Bottom trawl fishing footprints on the world's continental shelves

Bottom trawlers land around 19 million tons of fish and invertebrates annually, almost one-quarter of wild marine landings. The extent of bottom trawling footprint (seabed area trawled at least once in a specified region and time period) is often contested but poorly described. We quantify footprints using high-resolution satellite vessel monitoring system (VMS) and logbook data on 24 continental shelves and slopes to 1,000-m depth over at least 2 years. Trawling footprint varied markedly among regions: from 50% in some European seas. Overall, 14% of the 7.8 million-km² study area was trawled, and 86% was not trawled. Trawling activity was aggregated; the most intensively trawled areas accounting for 90% of activity comprised 77% of footprint on average. Regional swept area ratio (SAR; ratio of total swept area trawled annually to total area of region, a metric of trawling intensity) and footprint area were related, providing an approach to estimate regional trawling footprints when high-resolution spatial data are unavailable. If SAR was ≤0.1, as in 8 of 24 regions, there was >95% probability that >90% of seabed was not trawled. If SAR was 7.9, equal to the highest SAR recorded, there was >95% probability that >70% of seabed was trawled. Footprints were smaller and SAR was ≤0.25 in regions where fishing rates consistently met international sustainability benchmarks for fish stocks, implying collateral environmental benefits from sustainable fishing.
Individual transferable quotas, does one size fit all?: Sustainability analysis of an alternative model for quota allocation in a small-scale coastal fishery

The introduction of vessel-based Individual Transferable Quotas (ITQs) in Danish demersal fisheries in 2007 caused significant structural changes in the fleet, towards fewer and larger vessels deploying otter trawls. Mainly smaller coastal vessels deploying Danish seines and gillnets reduced in numbers. The ecosystem effects of this structural change were investigated by comparing the sustainability of a local, small-scale, coastal fishery (Thorupstrand) using Danish seines and gillnets with that of demersal trawling by larger vessels using the same fishing grounds. The fisheries were compared using six ecological and socio-economic indicators: 1), discards (food web), 2), by-catch incidences (food web/biodiversity), 3), seabed impacts, 4), fuel use efficiency, 5), quality of fish landed (food provision), and 6), social and cultural gains and drawbacks (social and cultural features). Except for by-catch of vulnerable species, the fisheries using Danish seines and gillnets scored better in all indicators when compared to otter trawls. Additional commercial and cultural benefits of establishing a local fishery guild with share-owned quotas and land-based facilities were investigated. The results and lessons learned are discussed in the context of an ecosystem approach to fisheries management and the current reform of the common fisheries policy of the European Union.

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Contributors: Dinesen, G. E., Rathje, I. W., Højrup, M., Bastardie, F., Larsen, F., Sørensen, T. K., Hoffmann, E., Eigaard, O. R.
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Stakeholder perceptions in fisheries management - Sectors with benthic impacts

The capture fishing sector causes direct and indirect impacts on benthic habitats and associated fauna and flora. Effectiveness of new mitigation measures depends on fisherman's perceptions; their acceptance of, and compliance to, those measures. Accordingly, by means of Advisory Councils (ACs), fisheries stakeholders are encouraged by the Common Fisheries Policy (CFP) reform to contribute to policy formulations. Still, the CFP reform remains unclear about how to possibly incorporate perceptions of specific conservation measures and objectives in practice. Against this background, this article aims at exploring a systematic multi-criteria approach that provides information about stakeholder preferences for objectives reflecting on what is more important to aim for ('what'), mitigation measures as strategies for reaching their objectives ('how'), and accountability options that can enhance trust in the people who carry out management ('who'). The approach applies a pairwise comparison approach to elucidate the stakeholder preferences, and to estimate the relative importance of the different options. It is conducted in the Black Sea, the Mediterranean Sea, the Baltic Sea, and the North Sea. The outcomes of the questionnaire survey succeed in transparently reflecting a diversity of preferences. It is advised that in order to inform the CFP, the ACs develop a user-friendly attractive online version of this approach that can reach multiple stakeholders across Europe and facilitate updates on a continuous basis. In this way the ACs could better facilitate bottom-up participation in fisheries management by representing a wide range of
stakeholder perceptions.

**General information**

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Wageningen University & Research, Hellenic Centre for Marine Research, Central Fisheries Research Institute (CFRI), CNR, Ondokuz Mayis University, Institute of Agricultural and Fisheries research (ILVO)


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BFI (2008): BFI-level 1
BENTHIS developed the scientific basis to quantify the impact of bottom trawling on the seafloor and the benthic ecosystem. Based on insight in how fishing gear affects the seafloor, an assessment framework was developed that provides indicators of impact and seafloor status on a continuous scale that can be applied in the context of the MSFD. The mechanistic approach allows us to set reference values of impact (status) to estimate the proportion of a region or habitat where the impact is below (status is above) the threshold. The methodology combines estimates of trawling intensity with the depth to which the fishing gear penetrates into the sea bed (penetration profile) and the sensitivity of the habitat. Habitat sensitivity is estimated from the longevity composition of the benthic community that is related to the recovery rate. The mortality imposed by trawling was shown to be related to penetration depth of the fishing gear. The framework was applied to explore which fisheries had the greatest impact and which habitats were impacted the most. Fishers concentrate their activities in only a part of their total fishing area. These core fishing grounds are characterised by a relative low status (high impact). Additional fishing in these core grounds have only a small impact. In the peripheral areas where fishing intensity is low, additional fishing will have a much larger impact. Hence, shifting trawling activities from the core fishing grounds to the peripheral areas will increase the overall impact. Shifting activities from the peripheral grounds to the core will reduce the overall impact. This asymmetry provides the possibility to reduce the impact at a minimal cost. It was shown that implementing a habitat credit management system can provide incentives to reduce fishing in peripheral areas at minimal cost. In collaboration with the fishing industry and gear manufacturers, technological innovations were studied to reduce the impact of trawling. Promising results were obtained showing that (semi-) pelagic otter doors can be applied to reduce bottom impact and at the same time reduce the fuel cost without affecting the catch rate of the target species. Replacing mechanical stimulation by tickler chains with electrical stimulation in the beam trawl fishery for sole, reduced footprint and penetration depth as well as the fuel cost. Electrical stimulation is also a promising innovation to reduce the bycatch and bottom contact in the beam trawl fishery for brown shrimps. Sea trials to replace bottom trawls with pots were inconclusive. Results suggest that creels may offer an alternative for small Nephrops fishers in the Kattegat. In waters off Greece, the catch rates were very low. Sea trials with the blue mussel fishery showed that fishers could reduce their footprint by deploying acoustic equipment to detect mussel concentrations that allow the fishers to more precisely target the mussel beds and hence reduce fishing in areas with low mussel density. A review of the various case studies carried out in BENTHIS revealed the critical success factors for implementing technological innovations to mitigate trawling impact. While economic investment theory predict that economic profitability should lead to investment in innovative gears, it appeared that many other factors play a role in the successful uptake of new technology such as social, regulatory, technological and environmental factors. For the successful development and implementation of gear innovations, collaboration between fishers, gear manufacturers, policy makers, scientist and society is important.
Differences in biological traits composition of benthic assemblages between unimpacted habitats

There is an implicit requirement under contemporary policy drivers to understand the characteristics of benthic communities under anthropogenically-unimpacted scenarios. We used a trait-based approach on a large dataset from across the European shelf to determine how functional characteristics of unimpacted benthic assemblages vary between different sedimentary habitats.

Assemblages in deep, muddy environments unaffected by anthropogenic disturbance show increased proportions of downward conveyors and surface deposit-feeders, while burrowing, diffusive mixing, scavenging and predation traits assume greater numerical proportions in shallower habitats. Deep, coarser sediments are numerically more dominated by sessile, upward conveyors and suspension feeders. In contrast, unimpacted assemblages of coarse sediments in shallower regions are proportionally dominated by the diffusive mixers, burrowers, scavengers and predators. Finally, assemblages of gravelly sediments exhibit a relatively greater numerical dominance of non-bioturbators and asexual reproducers. These findings may be used to form the basis of ranking habitats along a functional sensitivity gradient.
Fisheries Impact Evaluation Tool (FIT) with Application to Assess the Bottom Fishing Footprint in Western Baltic Sea (ICES Subdivisions 22-24)

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Monitoring and Data, Centre for Ocean Life, Wageningen IMARES
Contributors: Bastardie, F., Eigaard, O. R., Nielsen, J. R., Eggekvist, J., Hintzen, N. T., van Denderen, P. D., Rijnsdorp, A.
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Fisher's preferences and trade-offs between management options
Failure to understand the potential responses of fishers to management measures creates a significant risk of revisiting the familiar scenario of perverse and unintended consequences of those measures. This paper reports on a choice
experiment survey to evaluate fisher’s preferences for various management measures proposed under the EU Common Fisheries Policy (CFP) reform process, but the conclusions have wider relevance as similar measures are used by comparable fleets in fisheries globally. The survey was conducted with fishers involved in mixed pelagic and demersal fisheries in Ireland, pelagic fisheries in Denmark and demersal fisheries in Greece. Fisheries management policies were characterized by five attributes designed both to cover the principal CFP reform proposals and to integrate ecological, social, economic and institutional factors affecting fisher’s decisions. The study uses a random utility modelling framework to reveal the preferences of the fishers across the alternative policy attributes. Results show that while there are generally preferences both for healthy stocks and for maintaining the importance of fishing to the local community, strong interfishery preference differences exist. These differences are most notable in relation to a discard ban and to the use of individual transferable fishing rights, favoured in Denmark, but not in Ireland for instance. The strength of these interfishery differences supports the assertion that there are no panaceas in fisheries management and that solutions should be tailored within the context of specific fisheries. Not doing so could create a significant risk of inappropriately managed fisheries that may lead to unsustainable outcomes

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Web of Science (2011): Impact factor 5.8
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Lost in translation? Multi-metric macrobenthos indicators and bottom trawling

The member states of the European Union use multi-metric macrobenthos indicators to monitor the ecological status of their marine waters in relation to the Water Framework and Marine Strategy Framework Directives. The indicators translate the general descriptors of ecological quality in the directives into a single value of ecological status by combining indices of species diversity, species sensitivity and density. Studies and inter-calibration exercises have shown that the indicators respond to chemical pollution and organic enrichment, but little is known about their response to bottom trawling. We use linear mixed effects models to analyze how bottom trawling intensity affects the indicators used in the Danish (Danish Quality Index, DKI) and Swedish (Benthic Quality Index, BQI) environmental monitoring programs in the Kattegat, the sea area between Sweden and Denmark. Using year and station as random variables and trawling intensity, habitat type, salinity and depth as fixed variables we find a significant negative relationship between the BQI indicator and bottom trawling, while the DKI is related significantly to salinity, but not to trawling intensity. Among the indicator components, the species diversity and sensitivity indices used in the DKI are not significantly linked to trawling, and trawling only affects the BQI when species sensitivities are derived from rarefied samples. Because the number of species recorded per sample (species density) is limited by the number of individuals per sample (density), we expect species density and density to be positively correlated. This correlation was confirmed by a simulation model and by statistical analysis of the bottom samples in which log species density was highly significantly related to log density ($r = 0.75$, $df = 144$, $p$).
New policies may call for new approaches: the case of the Swedish Norway lobster (Nephrops norvegicus) fisheries in the Kattegat and Skagerrak

The European Common Fisheries Policy has in its 2013 reform increased in complexity, such as a call for coherence with the Marine Strategy Framework Directive and a landing obligation, posing new requirements and challenges to managers, scientists and the fishing industry. Therefore, re-evaluations of current practice are important as a basis for management actions. The Swedish fishery for Norway lobster (Nephrops norvegicus) in the Kattegat–Skagerrak area provides an interesting case study of relevance to emerging policies. Sprung from an unbalance in available fish- and Nephrops quotas and an ambition to protect coastal areas, the current fishery has been directed towards three separate fisheries (mixed trawling, directed trawling using a sorting grid and creeling). Studying direct and indirect effects from alternative Swedish quota allocations among gear types is therefore interesting. Accordingly, a screening study was conducted, taking into consideration area-gear interactions in catch rates, to compare the three different fisheries regarding quantified pressures on the target species, the by-catch species, and on the seafloor, as well as to qualitatively discuss social and economic dimensions. In the next step, alternative quota allocations were studied. In Swedish fisheries, we show that creeling offers a substantial reduction of fishing mortality of both undersized Nephrops and fish and a reduced seafloor pressure per landed kilo of Nephrops. Given that the fishing areas in many cases may be interchangeable between gears, allocating a larger quota share to creels in the Swedish fishery would therefore contribute to the integration of fisheries- and environmental management as called for in the new policies.

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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
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BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
The footprint of bottom trawling in European waters: distribution, intensity, and seabed integrity

Mapping trawling pressure on the benthic habitats is needed as background to support an ecosystem approach to fisheries management. The extent and intensity of bottom trawling on the European continental shelf (0-1000 m) was analysed from logbook statistics and vessel monitoring system data for 2010-2012 at a grid cell resolution of 1 x 1 min longitude and latitude. Trawling intensity profiles with seabed impact at the surface and subsurface level are presented for 14 management areas in the North-east Atlantic, Baltic Sea and Mediterranean Sea. The footprint of the management areas ranged between 53-99% and 6-94% for the depth zone from 0 to 200 m (Shallow) and from 201 to 1000 m (Deep), respectively. The footprint was estimated as the total area of all grid cells that were trawled fully or partially. Excluding the untrawled proportions reduced the footprint estimates to 28-85% and 2-77%. Largest footprints per unit landings were observed off Portugal and in the Mediterranean Sea. Mean trawling intensity ranged between 0.5 and 8.5 times per year, but was less in the Deep zone with a maximum intensity of 6.4. Highest intensities were recorded in the Skagerrak-Kattegat, Iberian Portuguese area, Tyrrhenian Sea and Adriatic Sea. Trawling was highly aggregated. For the Shallow zone the seabed area where 90% of the effort occurred comprised between 17% and 63% (median 36%) of the management area. Footprints were high over a broad range of soft sediment habitats. Using the longevity distribution of the untrawled infaunal community, the seabed integrity was estimated as the proportion of the biomass of benthic taxa where the trawling interval at the subsurface level exceeds their life span. Seabed integrity was low (< 0.1) in large parts of the European continental shelfs, although smaller pockets of seabed with higher integrity values occur. The methods developed here integrate official fishing effort statistics and industry-based gear information to provide high-resolution pressure maps and indicators, which greatly improve the basis for assessing and managing benthic pressure from bottom
trawling. Further they provide quantitative estimates of trawling impact on a continuous scale by which managers can steer

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An assessment of the Norwegian Deep/Skagerrak shrimp stock using the Stock Synthesis statistical framework

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Estimating seabed pressure from demersal trawls, seines, and dredges based on gear design and dimensions
This study assesses the seabed pressure of towed fishing gears and models the physical impact (area and depth of seabed penetration) from trip-based information of vessel size, gear type, and catch. Traditionally fishing pressures are calculated top-down by making use of large-scale statistics such as logbook data. Here, we take a different approach starting from the gear itself (design and dimensions) to estimate the physical interactions with the seabed at the level of the individual fishing operation. We defined 14 distinct towed gear groups in European waters (eight otter trawl groups, three beam trawl groups, two demersal seine groups, and one dredge group), for which we established gear “footprints”. The footprint of a gear is defined as the relative contribution from individual larger gear components, such as trawl doors, sweeps, and groundgear, to the total area and severity of the gear's impact. An industry-based survey covering 13 countries provided the basis for estimating the relative impact-area contributions from individual gear components, whereas sediment penetration was estimated based on a literature review. For each gear group, a vessel size–gear size relationship was estimated to enable the prediction of gear footprint area and sediment penetration from vessel size. Application of these relationships with average vessel sizes and towing speeds provided hourly swept-area estimates by métier. Scottish seining has the largest overall gear footprint of ∼1.6 km² h⁻¹ of which 0.08 km² has an impact at the subsurface level (sediment penetration ≥ 2 cm). Beam trawling for flatty fish ranks low when comparing overall footprint size/hour but ranks substantially higher when comparing only impact at the subsurface level (0.19 km²h⁻¹). These results have substantial implications for the definition, estimation, and monitoring of fishing pressure indicators, which are discussed in the context of an ecosystem approach to fisheries management

General information
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Expanding the concept of sustainable seafood using Life Cycle Assessment

Fisheries management and sustainability assessment of fisheries more generally have recently expanded their scope from single-species stock assessment to ecosystem-based approaches, aiming to incorporate economic, social and local environmental impacts, while still excluding global-scale environmental impacts. In parallel, Life Cycle Assessment (LCA) has emerged as a widely used and recommended framework to assess environmental impacts of products, including globalscale impacts. For over a decade, LCA has been applied to seafood supply chains, leading to new insights into the environmental impact of seafood products. We present insights from seafood LCA research with particular focus on evaluating fisheries management, which strongly influences the environmental impact of seafood products. Further, we suggest tangible ways in which LCA could be taken up in management. By identifying trade-offs, LCA can be a useful decision support tool and avoids problem shifting from one concern (or activity) to another. The integrated, product-based and quantitative perspective brought by LCA could complement existing tools. One example is to follow up fuel use of fishing, as the production and combustion of fuel used dominates overall results for various types of environmental impacts of seafood products, and is also often linked to biological impacts of fishing. Reducing the fuel use of fisheries is therefore effective to reduce overall impacts. Allocating fishing rights based on environmental performance could likewise facilitate the transition to low-impact fisheries. Taking these steps in an open dialogue between fishers, managers, industry, NGOs and consumers would enable more targeted progress towards sustainable fisheries.
Influence of twin and multi-rig trawl systems on CPUE in the Danish Norway lobster (Nephrops norvegicus) fishery

One of the most effective ways to alter catch and length compositions in trawls is to adjust the meshsize or add selective devices such as sorting grids and selective netting panels. These changes are often introduced into the fishery in a top-down manner whereby fishermen are forced to comply with specific legislation. However, fishermen have also introduced gear modifications that have contributed to improving species selectivity in trawls. One of the simplest and most effective modifications that came from industry was the development and introduction of twin and multi-rig trawls. Here we analyse catch rates of four target species, Norway lobster (Nephrops norvegicus), cod (Gadus morhua), plaice (Pleuronectes platessa) and haddock (Melanogrammus aeglefinus), to try and understand how the use of multi-rig trawls have altered catch rates within the Danish demersal trawl fishery over the last 16 years (1997–2012). Results
showed that catch rates of Nephrops in multi-rig trawls were significantly higher (1.89–2.03) than those in single trawls. For cod, haddock and plaice there was no significant effect of gear type. The results are discussed in relation to the Common Fisheries Policy reform and the increasing importance of industry introduced gear modifications.
Same stock, different management: quantifying the sustainability of three shrimp fisheries in the Skagerrak from a product perspective

The northern shrimp (Pandalus borealis L.) stock in the Skagerrak is shared by Sweden, Norway, and Denmark. Although the fishery is regulated by an annual agreement between the EU and Norway, there are also national regulations as well as differences in fleet composition and shrimp markets. In early 2014, the World Wildlife Fund gave all Skagerrak shrimp a red light in their seafood consumer guide, which led to an extensive debate, especially in Sweden, about the sustainability of this fishery. The aim of this study was to quantify a set of indicators that together give a broad picture of the sustainability of the three fisheries to provide an objective basis for a discussion on needed measures. The different indicators concerned environmental, economic or social aspects of sustainability and were quantified per tonne of shrimp landed by each country in 2012. The Danish fishery was most efficient in terms of environmental and economic indicators, while the Swedish fishery provided most employment per tonne of shrimp landed. Fuel use in all fisheries was high, also when compared with other shrimp fisheries. Interesting patterns emerged, with smaller vessels being more fuel efficient than larger ones in Sweden and Norway, with the opposite trend in Denmark. The study also demonstrated major data gaps and differences between the countries in how data are collected and made available. Various improvement options in the areas data collection and publication, allocation of quotas and enforcement of regulations resulted. Product-oriented studies could be useful to follow-up performance of fisheries over time and to identify how to best utilize the Skagerrak shrimp stock. This could involve evaluating novel solutions in terms of technology and management, based on current and future scenarios aiming to maximize societal benefits generated from this limited resource, at minimized environmental impacts.

General information
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Towards a framework for the quantitative assessment of trawling impact on the seabed and benthic ecosystem

A framework to assess the impact of mobile fishing gear on the seabed and benthic ecosystem is presented. The framework that can be used at regional and local scales provides indicators for both trawling pressure and ecological impact. It builds on high-resolution maps of trawling intensity and considers the physical effects of trawl gears on the seabed, on marine taxa, and on the functioning of the benthic ecosystem. Within the framework, a reductionist approach is applied that breaks down a fishing gear into its components, and a number of biological traits are chosen to determine either the vulnerability of the benthos to the impact of that gear component, or to provide a proxy for their ecological role. The approach considers gear elements, such as otter boards, twin trawl clump, and groundrope, and sweeps that herd the fish. The physical impact of these elements on the seabed, comprising scraping of the seabed, sediment mobilization, and penetration, is a function of the mass, size, and speed of the individual component. The impact of the elements on the benthic community is quantified using a biological-trait approach that considers the vulnerability of the benthic community to trawl impact (e.g. sediment position, morphology), the recovery rate (e.g. longevity, maturation age, reproductive characteristics, dispersal), and their ecological role. The framework is explored to compare the indicators for pressure and ecological impact of bottom trawling in three main seabed habitat types in the North Sea. Preliminary results show that the Sublittoral mud (EUNIS A5.3) is affected the most due to the combined effect of intensive fishing and large proportions of long-lived taxa.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Wageningen IMARES, Cefas Weymouth Laboratory, Wageningen University & Research, University of Aberdeen, IFREMER, Marine Scotland Science, Institute for Agricultural and Fisheries Research, CNR-Istituto per la Sintesi Organica e la Fotoreattività, Hellenic Centre for Marine Research, Central Fisheries Research Institute, Bangor University, Institute of Marine Research
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Competition for marine space: modelling the Baltic Sea fisheries and effort displacement under spatial restrictions

Maritime spatial planning (MSP) and fishery management may generate extra costs for fisheries by constraining fishers activity with conservation areas and new utilizations of the sea. More energy-efficient fisheries are also likely to alter existing fishing patterns, which already vary from fishery to fishery and from vessel to vessel. The impact assessment of new spatial plans involving fisheries should be based on quantitative bioeconomic analyses that take into account individual vessel decisions, and trade-offs in cross-sector conflicting interests. We use a vessel-
oriented decision-support tool (the DISPLACE model) to combine stochastic variations in spatial fishing activities with harvested resource dynamics in scenario projections.

The assessment computes economic and stock status indicators by modelling the activity of Danish, Swedish, and German vessels (.12 m) in the international western Baltic Sea commercial fishery, together with the underlying size-based distribution dynamics of the main fishery resources of sprat, herring, and cod. The outcomes of alternative scenarios for spatial effort displacement are exemplified by evaluating the fishers’s abilities to adapt to spatial plans under various constraints. Interlinked spatial, technical, and biological dynamics of vessels and stocks in the scenarios result in stable profits, which compensate for the additional costs from effort displacement and release pressure on the fish stocks. The effort is further redirected away from sensitive benthic habitats, enhancing the ecological positive effects. The energy efficiency of some of the vessels, however, is strongly reduced with the new zonation, and some of the vessels suffer decreased profits. The DISPLACE model serves as a spatially explicit bioeconomic benchmark tool for management strategy evaluations for capturing tactical decision-making in reaction to MSP.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Thünen Institute of Sea Fisheries, Swedish University of Agricultural Sciences
Contributors: Bastardie, F., Nielsen, J. R., Eigaard, O. R., Fock, H., Jonsson, P., Bartolino, V.
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
Does population genetic structure support present management regulations of the northern shrimp (Pandalus borealis) in Skagerrak and the North Sea?

Population structuring in the northern shrimp (Pandalus borealis) in the North Sea area (including Fladen and Skagerrak) was studied by microsatellite DNA analyses. Screening 20 sample locations in the open ocean and Skagerrak fjords for nine loci revealed low but significant genetic heterogeneity. The spatial genetic structure among oceanic samples of Skagerrak and the eastern North Sea was weak and non-significant, consistent with the current management regime of one single stock. However, Skagerrak fjord samples generally displayed elevated levels of genetic differentiation, and significantly so in several pairwise comparisons with other fjords and oceanic samples. Although the Skagerrak fjord populations are of less economic value, some of them are regulated separately (e.g. the Gullmarsfjord) and local stocks may prove important to uphold genetic variability and biocomplexity in a changing environment.

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Institute of Marine Research, University of Oslo, University of Gothenburg
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Journal: ICES Journal of Marine Science
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BFI (2018): BFI-level 1
Economic gains from introducing international ITQs - the case of the mackerel and herring fisheries in the Northeast Atlantic

Achieving a balance between fishing capacity and fishing opportunities is one of the major challenges in European fisheries. One way to achieve this is to introduce individual tradable quotas or similar management measures. In several mackerel and herring fisheries in the Northeast Atlantic, such systems have already been introduced on a national basis and the long term economic gains of this have been acknowledged. This paper takes this a step further and investigates the potential economic gains from introducing individual tradable quotas between countries. Overall, the results show that the gross cash flow can be improved by 21% by allowing the mackerel and herring quotas to be traded internationally in the Northeast Atlantic. This rent gain arises mainly from increased productivity by allowing tradability between areas and fleets. The analysis also shows that the Danish pelagic fleet will gain from increasing its share of mackerel and herring quotas, whereas the Irish fleets are incentivised to sell quota, if individual quotas are allowed to be traded among countries. This result is in line with the qualitative analyses that show that Irish fishermen targeting herring in the Celtic Sea are negatively oriented towards international individual tradable quotas, whereas the Danish pelagic fishermen have strong preferences for international individual tradable quotas.

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, University of Copenhagen, National University of Ireland, University of Iceland
Contributors: Thøgersen, T. T., Eigaard, O. R., Fitzpatrick, M., Mardle, S., Andersen, J. L., Haraldsson, G.
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Web of Science (2017): Impact factor 2.109
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.7 SJR 1.376 SNIP 1.167
Web of Science (2016): Impact factor 2.235
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.07 SJR 1.611 SNIP 1.387
Web of Science (2015): Impact factor 2.453
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.09 SJR 1.457 SNIP 1.544
Web of Science (2014): Impact factor 2.61
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.71 SJR 1.49 SNIP 1.604
Web of Science (2013): Impact factor 2.621
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.54 SJR 1.35 SNIP 1.477
Web of Science (2012): Impact factor 2.23
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.07 SJR 1.429 SNIP 1.266
Web of Science (2011): Impact factor 1.865
New policies may call for new approaches: the case of Swedish Norway lobster (Nephrops norvegicus) fisheries in the Kattegat and Skagerrak

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
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New policies will require new approaches: the case of the Swedish Norway Lobster (Nephrops norvegicus) fisheries in the Kattegat and Skagerrak

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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, SP Technical Research Institute of Sweden, Swedish University of Agricultural Sciences
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Bibliographical note
Reducing the impact of blue mussel (Mytilus edulis) dredging on the ecosystem in shallow water soft bottom areas

Dredging blue mussels (Mytilus edulis) and thus removing structural elements, inducing resuspension of sediment as well as reducing filtration capacity, will inevitably affect the ecosystem. The study demonstrates that the impacts of fishing can be reduced through gear developments. A new light dredge was tested on commercial vessels using two different experimental setups. First, a twin haul experiment tested the standard gear (i.e., a Dutch dredge) against the light dredge by fishing the two gears side by side onboard the same vessel. Second, a single dredge experiment tested the absolute performance of the two gears by fishing in areas with a known blue mussel density. Results from the twin haul experiment demonstrate that the weight of sediment retained in the gear per square metre fished is 49% less in the light dredge compared with the Dutch dredge which will reduce resuspension of sediment at the surface. Also, the drag resistance of the light dredge was significantly less (177.1 vs. 202.7kg.m⁻¹). In the twin haul experiment no significant difference was found in the catch per unit effort (CPUE) of the two gears. The single dredge experiment, on the other hand, demonstrated a significant increase in CPUE exceeding 200% when using the light dredge. Seafloor tracks made by the two dredges could not be distinguished by use of side-scan sonar and the tracks were still detectable 2 months after fishing. It was concluded that replacement of the Dutch dredge with the light dredge would reduce the impact of the fishery on the ecosystem by (i) reducing resuspension of sediment, (ii) reducing fuel consumption, and (iii) potentially reducing energy transfer to the sediment through a reduced gear drag resistance. A potential increase in catch efficiency may reduce the area affected. Fishing with the light dredge is discussed in relation to management of Natura 2000 sites.
Sustainability, fuel use, and profitability: interlinked consequences of stock dynamics and choices of individual vessel spatial effort allocation within the Western Baltic

Acoustic alarms reduce bycatch of harbour porpoises in Danish North Sea gillnet fisheries

A double-blind experiment in the Danish gillnet fishery for cod (Gadus morhua) demonstrated that pingers can substantially reduce bycatch of harbour porpoises (Phocoena phocoena). Fourteen vessels fished a total of 168 days in the North Sea in 1997. In the wreck fishery the total effort was 1052 nets with active pingers, 1056 nets with dummy pingers and 74 nets without pingers. Eight porpoises were caught, all in nets with dummy pingers. In the flat bottom/stony ground fishery the total effort was 5596 nets with active pingers, 5210 nets with dummy pingers and 2973 nets without pingers. Sixteen porpoises were caught, including 1 animal in a net with active pingers, 6 in nets with dummy pingers and 9 in nets without pingers. The difference in bycatch between nets with active pingers and nets with inactive or no pingers was highly significant (p < 0.007) for both the wreck fishery and the flat bottom/stony ground fishery. We conclude that the direct effects of the pinger signals on the porpoises caused the reduction in bycatch, which means that the results can be generalized to other situations where harbour porpoises are taken in gillnets. Generalized linear modelling demonstrated that cod cpue was not affected negatively by pingers. It was furthermore estimated that the stony ground fishery had significantly lower (p < 0.001) cpue values (a factor 0.47) compared to the wreck fishery. The results of this experiment led to the introduction of pingers in Danish gillnet fisheries in 2001 and were also part of the basis for EU Council Regulation 812/2004 introducing EU-wide use of pingers.
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.85 SJR 1.049 SNIP 1.167
Web of Science (2013): Impact factor 1.843
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.78 SJR 0.948 SNIP 1.189
Web of Science (2012): Impact factor 1.695
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.7 SJR 1.162 SNIP 1.142
Web of Science (2011): Impact factor 1.586
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.063 SNIP 1.107
Web of Science (2010): Impact factor 1.656
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.994 SNIP 1.068
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.946 SNIP 1.136
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.031 SNIP 1.079
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.028 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.924 SNIP 1.139
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.964 SNIP 1.032
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.078 SNIP 1.29
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.19 SNIP 1.246
Estimation of seafloor impact from demersal trawls, seines and dredges based on gear design and dimensions

This study estimates the seafloor impact of towed fishing gears from a bottom-up perspective. Traditionally fishing pressure, often in terms of indicators, is calculated top-down using the fishing effort information available in large-scale statistics such as logbook and VMS data. Here we take a different approach using the gear itself (design and dimensions) for understanding and estimation of the physical interactions with the seafloor at the individual fishing operation level. With reference to the métier groupings of EU logbooks, we defined 17 distinct towed gear groups in European waters (11 otter trawl groups, 3 beam trawl groups, 2 demersal seine groups, and 1 dredge group), for which we established seafloor “footprints”. The footprint of a gear was defined as the relative contribution from individual larger gear components, such as the trawl doors, sweeps and ground gear, to the total area and severity of the gear impact. An industry-based vessel and gear survey covering 13 different countries provided the basis for estimating the relative impact-area contributions from individual gear components, whereas seafloor penetration and resuspension was estimated for different sediment types based on a review of the scientific literature. For each defined gear group a vessel-size (kW or total length) – gear size (total gear width or circumference) relationship was estimated to enable the prediction of gear footprint area and sediment penetration from vessel size. The implications for the definition and monitoring of fishing pressure indicators are far-reaching, and are discussed in context of an ecosystem approach to fisheries management (EAFM).
High-resolution mapping of European fishing pressure on the benthic habitats

Mapping and monitoring of pressure from fishery on the marine benthic environment is necessary to support an ecosystem approach to fisheries management (EAFM). In many cases this need is not reflected in official fisheries statistics and logbooks, where focus typically is on catch rather than effort. Consequently, most logbook information is not well suited for quantitative estimation of seafloor impact (swept area and impact severity) of the different gears and trips. We present a method to overcome this information deficiency of official statistics and develop high-resolution large-scale maps of benthic fishing pressure covering the EU, Norwegian and Turkish waters. First individual logbook observations from 13 countries were assigned to 17 different functional gear groups (métiers) based on target species and gear type information. Secondly, relationships between gear width and vessel size (e.g. trawl door spread and vessel kW) for each métier were used to assign quantitative information of bottom contact to each logbook trip by translating vessel size information into measures of gear size. Thirdly the extended logbook data was merged with high-resolution activity data (VMS) and gear width estimates were assigned to individual interpolated vessel tracks based on VMS data. The outcome was European wide high-resolution fishing intensity maps (total yearly swept area within grid cells of 1°1 minutes longitude and latitude) for 2010, 2011 and 2012. Finally the high-resolution fishing pressure maps were overlaid with existing marine habitat maps to identify areas of potential ecosystem service conflicts.

Impact of deep-sea fishery for Greenland halibut (Reinhardtius hippoglossoides) on non-commercial fish species off West Greenland

Since the late 1980s, a deep-sea fishery for Greenland halibut (Reinhardtius hippoglossoides) has been developing gradually in West Greenland. Deep-sea fish species are generally long-lived and characterized by late age of maturity, low fecundity, and slow growth, features that probably cause low resilience following overexploitation. In order to evaluate whether populations of nine potential bycatch species are negatively affected by the commercial fishery for Greenland halibut, scientific data from bottom-trawl surveys conducted in the same area and period as the commercial fishery were analysed. During the period 1988–2011, population abundance and size composition changed as catch and effort in the Greenland halibut fishery increased. Two species showed a significant decrease in abundance, and four populations showed a significant reduction in mean weight of individuals (p < 0.05). Correlation analyses show that most of the observed trends in abundance are probably not related to increasing fishing effort for Greenland halibut. The analysis did, however, show that most of the observed decreases in mean weight were significantly correlated with fishing effort during the 24-year period.
Incorporating the Benthic Ecosystem in Fisheries Management: BENTHIS a European FP7-project

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Central Fisheries Research Institute
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Event: Poster session presented at 9th International Flatfish Symposium 2014, Cle Elum, United States.
Research output: Research – Poster – Annual report year: 2014

Introducing time-varying natural mortality in the length-based assessment model for the Pandalus Borealis stock in ICES Div. IIIa and IVa east

General information
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Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Marine Living Resources, Lund University
Contributors: Jørgensen, M., Munch-Petersen, S., Nielsen, A., Søvik, G., Ulmestrand, M., Devine, J., Eigaard, O. R.
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Miljøskånsomhed og økologisk bæredygtighed i dansk fiskeri

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

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

General information
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, Centre for Ocean Life
Contributors: Eigaard, O. R., Deurs, M. V., Behrens, J., Bekkevold, D., Brander, K., Plambech, M., Schreiber Plet-Hansen, K., Mosegaard, H.
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.75
Web of Science (2014): Impact factor 2.619
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Web of Science (2013): Impact factor 2.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
Web of Science (2012): Impact factor 2.546
Seasonal migration, vertical activity and winter temperature experience of Greenland halibut Reinhardtius hippoglossoides (Walbaum) in West Greenland waters

The deep-water flatfish Greenland halibut Reinhardtius hippoglossoides (Walbaum) is common along the West Greenland coast. In the northwestern fjords, Greenland halibut is an important socio-economic resource for the Greenland community, but due to the deep and partly ice-covered environment, very little is known about its behavior and habitat characteristics. We tagged adult Greenland halibut in the waters off Ilulissat with electronic data storage tags that collected information on depth, temperature, and time. Although clear differences between individuals in migration and vertical behavior were present, we discovered a consistent seasonal migration from the relatively shallow-water Disko Bay area into the deep waters of the Ilulissat Icefjord, where the fish resided in the winter months before returning to Disko Bay. Vertical activity was pronounced at both locations, with fish covering vertical distances of up to 100 m within 15 min. During the winter months, the fish experienced temperatures between ca. 0 and 4°C, with most experiencing temperatures of 2 to 3°C. Irrespective of year and quarter of the year, the fish experienced warmer water and a broader range of temperatures when resident in Disko Bay (mean range 2.6°C) than when resident in the ice fjord (mean range 1.4°C). Using the tagged halibut as a 'live tool,' we show that parts of the ice fjord are hundreds of meters deeper than previously thought. We also document the first seawater temperature measurements made beneath the Jakobshavn Isbrae outlet glacier, revealing a positive relationship between depth and temperature for the upper 600 m and a between-year variation in temperatures beneath the ice sheet in 2001, 2002, and 2003.
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.53
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.4
Web of Science (2016): Impact factor 2.292
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.56
Web of Science (2015): Impact factor 2.361
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.79
Web of Science (2013): Impact factor 2.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.9
Web of Science (2012): Impact factor 2.546
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.85
Web of Science (2011): Impact factor 2.711
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Impact factor 2.483
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
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Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
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Web of Science (2002): Indexed yes
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Supporting bio-economic evaluation of spatial planning constraining fishing activities: be quantitative, spatially-explicit, vessel-oriented, stochastic, and dynamically coupled to fish populations

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Contributors: Bastardie, F., Nielsen, J. R., Eigaard, O. R., Fock, O., Jonsson, P., Bartolino, V.
Publication date: 2014
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Research output: Research › Conference abstract for conference – Annual report year: 2014

Technological development in fisheries management
Many marine fish stocks are overexploited and considerable overcapacity exists in fishing fleets worldwide. One of the reasons for the imbalance between resource availability and fishing capacity is technological development, which continuously increases the efficiency of the vessels—a mechanism referred to as “technological creep.” We review how the introduction of new and more efficient electronic equipment, gear design, engines, deck equipment, and catch-handling procedures influences the capture efficiency (catchability) of commercial fishing vessels. On average, we estimate that catchability increases by 3.2% per year due to technological developments, an increase often ignored in fisheries management. The documentation and quantification of technological creep improves the basis for successfully integrating the effects of technological development (and catchability changes) in fisheries management regulations and policies. Ways of counteracting the undesired effects of technological creep are discussed as are the potential management benefits from improved fishing technology. Specific suggestions are given on the selection, application, and tuning of fisheries management tools that can be used to improve the balance between harvesting capacity and resource availability.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, IFREMER, Wageningen IMARES
Contributors: Eigaard, O. R., Marchal, P., Gislason, H., Rijnsdorp, A. D.
Pages: 156-174
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Publication Information
Journal: Reviews in Fisheries Science
Volume: 22
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BFI (2018): BFI-level 1
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BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
Web of Science (2015): Impact factor 2.032
BFI (2014): BFI-level 1
Web of Science (2014): Impact factor 1.867
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Web of Science (2013): Impact factor 2.368
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Web of Science (2012): Impact factor 2.417
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Web of Science (2011): Impact factor 1.946
The Northern shrimp (Pandalus borealis) stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa east)

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Ulmestrand, M., Munch-Petersen, S., Søvik, G., Eigaard, O. R.
Publication date: 2014
Peer-reviewed: No
Event:
Research output: Research - peer-review > Journal article – Annual report year: 2014

A stochastic length-based assessment model for the Pandalus stock in Skagerrak and the Norwegian Deep
This working document describes a length based stochastic assessment model of Pandalus in ICES areas IIIA and IVA. The model describing stock development is age based, but the model also estimates the relation between age and length assuming a von Bertalanfy growth curve. The model presented in this paper is based on the assessment data presented at the 2012 NIPAG meeting, but with updated survey information. Also the estimates shown here are based on equal standard deviations for survey and catch L = (c) L, which is the natural assumption, as this parameter describes the standard deviation of the length distribution in the population

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Ecosystem based Marine Management
Contributors: Nielsen, A., Munch-Petersen, S., Eigaard, O. R., Søvik, G., Ulmestrand, M.
Publication date: 2013
Number of pages: 12
Peer-reviewed: No

Publication information
Journal: Scientific Council Research Documents NAFO
Volume: 13/074
ISSN (Print): 0256-6915
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
URLs:
Research output: Research > Conference article – Annual report year: 2014

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 flatfish fisheries 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, indicates 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 on 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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Electronic versions:
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http://www.aqua.dtu.dk/Publikationer/Forskningsrapporter/Forskningsrapporter_siden_2008
Research output: Research › Report – Annual report year: 2013

Determining optimal pinger spacing for harbour porpoise bycatch mitigation
A trial was conducted in the Danish North Sea hake gillnet fishery in July to September 2006 to determine whether the spacing of the Aquatec AQUAmark100 pinger could be increased without reducing the effectiveness of the pinger in mitigating harbour porpoise bycatch. The trial was designed as a controlled experiment where nets without pingers formed the control group (41 hauls) and nets with pingers spaced at 455 m (24 hauls) and 585 m (43 hauls), respectively, formed the 2 experimental groups. Nets without pingers had a bycatch frequency of 0.54 incidents per haul, nets with pingers spaced at 585 m had a bycatch frequency of 0.12 incidents per haul, and nets with pingers spaced at 455 m had a bycatch frequency of 0. The bycatch frequencies for the 2 experimental groups were both significantly different from the bycatch frequencies of the control group (p < 0.0001). These results show that the spacing of the Aquatec AQUAmark100 pinger can be increased without reducing the effectiveness of the pinger in mitigating harbour porpoise bycatch, thereby reducing some of the disadvantages of widespread pinger deployment. The results also stress the importance of basing implementation regulation on solid evidence and led the Danish Fisheries Directorate in 2007 to allow the use of the AQUAmark100 pinger with a spacing of up to 455 m under derogation to the European Union’s Council Regulation No. 812/2004

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Krog Consult ApS
Contributors: Larsen, F., Krog, C., Eigaard, O. R.
Pages: 147-152
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Peer-reviewed: Yes

Publication information
Journal: Endangered Species Research
Volume: 20
Issue number: 2
ISSN (Print): 1863-5407
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.55 SJR 1.188 SNIP 1.115
Discarding in the shrimp fisheries in Skagerrak and the Norwegian Deep (ICES Divs. IIIa and IVa east)
In the Pandalus fisheries in Skagerrak, shrimp are discarded because of being non-marketable, either due to poor landing quality or too small size. However, smaller shrimp of low market value are also discarded (so called high-grading). This is mainly the case in the fisheries which are constrained by TACs and subsequent national quotas. Estimates of the total amount of discards in the shrimp fisheries in IIIa and IVa east are based both on onboard sampling of catches (Denmark and Sweden) and indirect estimates (Norway). In fisheries management in the North Atlantic discarding has become an important issue in recent years. In some countries’ EEZ a ban on discarding has been in force for many years, for instance in Norway. A discard ban is expected to be enforced in EU waters in the near future. It is therefore highly relevant with estimates of the existing discard practices and discard quantities to assess the possible impacts of such measures

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

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management
Contributors: Behrens, J. W., Neuenfeldt, S., Sparrevohn, C. R., Eigaard, O. R., Boje, J.
Publication date: 2013
Integrating individual trip planning in energy efficiency – Building decision tree models for Danish fisheries

Danish fishermen have provided information on dynamics in their fuel consumption, running costs, and fishing patterns through a web-based questionnaire. This detailed documentation of the fishing practices is used in spatial modelling tools to improve advice and research for fisheries. The tools integrate detailed information on vessel distribution, catch and fuel consumption for different fisheries with a detailed resource distribution of targeted stocks from research surveys to evaluate the optimum consumption and efficiency to reduce fuel costs and the costs of displacement of effort. The energy efficiency for the value of catch per unit of fuel consumed is analysed by merging the questionnaire, logbook and VMS (vessel monitoring system) information. Logic decision trees and conditional behaviour probabilities are established from the responses of fishermen regarding a range of sequential hypothetical conditions influencing their trip decisions, covering the duration of fishing time, choice of fishing ground(s), when to stop fishing and return to port, and the choice of the port for landing. Fleet-based energy and economy efficiency are linked to the decision (choice) dynamics. Larger fuel-intensive but efficient vessels conducting pelagic or industrial fishing are more inclined to base their decision on fish price only, while numerous smaller and less efficient vessels conducting demersal mixed or crustacean fishery usually consider other flexible factors, e.g., the potential for a large catch, weather, previous knowledge and experience, and the distance to/from port, which affect the number and duration of trips and the fuel consumption. Integration of the results into our recently developed spatially explicit individual-based fishing vessel model (IBM) incorporate the variability and predict the adaptations of individual fishermen to resource availability dynamics, increasing fuel prices, changes in regulations, and the consequences of socioeconomic external pressures on harvested stocks. A new methodology is described here to obtain quantitative information on the fishermen’s micro-scale decisions initially required.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Ecosystem based Marine Management, Section for Management Systems
Contributors: Bastardie, F., Nielsen, J. R., Andersen, B. S., Eigaard, O. R.
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Publication date: 2013
Peer-reviewed: Yes

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Udvikling af effektivt og skånsomt redskab til tobisfiskeri på Dogger Banke

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography, Section for Ecosystem based Marine Management, Section for Marine Living Resources
Contributors: Behrens, J., Dinesen, G. E., Tørring, P., Eigaard, O. R., Pedersen, E. M., Stage, B., Sørensen, T. K., Mosegaard, H.
Publication date: 2013
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.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Ulrich, C., Wilson, D. C., Nielsen, J. R., Bastardie, F., Reeves, S. A., Andersen, B. S., Eigaard, O. R.
Pages: 38-47
Publication date: 2012
Peer-reviewed: Yes

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Volume: 70
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.41 SJR 0.896 SNIP 1.103
Web of Science (2017): Impact factor 2.276
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.23 SJR 0.902 SNIP 1.165
Web of Science (2016): Impact factor 1.861
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.92 SJR 0.793 SNIP 1.023
Web of Science (2015): Impact factor 1.696
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.05 SJR 0.88 SNIP 1.294
Web of Science (2014): Impact factor 1.748
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.84 SJR 0.756 SNIP 1.351
Web of Science (2013): Impact factor 1.769
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.72 SJR 0.733 SNIP 1.086
Web of Science (2012): Impact factor 1.597
ISI indexed (2012): ISI indexed yes
Precautionary sandeel fishery in Natura 2000 areas on the Dogger Bank (North Sea): a way to comply with MSFD implementation?

General information
State: Published
Organisations: Section for Population Ecology and Genetics, National Institute of Aquatic Resources, Section for Management Systems, Section for Coastal Ecology
Contributors: Behrens, J., Tørring, P., Eigaard, O. R., Dinesen, G. E., Pedersen, E. M., Sørensen, T. K., Mosegaard, H.
Publication date: 2012

Short-term choice behaviour in a mixed fishery: investigating métier selection in the Danish gillnet fishery

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Andersen, B. S., Ulrich, C., Eigaard, O. R., Christensen, A.
Pages: 131-143
Publication date: 2012
Peer-reviewed: Yes
Transforming knowledge into quantitative modelling: Danish fishers respond to a web-based survey on dynamics in fuel consumption and fishing patterns

**General information**
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Bastardie, F., Nielsen, J. R., Andersen, B. S., Eigaard, O. R.
Publication date: 2012
Peer-reviewed: No
Event: Abstract from World Fisheries Congress, Edinburgh, United Kingdom.
Research output: Research › Conference abstract for conference – Annual report year: 2012

Discarding in the shrimp fisheries in Skagerrak and the Norwegian Deep (ICES Divs. Illa and IVa east)

**General information**
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Munch-Petersen, S., Ulmestrand, M., Sevik, G., Eigaard, O. R.
Publication date: 2011
Peer-reviewed: No
Source: orbit
Source-ID: 314883
Research output: Research › Paper – Annual report year: 2011

Fishing power increases from technological development in the Faroe Islands longline fishery

**General information**
State: Published
Contributors: Eigaard, O. R., Thomsen, B., Hovgard, H., Nielsen, A., Rijnsdorp, A. D.
Pages: 1970-1982
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Journal: Canadian Journal of Fisheries and Aquatic Sciences
Volume: 68
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.44 SJR 1.329 SNIP 1.036
Web of Science (2017): Impact factor 2.631
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.56 SJR 1.388 SNIP 1.185
Web of Science (2016): Impact factor 2.466
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.22 SJR 1.267 SNIP 1.025
Web of Science (2015): Impact factor 2.437
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.6 SJR 1.476 SNIP 1.379
Web of Science (2014): Impact factor 2.287
Improving fishing effort descriptors: Modelling engine power and gear-size relations of five European trawl fleets

Based on information from an international inventory of gears currently deployed by trawlers in five European countries, the relationship between vessel engine power and trawl size is quantified for different trawl types, trawling techniques and target species. Using multiplicative modelling it is estimated that the fishing circle (or circumference) of trawls targeting shoaling species such as mackerel (Scomber scombrus) and herring (Clupea harengus) increases approximately 44.1 m with each 100 hp increase, whereas the increase for trawls targeting demersal species such as Nephrops (Nephrops norvegicus) and monkfish (Lophius piscatorius) is only approximately 9.4 m per 100 hp. Trawling technique also affects...
the relationship between vessel horsepower and fishing c

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Rihan, D., Graham, N., Sala, A., Zachariassen, K.
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Publication date: 2011
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.85 SJR 1.049 SNIP 1.167
Web of Science (2013): Impact factor 1.843
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.78 SJR 0.948 SNIP 1.189
Web of Science (2012): Impact factor 1.695
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.7 SJR 1.162 SNIP 1.142
Web of Science (2011): Impact factor 1.586
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.063 SNIP 1.107
Web of Science (2010): Impact factor 1.656
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.994 SNIP 1.068
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Influence of fleet renewal and trawl development on landings per unit effort of the Danish northern shrimp (Pandalus borealis) fishery

Recent stock assessments of the Pandalus stock in the Skagerrak (ICES Division IIIa) and the Norwegian Deep (Division IVa east) have relied largely on a time-series of landings per unit effort (lpue) calculated from Danish logbook data. Because of fleet renewal and trawl-size changes, the relationship between nominal effort data as recorded in logbooks (days fishing) and effective effort is likely to have changed, so to standardize the nominal lpue time-series, trawl-size development has been taken into account using generalized linear modelling. As logbooks do not provide trawl-size information, this standardization was made possible by retrieving technical trawl and vessel data from industry order books. These data demonstrated an approximately linear relationship between vessel engine power and Pandalus trawl size, so validated the use of vessel horsepower from the logbooks as a proxy for an unknown trawl size. Standardized lpue time-series for the past 20 years indicated a lesser increase in stock size than nominal lpue, the modelling results demonstrating that vessel lpue increased by 9.5% with each 100 hp of engine power.

General information
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Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Munch-Petersen, S.
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Issue number: 1
ISSN (Print): 1054-3139
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.98
Web of Science (2017): Impact factor 2.906
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.63
Web of Science (2016): Impact factor 2.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.18
Web of Science (2015): Impact factor 2.626
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62
Web of Science (2014): Impact factor 2.377
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.46
Web of Science (2013): Impact factor 2.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.35
Web of Science (2012): Impact factor 2.277
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.32
Web of Science (2011): Impact factor 2.007
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Impact factor 1.808
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Keywords: Engine power, Fishing power, Stock assessment, Technological development, Trawl size, Effort, Cpu
standardization
DOIs: 10.1093/icesjms/fsq141
URLs: http://icesjms.oxfordjournals.org/content/early/2010/09/07/icesjms.fsq141.abstract
Source: orbit
Source-ID: 266436
Research output: Research - peer-review › Journal article – Annual report year: 2010
Influence of grid orientation and time of day on grid sorting in a small-meshed trawl fishery for Norway pout (Trisopterus esmarkii)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Herrmann, B., Nielsen, J. R.
Pages: 15-26
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Aquatic Living Resources
Volume: 25
ISSN (Print): 0990-7440
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.66 SJR 0.296 SNIP 0.299
Web of Science (2017): Impact factor 0.525
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.41 SJR 0.606 SNIP 0.728
Web of Science (2016): Impact factor 0.448
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.39 SJR 0.755 SNIP 0.843
Web of Science (2015): Impact factor 1.327
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.25 SJR 0.649 SNIP 0.892
Web of Science (2014): Impact factor 1.014
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.15 SJR 0.556 SNIP 0.695
Web of Science (2013): Impact factor 0.919
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.19 SJR 0.553 SNIP 0.586
Web of Science (2012): Impact factor 1.071
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.17 SJR 0.633 SNIP 0.687
Web of Science (2011): Impact factor 1.152
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.612 SNIP 0.564
Web of Science (2010): Impact factor 1.062
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.486 SNIP 0.589
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.741 SNIP 0.664
Scopus rating (2007): SJR 0.66 SNIP 0.811
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.652 SNIP 0.997
The Northern shrimp (Pandalus borealis) stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa east)

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Munch-Petersen, S., Eigaard, O. R., Søvik, G., Ulmestrand, M.
Publication date: 2011
Peer-reviewed: No

Udvikling af skånsomt redskab til fiskeri af blåmuslinger

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Coastal Ecology
Contributors: Eigaard, O. R., Frandsen, R., Andersen, B., Jensen, K. M., Poulsen, L. K., Tørring, D., Bak, F., Dolmer, P.
Number of pages: 33
Publication date: 2011

Effect of fishing effort allocation scenarios on energy efficiency and profitability: An individual based model applied to Danish fisheries

General information
State: Published
Effect of fishing effort displacement scenarios on energy efficiency: an individual based model applied to the Danish fisheries

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Bastardie, F., Nielsen, J. R., Andersen, B. S., Eigaard, O. R.
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at Conference on Climate Change Effects on Fish and Fisheries, Sendai, Japan, 25-29 April, .
Source: orbit
Source-ID: 268927
Research output: Research › Poster – Annual report year: 2010

Effects of fishing effort allocation scenarios on energy efficiency and profitability: an individual-based model applied to Danish fisheries

Global concerns about CO2 emissions, national CO2 quotas, and rising fuel prices are incentives for the commercial fishing fleet industry to change their fishing practices and reduce fuel consumption, which constitutes a significant part of fishing costs. Vessel-based fuel consumption, energy efficiency (quantity of fish caught per litre of fuel used), and profitability are factors that we simulated in developing a spatially explicit individual-based model (IBM) for fishing vessel movements. The observed spatial and seasonal patterns of fishing effort for each fishing activity are evaluated against three alternative effort allocation scenarios for the assumed fishermen's adaptation to these factors: (A) preferring nearby fishing grounds rather than distant grounds with potentially larger catches and higher values, (B) shifting to other fisheries targeting resources located closer to the harbour, and (C) allocating effort towards optimising the expected area-specific profit per trip. The model is informed by data from each Danish fishing vessel >15 m after coupling its high resolution spatial and temporal effort data (VMS) with data from logbook landing declarations, sales slips, vessel engine specifications, and fish and fuel prices. The outcomes of scenarios A and B indicate a trade-off between fuel savings and energy efficiency improvements when effort is displaced closer to the harbour compared to reductions in total landing amounts and profit. Scenario C indicates that historic effort allocation has actually been sub-optimal because increased profits from decreased fuel consumption and larger landings could have been obtained by applying a different spatial effort allocation. Based on recent advances in VMS and logbooks data analyses, this paper contributes to improve the modelling of fishing effort allocation, fuel consumption and catch distribution on a much disaggregated level compared to the fleet-based models we developed so far.

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Bastardie, F., Nielsen, J. R., Andersen, B. S., Eigaard, O. R.
Pages: 501-516
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Fisheries Research
Volume: 106
Issue number: 3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Implementering af sorteringssystem til bifangstreduktion i det danske sperlingfiskeri: Afsluttende projektrapport

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Juul Larsen, J., Larsen, O. L., Eigaard, O. R.
Number of pages: 10
Publication date: 2010

Publication information
Original language: Danish

Bibliographical note
Projektet er finansieret af EU og Fødevareministeriet under tilskud til Fælles initiativer inden for fiskeri- og akvakultursektoren
Source: orbit
Source-ID: 268819
Research output: Research › Report – Annual report year: 2010

Management challenges from technological development in commercial fisheries

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R.
Number of pages: 113
Publication date: 2010

Publication information
Place of publication: Wageningen
Publisher: Wageningen University and Technical University of Denmark, National Institute of Aquatic Resources
ISBN (Print): 978-90-8585-680-1
Original language: English
Electronic versions:
Phd_thesis_Ole_Eigaard.pdf

Bibliographical note
Supervisors: A.D. Rijnsdorp and J. Rasmus Nielsen
Source: orbit
Source-ID: 267155
Research output: Research › Ph.D. thesis – Annual report year: 2010

Rejerne i Skagerrak skal kortlægges

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Munch-Petersen, S.
Pages: 9
Publication date: 2010
Peer-reviewed: Unknown

Publication information
The northern shrimp (Pandalus borealis) stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa East)

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Munch-Petersen, S., Eigaard, O. R., Søvik, G., Ulmestrand, M.
Number of pages: 24
Publication date: 2010
Peer-reviewed: No
Source: orbit
Source-ID: 267928
Research output: Communication › Contribution to newspaper - Newspaper article – Annual report year: 2010

A bottom-up approach to technological development and its management implications in a commercial fishery

Analyses of electronic equipment on board Danish trawlers and gillnetters show that newer, larger vessels have a significantly higher "technological level" than older, smaller vessels. A hypothesis of linkage between fish-finding and navigation technology on board and standard vessel characteristics was tested based on the definition of a technological index. Using a proportional odds model, vessel length accounted for most of the variation in technological level on board, with odds of 1.17 (95% confidence interval: 1.16–1.18) of a higher index value for each increase in vessel length of 1 m. Vessel age was also significantly correlated with index values. In considering the technological index as an indicator of fishing power, the results have important implications for capacity-reduction schemes intended to reduce harvest pressure on fish stocks. In the course of such structural management plans, older, smaller vessels of a fleet are often replaced with newer, larger vessels within a fixed or reduced nominal capacity limit (e.g. total fleet tonnage), but according to the findings presented, nominal capacity reduction in fleet level may be undermined by increases in individual vessel fishing power.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R.
Pages: 916-927
Publication date: 2009
Peer-reviewed: Yes
By-catch reduction in a small meshed North sea trawl fishery through gear developments

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Nielsen, J. R.
Pages: 1-18
Publication date: 2009
The northern shrimp (Pandalus borealis) stock in Skagerrak and the Norwegian Deep (ICES Divisions IIIa and IVa East)

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Munch-Petersen, S., Eigaard, O. R., Søvik, G., Ulmestrand, M.
Number of pages: 22
Publication date: 2008

Host publication information
Title of host publication: NAFO / SCR Document
Volume: 08/76
Publisher: NAFO
Source-ID: 286915
Research output: Research › Article in proceedings – Annual report year: 2008
Reduction of harbour porpoise (Phocoena phocoena) bycatch by iron-oxide gillnets

General information
State: Published
Organisations: Section for Management Systems, National Institute of Aquatic Resources
Contributors: Larsen, F., Eigaard, O. R., Tougaard, J.
Pages: 270-278
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: Fisheries Research
Volume: 85
Issue number: 3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.85 SJR 1.049 SNIP 1.167
Web of Science (2013): Impact factor 1.843
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.78 SJR 0.948 SNIP 1.189
Web of Science (2012): Impact factor 1.695
Slutrapport TEMAS (Technical measures - development of evaluation model and application in danish fisheries)

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries- and Monitoring Technology
Number of pages: 31
Publication date: 2007

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

Bibliographical note
Modelling the effect of interaction between fish morphology and mesh shapes on discard levels in mixed fisheries

**General information**
State: Published
Organisations: Section for Fisheries- and Monitoring Technology, National Institute of Aquatic Resources, Section for Management Systems
Contributors: Lundgren, B., Herrmann, B., Krag, L. A., Frandsen, R., Madsen, N., Stæhr, K., Eigaard, O. R.
Publication date: 2006
Peer-reviewed: No
Event: Poster session presented at Fishing technology in the 21. century, Boston, MA, 
Source: orbit
Source-ID: 238723
Research output: Research › Poster – Annual report year: 2006

A retrospective analysis of technical creeping: trends and effects

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries Advice
Pages: 1-33
Publication date: 2005
Peer-reviewed: No

**Publication information**
Journal: I C E S Council Meeting
Volume: 10
ISSN (Print): 1015-4744
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2003): Indexed yes
Original language: English
URLs:
http://www.ices.dk/products/cmdocsindex.asp
Source: orbit
Source-ID: 226587
Research output: Research › Conference article – Annual report year: 2005

Tekniske reguleringer af fiskeriet - ikke bare teknik!

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R., Andersen, B. S., Christensen, A.
Pages: 38-48
Publication date: 2004
Peer-reviewed: No

**Publication information**
Journal: Fisk og Hav
Issue number: 57
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
URLs:
The effective selectivity of a composite gear for industrial fishing: a sorting grid in combination with a square mesh window

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries- and Monitoring Technology
Contributors: Eigaard, O. R., Holst, R.
Pages: 99-112
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Fisheries Research
Volume: 68
Issue number: 1/3
ISSN (Print): 0165-7836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 0.941 SNIP 0.959
Web of Science (2017): Impact factor 1.874
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 1.183 SNIP 1.153
Web of Science (2016): Impact factor 2.185
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.01 SJR 1.092 SNIP 1.131
Web of Science (2015): Impact factor 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.17 SJR 1.122 SNIP 1.305
Web of Science (2014): Impact factor 1.903
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.85 SJR 1.049 SNIP 1.167
Web of Science (2013): Impact factor 1.843
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.78 SJR 0.948 SNIP 1.189
Web of Science (2012): Impact factor 1.695
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.7 SJR 1.162 SNIP 1.142
Web of Science (2011): Impact factor 1.586
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.063 SNIP 1.107
Web of Science (2010): Impact factor 1.656
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.994 SNIP 1.068
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.946 SNIP 1.136
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.031 SNIP 1.079
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.028 SNIP 1.274
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.924 SNIP 1.139
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.964 SNIP 1.032
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.078 SNIP 1.29
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.19 SNIP 1.246
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.933 SNIP 0.902
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.541 SNIP 0.816
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.565 SNIP 0.838
Original language: English
Source: orbit
Source-ID: 225366

Research output: Research - peer-review › Journal article – Annual report year: 2004

**DFU's standardtrawl: Konstruktion og sammenlignende fiskeri**

**General information**
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Coastal Ecology
Contributors: Eigaard, O. R., Støttrup, J., Hoffmann, E., Hovgård, H., Poulsen, S.
Number of pages: 45
Publication date: 2003

**Publication information**
Place of publication: Charlottenlund
Publisher: Danmarks Fiskeriforundersøgelser
ISBN (Print): 87-90968-51-4
Original language: Danish
(DFU-rapport; No. 126-03).
Electronic versions:
126-03_dfus_standardtrawl_konstruktion_og_sammenlignende_fiskeri.pdf
URLs:
http://www.difres.dk/dk/publication/files/07012004$126-03%20DFUs%20standardtrawl.pdf
Source: orbit
Source-ID: 225363
Research output: Research › Report – Annual report year: 2003

**Moderne dansk linefiskeri**

**General information**
State: Published
Experiments with reduction of harbour porpoise by catch using high density gill nets: Final report to the Danish Ministry of Food, Agriculture and Fisheries

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems
Contributors: Eigaard, O. R.
Publication date: 2002

Publication information
Publisher: [s.n.]
Original language: English
Source: orbit
Source-ID: 225364
Research output: Research › Report – Annual report year: 2002

On the efficiency of a hand-towed two-metre beam trawl and two different designs of push nets for catching juvenile flounder (Platichthys flesus)

General information
State: Published
Organisations: Section for Coastal Ecology, National Institute of Aquatic Resources, Section for Management Systems
Contributors: Nicolajsen, H., Carl, J., Sparrevoehn, C. R., Eigaard, O. R.
Publication date: 2002
Peer-reviewed: No
Event: Poster session presented at 5th International Symposium on Flatfish Ecology, Isle of Man, United Kingdom.
Source: orbit
Source-ID: 284384
Research output: Research › Poster – Annual report year: 2002
Summer inputs of riverine nutrients to the Baltic Sea: Bioavailability and eutrophication relevance
Most nitrogen and phosphorus transported by world rivers to the oceans is associated with dissolved organic matter. However, organic matter as a potential source of N and P has hitherto been largely neglected in studies of coastal microbial food webs. We examined 50 rivers, draining a major part of the Baltic Sea watershed, with respect to summer concentrations, chemical composition, and biological availability of N and P. The broad spectrum of rivers studied enabled us to assess whether the input of terrigenous organic matter can be an important nutrient source, at various levels of anthropogenic loading of inorganic N and P. Concentrations of total N and P ranged from 9 to 220 mumol/L and from 0.14 to 5.66 mumol/L, respectively, with the highest concentrations in the southern part of the Baltic Sea drainage area and in several rivers on the Finnish western coast. Urea and dissolved combined amino acids (DCAA) each constituted 4-20% of dissolved organic nitrogen (DON), while dissolved free amino acids (DFAA) made up...
The effective selectivity of a composite gear: An industrial sorting grid in combination with a window panel

General information
State: Published
Organisations: Section for Fisheries- and Monitoring Technology, National Institute of Aquatic Resources, Section for Management Systems
Contributors: Holst, R., Eigaard, O. R.
Pages: 1-16
Publication date: 2002

Host publication information
Title of host publication: Papers presented at ICES FTFB Working Group Symposium
Publisher: International Council for the Exploration of the Sea
Source: orbit
Source-ID: 237036
Research output: Research › Article in proceedings – Annual report year: 2002

Development and testing of a grid system to reduce bycatches in Norway pout trawls

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Fisheries- and Monitoring Technology
Contributors: Eigaard, O. R., Holst, R., Hansen, K.
Number of pages: 32
Publication date: 2001
Udvikling af standard garnserie til brug ved bestandsanalyse af flad- og rundfisk i marine lavvandede områder

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Management Systems, Section for Coastal Ecology
Contributors: Eigaard, O. R., Støttrup, J., Hovgård, H.
Publication date: 2000

Projects:

Sand banks and fisheries impact in relation to EU fisheries and environmental policy (39519)
Objective of the project: The project will improve the knowledge base for ongoing and upcoming Natura 2000 and MSFD implementations in the North Sea. For nature-type 'sand banks', in particular Danish sandeel and plaice fishing will be affected. Activities in the project: The key activities of the project are targeted method developments and knowledge production in relation to EU fisheries and environmental policy: 1) Development of a gear and sediment-specific model for bottom impact from all types of mobile bottom-contacting fishing gears in the North Sea. 2) Field trials to document short-term impact on sandbank fauna from demersal seine fishery. 3) Analyses of data from the seine gear field trials and of existing data for the impact of sandbanks from trawlers, including impact differences between bottom and floating trawl doors. 4) Estimation of sediment impact from natural disturbance on sand banks (e.g. tide and wave impact) as well as scaling of these in relation to physical effects of different types of gear. 5) Integrated analysis of the impact of different fisheries and other pressure factors on sand banks. 6) Dissemination. Project Expected Effects: The project's results and method developments can be used directly in the management to separate different fisheries with regard to bottom impact; e.g. by nature conservation via area restrictions. Activity 4 and 5 will generate management tools that can quantitatively address descriptor 6 under the Marine Strategy Framework Directive relative to sand banks. The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF).
Eigaard, O. R., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Dinesen, G. E., Project Manager, National Institute of Aquatic Resources
Gislason, H., Project Participant, National Institute of Aquatic Resources
Bastardie, F., Project Participant, National Institute of Aquatic Resources
Nielsen, J. R., Project Participant, National Institute of Aquatic Resources
Egekvist, J., Project Participant, National Institute of Aquatic Resources
Pedersen, E. M., Project Participant, National Institute of Aquatic Resources
Støttrup, J. G., Project Participant, National Institute of Aquatic Resources
Nielsen, A., Project Participant, National Institute of Aquatic Resources
Hansen, F. T., Project Participant, National Institute of Aquatic Resources
O’Neill, B., Project Participant, National Institute of Aquatic Resources
Noack, T., Project Participant, National Institute of Aquatic Resources
Lundgaard, L. S., Project Participant, National Institute of Aquatic Resources
Hansen, A. D., Project Participant, National Institute of Aquatic Resources
Other pressure factors in the marine environment than nutrients (39529)

Anthropogenic pressures are potentially of major importance to the ecological state of the marine environment. In coastal areas, the ecological state of the marine environment is assessed according to the EU Water Framework Directive (WFD) using the quality elements phytoplankton, angiosperms (eelgrass), macro algae and benthic fauna. Additional supportive parameters like Secchi depth and occurrence of anoxia or hypoxia can be included in the assessment. Extensive research efforts have shown that excessive loading of the nutrients nitrogen and phosphorus are the most important pressure factors in the coastal marine environment of Denmark. However, other pressure factors like e.g. fisheries, gravel and sand extraction, invasive species, run-off of micro plastics and hazardous substances and physical modifications like sluices and dams. For Danish coastal areas, there is no overarching perspective to other pressure factors than nutrients and assessment of their potential impact on environmental status. In the present project, the aim is to assess the potential impact of a number of expected pressure factors other than excess loading of nutrients and effects of climate changes on environmental state of the Danish water bodies according to the WFD. The assessment will be based on existing knowledge and existing data. The assessment will be performed as a review of documented effects of the different pressure factors on the quality elements and supportive parameters, assessment of data availability for analysis on water body level and documentation of dependence on the pressure factor of external environmental parameters like salinity and temperature. Based on the review of each pressure factor, an analysis will be performed to assess the impact of the pressure factor on the indicators depth limit of eelgrass, DKI and concentration of chlorophyll a during the summer period. The analysis will only be performed if an effect of the pressure factor is well documented and sufficient data are available. Finally, the project will assess how pres factors can be cumulated. The project is funded by the Danish Environmental Protection Agency and is coordinated by DTU Aqua.

Petersen, J. K., Project Coordinator, National Institute of Aquatic Resources, Danish Shellfish Centre
Rindorf, A., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Gislason, H., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Christensen, A., Project Participant, National Institute of Aquatic Resources, Section for Marine Living Resources
Eigaard, O. R., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

The effect of bottom trawling on marine bottom fauna and eelgrass (ØB Bundfauna) (39192)

The project provided input to the analysis of the impact of fishing on the ecological quality of the Danish marine environment to the Danish Nature Agency in relation to the water plans needed in connection with the implementation of the Water Framework Directive. It contained three subprojects: - Quantifying the area of seabed swept by Danish bottom trawl fisheries. - Quantifying the impact of bottom trawling on marine benthos. - Quantifying the possible interaction between bottom trawling and the depth distribution of eelgrass (Zostera marina). This project was coordinated by DTU Aqua. The Project was funded by the Danish Nature Agency.

Gislason, H., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

Effects on benthic habitats of fishing activities

McLaverty, C., PhD Student, National Institute of Aquatic Resources
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15/12/2015 → 16/06/2019
Award relations: Effects on benthic habitats of fishing activities
Project: PhD

Danish seine - Ecosystem effects of fishing
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Using commercial gears to sample ecosystem effects
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15/12/2013 → 30/09/2017
Award relations: Using commercial gears to sample ecosystem effects
Project: PhD

Development of a by-catch excluder for the Danish and European trawl fisheries (39285)
The project aims to develop and test a widely usable gear that effectively sorts out unwanted species and sizes of fish during trawling. This objective should be seen in light of a future discard ban for the EU—a ban which, in Denmark and in other European countries, will result in a growing demand for technical solutions that can increase the sorting of fish in the gear during fishing. The development work of the project is based on a so-called "Excluder system" that can be integrated into most standard trawl gears. The "Excluder system" is developed for the North American market by Tor-Mo Trawl in Hirtshals in collaboration with the Green Line Fishing Gear. The Excluder is used today on a voluntary basis by approximately 15 large fishing vessels in Alaska, but is not directly applicable in Danish and European fisheries because the species composition, trawl size and type of vessel is significantly different in fisheries in Alaska. The project's main result will be the development, testing and documentation of an Excluder system, which is targeted the Danish and European trawl fisheries. In light of the political development in EU, a very large market potential is expected to appear for such an Excluder and the redemption of this market potential will result in 1) more successful implementation of the discard ban, 2) more selective and sustainable fisheries, and 3) increased growth and revenue for companies in the project. This project is coordinated by Denmark's Pelagic Producer Organisation. The project is funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).
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01/01/2015 → 31/12/2016
Keywords: Research areas: Fisheries Management & Fisheries Technology
Collaborators: Denmark's Pelagic Producer Organisation, Tor-mo trawl ApS, HG62 Beinur, Greenline Fishing Gear
Project: Research

The shrimp fisheries in the Skagerrak area of Sweden, Norway and Denmark analyzed using a systems perspective (39191)
In recent years the Shrimp stock in the Skagerrak has been drastically reduced. The three countries, who fish on the stock, differ substantially in terms of fleet structure, national quota management, fishing patterns and market. The market situation combined with the quota being fished has led to incentives for discarding of smaller shrimps (high-grading), mainly in the Swedish fishery. Discard of shrimp has been banned in Europe for a few years, and in 2016 more general EU discard ban will be implemented. Therefore the development of more size selective gear is being pushed in several
countries. The developments in the stock, the differences in the three countries' resource utilization and the coming management changes makes it very interesting to map and compare environmental and socio-economic aspects of the three countries' shrimp fishing in the Skagerrak. Life Cycle Assessment (LCA) is an ISO-standardized methodology that maps resource consumption and environmental impact of products from a systems perspective. There are now a number of case studies where you look at the role of management in the impact of the product. In these cases the product is mostly followed only during fishing until landing (not during processing, packaging and distribution after landing). A Canadian study compared Canadian and American fishing on the same stock of lobster using LCA and demonstrated significant differences in environmental impacts that mainly depended on the countries' management. The aim of this study was to quantify a set of indicators that together give a broad picture of the sustainability of the three fisheries to provide an objective basis for a discussion on needed measures. The different indicators concerned environmental, economic or social aspects of sustainability and were quantified per tonne of shrimp landed by each country in 2012. The Danish fishery was most efficient in terms of environmental and economic indicators, while the Swedish fishery provided most employment per tonne of shrimp landed. Fuel use in all fisheries was high, also when compared with other shrimp fisheries. Interesting patterns emerged, with smaller vessels being more fuel efficient than larger ones in Sweden and Norway, with the opposite trend in Denmark. The study also demonstrated major data gaps and differences between the countries in how data are collected and made available. Various improvement options in the areas data collection and publication, allocation of quotas and enforcement of regulations resulted and are described in more detail in a scientific paper in ICES Journal of Marine Science in 2016. This project was coordinated by SIK-SP Food and Bioscience. The project was funded by NordForsk, Nordic Council of Ministers.

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01/05/2014 → 30/04/2015
Keywords: Research area: Fisheries Management
Collaborators: Swedish University of Agricultural Sciences, SIK-SP Food and Bioscience, SINTEF
Project: Research

**Benthic ecosystem fisheries impact study (BENTHIS) (39021)**

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

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01/10/2012 → 30/09/2017
Keywords: Research areas: Fisheries Management & Observation Technology & Fisheries Technology & Ecosystem based Marine Management
Project: Research

**Efficient and low impact gear in the Danish fishery for industrial species (GUDP Tobis) (38849)**

The aim of the project was to ensure the future of the Danish industrial fisheries in the increasing demands for reduced environmental impact. The Danish industrial fisheries amount to around 800 million DKK a year in first value. The industrial fishing for sandeel, was seen threatened by a potential ban against bottom trawling in the main fishing areas at Dogger Bank in the North Sea, due to appointment of a large Natura 2000 area by UK, the Netherlands and Germany. Bottom trawl could be considered to affect the conservation status of the sand habitat negatively. In addition
profitability was threatened by the high vessel operating cost, considering fuel prices at the time. The objective was to develop and document a fishing method for industrial fisheries (sandeel, Norway pout and sprat) where the trawl doors don't have bottom contact and where modern materials are used in the gear and for the wire. Thus, compared to traditional gear, an overall energy saving of minimum 30% on each kg fish caught was expected, and also the damages on the benthic fauna was expected to be reduced or eliminated. The new pelagic gear was constructed according to specifications. It behaved as intended and could easily be operated on Dogger Bank. The new gear consisting of pelagic doors and Dynema equipped trawl has attracted considerable attention among fishers and can be considered a business success. Catch volumes (tons/hour) did not differ between the experimental and standard trawl under parallel fishing. Sandeel behavioral differences could not be identified from sonar and UV-camera recordings, and size and oil content of sandeels was not systematically different between the two gears. Calibration experiments demonstrated 24 % lower fuel consumption in the new trawl. Bottom surveys were carried out annually from 2012 to 2014 in the North-eastern part of Dogger Bank (in the Dutch/NL EEZ) at approximately 35 meters depth. Sediment analyses showed a grain size composition dominated by fine sand mixed with small amounts of gravel, whereas fine particles comprises 1 % maximum ideal as a sandeel habitat. Grain size composition was not altered by trawling or time. Bottom impact with new gear is estimated to be 30 % reduced compared to a similar trawl using conventional doors. Based on the side-scan sonar recordings it was not possible to distinguish differences between the two trawl types in sediment depth penetration. The foot prints left by both sandeel trawls in one year were not discernible in subsequent years. Results from the video record analyses showed especially conch and hermit crabs were more abundant soon after trawling compared to before impact. The sediment analyses revealed nearly 100 different invertebrate species many of which lives burrowed or tube building in the sand. Overall diversity did not differ significantly between transects trawled by the two gears and the non-trawled transect. Detailed analyses showed, however, that some species (fragile sea anemones, polychaetes and echinoderms) were less abundant after impact from the conventional trawl compared with the newly-designed trawl and the control transect. A few species were more abundant in the transect trawled by the conventional trawl, including some smaller crustaceans. These results suggest the newly-designed sand eel trawl has a lower impact on benthic fauna than the conventional trawl and we expect the final analyses will support these results. The project is coordinated by DTU Aqua. The project was funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).

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01/01/2012 – 05/01/2015
Keywords: Research areas: Marine Living Resources & Fisheries Management & Observation Technology
Collaborators: Thyborøn Harbours Fishermen’s Association, Northsea Trawl, Thyborøn Trawldoor.dk
Project: Research

Selective and low impact gear for fishing live nephrops (39042)

The Danish nephrops fishery is important with an annual value of the landings of approximately 300m DDK. The quota is high as many nephrops inhabit the inner Danish waters. However, cod is a frequent by-catch which is problematic due to low cod quotas, and resuitantly, nephrops quota a rarely fully exploited. Furthermore, nephrops are traditionally fished with bottom trawl which exert high impact on the seabed. The first aim of the project is to solve the cod by-catch issues by using trawling speed as a selective mechanism, which will take advantage of the superior swimming capabilities of cod as compared to nephrops. Lowering the trawling speed will enable cod to escape the trawl while still ensuring nephrops catch. The second aim is to design and implement a new type of trawl doors that do not touch the seabed and highly reduce impact of the sweeps. Besides, materials used for the new trawl will be produced in much lighter and stronger materials than the traditional trawls. Altogether this reduces the drag in the water and fuel consumption considerably. Trawling at a lower speed lessens the mechanical damage to the nephrops and this enhances their chances of survival. The project will take this one step further by establishing gentle handling routines on board the ships, in addition to appropriate conditions for keeping live animals. Physiological tests will define threshold levels in relation to temperature, light and moist, and characterise the most favourable conditions for further survival. Besides optimising conditions on board the ships this knowledge will be used in relation to temporary storage and to ensure optimal conditions during transport of live nephrops to southern Europe. The final aim of the project is thus to establish an export chain of live nephrops to markets in southern Europe. This can provide the fishermen up to three times the price as compared to when landing nephrops on ice, and the price that the Danish export companies’ gain will likewise increase. Within the project we successfully developed and tested pelagic doors for use in the nephrops fishery, showing that it is indeed possible to implement these in this fishery. Using reduced speed as a way to allow escape of round fish from the trawl (i.e reduce catch of these) did however not work as anticipated, and cannot be recommended for future practice. We tested the effects on survival of nephrops of sprinkling with fresh seawater on-board after trawling, light- and air exposure and various temperatures. Of these, air exposure and air temperature (the higher the worse) had the greatest effect on survival and in determining the period it took for nephrops to recover from post trawling and handling stress. Furthermore, a ‘one-tough’ packing system, including optimal conditions for the animals when transported, was successfully developed, tested and implemented, resulting in up to 95% survival of nephrops transported by truck to southern Europe. Finally, a manual with guidelines for optimal practic for fishery and export of live nephrops was made. The project was coordinated by AquaMind and CATch-Fish. The project was funded by Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).
Development of a sorting grid for the Danish Norway pout fishery (38954)

The objective of the project was to ensure a sustainable Danish fishery for Norway pout through the development of a sorting grid that minimizes unwanted by-catch. Through a series of grid designs and tests the project: - developed a durable and easy-to-handle grid which can sustain the large strains on gear and decks equipment typical of the Norway pout fishery. - identified an optimal bar spacing for the grid, that reduces by-catch to the extent possible without jeopardizing the rent ability of the fishery through large losses of target species. As a consequence of the scientific work in the project a sorting grid-system was made mandatory in the Danish trawl fishery for Norway pout to reduce unwanted by-catch (Danish legislation in 2013). The project was coordinated by Danish Fishermen's Association. The project was funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).

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Integrated management of agriculture, fishery, environment and economy – a strategic research alliance (IMAGE/MAFIA) (38772)

Background and Objectives Management of terrestrial and aquatic ecosystems is legally defined in several European directives. The scientific basis for implementing the directives has been limited by insufficient models, deficiencies in terms of uncertainties, local and regional aspects and lack of knowledge on the interplay between agriculture, fishery, environmental qualities in all surface waters, and economy. The project aimed to establish an interdisciplinary and international approach designed to establish a body of knowledge to develop tools, models, scenarios and predictions in order to integrate science and management from agriculture, fishery, aquatic environments and economy into a common platform. The main aims were to link the complex interplay between land use in the drainage basins, the transport of nutrients to water bodies, biogeo-chemistry of freshwater and marine water, marine ecosystem dynamics and the removal of biomass and nutrients in marine fisheries all integrated into a management strategy evaluation (MSE) framework consisting of linked catchment area and river-run-off models, marine bio-geo-chemical models, end-to-end marine ecosystem models, fishery models, economic and cost-minimization models, and ecosystem services assessments models. Such a complex model and MSE framework could be used to assess effects of changing market conditions, changed agricultural and fishery support policies, as well as fulfillments of water related directives. Tasks and Deliverables The Danish Strategic Research Council financed project IMAGE was a strategic research alliance between central Danish and international fisheries and marine environment based university institutes. The project integrated, educated, and trained new researchers and private and public end-users to develop and work with a number of empirical and dynamic models and management tools, further developed into cross traditional media and science-based decision support systems, to strengthen national and international environmental management. The results published in a high number of scientific peer reviewed articles have provided major scientific progress. The results and research quality included analyses of novel processes and development of new and improved models, integrated prognoses and scenarios for the interplay between changes in the drainage basins and the ecological and economic consequences, and a number of science-based decision support tools. The work involved (i) identification of key elements and reduction of uncertainties in using complex models, (ii) designing, developing and integrating important new concepts in the models, (iii) linking models and evaluating their ability to detect and follow changes in terrestrial environments into ecological and economic consequences, and (iv) strengthened Danish research in linking science, modeling and management of the environment and economics and thereby consolidating a strong international position. The DTU Aqua has focused on further development, implementation and validation of advanced models and fisheries and ecosystem management evaluation tools: Development, calibration and implementation of the Baltic ATLANTIS end-to-end ecosystem and tropho-dynamic model linked to the HBM-ERGOM physical and bio-geo-chemical models and the FISHERENT fishery economic model; Further development and implementation of the bio-economic and individual vessel based multi-stock-multi-fleet DISPLACE simulation model; Dynamic coupling of the Baltic FLR multi-stock-multi-fleet bio-economic model to the SMS-Multi-Species model. The focus has been on biological interactions and integrated fisheries interactions. Partners The project had 12 project partners mainly from Danish universities (AU, DTU, KU, SDU) and national fisheries economics and fisheries research institutes (SMHI Sweden), but also from American, Swedish and Finnish universities as well as SMEs
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.

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01/01/2004 → 31/12/2009

Keywords: Research area: Fisheries Management
Project: Research
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.


01/01/2012 → 29/02/2016

Keywords: Research areas: Ecosystem based Marine Management & Fisheries Management & Marine Living Resources
Project: Research

Sustainable shrimp fishery in Skagerrak (38994)
The main objective of the Norwegian-Swedish-Danish research project "Sustainable shrimp fishery in the Skagerrak" was to clarify whether there are one or more shrimp stocks in the Skagerrak. The management of shrimp fishing in the Skagerrak and Norwegian Deep is based on the perception of the shrimp resource as one large population. However, biological differences between shrimps (e.g. the size at sex change) indicate that there may be several stocks in the area. The question of one or more stocks was answered by collecting and genetically analyzing several thousand shrimp from Skagerrak and northern Kattegat, Norwegian Channel and the Norwegian fjords. The analyzed shrimps came both from research cruises and commercial fisheries. The kinship of the collected shrimp was examined with modern DNA technique and the results compared with existing knowledge of the biology of the species. This knowledge was obtained from scientific sources as well as from the fishing industry in terms of skipper interviews. The genetic analyses revealed that shrimps in Skagerrak and Norwegian Deep all belong to the same stock, but also that some of the fjord-populations are genetically distinct (can be considered separate stocks). These results are published in ICES Journal of Marine Science in 2015. The fisher information collected in the project was not only focused on shrimp biology but also addressed economical and technical aspects of the shrimp fishery. In this way, scientists have gained an understanding of both how shrimp populations are structured and distributed in the Skagerrak and of the economic importance. The exchange of knowledge between researchers and fishers was an important aspect of the project and was facilitated by regular meetings and interview schemes in all three countries. Another primary objective of the project was to improve the current assessment of the Skagerrak shrimp stock by developing a new length-based analytical model. DTU Aqua was in charge of this part of the project and in an assessment benchmark in 2012 the developed model was accepted. The project was coordinated by Institute for Marine Research, Norway. The projected was funded by EU, InterReg (regional collaboration). Eigaard, O. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

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01/01/2010 → 31/12/2013

Keywords: Research areas: Fisheries Management & Marine Living Resources Collaborators: Norwegian Directorate of Fisheries, Lund University, Norwegian Fishermen’s Association, Ministry of Environment and Food of Denmark, Institute of Marine Research, University of Gothenburg, Danish Fishermen’s Association
Project: Research
Development of fisheries with minimized emission of greenhouse gases (DEGREE) (38686)
Identification of methods and prioritization of areas for actions of minimizing greenhouse gas emissions, optimizing fuel consumption and, thus, improve the economy and reducing the environmental effects of fishing on marine habitats. The focus is on fishing with trawls. Two different strategies (work packages) are considered in the project: 1) Development of new and more energy efficient trawls. This work package targets the development of trawl design with improved relationship between capture efficiency and/or catch value in relation to energy use for towing the gear. In this work package we apply an internationally developed computational model based on fluid mechanics and finite element methods and models to predict the capture efficiency of trawl. Through computer simulations we investigate the predicted ratio between catch value and fuel consumption for different trawl designs. These simulations are accordingly applied to identify the most favorable trawl design with optimized value of the catch in relation to the fuel consumption to tow the trawl.

Through international cooperation, we also experimentally examine the consequences on catch efficiency of applying high strength thin twine netting with low drag in sections of trawls. 2) Fisheries tactics and management in relation to energy efficiency in fisheries effort allocation for different fisheries: This work package analyze management options for different types of fisheries, to investigate opportunities and incentives to achieve the same value (and catch) in fisheries with less effort or re-allocation of effort and consequently less fuel consumption. Advanced computer based bio-economic fisheries simulation models are developed and used in fleet and stock-based scenario analyses for energy efficiency in fishery by integrated evaluation of fishing effort, catch, catch composition and utilization, economics, and fuel consumption under given effort allocation schemes. This involves development and implementation of a generic bio-economic Individual Based Model (IBM) that works on individual vessel basis and which can simulate multi-stock-multi-fleet (mixed) fisheries and evaluate on a scale of very high resolution in time and space. This computer based management evaluation tool and simulation model can evaluate economic cost-benefits, biological impacts according to fish stock sustainability, as well energy efficiency according to catch in weight and value per fuel volume consumed and/or in relation to total fuel costs for different management scenarios. The implementation of the IBM model involves additionally development of advanced statistical and computer based models and methods for coupling information from logbook databases with information from VMS tracking (satellite monitoring) databases on vessel and fishing trip basis. Furthermore, it involves development of a web-based questionnaire and platform to obtain information from the Danish fishery on cost dynamics with focus on fuel costs and effort allocation. The project is coordinated by DTU Aqua.

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01/01/2008 → 31/12/2012
Keywords: Research area: Fisheries Technology & Fisheries Management
Collaborators: Technical University of Denmark, Johann Heinrich von Thünen-Institute, IFREMER
Project: Research

Development of fishing gears with reduced effect on the environment (DEGREE) (38222)
The DEGREE project main objectives were to (i) develop new gears and fishing techniques with a lower impact on benthic habitats, (ii) to quantify the potential reduction of the physical impact as well as the negative effects on benthic communities caused by the innovations and (iii) to weigh the socioeconomic consequences of these changes against those of alternative management measures, such as the closing of areas. The project consisted of six work packages (WPs), focusing on management and coordination, modelling and quantification of benthic impacts, otter trawl modifications, beam trawl and dredge modifications, economics, dissemination and implementation of knowledge. The DEGREE project fulfilled its primary objectives and combined expertise of the technology, biology and economy sectors. A number of alternative fishing gears and gear modifications were developed, with the potential to lower mortality of benthic invertebrates and non-target demersal fish. The bottom impact of the new gear designs and practices were assessed by modelling effects on sediments, comparative fishing experiments, observing tracks made on the sea bed. The economic consequences of using the new gear were analyzed for a number of cases. Among the gears tested and demonstrated to have reduced seabed impact were otter trawls with light weight doors and low impact ground gear, pulse trawls, light beam trawls and low impact oyster dredges. It was recommended to further work on the project findings through the development of innovative tools to enable an integrated evaluation of ecosystem effects of the developed alternative fishing gears, which were designed to decrease the impact on marine ecosystems and contribute to sustainable fisheries. The project was coordinated by IMARES, Wageningen UR, The Netherlands.

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01/01/2006 → 31/12/2009
Keywords: Research area: Fisheries Technology
Survey of existing bio-economic models (38589)
The project “Survey of existing Bio-Economic Models (S12.507729)” is an EU Lot-5 project under studies for carrying out the common fisheries policy (No MARE/200707 Lot5) which reviews and evaluates a long row of the most important European bio-economic fisheries evaluation models. In particular the models reviewed are: EIAA, TEMAS, MOSES, BEMM>FISH, BIRDMOD (Including Aladym), MEFISTO, AHF, EMFMID, SRRMCF, COBAS, ECOCORP, ECONMULT and FLR under EFIMAS. The review is done in two parts. Firstly a revision framework based on some specific and general tables is created in order to facilitate the comparison as well as the selection of the model for completing a specific task. Secondly a report of each model including model generalities, specific issues and implementation details, is produced. The structure of the review as well as the revision framework is based on the existing literature (reports and scientific papers including EFIMAS ECOKNOWS work and platforms), and after a feedback process among the group. BEms are used to understand the feedback between human activity and natural resources. When a model is built initial attention must be given to the fishery management problem. The simulation of fisherman behavior is not extensively included in the models. A trade-off between simplicity and usefulness emerges when integrated models are used. New research questions will stimulate the development of new models. The lessons learned from a review of thirteen existing European bio-economic models used in the evaluation of EU policies are produced. How these models compare and differ in terms of their biological and economic components, the integration between the components, which indicators are selected and how they are used, are described and analyzed. The publications from the project conclude that the multitude of construction differences reflects the necessity of adapting the modelling approach to answer different questions. Since real life questions in fisheries are so diverse, answering them requires a diversity of models. The project has built further on the networks and platforms produced under EU FP6 EFIMAS Project coordinated by DTU Aqua, including the EFIMAS ECOKNOWS (Economist Knowledge System). The DTU Aqua team associated to the project has produced 1 peer reviewed journal paper, 1 conference proceeding and a consolidated report under the Lot5 project. The project is coordinated by Marine and Food Technological Centre (AZTI), Spain.

Development of a lighter mussel dredger for blue mussel fishery (38692)
Mussel fishery has been identified as a possible treat to fulfilling the aims of habitat protection in specific sites. Also in the Limfjord during the last 10-15 years, the mussel population together with the landings has declined significantly. An explanation for this decline has been that the fishery removes stone and hard substrate reducing recruitment potential for newly-settled mussels. The project’s aim was to develop a lighter gear for blue mussel dredging that may have lower impact on removal of hard substrate, and be more in line with requirements for habitat protection. The development of this gear will be based on experience and technological innovation in connection with the development of a box-dredger for oyster fishery and by modification of existing gear. International experience from other mussel fisheries will also be incorporated. This aim was achieved and the lighter gear implemented by mussel fishers. Further, the project documented the environmental impact of the new gear and showed that the lighter Mussel dredge had an increased catch efficiency of mussels when compared against the Dutch mussel dredge, whilst the amount of mud stirred was considerably lower. The report concluded that the lighter dredge was therefore less detrimental to the environment than the Dutch dredge, whilst maintaining a high catch per unit effort for mussel fishery. The project is coordinated by DTU Aqua.

Optimal sustainable exploitation of Nephrops norvegicus in Kattegat and Skagerrak (38909)
The scientific advice on management of fisheries is primarily aiming at avoiding overfishing of the fish and shellfish stocks and only to a very limited extend addresses how the utilisation of the resources can be optimised within a sustainable ecosystem framework. An example is the regulation of the demersal trawl fisheries in the Skagerrak and the Kattegat which to protect the cod stock is sub-optimal in relation to the utilisation of the Norway lobster (Nephrops) stocks. The project takes a new approach to the management and aims at optimising the utilisation of Nephrops stocks without
compromising the protection of cod. The Nephrops fishery is one of the economically most important fisheries in Denmark. In the Kattegat and Skagerrak, Nephrops catches accounted in 2010 for 53% and 25% of the total value of fish and shellfish, respectively, landed by Danish fishermen. Cod is taken as by-catch in the Nephrops fishery and it has been necessary to introduce measures to limit the by-catches of cod, which is currently below agreed reference points for stock size. These measures have had a negative impact on Nephrops catches. The project addressed four objectives: (i) development of advice on the fishing mortality for the Nephrops stocks, which is consistent with maximum sustainable yield; (ii) mapping of the distribution of Nephrops in Skagerrak and Kattegat; (iii) development of a new trawl concept optimising the catchability on Nephrops while limiting the by-catches of cod and impact on the sea bed; and (iv) evaluating alternative fishing methods for Nephrops including fishing with pots. The project was coordinated by DTU Aqua. The project was funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP).

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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 led 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.

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01/01/2011 → 31/12/2014
Keywords: Research area: Fisheries Management
Project: Research

**Capacity, F and Effort (CAFE) (38100)**
The CAFE project was designed to investigate the links between the fleet capacity, the fishing effort of those fleets and the fishing mortality that results from that effort, so as to facilitate the development of a fishing management strategy. The fishing effort was considered as the amount of time a given fishing capacity was deployed in a fishery. Therefore, engine power could be seen as a capacity measure and kilowatt hours as the expression of the effort from that capacity. This estimate allowed for capacity and effort to be directly linked within the project. CAFE proved that relating higher capacity and/or effort to higher fish mortality was a common misinterpretation. Thus, the project aimed to test the hypothesis that there was a quantifiable relationship between the capacity and effort by particular fleets and the fishing mortality imposed on the various commercial stocks. The project covered six different case studies (the North Sea, the Bay of Biscay and the Mediterranean) accounting, both pelagic and demersal fisheries and single and multi-species fisheries. A combination of models and metrics was subsequently employed to quantify the links between capacity, effort and fishing mortality. External factors which affected the fishers’ choices were also identified. The modelling approach used both statistical and mathematical modelling techniques. The models and the understanding gained through them were subsequently used to examine the response of the system to a range of management measures for controlling capacity and effort. A series of simulations were performed to examine the fisheries' response to limitations of capacity, effort or other measures. Several of the models were run using data of different case studies to test the general applicability of the approaches and observe existing differences between individual countries. The project was coordinated by IMARES, Wageningen UR, The Netherlands.

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**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.

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01/01/2007 → 31/12/2009
Keywords: Research area: Fisheries Management
Collaborators: Wageningen IMARES, Marine and Food Technological Centre, Institute of Marine Research, University of Copenhagen, Hellenic Centre for Marine Research, Marine Scotland Science, Aalborg University, Cefas Weymouth Laboratory, Institute for Research in Economics and Business Administration, University of Portsmouth, IFREMER
Project: Research
Activities:

ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAQ (External organisation)
Period: 2015
Ole Ritzau Eigaard (Participant)
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Degree of recognition: International
Related external organisation

ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAQ
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - The Joint NAFO/ICES Pandalus Assessment Working Group - NIPAQ (External organisation)
Period: 2014
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Degree of recognition: International
Related external organisation

ICES - The Joint NAFO/ICES Pandalus Assessment Working Group - NIPAQ
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Inter Benchmark Protocol for Pandalus in Skagerrak and Norwegian Deep - IBPPAND (External organisation)
Period: 2012 → …
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Degree of recognition: International
Related external organisation

ICES - Inter Benchmark Protocol for Pandalus in Skagerrak and Norwegian Deep - IBPPAnd
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAG (External organisation)
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ICES - Joint NAFO/ICES Pandalus Assessment Working Group - NIPAG
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar