 6
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.589 SNIP 1.379
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.621 SNIP 1.236
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.354 SNIP 1.267
Web of Science (2006): Indexed yes
Effects of sex, stock, and environment on the shape of known-age Atlantic cod (Gadus morhua) otoliths

The effects of sex, stock, and environment on the shape of known-age Atlantic cod (Gadus morhua) otoliths from the Faroe Islands were investigated. Moreover, the feasibility of otolith shape analysis for stock identification was evaluated. The shape was described by using several normalized Fourier descriptors and morphometric variables. There were no consistent differences between the left and right otoliths and between sexes within different age classes, stocks, and environments. With our experimental design, we could evaluate the relative importance of genetic and environmental conditions (water temperature and diet regime) on otolith shape and morphometrics. Using otolith shape, cod individuals were significantly separated into Bank and Plateau stocks. Total classification success was between 79% and 85% between stocks and between 85% and 96% between environments for the different age classes. The significant differences in otolith shape between Faroe Bank and Faroe Plateau cod stocks provided a phenotypic basis for stock separation. Stock and environmental influences were substantial in determining the shape of cod otoliths.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Cardinale, M. (Ekstern), Doering-Arjes, P. (Ekstern), Kastowsky, M. (Ekstern), Mosegaard, H. (Intern)
Pages: 158-167
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 61
Issue number: 2
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
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
Märkning av liten fisk

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Petersson, E. (Ekstern), Mosegaard, H. (Intern)
Pages: 1-6
Publication date: 2004

Host publication information
Title of host publication: Kurs i märkningsteknik för fisk, Älvkarleby 11-12 februari 2004
Place of publication: Älvkarleby
Publisher: Fiskeriverket & Fiskhälsan
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227134
Publication: Research - peer-review › Journal article – Annual report year: 2004
Factors determining variations in otolith microincrement width of demersal juvenile Baltic cod Gadus morhua

Pelagic and demersal juvenile Baltic cod Gadus morhua L. were collected on the slope and the top of Rønne bank in the Baltic Sea during 2 cruises in November and December 1998. The objective of this study was to evaluate distinct changes in otolith increment width observed in demersal juveniles by comparison with laboratory-reared individuals, and to investigate the factors determining variation in these increments. The different increment-width patterns were identified with a method based on the widths of consecutive increments. Otolith increment widths of juvenile cod were found to be highly variable within and between individuals, in both the experimental and the field samples. The first change in increment pattern observed in the field samples was related to settling. The formation periodicity of increments within the different pattern intervals was confirmed with a growth model based on otolith growth rates of juvenile cod reared in the laboratory under different conditions. In this model, otolith growth rate was expressed as a function of rearing temperature and fish dry weight. Otolith growth of the field samples was calculated using ambient temperatures obtained from a 3D-circulation model. The best fit to observed otolith growth rates was obtained under the assumption that fish on the slope performed daily vertical migrations between the warm surface layer and the cold bottom layer. The data suggested that fish stayed in the surface layer during the first increment-pattern interval, performed vertical migrations during the second interval, and stayed in association with the seafloor in the subsequent interval, corresponding to the time after the breakdown of the thermocline.
Using otolith microstructure to analyse growth of juvenile Baltic cod Gadus morhua

Pelagic and demersal juvenile Baltic cod Gadus morhua L. were collected on the slope and the top of Rønne bank in the Baltic Sea during 2 cruises in November and December 1998. The growth, age at settling and vertical migration pattern were studied by otolith microstructure analysis. The relationship between fish and otolith size were found to change at settling, with an increase of fish size in relation to otolith size after settling. This change was more pronounced on the slope compared to the top of the bank. The timing of first settling at the 2 localities did not differ with respect to fish age. At both localities, fish that hatched early in the season spent a shorter time in the pelagic stage than late-hatched fish. However, significant differences in growth rate during the pelagic stage were observed, where fish captured on the slope grew faster. On the bank, individuals with fast otolith growth rates before settling continued to grow fast after settling. On the slope, no relationship between growth before and after settling was found. These results indicate that the different settling habitats occupied by juvenile Baltic cod have different potential for settling and nursery areas.
European Commission’s annual report on the impact of the Northeast sandeel fishery closure and status report on the monitoring fishery in 2000 and 2001

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Monitoring
Authors: Wright, P. (Ekstern), Jensen, H. (Intern), Mosegaard, H. (Intern), Dalskov, J. (Intern)
Number of pages: 16
Publication date: 2002

Publication information
Publisher: [s.n.]
Original language: English
Main Research Area: Technical/natural sciences
Source-ID: 227814
Publication: Research › Report – Annual report year: 2002

Fish ageing by otolith shape analysis : Final report to the European Commission

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Aquaculture
Number of pages: 204
Publication date: 2002

Publication information
Publisher: [s.n.]
Original language: English
Main Research Area: Technical/natural sciences
Bibliographical note
FAIR CT97 3402
Source-ID: 224825
Publication: Research › Report – Annual report year: 2002

Glossary

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Panfili, J. (Ekstern), Meunier, F. (Ekstern), Mosegaard, H. (Intern), Troade, H. (Ekstern), Wright, P. (Ekstern), Geffen, A. (Ekstern)
Pages: 373-383
Number of pages: 463
Publication date: 2002

Host publication information
Title of host publication: Manual of fish sclerochronology
Place of publication: Brest
Publisher: Ifremer
Editors: Panfili, J., de Pontual, H., Troade, H., Wright, P.
ISBN (Print): 28-44-33067-3
Main Research Area: Technical/natural sciences
Source: orbit
Indsamling af detaljerede oplysninger om tobisfiskeri i Nordsøen

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Monitoring
Authors: Jensen, H. (Intern), Mosegaard, H. (Intern), Rindorf, A. (Intern), Dalskov, J. (Intern), Brogaard, P. (Intern)
Number of pages: 44
Publication date: 2002

Publication information
Place of publication: Charlottenlund
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 87-90968-15-8
Original language: Danish

Series: DFU-rapport
Number: 97-02
Main Research Area: Technical/natural sciences
Electronic versions:
97-02_indsamling_af_oplysninger_om_tobisfiskeri_i_nordsoen.pdf
Links:
Source: orbit
Source-ID: 225976
Publication: Research › Report – Annual report year: 2002

Sclerochronological studies - Life history events

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Geffen, A. (Ekstern), de Pontual, H. (Ekstern), Wright, P. (Ekstern), Mosegaard, H. (Intern)
Pages: 99-105
Publication date: 2002

Host publication information
Title of host publication: Manual of fish sclerochronology
Volume: III:B
Place of publication: Brest
Publisher: Ifremer
Editors: Panfili, J., de Pontual, H., Troade, H., Wright, P.
ISBN (Print): 2-84433-067-3
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225485
Publication: Research - peer-review › Book chapter – Annual report year: 2002

Some uses of individual age data - Ecological applications

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Mosegaard, H. (Intern), Folkvord, A. (Ekstern), Wright, P. (Ekstern)
Pages: 167-180
Publication date: 2002

Host publication information
Title of host publication: Manual of fish sclerochronology
Volume: V:B
Place of publication: Brest
Some uses of individual age data - Growth and growth analysis

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Folkvord, A. (Ekstern), Mosegaard, H. (Intern)
Pages: 146-167
Publication date: 2002

Host publication information
Title of host publication: Manual of fish sclerochronology
Volume: V:A
Place of publication: Brest
Publisher: Ifremer
Editors: Panfili, J., de Pontual, H., Troadec, H., Wright, P.
ISBN (Print): 2-84433-067-3
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225428
Publication: Research - peer-review › Book chapter – Annual report year: 2002

Validation and verification methods - Direct validation

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Wright, P. (Ekstern), Panfili, J. (Ekstern), Folkvord, A. (Ekstern), Mosegaard, H. (Intern), Meunier, F. (Ekstern)
Number of pages: 463
Pages: 114-129
Publication date: 2002

Host publication information
Title of host publication: Manual of fish sclerochronology
Volume: IV:A
Place of publication: Brest
Publisher: Ifremer
Editors: Panfili, J., de Pontual, H., Troadec, H., Wright, P.
ISBN (Print): 28-44-33067-3
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227818
Publication: Research - peer-review › Book chapter – Annual report year: 2002

A new sampling regime for resource assessment of herring in the Skagerrak, Kattegat and SW Baltic: Final Report : EU study report in support of the DG:XIV

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern), Modin, J. (Ekstern), Groeger, J. (Ekstern), Gröhsler, T. (Ekstern)
Number of pages: 72
Publication date: 2001

Publication information
Place of publication: Charlottenlund, Denmark
Manual on herring otolith microstructure preparation and interpretation for stock identification. DIFRES manual produced under the EC study 98026: A new sampling regime for resource assessment of herring in the Skagerrak, Kattegat and SW Baltic

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Mosegaard, H. (Intern), Worsøe Clausen, L. (Intern), Lindberg, M. (Ekstern)
Number of pages: 8
Publication date: 2001

Modelling the population dynamics of sandeel (Ammodytes marinus) populations in the North Sea on a spatial resolved level: Final report

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Monitoring
Authors: Jensen, H. (Intern), Rindorf, A. (Intern), Horsten, M. (Ekstern), Mosegaard, H. (Intern), Brogaard, P. (Intern), Lewy, P. (Intern), Wright, P. (Ekstern), Kennedy, F. (Ekstern), Gibb, I. (Ekstern), Ruxton, G. (Ekstern), Arnott, S. (Ekstern), Leth, J. (Ekstern)
Number of pages: 102
Publication date: 2001

Revision of Baltic cod age determination based on otolith accretion characteristics and weight distribution

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Mosegaard, H. (Intern), Reeves, S. (Ekstern)
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Some considerations in the use of early life stages of Baltic sprat (Sprattus sprattus) in recruitment predictions: the importance of hatching date

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Management Systems
Authors: Reglero Baron, P. (Ekstern), Mosegaard, H. (Intern), Eero, M. (Intern)
Publication date: 2001
Main Research Area: Technical/natural sciences

Baltic cod: Resolving processes determining spatial and temporal windows of survival

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

Biomarkerer i sild viser vandringsvejen

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Division of Food Chemistry, National Food Institute
Authors: Worsøe Clausen, L. (Intern), Mosegaard, H. (Intern), St. John, M. (Intern), Cederberg, T. L. (Intern), Fromberg, A. (Intern)
Publication date: 2000
Section 1: Otolith physiology and morphology

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Technical University of Denmark
Authors: Mosegaard, H. (Intern), Morales-Nin, B. (Ekstern)
Pages: 3-4
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 46
Issue number: 1-3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.938 SNIP 1.142
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.022 SNIP 1.075
Web of Science (2007): Indexed yes
A new method for three-dimensional otolith analysis

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Hamrin, S. (Ekstern), Arneri, E. (Ekstern), Doering-Arjes, P. (Ekstern), Mosegaard, H. (Intern), Patwardhan, A. (Ekstern), Sasov, A. (Ekstern), Schatz, M. (Ekstern), van Dyck, D. (Ekstern), Wickström, H. (Ekstern), van Heel, M. (Ekstern)
Pages: 223-225
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 54
Issue number: 1
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
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
Dispersion pattern and survival in young brown trout (Salmo trutta) in a small stream. Manuscript II: From: Reproductive pattern and offspring performance in brown trout (Salmo trutta)

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Olofsson, H. (Ekstern), Mosegaard, H. (Intern)
Number of pages: 23
Publication date: 1999

Publication information
Place of publication: Uppsala
Publisher: Uppsala University
Original language: English

Series: Acta Universitatis Upsaliensis. Uppsala dissertations from the Faculty of Science and Technology
Number: 457
ISSN: 1104-2516
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281511
Publication: Research › Ph.D. thesis – Annual report year: 1999
Larger eggs in resident brown trout living in sympathy with anadromous brown trout

Freshwater resident brown trout (Salmo trutta L.) in the stream Jorlandaan (southwestern Sweden) had larger eggs (range of actual mean egg wet weights, 65.9-108.5 mg) than both sympatric migratory trout (76.8-84.2 mg) and trout from five other Swedish streams with allopatric resident (23.7-80.1 mg) or migratory populations (44.5-121.9 mg), after accounting for differences in body size. In Jorlandaan, some resident females even had a larger absolute mean egg weight than any of the migratory females found in the stream Resident trout had low absolute fecundity, and our data suggest that resident females in Jorlandan produce large eggs at the expense of their fecundity The extremely large relative egg size in resident Jorlandaan females suggests that the production of large offspring enhances fitness, possibly through increased fry survival.
Report of the study group on Baltic cod age reading

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Baranova, T. (Ekstern), Bratt, A. (Ekstern), Groeger, J. (Ekstern), Netzel, J. (Ekstern), Mosegaard, H. (Intern), Ustups, D. (Ekstern), Dahl-Poulsen, F. (Ekstern), Sjöberg, R. (Ekstern), Walter, Y. (Ekstern)
Pages: 1-23
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1999/
Volume: H:4
Original language: English
Source-ID: 226971
Publication: Research - peer-review › Journal article – Annual report year: 1999

Report of the study group on IIIa herring (SG3AH)

General information
State: Published
Organisations: Section for Monitoring, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Gröhsler, T. (Ekstern), Dalskov, J. (Intern), Groeger, J. (Ekstern), Mosegaard, H. (Intern), Modin, J. (Ekstern)
Pages: 1-38
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1999/
Volume: ACFM:10
Original language: English
Source-ID: 225578
Publication: Research › Conference article – Annual report year: 1999
The regulation of otolith formation and its significance to age determination, size back-calculation and elemental composition. The present status of otolith research and applications

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Wright, P. (Ekstern), Mosegaard, H. (Intern), Morales-Nin, B. (Ekstern), Geffen, A. (Ekstern)
Number of pages: 22
Publication date: 1998

Publication information
Publisher: [s.n.]
Original language: English
Series: EFAN Report
Number: 1-1998
Main Research Area: Technical/natural sciences
Links:
http://http://www.efan.no/

Bibliographical note
Proceedings of a workshop, held at ORSTROM Brest, 27-29 May, 1997
Source: orbit
Source-ID: 227817
Publication: Research › Report – Annual report year: 1998

Backcalculating Baltic cod size at age from otolith measurements

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Coastal Ecology
Authors: Mosegaard, H. (Intern), Hüssy, K. (Intern), Sparrevohn, C. R. (Intern)
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1997/
Volume: S:09
Original language: English
Source: orbit
Source-ID: 226691
Publication: Research › Conference article – Annual report year: 1997

Multivariate analysis and data structure: The present status of otolith research and applications

General information
State: Published
Partitioning of larval fish growth: The effects of age and developmental stage of larval herring on the accumulation rates of protein, triacylglycerol and otolith formation

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

Host publication information
Title of host publication: Ichthyoplankton Ecology
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281518
Publication: Research › Conference abstract in proceedings – Annual report year: 1997

Discrimination of mixed herring stocks in the North Sea using vertebral counts and otolith microstructure

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Mosegaard, H. (Intern), Madsen, K. (Ekstern)
Pages: 1-8
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1996/
Volume: H:17
Original language: English
Source: orbit
Source-ID: 226692
Publication: Research › Conference article – Annual report year: 1996

Implications of individual growth status on the future sex of the European eel
Sex-related differences in growth status was demonstrated in eels Anguilla anguilla reared indoors at 17, 20 or 26 degrees C, from the eel stage. Growth status was defined as length increase, weight increase and length-weight relationship. Eels attaining at least 10 g body weight (180-220 mm body length) were tagged with Passive integrated Transponders (PIT). Length and weight were measured at 6-week intervals, until individuals stopped growing or had attained 150 g weight (380-450 mm). Sex- specific data from potentially undifferentiated eels were provided by retrospective classification of sex. Comparisons between sexes were made within groups graded by length or weight data from the beginning of each 6-week period. There was no consistent difference in absolute length increase between small males and females, but below 40-60 g initial body weight, males displayed on average a higher weight increase than females. Males also had lower length at weight than females, even in the smallest weight groups. Early growth status may influence the future sex of undifferentiated eels, but other approaches are needed for distinction between cause and effect. (C) 1996 The Fisheries Society of the British Isles.

General information
Plasticity in growth of indoor reared European eel

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Holmgren, K. (Ekstern), Mosegaard, H. (Intern)
Pages: 63-70
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: Nordic Journal of Freshwater Research
Issue number: 72
ISSN (Print): 1100-4096
Ratings:
BFI (2008): BFI-level 1
Original language: English
Source: orbit
Source-ID: 225787
Publication: Research - peer-review › Journal article – Annual report year: 1996

Glossary for otolith studies

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources
Authors: Kalish, K. (Ekstern), Beamish, R. (Ekstern), Brothers, E. (Ekstern), Casselman, J. (Ekstern), Francis, R. (Ekstern), Mosegaard, H. (Intern), Panfili, J. (Ekstern), Prince, E. (Ekstern), Tresher, R. (Ekstern), Wilson, C. (Ekstern), Wright, P. (Ekstern)
Number of pages: 735
Publication date: 1995

Host publication information
Title of host publication: Recent Developments in Fish Otolith Research
Place of publication: Colombia
Publisher: University of South Carolina
Editors: Secor, D., Dean, J., Campagna, S.
ISBN (Print): 1-57003-011-1

Series: The Belle W. Baruch Library in Marine Science
Number: 19
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281437
Publication: Research - peer-review › Book chapter – Annual report year: 1995
Fluctuating recruitment and variable life history of migratory brown trout, Salmo trutta L., in a small, unstable stream
The recruitment dynamics and life history of migratory brown trout, Salmo trutta L., were investigated in a small Baltic coast stream subject to recurring drought. Spawning males consisted of both mature male parr (101-206 mm T.L.) and migrant males (205-780 mm T.L.). Spawning females were all migrants which delayed maturity until reaching a significantly greater size on average (424-805 mm T.L.) than migrant males. Male:female ratios were very high in spawning aggregations (9-12 males:1 female) with males representing up to five year-classes or more. Gametes from several generations of males per spawning event may be important for maintaining the genetic viability of this population with few female spawners per year. The amount of spawning was dependent on precipitation just prior to and during the spawning period since migrants could not enter the stream under drought conditions. Migrants did not overwinter in the stream. Drought also caused variable fry mortality following emergence in early summer. Recruitment of 0+ parr in autumn varied from c. 175 to 3000 during 3 years. Smolts were relatively young (ages 1-2) and small (≥8 cm), and were significantly longer on average than sibling parr. Yet emigration of 1-year-olds was not related to 0+ parr size the previous autumn because of overlapping growth rates. Persistence of the migratory brown trout in this unstable environment may be the consequence of (i) life history adaptation (e.g. short freshwater residence of both juveniles and spawners), and (ii) a complementary set of individual life histories where variation in age of migrant spawners and the occurrence of mature male parr result in a stable spawner population despite inconsistent recruitment of migrants to the sea.
Initial feeding in migratory brown trout (Salmo trutta L.) alevins

Initial feeding of brown trout was investigated under laboratory conditions. Fifty per cent feeding occurred when yolk constituted approximately 31% of total alevin dry weight, and feeding rate was positively correlated to developmental stage. The possible ecological implications of initial feeding are discussed.

General information
State: Published
Organisations: Uppsala University
Authors: Zimmerman, C. (Ekstern), Mosegaard, H. (Intern)
Pages: 647-650
Publication date: 1992
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Fish Biology
Volume: 40
Issue number: 4
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
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
Multi-aged emigration of brown trout (Salmo trutta) in a small Baltic-coast stream: a mechanism for population persistence in an unstable environment: From: The Role of Aquaculture in Fisheries

General information
State: Published
Organisations: Uppsala University
Authors: Titus, R. (Ekstem), Mosegaard, H. (Intern)
Number of pages: 20
Publication date: 1991

Publication information
Publisher: Nordiske Jordbrugsforskeres Forening
Original language: English

Series: Proc. from NJF seminar 194, Report
Number: 72
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281498
Publication: Research › Report – Annual report year: 1991

Selection for growth potential among migratory brown trout (Salmo trutta) fry competing for territories: evidence from otoliths

Otolith microstructure analysis was employed to determine differential size and growth characteristics between newly emerged migratory brown trout (Salmo trutta) fry which establish feeding territories and those which are forced to move downstream from the redd. Fry size at emergence was poorly predicted by otolith size, which precluded reliable backcalculation of fry size to investigate a possible size-selection mechanism. However, there was a clear-cut selection for individuals with significantly larger otoliths at emergence among fry which established territories in artificial stream sections. This elements pattern commenced with the onset of territorial aggression between fry. Fry which established territories to the end of the experiment had significantly higher initial otolith growth rates than emigrating fry, and their dry weights at the end of the experiment were well predicted by both otolith size at emergence and otolith size at the end of the experiment. Transparent zones in otoliths from downstream migrants suggested that these fry were starved; this was also supported by their declining dry weights over time. These results were explained as selection for greater growth potential as based on a proposed coupling between otolith microstructure formation and fish metabolism and on the behavioral ecology of migratory brown trout fry.

General information
State: Published
Organisations: Uppsala University
Undersökning av Tandåns fiskbestånd

General information
State: Published
Organisations: Unknown
Authors: Mosegaard, H. (Intern), Olofsson, H. (Ekstern)
Publication date: 1991

Publication information
Original language: Swedish
Series: Limn. Inst. Ser B
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281499
Publication: Research › Report – Annual report year: 1992

The relationship between growth and age at maturity in arctic charr, Salvelinus alpinus (L.), in Lake Fättjaure, Northern Sweden: Manuscript IV: From: On the reproductive Ecology of the Arctic Charr, Salvelinus alpinus (L.)

General information
State: Published
Organisations: Unknown
Authors: Svedäng, H. (Ekstern), Mosegaard, H. (Intern)
Publication date: 1990

Publication information
Place of publication: Uppsala
Publisher: Uppsala University
Original language: English
Series: Acta Universitatis Upplala University
Number: 331
ISSN: 1104-2516
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281507
Publication: Research › Ph.D. thesis – Annual report year: 1990

What is reflected by otolith size at emergence? - A reevaluation of the results in West and Larkin (1987)

General information
State: Published
Organisations: Uppsala University
Authors: Mosegaard, H. (Intern)
Pages: 225-228
Publication date: 1990
Main Research Area: Technical/natural sciences

Publication information
Journal: CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES
Volume: 47
Issue number: 1
Differences in age determination of roach using scales and otoliths

General information
State: Published
Organisations: Uppsala University
Authors: Mosegaard, H. (Intern), Appelberg, M. (Ekstern), Ängstrom-Klevbom, C. (Ekstern)
Publication date: 1989

Publication information
Original language: English
Series: Information från Sötvattenslaboratoriet, Drottningholm
Number: 1989(3)
Main Research Area: Technical/natural sciences

Bibliographical note
In Swedish, with an English abstract
Source: orbit
Source-ID: 281462
Publication: Research › Report – Annual report year: 1989

Smolting at age 1 and its adaptive significance for migratory trout, Salmo trutta L., in a small Baltic coast stream

General information
State: Published
Organisations: Uppsala University
Authors: Titus, R. (Ekstern), Mosegaard, H. (Intern)
Pages: 351-353
Publication date: 1989
Main Research Area: Technical/natural sciences

Publication information
Journal: JOURNAL OF FISH BIOLOGY
Volume: 35
Issue number: Suppl. A
ISSN (Print): 0022-1112
Ratings:
BFI (2018): BFI-level 1
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
Uncoupling of somatic and otolith growth rates in Arctic char

Experiments were conducted to study the effect of temperature, fish size, and somatic growth rate on mean daily otolith growth rate in Arctic char (Salvelinus alpinus) fry fed maximum rations. Long-term experiments at two different temperatures (8 and 13°C) showed exponential relationship between otolith weight and fish wet weight, with the exponent of wet weight for the higher temperature being significantly higher than for the lower temperature. Increasing exponents at each sampling date indicated a difference in growth rates of the char and its otoliths. Short-term experiments showed that specific growth rate of the fry at six different temperatures was that of an optimum curve whereas the otolith growth rate continued to increase with increasing temperatures. A clear uncoupling between otolith growth rate and fish growth rate was demonstrated whereas temperature and fish wet weight modeled otolith growth rate reasonably well. It was found that otolith growth rate expressed as daily increase in weight gave a model with better fit and higher generality than growth rate along various radii. Several examples of uncoupling between fish growth rate and otolith growth rate in the literature were reexamined, and an explanation of otolith growth rate in terms of a metabolic expression was suggested.
Issue number: 9
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.196
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.589 SNIP 1.379
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.621 SNIP 1.236
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.354 SNIP 1.267
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.558 SNIP 1.553
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.744 SNIP 1.542
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.097 SNIP 1.622
Scopus rating (2002): SJR 1.909 SNIP 1.457
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.769 SNIP 1.46
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.5 SNIP 1.464
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.928 SNIP 1.436
Original language: English
Source: orbit
Daily growth rates of otoliths in yolk sac fry of two salmonid species at five different temperatures

General information
State: Published
Organisations: Uppsala University
Authors: Mosegaard, H. (Intern), Titus, R. (Ekstern)
Pages: 221-227
Publication date: 1987

Host publication information
Title of host publication: Proceedings of the Fifth Congress of European Ichthyologists
Place of publication: Stockholm
Publisher: Swedish Museum of Natural History
Editors: Kullander, S., Fernholm, B.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281451
Publication: Research - peer-review › Article in proceedings – Annual report year: 1987

Manipulation of otolith micro structures as a means of mass marking salmonid yolk sac fry

General information
State: Published
Organisations: Uppsala University
Authors: Mosegaard, H. (Intern), Steffner, N. (Ekstern), Ragnarsson, B. (Ekstern)
Number of pages: 472
Pages: 213-220
Publication date: 1987

Host publication information
Title of host publication: Fifth Congress of European Ichthyologists: Proceedings
Place of publication: Stockholm
Publisher: Swedish Museum of Natural History
Editors: Kullander, S., Fernholm, B.
ISBN (Print): 91-86510-03-7
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281450
Publication: Research - peer-review › Article in proceedings – Annual report year: 1986

Growth in salmonid otoliths

General information
State: Published
Organisations: Uppsala University
Authors: Mosegaard, H. (Intern)
Pages: 1-18
Publication date: 1986
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Universitatis Upsaliensis. Comprehensive summaries of Uppsala dissertations from the Faculty of Science
Volume: 52
ISSN (Print): 0282-7468
Original language: English
Source: orbit
Source-ID: 281452
Publication: Research - peer-review › Journal article – Annual report year: 1985
Synopsis of the International Symposium on Age and Growth of Fish. Des Moines, Iowa, USA, 1985, 8-13 June

General information
State: Published
Organisations: Unknown
Authors: Mosegaard, H. (Intern)
Number of pages: 12
Publication date: 1986

Publication information
Publisher: Uppsala University, Limnological Inst.
Original language: English
Main Research Area: Technical/natural sciences

Bibliographical note
Report to SNV
Source: orbit
Source-ID: 281461
Publication: Research › Report – Annual report year: 1986

Statistisk analys av nosmärkningsresultaten på öring i Siljan åren 1977-84

General information
State: Published
Organisations: Unknown
Authors: Mosegaard, H. (Intern)
Pages: 17-22
Publication date: 1985
Main Research Area: Technical/natural sciences

Publication information
Journal: Fiskerinytt
Issue number: 22
Original language: Swedish
Source: orbit
Source-ID: 281460
Publication: Research › Journal article – Annual report year: 1985

Limnological investigations in the Narssaq Area: Fra: The Narssaq Project. Progress Report No. 2

General information
State: Published
Organisations: Unknown
Authors: Lindegaard, C. (Ekstern), Mosegaard, H. (Intern), Maehl, P. (Ekstern), Nielsen, B. (Ekstern), Rose-Hansen, J. (ed.) (Ekstern), Nielsen, C. (ed.) (Ekstern), Sørensen, H. (ed.) (Ekstern)
Publication date: 1982

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 281459
Publication: Research › Report – Annual report year: 1983

Statistisk bilaga: Fra: Ett forsök med "krokvana" hos öring

General information
State: Published
Organisations: Unknown
Authors: Mosegaard, H. (Intern), Nilsson, N. (Ekstern), Ragnarsson, B. (Ekstern), Steffner, N. (Ekstern)
Publication date: 1980

Publication information
Projects:

**Assessing cod growth and age by otolith microchemistry analysis**

National Institute of Aquatic Resources  
**Period:** 01/10/2016 → 30/09/2019  
**Number of participants:** 3  
**Phd Student:** Nielsen, Kristian Ege (Intern)  
**Supervisor:** Mosegaard, Henrik (Intern)  
**Main Supervisor:** Hüssy, Karin (Intern)

**Financing sources**  
**Source:** Internal funding (public)  
**Name of research programme:** Fonde  
**Project:** PhD

**Ballast water - Tool for supporting the delimitation of a "same risk area" (39348)**

A project financed by the Danish Maritime Fund via the Danish Nature Agency, to develop a decision support tool for authorities and consultants involved with the ballast water convention and measures preventing the spread of marine invasive species. The tool will support decision makers in member nations of the International Maritime Organisation (IMO) to identify and delimit marine areas with high connectivity considering hydrography and species biology. Identification of marine areas with high connectivity can provide a basis for granting exemptions in relation to the ballast water convention and the requirement for ships to treat ballast water before being discharged into the sea. The tool development is based on existing freeware including "IBM Lib" (DTU Aqua's own individual-based modeling system for linking individual-based models to hydrographical model data), Netlogo (a widely used IBM simulation system) and R (a statistical programming and data handling package).

This project is coordinated by DTU Aqua.

The project is funded by the Danish Maritime Fund via the Danish Nature Agency.

National Institute of Aquatic Resources  
Section for Marine Living Resources  
Danish Meteorological Institute  
Anchor-Lab  
**Period:** 01/03/2016 → 01/12/2016  
**Number of participants:** 9  
**Research areas:** Marine Living Resources & Observation Technology  
**Project participant:** Mosegaard, Henrik (Intern)  
**Stage, Bjarne (Intern)**  
**Eg Nielsen, Einar (Intern)**  
**Worsøe Clausen, Lotte (Intern)**  
**van Deurs, Mikael (Intern)**  
**Andersen, Niels Gerner (Intern)**  
**Project Manager, organisational:** Pedersen, Eva Maria (Intern)
Sound herding system for sustainable fisheries (GUDP-SHS) (39365)
The purpose of the project is to develop a new type of fishing gear, Sound Herding System (SHS), which applies sound to influence fish swimming direction and thereby herding them into a trawl. The sounders are mounted on the trawl boards, so as to create a wall of sound on both sides of the trawl opening. This increases the effective width and height of the trawl opening, resulting in higher catch rates. The frequency of the sounders is selected to be 4 kHz, which can be used to affect the clupeoid species herring, sprat and anchovy. Most other relevant species are not sound sensitive at this frequency.

The system can be used to avoid by-catches of herring in the mackerel fishery by closing trawl opening for herring with sound. Customers receive economic gains from higher catch rates and smaller by catch. The gain for the environment is a reduction in CO2 emissions and improved resource utilization.

The central work in the project is the development of trawl doors equipped with sounders as tested by exploratory scare effect measurements and mapping of sound fields. Fish response to sound is studied experimentally and finally the sounders’ impact on the environment is examined.

This project is coordinated by Sonus Aqua Aps, Denmark.

The project is funded by the Ministry of Environment and Food of Denmark through the Green Development and Demonstration Program (GUDP).

National Institute of Aquatic Resources
Section for Marine Living Resources
Sonus Aqua Aps
Aalborg University
Period: 01/01/2016 → 31/12/2018
Number of participants: 3
Research areas: Observation Technology & Marine Living Resources
Project participant:
Mosegaard, Henrik (Intern)
Pedersen, Eva Maria (Intern)
Project Manager, academic:
Stage, Bjarne (Intern)
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 Marine Living Resources
Danish Pelagic Producers Organisation
Danish Fishermen's Association

Marine Ingredients Denmark
Period: 11/11/2015 → 16/11/2017
Number of participants: 8
Research areas: Marine Living Resources & Population Genetics & Fish Biology & Marine Populations and Ecosystem Dynamics & Fisheries Management & Ecosystem based Marine Management
Project participant:
Rindorf, Anna (Intern)
van Deurs, Mikael (Intern)
Berg, Casper Willestofte (Intern)
Mosegaard, Henrik (Intern)
Bekkevold, Dorte (Intern)
Mortensen, Lars O. (Intern)
Christensen, Asbjørn (Intern)
Project Coordinator:
Worsøe Clausen, Lotte (Intern)

**Danish Fisher-Researcher Network (39315)**

The project aims to bring the active Danish fishing sector and operational fisheries research closer together through "fisher-researcher" networking activities. The project will contribute to the collection and exchange of information and knowledge on fisheries and research herein across sectors and generations. This knowledge exchange will take place at several levels of education (secondary schools, university studies and training of working fishermen).

The project will support innovation and development of sustainable fisheries through collation of ideas as well as preparation and planning of project cooperation for the solution of current and future challenges about fisheries, fish stocks and management. Bringing the primary fishing industries in direct contact with research and management in a network will support local skills in fishing ports to serve the development and succession in the coastal communities.

Workshops and demonstrations of novel development are intended to direct technology transfer, innovative collaborative proliferation of businesses and recruitment of newly qualified academic staff. In addition, Danish fishing industry participation at the international level will be strengthened through increased technical scientific support from DTU Aqua before and under meetings in e.g. Thematic and Regional Advisory Councils.

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 Marine Living Resources
Danish Fishermen's Association

Danish Pelagic Producer Organization
Period: 06/11/2015 → 06/11/2017
Number of participants: 2
Research areas: Marine Living Resources & Observation Technology & Population Genetics
Project Manager, organisational:
Pedersen, Eva Maria (Intern)
Project Coordinator:
Mosegaard, Henrik (Intern)

Project
Implementing robot and drone technology in fisheries (39303)
The project aims to provide proof of concept for the use of robots in the fishery, focusing on three specific types for three different implementations. One will be used to determine the species and size composition of fish in the catch to prevent discards, the other to search for fish optically with a drone (capelin in Greenland) and the third a sailing robot to search for fish using sonar. The robots/drones to be employed are available on the marked. A development project must subsequently design software etc. to produce marketable products. It is estimated that there is a great potential in Denmark and a huge world market for these technologies that presently are not employed in fishery.

This project is coordinated by DTU Aqua.

The project is funded by the Ministry of Environment and Food of Denmark through the Green Development and Demonstration Program (GUDP).

National Institute of Aquatic Resources
Arctic Section
Danish Pelagic Producers Organisation
Blue Ocean Robotics
Partrederiet M/S Isaold HG 333
AquaMind
Period: 01/07/2015 → 01/12/2016
Number of participants: 2
Research areas: Marine Living Resources & Observation Technology
Project participant:
Stage, Bjarne (Intern)
Mosegaard, Henrik (Intern)

Dynamic user-driven marine e-maps for the advancement of Danish industrial fisheries (GUPD-VIND) (39248)
This project aims at strengthening Danish industrial fisheries development in order to (i) reduce the search time and fuel consumption per ton of fish caught (revenues: 16 million DKK/year), (ii) make better use of the sprat quota (revenues: 15 million DKK/year), by a full quota uptake, (iii) pave the way for sustainable self-management of resources in the industrial fisheries sector and (iv) contribute to creating and maintaining jobs in the local fishing community.

The specific objectives of the project: Development of an IT tool that will contain (i) a platform to improve sharing of knowledge and registration of observable and derived variables (data), and (ii) user-defined and user-controlled digital Marine Maps with those specific data that fishermen consider important as background information in the planning and implementation of fishing trips. These marine data include (but are not limited to) a portfolio of Marine Maps spanning from the North Sea hydrography and bottom conditions over distribution of plankton and fish to water-DNA.

The needs for a technological development of this fishery comes from increasing average vessel size, while the number of large vessels is reduced to about 1/8 of what it was in the past. The immediate consequence is a reduction in the collective search performance and knowledge sharing. In addition, the area based management of the sandeel fishery introduced in 2011 has contributed to a reduction of fishermen’s opportunities to diversify fishing and explore a wider variety of fishing grounds. Finally, the sprat fishery is uncertain because of by-catch limits and a very variable CPUE driven by wind and weather. This has led to an underutilization of the sprat quota by around 100,000 tons per year. Fisherman knowledge of good fishing opportunities is based on the correspondence between historical catches and observable variables at the time of capture, such as the seasons, wind, waves and tides, and it is precisely this kind of knowledge that the project wants to combine with a technological solution, so that all relevant data is made widely available to the fishermen by developing user-controlled dynamic digital Marine Maps. The project includes a business plan for the IT company Anchor Lab, which develops the user-controlled Marine Maps, and plans for derived effects in terms of better utilization of the sprat quota and fuel savings through the use of the Marine Maps. Besides the economic effects, the project contributes to CO2 reduction, and supports the technological development of a modern industrial fishery sector, based on a natural resource to be managed by the EU in accordance with ICES’ advice.

This project is coordinated by DTU Aqua.

The project is funded by the Ministry of Environment and Food of Denmark through the Green Development and Demonstration Program (GUDP).

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Meteorological Institute

Anchor-Lab
Period: 01/01/2015 → 30/06/2018
Number of participants: 8
Research areas: Marine Living Resources & Marine Populations and Ecosystem Dynamics & Population Genetics & Observation Technology
Project participant:
Christensen, Asbjørn (Intern)
Stage, Bjarne (Intern)
Eg Nielsen, Einar (Intern)
Worsøe Clausen, Lotte (Intern)
van Deurs, Mikael (Intern)
Andersen, Niels Gerner (Intern)
Project Manager, organisational:
Pedersen, Eva Maria (Intern)
Project Coordinator:
Mosegaard, Henrik (Intern)

Tracing the dynamics of mixed stocks in a transition area: Herring in Skagerrak-Kattegat and Western Baltic

National Institute of Aquatic Resources
Period: 01/12/2013 → 04/06/2014
Number of participants: 6
Phd Student:
Worsøe Clausen, Lotte (Intern)
Supervisor:
Bekkevold, Dorte (Intern)
Main Supervisor:
Mosegaard, Henrik (Intern)
Examiner:
Hansen, Jakob Hemmer (Intern)
Grønkjær, Peter (Ekstern)
Hammer, Cornelius (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: §15 Re-enrolment
Project: PhD

Ecosystem based method for impact assessment (39142)
The project aimed to develop a methodology for impact assessment and measures to support the implementation of the Marine Strategy Framework and Natura 2000.

The project included
- Development of an approach to impact assessment and step by step guide for management actions to ensure biodiversity, marine food webs and seabed integrity.
- A Case Study on the Dogger Bank to support the implementation of the Natura 2000 processes was evaluated and best practice identified.
- A Case study in the Kattegat with monitoring and ecosystem analysis of muddy habitats to optimize nature conservation and fisheries management under the Marine Strategy was evaluated and best practice identified.
- Development of cost-effective methods for management, monitoring and control in a report that describes the best practices in the subareas and the related costs.

The project was coordinated by DTU Aqua.

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

National Institute of Aquatic Resources
Short-term projections for short-lived species managed under MSY: Management of the sandeel stock in the North Sea (39148)

The industrial fishery for small short-lived species represents the economically most important fishery in Denmark, and traditionally the North Sea sandeel (Ammodytes marinus) has played a key role in this fishery. Currently, quota advice for sandeel is based on the so-called B-escapement strategy, the purposes of which is to ensure that the spawning stock biomass remains large enough to maintain the survival of the population even after fish-eating fish, birds, and mammals have taken their share; and whatever is left is made available to the fishery. This type of management strategy relies on accurate predictions about the size of the incoming year class (the recruitment), if the criteria of MSY are to be fulfilled.

The aim of the project was therefore to ensure that the short-term prognosis reflects current knowledge about the biology of sandeels in the North Sea and applies all relevant data time-series. A new recruitment index was introduced. Seasonal and spatial patterns in log-book based catch rates of age-1 fish were analysed and compared to recruitment indices from the year before. Spatial differences in local larval retention strength were found. A genetic tool that allowed us to distinguish between different sandeel species in a quick and accurate way was developed. Lastly, development of a state based assessment model that can handle seasonal data (something which is necessary for sandeel) and estimate shifting selection patterns was initiated.

All of this work is currently contributing significantly to the preparation of the coming North Sea sandeel benchmark assessment in ICES to be held in the fall of 2016.

This project was coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).
Benthic ecosystem fisheries impact study (BENTHIS) (39021)
There is general concern about the adverse impact of fisheries on benthic ecosystem which may negatively affect the fisheries yield and integrity of the sea bed. In an integrated approach to marine management, there is a need to develop quantitative tools to assess the impact of fisheries on the benthic ecosystem and at the same time collaborate with the fishing industry to develop innovative technologies and new management approaches to reduce the impact on benthic ecosystems. BENTHIS will provide the knowledge to further develop the ecosystem approach to fisheries management as required in the Common Fisheries Policy and the Marine Strategy Framework Directive. It will study the diversity of benthic ecosystem in European waters and the role of benthic species in the ecosystem functioning. Fisheries impacts will be studied on benthic organisms and on the geo-chemistry. The newly acquired knowledge will be synthesized in a number of generic tools that will be combined into a fishing/seabed habitat risk assessment method that will be applied to fisheries in the Baltic, North Sea, Western waters, Mediterranean and Black Sea. Fisheries will be selected with the fishing industry based on the impact on the benthic ecosystem. BENTHIS will integrate fishing industry partners to collaborate in testing the performance of innovative technologies to reduce fishing impact. Finally, in collaboration with the fishing industry and other stakeholders, new management approaches will be developed and tested on their effects on the ecosystem and their socio-economic consequences. As such BENTHIS will substantially improve the scientific basis to integrate the role of marine benthic ecosystems in fisheries management.
The project has 33 partners from 12 countries.
The project is coordinated by Institute for Marine Resources & Ecosystem Studies (IMARES), Wageningen University, The Netherlands.
The project is funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Period: 01/10/2012 → 30/09/2017
Number of participants: 8
Research areas: Fisheries Management & Observation Technology & Fisheries Technology & Ecosystem based Marine Management
Project participant:
Bastardie, Francois (Intern)
Dinesen, Grete E. (Intern)
Serensen, Thomas Kirk (Intern)
Frandsen, Rikke (Intern)
Krag, Ludvig Ahm (Intern)
Mosegaard, Henrik (Intern)
Project Manager, academic: Nielsen, J. Rasmus (Intern)
Project Coordinator: Eigaard, Ole Ritzau (Intern)

Analysis of measures for increased stability in the industrial fisheries (39027)
The objective of the project "Analysis of measures for increased stability in the industrial fisheries" has been to improve fisheries advice to ensure more stable quotas for the three main industrial species in the North Sea; sandeel, sprat and Norway pout. The means to get there was to improve data, calculation procedure and management plans by taking into account the special conditions that exist for each species.

Through an industry-scientist-manager collaboration platform initiatives were taken to a theoretically and practical cooperation, where collection and analysis of biological and fishery-based data and knowledge sharing between fisheries, bio-economy, management and research has supported development of robust management strategies that may increase economic stability in the industry if implemented in the future.

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

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Fishermen's Association
Cefas
Association of Danish Fish Meal and Fish Oil Manufacturers

Danmarks Pelagiske Producentorganisation
Period: 10/07/2012 → 22/05/2014
Number of participants: 6
Research areas: Marine Living Resources & Ecosystem based Marine Management
Project participant:
van Deurs, Mikael (Intern)
Worsøe Clausen, Lotte (Intern)
Rindorf, Anna (Intern)
Christensen, Asbjørn (Intern)
Project Manager, organisational:
Pedersen, Eva Maria (Intern)
Project Coordinator:
Mosegaard, Henrik (Intern)

Towards Sustainable Management of Marine Benthic Ecosystems in Greenland - in relation to national and international standards
National Institute of Aquatic Resources
Period: 01/04/2012 → 12/10/2017
Number of participants: 6
Phd Student:
Jørgensbye, Helle (Intern)
Supervisor:
Mosegaard, Henrik (Intern)
Main Supervisor:
Stage, Bjarne (Intern)
Examiner:
Nielsen, Torkel Gissel (Intern)
Grehan, Anthony J. (Ekstern)
Møller, Peter Rask (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Grey-box methods for size-based estimation of fish stocks
National Institute of Aquatic Resources
Period: 01/03/2012 → 02/06/2016
Number of participants: 7
Phd Student:
Kokkalis, Alexandros (Intern)
Supervisor:
Nielsen, Anders (Intern)
Thygesen, Uffe Høgsbro (Intern)
Main Supervisor:
Andersen, Ken Haste (Intern)
Examiner:
Mosegaard, Henrik (Intern)
Fernández, Carmen (Ekstern)
O’Brien, Carl Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Efficient and low impact gear in the Danish fishery for industrial species (GUDP Tobis) (38849)

The aim of the project was to ensure the future of the Danish industrial fisheries in the increasing demands for reduced environmental impact. The Danish industrial fisheries amount to around 800 million DKK a year in first value. The industrial fishing for sandeel, was seen threatened by a potential ban against bottom trawling in the main fishing areas at Dogger Bank in the North Sea, due to appointment of a large Natura 2000 area by UK, the Netherlands and Germany where bottom trawl could be considered to affect the conservation status of the sand habitat negatively. In addition profitability was threatened by the high vessel operating cost, considering fuel prices at the time.

The objective was to develop and document a fishing method for industrial fisheries (sandeel, Norway pout and sprat) where the trawl doors don’t have bottom contact and where modern materials are used in the gear and for the wire. Thus, compared to traditional gear, an overall energy saving of minimum 30% on each kg fish caught was expected, and also the damages on the benthic fauna was expected to be reduced or eliminated.

The new pelagic gear was constructed according to specifications. It behaved as intended and could easily be operated on Dogger Bank. The new gear consisting of pelagic doors and Dynema equipped trawl has attracted considerable attention among fishers and can be considered a business success. Catch volumes (tons/hour) did not differ between the experimental and standard trawl under parallel fishing. Sandeel behavioral differences could not be identified from sonar and UV-camera recordings, and size and oil content of sandeels was not systematically different between the two gears.

Calibration experiments demonstrated 24 % lower fuel consumption in the new trawl. Bottom surveys were carried out annually from 2012 to 2014 in the North-eastern part of Dogger Bank (in the Dutch/NL EEZ) at approximately 35 meters depth. Sediment analyses showed a grain size composition dominated by fine sand mixed with small amounts of gravel, whereas fine particles comprises 1 % maximum ideal as a sandeel habitat. Grain size composition was not altered by trawling or time.

Bottom impact with new gear is estimated to be 30 % reduced compared to a similar trawl using conventional doors. Based on the side-scan sonar recordings it was not possible to distinguish differences between the two trawl types in sediment depth penetration. The foot prints left by both sandeel trawls in one year were not discernible in subsequent years. Results from the video record analyses showed especially conch and hermit crabs were more abundant soon after trawling compared to before impact. The sediment analyses revealed nearly 100 different invertebrate species many of which lives burrowed or tube building in the sand. Overall diversity did not differ significantly between transects trawled by the two gears and the non-trawled transect. Detailed analyses showed, however, that some species (fragile sea anemones, polychaetes and echinoderms) were less abundant after impact from the conventional trawl compared with the newly-designed trawl and the control transect. A few species were more abundant in the transect trawled by the conventional trawl, including some smaller crustaceans. These results suggest the newly-designed sand eel trawl has a lower impact on benthic fauna than the conventional trawl and we expect the final analyses will support these results.

The project is coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).

National Institute of Aquatic Resources
Section for Marine Living Resources
Thyboron Harbours Fishermen’s Association
Northeea Trawl
Thyboren Trawldoor.dk
Period: 01/01/2012 → 05/01/2015
Number of participants: 6
Research areas: Marine Living Resources & Fisheries Management & Observation Technology
Project participant:
Eigaard, Ole Ritzau (Intern)
Dinesen, Grete E. (Intern)
Stage, Bjarne (Intern)
Madsen, Niels (Intern)
Project Manager, organisational:
Pedersen, Eva Maria (Intern)
Project Coordinator:
Mosegaard, Henrik (Intern)
The aim of this project was to improve the management of western Baltic cod by incorporating stock identification routines in order to discriminate between eastern and western Baltic cod stocks. In recent years evidence from fishery patterns and otolith structures have indicated an increasing degree of mixing between the two cod stocks which up until 2013 were managed as two separate stocks. Changes in fishing pressure and patterns would therefore result in a risk for local depletion of the smaller western stock.

Stock identification methods were based on established approaches using genetic discrimination and otolith shape analysis, and improved by linking these methods. This method provides a tool to estimate the degree of stock mixing using the existing otolith archives. This approach documented an increase of eastern Baltic cod from 30% to > 80% in the eastern part of the western Baltic Sea management area. As a consequence of this stock mixing, a new procedure incorporating stock mixing on an annual basis was set in place in 2016, with the aim to improve stock exploitation and reduce the risk of local depletion. The knowledge gained also influenced recent management regulations, particularly a prolongation of spawning closer of the fishery in 2016.

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

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

Geographical distribution of fish resources and optimizing of fishery practice in the north-eastern North Sea (RESOURCE) (38878)
RESOURCE is a collaborative fishermen-scientist project in direct continuation of the REX projects in the north-eastern North Sea conducting small-scale scientific surveys, but only with one commercial trawler, encompassing also geographical distributional aspects as in OSKAR.

The REX project showed that changes in the biomass densities of cod differ between bottom types (and may depend on stock size) and the proportion of the cod population found on smooth bottoms is not constant. However, due to scaling problems and too short a time series the achieved results have so far had no impact on the assessment procedure or any
(measurable) effect on the TAC’s (but the RAC discussions may have affected decisions by the European Commission).

Continuation of the field work with the trawler in 2010-12 in the RESOURCE project should produce a sufficient time series for supplementing the abundance indices for the older ages in the assessment, which at present are based only on the catch rates in the international scientific surveys (IBTS). This total REX-RESOURCE time series will be used in the state space assessment of North Sea cod (SAM) and various other approaches applied to document how commercial CPUE may be used in the tuning procedure. Particular attention will be given to evaluate the size of the spawning stock of cod.

Mechanistic knowledge on vital rates together with REX, RESOURCE, OSKAR and IBTS (and possibly also UK) survey data will be used as input to the geostatistical tool GeoPop to estimate the temporal and spatial dynamics of the size distribution of the cod stock. This part of the project will represent a direct continuation of OSKAR principles including considerations to how to design an operational fishery-forecast system for North Sea cod.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
Danish Fishermen's Association
Period: 01/01/2010 → 30/09/2012
Number of participants: 13
Research area: Marine Populations and Ecosystem Dynamics
Project participant:
Andersen, Niels Gerner (Intern)
Pedersen, Eva Maria (Intern)
Andersen, Bo Sølgaard (Intern)
Hüssy, Karin (Intern)
Kristensen, Kasper (Intern)
Nielsen, Anders (Intern)
Stage, Bjarne (Intern)
Mosegaard, Henrik (Intern)
Christensen, Asbjørn (Intern)
Mariani, Patrizio (Intern)
Madsen, Niels (Intern)
Project Manager, academic:
Beyer, Jan (Intern)
Wieland, Kai (Intern)
Project

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 shonwthat some fish migrate towards the deeper basin centre, presumably to feed. Duringthese 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 strategery or a necessity due to limited or less accessible prey in the cod’s optimalhabitats.

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 facilitated 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 searchfor and ingest prey in the hypoxic water, this may implicate impaired digestivecapacity following the return to well-oxygenated waters, either by prolonginggastric 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 equippedanimals) 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, and whether (2) GBF will be spared or curtailed under the same circumstances, and if the latter, whether this will influence the digestive processess subsequent return to normal oxygen conditions.

We found that fish after 48hr 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, thenexposed 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).

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
University of Gothenburg
Period: 01/01/2009 → 31/05/2012
Number of participants: 4
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology & Marine Living Resources
Project participant:
Neuenfeldt, Stefan (Intern)
Thygesen, Uffe Høgsbro (Intern)
Mosegaard, Henrik (Intern)
Project Manager, academic:
Behrens, Jane (Intern)

Developing fisheries management indicators and targets (DEFINEIT) (38763)
DEFINEIT constructed operational models of fish stock dynamics explicitly taking into account exploitation and climatic conditions and combine these models with basic economic models. To ensure an outstanding scientific level in each of these areas, the project brought together key competences in operational multispecies modelling, stock recruitment relationships, population dynamics of non-target fish species and economic modelling of fisheries from a wide geographic area ranging from the Barents Sea to the North Sea. The project used multispecies models to investigate changes in predation induced by differences in the distribution and the amount of alternative food. Effects of technical interactions in the fishing process were considered to avoid delivering management advice for different stocks which is mutually inconsistent. Integrating the knowledge gained, the project suggested methods for estimating reference points. The project identified the main causes of variation in recruitment patterns between stocks as well as the key processes from spawning to recruitment of selected stocks. The consequences of using proxies to describe stock reproductive potential were determined and survival during early life stages was investigated in order to identify the role of the physical and biological environment. The improved understanding of recruitment variability was used in individual stock assessment and included in multispecies models to provide reliable predictions. The maximum level of fishing effort consistent with sustainment of susceptible species was estimated along with the effect of discard of by-catch on economic yield. The project developed resource indicators that combine economic, social and biological indicators and relate directly to the benefit for the society. Future stock dynamics limits to sustainable ecosystem exploitation and the fishing levels delivering maximum sustainable economic yield under selected climatic scenarios were analyzed in unison to ensure the delivery of mutually consistent management advice. General properties of the ecosystems were used to suggest rules of thumb for management in areas where the amount of data available is insufficient to construct similar models.

The project was coordinated by DTU Aqua.
The project was funded by EU, MariFish, ERA-NET.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Cefas
Institute of Marine Research
Hellenic Centre for Marine Research
Marine Research Institute
University of Copenhagen
University of St Andrews
University of Southern Denmark
Wageningen IMARES
Imperial College of Science, Technology and Medicine
Development of a method for long term spatially resolved management of the herring fishery in the North Sea and IIIa taking the migration of the primary herring stocks, the fishery pattern and by-catch of mackerel into consideration (URSIN) (38731)

The overall objective is to develop a tool to create long-term management plans for the two main herring stocks in the North Sea and IIIa, which may allow the industry an optimum use of the population under safe conditions relating to population maintenance and catch of mackerel.

The project will further develop, test and optimize a method for the quantification and prediction of herring stock spatial distribution in relation to life stages that is based on existing methods. This quantification of the migration patterns will provide more solid understanding of population development under various conditions. Moreover, the method will include a modeling of the herring fleet behavior, allowing for merging of herring spatial distribution in relation to life stage and hence potential economic value of fishing pattern. The historical and current behavior of the herring fleets will be quantified in collaboration with the industry. Similarly, mackerel skull occurrence will be mapped as it is of great importance for the herring fleet behavior, due to the economic incentives to minimize this by-catch.

The objective of the project is to generate a scientifically based tool for prediction of utilization of herring that can be used in future scientific advice to management, and information on optimal harvest strategies for the fishery in collaboration with the fishing industry. This is partly to increase the transparency and credibility of the scientific work and increase security in the input data and thus reduce uncertainty in the advice given in the end. Collaboration with industry includes Pelagic PO, Skagen PO and Esbjerg Fishermen and covers all types of fishing for herring (both industrial and human consumption).

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Pelagic Producers Organisation
Danish Fishermen's Association

Period: 01/01/2009 → 30/06/2012
Number of participants: 9
Research areas: Ecosystem based Marine Management & Marine Living Ressources & Marine Populations and Ecosystem Dynamics & Population Genetics
Project participant:
Gislason, Henrik (Intern)
Payne, Mark (Intern)
Worsøe Clausen, Lotte (Intern)
Mosegaard, Henrik (Intern)
Bekkevold, Dorte (Intern)
Eg Nielsen, Einar (Intern)
Vinther, Morten (Intern)
Lewy, Peter (Intern)
Payne, Mark (Intern)
Worsøe Clausen, Lotte (Intern)
Mosegaard, Henrik (Intern)
Bekkevold, Dorte (Intern)
Eg Nielsen, Einar (Intern)
Vinther, Morten (Intern)
Lewy, Peter (Intern)
Payne, Mark (Intern)
Worsøe Clausen, Lotte (Intern)
Mosegaard, Henrik (Intern)
Bekkevold, Dorte (Intern)
Eg Nielsen, Einar (Intern)
Vinther, Morten (Intern)
Lewy, Peter (Intern)
Project Manager, academic:
Rindorf, Anna (Intern)
Project

Development of a method for long term spatially resolved management of the herring fishery in the North Sea and IIIa taking the migration of the primary herring stocks, the fishery pattern and by-catch of mackerel into consideration (URSIN) (38731)

The overall objective is to develop a tool to create long-term management plans for the two main herring stocks in the North Sea and IIIa, which may allow the industry an optimum use of the population under safe conditions relating to population maintenance and catch of mackerel.

The project will further develop, test and optimize a method for the quantification and prediction of herring stock spatial distribution in relation to life stages that is based on existing methods. This quantification of the migration patterns will provide more solid understanding of population development under various conditions. Moreover, the method will include a modeling of the herring fleet behavior, allowing for merging of herring spatial distribution in relation to life stage and hence potential economic value of fishing pattern. The historical and current behavior of the herring fleets will be quantified in collaboration with the industry. Similarly, mackerel skull occurrence will be mapped as it is of great importance for the herring fleet behavior, due to the economic incentives to minimize this by-catch.

The objective of the project is to generate a scientifically based tool for prediction of utilization of herring that can be used in future scientific advice to management, and information on optimal harvest strategies for the fishery in collaboration with the fishing industry. This is partly to increase the transparency and credibility of the scientific work and increase security in the input data and thus reduce uncertainty in the advice given in the end. Collaboration with industry includes Pelagic PO, Skagen PO and Esbjerg Fishermen and covers all types of fishing for herring (both industrial and human consumption).

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Pelagic Producers Organisation
Danish Fishermen's Association

Period: 01/01/2009 → 31/12/2011
Number of participants: 6
Research area: Marine Living Resources
Project participant:
Payne, Mark (Intern)
Mosegaard, Henrik (Intern)
Dijkman, Teunis Johannes (Intern)
Nielsen, Anders (Intern)
Project Manager, organisational:
Ulrich, Clara (Intern)
Project Manager, academic:
Worsøe Clausen, Lotte (Intern)
Project
Effect of the Horns Rev 1 offshore wind farm on fish communities (38734 and 38735)
The present project focuses on the fish community at the Horns Rev 1 Offshore Wind Farm. The objective of the present study was to document possible refuge effects or changes in local fish communities, seven years after the establishment of the wind farm at a time where wind farm effects on the physical and biological environment could be assumed to have stabilized. Fish communities and sandeel assemblages were compared inside and outside the wind farm area, with the null-hypothesis that the introduction of an offshore wind farm does not affect species composition, temporal or spatial distribution of species or relative abundance.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Orbicon
Period: 01/01/2009 → 31/12/2011
Number of participants: 5
Research areas: Coastal Ecology & Marine Populations and Ecosystem Dynamics
Project participant:
Støttrup, Josianne Gatt (Intern)
vane Deurs, Mikael (Intern)
Dinesen, Grete E. (Intern)
Project Manager, academic:
Stenberg, Claus (Intern)
Mosegaard, Henrik (Intern)

Individual based modelling of growth and survival of cod and sandeel larvae
National Institute of Aquatic Resources
Period: 15/12/2008 → 22/04/2013
Number of participants: 5
Phd Student:
Gürkan, Zeren (Intern)
Main Supervisor:
Mosegaard, Henrik (Intern)
Examiner:
Hüssy, Karin (Intern)
Gaard, Eilif (Ekstern)
Skogen, Morten Dahlberg (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Local adaption in Baltic Sea small pelagic fishes
National Institute of Aquatic Resources
Period: 01/09/2008 → 28/03/2012
Number of participants: 8
Phd Student:
Limborg, Morten (Intern)
Supervisor:
Hansen, Michael Møller (Intern)
MacKenzie, Brian (Intern)
Eg Nielsen, Einar (Intern)
Main Supervisor:
Bekkevold, Dorte (Intern)
Examiner:
Mosegaard, Henrik (Intern)
Hauser, Lorenz (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Bridging the gap between science, stakeholders and policy makers (GAP 1 & GAP 2) (38133 & 38860)
Stakeholders and scientists involved in GAP1 initiated cooperative research by making plans to combine knowledge in participatory research through a series of European and regional workshops. GAP1 represented phase 1 of a three-phase program that aimed to explore the complementary nature of alternative knowledge and investigate how to combine it in ways that will enhance understanding and management of natural resources. Tied to knowledge, GAP1 was an evidence-based approach that used participation as the vehicle to improve understanding of fisheries research and management issues of common concern to stakeholders, scientists and policy makers. Through initiation of cooperative research and facilitating the building of the capacity of stakeholders to engage in participatory research, GAP1 contributed towards the wider aspiration of the Science in Society program. In particular, enhancing the democratic debate with a more engaged and informed public, thus providing better conditions for collective choices on scientific issues relating to sustainable management, conservation of ecosystem integrity and biodiversity of the marine environment.

GAP2 was about making a difference to an issue of significance to the whole of society; the wellbeing of the marine environment and the sustainability of fisheries upon which society depends for food. It continued the relationships, processes and plans made in GAP1 by enabling Mobilization and Mutual Learning (MML) actions that promoted stakeholder participation in the debate and development of research knowledge and structures relevant to emerging policy on fisheries and the marine environment. The aims were to promote and enable processes for open and effective participation of stakeholders in research and management, demonstrate through specific examples and critical evaluation the role and value of stakeholder driven science in the governance of fisheries and the marine environment. DTU Aqua was the case study leader of one of the selected cases of GAP2.

Find full list of participants at the website of GAP2.

These projects were coordinated by the Centre for Environment, Fisheries and Aquaculture Science, UK.

The projects were funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Marine Living Resources
Cefas
Universidade da Coruña
Aalborg University
University of Tromsø
Swedish Board of Fisheries
Istituto Superiore per la Protezione e la Ricerca Ambientale
Pelagic Regional Advisory Council
Baltic Sea Regional Advisory Council
Period: 01/01/2008 → 31/12/2015
Number of participants: 4
Research areas: Marine Living Resources & Population Genetics & Fisheries Management
Project participant:
Mosegaard, Henrik (Intern)
Ulrich, Clara (Intern)
Berg, Casper Willestofte (Intern)
Worsøe Clausen, Lotte (Intern)

Establishment and testing of area-based management models for North Sea sandeel fisheries (ETOMTOBIS) (38588)
The goal of this project is to investigate the effects of area-based management for sandeel stocks and the fisheries. Objectives include developing for optimal area-based management of sandeel fisheries in the North Sea. The tools will first be tested through computer simulations and the experience gained will be used to develop a revised management...
The project will also help fisheries managers to act proactively to other marine management initiatives. In connection with the implementation of the EU Habitat Directive in the North Sea, EU coastal states appoint Natura 2000 areas by 2010. Area based analysis of population dynamics is therefore necessary to quantify the effect of fishing at the local level, and subsequently assess whether fisheries are affecting the habitat. Additional field-based analysis will be valuable in assessing interaction of the sandeel fishery with potential Natura 2000 areas. Spatial management is not only intended to restrict fishing. A description of the consequences for fisheries and sandeel population dynamics are important in assessing the benefits and drawbacks of introducing area-based management of sandeel fisheries in the North Sea. Currently the sandeel fishery is managed under the assumption that there is one population of the sandeel (Ammodytes marinus) in the North Sea, in spite of this, the North Sea sandeel stock can be divided into several sub-populations. Based on recent research there is now a strong wish from ICES (see eg. ICES 2007 and 2008) and from the EU (see eg. STECF 2005), to introduce area based management of the sandeel fisheries, in order to adjust fishing to a level defined as sustainable for each of the local sub-populations. Sandeel stocks in the North Sea will be divided into separate management units, each of which can be regarded as sub-populations who have little or no mutual exchange of both sand eel fry and adult sandeels, as presented in the final report of the project TORTN (project 38128). An assessment model will be developed to analyze sandeel population dynamics for each of the identified management units. A forecast model based on the relevant scientific surveys will predict the actual size of the sandeel recruitment in each of the management areas. Finally a tool will be developed that calculates the catch of sandeels in each of the management areas in a number of scenarios that include output of maximum sustainable yield, the most stable catches, and optimal fisheries management.

The project also includes a field sampling module, using two different methods, pelagic larval and demersal 0-group sampling, associated with a tool technological module for this collection to measure the size of the sandeel recruitment. The purpose of the field collection is to continue and analyze existing time series of field data to further develop area based recruitment indices. Field data should also be used as a fishery independent index of the sandeel stock size in the developed assessment model.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources

Danish Fishermen's Association
Period: 01/01/2008 → 31/12/2010
Number of participants: 5
Research area: Marine Living Resources
Project Manager, academic:
Mosegaard, Henrik (Intern)
Vinther, Morten (Intern)
Rindorf, Anna (Intern)
Christensen, Asbjørn (Intern)
Jensen, Henrik (Ekstern)

Judgement and knowledge in fisheries involving stakeholders (JAKFISH) (38132)
JAKFISH aimed at developing institutions, practices and tools for dealing with scientific support to European Marine policy under high uncertainty. The objectives of JAKFISH are: (i) to examine and develop these institutions, practices and tools that allow complexity, uncertainty and ambiguity to be dealt with effectively within participatory decision-making processes, (ii) to examine how scientific information is used and what types of roles scientists play in the formulation of policies, (iii) to study how the current scientific processes take into account the multi-objective nature of fisheries management, and (iv) to synthesize the obtained views and to redefine the institutional role of science in EU polices to improve the overall governance in CFP.

Two parallel tracks were followed: First, a number of case studies involving participatory modeling processes with stakeholders involvements were developed, for support in policy decision-making: Western Baltic herring, Central Baltic herring, North Sea nephrops and Mediterranean swordfish. Second, sociological analyses of the practices and institutional forms that can most effectively involve the wider community in debates over developing science-based policies were carried in various regions both within Europe (North Sea, Baltic, Mediterranean) and outside (USA, Australia). Ultimately, both tracks were linked into a single synthesis.

The project was coordinated by IMARES, Wageningen UR, The Netherlands.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management

Wageningen IMARES
Sustainable fisheries, climate change and the North Sea ecosystem (SUNFISH) (38135)

Global climate changes will seriously challenge the governance of fisheries in the North Sea and elsewhere. Changes in temperature, wind conditions, river runoff and currents will affect primary and secondary production, the distribution, feeding, growth and survival of commercially exploited fish at all stages of life. Without improved knowledge about the effect of climate on the basic biological processes involved in fish production, it will be increasingly difficult to separate the effects of fishing from those of environmental fluctuations and change, identify biological reference points, and to develop management strategies for sustainable fisheries. By combining models of the effects of climate on the hydrographical and biological processes important for fish production with models of fish stock dynamics and fishing, the project provided a basis for improved predictions of the effects of climate change on the sustainable exploitation and maximum yield of North Sea fish stocks. The dynamics of cod (a top predator), herring and sandeel (two important prey for fish), seabirds and marine mammals were studied in detail. Their spawning, egg and larval drift, juvenile and adult distribution, growth and survival were investigated through experiments, statistical analyses of collected data and advanced bio-oceanographic models. The sustainability of exploitation under changing climate conditions were examined by modifying an existing stochastic multispecies fisheries model to make it account for climate effects on fish ecology. The project provided an integrated modelling framework for developing sustainable fisheries management strategies superior to using simple extrapolations of observed historical trends to predict the likely outcome of climate change on the North Sea ecosystem.

The project was coordinated by DTU Aqua.

The project was funded by the Danish Council for Strategic Research.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
University of Copenhagen
Aarhus University
Danish Meteorological Institute
Marine Scotland
University of Hamburg
Period: 01/01/2008 → 01/09/2012
Number of participants: 6
Research areas: Ecosystem Based Marine Management & Marine Living Resources
Project participant:
Munk, Peter (Intern)
Lewy, Peter (Intern)
Automated fish ageing (AFISA) (38111)

Most of European fish stocks are assessed using age-based models, the cost of the acquisition of age data from otolith readings raises several million euros annually. Low uncertainty in age estimation is however reached for only 25 % of fish stocks under ICES advising process. The impact of ageing errors on stock assessment is obvious though obscure. In this context, automated ageing systems would provide a mean to standardize ageing among laboratories and to control ageing consistency while reducing the cost of the acquisition of age data. No such system is currently available, although preliminary results provide the basis for such developments.

This two-year project aims at developing fully automated and robust systems for routine ageing. It will comprise four work packages in addition to project management (WP0): the collation of the otolith material and the creation of bases of annotated otolith images (WP1), the development of algorithms for fish ageing automation from otolith features (WP2), the implementation these automated ageing modules in a software platform dedicated to otolith imaging (WP3), the cost-benefit analysis of the proposed automated ageing systems (WP4).

The whole processing chain from the acquisition of otolith data to the actual ageing issue using pattern recognition or statistical inference will be coped with. The demonstration component will include the demonstration of the degree of automation of the proposed systems and a cost-benefit analysis of these automated solutions for three case studies: cod from Faeroes, North Sea and North East Artic, plaice from the Eastern English Channel (VIIId) and Iceland, and anchovy from the Bay of Biscay. The focus will be on demonstrating the consistency of automated age estimation with respect to the major steps of the processing chain and to the joint analysis of ageing precision and acquisition costs with respect to stock assessment objectives.

The project is coordinated by Institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER), France.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
IFREMER
Marine and Food Technological Centre
Cefas
Institute of Marine Research
Marine Research Institute
Polytechnic University of Catalonia
Period: 01/01/2007 → 31/12/2009
Number of participants: 5
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology
Project participant:
Christensen, Asbjørn (Intern)
Lewy, Peter (Intern)
Worsøe Clausen, Lotte (Intern)
Project Manager, academic:
Mosegaard, Henrik (Intern)
Hüssy, Karin (Intern)

Development and performance test of method for establishing an area based recruitment index for North Sea sandeels (TORTN) (38128)

The project's overall objective is to establish a recruitment index for sandeel in the North Sea, for use in preparation of the scientific advice for North Sea sandeel fisheries. It is also an objective that this index should be developed in collaboration with the fishing industry. This is partly to increase the transparency and credibility of the scientific work but also to reduce the cost of setting up the necessary information to as low as possible.

It is of significant interest to be able to subdivide North Sea sandeel habitats based on well-founded biological and
physical principles in order to provide spatial explicit stock assessment and advice on local fishing potential. Using hydrographic modeling and field sampling during the fishing season the coupled larval drift and population model (SPAM) will be validated.

The North Sea wide collection of winter hibernating sandeels from the seabed with the modified scallop dredges will be continued and the time series of abundance data will be analyzed. The project will further create a database of VMS, data corresponding to Danish vessels fishing for sand eels (defined by logbook database). From this data fishing effort, a fishing ground level will be estimated through the use of VMS and log book data. Using sandeel samples from the fishery area-based age-length keys will be developed using a continuation logit statistical approach. Combining recruitment data from population analysis and fisheries independent data on 0-group, the project will further develop, test and optimize a method for calculating the recruitment of 0-year-old sandeels to the North Sea stock. Real-time Monitoring of the sandeel fishery, which is the present basis for in season advice on fishing opportunities (applied 2004-2009), earliest establish the same basis by May i.e. in the middle of the fishing season. The new procedure developed in the project makes it possible to provide the scientific advice used in fisheries management in January, more than 2 months before the start of fishing season. Thus the procedure will allow the development of area based recruitment indices to manage the sandeel fishery in accordance with principles that ensure a more optimal utilization of sandeel stock and also reduces the risk of local overfishing.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Fishermen's Association
Period: 01/01/2007 → 31/12/2008
Number of participants: 4
Research area: Marine Living Resources
Project Manager, academic:
Mosegaard, Henrik (Intern)
Christensen, Asbjørn (Intern)
Rindorf, Anna (Intern)
Jensen, Henrik (Ekstern)

Improved methodology for cod age estimation (DECODE) (38120)
The objective of this project is to develop and implement an objective method for the age-determination of Eastern Baltic cod. The assessment for Eastern Baltic Cod (Sub-divisions 25-32) has presented a number of problems in recent years. The key problem is the severe inconsistencies in age determination which affect both the catch-at-age and the survey data. The methods to be developed within this project are based on the use of otolith biometrics. This procedure has proven successful in other stocks with age-reading problems. The data series on commercial and survey catch length distributions, otolith biometrics and biological parameters (collected for ICES Study Group on Ageing Issues in Baltic Cod (SGABC)) will be extended back as far as 2000. Mixture and conditional models to estimate age structure for a given component in stock assessment will be developed as statistically robust approaches to age-determination. Based on this new method, the historic catch and survey data will be reconstructed. The primary focus is on data for routine single-species assessments, but data for multi-species assessments will also be updated where possible.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Bundesforschungsanstalt für Fischerei
Swedish National Board of Fisheries
Morski Instytut Rybacki w Gdynia
Latvian Fish Resources Agency
Cefas
Period: 01/01/2007 → 31/12/2009
Number of participants: 5
Research area: Marine Living Resources
Project participant:
Lewy, Peter (Intern)
Resolving climatic impacts on fish stocks (RECLAIM) (38109)

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

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

A conceptual framework will be developed to distinguish between processes acting on individual (physiology, behavior), population (predation, competition) and ecosystem (physical habitat qualities, biological productivity, trophic coupling) levels. The framework structures a literature review to detect 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 hindcast as well as forecast the effects of climate change on the productivity and distribution of fish and shellfish stocks to formulate hypotheses and research needs to be addressed in future EU research.

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

National Institute of Aquatic Resources

Section for Marine Ecology and Oceanography
Period: 01/01/2007 → 31/12/2009
Number of participants: 12
Research area: Marine Populations and Ecosystem Dynamics

Contact person:
Christensen, Asbjørn (Intern)
Project participant:
Neuenfeldt, Stefan (Intern)
MacKenzie, Brian (Intern)
Andersen, Ken Haste (Intern)
Huwer, Bastian (Intern)
Payne, Mark (Intern)
Brander, Keith (Intern)
Gürkan, Zeren (Intern)
Mosegaard, Henrik (Intern)
Geitner, Kerstin (Intern)
Jensen, Henrik (Ekstern)
Project Manager, academic:
Köster, Fritz (Intern)
Project
Indicators for fisheries management in Europe (IMAGE) (38225)
The Common Fisheries Policy (CFP) requires the progressive implementation of an ecosystem-based approach to fisheries management (EBFM). To implement effective management, it is essential to develop a framework that allows for the evaluation of different management strategies based on indicators. Indicators can support the decision making process by (i) describing the pressures affecting the ecosystem, the state of the ecosystem and the response of managers, (ii) tracking progress towards meeting management objectives and (iii) communicating trends in complex impacts and management processes to a non-specialist audience. The aim of this project was to develop an indicator-based operational framework that can support ecosystem-based management, and also show how this can be applied to test and evaluate different management strategies or sampling programs.

The principal objectives of IMAGE were:-To develop an operational framework of candidate indicators (ecological, economic, social) that can support ecosystem-based fisheries management at the regional and pan-European scale-To elaborate these indicators in comprehensive dashboards (e.g. current values, trends, reference levels)-To develop methodology to integrate this information into tools supporting the decision-making process-To develop a framework that can evaluate management strategies based on indicators-To advise on how indicators can be used to support EBFM in selected regional case studies based on the RAC areas.

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

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

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
IFREMER
Aalborg University
COISPA Tecnologia & Ricerca
University of Tartu
Period: 01/01/2006 → 31/12/2009
Number of participants: 11
Research area: Ecosystem Based Marine Management
Contact person:
Nielsen, J. Rasmus (Intern)
Köster, Fritz (Intern)
Project participant:
Jarre, Astrid (Intern)
Bastardie, Francois (Intern)
Andersen, Ken Haste (Intern)
Serensen, Thomas Kirk (Intern)
Mosegaard, Henrik (Intern)
Thomsen, Kirsten (Intern)
Tomczak, Maciej (Ekstern)
Jacobsen, Jonathan Broch (Ekstern)
Project Manager, academic:
Eero, Margit (Intern)

Bank resolved prognoses of sandeel fishing potential in the North Sea (38563)
Sandeel stocks in the North Sea have experienced successive recruitment failures within the last 5 years. There is an urgent need to develop management tools that may contribute near and long term planning of the sandeel fishery and understand the reasons behind recent recruitment failures.

The project has three main goals:
(i) To fill some of the current knowledge gaps in the biology of North Sea sandeels and evaluate the North Sea sandeel
(ii) To demonstrate by combining advanced modelling with biological knowledge, that it is possible to generate fishing potential prognoses for sandeel spatially resolved at bank levels, just like ubiquitous whether forecasts, which at sight may be incorporated in the fishery management process;

(iii) To develop the collaboration with the Danish Fishermen’s Association (DF) and foster a sustainable sandeel fishery based on increased self regulation within the fishery.

The scientific activities in this project relate developing the necessary components, which are a premise for generating fishing potential forecasts. This encompasses computer model code writing and data collection. The efforts have been very successful and a first generation fishing potential forecast has been generated as final products of this project. On the modelling side two model components has been developed. The first is the larval module that describes hydrodynamical transport of sandeel larvae which is determining next year’s recruitment. The second component is the population model which combines the hydrodynamical transport output with available biological data and knowledge into a spatially explicit sandeel stock model. Two fishing vessels take part in the project.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Meteorological Institute
Danish Fishermen’s Association

Period: 01/01/2005 → 31/12/2007
Number of participants: 3
Research area: Marine Living Resources
Project participant:
Mosegaard, Henrik (Intern)
Jensen, Henrik (Ekstern)

Project Manager, academic:
Christensen, Asbjørn (Intern)

Improved advice for the mixed herring stocks in the Skagerrak and Kattegat (ICES area IIIa) (2011)

The ICES working group on Herring Assessment for the Area South of 62ºN (HAWG) has not been able to provide an advice applicable for the stock components in area IIIa due to limited resources to explore on the matter intersessionally. In previous years, the TAC for the fleets fishing herring in area IIIa have been decided by managers according to recommendations for the North Sea Autumn Spawners (NSAS), raised according to the historical fraction of NSAS in the catches by these fleets. The recommendation for the NSAS was guided by the need to rebuild that stock. By now, the NSAS stock has recovered and the main concern is for the Western Baltic Spring Spawners (WBSS) stock. The HAWG used a simple procedure in 2004 to find the highest total catch by fleet in area IIIa that would be compatible with a precautionary exploitation of WBSS. This procedure used two kinds of information about the fishery, the fraction of WBSS that is caught in area IIIa, and the fraction of the catches by the area IIIa fleets that consist of WBSS based on recent historic data. This very crude procedure can be refined with more detailed information on how the stocks on one hand and the fisheries on the other hand are distributed geographically and seasonally. Furthermore, the differences in both distribution and fishing pattern both in terms of season and stock components suggest a scope for a fishery management that is more fishery and stock oriented, allowing for more directed stock-wise exploitation. The primary goal of the project is to improve the assessment and advice of the mixed stock in area IIIa by elaborating fleet- and stock-based disaggregation on the existing projection method. The advice would so take into account both stocks and all fleet components in area IIIa. Temporal and spatial distribution of the different stock components and fleet exploitation patterns will form the basis for the elaboration.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Institute of Marine Research

Period: 01/01/2005 → 31/12/2007
Number of participants: 6
Research area: Marine Living Resources
Project participant:
Ulrich, Clara (Intern)
Mosegaard, Henrik (Intern)
Marine protected areas as a tool for ecosystem conservation and fisheries management (PROTECT) (38095)

1) To evaluate the potential of MPAs as a tool to protect sensitive species, habitats and ecosystems from the effect of fishing.

2) To outline and develop monitoring, assessment and management tools for MPAs that can assess: a) the impact of fisheries on marine ecosystems, b) the effect of different levels of protection and c) the impact and socio-economic effects of MPAs on fishing communities.

3) To facilitate linkages between science and management in the areas of: a) MPA design and implementation, b) timing and level of stakeholder involvement and c) management effectiveness and adaptability.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Finnish Game and Fisheries Research Institute
Swedish National Board of Fisheries
Institute for Marine Sciences
University of Hamburg
Sea Fisheries Institute
Centre for Ecology and Hydrology
Cefas
Marine Scotland
National University of Ireland
Institute of Marine Research
University of Portsmouth
University of Tromsø
IFREMER
University of Gothenburg
Wageningen IMARES
University of Copenhagen

Period: 01/01/2005 → 31/12/2008
Number of participants: 9
Research area: Ecosystem Based Marine Management
Contact person:
Nielsen, J. Rasmus (Intern)
Project participant:
Christensen, Asbjørn (Intern)
Sørensen, Thomas Kirk (Intern)
Project Manager, academic:
Hoffmann, Erik (Intern)
Mosegaard, Henrik (Intern)
Vestergaard, Ole (Ekstern)
Jensen, Henrik (Ekstern)
Analysis of biological key parameters, population structure and population dynamics of the lesser sandeel (Ammodytes marinus) in the North Sea, based on detailed information about the sandeel fishery (AHA.DOT) (2167)

The overall goal is to establish the scientific basis for a management system for the North Sea sandeel fishery that will prevent local depletion of sandeels due to fishing and improve the yield of the fishery.

Stock assessment of sandeels in the North Sea is based on the assumption that there is one stock of sandeels in the North Sea and one stock in the Shetland area. However, recent investigations suggest that sandeels in the North Sea can be divided into several stock components or sub-stocks. Further, growth and fecundity seem to vary significantly between the different stock components. This project will analyse spatial trends in key biological parameters (emergence behaviour, growth and fecundity) and the distribution of the lesser sandeel Ammodytes marinus in the North Sea.

Additionally the drift pattern of sandeels larvae between the spawning areas will be analysed by use of a hydrographical model. Information about distribution, biological parameters and the drift of larvae will be used to define the stock components of sandeels to be assessed as separate population units.

Besides the lack of information about the spatial heterogeneity on the biology of sandeels, the possibility to carry out regional assessments is hindered by a lack of information about the sandeel fishery and the catches of sandeels, where the main problem being the level of aggregation of the data. To carry out assessments for each of the stock components separately, more detailed information about the fishery and the catches of sandeels is needed. The data available about the fishery can only be allocated to ICES rectangles. However, data will have to be allocated to fishing grounds. Effort and catch data as well as biological samples has since 1999 been collected on a by haul basis for 15-20 Danish vessels representing the existing vessel categories and fishing pattern in the Danish North Sea sandeel fishery. During this project satellite data for all Danish vessels fishing sandeels in the North Sea will together with the detailed data from the 15-20 vessels, be used to disaggregate data on effort and catches of sandeels, from being on a trip and ICES rectangle level to being on a haul and fishing ground level.

The information about the biology and population structure of sandeels and the detailed data about catches and effort will be used to carry out separate assessments of each of the stock components of sandeels. Furthermore, a model that was developed at DTU Aqua (THEMAS) will be used to simulate the effect of different management scenarios on the fishing fleet and the sandeel populations.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources
Danish Fishermen's Association
Krog Consult ApS
University of Hamburg
Marine Scotland Science
Period: 01/01/2003 → 31/12/2007
Number of participants: 4
Research area: Marine Living Resources
Project Manager, academic:
Mosegaard, Henrik (Intern)
Rindorf, Anna (Intern)
Christensen, Asbjørn (Intern)
Jensen, Henrik (Ekstern)
Project

Conservation of diversity in an exploited species: Spatio-temporal variation in the genetics of herring (Clupea harengus) in the North Sea and adjacent areas (HERGEN) (5512)

National Institute of Aquatic Resources
Section for Marine Living Resources
Wageningen IMARES
Stockholm University
University of Gothenburg
Activities:

**ICES - Benchmark Workshop on Baltic Cod Stocks - WKBALTCOD (External organisation)**
Period: 2015
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

**Related external organisation**

**ICES - Benchmark Workshop on Baltic Cod Stocks - WKBALTCOD**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG (External organisation)**
Period: 2015
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

**Related external organisation**

**ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**ICES - Workshop to evaluate the TAC calculation for herring in IIIa and management plan for herring in the North Sea - WKHERTAC (External organisation)**
Period: 2015
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

**Related external organisation**

**ICES - Workshop to evaluate the TAC calculation for herring in IIIa and management plan for herring in the North Sea - WKHERTAC**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG (External organisation)
Period: 2014
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

Related external organisation
ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on Statistical Analysis of Biological Calibration Studies - WKSABCAL (External organisation)
Period: 2014
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

Related external organisation
ICES - Workshop on Statistical Analysis of Biological Calibration Studies - WKSABCAL
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop to consider reference points for all stocks - WKMSYREF (External organisation)
Period: 2014
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Marine Living Resources
Degree of recognition: International

Related external organisation
ICES - Workshop to consider reference points for all stocks - WKMSYREF
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

FVM - Fødevareministerens arbejdsgruppe om industrifiskeri (External organisation)
Period: 2012
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics

Related external organisation
FVM - Fødevareministerens arbejdsgruppe om industrifiskeri
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Benchmark Workshop on Pelagic Stocks - WKPELA (External organisation)
Period: 2012 → …
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation
ICES - Benchmark Workshop on Pelagic Stocks - WKPELA
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG (External organisation)
Period: 2012 → …
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation

ICES - Herring Assessment Working Group for the Area South of 62ºN - HAWG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Stock Identification Methods Working Group - SIMWG (External organisation)
Period: 2012 → …
Henrik Mosegaard (Participant)
National Institute of Aquatic Resources
Section for Population Ecology and Genetics
Degree of recognition: International

Related external organisation

ICES - Stock Identification Methods Working Group - SIMWG
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 → …
Henrik Mosegaard (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