Identifying choke species challenges for an individual demersal trawler in the North Sea, lessons from conversations and data analysis

A likely side-effect of introducing the landing obligation of the 2013 Common Fisheries Policy into mixed fisheries is the occurrence of the “choke species” problem. When discarding no longer is an option, leasing quota or changing fishing practices remain important tools to avoid choke species. Here, the scale and tactics linked to using avoidance behaviour to reduce choke species is investigated by analysing the fishing behaviour of a single demersal trawler in the North Sea. Analysis combined qualitative information collected from through interviews with the vessel owner and skipper, along with quantitative analysis on fisheries data. From the interviews, saithe and cod were identified as potential choke species and subsequent analysis focused on these two species. The analysis of catch and quota composition showed that cod would choke the fishery early if no catch-quota balancing options were available, resulting in a 87% reduction in revenue, while saithe could choke the fishery later, resulting in a 43% reduction in revenue. Avoidance behaviour was difficult to detect from fisheries data, which was explained by avoidance taking primarily place through very fine-scale tactical choices rather than large displacements. Catch composition showed that saithe is distributed more patchily than cod, with most hauls containing small amounts of saithe and a few hauls containing large amounts. In conclusion this paper supplies an view on the choke species problem seen from the perspective of an individual fisher and highlights the amount of real-time tactical decisions and trade-offs that need to be made when operating in mixed-fisheries.
Integrated ecological-economic fisheries models - evaluation, review and challenges for implementation

Marine ecosystems evolve under many interconnected and area-specific pressures. In order to fulfill society's intensifying and diversifying needs whilst ensuring ecologically sustainable development, more effective marine spatial planning and broader-scope management of marine resources is necessary. Integrated ecological–socioeconomic fisheries models (IESFM) of marine systems are needed to evaluate impacts and sustainability of potential management actions and understand, and anticipate ecological, economic, and social dynamics at a range of scales from local to national and regional. To make these models most effective, it is important to determine how model characteristics and methods of communicating results influence the model implementation, the nature of the advice that can be provided and the impact on decisions taken by managers. This paper presents a global review and comparative evaluation of 35 IESFM's applied to marine fisheries and marine ecosystem resources to identify the characteristics that determine their usefulness, effectiveness and implementation. The focus is on fully integrated models that allow for feedbacks between ecological and human processes though not all the models reviewed achieve that

General information

State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Oceans and Arctic, National Oceanographic and Atmospheric Administration, Christian-Albrechts-Universität zu Kiel, CSIRO, University of Washington, Plymouth Marine Laboratory, IFREMER, Thünen Institute of Sea Fisheries, New Economics Foundation, University of British Columbia, University of Vigo, AZTI Tecnalia, Université Bretagne Loire, Institut de Ciències del Mar-CSIC, Wageningen University, National Marine Fisheries Research Institute, Scottish Pelagic Fishermen's Association, AZTI Tecnalia, University of Southern Denmark, Swiss
Achieving maximum sustainable yield in mixed fisheries: a management approach for the North Sea demersal fisheries

Achieving single species maximum sustainable yield (MSY) in complex and dynamic fisheries targeting multiple species (mixed fisheries) is challenging because achieving the objective for one species may mean missing the objective for another. The North Sea mixed fisheries are a representative example of an issue that is generic across most demersal fisheries worldwide, with the diversity of species and fisheries inducing numerous biological and technical interactions. Building on a rich knowledge base for the understanding and quantification of these interactions, new approaches have emerged. Recent paths towards operationalizing MSY at the regional scale have suggested the expansion of the concept into a desirable area of “pretty good yield”, implemented through a range around FMSY that would allow for more flexibility in management targets. This article investigates the potential of FMSY ranges to combine long-term single-stock targets with flexible, short-term, mixed-fisheries management requirements applied to the main North Sea demersal stocks. It is shown that sustained fishing at the upper bound of the range may lead to unacceptable risks when technical interactions occur. An objective method is suggested that provides an optimal set of fishing mortality within the range, minimizing the risk of total allowable catch mismatches among stocks captured within mixed fisheries, and addressing explicitly the trade-offs between the most and least productive stocks.

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, IFREMER, Cefas, Wageningen IMARES, European Commission - Joint Research Center, Thünen Institute of Sea Fisheries
Authors: Ulrich, C. (Intern), Vermard, Y. (Ekstern), Dolder, P. J. (Ekstern), Brunel, T. (Ekstern), Jardim, E. (Ekstern), Holmes, S. J. (Ekstern), Kempf, A. (Ekstern), Mortensen, L. O. (Intern), Poos, J. (Ekstern), Rindorf, A. (Intern)
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Effectiveness of fully documented fisheries to estimate discards in a participatory research scheme

A key challenge for fisheries science and management is the access to reliable and verifiable catch data. In science, the challenge is to collect reliable, precise and traceable data to provide sound advice. In management, the challenge is that catch documentation is necessary to enforce regulations. Currently, catch inspection at sea, self-reporting through e-log and on-board observers are the primary methods to document catches at sea. However, at-sea control and on-board observers are costly and have limited coverage, while self-reporting is susceptible to fraud and provides limited coverage. New cost-effective methods are currently emerging involving Remote Electronic Monitoring (REM) and on-board cameras. Previous studies have tested REM with promising results. However, evaluation of the potential biases of REM is needed before full benefits can be obtained. We deployed REM with on-board cameras on 14 fishing vessels and were able to inspect 56% of 1523 hauls made in the 6 month trial period, using an estimated 582 man-hours of video audit. The results showed an overall good agreement between the fishers self-reported discards and the video inspectors discard estimates. However, there was large variation in precision between individual vessels and species. Additionally, trial setup and process errors were shown to have a large effect on the precision of the video inspectors discard estimates. Nevertheless, despite challenges, REM was evaluated to have the potential to streamline monitoring and scientific documentation in a medium-size fishing fleet.
Food for thought: pretty good multispecies yield

MSY principles for marine fisheries management reflect a focus on obtaining continued high catches to provide food and livelihoods for humanity, while not compromising ecosystems. However, maintaining healthy stocks to provide the maximum sustainable yield on a single-species basis does not ensure that broader ecosystem, economic, and social objectives are addressed. We investigate how the principles of a “pretty good yield” range of fishing mortalities assumed to provide >95% of the average yield for a single stock can be expanded to a pretty good multispecies yield (PGMY) space and further to pretty good multidimensional yield to accommodate situations where the yield from a stock affects the ecosystem, economic and social benefits, or sustainability. We demonstrate in a European example that PGMY is a practical concept. As PGMY provides a safe operating space for management that adheres to the principles of MSY, it allows the consideration of other aspects to be included in operational management advice in both data-rich and data-limited situations. PGMY furthermore provides a way to integrate advice across stocks, avoiding clearly infeasible management combinations, and thereby hopefully increasing confidence in scientific advice.

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FAST TRACK: Industry developed gear solutions under the landing obligation

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aalborg University
Authors: Rindorf, A. (Intern), Dichmont, C. M. (Ekstern), Levin, P. (Ekstern), Mace, P. (Ekstern), Pascoe, S. (Ekstern), Prellezo, R. (Ekstern), Punt, A. (Ekstern), Reid, D. G. (Ekstern), Stephenson, R. (Ekstern), Ulrich, C. (Intern), Vinther, M. (Intern), Worsøe Clausen, L. (Intern)
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Improving fisheries science with high resolution commercial fishery data

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Authors: Schreiber Plet-Hansen, K. (Intern), Mortensen, L. O. (Intern), Nielsen, J. R. (Intern), Larsen, E. (Intern), Ulrich, C. (Intern)
Publication date: 2017
Event: Abstract from ICES Annual Science Conference 2017, Fort Lauderdale, United States.
Main Research Area: Technical/natural sciences
Reducing discards without reducing profit: Free gear choice in a Danish result-based management trial

The 2013 Common Fisheries Policy introduced a landing obligation on a range of species. This is changing the fundamental principles on which EU fisheries management is based, with more focus on the full accountability of all catches (a move towards catch quota management) and less accountability on the means used to obtain these catches (a move towards results-based management). To investigate the potentials and challenges that these paradigm shifts give rise to, a 6-months ‘unrestricted gear’ trial was performed in Denmark in 2015. Twelve trawlers of different size, rigging, fishing area and target species were challenged to test their own solutions to reduce unwanted bycatch and/or choke species, while maintaining their profitability. Fully documented fishery (FDF) was required, including electronic monitoring, self-estimation of discards and haul-by-haul catch documentation. Fishers’ participation in the trial was partly incentivized through the allocation of additional quota. Fishers used twinned standard and test gears whenever possible, or switched gear sequentially otherwise. The participating fishers tested different options depending on their fishery and the type of issues they faced individually, and adjusted their test fishery over time through incremental small steps. A total of 1497 hauls were analysed for landings, discards and discard-ratio (discard to catch ratio), along with species composition and temporal trends. Nine vessels reduced discard ratio in the test fishery, one showed no difference between test and control fishery, while two vessels displayed an increase in discard ratio. The catch compositions were also significantly different, with fewer predicted “choke species” occurring in the test fisheries and a more valuable size composition. Ultimately, despite smaller landings in multiple vessels, no vessel showed reduction in value-per-unit-effort (VPUE) and one Baltic vessel significantly increased the VPUE. No temporal trends in discard ratio were noted. This trial showed that relaxing technical regulations has a potential to provide some flexibility to cope with the landing obligation, where unwanted catches could be reduced to some extent without negative effects on economic viability. Some practical implementation challenges were nevertheless encountered, which are discussed in the perspective of implementing results-based management at full scale.
Remote electronic monitoring and the landing obligation – some insights into fishers’ and fishery inspectors’ opinions

The European fisheries management is currently undergoing a fundamental change in the handling of catches of commercial fisheries with the implementation of the 2013 Common Fisheries Policy. One of the main objectives of the policy is to end the practice of discarding in the EU by 2019. However, for such changes to be successful, it is vital to ensure stakeholders acceptance, and it is prudent to consider possible means to verify compliance with the new regulation. Remote Electronic Monitoring (REM) with Closed-Circuit Television (CCTV) has been tested in a variety of fisheries worldwide for different purposes and is currently considered as one possible tool to ensure compliance with a European ban on discards. This study focuses on Danish fishery inspectors and on fishers with REM experience, whose opinions are less well known. Their views on the landing obligation and on the use of REM were investigated using interviews and questionnaires, and contrasted to some fishers without REM experience. 80% of fishery inspectors and 58% of REM-experienced fishers expressed positive views on REM. 9 out of 10 interviewed fishers without REM experience were against REM. Participation in a REM trial has not led to antipathy towards REM. Fishery inspectors saw on-board observers, at-sea control and REM as the three best solutions to control the landing obligation but shared the general belief that the landing obligation cannot be enforced properly and will be difficult for fishers to comply with. The strengths and weaknesses of REM in this context are discussed.

General information

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Organisations: Section for Marine Living Resources, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Aalborg University, Ministry of Food, Agriculture and Fisheries
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Are FMSY ranges a promising or a dangerous option?

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Authors: Ulrich, C. (Intern), Rindorf, A. (Intern)
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Does one glove fit all? A review of Remote Electronic Monitoring as a documentation tool

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State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Cefas
Authors: Mortensen, L. O. (Intern), Schreiber Plet-Hansen, K. (Intern), Bailey, N. (Ekstern), Catchpole, T. (Ekstern), Dolder, P. J. (Ekstern), van Helmond, E. (Ekstern), Kempf, A. (Ekstern), Needle, C. L. (Ekstern), Oesterwind, D. (Ekstern), Poos, J. J. (Ekstern), Zimmermann, C. (Ekstern), Ulrich, C. (Intern)
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Event: Abstract from IIFET 2016, Aberdeen, United Kingdom.
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Industry-led fishing gear selectivity improvements. How can we increase flexibility and ownership over the gears used whole ensuring an effective introduction of the new EU Common Fisheries Policy?

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Danish Fishermen's Producers' Organization, Aalborg University
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Event: Abstract from ICES-FAO Working Group on Fishing Technology and Fish Behaviour, Mérida, Mexico.
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MINIDISC-projektet fik afprøvet det frie redskabsvalg

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State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Danish Fishermen's Producers' Organization, Aalborg University
Authors: Mortensen, L. O. (Intern), Ulrich, C. (Intern), Olesen, H. J. (Intern), Eliaisen, S. Q. (Forskerdatabase), Lund, H. S. (Ekstern)
Pages: 16
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Paths to enhance the development and the uptake of industry-led technical solutions to improved selectivity

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aalborg University
Publication date: 2016
Event: Abstract from International Institute of Fisheries Economics and Trade Conference, Aberdeen, United Kingdom.
Main Research Area: Technical/natural sciences
Publication: Research › Conference abstract for conference – Annual report year: 2016

The discard ban and its impact on the MSY objective on fisheries-the North Sea

North Sea fisheries are characterised by numerous biological and technical interactions, which create difficulties in identifying MSY targets and achieving those for all stocks simultaneously. The landing obligation may reinforce these issues, as ‘choke’ effects might be triggered by the least productive stocks. A flexible management approach can help achieve the multiple objectives, but this requires trade-offs to be made. The ecological benefits of reducing fishing mortality are likely larger than those from the landing obligation itself

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Authors: Ulrich, C. (Intern)
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http://www.europarl.europa.eu/supporting-analyses
Publication: Research › Report chapter – Annual report year: 2016
Variability and connectivity of plaice populations from the Eastern North Sea to the Baltic Sea, part II. Biological evidence of population mixing

A multi-disciplinary study was conducted to clarify stock identity and connectivity patterns in the populations of European plaice (Pleuronectes platessa) in the Skagerrak-Kattegat transition area between the Eastern North Sea and the Baltic Sea. Five independent biological studies were carried out in parallel. Genetic markers suggested the existence of different genetic populations in the transition area. Growth backcalculation with otoliths resulted in significant although limited differences in growth rates between North Sea and Skagerrak, indicating weak differentiation or important mixing. Hydrogeographical drift modelling suggested that some North Sea juveniles could settle along the coast line of the Skagerrak and the Kattegat. Tagging data suggested that both juveniles and adult fish from the North Sea perform feeding migrations into Skagerrak in summer/autumn. Finally, survey data suggested that Skagerrak also belongs to the area distribution of North Sea plaice. The outcomes of the individual studies were then combined into an overall synthesis. The existence of some resident components was evidenced, but it was also demonstrated that North Sea plaice migrate for feeding into Skagerrak and might constitute a large share of the catches in this area. The mixing of different populations within a management area has implications for stock assessment and management. Choice must be made to either lump or split the populations, and the feasibility and constraints of both options are discussed. The outcomes of this work have directly influenced the management decisions in 2015.

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State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, BGI-Shenzhen
Authors: Ulrich, C. (Intern), Hansen, J. H. (Intern), Boje, J. (Intern), Christensen, A. (Intern), Hüsey, K. (Intern), Sun, H. (Ekstern), Worsøe Clausen, L. (Intern)
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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
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BFI (2012): BFI-level 1
Accounting for socio-economic constraints to define the path to sustainability: European examples

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State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Wageningen IMARES
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Event: Abstract from ICES MYFISH Symposium, Athens, Greece.
Main Research Area: Technical/natural sciences
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Achieving Mixed-fisheries and multispecies MSY in the North Sea demersal fisheries

General information
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A review of programs established to encourage industry-led approaches to selective gear development

General information
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Publication: Research › Conference abstract for conference – Annual report year: 2015

Discarding of cod in the Danish Fully Documented Fisheries trials

Denmark was the first nation in Europe to promote the use of Fully Documented Fisheries (FDF) through Remote Electronic Monitoring (REM) and CCTV camera systems, with pilot schemes in place since 2008. In theory, such a scheme could supplement and even potentially replace expensive control and monitoring programmes; and when associated with a catch quota management (CQM) system, incentivize positive changes in fishing patterns in a results-based management approach. New data flows are, however, required to ensure the practical implementation of such a scheme. This paper reviews the quality of the FDF data collected during 2008–2014 and their potential in strengthening information on cod discards. The analyses demonstrate the improved reporting of discards in logbooks and overall discard reductions, but they also show that some uncertainties around the absolute estimates of discard quantities have remained. Regular validation of weight estimation methods and close collaboration between scientific monitoring and control are important to support the use of reported discards as a reliable source of information. We discuss the potential of electronic monitoring in the context of the EU landing obligation.

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Empowering fishermen towards the landing obligations, with their own technical solutions

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data
Authors: Mortensen, L. O. (Intern), Olesen, H. J. (Intern), Egekvist, J. (Intern), Rindorf, A. (Intern), Ulrich, C. (Intern)
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Evaluation of integrated ecological-economic models – Review and challenges for implementation

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Experiences of how fishers grab opportunities in (more) free regulation of gear

In the Minidisc project 14 vessels fished under conditions corresponding to free choose of gear. Based on the skippers initial idea of gear adjustment and a subsequent interview 6 months later the experiences of the skippers’ choice of “free” gear, the process for adjusting it and the tools for evaluating the efficiency and selectivity are discussed. Only incremental development using elements from previous used gear and other fisheries were found. Gear development took place in an interaction between the skipper and trawl maker, while no research was involved. This indicates that free choice of gear (under monitored discard ban) would lead to incremental adjustments. Parts of the fleet would have difficulties in evaluating the gear and subsequently optimise by adjusting. This would leave a need for support for development of evaluation procedures, especially among the small vessels. Radical changes probably would still need collective or public investments.

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Aalborg University
Authors: Qvist Eliasen, S. (Intern), Mortensen, L. O. (Intern), Ulrich, C. (Intern)
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Fisheries Management: Is Europe turning the corner?

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Authors: Ulrich, C. (Intern)
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Fully documented fisheries - is remote electronic monitoring the future tool in fisheries control?

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Kan frit redskabsvalg hjælpe når discardforbudet kommer?

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MINIDISC - Minimering af discards i danske fiskerie

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MSC certification of plaice fisheries in area IIIa: Basic investigations and development of a management plan

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Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Section for Marine Ecology and Oceanography
Authors: Hansen, J. H. (Intern), Ulrich, C. (Intern), Boje, J. (Intern), Christensen, A. (Intern), Degel, H. (Intern), Hüssy, K. (Intern), Worsøe Clausen, L. (Intern)
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Optimal bæredygtig udnyttelse af tilgængelige tørskebestande for dansk fiskeri

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Centre for Ocean Life
Authors: Eero, M. (Intern), Hansen, J. H. (Intern), Hüssy, K. (Intern), Huwer, B. (Intern), Berg, C. W. (Intern), Mariani, P. (Intern), Mosegaard, H. (Intern), Nielsen, A. (Intern), Eg Nielsen, E. (Intern), Rindorf, A. (Intern), Ulrich, C. (Intern), Vinther, M. (Intern), Worsøe Clausen, L. (Intern)
Relaxing technical regulations under the Landings Obligation – effects on the discard ratio

The landings obligation (LO), currently being implemented in the new CFP, puts major constraints on fishers, by making the landing of unwanted catch mandatory. Less restrictive technical rules (TR) in a results-based management frame have been suggested as a mechanism to release some of these constraints. To investigate the effects of the existing TR, some fishers were relaxed from TR during the trial and could freely choose and develop alternative gears, aiming to optimize annual catch value, while reducing discards. The study included 14 demersal fishing vessels, operating in the North Sea, Skagerrak and the Baltic Sea. Fishers used test and control gears interchangeably or in pairs and were required to sort and weight all discard of seven common target species on a haul by haul basis. All vessels were equipped for Fully Documented Fisheries, including cameras. Collected data were analyzed to investigate differences in landings, discards, discard ratio, CPUE, VPUE and DPUE, between conventional (control) and new gears (test). The results showed a varying degree of success, depending both on area and on choices made by the individual fisher. The best results were observed in the Baltic Sea, where relaxing technical rules led to major improvements in fishing patterns. But gear changes did not contribute much in fisheries where initial discards rates were already low.
Achieving MSY and minimising conflicts in mixed-fisheries management

DTU Aqua søger fiskere til discardprojekt

DTU og fiskere samarbejder om optimering af fangstmuligheder
Evaluation of integrated ecological-economic models - What are they used for?

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Incentivising selective fishing under catch quotas: using an FCube modelling approach to evaluate management options for North Sea mixed fisheries

Reforms of EU Common Fisheries Policy will make fundamental changes to European fisheries management, including a discard ban with catch quotas for regulated species and management to achieve MSY. We evaluate the impact of these changes on revenue of North Sea demersal finfish fleets and fish stocks. With no change in behaviour, revenue is reduced by a mean of 31% compared to current management in the first year, but partly recovers by year 3, as fishing mortality is reduced and stocks increase. There are large differences in revenue changes between fleets, varying from -99% to +36%, depending on whether the stock with the most limiting catch quota is a primary target and the rate at which it is caught relative to other stocks. Impacts will be greatest if catch quotas are set at current landings quotas, and reduce with an uplift to reflect current discarding levels. Large reductions in revenue create a strong incentive to avoid catching the limiting species, particularly if it is not a primary target. Selectivity changes that avoid 30% cod catch reduced the economic impact for some fleets in moving to catch quotas. Increased flexibility will therefore be important in maintaining the profitability of the fisheries.

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Cefas, University of East Anglia
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Landings obligation as a pathway towards the integration of CFP and MSFD – lessons learned and forward look after 2015

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Minimising conflicts in mixed-fisheries management using flexible Harvest Control Rules

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Behind the shine: An appraisal of five years of Danish CCTV trials

Denmark has been the first nation in Europe to promote the use of Fully Documented Fisheries (FDF) through Remote Electronic Monitoring (REM) and CCTV camera systems, and some pilot schemes for monitoring cod catches have been in place since 2008. In theory, such a scheme could supplement and even potentially replace expensive control and monitoring programs; and, when associated to a Catch Quota management system, incentivize positive changes in fishing patterns in a results-based management approach. However, in practice, the technical and institutional challenges remain important hurdles to overcome for the system to be beneficial and reliable. In this paper we investigate the added value on catch information gained over the last five years, and discuss the future of REM as a monitoring program in the context of the future discards ban

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Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries

The present report is an EU-FP7-SOCIOEC Report giving an overview and critical evaluation of the current management measures implemented for the North Sea mixed demersal fisheries and the fish stocks involved in this. Also, this involves review and critical evaluation of the scientific advice supporting the fisheries management for the North Sea mixed demersal fisheries and the stocks involved herein. Management of the demersal roundfish and flatfisheries in the North Sea is conducted mainly through the EU Common Fisheries Policy (CFP) and the yearly EU-Norway Bilateral Fishery Agreements. The prevailing management system and principle has been landing quotas (TAC, Total Allowable Catch) mainly based on the EU principle of relative stability in the international sharing of the TAC. Also, general effort limitations and technical measures are set for the EU and Norwegian fisheries on top of the TAC regulations. Technical measures have mainly aimed at reducing the retention and discard of the juveniles through gear measures and to protect the spawners and/or recruits in the fish populations through closures. Furthermore, the management is based on a set of national measures especially concerning control and enforcement measures, national distribution of the overall TAC, individual special technical measures, allocation (distribution) of national TACs to different fisheries and vessels including the share to e.g. Individual Transferable Quotas (ITQs) or Vessel Quota Shares (VQSs). The management of the North Sea demersal fisheries has changed quite a lot over the last decades following the need to rebuild the fish stocks, and in particular the North Sea cod stock in relation to the present case study. The CFP has increasing focus towards implementing multi-annual or long term management plans (MAMPs, LTMPs) partly to avoid the annual political battles over setting the TAC. There has furthermore been a trend during the last decade to move away from the Precautionary Approach and towards Maximum Sustainable Yield as the overarching management objective and Harvest Control Rules (HCRs) based on this. There have been introduced increasingly restrictive fisheries-based effort limitations with possibilities for exemption or for less drastic effort reductions provided that cod avoidance behavior can be demonstrated. Although the decision-makers under the CFP have had a reputation of consistently setting TACs way above the scientific advice, the development in recent years has been towards this gap being reduced.

Management of the fisheries has undergone a number of structural and behavioral changes, and these have already yielded some positive results as the state of the demersal stocks in the North Sea have globally improved. The status of main demersal stocks has considerably improved over the last decade. Fishing mortality has globally decreased and biomass has increased, and most of the assessed demersal stocks are now within sustainable limits. Some issues remain with North Sea cod, for which recovery is slower. At present, cod is the limiting species for all the North Sea demersal fisheries. Over a time span from the 1960s landings of demersal stocks have declined with an accelerating decrease since the mid-1990s in line with the falling stock sizes and regulated reductions in total allowable catches (TACs). A clear decrease in the mean fishing mortality (F) is observed in the 2000-2010 period with current F values between Fmsy and Fpa, and the spawning stock biomass (SSB) has on average been above Bpa for the period 1983-2010 for the assessed stocks. The effort in the central North Sea and along the Norwegian waters has decreased as well as the number of operating fishing vessels (capacity). Overall, the nominal effort (kW-days) by European fleets using demersal trawl, seine, beam trawl and gillnet in the North Sea, Skagerrak and the Eastern Channel have been substantially reduced (-20% between 2003 and 2011). Since 2000, the total fish biomass for exploited stocks in the North Sea is about 4-5 million tonnes with an increasing trend in the most recent years. Despite the decrease of landings and fishing mortality in the last recent decade, the overall recruitment has shown a clear decreasing trend from 1985-2010. The recent increase in SSB during the last decade, which is likely due to lower landings and fishing mortality levels in the last 15 years, indicate inclinations of the North Sea ecosystem to recover. However, this has not converted in higher recruitment levels in the most recent years in which there may be a time delay. There is a clear trend that both the gross profit and the net profit has improved from 2008-2010 for the main fleets of the North Sea with the only exception of the Dutch beam trawlers 18-24m, for which the gross profit decreased by nearly 90%. The positive development in economic performance measures can be a result of the structural changes that have recently occurred in many fisheries. There are fewer vessels sharing the available resources (reduction in over-capacity). Especially, the movement towards right-based systems is expected to have had positive effects on reducing the over-capacity and improving the economic performance of many fleets. Historically, EU subsidies over the years have contributed to making the fleet more efficient, so the success of the CFP in the area of developing an efficient fleet has historically contributed to its failure in relation to conserve fish stocks, as overcapacity is consistently mentioned as one of the fundamental reasons for the conservation failure historically. Employment in fishing as a social indicator is shrinking, not least for the North Sea, and has been so for many years. There are multiple explanations for this: i) individual vessels are getting more efficient, ii) consolidation of fleets whereby fewer vessels catch the available resources with noticeable decrease in number of operating fishing vessels, and iii) decreasing fishing opportunities in the shape of lower quotas. The raw number of fishers tells a story of a sector that in reality, at least in the prosperous countries around the North Sea, provides only few jobs. Despite the above trends indicating positive effects of the most recent fisheries management of the North Sea mixed demersal fisheries there are a row of general problems in the present management. Population dynamics with respect to recruitment variations, sub-populations and changes in distribution of several demersal North Sea stocks influenced by environmental factors besides fishery are not fully understood and taken into consideration in management (and management advice). Also, biological multi-species interactions between the stocks are not fully taken into account in the management of the stocks when setting the MSY management and exploitation limits for the stocks. Management is not based on broader ecosystem and multi-species objectives, but based mainly on single stock objectives. Also technical interactions between fisheries are not taken fully into account in management of the North Sea demersal fisheries. The fisheries targeting cod, whiting, haddock, saithe, flatfish and Nephrops in the North Sea and Kattegat-Skagerrak are mixed demersal fisheries for towed gears. Mixed fisheries considerations are of primary importance for the management of North Sea species. Single stock management is a cause of discarding in mixed fisheries, because individual stock management objectives may not be consistent with each other. As such, the TAC of one species may be exhausted before the TAC of another, leading to catches of valuable fish that cannot be landed resulting in over-quotas discard. Overall, present management and fisheries
policy is characterized by the CFP having in many ways taken form of a classical intergovernmentalist, state-centric command-and-control, top-down management system, where member states’ ministers in the Council have exercised strong control over the fisheries management measures which have been developed and adopted on the background of proposals from the Commission and the Parliament, though since the ratification of the Lisbon Treaty the Parliament has assumed a role of co-legislator alongside the Council. EC has identified the lack of stakeholder involvement as one of the major weaknesses of the CFP, recognizing that this fact clearly undermine its legitimacy. Establishment of the Regional Advisory Councils (RACs) with the 2003 CFP can be seen as the first formal attempt to generate a network of multi-national, multi-interest advisory organizations with a strong regional focus among other involving resource users in the decision making. However, the RACs have at present only an advisory function on decisions and are not formally integrated directly in management on a regional basis, i.e. the RAC system is primarily intended to provide a regional stakeholder perspective to the Commission’s deliberations rather than providing stakeholders with real decision-making authority. RACs constitute, nevertheless, a move towards regionalization of the fisheries policy. Present management is, furthermore, characterized by a high degree of complexity, bureaucracy, and examples of micro-management where different management systems and measures are implemented in parallel making evaluation of impact of the individual measures and systems very complicated and the system suffers from lack of transparency. With respect to the complexity the different management measures are acting top of each other with impact on the same fisheries and stocks at the same time (and with time overlap in their implementation) creating a very complex management and associated advisory system, where it is difficult to distinguish specific effects and impacts of each individual measures implemented. Accordingly, it is also very difficult to make scientific management evaluation and advice associated to the individual measures.

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Evaluating the effect of fishery closures: lessons learnt from the Plaice Box
To reduce discarding of plaice Pleuronectes platessa in the North Sea flatfish fisheries, the major nursery areas were closed to large trawlers in 1995. The area closed was named the ‘Plaice Box’ (PB) and beam trawl effort fell by over 90% , while the exemption fleets of small flatfish beam trawlers, gill netters targeting sole (Solea solea) and shrimp (Crangon crangon) trawlers increased their effort. Contrary to the expectation, plaice landings and biomass declined. The initial support for the PB from the fisheries was lost, whereas other stakeholder groups claimed that any failure was due to the fact that fishing had never been completely prohibited in the area. To evaluate whether the PB has been an effective management measure, the changes in the ecosystem (plaice, demersal fish, benthos) and fisheries are analysed to test whether the observed changes are due to the PB or to changes in the environment unrelated to the PB. Juvenile growth rate of plaice decreased and juveniles moved to deeper waters outside the PB. Demersal fish biomass decreased, whereas the abundance of epibenthic predators (Asterias rubens and Cancer pagurus) increased in the PB. Endobenthos, in particular the main food items of plaice (polychaetes and small bivalves) remained stable or decreased both inside and outside the PB. Currently catches of both plaice and sole from within the PB are lower than in the late 1980s and the exemption fleet often prefers to fish outside the Plaice Box alongside much larger competitors. It is concluded that the observed changes are most likely related to changes in the North Sea ecosystem, which may be related to changes in eutrophication and temperature. It is less likely that they are related to the change in fishing. This case study highlights the importance setting testable objectives and an appropriate evaluation framework including both ecological and socio-economic indicators when implementing closed areas.

Key words: Marine Protected Area, MPA, spatial management, fisheries management, discards, climate change, trawling
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- Scopus rating (2006): SJR 1.325 SNIP 1.165
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- Scopus rating (2005): SJR 0.987 SNIP 0.923
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Lessons for fisheries management from the EU cod recovery plan

The performance of the EU long-term management plan for cod stocks, in force since 2009, is analysed focusing on the human and institutional factors. The plan operates through landings quotas (TACs) and effort restrictions following a Harvest Control Rule, and deploys a novel instrument allowing Member States to 'buy back' or increase fishing effort for fleet segments engaged in cod-avoidance measures. The stipulated fishing mortality reductions have not been achieved. On the positive side, the 'buy-back' instrument has led to increased uptake of selective gear and implementation of permanent and real-time temporary closures. On the negative side, ignoring the dimension of fishers as reactive agents in the design, the impact assessment, and the annual implementation of the measures has contributed to the failure to adequately implement the plan and achieve its objectives. The main problem is that the landings quotas taken in a mixed fishery did not limit catches because fishers were incentivised to continue fishing and discard overquota catch while quota for other species was available. The effort limitations intended to reduce this effect were insufficient to adequately limit fishing mortality in targeted fisheries, although fishers experienced them as prohibiting the full uptake of other quotas. Recommendations for future plans include (i) management through catch rather than landings quotas, (ii) the internalisation of the costs of exceeding quotas, (iii) use of more selective gear types, (iv) the development of appropriate metrics as a basis for regulatory measures and for evaluations, (v) participatory governance, (vi) fishery-based management, (vii) flexibility in fishing strategy at vessel level

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Variability and connectivity of plaice populations from the Eastern North Sea to the Western Baltic Sea, and implications for assessment and management.

An essential prerequisite of sustainable fisheries is the match between biologically relevant processes and management action. Various populations may however co-occur on fishing grounds, although they might not belong to the same stock, leading to poor performance of stock assessment and management. Plaice in Kattegat and Skagerrak have traditionally been considered as one stock unit. Current understanding indicates that several plaice components may exist in the transition area between the North Sea and the Baltic Sea. A comprehensive review of all available biological knowledge on plaice in this area is performed, including published and unpublished literature together with the analyses of commercial and survey data and historical tagging data. The results suggest that plaice in Skagerrak is closely associated with plaice in the North Sea, although local populations are present in the area. Plaice in Kattegat, the Belts Sea and the Sound can be considered a stock unit, as is plaice in the Baltic Sea. The analyses revealed great heterogeneity in the dynamics and productivity of the various local components, and suggested for specific action to maintain biodiversity.
A wasted resource: cod discards in the North Sea

The public, political, and stakeholder perception of fisheries discards is that they are a waste of a valuable resource. In the North Sea, fisheries discards are some of the highest in the world. Cod (Gadus morhua) has contributed considerably to the amount discarded. The declining cod stock within the North Sea has resulted in changes in technical measures, effort restrictions, closed areas, and the establishment of a recovery programme for cod; all which have attempted to reduce the amount discarded. Here, we combine European Union discard data from seven Member States to describe the trends, spatially and temporally, in discarding over the past decade while pinpointing the major reasons to why it occurs. We discuss how such information can be used to improve future fishing activities and their subsequent catch compositions under a discard.

Challenges and opportunities for fleet- and métier-based approaches for fisheries management under the European Common Fishery Policy

The inconsistency of single-species objectives in a mixed-fisheries context has repeatedly been highlighted as a key issue in the current European Common Fishery Policy, and it has long been suggested that this issue would be better addressed through fleet (group of vessels) and métier (type of activity) based approaches. Since the late 1980s, when such approaches were first introduced, there have been substantial developments in this area of science, to the point where the concepts of fleet and métier now underpin the whole EC Data Collection Framework. However, their implementation in the management system has been slow and difficult, being hampered by a number of intrinsic issues. Mixed fisheries are an ongoing “governance headache” combining management complexity, scientific uncertainty and political sensitivity. This paper summarises the current state of play for fleet-based approaches in EU fisheries management, and highlights our views on both their potential and the challenges they face in the context of the future CFP. As a convenient layer between the current single-stock level and the level of the individual vessel, fleet/métier approaches could potentially address a wide range of issues, especially with regards to the policy emphasis on ecosystem-based fisheries management. However, the rigid categorisation they induce may not properly address the flexibility of individual vessels, and should therefore be supplemented by more detailed considerations at the local scale.
Improving the assessment and management of the plaice stock complex between the North Sea and the Baltic Sea

Plaice in Kattegat and Skagerrak have traditionally been considered as one stock unit. However the collected information on biology and fishery in areas between the North and Baltic Seas suggest changes are needed in assessment units as well as in management areas. Plaice in Skagerrak (Division 20) is now considered to be closely associated with plaice in the North Sea and is proposed to be included in the North Sea plaice stock assessment, although it is recognized that
local populations are present in the area. Therefore, specific management of the Skagerrak plaice is suggested. Plaice in Kattegat (Division 21), the Belts (Division 22), and the Sound (Division 23) is considered a stock unit and is proposed to be assessed as such. However, separate management by area is also suggested to assure the preservation of the local populations. Plaice in the Baltic (Divisions 24–32) is considered a stock unit and is proposed to be assessed and managed as such. Pragmatic options are suggested for empirical harvest control rules accounting for the dynamic of local abundance, using a survey-based biomass indicator. For the future, new scientific analyses should be developed to better inform the origin of the catches, provided that additional resources are allocated to the annual monitoring of different stocks and components. Such information would provide on-going quantitative information on the degree of mixing of the various components, potentially allowing a more accurate assessment, management, and conservation of the status of these

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JAKFISH Policy Brief: coping with uncertainty, complexity and ambiguity in fisheries management through participatory knowledge development
The legitimacy of the scientific underpinning of European fisheries management is often challenged because of perceived exclusion of fishers knowledge and the lack of transparency in generating scientific advice. One of the attempts to address this lack of legitimacy has been through participatory knowledge development. In this paper, we will present the results of the JAKFISH project (Judgement and Knowledge in Fisheries Management involving Stakeholders) that focussed on the interplay between different actors in constructing the underpinning of policy decisions for sustainable fisheries. We tested participatory modelling as a tool to enhance mutual understanding and to increase legitimacy and found that it can be instrumental in developing a broader knowledge base for fisheries management and in building up trust between scientists and stakeholders. However, the participatory approach may not always work. Through social network analyses we found that the number of connections and the frequency of interactions between individuals in different groups (science, fisheries, eNGOs, policy) provides an important clue on the potential effectiveness of participatory approaches. We used three concepts to evaluate the role of scientific knowledge in policy making: salience, legitimacy and credibility. In situations with high stakes and high uncertainties, the evaluation of scientific analyses for policy decisions needs to involve a broader peer community consisting of scientists, policy-makers, NGOs and fisheries in order to increase legitimacy of results. When stakes are low and uncertainties are modest, the credibility of scientific results are sufficiently addressed through traditional scientific peer review

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Managing mixed fisheries in the European western waters: application of Fcube methodology

Fisheries management is moving towards ecosystem based management instead of traditional single species based advice. To progress towards an ecosystem approach, a new methodology called "Fleet and Fisheries Forecast" (Fcube) has been proposed. In the application of the method, a precise initial fleet and métier segmentation used is important to get representative results in the analysis. Once they were defined, different data aggregations for fleets and métiers were tested with the objective of getting the best aggregation level to get equilibrium between detailed results and real management. Results showed that the difference in the forecast catches in different aggregation levels was low. Finally, hindcasting analyses were carried out to evaluate how sensitive forecasts are to different parameters. Stock indicators and catchability show the highest source of error and the effort share the lowest. In this analysis, Western Waters fleet management results show consistency between stocks and their respective TACs. The study highlights that it is possible to deliver advice within the context of mixed fisheries using the Fcube method.

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Mixed fisheries forecasts – lessons learned from their initial application to North Sea fisheries

Mixed fisheries and technical interactions in European fisheries have been a subject of research for many years. The establishment in 2010 of an ICES Working Group tasked with producing annual mixed fisheries forecasts and advice for North Sea demersal fisheries represents a commitment to use these approaches in routine scientific advice for the first time. The demersal fisheries of the North Sea provide a particularly interesting context for this work due to their high complexity in terms of the numbers of fleets, gears, métiers and species involved, and also because mixed-fishery effects have contributed to the lack of recovery of the North Sea cod stock. The implementation of mixed-fishery forecasts which account for the fishery complexity and thus allow mixed-fishery effects to be modelled has posed a number of challenges relating to issues such as data requirements and the need to integrate the work with the existing single stock assessments. The explicit representation of the complexity of the fisheries also raises questions about the extent to which mixed fisheries science can be used to give “advice” in the traditional sense. This paper addresses the challenges and issues that have arisen through the practical implementation of mixed-fishery forecasts, then discusses the further developments that will be required to progress towards more integrated multi-stock management using mixed-fishery management plans

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Authors: Holmes, S. J. (Ekstern), Ulrich, C. (Intern), Reeves, S. A. (Ekstern)
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Publication: Research › Paper – Annual report year: 2012
Mixed fisheries forecasts—lessons learned from their initial application to North Sea fisheries

Mixed fisheries and technical interactions in European fisheries have been a subject of research for many years. The establishment in 2010 of an ICES Working Group tasked with producing annual mixed fisheries forecasts and advice for North Sea demersal fisheries represents a commitment to use these approaches in routine scientific advice for the first time. The demersal fisheries of the North Sea provide a particularly interesting context for this work because of their high complexity in terms of the numbers of fleets, gears, métiers, and species involved, and also because mixed-fishery effects have contributed to the lack of recovery of the North Sea cod stock. The implementation of mixed-fishery forecasts which account for the fishery complexity and thus allow mixed-fishery effects to be modelled has posed a number of challenges relating to issues such as data requirements and the need to integrate the work with the existing single-stock assessments. The explicit representation of the complexity of the fisheries also raises questions about the extent to which mixed fisheries science can be used to give “advice” in the traditional sense. This paper addresses the challenges and issues that have arisen through the practical implementation of mixed-fishery forecasts, then discusses the further developments that will be required to progress towards more integrated multistock management using mixed-fishery management plans.

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

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

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Population Ecology and Genetics, Department of Informatics and Mathematical Modeling, Mathematical Statistics, Section for Ocean Ecology and Climate
Authors: Ulrich, C. (Intern), Post, S. L. (Ekstern), Worsøe Clausen, L. (Intern), Berg, C. W. (Intern), Deurs, M. V. (Intern), Mosegaard, H. (Intern), Payne, M. (Intern)
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Multispecies fisheries management in the Mediterranean Sea: application of the Fcube methodology

The ecosystem approach (EA) advocates that advice should be given based on a holistic management of the entire marine ecosystem and all fisheries and fleets involved. Recent developments have advanced to multi-species, multi-fisheries advice, rather than on a single-species/fleet/area stock basis, bridging the gap between existing single-species approaches and the needs of the EA. The Fleet and Fisheries Forecast method (Fcube) method estimates potential levels of effort by fleet in mixed fisheries situations to achieve specific targets of fishing mortality. Data on effort, landings and socioeconomic parameters were used for coastal and trawl fisheries in the Aegean Sea. Results pointed out the strengths and weaknesses of alternative management strategies from both a biological and socioeconomic perspective. Fcube revealed the importance of effort control in the coastal fisheries that are still managed with no effort restrictions. The present findings, although preliminary, revealed that stringent cuts to effort and catch levels are required if EA management goals are to be met. The Fcube methodology, initially developed for mixed fisheries advice in northern European waters that are managed with TACs, also proved promising in providing advice to non-TAC fisheries.
Regional métier definition: A comparative investigation of statistical methods using a workflow applied to the international otter trawl fisheries in the North Sea

The European Common Fisheries Policy recognizes the importance of accounting for heterogeneity in fishing practices, and métier-based sampling is now at the core of the EU Data Collection Framework. The implementation of such an approach would require Member States to agree on the standard regional métier definitions and on practical rules to categorize logbook records into métiers. Several alternative approaches have been used in the past to categorize landings profiles, but no consensus has yet emerged. A generic open-source workflow is developed to test and compare a selection of methods, including principal components analysis (PCA), hierarchical agglomerative clustering (HAC), K-means, and Clustering LARge Applications (CLARA), and to provide simple allocation rules. This workflow is applied to a unique regional dataset consisting of bottom-trawl logbooks of five North Sea countries. No method proved to be infallible, but combining PCA with either CLARA or HAC performed best. For 2008, a hierarchical classification with 14 species assemblages is proposed. Discriminant analysis proved more robust than simple ordination methods for allocating a new logbook record into an existing métier. The whole approach is directly operational and could contribute to defining more objective and consistent métiers across European fisheries

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Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Deporte, N. (Ekstern), Ulrich, C. (Intern), Mahévas, S. (Ekstern), Demanèche, S. (Ekstern), Bastardie, F. (Intern)
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Short-term choice behaviour in a mixed fishery: investigating métier selection in the Danish gillnet fishery

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Authors: Andersen, B. S. (Intern), Ulrich, C. (Intern), Eigaard, O. R. (Intern), Christensen, A. (Ekstern)
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Spatiotemporal variability of North Sea cod discards

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Authors: Feekings, J. P. (Intern), Poos, J. J. (Ekstern), Aarts, G. (Ekstern), Madsen, N. (Intern), van Helmond, A. (Ekstern), Catchpole, T. (Ekstern), Rochet, M. (Ekstern), Pout, A. (Ekstern), Ulleweit, J. (Ekstern), Vandemaele, S. (Ekstern), Ulrich, C. (Intern), Kempf, A. (Ekstern)
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The added value of participatory modelling in fisheries management – what has been learnt?

How can uncertain fisheries science be linked with good governance processes, thereby increasing fisheries management legitimacy and effectiveness? Reducing the uncertainties around scientific models has long been perceived as the cure of the fisheries management problem. There is however increasing recognition that uncertainty in the numbers will remain. A lack of transparency with respect to these uncertainties can damage the credibility of science. The EU Commission's proposal for a reformed Common Fisheries Policy calls for more self-management for the fishing industry by increasing fishers' involvement in the planning and execution of policies and boosting the role of fishers' organisations. One way of higher transparency and improved participation is to include stakeholders in the modelling process itself. The JAKFISH project (Judgment And Knowledge in Fisheries Involving StakeHolders) invited fisheries stakeholders to participate in the process of framing the management problem, and to give input and evaluate the scientific models that are used to provide fisheries management advice. JAKFISH investigated various tools to assess and communicate uncertainty around fish stock assessments and fisheries management. Here, a synthesis is presented of the participatory work carried out in four European fishery case studies (Western Baltic herring, North Sea Nephrops, Central Baltic Herring and Mediterranean swordfish), focussing on the uncertainty tools used, the stakeholders' responses to these, and the lessons learnt. It is concluded that participatory modelling has the potential to facilitate and structure discussions between scientists and stakeholders about uncertainties and the quality of the knowledge base. It can also contribute to collective learning, increase legitimacy, and advance scientific understanding. However, when approaching real-life situations, modelling should not be seen as the priority objective. Rather, the crucial step in a science–stakeholder collaboration is the joint problem framing in an open, transparent way.

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Authors: Röckmann, C. (Ekstern), Ulrich, C. (Intern), Dreyer, M. (Ekstern), Bell, E. (Ekstern), Borodzicz, E. (Ekstern), Haapasaari, P. (Ekstern), Hauge, K. (Ekstern), Howell, D. (Ekstern), Mantyniemi, S. (Ekstern), Miller, C. (Ekstern), Tserpes, G. (Ekstern), Pastoors, M. (Ekstern)
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The Gordian knot: managing herring (Clupea harengus) bridging across populations, fishery units, management areas, and politics

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

VMStools: Open-source software for the processing, analysis and visualization of fisheries logbook and VMS data

VMStools is a package of open-source software, build using the freeware environment R, specifically developed for the processing, analysis and visualisation of landings (logbooks) and vessel location data (VMS) from commercial fisheries. Analyses start with standardized data formats for logbook (EFLALO) and VMS (TACSAT), enabling users to conduct a variety of analyses using generic algorithms. Embedded functionality handles erroneous data point detection and removal, métier identification through the use of clustering techniques, linking logbook and VMS data together in order to distinguish fishing from other activities, provide high-resolution maps of both fishing effort and -landings, interpolate vessel tracks,
calculate indicators of fishing impact as listed under the Data Collection Framework at different spatio-temporal scales. Finally data can be transformed into other existing formats, for example to populate regional databases like FishFrame. This paper describes workflow examples of these features while online material allows a head start to perform these analyses. This software incorporates state-of-the-art VMS and logbook analysing methods standardizing the process towards obtaining pan-European, or even worldwide indicators of fishing distribution and impact as required for spatial planning.

**General information**
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Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Public Sector Consultancy
Authors: Hintzen, N. T. (Ekstern), Bastardie, F. (Intern), Beare, D. (Ekstern), Piet, G. J. (Ekstern), Ulrich, C. (Intern), Deporte, N. (Ekstern), Egekvist, J. (Intern), Degel, H. (Intern)
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
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Addressing uncertainty in fisheries management through participatory modelling

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Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Röckmann, C. (Ekstern), Hauge, K. H. (Ekstern), Ulrich, C. (Intern), Bell, E. (Ekstern), Tserpes, G. (Ekstern), Haapasaari, P. (Ekstern), Mäntyniemi, S. (Ekstern), Dreyer, M. (Ekstern), Howell, D. (Ekstern), Borodzicz, E. (Ekstern), Pastoors, M. (Ekstern)
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https://www.surfgroepen.nl/sites/jakfish/Presentations/JAKFISH%2020110324%20Rockmann%202011%20C3%96stersund%20RiskUncertaintyPolicyConference.pdf
Publication: Research - peer-review › Journal article – Annual report year: 2011

JAKFISH Deliverable 3.1 A report on benefits and drawbacks of each tool for evaluating and communicating the uncertainty. This will be seen in relation to each of the case studies and will be input to WP4

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Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Hauge, K. H. (Ekstern), Mantyniemi, S. (Ekstern), Dreyer, M. (Ekstern), Bell, E. (Ekstern), Haapasaari, P. (Ekstern), Röckmann, C. (Ekstern), Terpes, G. (Ekstern), Ulrich, C. (Intern)
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https://www.surfgroepen.nl/sites/jakfish/Publications/JAKFISH%20D3.2%20Assessment%20of%20handling%20of%20uncertainty%20from%20a%20quantitative%20and%20qualitative%20perspective.pdf

JAKFISH Deliverable 4.2 Workshop reports and evaluation of case studies management strategy evaluation

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Röckmann, C. (Ekstern), Bell, E. (Ekstern), Haapasaari, P. (Ekstern), Mantyniemi, S. (Ekstern), Terpes, G. (Ekstern), Ulrich, C. (Intern)
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Reconciling single-species TACs in the North Sea demersal fisheries using the Fcube mixed-fisheries advice framework

Single-species management is a cause of discarding in mixed fisheries, because individual management objectives may not be consistent with each other and the species are caught simultaneously in relatively unselective fishing operations. As such, the total allowable catch (TAC) of one species may be exhausted before the TAC of another, leading to catches of valuable fish that cannot be landed legally. This important issue is, however, usually not quantified and not accounted for in traditional management advice. A simple approach using traditional catch and effort information was developed, estimating catch potentials for distinct fleets (groups of vessels) and métiers (type of activity), and hence quantifying the risks of over- and underquota utilization for the various stocks. This method, named Fcube (Fleet and Fisheries Forecast), was applied successfully to international demersal fisheries in the North Sea and shaped into the advice framework. The substantial overquota catches of North Sea cod likely under the current fisheries regimes are quantified, and it is estimated that the single-species management targets for North Sea cod cannot be achieved unless substantial reductions in TACs of all other stocks and corresponding effort reductions are applied.

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The added value of participatory modelling in fisheries management. What have we learned?
Challenges in integrating short-term behaviour in a mixed-fishery Management Strategies Evaluation frame: a case study of the North Sea flatfish fishery

This study presents a fleet-based bioeconomic simulation model to the international mixed flatfish fishery in the North Sea. The model uses a Management Strategies Evaluation framework including a discrete choice model accounting for short-term temporal changes in effort allocation across fisheries. A simplified random utility model was used based on the expected revenue (or economic attractiveness) and two tradition parameters related to short and long term historical fishing patterns. All three parameters were significant. Even though reactions and adaptations vary between fleets, the estimated conservative behaviour of the main fleets led to only marginal effect at the stock level. The importance of accounting for fleet behaviour was then evaluated using an elasticity analysis to explore how increased weight of economic attractiveness contributes to changes in the biological output and positive increase in the economic performance of the individual fleets. This showed the existence of a window of sensitivity of the model to the behaviour assumptions. The study highlights the challenge of implementing an effort allocation model in a general framework of Management Strategies Evaluation for mixed-fisheries, and illustrates the necessary trade-offs between very detailed numerical relationships and the representation of aggregated processes. (C) 2009 Elsevier B.V. All rights reserved.
Comparative evaluation of a mixed-fisheries effort-management system based on the Faroe Islands example

Total allowable catch (TAC) management has in many fisheries, especially mixed fisheries, failed to meet conservation objectives. For instance, for the Faroe Plateau mixed demersal fisheries, the TAC system failed to achieve the objective of an average annual fishing mortality of 0.45 for the three gadoid stocks cod (Gadus morhua), haddock (Melanogrammus aeglefinus), and saithe (Pollachius virens). Therefore, in 1996, an effort-regulation system with individual transferable effort quotas was introduced to manage the fisheries. Experience has shown that effort management without additional stock-specific measures may not be appropriate for such fisheries. A management strategy evaluation model was developed to compare an effort-management system based on the Faroese example with a TAC system as currently applied in EU fisheries. Results show that when stocks are considered in isolation, a total allowable effort system does not necessarily perform better than a TAC one. It depends on stock status and dynamics, the level of uncertainty, and the reactivity of the system to changes in scientific advice. When the stocks are considered together in mixed fisheries, effort management seems, however, to be appropriate, and interannual flexibility of the system appears to be the best compromise between short- and long-term objectives, as well as between biological sustainability and economic return.

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Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geo-localisation

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Authors: Bastardie, F. (Intern), Nielsen, J. R. (Intern), Ulrich, C. (Intern), Egekvist, J. (Intern), Degel, H. (Intern)
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Economic effort management in multispecies fisheries: the FcubEcon model

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Improving complex governance schemes around western Baltic herring through the development of a long-term management plan in an iterative process between stakeholders and scientists

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Improving complex governance schemes around Western Baltic Herring, through the development of a Long-Term Management Plan in an iterative process between stakeholders and scientists

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Stock-based vs. fleet-based evaluation of the multi-annual management plan for the cod stocks in the Baltic Sea
This study evaluated the EU 2008 multi-annual plan for Baltic cod stock recovery. The plan combines harvest control rules that set TACs with reductions in direct effort ($E$) and fishing mortality ($F$). Performance and robustness of the plan are tested with a management strategy evaluation model (MSE). Stochastic simulations are carried out under different scenarios of recruitment and sources of uncertainties. Under the different magnitudes of errors investigated, the plan in its current design is likely to reach precautionary targets for the Eastern and the Western Baltic cod stocks by 2015. It is, however, more sensitive to implementation errors (e.g. catch misreporting) than to observation errors (e.g. data collection) when the (i) current settings of the ICES single-stock assessment model are maintained, (ii) intended fishing effort reduction is fully complied with, and (iii) biological parameters are assumed constant. For the Eastern Baltic stock, additional sources of uncertainties from fishery adaptation to the plan are tested using a fleet-based and spatially explicit version of the model which leads to higher reductions in $F$ and no significant change in management robustness. The relative difference between both approaches is mainly due to differences in exploitation patterns in catching the same amount of fish. The effort control is demonstrated to be more efficient when supplemented with a TAC and avoids unintended effects from fishery responses, e.g. spatial effort reallocation. Medium term economic evaluation of fishery performance shows an initial reduction in profit with effort and TAC reductions, but profit is always positive. (C) 2009 Elsevier B.V. All rights reserved.

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Authors: Bastardie, F. (Intern), Vinther, M. (Intern), Nielsen, J. R. (Intern), Ulrich, C. (Intern), Storr-Paulsen, M. (Intern)
Pages: 188-202
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication information
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Issue number: 3
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<th>Year</th>
<th>BFI Level</th>
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Original language: English

DOIs:
An economic approach to overcoming over-quota catches in multi-species fisheries: The FcubEcon model

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Hoff, A. (Ekstern), Frost, H. (Ekstern), Ulrich, C. (Intern)
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Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
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Evaluating biological robustness of innovative management alternatives

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Bastardie, F. (Intern), Baudron, A. (Ekstern), Bilocca, R. (Ekstern), Boje, J. (Intern), Bult, T. P. (Ekstern), Garcia, D. (Ekstern), Hintzen, N. T. (Ekstern), Nielsen, J. R. (Intern), Petursdottir, G. (Ekstern), Sanchez, S. (Ekstern), Ulrich, C. (Intern)
Number of pages: 269
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Publication date: 2009

Host publication information
Title of host publication: Comparative Evaluations of Innovative Fisheries Management.
Place of publication: Dordrecht
Publisher: Springer Science+Business Media B.V.
Editors: Hauge, K. H., Wilson, D. C.
Main Research Area: Technical/natural sciences
Links:
http://www.worldcat.org/oclc/320197711
Source: orbit
Source-ID: 251220
Publication: Research - peer-review › Book chapter – Annual report year: 2009

Evaluation of the multiannual plan for the cod stocks in the Baltic Sea

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Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Bastardie, F. (Intern), Vinther, M. (Intern), Nielsen, J. R. (Intern), Ulrich, C. (Intern), Storr-Paulsen, M. (Intern)
Number of pages: 29
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Host publication information
Title of host publication: Book of Abstracts
Main Research Area: Technical/natural sciences
Potentials and challenges in fleet- and métierbased approaches for fisheries management in the CFP

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources, Section for Management Systems
Authors: Ulrich, C. (Intern), Wilson, D. (Ekstern), Nielsen, J. R. (Intern), Reeves, S. (Ekstern)
Pages: 1-21
Publication date: 2009

Host publication information
Title of host publication: ICES C.M.
Volume: R:06
Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252781
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Reconciling single-species management objectives in an integrated mixed-fisheries framework for avoiding overquota catches. Main outcomes of the FP6 AFRAME project

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State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Ulrich, C. (Intern), Garcia, D. (Ekstern), Damalas, D. (Ekstern), Frost, H. (Ekstern), Hoff, A. (Ekstern), HilleRisLambers, R. (Ekstern), Maravelias, C. (Ekstern), Reeves, S. (Ekstern), Santurtun, M. (Ekstern)
Pages: 1-30
Publication date: 2009

Host publication information
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Place of publication: Copenhagen
Publisher: International Council for the Exploration of the Sea
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Publication: Research › Article in proceedings – Annual report year: 2009

Rights-based management and participatory governance in Southwest Nova Scotia

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Ulrich, C. (Intern), Wilson, D. C. (Ekstern)
Number of pages: 269
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Publication date: 2009

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Title of host publication: Comparative Evaluations of Innovatie Fisheries Management: Global Experiences and European Prospects
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Editors: Hauge, K. H., Wilson, D. C.
Mixed fisheries and the ecosystem approach

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State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Ulrich, C. (Intern), Reeves, S. A. (Ekstern), Kraak, S. (Ekstern)
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http://www.ices.dk/products/insight.asp
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Source-ID: 284723
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The South West Nova Scotia case: From: Evaluation of innovative approaches to fisheries management outside the European Union: The cases of Alaska (USA), Canada, Iceland and New Zealand

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Wilson, D. (Ekstern), Ulrich, C. (Intern), Aranda, M. (ed.) (Ekstern)
Number of pages: 161
Publication date: 2008

Publication information
Volume: Chapter 2
Original language: English
Main Research Area: Technical/natural sciences

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Publication: Research › Report – Annual report year: 2008

Bridging the gap: fleets, fisheries and the ecosystem approach

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Reeves, S. (Ekstern), Ulrich, C. (Intern)
Pages: 1-10
Publication date: 2007
**Evaluation of management strategies for the North Sea roundfish fisheries with the FLR framework**

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Authors: Hamon, K. (Intern), Ulrich, C. (Intern), Hoff, A. (Ekstern), Kell, L. (Ekstern)
Pages: 2813-2819
Publication date: 2007

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Title of host publication: MODSIM 2007 International Congress on Modelling and Simulation
Publisher: Modelling and Simulation Society of Australia and New Zealand
ISBN (Print): 978-0-9758400-4-7
Main Research Area: Technical/natural sciences
Conference: MODSIM07, 10-13 december 2007, Christchurch, New Zealand, 01/01/2007
Links:
Source: orbit
Source-ID: 229018
Publication: Research › Article in proceedings – Annual report year: 2007

**Improved advice for the mixed herring stocks in the Skagerrak and Kattegat: EU Rolling Programme; FISH/2004/03**

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Ecosystem based Marine Management, Institute of Marine Research
Authors: Worsøe Clausen, L. (Intern), Ulrich, C. (Intern), Deurs, M. V. (Intern), Skagen, D. (Ekstern)
Number of pages: 74
Publication date: 2007

**Publication information**
Original language: English
Main Research Area: Technical/natural sciences
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Publication: Commissioned › Report – Annual report year: 2007

**Slutrapport TEMAS (Technical measures - development of evaluation model and application in danish fisheries)**

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Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries- and Monitoring Technology
Authors: Sparre, P. J. (Intern), Hovgård, H. (Intern), Ulrich, C. (Intern), Nielsen, J. R. (Intern), Munch-Petersen, S. (Intern), Andersen, B. S. (Intern), Horsten, M. (Ekstern), Eigaard, O. R. (Intern), Vermard, Y. (Ekstern), Madsen, N. (Intern),
TEMAS: fleet-based bio-economic simulation software to evaluate management strategies accounting for fleet behaviour

TEMAS (technical management measures) is a fleet-based bio-economic software for evaluating management strategies accounting for technical measures and fleet behaviour. It focuses on mixed fisheries in which several fleets can choose among several fishing activities to target different stocks in one or several areas. The software combines a management strategy evaluation framework, using a forward-running operating model and a management procedure with a fleet behaviour module simulating both short-term (effort allocation) and long-term (entry/exit) fleet dynamics. The suite of models behind TEMAS can be thought of as an extension of the traditional ICES forecast model. Alternative management scenarios can be compared and evaluated for their bio-economic consequences and robustness to parameter uncertainty. The software is generic and user-friendly, and can be run at several space and time scales.
An evaluation of multi-annual management strategies for ICES roundfish stocks

Current scientific management objectives for ICES roundfish stocks are to ensure conservation of the biological resource and do not explicitly consider economic or social objectives. For example, there are currently no objectives to maximize the sustainable yield or to reduce variability in total allowable catches (TACs). This is despite the fact that the current system can result in wide annual fluctuations in TAC, limiting the ability of the fishing industry to plan for the future. Therefore, this study evaluated management strategies that stabilized catches by setting bounds on the interannual variability in TACs. An integrated modelling framework was used, which simulated both the real and observed systems and the interactions between system components. This allowed the evaluation of candidate management strategies with respect to the intrinsic properties of the systems, as well as our ability to observe, monitor, assess, and control them. Strategies were evaluated in terms of risk (measured as the probability of spawning-stock biomass falling below a biomass threshold for the stock) and cumulative yield. In general, bounds on interannual TAC change of 10% and 20% affected the ability to achieve management targets, although the outcome of applying TAC bounds could not have been pre-judged because results were highly dependent on the specific biology of the stock, current status, and the interaction with assessment and management. For example, for North Sea haddock, management became less responsive to fluctuations resulting from large recruitment events. Simulated target fishing mortality levels were rarely achieved, regardless of the TAC bound applied, and actual fishing mortality rates oscillated around the target. In the longer term, more restrictive bounds resulted in oscillations of greater amplitude and wavelength in yield and SSB. Bounds had less effect when a stock was close to the biomass corresponding to the target F. Risk for stocks that are declining or currently at low abundance may be greater, because if bounds restrict the extent to which TACs can be reduced each year, they could lead to collapse of the stock and the loss of all future revenue. However, for a recovered stock or one at high abundance, the loss of yield as a result of bounds would be smaller than that caused by the total collapse of the fishery. At low stock size or if the stock was declining, catches should be changed more rapidly than when the stock was increasing or at a high level, especially high stock sizes acting as an insurance against uncertainty. Therefore, rebuilding strategies, and strategies aimed at maintaining the stock above prescribed limits, should be considered separately. (c) 2005 International Council for the Exploration of the Sea. Published by Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Authors: Kell, L. (Ekstern), Pilling, G. (Ekstern), Kirkwood, G. (Ekstern), Pastoors, M. (Ekstern), Mesnil, B. (Ekstern), Korsberekke, K. (Ekstern), Abaunza, P. (Ekstern), Aps, R. (Ekstern), Biseau, A. (Ekstern), Kunzlik, P. (Ekstern), Needle, C. (Ekstern), Roel, B. (Ekstern), Ulrich, C. (Intern)
Pages: 12-24
Improving the definition of fishing effort for important European fleets by accounting for the skipper effect

The scope of this paper is to quantify, for a wide selection of European fisheries, fishing tactics and strategies and to evaluate the benefits of adjusting the definition of fishing effort using these elements. Fishing tactics and strategies were identified by metiers choices and a series of indices. These indices have been derived to reflect shifts in tactics (within a fishing trip) and in strategies (within a year). The Shannon-Wiener spatial diversity indices of fishing tactics (FT_SW) and strategies (YE_SW) had the greatest impact on catch rates. In particular, FT_SW was always negatively correlated to catch rates. One may anticipate that during a fishing trip, vessels with high FT_SW have been searching fish aggregations for a long time, while vessels with low FT_SW have been more efficient in finding these aggregations. The linkage between YE_SW and catch rates was of a more complex nature. Adjusting fishing effort by means of (i) the metier effect and (ii) the indices of tactics and strategies generally led to a substantial gain in the precision of the relationship between fishing mortality and fishing effort.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Marchal, P. (Ekstern), Andersen, B. S. (Intern), Bromley, D. (Ekstern), Iriondo, A. (Ekstern), Mahevas, S. (Ekstern), Quirijns, F. (Ekstern), Rackham, B. (Ekstern), Santurtun, M. (Ekstern), Tien, N. (Ekstern), Ulrich, C. (Intern)
Pages: 510-533
Publication date: 2006
Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
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Scopus rating (2016): CiteScore 2.56 SJR 1.322 SNIP 1.163
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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
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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
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Scopus rating (2011): SJR 1.423 SNIP 1.09 CiteScore 2.13
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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
An evaluation of the implicit management procedure used for some ICES roundfish stocks

This paper describes a simulation study that evaluated the performance of the scientific advisory process used by ICES to recommend total allowable catches (TACs) for roundfish stocks. A "management strategy evaluation" approach is used, involving development of an operating model to represent the underlying reality, and an observation model to generate pseudo data that are then used within a management procedure. The management procedure comprises an assessment that uses data to estimate parameters of interest and a decision rule to derive TAC recommendations for the following year. There are two important results: including realistic sources and levels of uncertainty can result in far from optimal management outcomes based on the current procedures; and current ICES biomass and fishing mortality reference points are not always consistent, and several are clearly inappropriate. This is because the types of projection used by ICES do not incorporate important lags between assessing stock status and implementing management measures, and they also ignore important sources of uncertainty about the actual dynamics, as well as our ability to collect data and implement management regulations (i.e. model, measurement, and implementation error, respectively). The simulation approach also showed that better management is not necessarily going to be achieved by improving the assessment, because even with a perfect assessment (where the simulated working group knew stock status perfectly), stocks may crash at fishing levels that standard stochastic projections would suggest were safe. It is proposed that, in future, operating models that represent the best available understanding of the actual system dynamics be used to evaluate models and rules considered for application. These operating models should capture the plausible range of characteristics of the underlying dynamics, but not necessarily model their full complexity. In general, they will be more complex than those used by assessment working groups, so developing management procedures that are robust to a broad range of uncertainty. However, the models and rules used as part of the management procedure should be simpler than those used at present. Crown Copyright (c) 2005 Published by Elsevier Ltd on behalf of International Council for the Exploration of the Sea. All rights reserved.
Dynamics of fisheries, and the flexibility of vessel activity in Denmark between 1989 and 2001

Danish fishing vessels can be characterized by their diversity of fishing practice in terms of fishing gear and target species, and by their operational flexibility in respect of these fishing practices throughout the year. We describe the temporal fluctuations in this flexibility by following the activity of individual fishing vessels between 1989 and 2001. Initially, a typology of fisheries (classification of fishing trips) and vessel groups (classification of fishing vessels) was established through multivariate analyses of catch and effort data for 1999. In all, 54 fisheries and 25 vessel groups were identified. These typologies were then applied to all data for the whole time period, and the dynamics of fisheries and vessel groups
investigated. The dynamics of vessels groups are studied both within groups (main and secondary fisheries, changes in activity patterns) and between groups (tracking of vessels shifting between groups). Results show average stability of vessel activity in terms of the main fishery, along with a great diversity of secondary fisheries and some possibilities for shifting between gears and areas. We conclude that the level of technical interactions is high, and that separation into distinct management units is difficult. (C) 2004 International Council for the Exploration of the Sea. Published by Elsevier Ltd. All rights reserved.
Linking fishing effort and fishing mortality in a mixed-fisheries context

General information
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Organisations: Section for Management Systems, National Institute of Aquatic Resources, Section for Fisheries Advice
Authors: Marchal, P. (Ekstern), Andersen, B. S. (Intern), Bromley, D. (Ekstern), Iriondo, A. (Ekstern), Mahévas, S. (Ekstern), Quirijns, F. (Ekstern), Rackham, B. (Ekstern), Santurtun, M. (Ekstern), Tien, N. (Ekstern), Ulrich, C. (Intern)
Pages: 1-33
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Suggestion for an "Evaluation Frame" for comparison of alternative management regimes

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Authors: Sparre, P. J. (Intern), Ulrich, C. (Intern), Vermard, Y. (Ekstern), Andersen, B. S. (Intern), Hovgård, H. (Intern), Munch-Petersen, S. (Intern), Nielsen, J. R. (Intern)
Pages: 1-83
Publication date: 2004
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Conference: EFIMAS, Ijmuiden, 01/01/2004
Source: orbit
Source-ID: 237645
Publication: Research › Article in proceedings – Annual report year: 2004

Annual trends in catchability and fish stock assessments
Annual trends in catchability and fish stock assessments
A key assumption of many fish stock assessment models is that catchability is constant over time. We assume here that trends in catchability may occur through fishing power creeping. The tuning fleets, which are prone to fishing power development, may be identified using the "Hybrid" method. A range of catchability trends, including values derived from the "Hybrid" method, is then implemented to standardise the fishing effort of some tuning fleets used in the stock assessments performed by XSA (eXtended Survivors Analysis). Stocks being assessed are the North Sea cod, saithe, plaice and sole. The performances of the new and traditional XSA assessments are compared using criteria based on the precision of catchability estimates, stationarity of Log-catchability residuals and retrospective patterns relative to fishing mortality, spawning stock biomass and recruitment estimates. The performances of the North Sea cod, plaice and sole assessments could be enhanced by accounting for an overall annual increase in the catchability of some of the tuning fleets. No significant trends could be detected in the catchability of the tuning fleets relative to the assessment of the North Sea saithe. By contrast with the traditional assessment, the spawning biomass of cod is expected not to have increased between 1997 and 1998, while the fishing mortality of sole is expected to have increased over the same period.
A comparison of three indices of fishing power on some demersal fisheries of the North Sea

The scope of this study is to identify temporal dynamics in fishing power, by deriving three different indices (IFP1, IFP2, IFP3) based on three independent methods. IFP1 is derived from the GLM analysis of the relationship between fishing mortality and fishing effort, assuming that total fishing mortality estimates from XSA (eXtended Survivors Analysis) are accurate. IFP2 is derived from the GLM analysis of the difference between the Log-CPUE of a vessel and the average Log-CPUE of a set of reference vessels, which are chosen with regards to the stability of their Log-CPUE over time. IFP3 is derived from the GLM analysis of the Log-CPUE of a vessel relative to some external survey abundance index.

Particular attention is paid to the horsepower and year effects in IFP1, IFP2, and IFP3. This methodology is applied to the Danish, Dutch, English and Norwegian demersal fisheries of the North Sea. The fishing power estimated by all indices increases with horsepower, particularly in relation to target species. Despite less consensus in the estimation of annual variations in fishing power, some important features are highlighted. First, there are cases where fishing power has consistently increased over the period of investigation, possibly through an overall increase in fishing efficiency. Second, there are examples where fishing power has increased relative to one species, and remained constant or even decreased in relation to another one. In the context of mixed-species fisheries, this feature might reveal a shift in fishing tactics. Copyright 2002 International Council for the Exploration of the Sea. Published by Elsevier Science Ltd. All rights reserved.
A multi-species multi-fleet bioeconomic simulation model for the English Channel artisanal fisheries

Considering the large number of technical interactions between various fishing activities, the English Channel (ICES divisions VIIId and VIIe) fisheries may be regarded as one large and diverse multi-country, multi-gear and multi-species artisanal fishery, although rarely studied as such. A whole-scale bioeconomic model has been constructed. It does not take into account biological interactions, but focuses on competition among fleets. A large amount of biological and economic data have been preliminarily gathered, leading to a substantial increase of the quantitative knowledge available.

The main purpose of the model is to study the long-term consequences of various management alternatives on the economic situation of the English and French fleets fishing in the area and on exploited resources. The model describes this feature through the links between three entities on the one hand (stocks, fleets and "metiers", i.e. gear x target species x fishing area), and three modules on the other hand (activity, biological production and economics). The model is described and some simulation results are presented. An example simulating a decrease of one fleet segment effort illustrates these technical interactions among fleets and underlines the interest of a large-scale approach for these fisheries. (C) 2002 Elsevier Science B.V. All rights reserved
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.938 SNIP 1.142
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.022 SNIP 1.075
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.025 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.906 SNIP 1.134
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.944 SNIP 1.023
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.076 SNIP 1.314
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.299 SNIP 1.22
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.934 SNIP 0.891
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.611 SNIP 0.836
Web of Science (2000): Indexed yes
Area-based management and fishing efficiency

The scope of this study is to investigate the extent to which area-based management may have influenced the fishing efficiency of the Danish and Dutch demersal fleets harvesting cod, plaice and sole in the North Sea. Special consideration is given to the 'plaice box', a restricted area where fishing is prohibited to towed-gear fleets of horsepower exceeding 300 hp. An index of fishing power is calculated as the log-ratio between the catch per unit effort (CPUE) of any vessel and some survey abundance index. Annual trends in fishing are calculated as the year-effect derived from a general linear model (GLM) analysis of the index of fishing power. The fishing efficiency of Danish gill-netters and, to some extent, Danish seiners, has overall increased inside the 'plaice box', whilst remaining relatively stable outside. However, the fishing efficiency of the other exemption fleets has apparently been subject to little change. Overall, it is not possible to determine the extent to which the 'plaice box' has contributed to the fishing efficiency dynamics of the exemption fleets. However, some of the results of this study bear out the conclusions from recent investigations.
Influence of trends in fishing power on bioeconomics in the North Sea flatfish fishery regulated by catches or by effort quotas

Total allowable effort quotas (TAEs) are often considered as promising alternatives to single-species total allowable catch quotas (TACs) in fisheries management. However, implementing TAEs would primarily require converting nominal effort into fishing mortality rate, i.e., developing a relevant model of the dynamics of catchability. Assuming that trends in the catchability may occur through fishing-power creeping linked to increased capital invested and technology, we compare, by stochastic and dynamic simulation modelling, the relative biological and economic benefits and drawbacks of TAEs and TACs in the North Sea sole (Solea solea L.) and plaice (Pleuronectes platessa L.) fishery. Management targets are based on the Precautionary Approach and Harvest Control Rules developed by the International Council for the Exploration of the Sea (ICES). Fishermen are assumed to set their effort at the most (TAE) or least (TAC) conservative level. Overall, the outcomes are more sensitive to the catchability model when implementing TAEs, especially in the medium and long term, but the variability in catchability has a much greater impact on stock levels than on the fisheries profit.

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Ulrich, C. (Intern), Pascoe, S. (Ekstern), Sparre, P. J. (Intern), de Wilde, J. (Ekstern), Marchal, P. (Ekstern)
Pages: 829-843
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 59
Issue number: 5
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
This study examines the sensitivity of six biological reference points (BR's), both to variability and uncertainty of their input parameters, and to shifts in exploitation patterns. These shifts arise from accounting for the trends in catchability in extended survivors analysis (XSA) tuning fleets derived from the "hybrid method". By using non-parametric resampling and Monte Carlo stochastic procedures, we test whether such shifts in exploitation patterns significantly affect reference point values and probability distributions, for various levels of variation of input parameters. This method is applied to North Sea plaice, sole and cod stocks. We show that accounting for catchability trend generally induces only slight changes in reference point mean values. In particular, it is mostly significant over the last decade, especially for plaice, but...
not when introducing medium levels of uncertainty for the natural mortality. (C) 2002 Elsevier Science B.V. All rights reserved.

**General information**
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Ulrich, C. (Intern), Marchal, P. (Ekstern)
Pages: 153-169
Publication date: 2002
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Fisheries Research
Volume: 58
Issue number: 2
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.12 SNIP 1.136
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.067 SNIP 1.133 CiteScore 2.01
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.105 SNIP 1.312 CiteScore 2.17
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.037 SNIP 1.173 CiteScore 1.85
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.93 SNIP 1.177 CiteScore 1.78
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.154 SNIP 1.135 CiteScore 1.7
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.041 SNIP 1.1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.985 SNIP 1.065
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.938 SNIP 1.142
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.022 SNIP 1.075
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.025 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.906 SNIP 1.134
Estimation of technical interactions due to the competition for resource in a mixed-species fishery, and the typology of fleets and metiers in the English Channel

In a multi-gear and multi-species artisanal fishery, the level of technical interactions (i.e. the competitive externalities resulting from a shared exploitation of common resources or fishing grounds) among various fishing units is high. Assessing these technical interactions is of great importance for fishery management, as any control applied to one fishing unit may have positive or negative effects on others. The magnitude and direction of these effects cannot be easily measured, unless all fishing units and species in the fishery are considered simultaneously. Technical interactions are particularly important in the complex artisanal fisheries of the English Channel. Using a bioeconomic model of the English Channel that incorporates all the major fishing units (the BECHAMEL model), we describe a method for measuring and classifying the technical interactions due to the competition for resource (stock externalities). The results are used to develop a typology of metiers and fleets based on their overall level of interaction for the resource. We also define fleets and metiers as structuring, dependent, intermediate or autonomous. (C) 2001 Ifremer/CNRS/Inra/IRD/Cemagref/Editions scientifiques et médicales Elsevier SAS.
On the applicability of biological and economic indicators to improve the understanding of the relationship between effort and mortality: Examples from the flat- and roundfish fisheries of the North Sea. Final Report.

General information
State: Published
Organisations: Section for Fisheries Advice, National Institute of Aquatic Resources
Authors: Marchal, P. (Ekstern), Ulrich, C. (Intern), Andersen, J. (Ekstern), Pastoors, M. (Ekstern), Poos, J. (Ekstern), de Wilde, J. (Ekstern), Korsbreekke, K. (Ekstern), Casey, J. (Ekstern), O’Brien, C. (Ekstern), Rackham, B. (Ekstern), Pascoe, S. (Ekstern)
Number of pages: 276
Publication date: 2001

Publication information
Publisher: [s.n.]
Original language: English

Series: EU Study
Number: 98/027
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226595
VPBase : A prototype of database for storage and processing of vpa-input data

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Monitoring, Section for Management Systems
Authors: Sparre, P. J. (Intern), Folmer, O. (Intern), Ulrich, C. (Intern)
Pages: 1-29
Publication date: 2001
Main Research Area: Technical/natural sciences

Modélisation multi-flottilles et multimétiers des pêcheries artisanales de la Manche. Evaluation plurispécifique des stocks, étude des interactions techniques et intégration dans la modélisation bioéconomique

General information
State: Published
Organisations: Unknown
Authors: Ulrich, C. (Intern)
Publication date: 2000

Quantification de l’importance des stocks locaux dans la Manche : Application du modèle In/Out à 7 stocks

General information
State: Published
Organisations: Unknown
Authors: Ulrich, C. (Intern), Gascuel, D. (Ekstern), Bellail, R. (Ekstern)
Pages: 125-146
Publication date: 2000

Analysis of the impact of fishing activities on exploited marine resources at the ecosystem scale: the case of English Channel fisheries

General information
State: Published
Bioeconomic modelling of English Channel fisheries and their technical interactions: presentation of the simulation model BECHAMEL (BioEconomic CHAnnel ModEL)

General information
State: Published
Organisations: University of Portsmouth, Universite de Bretagne Occidentale, Ecole Nationale Supérieure Agronomique
Authors: Ulrich, C. (Intern), Le Gallic, B. (Ekstern), Dunn, M. (Ekstern)
Publication date: 1999
Main Research Area: Technical/natural sciences
Publication information
Journal: ICES C.M.
Volume: S:04
Original language: English
Source-ID: 283662
Publication: Research › Conference article – Annual report year: 1999

Biological and bioeconomic modelling in fisheries: A review

This review was undertaken as part of the EU funded project "Bioeconomic modelling of the fisheries of the English Channel" (FAIR - CT96 - 1993). The specific aim of the review was to examine bioeconomic and biological modelling techniques, and to examine how these techniques have been applied to the fisheries of the English Channel in the past. The review was used to focus attention on the methodologies to be applied in the EU funded research project

General information
State: Published
Organisations: Unknown
Authors: Pascoe, S. (Ekstern), Dunn, M. (Ekstern), Ulrich, C. (Intern)
Publication date: 1998
Publication information
Original language: English
Series: CEMARE Miscellaneous Papers
Number: M43
Main Research Area: Technical/natural sciences
Source-ID: 283670
Publication: Research › Report – Annual report year: 1998

Foraging success of juvenile pike Esox lucius depends on visual conditions and prey pigmentation

General information
State: Published
Organisations: Unknown
Authors: Ulrich, C. (Intern), Gascuel, D. (Ekstern), Maury, O. (Ekstern)
Projects:

Integration of bycatch in mixed-fisheries management
National Institute of Aquatic Resources
Period: 01/08/2016 → 16/10/2019
Number of participants: 4
PhD Student:
Schreiber Plet-Hansen, Kristian (Intern)
Supervisor:
Mortensen, Lars O. (Intern)
Nielsen, J. Rasmus (Intern)
Main Supervisor:
Ulrich, Clara (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Study on approaches to management for data-poor stocks in mixed fisheries (MIXDLS) (39342)
The tender requires advancement of methods for advice on the status and management of data-poor stocks in mixed fisheries. In order to meet this requirement, we will undertake a detailed review of assessment and management approaches for data-poor stocks and identify relevant approaches for application in the case studies and wider EU fisheries.

The approaches should be compatible with the Common Fisheries Policy (CFP; EU 2013) in terms of (i) fishing mortality ranges compatible with Maximum Sustainable Yield (MSY), (ii) fish caught to be landed, and (iii) addressing uncertainty in significant components of the marine fish ecosystem.

The most promising methods will be tested through simulation to ensure robustness to uncertainties and to deliver confidence in methods for future operational use. The suite of identified, assured methods will then be used to develop an objective framework to apply the most relevant assessment or management methods to each stock in each of the case study areas. Based on the output of these assessments of data-poor stocks, and where relevant, the existing assessments of data rich stocks, a mixed fisheries simulation framework will be developed to assess the performance of candidate management strategies.

Adaptation of the existing mixed fisheries tools will be required in order to incorporate data-poor stocks in the simulation framework.

This project is coordinated by DTU Aqua & IMARES, Netherlands.
The project is funded by EU, Calls for proposals/tenders (EU DG Mare).
Sustainable, cost effective and responsive gear solutions under the landing obligation (FAST-TRACK) (39323)

With the reform of the Common Fisheries Policy and the introduction of a Landing Obligation the ability of fishers to adjust the selectivity of their gears to suit the quotas which are available to them will be an important factor in determining the revenue and profitability in the fishery. As the combination of gear, fishing practice and quota shares will differ between vessels, changes to the selectivity of the gears will need to be implemented at the vessel level and based on the quotas which are available to the vessel at a given time. For this to be realized, simple and cost effective solutions which can be quickly coupled with existing gears will be in demand. These solutions will need to be implemented quickly in order for them to solve the issues at hand without losing substantial income. Furthermore, these solutions will need to be scientifically tested to document their effect before being considered for implementation into the legislation.

Fast-Track aims to increase flexibility and ownership over the gears used while ensuring an effective introduction of the new EU Common Fisheries Policy. To achieve this, Fast-Track aims to facilitate the development of more selective gears by providing the industry with the possibility to take a more proactive role in the development and testing of new ideas. Here we try to facilitate a more bottom-up approach where the industry are responsible for coming up with the ideas they feel applicable for their fishery, as well as having an important role in the testing of the gear and the collection of the data. Furthermore, it aims to speed up the testing process and diversity of gears being tested by initially having the industry to define the idea and carry out a development/pre-test to refine the gears performance before proceeding to a more rigorous scientific test.

The expected effects of the project are 1) the establishment of a permanent platform comprised of stakeholders (fishermen, net makers producer organizations, managers and scientists) which can facilitate the development of ideas and solutions originating from the industry, 2) that the industry becomes more proactive role in the development and testing of solutions for the effective implementation of the landing obligation, 3) that the close cooperation between industry and researchers leads to greater ownership of the solutions developed, and 4) the speed with which innovative tools are developed, tested and approved is reduced while profitability and sustainability are increased.

This project is coordinated by DTU Aqua.

The project is funded by the Ministry of Environment and Food of Denmark and the European Maritime and Fisheries Fund (EMFF).
Strategies for the gradual elimination of discards in European fisheries (DiscardLess) (39238)
DiscardLess will help provide the knowledge, tools and technologies as well as the involvement of the stakeholders to achieve the gradual elimination of discarding. These will be integrated into Discard Mitigation Strategies (DMS) proposing cost-effective solutions at all stages of the seafood supply chain.

This project is coordinated by DTU Aqua.
The project is funded by EU, Horizon2020.
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
IFREMER
Instituto Español de Oceanografía
University of Bergen
Strathclyde University
University of Copenhagen
Université de Bretagne Occidentale
Sea Fish Industry Authority
Marine Scotland Science
FAO
Simrad Spain SLU
Hampiðjan hf
SafetyNet Technologies LTD
Marine Institute
NAYS Ltd
Pôle AQUIMMER
University of the Azores
Cefas
Matis ltd.
MAREL
ShipCon
TRACE Wildlife Forensics Network Limited
AZTI-Tecnalia
BARNANUSCIENCE
University of Tromsø
Marine Natural Resources Governance
FishFix
Agrocampus Ouest
AlphaFilm
Minimising discards in Danish fisheries (MINIDISC) (39020)
The landings obligation, currently being implemented in the new CFP, puts major constraints on fishers, by making the
landing of unwanted catch mandatory. Less restrictive technical rules (TR) in a results-based management frame under
Catch Quota Management (CQM) have been suggested as a mechanism to release some of these constraints. To
investigate the effects of the existing TR, some fishers were relaxed from TR during the trial and could freely choose and
develop alternative gears, aiming to optimize annual catch value, while reducing discards. The study included 14 demersal
fishing vessels, operating in the North Sea, Skagerrak and the Baltic Sea.

Fishers used test and control gears interchangeably or in pairs during up to 6 months and were required to sort and weigh
discard of seven common target species on a haul by haul basis. All vessels were equipped for Fully Documented
Fisheries (FDF), including cameras. Collected data were analyzed to investigate differences in landings, discards, discard
ratio, CPUE, VPUE and DPUE, between conventional (control) and new gears (test). The results showed a varying degree
of success, depending both on area and on choices made by the individual fisher. The best results were observed in the
Baltic Sea, where relaxing technical rules led to major improvements in fishing patterns. But gear changes did not
contribute much in fisheries where initial discards rates were already low. Interviews realized with the skippers around the
end of the trial were performed and analyzed to investigate (i) their experiences with “free” choice of gear, (ii) the
processes that they followed for developing their gears and (iii) their tools for evaluating the efficiency and selectivity of
their trial.

In addition to the trial, a number of other activities were performed under the MINIDISC project, including (i) the publishing
of a catalogue (in Danish) of the selectivity devices experimented in Danish fisheries, (ii) a scientific selectivity trial on
Danish seines fisheries in Skagerrak and (iii) a review of international experiences in the uptake of selective devices.

The project has been disseminated through several meetings and conferences. A number of scientific publications are in
review or close to submission.

This project was coordinated by DTU Aqua.

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

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Danish Fishermen’s Producers’ Organization
Period: 01/01/2014 → 15/07/2015
Number of participants: 8
Research areas: Fisheries Management & Fisheries Technology & Marine Living Resources
Project participant:
Mortensen, Lars O. (Intern)
A management plan is an important requirement for MSC certification of specific fisheries. However, prior to this project, reliable stock assessments, which are necessary for a management plan for plaice (*Pleuronectes platessa*) in area IIIa (Kattegat/Skagerrak), had not been available. These problems most likely originated from insufficient knowledge about the geographical distribution of populations as well as the interactions between populations in Kattegat/Skagerrak and neighbouring areas. Through a mapping of the distribution and dynamics of populations, this project aimed at providing the missing data that would ultimately allow for the development of a management plan for the plaice fishery in area IIIa. The work included information from genetics, tagging, otolith-based growth estimation, oceanographic modelling and analyses of survey and fisheries data.

Results from the project showed evidence of both local population components in the Kattegat/Skagerrak as well as substantial mixing between North Sea population and these local components, and consequences of lumping or splitting the populations for stock assessment and management were discussed.

The outcomes of the work directly influenced the policy decisions since 2015. Decision was finally made to proceed with the lumping option, thus allowing a quantitative analytical assessment and management advice for the area. However, because of the differences in size between the two populations, there is a risk of depletion of the local Skagerrak population if the fisheries on it increase as a consequence of the increase in the North Sea stock. In terms of management, some mechanisms already exist for reducing the fishing pressure in the Skagerrak if deemed necessary, as plaice in the North Sea and in the Skagerrak are managed by two different Total Allowable Catches (TACs). It has therefore been suggested that routine monitoring of the survey and fisheries patterns would allow detecting any departures from the current situation, i.e. a decoupling of trends in the different areas and the different seasons that could indicate a reduced productivity of the local stock.

In the longer-term, the current progresses on the biological knowledge of the stock in Skagerrak should be sustained. Additional genetic allocation of individual fish to the different populations should be performed to obtain a better quantification of the mixing in different areas and seasons, and the survey coverage should be improved in the Skagerrak. The project was coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).
Maximizing yield of fisheries while balancing ecosystem, economic and social concerns (MYFISH) (38850)

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

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

The project was coordinated by DTU Aqua.

The project was funded by EU, Framework Programme 7.

National Institute of Aquatic Resources

Section for Ecosystem based Marine Management
Period: 01/01/2012 → 29/02/2016
Number of participants: 10
Research areas: Ecosystem based Marine Management & Fisheries Management & Marine Living Resources

Project participant:
Ulrich, Clara (Intern)
Eigaard, Ole Ritzau (Intern)
Mortensen, Lars O. (Intern)
Nielsen, J. Rasmus (Intern)
Worsøe Clausen, Lotte (Intern)
Nielsen, Anders (Intern)
van Deurs, Mikael (Intern)
Vinther, Morten (Intern)
Neuenfeldt, Stefan (Intern)
Project Manager, academic:
Rindorf, Anna (Intern)

Socio economic effects of management measures of the future CFP (SOCIOEC) (38940)

Objectives and Background

The main aim of the SOCIOEC FP7-KBBE-2011-5 project under KBBE.2011.1.2-10 (Socio-economic effects of the main management principles of the future CFP: impact of new policy framework and opportunities for the fishing sector) was to evaluate innovative fisheries management measures and develop self- and co-management. It has been important that the project focused on the interpretation of overarching (i.e. EU) objectives in local and regional contexts.

Deliverables and Tasks

In the first step the project developed a coherent and consistent set of objectives for fisheries management, which addressed ecological, economic and social sustainability targets. The objectives were consistent with the aims of the CFP, MSFD and other EU directives, but also understandable by stakeholders and the community and engaged their support. This leaded to the proposal of a number of innovative management measures, based on existing or new approaches. The second step was to analyze the incentives for compliance provided by these measures through examination of fisher’s responses to and perceptions of measures based on historical analysis, direct consultation and interviews, and how the governance of the measures operated.

Finally, the project examined the impact of the measures that emerge from this process, particularly in terms of their economic and social impacts on the industry and the wider community. All this was done through a generic analysis of the wide range of current and emerging measures in the current CFP and possible measures introduced in the future. This required and has resulted in interdisciplinary work across a range of scientific disciplines (economics, social and natural sciences).
DTU Aqua was involved in the North Sea and Baltic Sea case studies and in the project Steering Group. For the North Sea, DTU Aqua focused on analyses of catch quotas compared to landing quotas in mixed consume fisheries including related discard processes. Also, small meshed pelagic fisheries in the North Sea were addressed for efficient management of those. For the Baltic Sea, DTU Aqua focused on evaluation of spatial management measures among other in relation to NATURA 2000 areas and implementation of windmill farms, and larger marine constructions. This resulted in evaluation of success and failures of several management measures, and enabled us to draw conclusions on which measures are best introduced in which circumstances, possibly on a regional basis. On this basis DTU Aqua has produced several peer reviewed journal papers under SOCIOEC. In the CFP we need to distinguish between the basic, overarching regulations of the EU or regional seas level and the specific and local management by Member States in sea areas where self- and co-management schemes are often already informally in place. Here the cooperation with the ACs was essential to derive objectives applicable for the CFP based on the ecological, economic and social drivers and to reconsider management at more regional or local levels. This process involved: (i) investigation of how the objectives regarding ecological, economic and social sustainability could be defined in the short term and ensures the long-term sustainability and viability of fisheries; (ii) analyzing which management measures and at what organization level, created the right incentives to tackle structural failings in the CFP with focus on technical measures, command and control instruments (TACs, quotas, effort), market instruments (transferability of collective or individual rights) and social instruments (self- or co-management possibilities); and (iii) determination of the socio-economic and spatial effects of these management measures.

The project had 30 project participants from European universities and National Fisheries Economics and Fisheries Research Institutes as well as SMEs.

The project was coordinated by Institute of Sea Fisheries, Johann Heinrich von Thünen Federal Research Institute for Rural Areas, Forestry and Fisheries, Germany.

The project was funded by EU, Framework Programme 7.

**National Institute of Aquatic Resources**

Section for Ecosystem based Marine Management  
Period: 01/01/2011 → 31/12/2014  
Number of participants: 4  
Research area: Fisheries Management  
Project participant:  
Bastardie, Francois (Intern)  
Ulrich, Clara (Intern)  
Eigaard, Ole Ritzau (Intern)  
Project Manager, academic:  
Nielsen, J. Rasmus (Intern)  
Project  

**Eco-certification of Danish fisheries (38885)**

Danish Fishers PO had decided that all commercial fisheries in Denmark should, where possible, operate at the standard necessary to obtain MSC certification by 2012. This project was the third of a suite of EFF-financed projects supporting this challenge.

Of particular focus was the absence of management plan for plaice and sole in Kattegat-Skagerrak area, which is one of the prerequisite for certification. Sole stock is regularly assessed by ICES, implying that a management plan could potentially be established on a standard basis. But the situation was more problematic for plaice, which assessment suffered from a number of uncertainties and issues which could not be solved through a standard benchmark process. DTU Aqua was thus involved in order to clarify the biological knowledge base for this stock and contributed to suggestions for a more tailored approach to the assessment and management of plaice in Skagerrak.

The project resulted in significant changes in the perception of plaice population dynamics in the Skagerrak-Kattegat. An ICES workshop was convened in 2012 (WKPESTO) on the basis of the project, and a new basis for scientific advice was agreed. The scientific and advice outcomes of the project have been disseminated in a scientific publication by Ulrich et al. (2013), DOI: 10.1016/j.seares.2013.04.007

The research underlying this project was continued in project 39025 in 2013-2014.

The project was coordinated by Danish Fishermen's Producers' Organisation, Denmark.

The project was funded by the Danish Ministry of Food, Agriculture and the Fisheries and the European Fisheries Fund (EFF).
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management

Danish Fishermen's Producers' Organization
Period: 01/01/2010 → 01/02/2013
Number of participants: 2
Research areas: Fisheries Management & Ecosystem based Marine Management
Project participant:
Boje, Jesper (Intern)
Project Manager, academic:
Ulrich, Clara (Intern)

Project

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

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

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

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

The project is coordinated by DTU Aqua.

National Institute of Aquatic Resources
Section for Marine Living Resources

Danish Pelagic Producers Organisation

Danish Fishermen's Association
Period: 01/01/2009 → 31/12/2011
Number of participants: 6
Research area: Marine Living Resources
Project participant:
Payne, Mark (Intern)
Mosegaard, Henrik (Intern)
Dijkman, Teunis Johannes (Intern)
Nielsen, Anders (Intern)

Project Manager, organisational:
Ulrich, Clara (Intern)
Project Manager, academic:
Worsøe Clausen, Lotte (Intern)

Project

Development of tools for logbook and VMS data analysis (38751)

Objectives and Background
The project “Development of tools for logbook and VMS data analysis” was an EU project under studies for carrying out the common fisheries policy (No MARE/2008/10 LoI2). The aim of the project was to develop a set of standard protocols for coupling and simultaneous analyses of EU fisheries logbook and VMS satellite vessel record data.

Tasks and Deliverables
The process began with the construction of standardized data formats for logbook (EFLALO) and VMS (TACSAT). The software for analyzing the data took the form of a fully documented package called vmstools, built using the freeware package, R (http://cran.rproject.org/). Once the data have been imported into R in the correct format, a series of R programs or 'functions', linked by 'scripts' enable all tasks necessary to be completed in a single software environment. The software can ‘clean’ data and format input data, estimate distances between VMS positions, and métiers can be identified objectively from species assemblages in catch data using multivariate statistical techniques.

We have included a range of complimentary methods for determining fishing activity from VMS position registrations. Positions at sea, for example, can be distinguished from vessels in harbor or erroneous positions on land. Position registrations of vessels actually fishing can be separated from those engaged in other activities (e.g. steaming) using their speed in conjunction with other information such as vessel size and gear being used.

Logbook and VMS data can be merged such that high-resolution spatial maps of catches of various commercial species can be generated. Individual vessel tracks can be reconstructed for more realism through different interpolation techniques (both linear and non-linear, i.e. using Hermite spline functions). Further, all the fishing activity indicators required under the Data Collection Framework can be calculated using vmstools. The package can also be used to explore the impact of different spatial (grid size) and temporal aggregations (month, quarterly, annual) which need to be explicitly considered when assessing fishing impact on the sea floor. There are also scripts for displaying results using Google Earth which is a useful aid for dissemination.

The combination of all these routines ‘under one roof’ permitted and permits the construction of ‘Regional’ databases (i.e. FishFrame developed by DTU Aqua - a regional database hosted by one of the project partners) and scripts to produce output suitable for this are included with the vmstools package.

As proof of concept, all analyses performed within each work package have been tested, using the vmstools package, against national datasets with contributions from the French, Danish, Irish, UK and Dutch institutes. As an example, FishFrame has been populated with Dutch and Danish combined VMS and logbook data for 2005-2009. The project demonstrated emphatically that logbook and VMS data from disparate countries with often different data collection regimens can be combined and compared using generic tools and that the output can be sent to regional databases permitting more holistic assessments of fishing activity.

The project has built further on the networks and platforms produced under EU FP6 EFIMAS Project coordinated by DTU Aqua, and the DTU Aqua team associated with the project has produced several peer reviewed journal papers under Lot 2.

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

This project is funded by EU, Framework Programme 7.

Software Engineering
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
IFREMER
Marine Scotland
Sea Fisheries Institute

Marine Institute
Period: 01/01/2009 → 31/12/2012
Number of participants: 5
Research areas: Fisheries Management & Marine Living Resources
Project participant:
Bastardie, Francois (Intern)
Ulrich, Clara (Intern)
Egekvist, Josefine (Intern)
Degel, Henrik (Intern)
Nielsen, J. Rasmus (Intern)

Study for the revision of the plaice box (PBox) (38847)
This project has attempted to evaluate the effectiveness of the fisheries management, measure known as the “Plaice Box” (PB) for the conservation of plaice and other species of marine organisms in the south-eastern North Sea. The study provides an inventory of existing information and collects new material on the effects of the PB on the conservation of plaice and the impact of the PB on various components of the commercial fishing fleets.
Based on an analysis of key processes that affect the impact of the PB, modifications were explored to improve the positive effect on the conservation of plaice and other species of marine organisms, including catches and bycatches of other marketable fish. An economic assessment of the consequences of those modifications, in terms of their cost-effectiveness, and implications for profitability of the activity was presented. Finally, the data requirements for future evaluations on the effects of the PB on conservation were discussed.

Stakeholder interest in the project has been high and they made extremely useful contributions to a workshop held in October 2009.

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

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Johann Heinrich von Thünen-Institute
Alfred Wegener Institute
Period: 01/01/2009 → 31/12/2010
Number of participants: 2
Research area: Fisheries Management
Contact person:
Ulrich, Clara (Intern)
Project participant:
Blæsbjerg, Mette (Ekstern)
Project

**Bridging the gap between science, stakeholders and policy makers (GAP 1 & GAP 2) (38133 & 38860)**

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

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

Find full list of participants at the website of GAP2.

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

The projects were funded by EU, Framework Programme 7.

National Institute of Aquatic Resources
Section for Marine Living Resources
Cefas
Universidade da Coruña
Aalborg University
University of Tromsø
Judgement and knowledge in fisheries involving stakeholders (JAKFISH) (38132)

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

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

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

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Wageningen IMARES
Cefas
Institute of Marine Research
Aalborg University
Hellenic Centre for Marine Research
University of Tartu
University of Helsinki
University of Portsmouth
Dialogik gemeinnützige Gesellschaft für Kommunikations- und Kooperationsforschung mbH
Period: 01/01/2008 → 31/12/2011
Number of participants: 5
Research area: Fisheries Management
Contact person:
Mosegaard, Henrik (Intern)
Project participant:
Worsøe Clausen, Lotte (Intern)
Payne, Mark (Intern)
Nielsen, Anders (Intern)
Project Manager, academic:
A framework for fleet and area based fisheries management (AFRAME) (38110)
Basing advice on fleets or fisheries requires switching focus from a biological unit (a fish stock) to a social one (a fleet or fishery). This is a major shift away from the current TAC-dominated, stock-based approach. The general objective of the AFRAME project was to develop an operational area- and fleet-based framework that integrates single-species assessment and advice. The framework must be robust to uncertainty caused by, for instance, lack of discard data. Work also included development of indicators as a basis for setting management targets, as well as the analysis of stakeholder perspective in relation to these developments.

Three case studies of mixed demersal fisheries were included focusing on areas where the need for a fleet-based management is particularly urgent: (i) The North Sea, (ii) The Western Waters in ICES areas VII & VIII (Celtic Sea to the Bay of Biscay), and (iii) the Eastern Mediterranean.

The AFRAME project has been particularly successful in developing a simple and operational approach for mixed-fisheries advice. This approach is now integrated as part of the ICES Advice for the North Sea, through the setup of a dedicated working group applying this approach on a routine basis.

The project was coordinated by Marine and Food Technological Centre (AZTI), Spain.
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Marine and Food Technological Centre
Wageningen IMARES
Cefas
IFREMER
Institute of Marine Research
University of Copenhagen
Aalborg University
Marine Scotland Science
Hellenic Centre for Marine Research

Period: 01/01/2007 → 31/12/2009
Number of participants: 5
Research area: Fisheries Management
Contact person:
Nielsen, J. Rasmus (Intern)
Project participant:
Andersen, Bo Sølgaard (Intern)
Eigaard, Ole Ritzau (Intern)
Hamon, Katell (Ekstem)
Project Manager, academic:
Ulrich, Clara (Intern)

Comparative evaluations of innovative solutions in European fisheries management (CEVIS) (38105)
CEVIS is an FP6 project that assessed potential innovations for European fisheries management regimes with respect to four general management objectives: biological robustness, economic efficiency, the cost effectiveness of management activities, and social robustness. CEVIS examines four types of regime-level innovations: the use of participatory approaches to fisheries governance, rights-based regimes, effort-control regimes and decision rule systems. These innovations are assessed in respect to four general management objectives: biological robustness, economic efficiency, the cost effectiveness of management activities, and social robustness. The four regime level innovations measured against the four general management objectives define the CEVIS research’s conceptual framework. The conceptual framework is tested against four European test cases. However, before these case studies begin, the research will take a close look at international cases of innovative fisheries management in other developed countries. Visits will be made to four places outside the EU that have similar fisheries and have implemented these four types of innovations.

The project has built further on the networks and platforms produced under EU FP6 EFIMAS project (38094) which DTU
Aqua coordinated, and the DTU Aqua team associated to the project has produced several peer reviewed journal papers under CEVIS and been co-authors to a book published by Elsevier in relation to CEVIS. Besides this, CEVIS has two final products. The first is an Innovation Evaluation Framework made up of indicators of inputs and outcomes in relation to the four general management objectives. This is an aid to fisheries managers wishing to assess the suitability of possible changes in EU fisheries management practice. The second is a report based on the case studies that evaluates this specific set of potential regime-level innovations for use in EU fisheries management. The developed framework makes it possible for managers to evaluate the extent to which any given management system will contribute positively to attaining Common Fisheries Policy objectives. A range of options for implementing cost-effective and participatory management systems have been provided and finally, the CEVIS project helps fishery managers to be better informed about the ecological, social and economic consequences of implementing any particular management regime.

The project was coordinated by Innovative Fisheries Management (IFM), Aalborg University, Denmark.

National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Aalborg University
University of Copenhagen
Marine Scotland
University of Tromsø
Lulea University of Technology
Institute of Marine Research
European Commission - Joint Research Center
Sea Fisheries Institute
Marine and Food Technological Centre
Öko-Institut
Netherlands Institute for Fisheries Research
Period: 01/01/2005 → 31/12/2009
Number of participants: 5
Research area: Fisheries Management
Project participant:
Bastardie, Francois (Intern)
Ulrich, Clara (Intern)
Baodrun, Alain (Ekstern)
Sparre, Per J. (Ekstern)
Project Manager, academic:
Nielsen, J. Rasmus (Intern)

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

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

The project was coordinated by DTU Aqua.
Creation of multi-annual management plans for commitment (COMMIT) (2212)

The objective of COMMIT was to provide a sound scientific basis for the long-term planning of fisheries management consistent with sustainable development, while also identifying any short-term biological and socio-economic consequences. This was done through the evaluation of multi-annual management plans that reduce annual fluctuations in exploitation strategy and ensure commitment of the stakeholders to the plan. Strategies were based upon harvest rules and developed explicitly recognizing uncertainty due to process, measurement, estimation, model and implementation error. In particular, a socio-economic analysis identified mechanisms affecting the commitment of key stakeholders and hence the level of implementation error. Robust strategies were designed that explicitly took this into account. Stocks chosen are those of interest to the community (Baltic salmon, North Sea flatfish and Northern hake) and in particular those exploited in mixed fisheries, although the methods developed are generic and applicable to other stocks.

The project was coordinated by Centre for Environment, Fisheries & Aquaculture Science (CEFAS), UK.

Operational evaluation tools for fisheries management options (EFIMAS) (38094)

Existing models in fisheries management advice (FMA) only consider effects of overall fishing on single fish stocks, while not taking broader ecosystem, social and economic impacts of management decisions into account. Mixed fisheries
aspects where several fishing fleets fish on several stocks in the same fishery, spatial planning, and long-term management strategy evaluation are also not considered adequately.

In response to this situation, managers launched EFIMAS aiming to develop alternative management evaluation tools and management strategies that have broader, multi-disciplinary and long-term perspectives. These include social and economic impacts and ecosystem impacts (e.g. by-catch and discards), besides biological consequences on single stocks.

This is a new way of thinking international fisheries research and FMA, by developing conceptual and comprehensive multi-fleet and multi-stock bio-economic simulation tools and management evaluation frameworks (MEF), being spatial and seasonal explicit. A successful implementation of ecosystem, social and economic dynamics and factors on a spatial scale in the advisory process is a major leap towards more holistic and sustainable management within EU waters and fisheries. MEFs enable higher degree of participatory management evaluation by involving various stakeholders in FMA.

EFIMAS, and sister projects, develop and integrates a set of new and existing software tools and simulation models (especially FLR – Fisheries Library in R), generating a more robust Management Strategy Evaluation (MSE) framework, that allows testing plausible hypotheses about dynamics of fish stocks, fisheries and fleets.

The MEF contributes to a conceptual change and paradigm shift in generating advice and management with entire fleets and fisheries as the central units. Here the basic management instrument is the input, i.e. the capacity of fishing fleets, the vessel efficiency, and the effort (activity). This differs from the traditional output based ICES approach, providing advice on single fish stock catch limit from rather uncertain terminal year stock assessments and under strong assumptions on future total stock fishing mortality (F) without much consideration on factors, creating and controlling F and partial Fs by fleet.

The developed frameworks allow simulating and evaluating, respectively, the biological, social and economical consequences of a range of proposed management options and objectives within different management regimes. They can evaluate fleet and mixed fisheries interactions and fisheries behavior, uncertainties in stock and fisheries dynamics, data collection, assessment, modelling, as well as the advisory management and implementation processes. Being capable of evaluating the relative performance of multiple alternative options the MEFs possess strong capacity in performing sensitivity and risk analyses of consequences.

Managing fisheries in a virtual environment provides more reliable scientific advice to stakeholders: In the same way that a pilot might fly in a simulator before flying for real, the simulation tools evaluates the robustness of alternative strategies and virtual regimes to give more holistic FMA in broader context before implementation. This provides managers and stakeholders a better idea of the consequence of a given strategy or intervention before opting for a particular management approach.

The overall evaluation comprises process evaluation (PE) and technical evaluation (TE). PE focuses on participatory management. Here participatory and iterative scenario-based MEF modelling is used to obtain input and cyclic feedback from multiple stakeholders for different options, and to test the general utility of the operational MEF.

Participants: 30 European universities and national fisheries research institutes with biological and economic expertise as listed under www.efimas.org.

The project was coordinated by DTU Aqua.

National Institute of Aquatic Resources

Section for Ecosystem based Marine Management
Period: 01/01/2004 → 31/12/2009
Number of participants: 11
Research area: Fisheries Management
Project participant:
Bastardie, Francois (Intern)
Munch-Petersen, Sten (Intern)
Eigaard, Ole Ritzau (Intern)
Andersen, Bo Sølgaard (Intern)
Nielsen, Jacob (Ekstern)
Blaesbjerg, Mette (Intern)
Vestergaard, Ole (Intern)
Project Manager, academic:
Ulrich, Clara (Intern)
Degnbol, Poul (Ekstern)
Sparre, Per Johan (Intern)
Project Coordinator:
Nielsen, J. Rasmus (Intern)

Project Activities:

**ICES - Benchmark Workshop on Plaice - WKPLE (External organisation)**
Period: 2015
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Degree of recognition: International

**Related external organisation**
**ICES - Benchmark Workshop on Plaice - WKPLE**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**ICES - Working Group on Mixed Fisheries Advice for the North Sea - WGMIXFISH (External organisation)**
Period: 2015
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Degree of recognition: International

**Related external organisation**
**ICES - Working Group on Mixed Fisheries Advice for the North Sea - WGMIXFISH**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK (External organisation)**
Period: 2015
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Degree of recognition: International

**Related external organisation**
**ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK (External organisation)**
Period: 2014
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Degree of recognition: International

**Related external organisation**
**ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK**
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK (External organisation)
Period: 2013 → …
Clara Ulrich (Chairman)
National Institute of Aquatic Resources
Section for Ecosystem based Marine Management
Degree of recognition: International

Related external organisation

ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Annual Meeting of Advisory Working Group Chairs - WGCHAIRS (External organisation)
Period: 2012 → …
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Management Systems
Degree of recognition: International

Related external organisation

ICES - Annual Meeting of Advisory Working Group Chairs - WGCHAIRS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Maritime Systems - WGMARS (External organisation)
Period: 2012 → …
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Management Systems
Degree of recognition: International

Related external organisation

ICES - Working Group on Maritime Systems - WGMARS
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on Mixed Fisheries Advice for the North Sea - WGMIXFISH (External organisation)
Period: 2012 → …
Clara Ulrich (Participant)
National Institute of Aquatic Resources
Section for Management Systems
Degree of recognition: International

Related external organisation

ICES - Working Group on Mixed Fisheries Advice for the North Sea - WGMIXFISH
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK (External organisation)
Period: 2012 → …
Clara Ulrich (Participant)
National Institute of Aquatic Resources

Section for Management Systems
Degree of recognition: International

Related external organisation

ICES - Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - WGNSSK
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Workshop on the Evaluation of Plaice Stocks - WKPESTO (External organisation)
Period: 2012 → …
Clara Ulrich (Participant)
National Institute of Aquatic Resources

Section for Management Systems
Degree of recognition: International

Related external organisation

ICES - Workshop on the Evaluation of Plaice Stocks - WKPESTO
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar