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Authors: MacKenzie, B. (Intern), Aarestrup, K. (Intern), Christoffersen, M. (Intern)
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Global biogeochemical provinces of the mesopelagic zone

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Oceans and Arctic, University of British Columbia, Sorbonne Universités, National Oceanography Centre, Nova Southeastern University, University of Cape Town, CNRS
Authors: Reygondeau, G. (Intern), Guidi, L. (Ekstern), Beaugrand, G. (Ekstern), Henson, S. A. (Ekstern), Koubbi, P. (Ekstern), MacKenzie, B. (Intern), Sutton, T. T. (Ekstern), Fioroni, M. (Ekstern), Maury, O. (Ekstern)
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Scopus rating (2014): CiteScore 4.58
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Scopus rating (2013): CiteScore 4.54
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BFI (2011): BFI-level 2
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Global patterns in marine predatory fish
Large teleost (bony) fish are a dominant group of predators in the oceans and constitute a major source of food and livelihood for humans. These species differ markedly in morphology and feeding habits across oceanic regions; large pelagic species such as tunas and billfish typically occur in the tropics, whereas demersal species of gadoids and flatfish dominate boreal and temperate regions. Despite their importance for fisheries and the structuring of marine ecosystems, the underlying factors determining the global distribution and productivity of these two groups of teleost predators are poorly known. Here, we show how latitudinal differences in predatory fish can essentially be explained by the inflow of energy at the base of the pelagic and benthic food chain. A low productive benthic energy pathway favours large pelagic species, whereas equal productivities support large demersal generalists that outcompete the pelagic specialists. Our findings demonstrate the vulnerability of large teleost predators to ecosystem-wide changes in energy flows and hence provide key insight to predict the responses of these important marine resources under global change.
Global patterns in the productivity of marine fish along parallel pathways of energy

Lessons from the first generation of marine ecological forecast products
Multi-decadal cod reproductive habitat variability in the Baltic Sea and its impact on reproductive success

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Plikshs, M. (Ekstern), MacKenzie, B. (Intern), Müller-Karulis, B. (Ekstern)
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Main Research Area: Technical/natural sciences

Predicting ecosystems for managing a dynamic ocean

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, CSIRO, Bureau of Meteorology, Princeton University, CSIRO Marine and Atmospheric Research
Authors: Hobday, A. J. (Ekstern), Hartog, J. R. (Ekstern), Spillman, C. M. (Ekstern), Payne, M. (Intern), MacKenzie, B. (Intern), Tommasi, D. (Ekstern)
Publication date: 2017

Productivity and recovery of forage fish under climate change and fishing: North Sea sandeel as a case study
Forage fish occupy a central position in marine food-webs worldwide by mediating the transfer of energy and organic matter from lower to higher trophic levels. The lesser sandeel (Ammodytes marinus) is one of the ecologically and economically most important forage fish species in the North-east Atlantic, acting as a key prey for predatory fish and sea birds, as well as supporting a large commercial fishery. In this case study, we investigate the underlying factors affecting recruitment and how these in turn affect productivity of the North Sea sandeel using long-term data and modelling. Our results demonstrate how sandeel productivity in the central North Sea (Dogger Bank) depends on a combination of external and internal regulatory factors, including fishing and climate effects, as well as density dependence and food availability of the preferred zooplankton prey (Calanus finmarchicus and Temora longicornis). Furthermore, our model scenarios suggest that while fishing largely contributed to the abrupt stock decline during the late 1990s and the following period of low biomass, a complete recovery of the stock to the highly productive levels of the early 1980s would only be possible through changes in the surrounding ecosystem, involving lower temperatures and improved feeding conditions. To that end, we stress the need for ecosystem-based management accounting for multiple internal and external factors occurring within the broader context of the ecosystem in which forage fish species, such as sandeel, play an important and integral part

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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources, Section for Oceans and Arctic, Section for Ecosystem based Marine Management, International Council for the Exploration of the Sea
Authors: Lindegren, M. (Intern), van Deurs, M. (Intern), MacKenzie, B. (Intern), Worsøe Clausen, L. (Intern), Christensen, A. (Intern), Rindorf, A. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Trophic impact of Atlantic bluefin tuna migrations in the North Sea

Large highly migratory predators can have major impacts on local marine ecosystems by reducing prey populations and leading to trophic cascades that affect the entire fish community. These trophic interactions are typically non-linear and can alter both the migratory behaviour of the predator and the stability of the fish community. The impact of a migrating top-predator is investigated here for Atlantic bluefin tuna in the North Sea. Bluefin tuna has been absent from the region for half-century, but recent years have seen recovery of migrations and a return of bluefin tuna in the area. We use a size spectrum model to analyse the trophic impact of the returning tuna on the entire fish community, under scenarios with varying levels of tuna consumption and fishing mortality on the prey. We show that with high level of prey fishing mortality in the North Sea, the effect of a tuna re-colonization results in only limited trophic cascades. However, high tuna consumption or changes in fishing mortality may result in a sudden recruitment failure of small-pelagic fish due to cascading effects on the fish community. In present-day conditions, the level of tuna consumption that triggers recruitment...
failure is lower at increasing fishing mortalities on their prey, providing indications for the future sustainable management of both small-pelagics and bluefin tuna in the area.

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Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Section for Oceans and Arctic
Authors: Mariani, P. (Intern), Andersen, K. H. (Intern), Lindegren, M. (Intern), MacKenzie, B. (Intern)
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Web of Science (2004): Indexed yes
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Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Adult lifetime reproductive value in fish depends on size and fecundity type

In a stable population, the adult lifetime reproductive value must be balanced against early life survival. Although delaying maturity may increase fecundity, it also reduces survival. Larger size at maturity therefore not only allows for higher fecundity, but requires it. Using simple arguments from life history, we derive a direct proportionality relationship between the adult lifetime reproductive value and weight at maturation and find that this relationship is consistent with empirical evidence from 28 stocks and species of bony fish from temperate–boreal environments. However, the expected proportionality falls off if mortality increases to include fishing. Furthermore, we find that the fecundity type (determinate or indeterminate) affects the predicted adult reproductive value, which is significantly (10-fold) higher for an indeterminate spawner than for a determinate spawner of the same weight. These differences may relate to trade-offs in the adult life history traits and (or) to seasonality in the spawning environment, with subsequent consequences for early life stage survivorship.
Dietary evidence of mesopelagic and pelagic foraging by Atlantic bluefin tuna (Thunnus thynnus L.) during autumn migrations to the Iceland Basin

Atlantic bluefin tuna (ABFT; Thunnus thynnus) is a large highly mobile predator fish species in the North Atlantic Ocean and Mediterranean Sea. Knowledge of its trophic role in marine food webs in summer feeding areas is presently based on recent (1980–2010s) sampling in the Bay of Biscay, Gulfs of Maine and St. Lawrence, and from historical (1950–1960s) sampling in the Norwegian-North Sea-Kattegat. No study has yet investigated the diets of ABFT in Icelandic waters, where it supported an experimental fishery during 1996–2005, nor in any region north of the Bay of Biscay since the 1960s. However, north Atlantic temperatures and fish species distributions, including some ABFT prey species (e.g., mackerel) have been changing in the 2000s. New knowledge of ABFT diets in previously understudied parts of the species range will be useful for understanding factors affecting the trophic role, migration behavior, and bioenergetics of ABFT. Here, we report the dietary composition of ABFT during autumn migrations to the Iceland Basin south of the continental shelf of Iceland. A total of 36 prey species or higher taxa were observed in 421 stomach samples: 17 teleost fishes, 4 squid, 1 octopus, 12 crustaceans, and 2 other invertebrate species. The most important prey species were European flying squid (Todarodes sagittatus) (%N = 16.70, %W = 48.89; %FO = 87.65), barracudinas (Paralepididae) (%N = 14.05, %W = 28.59, %FO = 76.48), and gonate squid (Gonatus sp.) (%N = 9.17, %W = 7.85, %FO = 75.06). Prey sizes were highly variable relative to ABFT sizes indicating highly opportunistic feeding on diverse sizes. The presence of a large proportion of mesopelagic species in the diet indicates feeding in the mesopelagic layer and extensive dive behavior. These results give new baseline knowledge for future comparison with anticipated oceanographic-biological changes in the region in the coming decades and can be used to help parameterize new models of ABFT migration behavior and trophic role.
Atlantic Bluefin Tuna, Diet, Mesopelagic, Iceland, Squid, Barracudina, Trophic Role, Food Web

Functional responses of North Atlantic fish eggs to increasing temperature

Temperature increase associated with global climate change can be expected to directly influence the spawning success of fish species, with implications for abundance and distribution. We conducted a meta-analysis to investigate and compare responses of development time, cumulative degree-days and survival of fish eggs from 32 populations of 17 species in the North Atlantic to different temperatures in order to determine potential consequences of global warming for these species. The response of development time exhibited a similar decreasing trend with respect to temperature across species. The similar slopes of regression lines relating ln-transformed development time and temperature indicate similar sensitivity to temperature changes. Across-species differences were mainly driven by intercept values, indicating up to 8-fold differences in development time at given temperature. There was an overall decrease, across species, in an index of thermal requirement (cumulative degree-days) for egg development with increasing temperature. Within an empirically derived optimal thermal range for egg survival, the thermal requirement was more variable in species adapted to cold waters compared to species adapted to warmer waters. Moreover, the sensitivity of survival of eggs from different species to increases in temperature differed, reflecting a pattern of sensitivity along a stenotherm-eurytherm gradient of vulnerability to temperature among species. The results quantify physiological effects of temperature on the eggs, and we propose that such effects are major factors leading to a close correspondence between the physiological optimal temperature for survival and observed temperature at spawning sites. Temperature during egg development appears to be a key evolutionary
force affecting spawning time and location

Global patterns in the feeding ecology of large marine fish

Global patterns in the feeding ecology of large marine fish
**Habitat suitability of the Atlantic bluefin tuna by size class: An ecological niche approach**

**General information**

State: Published

Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, European Commission - Joint Research Center, IFREMER, Fisheries and Oceans Canada, AZTI-Tecnalia, Institute of Oceanography and Fisheries, World Wide Fund for Nature (WWF), Instituto Nacional de Pesca, Institute of Marine Biological Resources and Inland Waters, Instituto Español de Oceanografía, Università degli Studi di Bari Aldo Moro, Istanbul University, University of Athens, Ege University, National Oceanographic and Atmospheric Administration, Universidade dos Açores, Università degli studi di Cagliari


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- Web of Science (2016): Indexed yes
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- Web of Science (2015): Indexed yes
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- ISI indexed (2013): ISI indexed yes
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- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 2.643 SNIP 1.586
- Web of Science (2010): Indexed yes
Has eutrophication promoted forage fish production in the Baltic Sea?
Reducing anthropogenic nutrient inputs is a major policy goal for restoring good environmental status of coastal marine ecosystems. However, it is unclear to what extent reducing nutrients would also lower fish production and fisheries yields. Empirical examples of changes in nutrient loads and concurrent fish production can provide useful insights to this question. In this paper, we investigate to what extent a multi-fold increase in nutrient loads from the 1950s to 1980s enhanced forage fish production in the Baltic Sea. We use monitoring data on fish stock dynamics covering the period of the nutrient increase, combined with nutrient concentrations from a 3-dimensional coupled physical-biogeochemical ocean model. The results suggest that nutrient enrichment enhanced the biomass level of forage fish by up to 50% in some years and areas due to increased body weight of fish. However, the trends in fish biomasses were generally decoupled from changes in nutrient concentrations.

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography, Swedish Meteorological and Hydrological Institute
Authors: Eero, M. (Intern), Andersson, H. C. (Ekstern), Almroth-Rosell, E. (Ekstern), MacKenzie, B. (Intern)
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Scopus rating (2016): CiteScore 3.19 SJR 1.221 SNIP 1.194
ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context

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Pages: 1386-1403
Multidisciplinary perspectives on the history of human interactions with life in the ocean

There is an essentially circular interaction between the human social system and the marine ecosystem. The Oceans Past V Conference "Multidisciplinary perspectives on the history of human interactions with life in the ocean" held in Tallinn, Estonia, in May 2015 was an opportunity for the presentation and discussion of papers on a diverse array of topics that examined this socio-ecological system from a historical perspective. Here we provide background to the disciplines participating in the conference and to the conference itself. We summarize the conference papers that appear in this special volume of the ICES JMS and highlight issues which arose during general discussion. We make two conclusions. First, to have greater impact and ensure more efficient use of knowledge gained from marine historical ecology (MHE) and marine environmental history (MEH) in ecosystem-based management and related policy development, practitioners need to work more routinely with population and ecological modellers and statisticians. This will allow greater processing of the available historical data to derive ecologically meaningful properties that can then be used to assess the ecological impact of long-term changes of affected species and define appropriate and realistic management targets. Second, increased multi-and trans-disciplinary effort is required to better understand the relative importance of different human demographic, technological, economic, and cultural drivers on the patterns, intensities and trajectories of human activities affecting marine ecosystems.

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Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, NIWA, University of Tartu
Authors: MacDiarmid, A. (Ekstern), MacKenzie, B. (Intern), Ojaveer, H. (Ekstern)
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ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
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BFI (2011): BFI-level 1
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ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
Ocean warming expands habitat of a rich natural resource and benefits a national economy

Geographic redistribution of living natural resources changes access and thereby harvesting opportunities between countries. Internationally shared fish resources can be sensitive to shifts in the marine environment and this may have great impact on the economies of countries and regions that rely most heavily on fisheries to provide employment and food supply. Here we present a climate change-related biotic expansion of a rich natural resource with substantial economic consequences, namely the appearance of northeast Atlantic mackerel (Scomber scombrus) in Greenlandic waters. In recent years, the summer temperature has reached record highs in the Irminger Current, and this development has expanded the available and realized mackerel habitat in time and space. Observations in the Irminger Current in east Greenland in 2011 of this temperature-sensitive epipelagic fish were the first records so far northwest in the Atlantic. This change in migration pattern was followed by a rapid development of a large-scale fishery of substantial importance for the national economy of Greenland (23% of Greenland's export value of all goods in 2014). A pelagic trawl survey was conducted in mid-summer 2014 and the results showed that the bulk of similar to 1 million Mg (=t) of mackerel in the Irminger Current in southeast Greenland were located in the relatively warm (>8.5 degrees C) surface layer. Mackerel was also observed in southwest Greenland. Finally, 15 CMIP5 Earth System Model projections of future marine climate were used to evaluate the epipelagic environment in Greenland. These projections for moderate and high CO2 emission scenarios (representative concentration pathways [RCP] 4.5 and 8.5) suggest how the available mackerel habitat may expand further in space and time. Overall, our results indicate that, if the stock remains large, productive, and continues its current migration pattern, then climate change has provided Greenland with a new unique opportunity for commercial exploitation. However, positive cases like this should not be cherry-picked and misused as arguments against timely and effective mitigation of climate change.

General information

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Authors: Jansen, T. (Intern), Post, S. L. (Intern), Kristiansen, T. (Ekstern), Oskarsson, G. J. (Ekstern), Boje, J. (Intern), MacKenzie, B. R. (Intern), Broberg, M. (Ekstern), Siegstad, H. (Ekstern)
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Web of Science (2015): Indexed yes
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Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 2.965 SNIP 1.937 CiteScore 4.55
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.286 SNIP 1.975 CiteScore 4.86
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 2.784 SNIP 1.675
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.664 SNIP 1.759
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.869 SNIP 1.749
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.805 SNIP 1.876
Scopus rating (2006): SJR 3.065 SNIP 2.06
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Scopus rating (2001): SJR 3.178 SNIP 2.18
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Electronic versions:
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The migration game in habitat network: the case of tuna

Long-distance migration is a widespread process evolved independently in several animal groups in terrestrial and marine ecosystems. Many factors contribute to the migration process and of primary importance are intra-specific competition and seasonality in the resource distribution. Adaptive migration in direction of increasing fitness should lead to the ideal free distribution (IFD) which is the evolutionary stable strategy of the habitat selection game. We introduce a migration game which focuses on migrating dynamics leading to the IFD for age-structured populations and in time varying habitats, where dispersal is costly. The model predicts migration dynamics between these habitats and the corresponding population distribution. When applied to Atlantic bluefin tunas, it predicts their biomass is located in the spawning areas which have also the largest diversity in the age-structure. Distant feeding areas are occupied on a seasonal base and often by larger individuals, in agreement with empirical observations. Moreover, we show that only a selected number of migratory routes emerge as those effectively used by tunas.
Uncertainties in projecting climate-change impacts in marine ecosystems

Projections of the impacts of climate change on marine ecosystems are a key prerequisite for the planning of adaptation strategies, yet they are inevitably associated with uncertainty. Identifying, quantifying, and communicating this uncertainty is key to both evaluating the risk associated with a projection and building confidence in its robustness. We review how uncertainties in such projections are handled in marine science. We employ an approach developed in climate modelling by breaking uncertainty down into (i) structural (model) uncertainty, (ii) initialization and internal variability uncertainty, (iii) parametric uncertainty, and (iv) scenario uncertainty. For each uncertainty type, we then examine the current state-of-the-art in assessing and quantifying its relative importance. We consider whether the marine scientific community has addressed these types of uncertainty sufficiently and highlight the opportunities and challenges associated with doing a better job. We find that even within a relatively small field such as marine science, there are substantial differences between subdisciplines in the degree of attention given to each type of uncertainty. We find that initialization uncertainty is rarely treated explicitly and reducing this type of uncertainty may deliver gains on the seasonal-to-decadal time-scale. We conclude that all parts of marine science could benefit from a greater exchange of ideas, particularly concerning such a universal problem such as the treatment of uncertainty. Finally, marine science should strive to reach the point where scenario uncertainty is the dominant uncertainty in our projections.

General information

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Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, Plymouth Marine Laboratory, University of British Columbia, North Pacific Marine Science Organization, IFREMER, Dalhousie University, National Oceanographic and Atmospheric Administration, Dragonfly Data Science, University of Washington, Universidade de Lisboa
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Web of Science (2015): Indexed yes
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A time for every season: seasonal cycles of plankton and fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern)
Number of pages: 180
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Biogeographic changes in fish diversity driven by changes in climate and exploitation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, University of Copenhagen
Authors: Bryndum, K. M. (Intern), Christensen, A. (Intern), She, J. (Ekstern), Richardson, K. (Ekstern), MacKenzie, B. (Intern)
Number of pages: 2
Publication date: 2015
Event: Abstract from ICES Annual Science Conference 2015, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Control factors in fish early life history and how they combine to influence trophic links across the North Atlantic Ocean.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and Oceanography, University of Hawaii
Authors: Neuheimer, A. (Intern), Payne, M. (Intern), MacKenzie, B. (Intern)
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Fisheries oceanography of northern pelagic fish species
People are familiar with marine fish species and the great variety of different species that are available in the market, such as herring, cod and sole. What may not be well known is that every individual fish goes through a long, risky journey during its life before reaching maturity. Most of the marine fish species are important prey for larger predators, such as larger fish in the ocean, marine mammals, birds and humans. Every individual female fish can produce many thousands to millions of eggs every year during the spawning season. The eggs (usually less than 2 mm in diameter) that live free in the environment, and depending on species, eggs either drift/float in the water or are attached to the bottom close to each other. The larvae that hatch from the eggs grow in size continuously until they reach a certain size and become adults. The first few weeks of its life are the riskiest and most of the eggs and larvae become prey for other organisms living in the sea or perish due to unfavorable conditions, for example high or low temperature or salinity. Those that survive to adulthood will participate with the rest of the population to the reproductive process, called spawning which takes place every year. The period of time that spawning takes place depends on the environmental conditions that each species has adapted to during the life of the species.

Here, I have found that temperature is a significant factor that strongly affects egg development and survival. There are large differences in the temperature range that maximizes survival among different species, but the sensitivity of egg development rate in a degree of temperature increase is similar among the 32 species and populations I analysed. I also found that adults spawn at temperature conditions that are generally close to the egg preferences, indicating that the egg stage is critical to the population abundance.

Two significant factors that regulate the time of spawning are the temperature at which the eggs and larvae can survive best and the availability of food for larvae. In general, at higher latitudes (northern North Atlantic) the optimal conditions are found during a narrower period and at lower latitudes (southern North Atlantic) the optimal conditions last longer. Temperature is also one of the factors that gives the signal to adults that the time to spawn has come. Another finding of my study is that species that have longer spawning seasons, at lower latitudes, are able to produce 10 times more eggs during their life time than species than have a limited spawning season. This may reflect the more un-predictable environmental conditions at lower latitudes. People are also familiar with the words "climate change" and "warming of the oceans". There is already evidence in the scientific community that the temperature in the surface water (0-75m depth) of the North Atlantic has been increasing by 0.11 °C per decade since the 1970s. This will lead to a significant cumulative increase in the next few decades, with many consequences for marine organisms. One of the impacts will be the time that species start to spawn, and there is already evidence for earlier spawning in some North Sea fish species. A change like that may likely have a chain reaction, affecting larval stages and whether they will live in environments with high food availability. Warming temperature may also result in changes in the geographical distributions of species. If the environment becomes too warm at the areas that species live now, they may move to northern or deeper waters. This will leave space for other species, now living southern to move north. As a result the composition of the communities in the oceans will probably change. In my thesis, I also evaluated how expected climate change could affect the timing, location and success of spawning by herring in the North Sea. This species is an important species for the food-web and has an important commercial value for countries bordering the North Sea. I first developed a model that could describe the most important environmental conditions that determine herring spawning areas and times in the North Sea, and then used these model with future temperatures estimated by climate change models to estimate where and when spawning might occur in future. I found that egg survival will generally remain high but that spawning times and locations will likely change. These
changes could affect herring ecology (e.g., survival rates), if the larvae experience substantially different levels of food or predators than at present, and subsequently the North Sea herring populations. However, there can be differences in the sensitivity of some species to temperature changes, which for some will be greater compared to others. From the global perspective, humans will likely see the effects of climate change in the oceans by reduced availability of the species they consume now and increased availability of new species. In addition, there will likely be economic impacts on the local fishing communities. How species respond to climate change is a field of research that receives great attention because the responses will affect the management of fisheries.

Functional responses of North Atlantic fish eggs to increasing temperature

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Authors: Tsoukali, S. (Intern), MacKenzie, B. (Intern), Visser, A. (Intern)
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Place of publication: Charlottenlund
Publisher: Technical University of Denmark, National Institute of Aquatic Resources
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Publication: Research › Conference abstract for conference – Annual report year: 2015

GOFORIT: IntelliGent Oceanographically – based short-term fishery FOREcasting applications

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Marine Living Resources
Authors: MacKenzie, B. (Intern), Ak, O. (Ekstern), Astthorsson, O. (Ekstern), Gislason, A. (Ekstern), Jonasdottir, S. (Intern), Radu, G. (Ekstern), Salihoglu, B. (Ekstern), Timofte, F. (Forskerdatabase), Deurs, M. V. (Intern)
Number of pages: 2
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Has human-induced eutrophication promoted fish production in the Baltic Sea?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Ecology and Oceanography
Predicting future shifts in herring spawning habitat in the North Sea

Growing evidence has shown a profound modification of plankton communities of the North East Atlantic and adjacent seas over the past decades. This drastic change has been attributed to a modification of the environmental conditions that regulate the dynamics and the spatial distribution of ectothermic species in the ocean. Recently, several studies have highlighted modifications of the regional climate station L4 (50° 15.00'N, 4° 13.02'W) in the Western English Channel. We here focus on the modification of the plankton community by studying the long-term, annual and seasonal changes of five zooplankton groups and eight copepod genera. We detail the main composition and the phenology of the plankton communities during four climatic periods identified at the L4 station: 1988-1994, 1995-2000, 2001-2007 and 2008-2012. Our results show that long-term environmental changes underlined by Molinero et al. (2013) drive a profound restructuration of the plankton community modifying the phenology and the dominance of key planktonic groups including fish larvae. Consequently, the slow but deep modifications detected in the plankton community highlight a climate driven ecosystem shift in the Western English Channel.

Progressive changes in the Western English Channel foster a reorganization in the plankton food web

Our results show that long-term environmental changes underlined by Molinero et al. (2013) drive a profound restructuration of the plankton community modifying the phenology and the dominance of key planktonic groups including fish larvae. Consequently, the slow but deep modifications detected in the plankton community highlight a climate driven ecosystem shift in the Western English Channel.
Spatially explicit estimates of stock sizes, structure and biomass of herring and blue whiting, and catch data of bluefin tuna

The North Atlantic is a productive marine region which has supported important commercial fisheries for centuries. Many of these fisheries have exploited the pelagic species, including herring, blue whiting and tuna. Here we present data on the distribution of herring and blue whiting based on the international ecosystem survey in the Nordic Seas (IESNS), the bottom trawl survey in the Bay of Biscay and Celtic Sea (EVHOE) and the pelagic survey in the Bay of Biscay (PELGAS). We also present catch data on bluefin tuna, which has been depleted for decades but historically used to be a key predator on the other pelagic stocks during summer. The results show that there were substantial changes in the herring and blue whiting distribution during the 1990s and early 2000s. The earliest bluefin tuna catches noted were in 1907. The catches in the Norwegian Sea area peaked in the 1950s and there have been very small catches since the 1980s.
A cascade of warming impacts brings bluefin tuna to Greenland waters

Rising ocean temperatures are causing marine fish species to shift spatial distributions and ranges, and are altering predator-prey dynamics in foodwebs. Most documented cases of species shifts so far involve relatively small species at lower trophic levels, and consider individual species in ecological isolation from others. Here we show that a large highly migratory top predator fish species has entered a high latitude sub-polar area. Bluefin tuna, Thunnus thynnus Linnaeus 1758, were captured in waters east of Greenland (65ø N) in August 2012 during exploratory fishing for Atlantic mackerel, Scomber scombrus Linnaeus 1758. The bluefin tuna were captured in a single net-haul in 9-11ø C water together with 6 tonnes of mackerel, which is a preferred prey species and itself a new immigrant to the area. Regional temperatures in August 2012 were historically high and contributed to a warming trend since 1985, when temperatures began to rise. The presence of bluefin tuna in this region is likely due to a combination of warm temperatures that are physiologically more tolerable and immigration of an important prey species into the region. We conclude that a cascade of climate change impacts is restructuring the food web in east Greenland waters.
A cascade of warming impacts brings bluefin tuna to Greenland waters

Rising ocean temperatures are causing marine fish species to shift spatial distributions and ranges, and are altering predator-prey dynamics in food webs. Most documented cases of species shifts so far involve relatively small species at lower trophic levels, and consider individual species in ecological isolation from others. Here, we show that a large highly migratory top predator fish species has entered a high latitude subpolar area beyond its usual range. Bluefin tuna, Thunnus thynnus Linnaeus 1758, were captured in waters east of Greenland (65°N) in August 2012 during exploratory fishing for Atlantic mackerel, Scomber scombrus Linnaeus 1758. The bluefin tuna were captured in a single net-haul in 9-11 °C water together with 6 tonnes of mackerel, which is a preferred prey species and itself a new immigrant to the area. Regional temperatures in August 2012 were historically high and contributed to a warming trend since 1985, when temperatures began to rise. The presence of bluefin tuna in this region is likely due to a combination of warm temperatures that are physiologically more tolerable and immigration of an important prey species to the area. We conclude that a cascade of climate change impacts is restructuring the food web in east Greenland waters.
Accuracy and precision in the calculation of phenology metrics

Phytoplankton phenology (the timing of seasonal events) is a commonly used indicator for evaluating responses of marine ecosystems to climate change. However, phenological metrics are vulnerable to observation-(bloom amplitude, missing data, and observational noise) and analysis-related (temporal resolution, preprocessing technique, and phenology metric) processes. Here we consider the impact of these processes on the robustness of four phenology metrics (timing of maximum, 5% above median, maximum growth rate, and 15% of cumulative distribution). We apply a simulation-testing approach, where a phenology metric is first determined from a noise- and gap-free time series, and again once it has been modified. We show that precision is a greater concern than accuracy for many of these metrics, an important point that has been hereto overlooked in the literature. The variability in precision between phenology metrics is substantial, but it can be improved by the use of preprocessing techniques (e.g., gap-filling or smoothing). Furthermore, there are important differences in the inherent variability of the metrics that may be crucial in the interpretation of studies based upon them. Of the considered metrics, the 15% of cumulative distribution metric best satisfies the precision criteria. However, the 5% above median metric is comparable in terms of precision and exhibits more inherent variability. We emphasize that the choice of phenology metric should be determined by the specific nature of the question being asked. We believe these findings to be useful to the current discussion on phenology metrics of phytoplankton dynamics.
A life-history evaluation of the impact of maternal effects on recruitment and fisheries reference points

Fishing causes dramatic changes in the age and size structure of fish stocks. In particular, the targeting of the largest and oldest individuals in a stock changes the age and size distribution of that stock. A large female produces a higher quantity of eggs than a young female because of its larger size, but recent laboratory evidence further indicates that large females also produce eggs of higher quality, a phenomenon known as maternal effects. However, most traditional management models assume that all female fish contribute equally per unit biomass to future recruitment. Here we investigate whether this assumption is valid by calculating the impact of maternal effects both before and after accounting for density-dependent effects. We find that the contribution of large individuals to reproduction is much more pronounced for unfished than for fished stocks. Fisheries reference points are largely unaffected by maternal effects. Our results indicate that the incorporation of maternal effects into impact assessments of fisheries is not expected to change advice substantially. Important exceptions are stocks whose demography is very vulnerable to fishing (and which therefore have low fishing reference points) for which maternal effects are relevant and necessary to consider.

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Organisations: Centre for Ocean Life, National Institute of Aquatic Resources, Max Planck Institute
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Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed yes
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Web of Science (2016): Indexed yes
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
Comparative ecology of widely distributed pelagic fish species in the North Atlantic: Implications for modelling climate and fisheries impacts

This paper reviews the current knowledge on the ecology of widely distributed pelagic fish stocks in the North Atlantic basin with emphasis on their role in the food web and the factors determining their relationship with the environment. We consider herring (Clupea harengus), mackerel (Scomber scombrus), capelin (Mallotus villosus), blue whiting (Micromesistius poutassou), and horse mackerel (Trachurus trachurus), which have distributions extending beyond the continental shelf and predominantly occur on both sides of the North Atlantic. We also include albacore (Thunnus alalunga), bluefin tuna (Thunnus thynnus), swordfish (Xiphias gladius), and blue marlin (Makaira nigricans), which, by contrast, show large-scale migrations at the basin scale. We focus on the links between life history processes and the environment, horizontal and vertical distribution, spatial structure and trophic role. Many of these species carry out extensive migrations from spawning grounds to nursery and feeding areas. Large oceanographic features such as the North Atlantic subpolar gyre play an important role in determining spatial distributions and driving variations in stock size. Given the large biomasses of especially the smaller species considered here, these stocks can exert significant top-down pressures on the food web and are important in supporting higher trophic levels. The review reveals commonalities and differences between the ecology of widely distributed pelagic fish in the NE and NW Atlantic basins, identifies knowledge gaps and modelling needs that the EURO-BASIN project attempts to address. © 2014 Elsevier Ltd. All rights reserved.
Comparative impacts of temperature and trade-offs on egg ecology of north Atlantic pelagic fish species

The early life history stages of fish are considered the most vulnerable and can be strongly affected by environmental variability, leading to population fluctuations. Temperature has a major role on development and mortality rates, with consequences for recruitment and overall stock productivity. We collated development and survival data from publications on laboratory egg incubation experiments to investigate and compare the development, daily mortality and survival of fish eggs from pelagic species in the north Atlantic at different temperatures, and to investigate whether trade-offs exist between these traits at the population and species level and between habitat types (pelagic and demersal). While differing in magnitude, the response of these traits exhibited similar trends with respect to temperature, regardless of species, population or habitat type. A trade-off appears between rapid development and high mortality or slow development and low mortality, resulting in similar survivorship percentages across species. These results quantify physiological effects of temperature on the eggs and are a major factor in yielding a close correspondence between the physiological optimum temperature for survivorship and observed temperature at spawning sites. Temperature during egg development may be a key evolutionary force affecting spawning time and location.

Explaining life history variation in a changing climate across a species' range

Timing of reproduction greatly influences offspring success and resulting population production. Explaining and predicting species' dynamics necessitates disentangling the intrinsic (genotypic) and extrinsic (climatic) factors controlling reproductive timing. Here we explore temporal and spatial changes in spawning time for 21 populations of Atlantic cod (Gadus morhua) across the species' range (40 degrees to 80 degrees N). We estimate spawning time using a physiologically relevant metric that includes information on fish thermal history (degree-days, DD). First, we estimate spawning DD among years (within populations) to show how recent changes in spawning time can be explained by local changes in temperature. Second, we employ spawning DD to identify temperature-independent trends in spawning time among populations that are consistent with parallel adaptive evolution and the evolutionary history of the species. Finally, we use our results to estimate spawning time under future climate regimes, and discuss the implications for cod ecology across the species' range.
Explaining variation in life history timing across a species range: Effects of climate on spawning time in an exploited marine fish

The capacity of a species to tolerate and/or adapt to environmental conditions will shape its response to future climate change including climate extremes. Of the many life-history processes affected by climate change, timing of reproduction greatly influences offspring success and resulting population production. Here we explore temporal and spatial changes in...
spawning time for Atlantic cod (Gadus morhua) across the species’ range (4 to 80°N). We estimate spawning time using a
physiologically relevant metric that includes information on fish thermal history (degree days, DD). First, we estimate
spawning DD among years (within populations) to show recent changes in spawning time can be explained by local
changes in temperature. Second, we employ spawning DD to identify temperature independent trends in spawning time
among populations that are consistent with the evolutionary history of the species. Combined, these results shed light on
the adaptive capacity of the species in the face of changing climate. We use our results to estimate expected spawning
time under future climate regimes, and discuss the implications for codecology and management across the species’
range, and in the greater ecosystem

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, University of
Hawaii
Authors: Neuheimer, A. (Intern), MacKenzie, B. (Intern)
Publication date: 2014
Event: Abstract from ESSAS Annual Science Meeting, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Fishing out collective memory of migratory schools
Animals form groups for many reasons but there are costs and
benefit associated with group formation. One of the benefits is collective
memory. In groups on the move, social interactions play a crucial
role in the cohesion and the ability to make consensus decisions.
When migrating from spawning to feeding areas fish schools need to
retain a collective memory of the destination site over thousand of
kilometers and changes in group formation or individual preference
can produce sudden changes in migration pathways. We propose a
modelling framework, based on stochastic adaptive networks, that
can reproduce this collective behaviour. We assume that three factors
control group formation and school migration behaviour: the intensity
of social interaction, the relative number of informed individuals
and the preference that each individual has for the particular migration
area. We treat these factors independently and relate the individuals’
preferences to the experience and memory for certain migration
sites. We demonstrate that removal of knowledgable individuals
or alteration of individual preference can produce rapid changes in
group formation and collective behavior. For example, intensive fishing
targeting the migratory species and also their preferred prey can
reduce both terms to a point at which migration to the destination
sites is suddenly stopped. The conceptual approaches represented by
our modelling framework may therefore be able to explain large-scale
changes in fish migration and spatial distribution

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Section for Marine Ecology and
Oceanography
Authors: De Luca, G. (Ekstern), Mariani, P. (Intern), MacKenzie, B. (Intern), Marsili, M. (Ekstern)
Publication date: 2014
Main Research Area: Technical/natural sciences

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Volume: 11
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ISSN (Print): 1742-5689
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.04
From fish to phytoplankton

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern), Payne, M. (Intern)
Publication date: 2014
Event: Abstract from NorMER Annual Meeting 2014, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

How can we distinguish between competing explanations of year class strength?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), MacKenzie, B. (Intern), Butenschön, M. (Ekstern), Payne, M. (Intern)
Publication date: 2014
Event: Abstract from Johan Hjort Symposium, Bergen, Norway.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014
ICES and PICES strategies for coordinating research on the impacts of climate change on marine ecosystems

The social, economic, and ecological consequences of projected climate change on fish and fisheries are issues of global concern. In 2012, the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES) established a Strategic Initiative on Climate Change Effects on Marine Ecosystems (SICCME) to synthesize and to promote innovative, credible, and objective science-based advice on the impacts of climate change on marine ecosystems in the Northern Hemisphere. SICCME takes advantage of the unique and complementary strengths of the two organizations to develop a research initiative that focuses on their shared interests. A phased implementation will ensure that SICCME will be responsive to a rapidly evolving research area while delivering ongoing syntheses of existing knowledge, thereby advancing new science and methodologies and communicating new insights at each phase.

General information
State: Published
Organizations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Pukyong National University, Plymouth Marine Laboratory, National Oceanographic and Atmospheric Administration
Authors: Kim, S. (Ekstern), Hollowed, A. B. (Ekstern), Barange, M. (Ekstern), MacKenzie, B. (Intern)
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Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 1.566 SNIP 1.043 CiteScore 2.29
Scopus rating (2014): SJR 1.703 SNIP 1.168 CiteScore 2.33
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 1.601 SNIP 1.006 CiteScore 2.14
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 1.771 SNIP 1.164 CiteScore 2.24
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 1.35 SNIP 0.92 CiteScore 1.61
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 1.567 SNIP 1.162
Scopus rating (2009): SJR 0.903 SNIP 0.789
Scopus rating (2008): SJR 0.679 SNIP 0.845
Scopus rating (2007): SJR 0.748 SNIP 0.647
Scopus rating (2006): SJR 0.78 SNIP 0.591
Scopus rating (2005): SJR 0.736 SNIP 0.55
Scopus rating (2004): SJR 0.994 SNIP 0.936
Scopus rating (2003): SJR 1.285 SNIP 1.281
Scopus rating (2002): SJR 0.617 SNIP 0.635
Scopus rating (2001): SJR 0.556 SNIP 0.442
Scopus rating (2000): SJR 0.312 SNIP 0.706
Scopus rating (1999): SJR 0.815 SNIP 1.14
Original language: English
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Warming impacts on fish species composition in the Kattegat-Belt Sea

Sea temperatures have been rising in the waters near Denmark during the past 1-2 decades and are expected to affect marine populations, species, communities and foodwebs. Here we investigate whether and how the species richness and composition of the marine fish community in the Kattegat and Belt Sea have been influenced by these changes. We
hypothesize that the recent warming has led to an increase in species richness of the local community and that this increase is due to immigration of species from warmer areas. We use spring and fall survey data collected by DTU Aqua during the years 1994-2013 and bottom temperature data (observed and model outputs from a regional physical oceanographic model) to test these ideas. Species richness has increased significantly during the time period in both seasons of the year, and the increases were significantly correlated with bottom temperatures. Analysis of the southern range limits of all species captured in the surveys shows that the mean southern latitudinal limit of the fish community has been decreasing and is also correlated with bottom temperatures; these patterns are consistent with immigration of fish from southerly zoogeographic regions. Warm-adapted species also increased their distributional area (i.e., probability of occurrence) in the sampling region and some cold-adapted species became rarer and more narrowly distributed. Similar results were generally obtained using both observed and modelled temperature data. The changes reported in this study contribute to a growing documentation of how climate variability and changes are affecting marine communities and biodiversity.

Climate-induced response of commercially important flatfish species during the 20th century
The consequence of elevated ocean temperatures on commercial fish stocks is addressed using time series of commercial landings (1906–2004) and juvenile survey catch data (1904–2006) collected around Denmark. We analyze (i) whether warm-water sole (Solea solea) has increased relative to Boreal plaice (Pleuronectes platessa) and (ii) whether two related warm-water species (turbot, Psetta maxima and brill, Scophthalmus rhombus) show similar responses to increasing temperature or, alternatively, whether turbot (which has a broader juvenile diet) has been favored. Since the early 1980s, both sole and turbot have constituted an increasing part of the commercial landings and survey catches, as compared with plaice and brill, respectively. These changes in species composition were linked to sea surface temperatures, Northern Hemisphere temperature anomalies (NHA) and the North Atlantic Oscillation. NHA was closely related and explained 43% of the observed variation in sole survey catches relative to the plaice catches and almost 38% of the observed variation in the sole landings relative to the plaice landings. For the less common species, turbot and brill, none of the global change indicators explained more than 15% of the variation, although all showed a positive relationship. Survey catch per unit effort increased significantly for both sole and turbot around the early 1980s, whereas catch per unit effort for plaice and brill remained constant. The results indicate that the abundance of warm-water species is likely to increase with increasing temperature but also that species with similar life histories might react differently according to degree of specialization.
Combined effects of global climate change and regional ecosystem drivers on an exploited marine food web

Changes in climate, in combination with intensive exploitation of marine resources, have caused large-scale reorganizations in many of the world's marine ecosystems during the past decades. The Baltic Sea in Northern Europe is one of the systems most affected. In addition to being exposed to persistent eutrophication, intensive fishing, and one of the world's fastest rates of warming in the last two decades of the 20th century, accelerated climate change including atmospheric warming and changes in precipitation is projected for this region during the 21st century. Here, we used a new multimodel approach to project how the interaction of climate, nutrient loads, and cod fishing may affect the future of the open Central Baltic Sea food web. Regionally downscaled global climate scenarios were, in combination with three nutrient load scenarios, used to drive an ensemble of three regional biogeochemical models (BGMs). An Ecopath with Ecosim food web model was then forced with the BGM results from different nutrient-climate scenarios in combination with two different cod fishing scenarios. The results showed that regional management is likely to play a major role in determining the future of the Baltic Sea ecosystem. By the end of the 21st century, for example, the combination of intensive cod fishing and high nutrient loads projected a strongly eutrophicated and sprat-dominated ecosystem, whereas low cod fishing in combination with low nutrient loads resulted in a cod-dominated ecosystem with eutrophication levels close to present. Also, nonlinearities were observed in the sensitivity of different trophic groups to nutrient loads or fishing depending on the combination of the two. Finally, many climate variables and species biomasses were projected to levels unseen in the past. Hence, the risk for ecological surprises needs to be addressed, particularly when the results are discussed in the ecosystem-based management context.

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Estimating phytoplankton phenology metrics from noisy, gappy data

General information
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Main Research Area: Technical/natural sciences
Publication: Research - Poster – Annual report year: 2013

Fisheries: Manage declines

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: MacKenzie, B. R. (Intern), Payne, M. R. (Intern)
Pages: 314
Publication date: 2013
Main Research Area: Technical/natural sciences

Publication information
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Volume: 495
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ISSN (Print): 0028-0836
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BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 13.33
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 14.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 14.22
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 14.96
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
From phytoplankton to fish

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern), Payne, M. (Intern)
Publication date: 2013
Event: Abstract from NorMER Annual Meeting 2013, Reykjavik, Iceland.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2014

Projected impacts of climate change on marine fish and fisheries
This paper reviews current literature on the projected effects of climate change on marine fish and shellfish, their fisheries, and fishery-dependent communities throughout the northern hemisphere. The review addresses the following issues: (i) expected impacts on ecosystem productivity and habitat quantity and quality; (ii) impacts of changes in production and habitat on marine fish and shellfish species including effects on the community species composition, spatial distributions, interactions, and vital rates of fish and shellfish; (iii) impacts on fisheries and their associated communities; (iv) implications for food security and associated changes; and (v) uncertainty and modelling skill assessment. Climate change will impact fish and shellfish, their fisheries, and fishery-dependent communities through a complex suite of linked processes. Integrated interdisciplinary research teams are forming in many regions to project these complex responses. National and international marine research organizations serve a key role in the coordination and integration of research to accelerate the production of projections of the effects of climate change on marine ecosystems and to move towards a future where relative impacts by region could be compared on a hemispheric or global level. Eight research foci were identified that will improve the projections of climate impacts on fish, fisheries, and fishery-dependent communities.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life, Plymouth Marine Laboratory, Fisheries and Oceans Canada, Department of Ichthyology and Fisheries Science, Institute of Marine Research, National Oceanographic and Atmospheric Administration, Tohoku National Fisheries Research Institute, Pukyong National University, University of Alaska Fairbanks, University of Victoria, Institute for Hydrobiology and Fisheries Science, Pacific Research Institute of
Comparing reconstructed past variations and future projections of the Baltic Sea ecosystem—first results from multi-model ensemble simulations

Multi-model ensemble simulations for the marine biogeochemistry and food web of the Baltic Sea were performed for the period 1850–2098, and projected changes in the future climate were compared with the past climate environment. For the past period 1850–2006, atmospheric, hydrological and nutrient forcings were reconstructed, based on historical measurements. For the future period 1961–2098, scenario simulations were driven by regionalized global general circulation model (GCM) data and forced by various future greenhouse gas emission and air- and riverborne nutrient load scenarios (ranging from a pessimistic ‘business-as-usual’ to the most optimistic case). To estimate uncertainties, different models for the various parts of the Earth system were applied. Assuming the IPCC greenhouse gas emission scenarios A1B or A2, we found that water temperatures at the end of this century may be higher and salinities and oxygen concentrations may be lower than ever measured since 1850. There is also a tendency of increased eutrophication in the future, depending on the nutrient load scenario. Although cod biomass is mainly controlled by fishing mortality, climate change together with eutrophication may result in a biomass decline during the latter part of this century, even when combined with lower fishing pressure. Despite considerable shortcomings of state-of-the-art models, this study suggests that the future Baltic Sea ecosystem may unprecedentedly change compared to the past 150 yr. As stakeholders today pay only little attention to adaptation and mitigation strategies, more information is needed to raise public awareness of the possible impacts of climate change on marine ecosystems.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Swedish Meteorological and Hydrological Institute, 60176 Norrköping, Sweden, Stockholm University, Russian Academy of Sciences, Linköping University, Polish Academy of Sciences, Helmholtzt Centre Geesthacht Centre for Materials and Coastal Research, Finnish Meteorological Institute, Institut für Ostseeeforschung, Tallinn University of Technology, University of Gothenburg
Pages: 034005
Publication date: 2012
Main Research Area: Technical/natural sciences
How the Subpolar gyre strength influences phytoplankton blooms dynamics in the North Atlantic

Changes in the North Atlantic Subpolar gyre (NASPG) have been linked to the interannual variability of primary production. However, little is known about the mechanisms behind both environmental processes, and how the NASPG strength may extend its potential impacts to higher trophic levels, including early life stages of commercial fish species.

We assess NASPG strength effect on North Atlantic phytoplankton bloom dynamics. We analyse time-series (from 1998 to 2010) of chlorophyll a (Chl a, from the Globcolour project) annual anomaly as a proxy of phytoplankton abundance, and of sea surface height (SSH, from the AVISO project) as a proxy of current strength. Three regions were strategically chosen to characterize positions relative to the NASPG, describing: region 1—the northern part of NASPG, including the Irminger Current (IC); region 2—the North Atlantic Current (NAC), its northwards drift, and the influence of the NASPG; region 3—the South Atlantic Current (SAC), its northwards drift, and the influence of the SAC.
strength; and region 3—the within-NASPG dynamics. It is hypothesized that a strong NASPG index will be associated with a low-abundance, late phytoplankton bloom, possibly induced by higher heat losses, and thus lower temperatures. A correlation between the annual anomaly in chlorophyll concentrations and the gyre index was found for the southern region (region 3).

Indications of a strong influence of NASPG index are related to areas within the gyre, which may have an impact in the ecosystem functioning. The results also suggest that physical forcing other than the strength of the NASPG influence the primary production of the more northerly regions east and west of Iceland.
Spatial patterns in the distribution and early life characteristics of North Sea cod - Influence from environmental factors and climate change

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Marine Ecology and Oceanography
Authors: Höffle, H. (Intern), Munk, P. (Intern), MacKenzie, B. (Intern)
Number of pages: 171
Publication date: 2012

Publication information
Place of publication: Charlottenlund
Publisher: Technical University of Denmark, National Institute of Aquatic Resources
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Phd_thesis_Hannes_Hoffle.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2012
Spawning of bluefin tuna in the black sea: historical evidence, environmental constraints and population plasticity

The lucrative and highly migratory Atlantic bluefin tuna, Thunnus thynnus (Linnaeus 1758; Scombridae), used to be distributed widely throughout the north Atlantic Ocean, Mediterranean Sea and Black Sea. Its migrations have supported sustainable fisheries and impacted local cultures since antiquity, but its biogeographic range has contracted since the 1950s. Most recently, the species disappeared from the Black Sea in the late 1980s and has not yet recovered. Reasons for the Black Sea disappearance, and the species-wide range contraction, are unclear. However bluefin tuna formerly foraged and possibly spawned in the Black Sea. Loss of a locally-reproducing population would represent a decline in population richness, and an increase in species vulnerability to perturbations such as exploitation and environmental change. Here we identify the main genetic and phenotypic adaptations that the population must have (had) in order to reproduce successfully in the specific hydrographic (estuarine) conditions of the Black Sea. By comparing hydrographic conditions in spawning areas of the three species of bluefin tunas, and applying a mechanistic model of egg buoyancy and sinking rate, we show that reproduction in the Black Sea must have required specific adaptations of egg buoyancy, fertilisation and development for reproductive success. Such adaptations by local populations of marine fish species spawning in estuarine areas are common as is evident from a meta-analysis of egg buoyancy data from 16 species of fish. We conclude that these adaptations would have been necessary for successful local reproduction by bluefin tuna in the Black Sea, and that a locally-adapted reproducing population may have disappeared. Recovery of bluefin tuna in the Black Sea, either for spawning or foraging, will occur fastest if any remaining locally adapted individuals are allowed to survive, and by conservation and recovery of depleted Mediterranean populations which could through time re-establish local Black Sea spawning and foraging.
Subpolar gyre strength influences phytoplankton bloom dynamics

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Journal article – Annual report year: 2012

Weak subpolar Gyre lead to early blooms

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life, Faroe Marine Research Institute
Publication date: 2012
Event: Abstract from NorMER Annual Meeting 2012, Helsinki, Finland.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2012

Could seals prevent cod recovery in the Baltic Sea?
Fish populations are increasingly affected by multiple human and natural impacts including exploitation, eutrophication, habitat alteration and climate change. As a result many collapsed populations may have to recover in ecosystems whose structure and functioning differ from those in which they were formerly productive and supported sustainable fisheries. Here we investigate how a cod (Gadus morhua) population in the Baltic Sea whose biomass was reduced due to a combination of high exploitation and deteriorating environmental conditions might recover and develop in the 21st century in an ecosystem that likely will change due to both the already started recovery of a cod predator, the grey seal Halichoerus grypus, and projected climate impacts. Simulation modelling, assuming increased seal predation, fishing levels consistent with management plan targets and stable salinity, shows that the cod population could reach high levels well above the long-term average. Scenarios with similar seal and fishing levels but with 15% lower salinity suggest that the Baltic will still be able to support a cod population which can sustain a fishery, but biomass and yields will be lower. At present knowledge of cod and seal interactions, seal predation was found to have much lower impact on cod recovery, compared to the effects of exploitation and salinity. These results suggest that dual management objectives (recovery of both seal and cod populations) are realistic but success in achieving these goals will also depend on how climate change affects cod recruitment.
Could seals prevent cod recovery in the Baltic Sea?

**General information**
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Management Systems
Authors: MacKenzie, B. (Intern), Eero, M. (Intern), Ojaveer, H. (Ekstern)
Publication date: 2011
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ICES Council Meeting
Volume: I:24
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 286881

Extending time-series of fish biomasses using a simple surplus production based approach

**General information**
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Eero, M. (Intern), MacKenzie, B. (Intern)
Pages: 191-201
Publication date: 2011
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Marine Ecology - Progress Series
Volume: 440
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Four regional marine biodiversity studies: Approaches and contributions to ecosystem-based management

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Management Systems
Authors: Ellis, S. L. (Ekstern), Incze, L. S. (Ekstern), Lawton, P. (Ekstern), Ojaveer, H. (Ekstern), MacKenzie, B. (Intern), Pitcher, R. C. (Ekstern), Shirley, T. C. (Ekstern), Eero, M. (Intern), Tunnell, J. W. J. (Ekstern), Doherty, P. J. (Ekstern), Zeller, B. M. (Ekstern)
Pages: e18997
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS ONE
Volume: 6
Issue number: 4
ISSN (Print): 1932-6203
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Historical ecology provides new insights for ecosystem management: Eastern Baltic cod case study

A recent historical marine ecological case study (cod in the eastern Baltic Sea) is used to show how long-term data and knowledge of fluctuations can contribute to revisions of fishery management policy. The case study first developed new longer analytical time series of spawner biomass and recruitment back to the 1920s, which extended knowledge of population dynamics into a time period when ecosystem state was characterized by temporally varying combinations of exploitation, climate-hydrographic conditions, marine mammal predation and eutrophication. Recovery of spatially resolved historical catch data from the late 1500s to early 1600s also contributed new perspectives to cod population dynamics under alternative ecosystem forcings. These new perspectives have contributed, and will likely continue to contribute to new management policies (e.g., revision of fishery management reference points), which should lead to higher sustainability of the population and fishery yields, and improved overall ecosystem health. These perspectives will likely continue to provide baseline information as ICES and the EU develop new policies based on maximum sustainable yield concepts.

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Management Systems
Multi-decadal responses of a cod (Gadus morhua) population to human-induced trophic changes, fishing, and climate

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

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

Publication information
Journal: Ecological Applications
Volume: 21
Issue number: 1
ISSN (Print): 1051-0761
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.4 SJR 2.265 SNIP 1.576
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.76 SNIP 1.759 CiteScore 4.63
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.593 SNIP 1.842 CiteScore 4.59
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.676 SNIP 1.863 CiteScore 4.77
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.965 SNIP 1.937 CiteScore 4.55
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.286 SNIP 1.975 CiteScore 4.86
Phytoplankton spring bloom influence on larval and juvenile fish survival

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Ferreira, A. S. (Intern), Visser, A. (Intern), MacKenzie, B. (Intern), Payne, M. (Intern)
Publication date: 2011
Event: Abstract from NorMER Annual Meeting 2011, Oslo, Norway.
Main Research Area: Technical/natural sciences
Publication: Research › peer-review › Journal article – Annual report year: 2010

Scenarios of ecological and economic consequences of rebuilding paths of depleted populations

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Verdiell, N. C. (Intern), Andersen, K. H. (Intern), MacKenzie, B. (Intern), Ravn-Jonsen, L. (Ekstern), Vaupel, J. W. (Ekstern)
Publication date: 2011
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2011
Stable isotope evidence for late medieval (14th-15th C) origins of the eastern Baltic cod (Gadus morhua) fishery

Although recent historical ecology studies have extended quantitative knowledge of eastern Baltic cod (Gadus morhua) exploitation back as far as the 16th century, the historical origin of the modern fishery remains obscure. Widespread archaeological evidence for cod consumption around the eastern Baltic littoral emerges around the 13th century, three centuries before systematic documentation, but it is not clear whether this represents (1) development of a substantial eastern Baltic cod fishery, or (2) large-scale importation of preserved cod from elsewhere. To distinguish between these hypotheses we use stable carbon and nitrogen isotope analysis to determine likely catch regions of 74 cod vertebrae and cleithra from 19 Baltic archaeological sites dated from the 8th to the 16th centuries. δ13C and δ15N signatures for six possible catch regions were established using a larger sample of archaeological cod cranial bones (n = 249). The data strongly support the second hypothesis, revealing widespread importation of cod during the 13th to 14th centuries, most of it probably from Arctic Norway. By the 15th century, however, eastern Baltic cod dominate within our sample, indicating the development of a substantial late medieval fishery. Potential human impact on cod stocks in the eastern Baltic must thus be taken into account for at least the last 600 years

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Pages: art. no. e27568
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: PLoS ONE
Volume: 6
Issue number: 11
ISSN (Print): 1932-6203
Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Ecological forecasting under climate change - the case of Baltic cod

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Ocean Ecology and Climate
Authors: Lindegren, M. (Intern), Möllmann, C. (Ekstern), Nielsen, A. (Intern), Brander, K. (Intern), MacKenzie, B. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
http://www.ices.dk/pubs/crr/crr301/CRR%20301-Web-100531.pdf
Source: orbit
Source-ID: 277805
Publication: Research › Report – Annual report year: 2010

Ecological forecasting under climate change: the case of Baltic cod

Good decision making for fisheries and marine ecosystems requires a capacity to anticipate the consequences of management under different scenarios of climate change. The necessary ecological forecasting calls for ecosystem-based models capable of integrating multiple drivers across trophic levels and properly including uncertainty. The methodology presented here assesses the combined impacts of climate and fishing on marine food-web dynamics and provides estimates of the confidence envelope of the forecasts. It is applied to cod (Gadus morhua) in the Baltic Sea, which is vulnerable to climate-related decline in salinity owing to both direct and indirect effects (i.e. through species interactions) on early-life survival. A stochastic food web-model driven by regional climate scenarios is used to produce quantitative forecasts of cod dynamics in the twenty-first century. The forecasts show how exploitation would have to be adjusted in order to achieve sustainable management under different climate scenarios.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Ocean Ecology and Climate
Authors: Lindegren, M. (Intern), Möllmann, C. (Ekstern), Nielsen, A. (Intern), Brander, K. (Intern), MacKenzie, B. (Intern), Stenseth, N. C. (Ekstern)
Pages: 2121-2130
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: Royal Society of London. Proceedings. Biological Sciences
Volume: 277
Issue number: 1691
ISSN (Print): 0962-8452
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.89 SJR 2.541 SNIP 1.474
Feasibility of removal of dioxin and dioxin-like PCPs by intensive fishery of herring and sprat in the Baltic Sea

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Gustavson, K. (Ekstern), Bjergström, M. (Ekstern), Aro, E. (Ekstern), Hedman, J. (Ekstern), Strandmark, A. (Ekstern), Bignert, A. (Ekstern), MacKenzie, B. (Intern), Hagebro, C. (Ekstern)
Number of pages: 78
Understanding how temperature affects cod (Gadus morhua) ecology is important for forecasting how populations will develop as climate changes in future. The effects of spawning-season temperature and habitat size on cod recruitment dynamics have been investigated across the North Atlantic. Ricker and Beverton and Holt stock–recruitment (SR) models were extended by applying hierarchical methods, mixed-effects models, and Bayesian inference to incorporate the influence of these ecosystem factors on model parameters representing cod maximum reproductive rate and carrying capacity. We identified the pattern of temperature effects on cod productivity at the species level and estimated SR model parameters with increased precision. Temperature impacts vary geographically, being positive in areas where temperatures are
Macro- ecological patterns in fish biodiversity and survey abundance

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate, Section for Management Systems
Number of pages: 346
Publication date: 2010

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 CM 2010/Q:11
Source: orbit
Source-ID: 267858
Publication: Research › Conference abstract in proceedings – Annual report year: 2010

Macro- ecological patterns in fish biodiversity and survey abundance

General information
Marine animal populations: a new look back in time

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Holm, P. (Ekstern), Marboe, A. (Ekstern), Poulsen, B. (Ekstern), MacKenzie, B. (Intern)
Number of pages: 384
Pages: 3-23
Publication date: 2010

Host publication information
Title of host publication: Life in the world's oceans: diversity, distribution and abundance
Place of publication: Chichester
Publisher: Wiley-Blackwell
Editor: McIntyre, A.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 278193
Publication: Research - peer-review › Book chapter – Annual report year: 2010

Modelling retention and dispersion mechanisms of bluefin tuna eggs and larvae in the Northwest Mediterranean Sea

Knowledge of early life history of most fish species in the Mediterranean Sea is sparse and processes affecting their recruitment are poorly understood. This is particularly true for bluefin tuna, Thunnus thynnus, even though this species is one of the world's most valued fish species. Here we develop, apply and validate an individually based coupled biological-physical oceanographic model of fish early life history in the Mediterranean Sea. We first validate the general structure of the coupled model with a 12-day Lagrangian drift study of anchovy (Engraulis encrasicolus) larvae in the Catalan Sea. The model reproduced the drift and growth of anchovy larvae as they drifted along the Catalan coast and yielded similar patterns as those observed in the field. We then applied the model to investigate transport and retention processes affecting the spatial distribution of bluefin tuna eggs and larvae during 1999-2003, and we compared modelled distributions with available field data collected in 2001 and 2003. Modelled and field distributions generally coincided and were patchy at mesoscales (10s-100s km); larvae were most abundant in eddies and along frontal zones. We also identified probable locations of spawning bluefin tuna using hydrographic backtracking procedures; these locations were situated in a major salinity frontal zone and coincided with distributions of an electronically tagged bluefin tuna and commercial bluefin tuna fishing vessels. Moreover, we hypothesized that mesoscale processes are responsible for the aggregation and dispersion mechanisms in the area and showed that these processes were significantly correlated to atmospheric forcing processes over the NW Mediterranean Sea. Interannual variations in average summer air temperature can reduce the intensity of ocean mesoscale processes in the Balearic area and thus potentially affect bluefin tuna larvae. These modelling approaches can increase understanding of bluefin tuna recruitment processes and eventually contribute to management of bluefin tuna fisheries.
Productivity responses of a widespread marine piscivore, Gadus morhua, to oceanic thermal extremes and trends
Climate change will have major consequences for population dynamics and life histories of marine biota as it progresses in the twenty-first century. These impacts will differ in magnitude and direction for populations within individual marine species whose geographical ranges span large gradients in latitude and temperature. Here we use meta-analytical methods to investigate how recruitment (i.e. the number of new fish produced by spawners in a given year which subsequently grow and survive to become vulnerable to fishing gear) has reacted to temperature fluctuations, and in particular to extremes of temperature, in cod populations throughout the north Atlantic. Temperature has geographically explicit effects on cod recruitment. Impacts differ depending on whether populations are located in the upper (negative effects) or in the lower (positive effects) thermal range. The probabilities of successful year-classes in populations living in warm areas is on average 34 per cent higher in cold compared with warm seasons, whereas opposite patterns exist for populations living in cold areas. These results have implications for cod dynamics, distributions and phenologies under the influence of ocean warming, particularly related to not only changes in the mean temperature, but also its variability (e.g. frequency of exceptionally cold or warm seasons).
Status of biodiversity in the Baltic Sea

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Pages: e12467
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
Journal: PLOS ONE
Volume: 5
Issue number: 9
ISSN (Print): 1932-6203
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Why is haddock overtaking cod? Comparing the effects of temperature and habitat size on recruitment dynamics of both species across the N Atlantic

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Mantzouni, I. (Intern), MacKenzie, B. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Links:
http://www.ices.dk/products/cmdocsindex.asp
Source: orbit
Source-ID: 267055
Publication: Research › Peer-review › Journal article – Annual report year: 2010

Can we sustain fisheries as the climate changes?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Brander, K. (Intern)
Pages: 148-159
Publication date: 2009
Ecosystem productivity: From: DTU Climate Change Technologies

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Biosystems Division. Management, Biosystems Division, Rise National Laboratory for Sustainable Energy, Ecosystems, Section for Ocean Ecology and Climate, Research Secretariat
Publication date: 2009

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

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Fisheries Advice, Section for Population- and Ecosystem Dynamics, Section for Management Systems
Authors: Köster, F. (Intern), Vinther, M. (Intern), MacKenzie, B. (Intern), Eero, M. (Intern), Plikshs, M. (Ekstern)
Pages: 205-220
Publication date: 2009
Main Research Area: Technical/natural sciences
Fishing and jellyfish eradicate fish 180 years ago

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources

10.2960/J.v41.m636
http://journal.nafo.int/41/koster/18-koster.html
Source: orbit
Source-ID: 241285
Publication: Research - peer-review › Journal article – Annual report year: 2009
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.
Konsekvensen af klimatiske ændringer på det danske tungefiskeri

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Nielsen, E. (Intern), MacKenzie, B. (Intern)
Publication date: 2009
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252673
Publication: Research › Conference abstract for conference – Annual report year: 2009

Productivity patterns and abundance-area relationships in 3 marine fish species (cod, herring and haddock); meta-analyses on the effects of temperature, life-history and habitat size across the N Atlantic

Stock status evaluation and recovery policies in fisheries management rely largely on reference points derived from spawner-recruit (SR) models. The key-parameters of these models, representing productivity and carrying capacity, have been shown to be sensitive to environmental forcing and to depend on the biological and ecological characteristics of the stocks. Our aim was to identify the patterns of the temperature, habitat size and life-history effects on the SR dynamics across the N Atlantic range of 3 species; cod (21 stocks), herring (16 stocks) and haddock (7 stocks). Using hierarchical, Bayesian SR models, we combined the data across the distribution of the species in order (i) to determine the functional forms of the SR parameters dependence on these factors among and within stocks and (ii) to borrow strength and provide estimates of increased precision. Temperature during the spawning season was found to have significant effects on the productivities of all species, while carrying capacity was shown to depend also on the available habitat size. Using the derived relationships, it was possible to predict the expected changes in population-specific dynamics resulting from temperature increases. Synthesizing these patterns can improve our understanding of environmental impacts on key population parameters, which is required for an ecosystem approach to management.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Authors: Mantzouni, I. (Intern), MacKenzie, B. (Intern)
Publication date: 2009
Event: Abstract from ICES/PICES/UNCOVER Symposium 2009 on Rebuilding Depleted Fish Stocks, Warnemünde/Rostock, Germany.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2009

Beware the misapplication of results: Response to Cardinale and Svedäng (2007)

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Poulsen, R. (Ekstern), Cooper, A. (Ekstern), Holm, P. (Ekstern), MacKenzie, B. (Intern)
Pages: 307-308
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 89
Issue number: 3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Climate related marine ecosystem changes

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

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

Effect of recent climatic changes on abundance of sole, Solea solea, in the Kattegat and the Belt Sea

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Nielsen, E. (Intern), MacKenzie, B. (Intern)
Publication date: 2008

Host publication information
Title of host publication: Proceedings of the 7th International Symposium on Flatfish Ecology
Main Research Area: Technical/natural sciences
Conference: The 7th International Flatfish Symposium will be held in Sesimbra, Portugal from November 2nd to 7th, 01/01/2008
Source: orbit
Source-ID: 259946
Publication: Research › Conference abstract in proceedings – Annual report year: 2008

Fish

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

Host publication information
Title of host publication: Assessment of Climate Change for the Baltic Sea Basin
Volume: 5.8
Fish stock development under hydrographic and hydrochemical aspects - the history of Baltic Sea fisheries and its management

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

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

Hierarchical modeling of temperature and habitat effects on carrying capacity and maximum reproductive rate of North Atlantic cod in the Baltic Sea, Gulf of St. Lawrence and throughout the North Atlantic

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Mantzouni, I. (Intern), MacKenzie, B. (Intern)
Pages: 67
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication Information
Journal: ICES C.M.
Volume: J:07
Original language: English
Links:
Source: orbit
Source-ID: 284624
Publication: Research › Conference article – Annual report year: 2008

Hindcasting the temperature and growth history of surviving larvae of bluefin tuna (Thunnus thynnus) in the Northwest Mediterranean Sea

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Mariani, P. (Intern), Garcia, A. (Ekstern), MacKenzie, B. (Intern), Alemany, F. (Ekstern), Cortés, D. (Ekstern), Velez-Belchí, P. (Ekstern)
Importance of fish biodiversity for the management of fisheries and ecosystems

A group of fisheries scientists participating in a European Union Network of Excellence (MARBEF) summarizes risks to the biodiversity of fish in European seas and recommends ways how existing fish diversity can be conserved, restored and managed. (C) 2008 Elsevier B.V. All rights reserved.
Incorporating environmental variability in stock assessment: predicting recruitment, spawner biomass and landings of sprat (Sprattus sprattus) in the Baltic Sea

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

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 7
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Reconstructing historical stock development of Atlantic cod (Gadus morhua) in the eastern Baltic Sea before the beginning of intensive exploitation

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

**General information**

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

**Publication information**

Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 65
Issue number: 12
ISSN (Print): 0706-652X
Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- 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
Daily ocean monitoring since the 1860s shows record warming of northern European seas

Ocean temperatures in most parts of the world are increasing and are expected to continue to rise during the 21st century. A major challenge to ecologists and marine resource managers is to understand and predict how these global changes will affect species and ecosystems at local scales where temperature more directly affects biological responses and species interactions. Here, we investigate historical variability in regional sea surface temperature in two large heavily exploited marine ecosystems and compare these variations with expected rates of temperature change for the 21st century. We use four of the world’s longest calibrated daily time series to show that trends in surface temperatures in the North and Baltic Seas now exceed those at any time since instrumented measurements began in 1861 and 1880. Temperatures in summer since 1985 have increased at nearly triple the global warming rate, which is expected to occur during the 21st century and summer temperatures have risen two to five times faster than those in other seasons. These warm temperatures and rates of change are due partly to an increase in the frequency of extremely warm years. The recent warming event is exceeding the ability of local species to adapt and is consequently leading to major changes in the structure, function and services of these ecosystems.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Publication: Research - peer-review › Journal article – Annual report year: 2008
A long term (1667-1860) perspective on impacts of fishing and environmental variability on fisheries for herring, eel, and whitefish in the Limfjord, Denmark

This investigation reconstructs the development of major fisheries for herring, eel and whitefish in the Limfjord estuary, Denmark ca. 1667-1860, and then evaluates how their long-term dynamics have been influenced by some key fishery and environmental developments. The commercially most important fishery was for herring, Clupea harengus, which spawned in the Limfjord. This fishery underwent large changes in these centuries. High landings occurred in two periods in the early 18th and again in the early 19th centuries, when 4000-8000 metric tonnes were caught annually. In 1830, the fishery collapsed and landings were...
An abundance estimate of ling (Molva molva) and cod (Gadus morhua) in the Skagerrak and the northeastern North Sea, 1872

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Poulsen, R. (Ekstern), Cooper, A. (Ekstern), Holm, P. (Ekstern), MacKenzie, B. (Intern)
Pages: 196-207
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 87
Issue number: 2-3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Daily ocean monitoring since the 1860s shows record warming of northern European seas

Development of international fisheries for the eastern Baltic cod (Gadus morhua) from the late 1880s until 1938

The paper provides an overview of eastern Baltic cod (Gadus morhua) fisheries from the end of the 1880s until 1938, in order to improve the knowledge of long-term stock dynamics. The data compiled and included in the study comprise catches and economic values of exploited fish species, time series of indicators of fishing effort and qualitative information on developments in fishing technology. This information has been assembled for different countries and locations in the Baltic Sea. We first summarize the multi-decadal development of national cod fisheries and their relative importance during the first decades of the 20th century. We then assess whether these data can be used to estimate the relative roles of fishing and ecosystem changes on variations in catches. We conclude that the assembled data reveal biologically meaningful variations in the state of the cod stock and that some of the variations in the catches of different countries (e.g. decline in the late 1920s; increase in the late 1930s) were caused by factors other than fishery developments. These factors probably include ecosystem-induced variations in cod population dynamics and need further investigation. (c) 2007 Elsevier B.V. All rights reserved.
Historical analysis of Pan I in Atlantic cod (Gadus morhua): temporal stability of allele frequencies in the southeastern part of the species distribution

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Eg Nielsen, E. (Intern), MacKenzie, B. (Intern), Magnussen, E. (Ekstern), Meldrup, D. (Intern)
Pages: 1448-1455
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 64
Issue number: 10
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Historical development of fisheries in northern Europe - Reconstructing chronology of interactions between nature and man: Introduction

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Ojaveer, H. (Ekstern), MacKenzie, B. (Intern)
Pages: 102-105
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 87
Issue number: 2-3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
The Baltic Sea is a large brackish semienclosed sea whose species-poor fish community supports important commercial and recreational fisheries. Both the fish species and the fisheries are strongly affected by climate variations. These climatic effects and the underlying mechanisms are briefly reviewed. We then use recent regional-scale climate-ocean modelling results to consider how climate change during this century will affect the fish community of the Baltic and fisheries management. Expected climate changes in northern Europe will likely affect both the temperature and salinity of the Baltic, causing it to become warmer and fresher. As an estuarine ecosystem with large horizontal and vertical salinity gradients, biodiversity will be particularly sensitive to changes in salinity which can be expected as a consequence of altered precipitation patterns. Marine-tolerant species will be disadvantaged and their distributions will partially contract from the Baltic Sea; habitats of freshwater species will likely expand. Although some new species can be expected to immigrate because of an expected increase in sea temperature, only a few of these species will be able to successfully
colonize the Baltic because of its low salinity. Fishing fleets which presently target marine species (e.g. cod, herring, sprat, plaice, sole) in the Baltic will likely have to relocate to more marine areas or switch to other species which tolerate decreasing salinities. Fishery management thresholds that trigger reductions in fishing quotas or fishery closures to conserve local populations (e.g. cod, salmon) will have to be reassessed as the ecological basis on which existing thresholds have been established changes, and new thresholds will have to be developed for immigrant species. The Baltic situation illustrates some of the uncertainties and complexities associated with forecasting how fish populations, communities and industries dependent on an estuarine ecosystem might respond to future climate change.
Impact of 21st century climate change on the Baltic Sea fish community and fisheries

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

Publication information
Journal: ICES Council Meeting
Volume: E:11
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Links:

Bibliographical note
This paper has later been published in: Global Change Biology 13: 1348-1367 (2007)
Source: orbit
Source-ID: 226520
Publication: Research › Conference article – Annual report year: 2007

Incorporating environmental variability in stock assessment - predicting recruitment, spawner biomass and landings of sprat in the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Horbowy, J. (Ekstern), Köster, F. (Intern)
Individual based model of cod larvae feeding behavior: interaction with turbulence and search shape

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: MacKenzie, B. (Intern), Mariani, P. (Intern), Visser, A. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences

Bibliographical note
Oral presentation and abstract
Source: orbit
Source-ID: 242019
Publication: Research › Conference abstract for conference – Annual report year: 2007

Individual-based simulations of larval fish feeding in turbulent environments

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Mariani, P. (Intern), MacKenzie, B. (Intern), Visser, A. (Intern), Botte, V. (Ekstern)
Pages: 155-169
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 347
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Coastal areas such as estuaries, bays and fjords usually have hydrographic characteristics (e.g., temperature, salinity) which differ from those at larger spatial scales and in offshore areas. The differences can arise if the areas are subject to different climatic forcing or if they are relatively isolated from each other due to topographic and ocean circulation features which inhibit advective inputs of water mass properties. Local differences in hydrographic conditions can therefore potentially limit the applicability of existing long time series of coastally monitored temperatures for addressing questions at large spatial scales, such as the response of species distributions and phenologies to climate change. In this study we investigate the spatial synchrony of long-term sea surface temperatures in the North Sea-Baltic Sea region as measured daily at four coastal sites (Marsdiep, Netherlands; Torungen, Norway; Skagens Reef, Denmark; and Christianso, Denmark) and in several large offshore areas. All time series, including two series reconstructed and intercalibrated for this study (Skagens Reef and Christianso, Denmark), began during 1861-1880 and continue until at least 2001. Temperatures at coastal sites co-varied strongly with each other and with opportunistically measured offshore temperatures despite separation distances between measuring locations of 20-1200 km. This covariance is probably due to the influence of large-scale atmospheric processes on regional temperatures and is consistent with the known correlation radius of atmospheric fluctuations (ca. 1000 km). Differences (e.g., long-term trends, amplitude of seasonal variations) between coastal temperatures and those measured in adjacent offshore areas varied nonrandomly over time and were often significantly autocorrelated up to 2 years. These differences suggest that spatial variations in physical oceanographic phenomena and sampling heterogeneities associated with opportunistic sampling could affect perceptions...
of biological responses to temperature fluctuations. The documentation that the coastally measured temperatures co-vary with those measured opportunistically in offshore areas suggests that the coastal data, which have been measured daily using standardized methods and instruments, contain much of the variability seen at larger spatial scales. We conclude that both types of time series can facilitate assessments of how species and ecosystems have responded to past temperature changes and how they may react to future temperature changes. (C) 2007 Elsevier B.V. All rights reserved.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Schiedek, D. (Ekstern)
Pages: 405-420
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Marine Systems
Volume: 68
Issue number: 3-4
ISSN (Print): 0924-7963
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.403 SNIP 1.282 CiteScore 2.61
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.093 SNIP 1.033 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.231 SNIP 1.494 CiteScore 2.69
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.609 SNIP 1.457 CiteScore 2.99
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.534 SNIP 1.276 CiteScore 2.51
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.51 SNIP 1.289 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.43 SNIP 1.122
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.4 SNIP 1.097
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.295 SNIP 1.289
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.164 SNIP 1.235
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.044 SNIP 1.31
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.372 SNIP 1.246
MarFish: Causes and consequences of changing marine biodiversity, a fish and fisheries perspective

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Lorance, P. (Ekstern)
Pages: 1-10
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Volume: E:25
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Links:
Source: orbit
Source-ID: 226524
Publication: Research - peer-review › Journal article – Annual report year: 2007

Modelling retention dispersion mechanisms of bluefin tuna eggs and larvae in the Balearic area

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Mariani, P. (Intern), MacKenzie, B. (Intern), Ribera, M. (Ekstern), Bozec, A. (Ekstern)
Publication date: 2007
Event: Abstract from CLIOTOP Symposium Conference, La Paz, Mexico, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 277777
Publication: Research › Conference abstract for conference – Annual report year: 2007

Molecular methods for assessing temporal adaptive changes in fish populations, a case study employing historical analysis of Pan I in cod (Gadus morhua)

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Multi-decadal scale variability in the eastern Baltic cod fishery 1550-1860 - Evidence and causes

Identification of periods of high and low cod production, and the reasons for these periods, can increase understanding of variability in populations and ecosystems. In this study we investigate the multi-decadal and multi-century scale variations in the cod population in the eastern Baltic Sea (ICES Subdivisions 25-32). Analytically derived estimates of biomass are available since 1966. These estimates show that biomass increased in the late 1970s-early 1980s, but decreased nearly 10-fold until the early 1990s and is still well below the long-term average. Prior to 1966 the biomass of cod is unknown, as is the relative role of fishing, climate variability/ regimes, eutrophication and reduction of marine mammal predator populations. We have begun to investigate whether historical fisheries information (landings, effort, distribution) from before the 1880s is available in Baltic archives and museums, and to what extent this information can be used to interpret variations in this population. We have located fisheries data for different parts of the Baltic for different time periods since the 1550s and have interpreted the findings using current process knowledge of oceanographic mechanisms affecting cod reproduction and ecology in the Baltic Sea. The recovered data show that the Baltic ecosystem was able to support modest-large cod populations even though it was oligotrophic and contained large populations of cod predators (e.g., marine mammals). Current ecosystem management policy in the Baltic as developed and implemented by organisations such as the International Council for the Exploration of the Sea (ICES), the Baltic Marine Environment Protection Commission (HELCOM), the nine coastal countries and the European Union includes recovery of the cod population, a reduction in nutrient loading and measures to promote recovery of seal and harbour porpoise populations. If these policies are successful, the role of predatory fish in the future Baltic could again be substantial and comparable to that which we show existed 450 years ago. However, such a scenario will also require a major reduction in cod fishing mortality and suitable hydrographic conditions which promote successful cod reproduction. Historical ecology investigations in the Baltic can contribute to scientifically based fishery and ecosystem management and recovery plans. (c) 2007 Elsevier B.V. All rights reserved.
The Danish fish fauna during the warm Atlantic period (ca. 7000-3900 bc): Forerunner of future changes?

Vast amounts of fish bone lie preserved in Denmark's soil as remains of prehistoric fishing. Fishing was particularly important during the Atlantic period (ca. 7000-3900 bc, i.e. part of the Mesolithic Stone Age). At this time, sea temperature and salinity were higher in waters around Denmark than today. Analyses of more than 100,000 fish bones from various settlements from this period document which fish species were common in coastal Danish waters at this time. This study provides a basis for comparing the fish fauna in the warm Stone Age sea with the tendencies seen and predicted today as a result of rising sea temperatures. One example concerns the anchovy (Engraulis encrasicolus), which lived in the Stone Age sea, and has become more numerous in Danish waters since the mid-1990s. Other warm water fishes represented among the Stone Age bone samples include smoothhound (Mustelus sp.), common stingray (Dasyatis pastinaca), European sea bass (Dicentrarchus labrax), black sea bream (Spondyliosoma cantharus) and swordfish (Xiphias gladius). Surprisingly, Atlantic cod (Gadus morhua), whose biomass in the Kattegat and eastern Baltic Sea is presently at record low levels, was one of the most frequently caught species in the Danish Stone Age sea. These results demonstrate that major changes to the fish fauna near Denmark will occur as climate changes. However, exploitable cod populations can potentially be maintained in waters near Denmark, including the North Sea, but the vulnerability to climate change and the risk of stock collapse will increase at present high fishing mortalities.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Enghoff, I. (Ekstern), MacKenzie, B. (Intern), Eg Nielsen, E. (Intern)
Pages: 167-180
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 87
Issue number: 2-3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
The Danish fish fauna during the warm Atlantic period (ca. 7,000-3,900 BC): forerunner of future changes?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Population Ecology and Genetics
Authors: Enghoff, I. B. (Ekstern), MacKenzie, B. (Intern), Eg Nielsen, E. (Intern)
The development of fisheries at Bornholm, Denmark (Baltic Sea) during 1880s-1914

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Bager, M. (Ekstern), Søndergaard, M. (Ekstern), MacKenzie, B. (Intern)
Pages: 146-154
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Research
Volume: 87
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
The development of the northern European fishery for north Atlantic bluefin tuna Thunnus thynnus during 1900-1950

North Atlantic bluefin tuna, Thunnus thynnus, used to migrate to northern European waters (Norwegian Sea, North Sea, Skagerrak, Kattegat, and Øresund) where it supported important commercial and sportfisheries. The species disappeared from the region in the early 1960s and the species is now still extremely rare. The factors which led to the development of the fishery and its subsequent decline remain unclear and poorly documented. This investigation documents the development of the fishery in terms of landings, effort, and gears with focus on the time period from 1900 to 1950 when landings were increasing. The species was frequently sighted while fishermen were targeting other species (herring, mackerel) and occasionally was caught as bycatch with these and other species. Information from scientifically trained observers demonstrate that tuna schools were common in the North Sea for 2–3 months during the summers of 1923–1931. As fishermen realized that the species had market value, new catch methods were developed and employed. These included harpoon-rifle, improved hook and line methods, and hydraulically operated purse seines. Landings rose sharply as did the number of vessels and the capacity of processing facilities for bluefin tuna. Bluefin tuna in this area were generally medium-large (>50 kg whole weight). The most important countries which participated in bluefin tuna fisheries in this period were Norway, Denmark and Sweden, but bluefin tuna were also exploited by France, Germany, The Netherlands and the United Kingdom. Similarly sportfishing increased in popularity in some of these countries and attracted many foreign participants. The increase in landings between 1900 and 1950 was driven particularly by an increase in fishing effort and technology. We found no evidence that the increase was due to a temperature-related shift in habitat into the region. Our results demonstrate that the species was an important part of the ecosystem at least back to the early 1900s and that commercial and recreational fisheries were well established in northern European waters before official ICCAT records.
The development of the northern European fishery for north Atlantic bluefin tuna Thunnus thynnus during 1900-1950

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Myers, R. A. (Ekstern)
Pages: 1-29
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
Volume: E:12
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English

Bibliographical note
This paper has later been published in: Fisheries Research 87: 229-239 (2007)
Source: orbit
Source-ID: 226537
Publication: Research › Conference article – Annual report year: 2007

Ansjosen bliver måske en dansk fisk om få år

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern)
Pages: 24-24
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Amatørfiskeren
Volume: 6
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
Dutch North Sea cod fishing in the early 1800s and the potential for climate influences

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources
Authors: Overgård, C. (Ekstern), MacKenzie, B. (Intern)
Publication date: 2006
Event: Poster session presented at CONWOY Conference on Vand og Vejr om 100 år, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226502
Publication: Research › Journal article – Annual report year: 2006

Klimaforandringer betydning for fisk og fiskeri

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Poulsen, B. (Ekstern), MacKenzie, B. (Intern), Bager, M. (Ekstern), Holm, P. (Ekstern)
Number of pages: 144
Pages: 107-121
Publication date: 2006

Host publication information
Title of host publication: Vand og vejr om 100 år - klimaforandringer og det danske vandmiljø
Volume: 8
Place of publication: Højbjerg
Publisher: Hovedland
Editors: Søndergaard, M., Kronvang, B., Pejrup, M., Sand-Jensen, K.
ISBN (Print): 87-77-39889-0
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227147
Publication: Research › Book chapter – Annual report year: 2006

The Danish fish fauna during the warm Atlantic period (ca. 7.000-3.900 BC): forerunner of future changes?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Enghoff, I. (Ekstern), MacKenzie, B. (Intern)
Publication date: 2006
Event: Poster session presented at CONWOY Conference on Vand og Vejr om 100 år, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225384
Publication: Research › Poster – Annual report year: 2006

Torsken og klimaforandringer

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Köster, F. (Intern)
Publication date: 2006
Event: Poster session presented at CONWOY Conference on Vand og Vejr om 100 år, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Bibliographical note
Poster
Source: orbit
Source-ID: 226539
Publication: Research › Poster – Annual report year: 2006

Baltic

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

Host publication information
Title of host publication: Spawning and life history information for North Atlantic cod stocks
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Editor: Brander, K.
ISBN (Print): 87-7482-034-6
Series: ICES cooperative research report
Number: 274
Main Research Area: Technical/natural sciences

Links:
http://www.ices.dk/pubs/crr/crr274/crr274.pdf

Source: orbit
Source-ID: 226363
Publication: Research › Book chapter – Annual report year: 2005

Baltic cod recruitment - the impact of climate variability on key processes

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Fisheries- and Monitoring Technology, Section for Population- and Ecosystem Dynamics, Section for Population Ecology and Genetics
Pages: 1408-1425
Publication date: 2005

Publication information
Journal: ICES Journal of Marine Science
Volume: 62
Issue number: 7
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Changes in nursery area utilisation by flatfish in Danish coastal waters of the Kattegat 1957-2004

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: Sparrevohn, C. R. (Intern), Nielsen, E. (Intern), Støttrup, J. (Intern), MacKenzie, B. (Intern)
Publication date: 2005
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226366
Publication: Research - peer-review » Journal article – Annual report year: 2005

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

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Section for Fisheries- and Monitoring Technology, Section for Population Ecology and Genetics
Can cod help to clean up the Baltic Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Almesjö, L. (Ekstern), Hansson, S. (Ekstern), Fletcher, N. (Ekstern)
Pages: 24–27
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 226365
Publication: Research › Conference article – Annual report year: 2004

Environmental history and historical fish populations in the Baltic

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Holm, P. (Ekstern), MacKenzie, B. (Intern)
Pages: 39–44
Publication date: 2004
Main Research Area: Technical/natural sciences

Host publication information
Title of host publication: Learning from environmental history in the Baltic countries
Place of publication: Stockholm
Publisher: Swedish National Agency for School Improvement
Editor: Eliasson, P.
ISBN (Print): 91-85128-31-7

Series: Learners guide
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225784
Publication: Research › Book chapter – Annual report year: 2004

Fish, fishing, and pollutant reduction in the Baltic Sea
The Baltic Sea is heavily polluted yet supports major Commercial fisheries for cod (Gadus morhua), herring (Clupea harengus), and sprat (Sprattus sprattus). Emissions of persistent organic pollutants, such as polychlorinated biphenyls (PCBs) and DDT, were high during the 1960s and 1970s, and concentrations in fish and other fauna are still significant. Several models of the fluxes of these pollutants among the water, sediment, and atmosphere have been developed, but
These generally omit the roles of fish and fisheries. We show that the standing stock of the most abundant fish species in the Baltic Sea was a sink for 260 kg of PCBs in the late 1980s to early 1990s and that the fishery removed as much or more PCB (31 kg yr\(^{-1}\)) than other budget components (e.g., degradation in the water column). Accounting for fish and fisheries could increase our understanding of the fluxes of pollutants, and banning the discard of highly contaminated organs such as cod liver could be part of the pollution management.
Fish production and climate: Sprat in the Baltic Sea

Processes controlling the production of new fish (recruitment) are poorly understood and therefore challenge population ecologists and resource managers. Sprat in the Baltic Sea is no exception: recruitment varies widely between years and is virtually independent of the biomass of mature sprat. Sprat is a key prey and predator species in the Baltic ecosystem and is commercially exploited (1.86 X 10^8 kg/yr since 1974). The population and fishery must therefore be managed sustainably and if necessary accommodate environmental effects on population dynamics. We demonstrate using 45 years of data that recruitment depends on temperature conditions during the months when sprat gonads, eggs, and larvae are developing. We also show that recruitment can be predicted before adults spawn (and fully 15 months earlier than using present technology) by using linkages between recruitment, large-scale climate variability (North Atlantic Oscillation), Baltic Sea ice coverage, and water temperature. These relationships increase our understanding of sprat population dynamics and enable a desirable integration of fisheries ecology and management with climatology and oceanography.
The spawning of plaice Pleuronectes platessa in the Kattegat
Cruises were carried out in the entire Kattegat in early March of 1998 and 2000 to investigate the spawning of plaice Pleuronectes platessa. The data showed that plaice still spawn in the Kattegat, with a main spawning area in the southern Kattegat and an area of less, but variable importance in the northern coastal Kattegat. The results indicate that spawning in the southern part of Kattegat occurs earlier than in the northern Kattegat. The preferred spawning depth was found to be around 30-40 m. Juvenile recruitment in the nursery areas along the Danish east coast derives mainly from the southern stock in the southern Kattegat with low and variable input of Skagerrak plaice. Maturity ogives for both sexes were obtained and both A(50) and L-50 were lower than those estimated 10 years previous to this Study and for plaice in the North Sea. The shift towards earlier maturity and the absence of the larger age groups in the catches indicate that the Kattegat plaice stock is under severe pressure today. (C) 2004 Elsevier B.V. All rights reserved
Issue number: 3-4
ISSN (Print): 1385-1101
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.98 SJR 0.932 SNIP 0.931
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.008 SNIP 1.007 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.977 SNIP 1.024 CiteScore 2.15
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.928 SNIP 1.098 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.115 SNIP 1.06 CiteScore 2.18
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.371 SNIP 1.28 CiteScore 2.5
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.267 SNIP 1.242
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.261 SNIP 1.071
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.289 SNIP 1.156
Scopus rating (2007): SJR 1.402 SNIP 1.179
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.325 SNIP 1.165
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.987 SNIP 0.923
Scopus rating (2004): SJR 0.932 SNIP 0.957
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.366 SNIP 1.146
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.059 SNIP 0.926
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.131 SNIP 0.954
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.127 SNIP 1.021
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.182 SNIP 1.014
Original language: English
Source: orbit
Source-ID: 226809
Publication: Research - peer-review › Journal article – Annual report year: 2004
Østersøens historiske fiskebestande - hvor mange fisk var der i gamle dage?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Holm, P. (Ekstern), MacKenzie, B. (Intern)
Pages: 4-10
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Volume: 55
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 225785
Publication: Research › Journal article – Annual report year: 2003

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

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

Publication information
Journal: Scientia Marina
Volume: 67
Issue number: 1
ISSN (Print): 0214-8358
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
Few marine ecologists have addressed important questions about the relative productivity and carrying capacity of different ecosystems required to support fish populations. Whereas many researchers have investigated interannual variability in recruitment within a stock, we asked whether relationships between spawner abundance and subsequent recruitment are similar among populations (n = 3 to 20) of the same species, and among species (n = 14). We found that a large and significant amount of the variation (R^2 = 75 to 95 %) in mean-log recruitment is explained by mean-log spawner biomass when the spawner-recruit relationship is examined among populations of the same species. The slopes of these relationships are close to 1 (i.e. proportional). However, mean recruitment per spawner varies greatly among species (range 3 to 10). Some ecosystems allowed cod Gadus morhua, haddock Melanogrammus aeglefinus and herring Clupea harengus populations to produce an average of ca. 8-fold more recruits per spawner than other ecosystems. Also, the abundance of at least 1 species (cod) is strongly related to habitat size. Reasons for the differences in recruit production per spawner between ecosystems are unclear, but the differences themselves may need to be considered in marine ecosystem management contexts.

**Spawner-recruit relationships and fish stock carrying capacity in aquatic ecosystems**

Few marine ecologists have addressed important questions about the relative productivity and carrying capacity of different ecosystems required to support fish populations. Whereas many researchers have investigated interannual variability in recruitment within a stock, we asked whether relationships between spawner abundance and subsequent recruitment are similar among populations (n = 3 to 20) of the same species, and among species (n = 14). We found that a large and significant amount of the variation (R^2 = 75 to 95 %) in mean-log recruitment is explained by mean-log spawner biomass when the spawner-recruit relationship is examined among populations of the same species. The slopes of these relationships are close to 1 (i.e. proportional). However, mean recruitment per spawner varies greatly among species (range 3 to 10). Some ecosystems allowed cod Gadus morhua, haddock Melanogrammus aeglefinus and herring Clupea harengus populations to produce an average of ca. 8-fold more recruits per spawner than other ecosystems. Also, the abundance of at least 1 species (cod) is strongly related to habitat size. Reasons for the differences in recruit production per spawner between ecosystems are unclear, but the differences themselves may need to be considered in marine ecosystem management contexts.

**General information**

State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Myers, R. (Ekstern), Bowen, K. (Ekstern)
Fish and marine mammal populations in the Baltic Sea and Skagerrak have undergone major fluctuations over the past five centuries. We summarize how these fluctuations may have depended on various forms of predation (e.g., cannibalism, fishing, hunting) and environmental processes. The best-documented long-term fisheries in this region are the herring (Clupea harengus) fisheries near Bohuslan, western Sweden, and in the Oresund. These fisheries have been important since at least the 1200s and appear to be partly climatically driven. However, in the rest of the Baltic, information about fisheries for herring and other fish species is rare until after 1900. During the 20th century, while the Baltic underwent eutrophication, the biomass and landings of three fish species (cod (Gadus morhua), herring, and sprat (Sprattus sprattus)) all increased, whereas the biomass of marine mammals (grey seals (Halichoerus grypus), ringed seals (Phoca hispida), harbour porpoises (Phocoena phocoena)) decreased. The relative roles of exploitation, marine mammal predation, and environmental variability (e.g., eutrophication, major inflows of saline water, climate change) on the long-term dynamics of key fish species is not clear and requires increased collaboration among historians, fisheries and marine mammal ecologists, oceanographers, and climatologists.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Alheit, J. (Ekstern), Conley, D. (Ekstern), Holm, P. (Ekstern), Kinze, C. (Ekstern)
Pages: 173-190
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 59
Issue number: 1
ISSN (Print): 0706-652X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.256 SNIP 1.051 CiteScore 2.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.443 SNIP 1.379 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.421 SNIP 1.081 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.324 SNIP 1.196 CiteScore 2.29
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.425 SNIP 1.118
New discoveries, findings and concepts in biological oceanography during 1979-1999: the role of ICES publications

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

Publication information
Place of publication: Copenhagen
Publisher: ICES
Original language: English

Series: ICES Cooperative Research Report
Number: 253
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226527
Publication: Research › Report – Annual report year: 2002

Process-based models of feeding and prey selection in larval fish
Feeding success is essential to larval fish survival. We present detailed mechanistic models of the foraging processes (prey encounter, approach, pursuit, and capture) in larval fish, where all parameters have explicit physical or biological meaning. The model is a unification of the processes believed to be important to prey selectivity and environmental regulation of feeding in fish. We include the sensitivity of prey to the hydrodynamic signal generated by approaching larval fish and a simple model of the potential loss of prey due to turbulence whereby prey is lost if it leaves the perceptive field during pursuit time. We parameterise the model for larval cod Gadus morhua L., a species for which data from numerous experimental and field studies are available. Model predictions are compared to observations of feeding rates under various conditions and appear to match estimated ingestion rates and prey selection in larval cod. Observed pursuit times of larvae are long and approach velocity slow enough to avoid an escape response from prey, but too short to avoid loss of prey at high turbulence levels. The pause-travel search mode is predicted to promote ingestion of larger prey than a cruising search mode. We use these models to evaluate temporal and spatial (vertical) diel feeding rates of larval cod.
across Georges Bank. Contrary to previous models, our model suggests that larval cod are food-limited only in deep waters along a 160 km transect of the bank at a prey concentration of 20 jig dry wt l\(^{-1}\). The spatio-temporal fluctuation of turbulence (tidal cycle) and light (sun height) over the bank generates complex structure in the patterns of food intake of larval fish, with different patterns emerging for small and large larvae.

**General information**

State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Fiksen, O. (Ekstern), MacKenzie, B. (Intern)
Pages: 151-164
Publication date: 2002
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Marine Ecology - Progress Series
Volume: 243
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
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
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Resolving the impact of short-term variations in physical processes impacting on the spawning environment of eastern Baltic cod: application of a 3-D hydrodynamic model

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

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics, Institute Management
Authors: Hinrichsen, H. (Ekstern), St. John, M. (Intern), Lehmann, A. (Ekstern), MacKenzie, B. (Intern), Köster, F. (Intern)
Pages: 281-294
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Marine Systems
Volume: 32
Issue number: 4
ISSN (Print): 0924-7963
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.403 SNIP 1.282 CiteScore 2.61
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.093 SNIP 1.033 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.231 SNIP 1.494 CiteScore 2.69
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.609 SNIP 1.457 CiteScore 2.99
ISI indexed (2013): ISI indexed yes
Understanding the role of turbulence on fisheries production during the first century of ICES

Developing Baltic cod recruitment models II: Incorporation of environmental variability and species interaction
factors affecting survival of the eggs (oxygen conditions, predation) were also significant and when incorporated explained 69% of the variation in 0-group recruitment. In other spawning areas, variable hydrographic conditions did not allow for regular successful egg development. Hence, relatively simple models proved sufficient to predict recruitment of 0-group cod in these areas, suggesting that key biotic and abiotic processes can be successfully incorporated into recruitment models.
Fisheries and climate change: the Danish perspective

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: MacKenzie, B. (Intern), Visser, A. (Intern)
Publication date: 2001

Host publication information
Title of host publication: Climate change research - Danish contributions
Volume: 19
Place of publication: Copenhagen
Publisher: Danish Climate Centre, Danish Meteorological Institute
Editors: Jørgensen, A., Fenger, J., Halsnæs, K.
ISBN (Print): 87-12-03775-3
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226368
Publication: Research - peer-review › Journal article – Annual report year: 2001

Klimaændringer og mulige effekter på dyre- og plantelivet i danske farvande

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, DHI Denmark, Aarhus University, University of Copenhagen
Number of pages: 42
Publication date: 2001

Publication information
Publisher: Skov- og Naturstyrelsen
ISBN (Print): 87-7279-343-0
Original language: Danish
Main Research Area: Technical/natural sciences
Electronic versions:
Publishers version
Larval trophodynamics, turbulence, and drift on Georges Bank: A sensitivity analysis of cod and haddock

Using an individual-based model approach we consider trophodynamic effects on the growth and survival of larval cod (Gadus morhua) and haddock (Melanogrammus aeglefinus) on Georges Bank during late winter/early spring. These studies represent an extension of results described in Werner et al. (1996; Deep-Sea Res. If), wherein the effect of turbulence-enhanced larval-prey contact rates increased the effective prey concentration resulting in growth of cod larvae consistent with observed rates in the field. We reformulated the feeding of the larvae to include existing relationships between maximum prey-length and larval-length and we examined: (i) larval search behaviour and its effect on encounter with prey, (ii) the ability of larvae to pursue and capture prey in a turbulent environment, and (iii) the effect of turbulence on the dispersion of larvae in the vertical. We find that search behaviour, the effect of turbulence on pursuit and capture, and vertical dispersion decrease the predicted larval growth rates compared to those observed in the earlier study. These results suggest that larval feeding behaviour, and especially the ability of larvae to pursue encountered prey, could be an important input to larval growth and survival models. The inclusion of turbulence in determining the position of passive larvae in the water column allows the larvae to sample the entire water column, contributing to a decrease in the variance of the size of the larvae over time. The ability of larvae to swim and aggregate in the vertical will be necessary to reproduce distributions observed in the field.
Optimal state-dependent allocation to growth or reproduction in cod

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Fiksen, O. (Ekstern), MacKenzie, B. (Intern)
Pages: 1-9
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES C.M. 2001/
Volume: V:12
Original language: English
Source: orbit
Source-ID: 227777
Publication: Research - peer-review › Journal article – Annual report year: 2001

What is the carrying capacity for fish in the ocean? A meta analysis of population dynamics of North Atlantic cod

Population and community data in one study are usually analyzed in isolation from other data. Here, we introduce statistical methods that allow many data sets to be analyzed simultaneously such that different studies may "borrow strength" from each other. In the simplest case, we simultaneously model 21 Atlantic cod (Gadus morhua) stocks in the North Atlantic assuming that the maximum reproductive rate and the carrying capacity per unit area are random variables. This method uses a nonlinear mixed model and is a natural approach to investigate how carrying capacity varies among populations. We used empirical Bayes techniques to estimate the maximum reproductive rate and carrying capacity of each stock. In all cases, the empirical Bayes estimates were biologically reasonable, whereas a stock by stock analysis occasionally yielded nonsensical parameter estimates (e.g., infinite values). Our analysis showed that the carrying capacity per unit area varied by more than 20-fold among populations and that much of this variation was related to temperature. That is, the carrying capacity per square kilometre declines as temperature increases.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Myers, R. (Ekstern), MacKenzie, B. (Intern), Bowen, K. (Ekstern), Barrowman, N. (Ekstern)
Pages: 1464-1476
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 58
Issue number: 7
Larval fish feeding and turbulence: A case for the downside

Theory states that small-scale turbulence decreases pursuit success of planktonic predators by advecting the encountered prey from the reactive zone of the predator during the pursuit event. We tested the quantitative predictions of a previously published model describing this phenomenon in larval cod by videorecording particle motion and feeding behavior of larval cod (8.7-12.3 mm) preying on copepods in a laboratory tank. Fluid motion shared characteristics with that in the ocean, i.e., intermittent, logarithmically distributed, average particle-particle velocity difference proportional to separation distance (1/3). Estimated bulk dissipation rates were 0-2 X 10(-8) m(2) s(-3) and similar to those commonly experienced by larval cod in nature (e.g., located at 30 m during winds of ca. 7 m s(-1)). Owing to the intermittent nature of turbulence, we related individual predation events to local, instantaneous relative velocities instead of bulk averages. Pursuit success decreased significantly with relative velocity and the observations approximated the predicted effect of turbulence on pursuit success. Nonlinear and counteracting effects of turbulence on pursuit success and encounter may partly explain the contradictory observations of how turbulence affects larval fish feeding, growth, and survival in the sea.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Authors: MacKenzie, B. (Intern), Kiørboe, T. (Intern)
Pages: 1-10
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Limnology and Oceanography
Volume: 45
Issue number: 1
ISSN (Print): 0024-3590
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.5 SJR 1.712 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.472 SNIP 1.422 CiteScore 3.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.112 SNIP 1.584 CiteScore 3.73
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.256 SNIP 1.587 CiteScore 3.98
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.456 SNIP 1.5 CiteScore 3.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.374 SNIP 1.445 CiteScore 3.59
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.38 SNIP 1.425
Web of Science (2010): Indexed yes
Quantifying environmental heterogeneity: habitat size necessary for successful development of cod Gadus morhua eggs in the Baltic Sea

Spatial and temporal variability in environmental factors can exert major influences on survival and growth of living organisms. However, in many key areas of fisheries science (e.g. growth, survival and recruitment determination), environmental heterogeneity is usually ignored because of insufficient environmental or fisheries data or lack of evidence that such heterogeneity impacts response variables. For the eastern Baltic Sea (ICES Subdivisions 25 to 32), we evaluated spatial and temporal differences in conditions affecting the survival of cod Gadus morhua L, eggs at survival on four distinct spawning sites within the assessment area. We intercalibrated ways of quantifying the volume of water ('reproductive volume') at each site where salinity, oxygen and temperature conditions permitted successful egg development. We have developed and compared a time series (1952 to 1996) of reproductive volumes among the areas to identify spatial differences. The results of 2 independent volume-estimation methods are comparable, indicating that highly significant differences exist among the sites, and that the westernmost spawning ground, Bornholm Basin, has on average the highest reproductive volume and the lowest variability among the 4 sites. These findings may be useful in evaluating how spatial and temporal variability in environmental conditions affect egg hatching success and possibly recruitment in the Baltic stock.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Fisheries- and Monitoring Technology
Authors: MacKenzie, B. (Intern), Hinrichsen, H. (Ekstern), Plikshs, M. (Ekstern), Wieland, K. (Intern), Zezera, A. (Ekstern)
Pages: 143-156
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 193
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Recruitment of Baltic cod and sprat stocks: Identification of critical life stages and incorporation of environmental variability and spatial heterogeneity into stock-recruitment relationships

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Stock recruitment relationships for cod (Gadus morhua L.) in the central Baltic Sea incorporating environmental variability

Recruitment of central/eastern Baltic cod critically depends on favourable oceanographic conditions in the deeper basins of the Baltic Sea creating a suitable habitat for the development of early life stages. The decline in the size of the spawning stock since the mid-1980s initiated a series of investigations on recruitment, which were continued through a partial recovery of the stock in the mid-1990s. The principal factors influencing recruitment and recognized at present are: (i) the volume of water with temperature, oxygen and salinity conditions which meet the minimum requirements for successful egg development ('reproductive volume'); (ii) the age-structure of the spawning stock; (iii) the timing of spawning; and (iv) predation mortality on eggs due to sprat (Sprattus sprattus) and herring (Clupea harengus), as well as cod cannibalism. We relate recruitment at age 2 to parent stock size using updated time series of these variables, comprising the period 1966 to 1994. Spawning stock biomass and egg production are compared as measures of parent stock size. The influence of wind energy and zooplankton abundance on cod recruitment are discussed. A modified Ricker model is outlined explicitly accounting for environmentally-induced oscillations around the two observed levels of cod stock size.

General information

State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Fisheries- and Monitoring Technology, Section for Population- and Ecosystem Dynamics
Authors: Jarre, A. (Intern), Wieland, K. (Intern), MacKenzie, B. (Intern), Hinrichsen, H. (Ekstern), Plikshs, M. (Ekstern), Aro, E. (Ekstern)
Pages: 97-123
Publication date: 2000
Main Research Area: Technical/natural sciences
Turbulence, larval fish ecology and fisheries recruitment: a review of field studies

Fish recruitment varies widely between years but much of this variability cannot be explained by most models of fish population dynamics. In this review, I examine the role of environmental variability on fish recruitment, and in particular how turbulence affects feeding and growth of larval fish, and recruitment in entire populations. One of the main findings is that field studies show contrasting effects of turbulence on feeding, growth and mortality rates in nature and on recruitment. Coincident and multiple variations in ecosystem processes, lack of understanding of how some of these processes (e.g. larval diet composition, feeding behaviour, growth rates, prey patchiness) respond to turbulence, and unavoidable sampling artifacts are mainly responsible for this result. Upwelling as well as frontal processes appear important for larval fish growth and survival, and turbulence levels vary both within and across these features. Process-oriented studies of some of these interactions could provide more definitive links between turbulence and biological responses in future. (C) 2000 Ifremer/CNRS/IRD/Editions scientifiques et médicales Elsevier SAS.

Diel variability of feeding activity in haddock (Melanogrammus aeglefinus) larvae in the East Shetland area, North Sea

Investigations of factors affecting feeding success in fish larvae require knowledge of the scales of variability of the feeding process itself and the indices used to assess this variability. In this study, we measured short-term (diel) variability in feeding rates of wild haddock (Melanogrammus aeglefinus) larvae four times per day during a 10-d cruise in the northern North Sea. Feeding activity was evaluated using indices of gut fullness, prey digestive state and biochemical measurements (tryptic enzyme activity). The gut fullness and the enzyme activity indices indicated moderate to high rates of food consumption throughout the cruise. Time series analysis of the three indices showed significant diel variability in all indices and enabled identification of significant lags between food uptake and peak digestive enzyme activity. The typical pattern of food consumption and digestion was characterized by maximal ingestion of prey early in the evening (19:00 hrs) and peak digestive enzyme activity at 01:00 hrs. The time scale over which enzyme activities reacted to prey ingestion was ca. 6 h, and is consistent with expectations from controlled laboratory experiments with other larval fish species. Significant diel variability in tryptic enzyme activity suggests that attempts to relate this measure of feeding success to other variables (e.g. food concentrations) should take care to accommodate natural cycles in feeding activity before making statistical comparisons.
Does spatial match-mismatch of spawning and environmental conditions and recruitment in Baltic cod?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Plikshs, M. (Ekstern), Köster, F. (Intern), Hinrichsen, H. (Ekstern)
Pages: 1-12
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1999/
Volume: Y:16
Original language: English
Source: orbit
Source-ID: 226508
Publication: Research › Conference article – Annual report year: 1999

Empirical models of carrying capacity, maximum reproductive rate, and species interactions using a meta-analysis approach

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Myers, R. (Ekstern), MacKenzie, B. (Intern), Bowen, K. (Ekstern), Barrowman, N. (Ekstern)
Pages: 1-8
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1999/
Volume: Y:18
Original language: English
Source: orbit
Source-ID: 226732
Publication: Research › Conference article – Annual report year: 1999

 Hvordan reagerer fiskerier og fiskebestande på miljøsvingninger?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, National Veterinary Institute
Authors: MacKenzie, B. (Intern), Mellergaard, S. (Intern)
Pages: 23-31
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk & Hav
Stock-recruitment meta-analysis reveal differences in fish stock productivity between marine ecosystems

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Myers, R. (Ekstern), Bowen, K. (Ekstern)
Pages: 1-8
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1999/
Volume: Y:17
Original language: English
Source: orbit
Source-ID: 226534
Publication: Research › Conference article – Annual report year: 1999

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

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

Publication information
Journal: ICES CM 1999/
Volume: Y:26
Original language: English
Source: orbit
Source-ID: 226376
Publication: Research › Conference article – Annual report year: 1999

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

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

Publication information
Publisher: [s.n.]
Variability in growth rates of larval haddock in the northern North Sea
The large-scale distribution of haddock (Melanogrammus aeglefinus) larvae in the northern North Sea was mapped in a grid survey carried out in late April 1996. A drifting buoy was deployed in the centre of one of the areas of concentration of larvae located off the east coast of the Shetland Isles, where intensive sampling was carried out for approximate to 10 days. Daily larval haddock growth variability, estimated from otolith microstructure analysis, was independent of the measured variability of the physical and biological environment of the larvae. The survey coincided with the onset of the spring plankton production bloom, and a likely explanation for the absence of environmental effects on larval growth was high food availability and larval feeding rates. Nevertheless, differences in growth were observed between cohorts, with larvae hatched later in the spring displaying higher growth at age than those hatched earlier. Particle-tracking modelling suggested that differences in temperature history between cohorts, on their own or compounded by a potential interaction between temperature and the development of plankton production, may explain the higher growth rate of the larvae hatched later in the season.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Gallego, A. (Ekstern), Heath, M. (Ekstern), Basford, D. (Ekstern), MacKenzie, B. (Intern)
Pages: 77-92
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisheries Oceanography
Volume: 8
Issue number: 2
ISSN (Print): 1054-6006
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.19
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.61
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.21
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.42
ISI indexed (2011): ISI indexed yes
Diel variability of feeding activity in haddock larvae in the east Shetland area, North Sea

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Ueberschar, B. (Ekstern), Basford, D. (Ekstern), Heath, M. (Ekstern), Callego, A. (Ekstern)
Pages: 1-10
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1998
Volume: CC:11
Original language: English

Bibliographical note
ICES Annual Science Council
Source: orbit
Source-ID: 225474
Publication: Research - peer-review › Journal article – Annual report year: 1999

Environmental variability along the drift track of larval haddock in the east Shetland Atlantic inflow

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Pages: 1-16
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1998/
Volume: CC:16
Original language: English

Bibliographical note
ICES Annual Science Council
Source: orbit
Quantifying and disaggregating the spawner effect: Incorporating stock structure, spatial distribution and female influences into estimates of annual population egg production

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Institute Management
Authors: MacKenzie, B. (Intern), Tomkiewicz, J. (Intern), Köster, F. (Intern), Nissling, A. (Ekstern)
Pages: 1-23
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1998/
Volume: BB:11
Original language: English
Source: orbit
Source-ID: 226531
Publication: Research › Conference article – Annual report year: 1998

Turbulence-induced contact rates of plankton: the question of scale
Modelling encounter rates between planktonic predators and prey in turbulent waters requires an estimate of a spatial scale. One spatial scale proposed in the literature based on prey concentration is shown to be systematically inconsistent and its use is shown to imply that plankton sampling methodology can bias encounter rate estimates in turbulent situations. We show that a scale based on the predator's reactive distance is more appropriate, as it has clear theoretical support, and is consistent with other mathematical treatments of encounter problems. Applying the reactive distance as the length scale produces encounter rates for small (e.g. 4 to 10 mm) fish larvae 2- to 3-fold lower than those using prey separation distance

General information
State: Published
Organisations: Section for Ocean Ecology and Climate, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Visser, A. (Intern), MacKenzie, B. (Intern)
Pages: 307-310
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Marine Ecology - Progress Series
Volume: 166
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Wind-induced transport of plaice (Pleuronectes platessa) early life-history stages in the Skagerrak-Kattegat

Identifying mechanisms of exchange between adjacent fish populations is important to understanding causes of fluctuations in abundance. This study addresses the hypothesis that the abundance of settled O-group plaice along the Danish coast of the Kattegat depends on transport from the Skagerrak. Abundance data are derived from annual (1957-1994; 10-15 years missing depending on sample site) juvenile fish surveys conducted at four sites by the Danish Institute for Fisheries Research. The O-group abundance measured in July-August is significantly higher in years when wind conditions during the larval development period (March-April) were moderate to strong. Meristic variation (number of anal fin rays) depends on wind conditions in a manner consistent with the role of wind on abundance. In years with strong winds, meristic variation along the coast is low due to influx of progeny from the Skagerrak; in years with weak winds (when influx of Skagerrak progeny is low), regional variation in meristic counts is larger. These abundance and meristic patterns are consistent with historical observations of stock distribution and mixing in the area, and demonstrate the potential for physical processes to mediate exchange of eggs and larvae between areas. Abundances showed no evidence of long-term changes, even after allowing for the significant role of wind on abundance, and despite eutrophication of the Kattegat. (C) 1998 Elsevier Science B.V. All rights reserved
Er det højere magter eller biologer der styrer fiskebestanden?

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Nielsen, E. (Intern), MacKenzie, B. (Intern)
Pages: 2-11
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk & hav
Volume: 48
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 226805
Publication: Research › Journal article – Annual report year: 1997

Theme Session on Intermediate-Scale Physical Processes and their Influence on the Transport and Food Environment of Fish, 1995 - Introduction

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), Werner, F. (Ekstern)
Pages: 159-159
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Journal of Marine Science
Volume: 54
Issue number: 2
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Baltic cod recruitment project (CORE)

General information
State: Published
Organisations: Institute Management, National Institute of Aquatic Resources, Section for Monitoring, Section for Population Ecology and Genetics, Section for Population- and Ecosystem Dynamics
Pages: 1-21
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English

Bibliographical note
Source: orbit
Eastern Baltic cod: Perspectives from existing data on processes affecting growth and survival of eggs and larvae

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

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

Publication information
Journal: Marine Ecology - Progress Series
Volume: 134
ISSN (Print): 0171-8630
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Indexed yes
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
Oceanographic processes influencing seasonal and interannual variability in cod spawning habitat in the eastern Baltic Sea

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

Publication information
Journal: I C E S Council Meeting
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 226528
Publication: Research › Conference article – Annual report year: 1996

Oxygen in the deep basins of the Baltic Sea: The influence of winter mixing

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: St. John, M. (Intern), Hinrichsen, H. (Ekstern), Lehmann, A. (Ekstern), MacKenzie, B. (Intern)
Pages: C+J:2
Encounter rates and swimming behavior of pause-travel and cruise larval fish predators in calm and turbulent laboratory environments

We observed the feeding and swimming behavior of freely swimming cod (Gadus morhua) and herring (Clupea harengus) larvae in calm and turbulent (\( \varepsilon \approx 7.4 \times 10^{-8} \) m\(^2\) s\(^{-3}\)) laboratory environments at limiting and satiating abundances of Acartia tonsa prey. Attack position rates (a measure of prey encounter rate in unsatiated larvae) were significantly higher in turbulent than in calm water at low food abundances for two size groups of cod. The difference in cod attack position rate between calm and turbulent water was much less when prey was more abundant. Attack position rates of herring larvae were higher in turbulent water than in calm water, but the difference was not significant. Interspecific differences in swimming and pausing behavior were related to differences in prey search strategy used by the two species (cod: pause-travel; herring: cruise). We used a newly developed search model for pause-travel predators in calm and turbulent environments to compare encounter rates for predators using cruise and pause-travel search strategies. Encounter rates for cod and herring larvae, estimated with respective search models, were similar in calm and low turbulence water; at high turbulence levels, the pause-travel model predicts higher encounter rates than does the cruise model. In terms of prey encounter rate, cod larvae benefit more from turbulent motion than do herring larvae. However, aspects of larval behavior other than prey search strategy (e.g., prey capture success) need to be examined experimentally before the overall effects of turbulence on larval fish feeding rates can be fully evaluated.

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Ocean Ecology and Climate
Larval trophodynamics, turbulence and drift on Georges Bank: a sensitivity analysis of cod and haddock

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: Werner, F. (Ekstern), Perry, R. (Ekstern), MacKenzie, B. (Intern), Lough, R. (Ekstern)
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES Council Meeting 1995/
Volume: Q:26
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source-ID: 226512
Publication: Research - peer-review › Journal article – Annual report year: 1995

Patchiness of plankton and abiotic variables: at what scales and turbulence levels to distributions differ?

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources
Authors: MacKenzie, B. (Intern), St John, M. (Ekstern)
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1995/
Volume: Q:22
Original language: English
Source: orbit
Source-ID: 227776
Publication: Research › Conference article – Annual report year: 1995

Processes affecting growth and survival of cod eggs and larvae in the eastern Baltic

General information
State: Published
Organisations: Section for Population- and Ecosystem Dynamics, National Institute of Aquatic Resources, Section for Monitoring
Authors: MacKenzie, B. (Intern), St John, M. (Ekstern), Wieland, K. (Intern)
Publication date: 1995
Turbulence-enhanced prey encounter rates in larval fish: Effects of spatial scale, larval behaviour and size

Turbulent water motion has several effects on the feeding ecology of larval fish and other planktivorous predators. In this paper, we consider the appropriate spatial scales for estimating relative velocities between larval fish predators and their prey, and the effect that different choices of scales might have on encounter and ingestion rates. Four possible scaling choices have been used in the literature, giving rise to varying estimates of the effect of turbulence on encounter rate. We argue that the correct scale is that based on the larval reactive distance, and that this interpretation is consistent with classical coagulation theory. We then demonstrate that differences in larval search strategy (pause-travel versus cruise search) and behaviour (e.g., reactive distance, swimming speed, pause duration) will lead to substantial differences in estimated encounter rates. In general, small larvae are more likely to benefit from turbulence-increased encounter than larger larvae. Overall ingestion rate probability (= probability of encounter × probability of successful pursuit) is likely to be highest at moderate-high levels of turbulence. In most larval fish habitats, turbulence levels appear to lie in the range in which turbulent intensity has an overall positive effect on larval fish ingestion rate probability. However, experimental data to test the model predictions are lacking. We suggest that the model inputs require further empirical study.
Water temperature and wind effects on the abundance of 0 group plaice (Pleuronectes platessa) in the Kattegat

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Population- and Ecosystem Dynamics
Authors: Nielsen, E. (Intern), MacKenzie, B. (Intern), Bagge, O. (Ekstern)
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: ICES CM 1995/
Volume: J:29
Original language: English
Source: orbit
Source-ID: 226811
Publication: Research › Conference article – Annual report year: 1995

Projects:

Marine Ecosystem Climate Services
Intelligent oceanographically-based short-term fishery forecasting applications (GOFORIT) (39270)

Fisheries for short lived species are highly variable because they primarily target a low number of age groups within stocks as well as irregularly recruiting year-classes. As a result, environmental fluctuations (e.g., temperature, food abundance), which cause major changes in fish productivity, can lead to rapid fluctuations in fishing opportunities and stock declines if fishing effort is not reduced accordingly. Such fluctuations are not foreseen or accommodated by management advisory frameworks for short-lived species, which generally assume environmental stability and constant productivity. The GOFORIT project will use climatic and oceanographic process knowledge with the goal to improve short-term fishery forecasts.

The project is coordinated by DTU Aqua.

Funding
The project is funded by EU, COFASP, ERA-NET.

National Institute of Aquatic Resources
Section for Oceans and Arctic
Marine Research Institute
National Institute for Marine Research and Development
Central Fisheries Research Institute
Institute of Marine Sciences
Period: 01/04/2015 → 01/04/2018
Number of participants: 3
Research areas: Oceanography & Marine Populations and Ecosystem Dynamics & Marine Living Resources
Project participant:
van Deurs, Mikael (Intern)
Jonasdottir, Sigrun (Intern)
Project Coordinator:
MacKenzie, Brian (Intern)

Copepo traits and trade-offs: characterizing gender and feeding type specific behavior

National Institute of Aquatic Resources
Period: 01/05/2014 → 30/08/2017
Number of participants: 6
Phd Student:
van Someren Gréve, Hans (Intern)
Supervisor:
Almeda, Rodrigo (Intern)
Main Supervisor:
Kjærboe, Thomas (Intern)
Examiner:
MacKenzie, Brian (Intern)
Fiksen, Øyvind (Ekstern)
Biodiversity changes - causes, consequences and management implications (BIO-C3) (39117)

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

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

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

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

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

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

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
GEOMAR - Helmholtz Centre for Ocean Research Kiel
University of Hamburg
Stockholm University
National Marine Fisheries Research Institute
University of Tartu
Finnish Environment Institute
Klaipeda University
DHI Denmark
University of Gothenburg
Johann Heinrich von Thünen-Institute
Swedish Meteorological and Hydrological Institute
Åbo Academy University
Period: 01/03/2014 → 28/02/2018
Number of participants: 10
Research areas: Marine Populations and Ecosystem Dynamics & Fish Biology & Population Gentic & Ecosystem based Marine Management
Project participant:
Tomkiewicz, Jonna (Intern)
MacKenzie, Brian (Intern)
Eero, Margit (Intern)
Bekkevold, Dorte (Intern)
Dutz, Jörg (Intern)
Behrens, Jane (Intern)
A trait-based approach towards understanding benthic-pelagic pathways in marine ecosystems

National Institute of Aquatic Resources
Period: 15/12/2013 → 06/06/2017
Number of participants: 7
Phd Student:
Pécuchet, Lauréne (Intern)
Supervisor:
Andersen, Ken Haste (Intern)
Payne, Mark (Intern)
Main Supervisor:
Lindegren, Martin (Intern)
Examiner:
MacKenzie, Brian (Intern)
Nordström, Marie C. (Ekstern)
Primicerio, Raul (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

North Atlantic climate (NACLIM) (38945)
The North Atlantic Ocean is one of the most important drivers for the global ocean circulation and its variability on time scales beyond inter-annual. Global climate variability is to a large extent triggered by changes in the North Atlantic sea surface state. The quality and skill of climate predictions depends crucially on a good knowledge of the northern sea surface temperatures (SST) and sea ice distributions. On a regional scale, these parameters strongly impact on weather and climate in Europe, determining precipitation patterns and strengths, as well as changes in temperature and wind patterns. Knowledge of these factors, and of their development in the years to come, is of paramount importance for society and key economic sectors, which have to base their planning and decisions on robust climate information.

NACLIM will contribute to this goal.

DTU Aqua is the leader of work package developing such climate services for marine ecosystems, pioneering the translation of decadal-scale forecasts of the ocean’s physical environment to forecasts of the biological environment.

There are 18 project partners in total. See http://naclim.zmaw.de/Consortium.2126.0.html

The project is coordinated by University of Hamburg, Germany.

The project is funded by EU, Framework Programme 7.

Section for Marine Ecology and Oceanography
National Institute of Aquatic Resources

Section for Oceans and Arctic
Period: 01/11/2012 → 31/01/2017
Number of participants: 3
Research areas: Marine Populations and Ecosystem Dynamics & Oceanography
Project participant:
MacKenzie, Brian (Intern)
Phd Student:
Miesner, Anna Katharina (Intern)
North Sea Mackerel or Mackerel in the North (Sea)?

National Institute of Aquatic Resources
Period: 01/08/2012 → 21/11/2012
Number of participants: 5
Phd Student:
Jansen, Teunis (Intern)
Main Supervisor:
Gislason, Henrik (Intern)
Examiner:
MacKenzie, Brian (Intern)
Sparholt, Henrik (Ekstern)
Villamor, Begoña (Ekstern)

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

Center for Ocean Life (COOL) - a Vilum-Kahn Rasmussen Centre of excellence for the study of life in a changing ocean (38960)

Our goal is to develop a fundamental understanding and predictive capability of marine ecosystems through the use of novel trait-based approaches and models.

The Centre is organized around three main research activities:
- Identification and mechanistic description of the traits and trade-offs required to characterize the main Darwinian missions (feed, survive, reproduce) of the various life forms in the ocean through experimental and theoretical work, as well as analysis of literature data.
- Models: scaling of individual behavior to population and ecosystem dynamics through the development of trait-based models.
- Testing model prediction by comparing to observed trait patterns in the ocean.

The Centre involves biologists, physicists, chemists, and mathematicians and has a very strong training component through the supervision of master students, and about 30 PhD and postdoctoral fellows as well as by offering PhD summer schools and organizing international workshops. The Centre in addition host many visiting students and scientists.

The Centre is lead by DTU Aqua.

The project is funded by the Vilum Kahn-Rasmussen Foundation (Velux Foundations) as well as through various national and European fellowship programs (Research Council, H.C. Ørsted Fellowship programme, Marie Curie, Carlsberg Foundation, etc).

National Institute of Aquatic Resources
Centre for Ocean Life
Roskilde University
University of Copenhagen
Massachusetts Institute of Technology
University of Oxford
Michigan State University
University of Bergen
Kiel University
Period: 01/01/2012 → 31/12/2017
Number of participants: 10
Research areas: Oceanography & Marine Populations and Ecosystem Dynamics & Marine Living Resources & Ecosystem based Marine Management
Project participant:
Andersen, Ken Haste (Intern)
Visser, Andre (Intern)
Stedmon, Colin (Intern)
Gislason, Henrik (Intern)
Payne, Mark (Intern)
Thygesen, Uffe Høgsbro (Intern)
MacKenzie, Brian (Intern)
Mariani, Patrizio (Intern)
Nielsen, Torkel Gissel (Intern)

Project Manager, academic:
Kiørboe, Thomas (Intern)

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

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

Fisheries Oceanography of Northern Pelagic Fish Populations
National Institute of Aquatic Resources
Period: 15/12/2011 → 02/09/2015
Number of participants: 6
Phd Student:
Tsoukali, Stavroula (Intern)
Supervisor:
Visser, Andre (Intern)
Main Supervisor:
MacKenzie, Brian (Intern)
Examiner:
Nielsen, Torkel Gissel (Intern)
Folkvord, Arild (Ekstern)
Miller, Thomas J. (Ekstern)

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

Comparative growth and feeding ecology between whiting (Merlangius merlangus) in the Baltic Sea and the North Sea
National Institute of Aquatic Resources
Period: 01/11/2011 → 21/04/2016
Number of participants: 7
Phd Student:
Ross, Stine Dalmann (Intern)
Supervisor:
Andersen, Niels Gerner (Intern)
Gislason, Henrik (Intern)
Main Supervisor:
Nielsen, J. Rasmus (Intern)
Examiner:
MacKenzie, Brian (Intern)
Rijnsdorp, Adriaan D. (Ekstern)
Temming, Axel (Ekstern)

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

**PhD Scholarship in Marine Ecology and Climate**
National Institute of Aquatic Resources
Period: 15/09/2011 → 01/04/2015
Number of participants: 6
Phd Student:
Ferreira, Ana Sofia (Intern)
Supervisor:
MacKenzie, Brian (Intern)
Main Supervisor:
Visser, Andre (Intern)
Examiner:
Gislason, Henrik (Intern)
Martin, Adrian Peter (Ekstern)
Subramaniam, Ajit (Ekstern)

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

**Externally driven mortality of Eastern Baltic cod early life stages: Impact of predation and hydrography**
National Institute of Aquatic Resources
Period: 01/02/2011 → 30/08/2017
Number of participants: 6
Phd Student:
Neumann, Viola (Intern)
Supervisor:
Eero, Margit (Intern)
Main Supervisor:
Köster, Fritz (Intern)
Examiner:
MacKenzie, Brian (Intern)
Grønkjær, Peter (Ekstern)
Kraus, Gerd (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD
Climate change on marine ecosystems and resource economics (NorMER) (38898)

Marine ecosystems are under pressure from both anthropogenic climate change and high exploitation rates. A major challenge to managers and scientists is to identify ways that oceans can provide food and other services in a sustainable way under changing climatic and socioeconomic conditions. As physical, biological and socioeconomic factors interact at several levels, cross-disciplinary approaches are needed to meet this challenge.

This Nordic project has
(1) evaluated climate effects on Nordic marine ecosystems,
(2) Build new tools for predicting biological consequences of climate change,
(3) quantified impacts on profit, employment, and harvesting of cod.

This has been achieved through the work of 16 PhDs, 4 postdocs, 1 climate scientist, and the combined expertise of 45 senior scientists located at 10 institutions in 8 Nordic countries.

The project was coordinated by University of Oslo, Norway.

The project was funded by Nordforsk, Nordic Council of Ministers.

National Institute of Aquatic Resources
Centre for Ocean Life
University of Oslo
Stockholm University
Åbo Academy University
University of Helsinki
Swedish Meteorological and Hydrological Institute
University of Iceland
University of the Faroe Islands
Greenland Institute of National Resources
University of Bergen
Period: 01/01/2011 → 31/12/2015
Number of participants: 6
Research areas: Oceanography & Marine Population and Ecosystem Dynamics & Population Genetics
Project participant:
Andersen, Ken Haste (Intern)
Visser, Andre (Intern)
Thygesen, Uffe Høgsbro (Intern)
Eg Nielsen, Einar (Intern)
MacKenzie, Brian (Intern)
Project Manager, academic:
Kiorboe, Thomas (Intern)

History of marine animal populations (HMAP) (38156)

The History of Marine Animal Populations (HMAP) is the historical component of the Census of Marine Life program (CoML), which is an international, multi-disciplinary project which will investigate biodiversity in the world's oceans. HMAP's long-term aim is to improve our historical understanding of ecosystem change and our ecological understanding of man's role in changing marine ecosystems.

The long data series and time-specific snapshots of marine ecological conditions that are being generated are being used to provide input to contemporary ecological modelling in order to characterize and visualize variations in past ecosystems. Such visualizations and testing of ecological hypotheses will enhance the disciplines of history and ecology in seeking to explain long-term changes in marine animal populations and their ecosystems, especially those changes resulting from man's activities.

Some key results from our earlier historical ecology work include reconstructions of extended time series of cod and sprat biomasses in the Baltic Sea which have enabled us to document how the relative importance of different ecosystem drivers (e. g., fishing, hydrographic variability, mammal predation, eutrophication) of biomass dynamics change and
interact over time, and how eutrophication has affected forage fish production in the Baltic Sea. Ongoing work is evaluating and documenting the causes of long-term declines of a local herring population in the Baltic Sea and swordfish fisheries in coastal New England, Nova Scotia and Italy. Another key result is a recent consensus article by an ICES expert group on how historical ecology can contribute to fisheries and ecosystem management.

Because HMAP and CoML have ended, DTU Aqua's work in this area continues with support from other projects and as contributions to new successor fora established in 2013-2015. These include the Oceans Past Initiative, ICES Study Group on the History of Fish and Fisheries and the EU COST program Oceans Past Platform (2015). DTU Aqua's work will contribute to the development of new management and conservation policies by demonstrating the species compositions, sizes and distributions of animals that lived in the ocean during periods with less human impact than today, and how these biological properties have changed over time.

The project was coordinated by Trinity College, Ireland.

The project was funded by Trinity College, Dublin, Ireland.

National Institute of Aquatic Resources
Section for Marine Ecology and Oceanography
University of Copenhagen
University of Tartu
Trinity College Dublin
University of Cambridge
Period: 01/01/2011 → 01/03/2012
Number of participants: 2
Research areas: Oceanography & Marine Populations and Ecosystem Dynamics
Contact person:
MacKenzie, Brian (Intern)
Project Manager, academic:
Eero, Margit (Intern)

Integration of European marine research networks of excellence (EUROMARINE) (38903)
EuroMarine seeks to integrate three major European marine FP6 networks of excellence (EUR-OCEANS, MarBEF and Marine Genomics Europe) into one organization, “The EuroMarine Consortium” with a roadmap for joint programming, creating synergies between different scientific fields, towards a common research strategy and a shared vision for the oceans of tomorrow. EuroMarine will bring together leading European marine scientists to create a major internationally competitive network.

The goal is to exploit the knowledge created within the consortium to address questions related to the functioning of marine ecosystems and the needs of society. This project also wishes to engage the European marine data management and scientific communities in shaping the long-term integration of data, historical, present and future. Moreover, EuroMarine aims to create a 21st century marine scientist, with deep knowledge in one discipline and basic “fluency” in several others, as well as a natural ability and desire to work as part of a team.

The project is coordinated by University of Gothenburg, Sweden.

National Institute of Aquatic Resources
Centre for Ocean Life
University of Gothenburg
Centre of Marine and Environmental Research
Centro de Ciências do Mar do Algarve
Centre National de la Recherche Scientifique
Station Biologique de Roscoff
IFREMER
Centre de Recherche Halieutique Méditerranéenne et Tropicale, Institut de recherche pour le développement
Royal Netherlands Institute for Sea Research - NIOZ
This project investigated large scale patterns and variations of life in the ocean, focusing primarily on fishes. The theme used fishes to investigate how processes associated with climate change and human impacts (e.g., fishing and eutrophication) influence fish life histories, biodiversity and the dynamics of populations and species over large time and space scales. Studies have focused on key processes affecting life histories and distribution of populations and species, including reproduction, mortality, and migration.

The project had one full-time PhD student, and 5 postdoctoral scientists. The relatively high number of postdocs in a short period was due to their success at finding permanent jobs as tenure-track assistant professors, or as research scientists or managers in either industry or academia.

Key results by DTU Aqua colleagues in the project include the following:
- A pan-Atlantic analysis and discovery of how temperature affects reproductive timing in cod, with evidence for local adaptation of cod thermal physiology and counter-gradient evolution. Our ongoing work is now investigating the consequences of this adaptation for match-mismatch of cod larval production with the timing of the peak production of major zooplankton prey species (e.g., *Calanus finmarchicus*, *Pseudocalanus* sp.)
- New estimates of the numbers, locations and volumes of the mesopelagic provinces of the world’s oceans, and based for the first time on the dynamics of ocean primary productivity, C sedimentation and photic zones. These new habitat descriptors of the mesopelagic ocean will provide new contexts for studies of ocean biodiversity, and the distribution and productivity of mesopelagic fishes and other biota.
- New models of fish lifetime reproductive output which demonstrated that a fish’s annual reproductive output was strongly related to maximum body size. Moreover, indeterminate spawners had ca. 10-fold higher reproductive output per unit weight than determinate spawners suggesting possible differences in survival rates among the early life history stages between these two groups of fishes.
- Estimates of how climate change will affect the spawning locations and timing for herring in the North Sea, based on climate change scenarios, lab studies of temperature effects on egg survival rate and substrate requirements for herring egg deposition
- Global patterns in taxonomic and functional descriptors of fish biodiversity and how these are inter-related and affected by ocean conditions (e.g., primary production, ecosystem size). Ongoing work is relating these patterns to biodiversity protection (e.g., MPA coverage).

The project was coordinated by University of Copenhagen, Denmark. The project was funded by the Danish National Research Foundation.
European basin-scale analysis, synthesis and integration (EURO-BASIN) (38899)

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

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

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

The project was coordinated by DTU Aqua.

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources

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

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

Demography of fished Populations: Yield, Resilience and Evolutionary Change

National Institute of Aquatic Resources
Period: 01/12/2009 → 28/03/2012
Number of participants: 7
Phd Student:
Verdiell, Nuria Calduch (Intern)
The Baltic Sea is subject to several major human impacts, and three of the most important are fishing, eutrophication and climate change. Understanding and projecting how these impacts will affect the food web and its fish populations in future is therefore challenging, and requires modelling approaches which include climatic-hydrographic forcing, nutrient loading scenarios and likely fishing intensities.

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

One of the major novelties of the project was the availability of 3 different NPZD models, which enable estimation of output uncertainties to different model parameterizations and assumptions in the lower trophic levels and physical oceanographic processes, and to compare these with uncertainties due to fish population dynamics (e.g., recruitment variability). These comparisons suggest that the biological uncertainty associated with fish population dynamics was larger than that associated with the choice of the oceanographic NPZD model.
Marine fish atlas of Denmark (38852)
This project will produce an atlas of all the marine fish species found in waters around Denmark. The species occurrence data for the atlas will be based on all types of observational data, such as; fisheries research surveys, commercial fish landings data, recreational fishermen’s landings and diver observations. Users and target audience of the atlas are university and high school students and instructors, scientists, government officials, private companies, NGOs, and the wider Danish public. The atlas will be a reference for scientific outreach product and is a collaboration between DTU Aqua, the Zoological Museum of the Natural History Museum of Denmark and a small private consulting company operated by the former biologist of the Danish Fishermen’s Association. The atlas will contain photographs and maps of the distributional area each species and a short (3-5 page) text describing current knowledge of species’ biology and life history in Danish waters.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Centre for Ocean Life
University of Copenhagen
Krog Consult ApS
Period: 01/01/2009 → 31/12/2013
Number of participants: 3
Research area: Marine Populations and Ecosystem Dynamics
Contact person:
MacKenzie, Brian (Intern)
Project participant:
Støttrup, Josianne Gatt (Intern)
Hoffmann, Erik (Intern)
Project

Torskens populationsdynamik | Nordsøen
National Institute of Aquatic Resources
Period: 15/12/2008 → 27/06/2012
Number of participants: 6
Phd Student:
Höffle, Hannes (Intern)
Supervisor:
MacKenzie, Brian (Intern)
Main Supervisor:
Munk, Peter (Intern)
Examiner:
Brander, Keith (Intern)
Gallego, Alejandro (Ekstern)
Grønkjær, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Stereology as a tool to assess reproduction strategy and fecundity of teleost fishes
National Institute of Aquatic Resources
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)
Nielsen, Einar (Intern)
Main Supervisor: Bekkevold, Dorte (Intern)
Examiner: Mosegaard, Henrik (Intern)
Hauser, Lorenz (Ekstern)
Vasemägi, Anti (Ekstern)

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

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

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

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

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

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Marine Living Resources
Period: 01/01/2008 → 15/10/2012
Number of participants: 11
Resolving climatic impacts on fish stocks (RECLAIM) (38109)
Climate change will impact fisheries resources and challenge managers to develop sustainable exploitation strategies. Knowledge on the impacts of climate on fisheries resources is still fragmentary.

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

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

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

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

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

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

The project is coordinated by IMARES, The Netherlands, and has nine partners from the EU.
Elucidating the structure and functioning of marine ecosystems through synthesis and comparative analysis (META-OCEANS) (38154)

This project was an EU Marie Curie Early Stage Training PhD network. The project was designed to improve and apply meta-analytical methods to oceanographic and fishery research questions.

There are significant gaps in knowledge regarding the structure of marine food webs, the ecological roles of taxa of different sizes and the factors controlling linkages between different functional groups. Moreover, marine ecosystems continue to suffer from the impacts of human society superimposed on naturally and anthropogenically induced climate variability. These impacts include exploitation, eutrophication, pollution, species transfers and habitat alteration; they cause changes in the structure, function and biodiversity of marine ecosystems. However, the ability of marine scientists to predict the magnitude and direction of how marine taxa, functional groups and entire ecosystems respond to these changes, remains fragmentary. As a result, when asked by society for advice about how marine ecosystems will respond to different kinds of perturbations (including management actions), the marine science community can often only provide answers with high levels of uncertainty.

Students were trained in the use of meta-analysis techniques for marine ecological problems. The statistical methods were comparative and involved regression analysis, time series analysis, Bayesian analysis and trophic modelling. Students attended seminars organized by network scientists and visited scientists in partner institutes to attain additional training.

Meta-analyses approaches make use of existing data, produced in the context of different specific analyses, but which gain new value when assembled and re-analysed in a broader perspective. Meta-analyses involve several stages: (1) data mining; (2) quality control, (3) data analysis, and (4) validation. Students were trained in all these steps.

DTU Aqua had two PhD students involved in the project. These projects used Bayesian and meta-analytical methods to show that standardized estimates of maximum population growth rate for all assessed cod stocks vary spatially across the Atlantic and in a dome-shaped relationship with temperature, and that extremely good or bad recruitment occurs in years with extreme temperatures. In addition, new time series-based ways of forecasting cod population dynamics under climate change-exploitation scenarios were developed and the role of a trawling ban on a local cod population was shown to override temperature or other climate effects on stock productivity. Both projects produced papers in high impact journals (2 in Proc. Roy. Soc., 1 in PNAS), as well as in other leading fishery-marine ecology journals (MEPS, ICES, JMS, etc.)

This project was coordinated by AZTI Tecnalia, Spain.

This project was funded by EU, Marie Curie.

National Institute of Aquatic Resources
Centre for Ocean Life
AZTI-Tecnalia
Plymouth Marine Laboratory
National Center for Scientific Research
CSIC

University of Bergen
Period: 01/03/2006 → 09/12/2011
Number of participants: 3
Research areas: Oceanography & Marine Populations and Ecosystem Dynamics
Incorporating extrinsic drivers into fisheries management (IN EX FISH) (38188)
The overall aim of the IN EX FISH project is to increase the responsiveness of fisheries management to a range of anthropogenic and non-anthropogenic forcing factors. This will be achieved through a systematic review of the factors influencing fish stock dynamics in European Seas and by developing a suite of management tools. These management tools will use robust metrics of ecosystem state, and will provide varied management responses depending on the ecosystem state compared to a historic reference condition. The framework will be developed specifically to be integrated into European fishery management processes and will be based on the geographical areas defined by the regional advisory councils (RACs).

A holistic ecosystem approach will be used to assess the effects of anthropogenic and non-anthropogenic factors on the main functions of the biological cycle of exploited fish species and the ecosystem that supports them. The IN EX FISH project recognizes that humans are part of the marine ecosystem and that some are dependent upon it for their livelihoods. The project will validate its management recommendations through consultation with stakeholder groups and incorporate their feedback into the project outputs.

The IN EX FISH project has four specific and verifiable scientific and technical objectives. These are (i) To provide a state of the art review of the impact of anthropogenic and non-anthropogenic factors on the dynamics of fish stocks; (ii) To develop a framework for the systematic evaluation of the impact of anthropogenic and non-anthropogenic factors on the dynamics of exploited fish species; (iii) To develop criteria for the selection of appropriate metrics, to review available metrics of ecosystem status, to select those that match the criteria and establish reference levels in four geographic regions for these metrics and (iv) To incorporate IN EX FISH knowledge of anthropogenic and non-anthropogenic effects into fisheries management.

The project is coordinated by School of Biological Science, University of Liverpool, UK.

National Institute of Aquatic Resources
University of Liverpool
Instituto Português de Investigação das Pescas e do Mar
Marine Research Institute
Wageningen IMARES
Heinrich-Heine-Universität Düsseldorf
Sea Fisheries Institute
University of Bari
Stockholm University
Period: 01/01/2006 → 31/12/2008
Number of participants: 4
Research area: Ecosystem Based Marine Management
Project participant:
van Deurs, Mikael (Intern)
MacKenzie, Brian (Intern)
Jensen, Henrik (Ekstern)
Project Manager, academic:
Dolmer, Per (Intern)

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

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

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

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

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

National Institute of Aquatic Resources
Section for Marine Living Resources
Bundesforschungsanstalt für Fischerei
Marine Research Unit, Marine and Food Technological Centre
Cefas
University of Portsmouth
Marine Laboratory
Instituto Español de Oceanografía
Aalborg University
Leibniz Institut für Meereswissenschaften, Universität Kiel
IFREMER
Institute of Marine Research
Sea Fisheries Institute
Knipovich Polar Research Institute of Marine Fisheries and Oceanography
Nederlands Instituut voor Visserij Onderzoek b.v.
University of Aberdeen
University of Bergen

Period: 01/01/2006 → 31/12/2010
Number of participants: 14
Research areas: Marine Living Resources & Fish Biology
Contact person:
Köster, Fritz (Intern)
Project participant:
Tomkiewicz, Jonna (Intern)
Vinther, Morten (Intern)
Payne, Mark (Intern)
Munk, Peter (Intern)
Støttrup, Josianne Gatt (Intern)
Danish Network for Aquaculture and Fisheries Research (FISHNET) (38082)
FISHNET is a network of Danish Fisheries and Aquaculture scientists. It was established to foster cooperation in aquaculture and fisheries research and research education in Denmark.

From the start it functioned as an umbrella over four independent thematic research schools and networks in fisheries biology (SLIP), Fisheries and Aquaculture Management and Economics (FAME), Fish Food, Biochemistry and Physiology (FIBP) and Sustainable Control of Fish Diseases in Aquaculture (SCOFDA). In 2001 a research school in Maritime History and Marine Environmental Research (MARINERS) was added to the network.

FISHNET aims to enhance the visibility and quality of Danish fisheries and aquaculture research through improved collaboration and communication, improving the recruitment and training of PhD students through networks and research schools, thus providing high quality courses, seminars and workshops.

FISHNET has organised a large number of joint courses, seminars, workshops and conferences connecting more than 100 fisheries and aquaculture scientists from Danish universities and sectoral research institutions.

In 2004 Fishnet received funds to embed the network through a number of postdoc grants and co-funded professorships in Fisheries Oceanography, Fisheries Management and Fish Physiology.

The merger of the Danish Universities and Sectoral Research Institutions and various changes in Danish marine research made it necessary to extend the second phase of the project from 2008 to the end of 2012.

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
University of Copenhagen
Aarhus University
University of Southern Denmark

Period: 01/01/2000 → 31/12/2012
Number of participants: 4
Research area: Marine Populations and Ecosystem Dynamics
Project participant:
Rindorf, Anna (Intern)
van Deurs, Mikael (Intern)

Project Manager, academic:
Gislason, Henrik (Intern)
MacKenzie, Brian (Intern)

Activities:

ICES - Science Committee meeting - SCICOM (External organisation)
Period: 2012 → …

Brian MacKenzie (Participant)

National Institute of Aquatic Resources
Section for Ocean Ecology and Climate
Degree of recognition: International

Related external organisation

ICES - Science Committee meeting - SCICOM
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar