**Protecting bycaught species in mixed fisheries (PROBYFISH) (39549)**

PROBYFISH aims to develop a modelling framework and a support tool to assess whether proposals for regionalised management measures in the North Sea, Southwestern and Northwestern waters are in accordance with the objectives of the CFP. The project approaches this aim by developing agreed and robust methods to define target and bycatch species, identifying the bycatch species for which TAC management of target species would be sufficient, identifying measures that will lead to the sustainable development of the bycatch stocks (technical, spatial etc), producing agreed reference levels to safeguard stocks and combining the results of all activities in a user-friendly and flexible tool.

The project is coordinated by DTU Aqua and is funded by EU Executive Agency for Small and Medium-sized Enterprises (EASME).

Rindorf, A., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
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24/05/2018 → 23/05/2021

**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) and the Danish Fisheries Agency.

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01/02/2018 → 31/01/2020

**Investigation of causes affecting distribution and density of cod and plaice in Danish coastal areas (Kystfisk 3) (39413)**

Danish coastal fishermen have for several years wondered at the apparent drastic decrease in coastal fish abundance and have raised the question of the reason for these changes.

The objective of Kystfisk 3 is to investigate the causes of the decline in coastal cod and plaice by providing:
A thorough analysis of the stock structure of plaice and cod.
A description of the spatial distribution of plaice and cod.
A description of the historical development in spatial distribution.
A model of the distribution and density of cod and plaice stocks in relation to environmental conditions.

Kystfisk3 is a continuation of the work conducted in Kystfisk 1 and Kystfisk 2. In Kystfisk 1 and Kystfisk 2, interviews with fishermen were conducted and the issues reported confirmed by analysis of survey trawl data. In Kystfisk 3 a combination of spatial models and genetic analyses are used to determine the contribution of migration, environment and decreased stock abundance. The project analyses are based on existing data, including otoliths collected in the 1990’s. Data are compared to current daya collected from specific areas in Kattegat, Skagerrak and the North Sea.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

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22/12/2016 → 30/09/2019
Keywords: Research areas: Marine habitats, Fisheries Management & Ecosystem based Marine Management
Project: Research

Stock assessment and management of sole fishery (39383)
The project is focused on improving the stock assessment and management of sole fishery in the Skagerrak, Kattegat, Belts and Western Baltic Sea. Input to the stock assessment and the scientific basis for counseling on the sole population in Danish waters is developed continuously. This project aims at collecting biological data and acquire new knowledge on sole distribution as well as including knowledge from the fishermen and give advice on efficiency of using different fishing gear.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

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Støttrup, J. G., Project Participant, National Institute of Aquatic Resources
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16/09/2016 → 31/12/2018
Keywords: Research area: Fisheries Management
Project: Research

Eastern Baltic cod - New knowledge of growth and mortality is the way to improved management advice (39366)
The aim of the project is to improve the knowledge and data basis for stock assessment and management for cod in the eastern Baltic Sea. In later years, changes in growth and natural mortality of cod have presumably taken place and new knowledge on these parameters is essential for restoring analytical stock assessment for Eastern Baltic cod that is currently lacking. Improved knowledge on cod growth and mortality is therefore a prerequisite for being able to evaluate the stock status in relation to management targets and implement management plans that are built on quantitative stock assessment. Ecological situation in the Baltic Sea has changed in later years, which requires updated biological information. This is done in the project using different approaches, bringing together expertise of different research areas. The approaches applied include molecular-genetic analyses of cod growth, bioenergetic modelling, and analyses of monitoring data on predation and condition/growth of cod. An important component of the project is cooperation with
fishing industry to support tagging experiments of Baltic cod, to obtain updated estimates of cod growth. Finally, the project combines the new knowledge on cod that becomes available from this and other relevant projects to ensure that the assessment of stocks status and management advice is based on best available scientific information.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

Keywords: Research areas: Ecosystem based Marine Management & Fish Biology & Marine Populations and Ecosystem Dynamics & Population Genetics & Marine Living Resources & Fisheries Management

Collaborators: University of Copenhagen, Danish Fishermen's Association

Project: Research

New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas (ECOAST) (39339)

ECOAST aims to identify, develop and test new methodologies for spatial and temporal management of fisheries and aquaculture in coastal areas. The overall approach will assess the impact of fisheries and aquaculture on coastal ecosystems, including essential fish habitats and conservation priority habitats, as well as synergies and conflicts between human activities.

Building on previous methodologies and experiences the project will evaluate marine spatial planning in seven coastal case study areas having different ecological and socio-economic characteristics: 1) Adriatic Sea (ADR), 2) Ionian Sea (ION), 3) Black Sea (BLK), 4) Tyrrhenian Sea (TYR), 5) Baltic Sea (BAL), 6) Norwegian Fjords (NOR) and 7) NE Atlantic Coasts (ATL).

The project outcomes will produce case specific evaluation of the ecological footprints of fisheries and aquaculture in coastal areas, maps of optimal areas for fisheries and aquaculture, evaluation of compatibility between fisheries, aquaculture and other human activities in coastal areas, as well as implementation of holistic methods and an operational modelling framework to evaluate and predict stakeholder responses to coastal spatial management options covering marine cross sector occupation of space. Several methodologies already exist to assess the impacts on the ecosystem and the socio-economic effects of some spatial management measures, as well as to spatially manage some cross sector marine activities, but none of them integrate all relevant management aspects for coastal areas. Therefore, the holistic methodology will cover in a single system different approaches and management aspects, identifying realistic spatial and temporal potentials and limitations for the integration of fisheries and aquaculture in coastal areas, in order to allow policy makers and stakeholders to evaluate management measures from different points of view and share decisions in a transparent manner on case specific basis. ECOAST results will support the EU and national policies through the provision of tools and data for an ecosystem based allocation of space and sustainable use of marine resources in coastal areas on case specific basis.

This project is coordinated by Institute of Marine Science of the National Research Council, Italy. This project is funded by EU, COFASP, ERA-NET.

Keywords: Research area: Fisheries Management


Project: Research

Process integration into multispecies and ecosystem models: Resulting ecological, economic and social trade offs (PRIME TRADE OFFS) (39324)

Extensive multispecies and ecosystem research has been done in the Baltic, North Sea, Barents Sea/Norwegian Sea, Bay of Biscay and the Black Sea in the past about 30 years. There has been invested substantially in the research on multispecies interactions, and ecosystem functioning.

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

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

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

This project is coordinated by DTU Aqua and is funded by the EU, COFASP, ERA-NET.

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Andersen, N. G., Project Participant, National Institute of Aquatic Resources

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01/03/2016 → 28/02/2019

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

Collaborators: AZTI Technalia, Institute of Marine Research, University of Hamburg, IFREMER

Project: Research

Sustainable management of Kattegat cod; Improved knowledge about stock components and migration (39346)

The Kattegat cod has been categorized as a data limited stock, mainly due to a large unallocated mortality, which may be caused by migration between Kattegat and neighbouring areas. In this project, we aim to improve our understanding of migration patterns and mixing of different stock components within the Kattegat through a novel combination of genetic and micro-chemical signatures for individual fish. Results from the project will feed directly into the ICES advisory process, including a scheduled benchmark meeting in early 2017 where new procedures for stock assessment will be discussed. As cod are also caught as bycatch in other fisheries, a more robust stock assessment for cod will also be important to fisheries for other species under the landing obligation, which is scheduled for implementation in the Kattegat in 2017.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

Hansen, J. H., Project Coordinator, National Institute of Aquatic Resources, Section for Marine Living Resources

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01/03/2016 → 28/02/2018

Keywords: Research areas: Population Genetics & Marine Living Resources & Fisheries Management

Collaborators: Danish Fishermen's Association

Project: Research

Study on approaches to management for data-poor stocks in mixed fisheries (MIXDLS) (39342)

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

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

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

The project is coordinated by DTU Aqua & IMARES, Netherlands.

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01/01/2016 → 31/12/2017

Keywords: Research areas: Fisheries Management & Marine Living Resources

Collaborators: French Research Institute for Exploitation of the Sea, Hellenic Centre for Marine Research, IMARES, Italian National Research Council, Cefas Weymouth Laboratory, AZTI-Tecnalia, Galway - Mayo Institute of Technology, Thunen-Institut
**Sustainable, cost effective and responsive gear solutions under the landing obligation (FAST TRACK I) (39323)**

With the reform of the Common Fisheries Policy and the introduction of a Landing Obligation the ability of fishers to adjust the selectivity of their gears to suit the quotas which are available to them will be an important factor in determining the revenue and profitability in the fishery. As the combination of gear, fishing practice and quota shares will differ between vessels, changes to the selectivity of the gears will need to be implemented at the vessel level and based on the quotas which are available to the vessel at a given time. For this to be realized, simple and cost effective solutions which can be quickly coupled with existing gears will be in demand. These solutions will need to be implemented quickly in order for them to solve the issues at hand without losing substantial income. Furthermore, these solutions will need to be scientifically tested to document their effect before being considered for implementation into the legislation. Fast-Track aims to increase flexibility and ownership over the gears used while ensuring an effective introduction of the new EU Common Fisheries Policy. To achieve this, Fast-Track aims to facilitate the development of more selective gears by providing the industry with the possibility to take a more proactive role in the development and testing of new ideas. Here we try to facilitate a more bottom-up approach where the industry are responsible for coming up with the ideas they feel applicable for their fishery, as well as having an important role in the testing of the gear and the collection of the data. Furthermore, it aims to speed up the testing process and diversity of gears being tested by initially having the industry to define the idea and carry out a development/ pre-test to refine the gears performance before proceeding to a more rigorous scientific test. The expected effects of the project are 1) the establishment of a permanent platform comprised of stakeholders (fishermen, net makers producer organizations, managers and scientists) which can facilitate the development of ideas and solutions originating from the industry, 2) that the industry becomes more proactive role in the development and testing of solutions for the effective implementation of the landing obligation, 3) that the close cooperation between industry and researchers leads to greater ownership of the solutions developed, and 4) the speed with which innovative tools are developed, tested and approved is reduced while profitability and sustainability are increased.

This project is coordinated by DTU Aqua. The project is funded by the Ministry of Environment and Food of Denmark and the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

**Keywords:** Research areas: Fisheries Technology & Fisheries Management

**Collaborators:** SINTEF, Aalborg University, Danish Fishermen’s Association

**Project:** Research

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**Forward management of sandeel in the North Sea (39316)**

The project will define and align the management of sandeel considering the goals and desires of the fishing industry, administration and science while taking the biology and importance of the sandeel in the ecosystem into account. The project is structured by several work-packages, each dealing with specific aspects of sandeel biology and/or fishery relevant for management. Among these will the sandeel population structure and its influence on stock assessment, CPUE and counselling be discussed. Analyses of fisheries development and sandeel availability over the fishing season will enable a more accurate calculation of fishing mortality. Furthermore, it is examined whether the increasing concentration of fishing effort on certain banks potentially causes an error in the stock assessment in relation to recruitment from unfished banks. The project will perform a statistical evaluation of fisheries-independent data for sandeel in the North Sea and evaluate existing and alternative methods of stock assessment for sandeel in the North Sea with current and alternative management areas, including implementing an analytical stock assessment of sandeel in sandeel area 4. Finally the project will evaluate existing biological and management reference points, and discuss these in relation to ecosystem reference points. Throughout the project period, a series of workshops and meetings will be held in order to discuss possible management strategies for sandeel in the North Sea. These discussions will imply a number of fundamental prerequisites defined in collaboration between management, fisheries and science in order to form the basis for an optimal management of sandeel.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

**Keywords:** Research areas: Fisheries Technology & Fisheries Management

**Collaborators:** SINTEF, Aalborg University, Danish Fishermen’s Association

**Project:** Research
Value of the landing obligation – Former discard fraction (39347)

The aim of the project is to increase the value of those fish species that are landed due to the new regulation of the fisheries policy in EU – the landing obligation. This creates challenges both on board the fishing vessels and in the harbours. It is necessary to have smooth and efficient procedures to solve the challenges and to have a suitable both environmental and economic for both the fishermen and the fishing harbours.

The project is coordinated by Hanstholm Harbour, Denmark and is funded by the European Maritime and Fisheries Fund (EMFF) and the Danish Fisheries Agency.

Baltic Sea project to boost regional coherence of marine strategies through improved data flow, assessments, and knowledge Base for development of measures (BalticBOOST) (39312)

General objectives

The general objective of the project is to enhance regional coherence in the accomplishment of the 2018 reporting under the EU MSFD by developing joint tools, defining data needs and to set up data arrangements to support indicator-based assessments of the state of and pressures on the Baltic Sea. The project take steps towards development of joint environmental targets for pressures affecting seabed habitats by developing a knowledge base and principles for defining such targets. The project addresses in particular MSFD Descriptors 1, 6, 8 and 11.

BalticBOOST is based on five themes with one or several work packages: Theme 1 (Biodiversity), Theme 2 (Hazardous substances), Theme 3 (Physical loss and damage to seabed habitats), Theme 4 (Noise), and Theme 5 (Joint documentation of Programmes of Measures).

DTU Aqua is involved in themes 3 and 5:

- Theme 3, Physical loss and damage to seabed habitats, develops joint principles for defining environmental targets for pressures affecting seabed habitats (WP 3.1). The development of such environmental targets is challenging and as a starting point the WP explores ways to determine how much disturbance from different activities that specific seabed habitats can tolerate while remaining in Good Environmental Status (GES). Under this Theme, a tool for assessing the impacts of fishing gear on specific habitat types and species is also developed (WP 3.2). Finally, an arrangement for regular collection of data and information on pressures and activities that affect the Baltic Sea is piloted, to provide support to this Theme as well as future assessment of pressures impacting the Baltic Sea (WP 3.3). A shared component across Themes 1-3 is improving access to high quality data to carry out future assessments feeding into the MSFD reporting. This involves alignment of the formats of reported data to relevant international or European data format and making the resultant spatial data products (indicator maps) available as INSPIRE compliant (OGC WMS/WFS) web map services.

- Theme 5, Joint documentation of Programmes of Measures (PoMs), provides support for HELCOM GEAR, the working group responsible for regional coordination in the implementation of the HELCOM BSAP and the MSFD. Support is provided to the agreed development of a joint document on regional coordinated PoMs and a system to follow-up actions agreed by HELCOM.

Tasks and Deliverables

DTU Aqua is involved in Theme 3, WP3.1 and especially WP3.2, where we will develop methods for assessing and apply fishing intensity maps according to fishing gear (footprint), explore benthic sensitivity indicators of fishery, and evaluate fishing impact according to MSFD indicators, all with focus on the Femern Belt Case Study. DTU Aqua is responsible for and coordinating the Technical WP3.2 (coordinator Prof. J. Rasmus Nielsen).

This project is coordinated by DTU Aqua.

The project is funded by EU, Calls for proposals/tenders (DG ENV/MSFD Action Plans/2014).

Baltic Sea: project to boost regional coherence of marine strategies through improved data flow, assessments, and knowledge Base for development of measures (BalticBOOST) (39312)

General objectives

The general objective of the project is to enhance regional coherence in the accomplishment of the 2018 reporting under the EU MSFD by developing joint tools, defining data needs and to set up data arrangements to support indicator-based assessments of the state of and pressures on the Baltic Sea. The project take steps towards development of joint environmental targets for pressures affecting seabed habitats by developing a knowledge base and principles for defining such targets. The project addresses in particular MSFD Descriptors 1, 6, 8 and 11.

BalticBOOST is based on five themes with one or several work packages: Theme 1 (Biodiversity), Theme 2 (Hazardous substances), Theme 3 (Physical loss and damage to seabed habitats), Theme 4 (Noise), and Theme 5 (Joint documentation of Programmes of Measures).

DTU Aqua is involved in themes 3 and 5:

- Theme 3, Physical loss and damage to seabed habitats, develops joint principles for defining environmental targets for pressures affecting seabed habitats (WP 3.1). The development of such environmental targets is challenging and as a starting point the WP explores ways to determine how much disturbance from different activities that specific seabed habitats can tolerate while remaining in Good Environmental Status (GES). Under this Theme, a tool for assessing the impacts of fishing gear on specific habitat types and species is also developed (WP 3.2). Finally, an arrangement for regular collection of data and information on pressures and activities that affect the Baltic Sea is piloted, to provide support to this Theme as well as future assessment of pressures impacting the Baltic Sea (WP 3.3). A shared component across Themes 1-3 is improving access to high quality data to carry out future assessments feeding into the MSFD reporting. This involves alignment of the formats of reported data to relevant international or European data format and making the resultant spatial data products (indicator maps) available as INSPIRE compliant (OGC WMS/WFS) web map services.

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Tasks and Deliverables

DTU Aqua is involved in Theme 3, WP3.1 and especially WP3.2, where we will develop methods for assessing and apply fishing intensity maps according to fishing gear (footprint), explore benthic sensitivity indicators of fishery, and evaluate fishing impact according to MSFD indicators, all with focus on the Femern Belt Case Study. DTU Aqua is responsible for and coordinating the Technical WP3.2 (coordinator Prof. J. Rasmus Nielsen).

This project is coordinated by DTU Aqua.

The project is funded by EU, Calls for proposals/tenders (DG ENV/MSFD Action Plans/2014).

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15/09/2015 → 31/12/2016

Keywords: Research area: Fisheries Management

**Objectives**

The aim of this project is to improve the knowledge basis, data, and methodology for providing robust stock assessment and short term forecast according to MSY for data limited fish stocks with importance for Danish commercial fishery.

**Background**

A number of fish stocks in the Baltic, Skagerrak-Kattegat and North Sea area with importance for Danish commercial fishery either as target species, commercially important by-catch species, or as unintended by-catch species are data limited stocks with no analytical stock assessment. More than 60% of fish stocks that ICES gives advice on are category 3 and 4. These categories include stocks for which the data and knowledge are insufficient to conduct a full analytical assessment of their state and exploitation. Until now, ICES has not been able to assess their state relative to the objective of achieving MSY (Maximum Sustainable Yield) sustainability. A major task of fisheries management is broadening from the narrow analysis of few main commercial species toward accounting for by-catches, i.e. the great range of species and sizes of lesser importance caught at the same time in non-selective fisheries (mixed-fisheries). This unwanted part of catches is becoming politically important because it may trigger restrictive management decisions for the commercial fisheries, both as part of the ecosystem-based marine management (EU MSFD), and because of the potential of these species to become limiting for some fleets in the frame of the landing obligation (=discard ban) of the EU CFP, i.e. when a fishery can be closed because it has reached the authorized catch quantity (quota) of a low-value species even though it still has some quota left for more valuable commercial species (so-called “choke species” effect).

**Tasks and Deliverables**

- Develop assessment and forecast models and methods for stocks in the categories 3-4 and integrate them as standard models in the ICES advisory framework in relation to method development and assessing data poor stocks in special working groups (ICES WKLIFE V-VI, ICES WKPROXY) and in standard stock assessment working groups covering the Skagerrak-Kattegat, Baltic Sea and North Sea areas (ICES WGNSSK, ICES WGBFAS).
- Apply the models to selected fish stocks with importance for Danish fishery with the aim of promoting analytical and benchmark assessments to assess stock status relative to MSY objectives. Application of these methods means that the status of those category 3 and 4 stocks can be classified as desirable or undesirable in relation to MSY objectives, and the stocks can be lifted to category 2 or 1 stocks with analytical assessments. The stocks are selected in close collaboration and agreement with the Ministry of Environment and Food (several directorates), the fishing industry and associations (DF), NGO environmental stakeholders and Science (DTU Aqua).
- The work includes estimation of fish stock growth parameters, performing yield per recruit analyses, and conducting stock assessments with application of a stochastic stock production model and/or a length based stochastic assessment model, as well as where possible a stochastic age based VPA stochastic assessment model.
- Management Strategy Evaluation (MSE) for selected stocks: Establishment of biological (biomass- or fishing mortality based) reference points for each of the selected stocks involving growth models and logistic models (ogives). MSE for establishing output-based harvest control rules according to short to medium term forecasts for the selected stocks. This includes provision and further development of model software to carry out MSE of the selected stocks.

This project is coordinated by DTU Aqua.

The project is funded by the Danish Ministry og Environment and Food (under Framwork Contract with DTU).

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01/07/2015 – 01/03/2017

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

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**Tender for scientific support to the Saudi Arabian fisheries sector (SaudiTender I) (39153)**

**Objective**

The general aim of the Fisheries Program at the Marine Studies Section, Center for Environment and Water, Research Institute, King Fahd University of Petroleum and Minerals (KFUPM/RI), is to establish a modern system of data collection, biological and ecological assessment, stock assessment modelling, and government management, in order to evaluate the exploitation status and enhance the sustainability of finfish and invertebrate stocks of Saudi Arabia (SA) Exclusive Economic Zone in the Arabian Gulf. The overall principle underlying this effort is the food security of SA, and the duty to carry out the best efforts to guarantee sustainable exploitation of fishery resources and ensure economic viable fisheries. The Program is organized in four main branches, or Work Packages: Population Dynamics and Stock Assessment, Essential Fish Habitats, Environmental Impacts of Fishing Methods, and Management Strategy Framework.

**Background**

The KFUPM/RI of Saudi Arabia and AZTI-Tecnalia, Marine and Food Research Institute of the Basque Country, Spain, in partnership with DTU-Aqua, runs this project with an extensive collaboration program in fisheries monitoring, research, and management advice. A service contract according has been signed between KFUPM/RI and AZTI. A sub-contract to this service contract has been made between AZTI and DTU Aqua where parts of the service contract forms an integral part of the subcontract and where DTU Aqua is co-responsible for the below listed specific tasks and deliverables.
Tasks and Deliverables
Population Dynamics and Stock Assessment: Provision and further development of suitable model software to carry out stock assessment for data limited fish stocks. Stock assessment models suitable to data-poor fisheries are applied to historical catch and effort data (2002-2012) and to data from the new Data Collection Framework (2013-) for major stocks. DTU Aqua is responsible for provision of model software to carry out assessments and application of this to 5 major finfish stocks out of the appointed 13 major stocks exploited by SA in the area. The work include estimation of fish stock growth parameters, performing yield per recruit analyses, and conducting stock assessments with application of a stochastic stock production model using the above data to estimate MSY (Maximum Sustainable Yield) sustainability reference levels according to exploitation. Templates for assessment and advice are developed on the basis of the data and knowledge available in cooperation with AZTI which includes a Stock Summary Sheet for each of the stocks.

Management Strategy Evaluation (MSE) for Major Stocks: Conducting and reporting MSE for data-poor fisheries considering several prospective harvest control rules in the short to medium term according to MSY. This involves identification of biological reference points (biomass- and fishing mortality based reference points) and identification of input or output based harvest control rules according to short term forecast for the 5 major fish stocks. Also, this involves provision and further development of model software to carry out MSE according to MSY in the short to medium term.

Management Strategy Framework: Provision of formal considerations, evaluations, recommendations and reporting of relevant and appropriate management regimes and systems of data collection and stock assessments for scientifically-based advice to the SA Ministry of Agriculture on basis of current fishery system and exploitation of the 13 major stocks. This addresses needs for data, methods, institutional set-up, provision of advice, and possible management systems.

This project is coordinated by AZTI Technalia, Spain.
The project is funded by AZTI Technalia, Spain as to KFUPM University Saudi Arabia.

Nielsen, J. R., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Pedersen, M. W., Project Participant, National Institute of Aquatic Resources
Berg, C. W., Project Participant, National Institute of Aquatic Resources
Degel, H., Project Participant, National Institute of Aquatic Resources
Bastardie, F., Project Participant, National Institute of Aquatic Resources

01/05/2015 → 30/06/2017

Keywords: Research area: Fisheries Management
Collaborators: King Fahd University of Petroleum and Minerals, AZTI-Technalia
Project: Research

Strategies for the gradual elimination of discards in European fisheries (DiscardLess) (39238)
DiscardLess will help provide the knowledge, tools and technologies as well as the involvement of the stakeholders to achieve the gradual elimination of discarding. These will be integrated into Discard Mitigation Strategies (DMS) proposing cost-effective solutions at all stages of the seafood supply chain.

This project is coordinated by DTU Aqua.
The project is funded by EU, Horizon2020.

Ulrich, C., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Rindorf, A., Project Participant, National Institute of Aquatic Resources
Larsen, E., Project Participant, National Institute of Aquatic Resources
Eg Nielsen, E., Project Participant, National Institute of Aquatic Resources
Mortensen, L. O., Project Participant, National Institute of Aquatic Resources
Bekkevold, D., Project Participant, National Institute of Aquatic Resources
O'Neill, B., Project Participant, National Institute of Aquatic Resources

01/03/2015 → 28/02/2019

Keywords: Research areas: Fisheries Management &Population Genetics & Fisheries Technology & Ecosystem based Marine Management
Collaborators: Instituto Español de Oceanografía, AlphaFilm, Marine Institute, Marine Scotland Science, UIT The Arctic University of Norway, Cefas Weymouth Laboratory, TRACE Wildlife Forensics Network Limited, IFREMER, NAYS Ltd, Irish Department of Communications, Marine and Natural Resources, University of Bergen, Universite de Bretagne Occidentale, Matis ltd., FishFix, Memorial University of Newfoundland, University of the Azores, University of Strathclyde, Pôle AQUIMER, Food and Agriculture Organization of the United Nations, Simrad Spain SLU, Barna Group, Agrocampus Ouest, Hampiðjan Group, University of Copenhagen, Nuscience Group, SafetyNet Technologies LTD, Marel hf, Sea Fish Industry Authority, ShipCon, AZTI-Technalia

Documents:
DiscardLess - An overview of the project
DiscardLess - What can science do to help with the landing obligation? Presentation from Sinaval, Bilbao, Spain 22 April 2015
DiscardLess - Poster from ICES Annual Science Conference 2015
DiscardLess - Newsletter no. 1 2015
Project: Research
Upgrading pangas and tilapia value chains in Bangladesh (39244)
Growth in aquaculture is important because it can help alleviate poverty by providing food and creating jobs in Bangladesh. The purpose is to promote green growth in freshwater pangas/tilapia aquaculture by providing knowledge on how to improve water quality and farm management and exploit the market potential for farmed fish through value chains functioning. Focus is on water quality since pangas/tilapia might include contaminants, offflavors and be a bit yellow, not white, as preferred by the consumers at export markets.
Farm management, governance of value chains, knowledge on domestic/international markets and on fish quality can improve the basis for sustainable growth, increase value added and prepare the sector for export, thereby providing livelihood for locals and foreign exchange. Knowledge is increased through senior research cooperation and by educating PhDs.
Research questions are: To what extent are fish-depleting microorganisms, arsenic, lead and pesticides of economic importance? Can they be reduced? Do water quality initiatives pay? Who are the main actors in the value chain? What are the major bottlenecks? How are prices formed? How much are consumers willing to pay for improved quality of fish? Can chains be upgraded through governance, water and fish quality and export focus?
The foundation is value chain analysis, economic optimization, applied economics and environmental science. The knowledge provided forms basis for assessing governance and firm management. It will be disseminated to actors in the chains.
This project is coordinated by Department of Food and Resource Economics, University of Copenhagen, Denmark.
The project is funded by DANIDA, Ministry of Foreign Affairs of Denmark.
Larsen, E., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
01/03/2015 → 28/02/2019
Keywords: Research area: Fisheries Management
Collaborators: University of Southern Denmark, Kiel University, University of Copenhagen, Norwegian University of Life Sciences, Bangladesh Agricultural University, Patuakhali Science and Technology University
Project: Research

Development of a by-catch excluder for the Danish and European trawl fisheries (39265)
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).
Eigaard, O. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Krag, L. A., Project Participant, National Institute of Aquatic Resources
Berg, C. W., Project Participant, National Institute of Aquatic Resources
Thaarup, F., Project Participant, National Institute of Aquatic Resources
Feekings, J. P., Project Participant, National Institute of Aquatic Resources
01/01/2015 → 31/12/2016
Keywords: Research areas: Fisheries Management & Fisheries Technology
Collaborators: Danish Pelagic Producers Organisation, Tor-mo trawl ApS, HG62 Beinur, Greenline Fishing Gear A/S
Project: Research

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 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.

Eigaard, O. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

New possibilities for growth and robustness in organic aquaculture (ROBUSTFISH) (39159)

Main aim:
To support the credibility, growth and robustness in the production of healthy and stress resilient Danish organic rainbow trout, considering environmental, ethical as well as economic aspects.

Sub goals:
1) Develop methods for selecting robust fry.
2) Investigating how sustainable non-fish based feed given early in the development affect the robustness of the fry.
3) Include welfare and environmental aspects in relation to water treatment procedures.
4) Improve economic competitiveness of Danish organic aquaculture.

The project is coordinated by DTU Aqua.

This project is funded by Organic RDD 2 Programme, which is coordinated by the International Centre for Research in Organic Food Systems (ICROFS). It has received grants from the Danish Ministry of Food, Agriculture and Fisheries through the Green Growth and Development Programme (GUDP).

Jokumsen, A., Project Coordinator, National Institute of Aquatic Resources, Section for Aquaculture

Gesto, M., Project Participant, National Institute of Aquatic Resources
Minimising discards in Danish fisheries (MINIDISC) (39020)
The landings obligation, currently being implemented in the new CFP, puts major constraints on fishers, by making the landing of unwanted catch mandatory. Less restrictive technical rules (TR) in a results-based management frame under Catch Quota Management (CQM) have been suggested as a mechanism to release some of these constraints. To investigate the effects of the existing TR, some fishers were relaxed from TR during the trial and could freely choose and develop alternative gears, aiming to optimize annual catch value, while reducing discards. The study included 14 demersal fishing vessels, operating in the North Sea, Skagerrak and the Baltic Sea.

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

In addition to the trial, a number of other activities were performed under the MINIDISC project, including (i) the publishing of a catalogue (in Danish) of the selectivity devices experimented in Danish fisheries, (ii) a scientific selectivity trial on Danish seines fisheries in Skagerrak and (iii) a review of international experiences in the uptake of selective devices. The project has been disseminated through several meetings and conferences. A number of scientific publications are in review or close to submission.

This project was coordinated by DTU Aqua.
The project was funded by the Danish Ministry of Food, Agriculture and the Fisheries and the European Fisheries Fund (EFF).
Ulrich, C., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Mortensen, L. O., Project Participant, National Institute of Aquatic Resources
Olesen, H. J., Project Participant, National Institute of Aquatic Resources
Krag, L. A., Project Participant, National Institute of Aquatic Resources
Feekings, J. P., Project Participant, National Institute of Aquatic Resources
Dalskov, J., Project Participant, National Institute of Aquatic Resources
Storr-Paulsen, M., Project Participant, National Institute of Aquatic Resources
Qvist Eliasen, S., Project Participant, National Institute of Aquatic Resources
01/01/2014 → 15/07/2015
Keywords: Research areas: Fisheries Management & Fisheries Technology & Marine Living Resources
Collaborators: Danish Fishermens Producers Organization
Project: Research

Catch Quota Management and choke species 2014 (39079)
The aim of the project is further development and test of Catch Quota Management (CQM) systems in Danish demersal fisheries by the use of electronic monitoring systems. Furthermore, to test whether electronic monitoring – video and sensor recordings – can provide the necessary documentation to support a CQM system. In addition the project will illustrate whether full documentation of catches can support implementation and certification and traceability solutions which requires linkage to project dealing with these issues.

This project is coordinated by DTU Aqua.
Olesen, H. J., Project Manager, National Institute of Aquatic Resources, Section for Monitoring and Data
Dalskov, J., Project Participant, National Institute of Aquatic Resources
Hákansson, K. B., Project Participant, National Institute of Aquatic Resources
Degel, H., Project Participant, National Institute of Aquatic Resources
22/07/2013 → 15/07/2015
Keywords: Research area: Fisheries Management
Collaborators: Ministry of Environment and Food of Denmark
Project: Research
The project will take this one step further by establishing gentle handling routines on board the ships, in addition to trawling at a lower speed lessens the mechanical damage to the nephrops and this enhances their chances of survival. Moreover, using trawling speed as a selective mechanism, which will take advantage of the superior swimming capabilities of cod as bottom trawl which exert high impact on the seabed. The first aim of the project is to solve the cod by-catch issues by low cod quotas, and resultantly, nephrops quota a rarely fully exploited. Furthermore, nephrops are traditionally fished with high as many nephrops inhabit the inner Danish waters. However, cod is a frequent by-catch which is problematic due to selective and low impact gear for fishing live nephrops (39042)

Optimal sustainable use of cod stocks accessible for Danish fisheries (DEL-TORSK) (39103)

The project included mapping of distribution of sub-populations using genetic analyses and modelling of transport of early life stages. These results were combined with existing knowledge on cod population structure both in the Baltic and North Sea, to identify distribution areas of sub populations. This information was then incorporated in area-specific stock assessment analyses.

Changes in marine resources in Skagerrak and Kattegat 1946-2012 – Catch and revenue in the post war fishery and transformation of the fleet (DIGIFISH) (39103)

This project was coordinated by DTU Aqua.

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

The project was coordinated by DTU Aqua.

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

Behrens, J., Project Manager, National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Karlsen, J. D., Project Participant, National Institute of Aquatic Resources
Skov, P. V., Project Participant, National Institute of Aquatic Resources
Eigaard, O. R., Project Participant, National Institute of Aquatic Resources
01/01/2013 → 31/03/2015

Keywords: Research areas: Fish Biology & Aquaculture & Fisheries Technology & Fisheries Management
Collaborators: Strandby Net A/S, Seafood-Supply.dk Aps, CATch-Fish, STMI, Kim Sørensen s42, Aquamind A/S, Infuser Aps, Frank Maiken s281, Danish Fishermen's Association, ChriishFish Danmark A/S
Project: Research

Benthic ecosystem fisheries impact study (BENTHIS) (38021)

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

The project has 33 partners from 12 countries.

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

The project is funded by EU, Framework Programme 7.

Eigaard, O. R., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Nielsen, J. R., Project Manager, National Institute of Aquatic Resources
Bastardie, F., Project Participant, National Institute of Aquatic Resources
Dinesen, G. E., Project Participant, National Institute of Aquatic Resources
Sørensen, T. K., Project Participant, National Institute of Aquatic Resources
Frandsen, R., Project Participant, National Institute of Aquatic Resources
Krag, L. A., Project Participant, National Institute of Aquatic Resources
Mosegaard, H., Project Participant, National Institute of Aquatic Resources
01/10/2012 → 30/09/2017

Keywords: Research areas: Fisheries Management & Observation Technology & Fisheries Technology & Ecosystem based Marine Management
Project: Research

On the road to 2020 (38984)

The goal of the project is to combine the present information systems and documentations systems such as traceability, electronic documentation systems, environmental labeling, economic analyzing tools and different communications methods in the fish sector.
The project is coordinated by DTU Aqua.
Larsen, E., Project Participant, National Institute of Aquatic Resources, Public Sector Consultancy
01/08/2012 → 31/12/2013

Keywords: Research area: Fisheries Management
Collaborators: Aalborg University, Icelandic Food Research
Project: Research

**MSC certification of the plaice fishery in area Illa – basic investigations and development of a management model (39025)**

A management plan is an important requirement for MSC certification of specific fisheries. However, prior to this project, reliable stock assessments, which are necessary for an management plan for plaice (Pleuronectes platessa) in area Illa (Kattegat/Skagerrak), had not been available. These problems most likely originated from insufficient knowledge about the geographical distribution of populations as well as the interactions between populations in Kattegat/Skagerrak and neighbouring areas. Through a mapping of the distribution and dynamics of populations, this project aimed at providing the missing data that would ultimately allow for the development of an management plan for the plaice fishery in area Illa. The work included information from genetics, tagging, otolith based growth estimation, oceanographic modelling and analyses of survey and fisheries data.

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

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

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

The project was coordinated by DTU Aqua.

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

Hansen, J. H., Project Coordinator, National Institute of Aquatic Resources, Section for Marine Living Resources
Christensen, A., Project Participant, National Institute of Aquatic Resources
Ulrich, C., Project Participant, National Institute of Aquatic Resources
Boje, J., Project Participant, National Institute of Aquatic Resources
Hüssy, K., Project Participant, National Institute of Aquatic Resources
Geitner, K., Project Participant, National Institute of Aquatic Resources
Worsøe Clausen, L., Project Participant, National Institute of Aquatic Resources
Meldrup, D., Project Participant, National Institute of Aquatic Resources
Hansen, F. I., Project Participant, National Institute of Aquatic Resources

01/07/2012 → 31/12/2014

Keywords: Research areas: Population Genetics & Fisheries Management & Marine Living Resources
Collaborators: Danish Fishermen's Producers Organization, Danish Fishermen's Association
Project: Research

**Restoration and management of cod in the Skagerrak/Kattegat (CodS) (38969)**

The project had two main aims:
- To develop plans for ecosystem based and sustainable management of coastal stocks of cod in Skagerrak/Kattegat.
- To develop necessary scientific knowledge needed for a first pilot restoration of a locally extinct stock of cod.

The work in the project was highly multi-disciplinary and included aspects of law, policies and institutional rules, socioeconomy, genetics, ecology, physiology and behavioural ecology. The work was divided into 10 work packages and one work package responsible for coordination.

The different WPs addressed the following tasks:
- WP1: Genetic mapping of potential donor stocks of cod.
- WP2: Genetic characterization of extinct cod stocks in fjord areas of Skagerrak.
- WP3: Ecological inventory of fjords with and without cod, to establish the effect of local cod stocks on fjord ecosystems.
- WP4: Risk assessment in particular focusing on the risk of contamination of released cod larvae or juveniles that migrate into nearby stocks.
- WP5: Legal and institutional aspects of restoring fjord stocks of fish.
- WP6: Societal costs and values of cod restoration.
- WP7: Establishing production of cod juveniles, for tests of feeding and migration behaviours in relation to individual genotype.
- WP8: Developing a step-by-step plan for starting a pilot restoration, including applications for necessary permissions.
- WP9: Development of suggestions of management plans for existing or restored fjord stocks of cod.
- WP10: Synthesis and final report to stakeholders. (Scientific reports will be submitted for publication in scientific journals, in addition).
- WP11: Coordination, internal and external communication including project meetings.

The main results of the project were:
- Cod was present in very small stocks in fjords in eastern Skagerrak, as found from trawling of fish eggs during spawning period. The eggs found were identified as cod from genetic markers. Thus restoration should wait and instead all possible protection should be applied so that these tiny small groups of local spawning cod can increase in numbers over the years to come.
- Several of the fjords in Skagerrak/Kattegat have cod that genetically is a mix of North Sea cod and Kattegat cod. Some fjords along the Norwegian coast have genetically unique elements in the cod stocks.
- The Kattegat spawning stock should be a very important source for eastern Skagerrak cod populations, according to our oceanographic models.

The project was coordinated by Department of Biological and Environmental Science, University of Gothenburg.

This project was funded by EU, InterReg (regional collaboration).

Hansen, J. H., Project Participant, National Institute of Aquatic Resources, Section for Marine Living Resources
Nielsen, E., Project Participant, National Institute of Aquatic Resources
Bonanomi, S., PhD Student, National Institute of Aquatic Resources
Meldrup, D., Project Participant, National Institute of Aquatic Resources
Mensberg, K. D., Project Participant, National Institute of Aquatic Resources

01/07/2012 → 31/12/2014

Keywords: Research areas: Population Genetics & Marine Living Resources & Fisheries Management
Collaborators: Lund University, Institute of Marine Research, University of Gothenburg
Project: Research

**Sustainable bycatch in Danish fishery - Reasonable management under the landing obligation (38028)**

The project facilitated a more robust advice of by-catch species in the Danish fishery in the Skagerrak by suggesting and testing stock assessment approaches for data poor stocks as well as providing guidance for various options to reduce by-catch without limiting the target fishery.

The approach applied in the projects was suggested to be adopted for other areas where the landing obligation potentially can be restrictive for target fisheries (mixed-fish cases). Through thorough exploration of existing data in survey time-series it was possible to provide size-based life-history models to gauge the sensitivity of stocks in relation to fishing pressure.

The models were used to determine relevant biological reference points for the most relevant by-catch species and the resulting assessment and stock status was then compared to the prevailing ICES/RGLIFE classification. Finally, the project suggested upgrading the stocks to a higher and less restrictive ICES category for management purposes where possible.

This project was coordinated by DTU Aqua.

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

Worsøe Clausen, L., Project Manager, National Institute of Aquatic Resources, Section for Marine Living Resources
Gislason, H., Project Participant, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Jørgensen, O. A., Project Participant, National Institute of Aquatic Resources
Kokkalis, A., PhD Student, National Institute of Aquatic Resources

01/06/2012 → 31/01/2014

Keywords: Research areas: Marine Living Resources & Fisheries Management & Marine Populations and Ecosystem Dynamics
Collaborators: Danish Agricultural Agency, Danish Fishermen's Association
Project: Research

**The Mysterious Lumpfish (Cyclopterus lumpus) (38985)**

The aim of the project is to exchange the knowledge of the lumpfish resources between the Nordic countries. There is no firm knowledge that can support a sustainable utilization of lumpfish e.g. lumpfish roe. We exchange data of the size and age distribution of the individual fish populations.

The project is coordinated by the Institute of Marine Research, Norway.

Larsen, E., Project Manager, National Institute of Aquatic Resources, Public Sector Consultancy
Hüssy, K., Project Participant, National Institute of Aquatic Resources

01/02/2012 → 31/12/2012

Keywords: Research area: Fisheries Management
Demonstration Program (GUDP). The project was funded by the Danish Ministry of Food, Agriculture and Fisheries through the Green Development and Demonstration Program (GUDP Tobis) (38849).

Developing competences in the fishing activities of round goby (39071)

The fishermen in the southern part of the island of Zealand have the last years fished large quantity of the invasive fish species round goby (Neogobius melanostomus). When the project started the fishermen lacked the necessary skills to handle these catches and to find buyers of the catch. The majority of the catches were discarded or sold to fishmeal- and fish oil factories. So it was evident that a proper catch handling and reliable sale was needed.

The main results are:
- The nature History Museum of Denmark has mapped the distribution of the round goby and has gained new knowledge of the goby’s biology and behaviour.
- The fishermen have developed new fishing gear, especially as traps. The catch handling has been improved with rapid cooling.
- Small round goby has been found to be of no value as fish for human consumption.
- Silage has proved to be a good method to store the catch, before used as raw material to the feed producers. The only drawback is that the prices paid to the fishermen were too low.
- A manual for proper handling of the catch has been produced.

This project was coordinated by Danish Seafood Association.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF). Larsen, E., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management 01/01/2012 – 31/12/2014

Keywords: Research area: Fisheries Management
Collaborators: Natural History Museum of Denmark, Danish Seafood Association, Fishermen, Gemba Seafood Consulting

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 were 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). Mosegaard, H., Project Coordinator, National Institute of Aquatic Resources, Section for Marine Living Resources Pedersen, E. M., Project Manager, Section for Marine Living Resources Eigaard, O. R., Project Participant, National Institute of Aquatic Resources Dinesen, G. E., Project Participant, National Institute of Aquatic Resources
Harmonised environmental sustainability in the European food and drink chain (SENSE) (38973)

The food and drink industry in Europe, of which 99% are SMEs, is highly fragmented, and food chains are very complex. Hence, to assess the environmental sustainability of a product there is a need for applying integrated, harmonised and scientifically robust methodologies, together with appropriate communication strategies for making environmental sustainability understandable to the market.

SENSE will deliver a harmonized system for environmental impact assessment of food & drink products. The research will evaluate existing relevant environmental impact assessment methodologies, and consider socio-economical, quality and safety aspects, an approach that has been rare up till now, to deliver a new integral system that can be linked to monitoring and traceability data. The concept of harmonized environmental impact assessment system will integrate: (i) (regionalized) data gathering system; (ii) matrix of key environmental performance indicators; (iii) methodology for environmental impact assessment; and (iv) a certification scheme. The methodology will be transferred to food & drink sectors and stakeholders of the food supply chain by means of specific communications strategies.

SENSE will validate the new harmonized system in the juice, meat & dairy and aquaculture chains. The methodology and the associated software will be modular allowing its implementation for any food product. In addition, it will be economically viable and acceptable for the consumers, food industry and relevant stakeholders of the food and drink chain.

These tools will allow food companies to set realistic environmental sustainability goals and to improve their competitiveness towards a more sustainable production culture for all levels of the production process. The sustainability information collected along the production cycle of any food stuff and reflected into the EID (Environmental Identification Document) will be accessible by the EID-Communication Platform, contributing to make the environmental sustainability part of the usual purchasing behavior of consumers and provide a competitive advantage to those products (and companies) which choose to use the developed concept.

External partners are five universities and public research institutions, four national and European organizations and eleven private companies.

The project is coordinated by Marine and Food Technological Centre (AZTI), Spain.

The project is funded by EU, Framework Programme 7.

Larsen, E., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

01/01/2012 → 31/12/2014

Keywords: Research area: Fisheries Management

Project: Research

How Danish fisheries can exploit the CFP discard ban – An elucidation (39075)

European fisheries should ultimately operate without discards. This is clearly expressed by both the European Union and the most important fishery nations outside the Union in Europe. This is in accordance with the overall intention to reduce the ecological impact through changing production and consumption patterns. The most important tool introduced by the Union is the Landing Obligation (LO). The new Common Fisheries Policy (CFP) will move towards a gradual elimination of discards on a case-by-case basis (EC, 2013). This policy is fully implemented in 2019. To be in due time, before the implementation of the LO, a project trying to describe the consequence of this new policy, was done in the years 2012 to 2014. The state of the art of knowledge of discard and the future use of this fraction that will be landed has been evaluated.

The final report suggests that the practical implementation of the LO-principle may take place as a scheme where large scale trials on results based management demonstrate the possible needs of prescriptive regulation in addition to full catch accountability.

The report thoroughly investigates the issues related to a management that can give the fishermen the incentive and tools to comply with full catch accountability it assesses the amounts of discard and offal in Danish fisheries and it points to solutions regarding handling and marketing of the “discard fraction” in the form of fresh raw material or silage solutions. The report recommended to:

- Evaluate the economy of a silage solution on vessels and in relevant harbours. The evaluation should be made as a commercial venture projects including storage, handling distribution, marketing and economic performance.
- Analyse the values fish under reference sizes if sold for human consumption.
- Establish reliable and cheap methods to quantify species composition in silage.

This project was coordinated by DTU Aqua.

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

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01/01/2012 → 31/12/2014

Keywords: Research areas: Fisheries Management & Population Genetics
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.

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Neuenfeldt, S., Project Participant, National Institute of Aquatic Resources

01/01/2012 → 29/02/2016

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

Pilot project: Demonstration of possible energy efficiency in a North Sea fishery using the top end technology and having the maximal selectivity and ability to document the activities (38988)

The aim of the project is to demonstrate how the use of “best ad viable technology” in fishing gear and equipment can increase the earning for the indivial fishing vessel.

The project is coordinated bt Thyboron Fiskerforeningen, Denmark.
Larsen, E., Project Participant, National Institute of Aquatic Resources, Public Sector Consultancy

01/01/2012 → 31/12/2012

Keywords: Research area: Fisheries Management
Collaborators: Thyboron Fiskerforeningen, Neksø Vodbinderi ApS, Thyborøn Trawldoor.dk, Danish Technological Institute
Project: Research

Eastern-western Baltic cod: Improved management based on stock discrimination of eastern and western Baltic cod (Øst-Vesttorsk) (38989)

Theaim of this project was to improve the management of western Baltic cod by incorporating stock identification routines in order to discriminate between eastern and western Baltic cod stocks.

In recent years evidence from fishery patterns and otolith structures have indicated an increasing degree of mixing between the two cod stocks which up until 2013 were managed as two separate stocks. Changes in fishing pressure and patterns would therefore result in a risk for local depletion of the smaller western stock.

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

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

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27/06/2011 → 29/03/2013

Keywords: Research areas: Marine Populations and Ecosystem Dynamics & Marine Living Resources & Population Genetics & Fisheries Management
Collaborators: Cefas Weymouth Laboratory
Project: Research

Pilot project for the preparation of certification (MSC) of gillnet fishing in the Baltic Sea (38974)
Fishing for some important stocks has been assessed in accordance with Marine Stewardship Council (MSC) principles for sustainable fisheries. All these fisheries have now passed the assessment and are certified, with a single exception: Gillnet fishing in the Baltic. This is due to the lack of evidence for gillnet fishing East of Bornholm not having by-catches of the very small population of harbor porpoises which are found in the Baltic Sea in Ices Subdivision (SD) 24 and East. There has not been registered by-catch of porpoises in the Danish gillnet fishing East of Bornholm, neither in biological studies nor by fishermen themselves. But as the Swedish and Polish studies have shown individual by-catches in some gillnet fisheries and the current estimates of stock size means that the by-catch of even a few individuals can prevent it from being restored, the MSC considered that it was not sufficiently proven that the Danish gillnet fisheries did not constitute a threat to the population.

There is therefore a need for documentation of the level of by-catch of harbor porpoises in the Danish gillnet fisheries. This project is coordinated by Danish Fishermen's Association.

Olesen, H. J., Project Manager, National Institute of Aquatic Resources, Section for Monitoring and Data
Larsen, F., Project Participant, National Institute of Aquatic Resources
Kindt-Larsen, L., Project Participant, National Institute of Aquatic Resources
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Rasmussen, M. L., Project Participant, National Institute of Aquatic Resources
Lundgaard, L. S., Project Participant, National Institute of Aquatic Resources

09/06/2011 → 01/05/2015

Keywords: Research area: Fisheries Management
Collaborators: Danish Fishermen's Association
Project: Research

Catch quota project 2011 (38823)
The aim of the project is further development and test of Catch Quota Management (CQM) systems in Danish fisheries by the use of electronic monitoring systems. Furthermore, to test whether electronic monitoring – video and sensor recordings – can provide the necessary documentation to support a CQM system. In addition the project will illustrate whether full documentation of catches can support implementation and certification and traceability solutions which requires linkage to project dealing with these issues.

As the Danish Government has worked intensively for the implementation of CQM in the new Common Fisheries Policy (to be implemented from 2013 and onwards) the project should also facilitate international cooperation on European level to set up common standards for CQM data collection, data processing, data exchange and base development.

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).

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

**Objectives and Background**

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

**Deliverables and Tasks**

In the first step the project developed a coherent and consistent set of objectives for fisheries management, which addressed ecological, economic and social sustainability targets. The objectives were consistent with the aims of the CFP, MSFD and other EU directives, but also understandable by stakeholders and the community and engaged their support. This 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 funded by EU, Framework Programme 7.

Nielsen, J. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

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Eigaard, O. R., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

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.

Keywords: Research area: Fisheries Management

Project: Research

Vectors of change (VECTORS) (38907)

Marine life makes a substantial contribution to the economy and society of Europe. VECTORS aimed at elucidating the drivers, pressures and vectors that cause change in marine life, the mechanisms by which they do so, the impacts that they have on ecosystem structures and functioning, and on the economics of associated marine sectors and society. VECTORS particularly focused on causes and consequences of invasive alien species, outbreak forming species, and changes in fish distribution and productivity. New and existing knowledge and insight was synthesized and integrated to project changes in marine life, ecosystems and economies under future scenarios for adaptation and mitigation in the light of new technologies, fishing strategies and policy needs. VECTORS also evaluated current forms and mechanisms of marine governance in relation to the vectors of change. Based on its findings, VECTORS outlined solutions and tools for relevant stakeholders and policymakers during the lifetime of the project. The VECTORS consortium included a mixture of natural scientists with knowledge of socio-economic aspects, and social scientists (environmental economists, policy and governance analysts and environmental law specialists) with interests in natural system functioning. DTU Aqua contributed to VECTORS by developing new statistical models of fish species distributions, by further developing spatially resolved bio-economic models of fishing, and by analyzing fish species richness and distribution in the north Atlantic and the general relationship between changes in fish stock abundance and distribution area. We coordinated the Baltic WP where we implemented the ATLANTIS end-to-end model and performed initial scenario testing. We also analyzed the most important drivers of fish population dynamics in the Baltic, and contributed to the study of invasive species.

VECTORS comprised a total of 37 European Universities, research institutions and professional associations dealing with applied maritime and marine research.

The project included marine environmental scientists, fisheries scientists, conservation biologists, sociologists and economists from across the European scientific community providing expertise in marine ecosystems, management, fisheries, maritime transport, tourism and coastal development.

The project was coordinated by Plymouth Marine Laboratory, UK.

The project was funded by EU, Framework Programme 7.

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

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Bastardie, F., Project Participant, National Institute of Aquatic Resources

Kristensen, K., Project Participant, National Institute of Aquatic Resources
Development of an energy saving trawl (39029)
The aim of the project was to test and document the reduced drag in a novel trawl design made by Herman Trawl. Detailed testing and drag measurements were conducted at the flumetank in Hirtshals where the new designs measurements were compared with similar drag measurements of a standard trawl of similar size. The developed design demonstrated a relative large reduction in drag compared to similar sized standard gears. The specific effect was documented at different towing speeds. All measurements were made on scale models. This project was coordinated by DTU Aqua. The project was funded by the Danish Agency for Science, Technology and Innovation.
Keywords: Research areas: Fisheries Technology & Fisheries Management
Collaborators: Municipality of Frederikshavn, SINTEF, Herman Trawl
Project: Research

Catch quota project 2010 (38787)
The aim of the project is further development and test of Catch Quota Management (CQM) systems in Danish fisheries by the use of electronic monitoring systems. Furthermore, to test whether electronic monitoring – video and sensor recordings – can provide the necessary documentation to support a CQM system.

In addition the project will illustrate whether full documentation of catches can support implementation and certification and traceability solutions which requires linkage to project dealing with these issues.

From January 2010 the European Council has adopted possibilities for EU Members States to conduct trials on catch quota management on cod in the North Sea, the Skagerrak and the Kattegat.

As the Danish Government has worked intensively for the implementation of CQM in the new Common Fisheries Policy (to be implemented from 2013 and onwards) the project should also facilitate international cooperation on European level to set up common standards for CQM data collection, data processing, data exchange and data base development.

The project is coordinated by DTU Aqua.
Dalskov, J., Project Manager, National Institute of Aquatic Resources, Public Sector Consultancy
Olesen, H. J., Project Participant, National Institute of Aquatic Resources
Jensen, R., Project Participant, National Institute of Aquatic Resources
Kirkegaard, E., Project Participant, National Institute of Aquatic Resources
Håkansson, K. B., Project Participant, National Institute of Aquatic Resources 01/01/2010 → 31/12/2011
Keywords: Research area: Fisheries Management
Collaborators: Danish Directorate for Fisheries, Archipelago Marine Research Ltd.
Project: Research

Eco-certification of Danish fisheries (38885)
Danish Fishers PO had decided that all commercial fisheries in Denmark should, where possible, operate at the standard necessary to obtain MSC certification by 2012. This project was the third of a suite of EFF-financed projects supporting this challenge.

Of particular focus was the absence of management plan for plaice and sole in Kattegat-Skagerrak area, which is one of the prerequisite for certification. Sole stock is regularly assessed by ICES, implying that a management plan could potentially be established on a standard basis. But the situation was more problematic for plaice, which assessment suffered from a number of uncertainties and issues which could not be solved through a standard benchmark process.

DTU Aqua was thus involved in order to clarify the biological knowledge base for this stock and contributed to suggestions for a more tailored approach to the assessment and management of plaice in Skagerrak.

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

The research underlying this project was continued in project 39025 in 2013-2014. The project was coordinated by Danish Fishermen's Producers' Organisation, Denmark. The project was funded by the Danish Ministry of Food, Agriculture and the Fisheries and the European Fisheries Fund (EFF).

Ulrich, C., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Boje, J., Project Participant, National Institute of Aquatic Resources
01/01/2010 → 01/02/2013

Keywords: Research areas: Fisheries Management & Ecosystem based Marine Management
Collaborators: Danish Fishermens Producers Organization

Electronic monitoring on smaller fishing vessels fishing with gillnets (38773)
The aim of the project is to examine whether electronic monitoring by the use of CCTV and sensor recordings can ensure full documentation of the fisheries carried out by smaller gillnetters, and whether the use of “pingers” (acoustic deterrent devises) can be more operational.

Furthermore, the project has the aim to proof that:

- A total recording of all catches of quota managed species and a reduction of “high-grading”
- Involvement of the fishing industry in collection of detailed data and thereby ensure industry involvement for joint responsibility for the collection of data to be used as the basis for the scientific advice
- An adequately documentation that can ensure that the fishery could be carried out sustainably in sensitive marine areas such as NATURA 2000 sites
- An improved economy for vessels that participate in fully documented fishery
- A documentation that can provide the basis for the marked to be able to evaluate sustainability of the fisheries.

The project is coordinated by DTU Aqua.
Dalskov, J., Project Manager, National Institute of Aquatic Resources
Kindt-Larsen, L., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Larsen, F., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Olesen, H. J., Project Participant, National Institute of Aquatic Resources
Jensen, R., Project Participant, National Institute of Aquatic Resources
01/01/2010 → 31/12/2011

Keywords: Research areas: Fisheries Management & Observation Technology
Collaborators: Archipelago Marine Research Ltd.

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 FISHRENT 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.

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 (e.g. DHI). The project was coordinated by Aarhus University. DTU Aqua was main project developer, WP4 leader and member of the Project Steering Group.

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

Nielsen, J. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Bastardie, F., Project Participant, National Institute of Aquatic Resources
Ross, S. D., Project Participant, National Institute of Aquatic Resources
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Christensen, A., Project Participant, National Institute of Aquatic Resources
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Andersen, B. S., Project Participant, National Institute of Aquatic Resources
01/01/2010 → 31/12/2015
Keywords: Research areas: Fisheries Management & Ecosystem based Marine Management

Open Minds (38782)
Open Minds is a user driven innovation process. The project includes three important Danish sectors, which is headed by the following research and GTS institutions:

- Building sector: Technology College, Aalborg, Denmark
- Food sector: Technical University of Denmark
- Experience sector: Alexandra Instituttet, Aarhus, Denmark

More than 15 companies are affiliated the project and two organizations with more than 350 members are working within the project. The project is creating an innovation process by using representatives from the different sectors. The project is creating a forum where IBT technology providers (IBT: Information technology carrier) can meet the users, this forum is facilitated by the research and GTS institutions.

Larsen, E., Project Manager, National Institute of Aquatic Resources, Public Sector Consultancy
01/01/2010 → 31/12/2011
Keywords: Research area: Fisheries Management
Collaborators: Technology College Aalborg, Aalborg University, Alexandra Institutet A/S, Naviair
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 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 project was funded by EU, InterReg (regional collaboration).

Eigaard, O. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Munch-Petersen, S., Project Participant, National Institute of Aquatic Resources
Nielsen, A., Project Participant, National Institute of Aquatic Resources
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Holm, N., Project Participant, National Institute of Aquatic Resources
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 Fisherman’s Association
Project: Research

**Traceability in the Danish fish sector (SIF) (38883)**

The development of an operative system to have full traceability in the Danish fish sector, started in 2009, with the first project SIF 1. This was a specification of what an IT program should contain to meet the demands of the sector. The actual software development took place in the next project SIF 2. Due to some political implications to finance SIF 2 it was divided in SIF 2.1 and SIF 2.2. SIF 3 had to start before SIF 2.2 was finished and some elements were transferred between the two projects.

SIF 3 has the Danish title of “Dataopsamling af sporbarhedsdata” (collection of traceability data). The main activities are to specify and build the access points to the database constructed in SIF 2.1 and extend the use to the processing industry and wholesalers. The overall aim is to construct a “single string system” that collects all relevant data. This last expansion has been done to meet the challenge from the EU Regulation 1224/2009 and the Commissions Regulation 404/2011, to have valid traceable data.

DTU Aqua’s part in SIF 3 has been concentrated on constructing a software program to be used on the fishing vessels to communicate with the fishery inspections IT based Logbook (E-Log) and the SIF-database. This has been done in close cooperation with DTU IMM (Institute for Mathematical Modeling), which have a software development group, originally coming from DTU Aqua. The developed program has been built partly on a previous program with the name of PIP – developed for the pelagic sector.

The project is coordinated by Danish Fishermen's Producers' Organisation, Denmark.
Larsen, E., Project Manager, National Institute of Aquatic Resources, Public Sector Consultancy
01/01/2010 → 31/03/2012

Keywords: Research area: Fisheries Management
Project: Research

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

Objectives and Background
The project “Development of tools for logbook and VMS data analysis” was an EU project under studies for carrying out
The aim of the project was to develop a set of standard protocols for coupling and simultaneous analyses of EU fisheries logbook and VMS satellite vessel record data. 

Tasks and Deliverables

The process began with the construction of standardized data formats for logbook (EFLALO) and VMS (TACSAT). The software for analyzing the data took the form of a fully documented package called vmstools, built using the freeware package, R (http://cran.r-project.org/). Once the data have been imported into R in the correct format, a series of R programs or ‘functions’, linked by ‘scripts’ enable all tasks necessary to be completed in a single software environment. The software can ‘clean’ data and format input data, estimate distances between VMS positions, and métiers can be identified objectively from species assemblages in catch data using multivariate statistical techniques. We have included a range of complimentary methods for determining fishing activity from VMS position registrations. Positions at sea, for example, can be distinguished from vessels in harbor or erroneous positions on land. Position registrations of vessels actually fishing can be separated from those engaged in other activities (e.g. steaming) using their speed in conjunction with other information such as vessel size and gear being used.

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

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

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

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

The project is coordinated by Institute for Marine Resources and Ecosystem Studies (IMARES), Wageningen UR, The Netherlands. This project is funded by EU, Framework Programme 7.

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Ulrich, C., Project Participant, National Institute of Aquatic Resources
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01/01/2009 → 31/12/2012

Keywords: Research areas: Fisheries Management & Marine Living Resources
Collaborators: Wageningen IMARES, Sea Fisheries Institute, Marine Institute, Marine Scotland, Cefas Weymouth Laboratory, IFREMER
Project: Research
commercial fisheries data, and information on recruitment dynamics with emphasis on fluctuations in distribution and productivity with respect to environmental and anthropogenic drivers of change including species interactions and fisheries.

WP 2 included extension of existing standard surveys in the near field area and analyses of both the standard and extended time series with respect to variability in distribution, density and abundance patterns of relevant stocks, as well as developing advanced scientific survey evaluation models and methods for doing this.

WP 3 analyzed stock and fisheries dynamics by use and development of complex multi-fleet-multi-stock bio-economic management evaluation models performing analyses on a very high spatial and temporal resolution scale using integrated fisheries, stock and survey data. The models evaluated different management options and scenarios relevant for the establishment of the fixed link.

WP 4 evaluated variability in recruitment and important spawning areas according to hydrographic features and in relation to impact of the fixed link among other by use and further development of complex hydro-dynamic models.

WP 5 evaluated herring stock occurrence and migration patterns in the Baltic area by use of genetic identity markers, otolith micro-structures and information from fisheries and research surveys in order to evaluate impact of the fixed link. The project has besides a long row of project reports produced around 30 scientific peer reviewed journal papers where DTU Aqua are first author on more than half and co-author on more than 20 of the papers.

The project was coordinated by DTU Aqua.

The project was funded by the 3 partners with external Funding from Femern Bælt A/S.

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Jepsen, N., Project Participant, National Institute of Aquatic Resources

Lewy, P., Project Participant, National Institute of Aquatic Resources

Kristensen, K., Project Participant, National Institute of Aquatic Resources

Dutz, J., Project Participant, National Institute of Aquatic Resources

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01/01/2009 → 31/12/2013

Keywords: Research area: Fisheries Management & Fish Biology & Marine Living Resources & Population Genetics

Collaborators: Femern A/S, Thunen-Institut

Project: Research

Improving the knowledge of the biology and the fisheries of the new species for management (NESPMAN) (38689)

The NESPMAN (New Species for Management) project is meant to improve the knowledge of the biology and the fisheries of the new species for management. Apart from highly priced turbot, brill, striped red mullet and sea bass, these 12 species comprise also 3 gurnard species and 4 flatfishes. This report presents information for these 12 species that are becoming increasingly important for fisheries in NW Europe, partly due to the generally poor state of some of the main commercial fish species.

DTU tasks in the project:

- Danish fishery for witch flounder: compilation of data and description.

- Assessment of the witch flounder stock in the North Sea and Skagerrak.

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

Munch-Petersen, S., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

01/01/2009 → 31/12/2010

Keywords: Research area: Fisheries Management

Collaborators: Thuen-Institut, Wageningen IMARES, Institute of Marine Research, Marine and Food Technological Centre, Cefas Weymouth Laboratory, Institute for Agricultural and Fisheries Research, IFREMER

Project: Research
Study for the revision of the plaice box (PBox) (38647)

This project has attempted to evaluate the effectiveness of the fisheries management, measure known as the “Plaice Box” (PB) for the conservation of plaice and other species of marine organisms in the south-eastern North Sea. The study provides an inventory of existing information and collects new material on the effects of the PB on the conservation of plaice and the impact of the PB on various components of the commercial fishing fleets.

Based on an analysis of key processes that affect the impact of the PB, modifications were explored to improve the positive effect on the conservation of plaice and other species of marine organisms, including catches and bycatches of other marketable fish. An economic assessment of the consequences of those modifications, in terms of their cost-effectiveness, and implications for profitability of the activity was presented. Finally, the data requirements for future evaluations on the effects of the PB on conservation were discussed.

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

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

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01/01/2009 → 31/12/2010
Keywords: Research area: Fisheries Management
Collaborators: Wageningen IMARES, Alfred Wegener Institute, Thunen-Institut
Project: Research

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

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

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

Find full list of participants at the website of GAP2.

These projects were coordinated by the Centre for Environment, Fisheries and Aquaculture Science, UK.
The projects were funded by EU, Framework Programme 7.
Worsøe Clausen, L., Project Manager, National Institute of Aquatic Resources, Section for Marine Living Resources
Mosegaard, H., Project Participant, National Institute of Aquatic Resources
Ulrich, C., Project Participant, National Institute of Aquatic Resources
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01/01/2008 → 31/12/2015
Keywords: Research areas: Marine Living Resources & Population Genetics & Fisheries Management
Collaborators: Istituto Superiore per la Protezione e la Ricerca Ambientale, Pelagic Regional Advisory Council, Swedish National Board of Fisheries, Baltic Sea Regional Advisory Council, Universidade da Coruña, UiT The Arctic University of Norway, Aalborg University, Cefas Weymouth Laboratory
Project: Research
**Development of fisheries with minimized emission of greenhouse gases (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.

Herrmann, B., Project Manager, National Institute of Aquatic Resources
Nielsen, J. R., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
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Andersen, B. S., Project Participant, National Institute of Aquatic Resources
Eigaard, O. R., Project Participant, National Institute of Aquatic Resources
Madsen, N., Project Participant, National Institute of Aquatic Resources

01/01/2008 → 31/12/2012

Keywords: Research area: Fisheries Technology & Fisheries Management
Collaborators: Technical University of Denmark, Thunen-Institut, IFREMER
Project: Research.

**JUDGEMENT AND KNOWLEDGE IN FISHERIES INVOLVING STAKEHOLDERS (JAKFISH) (38132)**

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

Two parallel tracks were followed: First, a number of case studies involving participatory modeling processes with stakeholders involvements were developed, for support in policy decision-making: Western Baltic herring, Central Baltic herring, North Sea nephrops and Mediterranean swordfish. Second, sociological analyses of the practices and institutional forms that can most effectively involve the wider community in debates over developing science-based policies were carried in various regions both within Europe (North Sea, Baltic, Mediterranean) and outside (USA, Australia). Ultimately, both tracks were linked into a single synthesis.
The project was coordinated by IMARES, Wageningen UR, The Netherlands.
Ulrich, C., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
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01/01/2008 → 31/12/2011
Keywords: Research area: Fisheries Management
Collaborators: Wageningen IMARES, Institute of Marine Research, Hellenic Centre for Marine Research, University of Helsinki, Dialogik, University of Tartu, Aalborg University, Cefas Weymouth Laboratory, University of Portsmouth
Project: Research

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

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

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

The project was coordinated by Plymouth Marine Laboratory, UK, and had 21 partners from the EU.
The project was funded by EU, Framework Programme 7.

Christensen, A., Contact Person, National Institute of Aquatic Resources, Section for Marine Living Resources
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Nielsen, J. R., Project Participant, National Institute of Aquatic Resources
Eero, M., Project Participant, National Institute of Aquatic Resources
Andersen, K. H., Project Participant, National Institute of Aquatic Resources
Bastardie, F., Project Participant, National Institute of Aquatic Resources
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01/01/2008 → 15/10/2012
Keywords: Research areas: Marine Living Resources & Marine Populations and Ecosystem Dynamics & Fisheries Management
Project: Research

**Optimizing the exploitation of fishery resources in Skagerrak (OSKAR) (38720)**

The purpose of this project was formulated in 2008 to establish knowledge on the geographical distribution of target species in Skagerrak, which enables the fishermen to plan and execute sustainable fisheries on these species with a minimum of discard and unwanted by-catch of cod, and without drastically reducing or unjustified closure of areas.

OSKAR was a collaborative fishermen-scientist project building on the experience from the REX-project conducting small-scale scientific surveys with commercial ships.

To separate control issues of the mixed fishery of Skagerrak from the issues of using fishermen’s and scientists’ combined knowledge and experience to produce more selective fisheries, some of the key questions addressed were:
- Is it feasible to predict the size distribution of cod on a small spatial scale (single trawl haul) from surveys?
- How important are the seasonal changes for the spatial distribution of cod in Skagerrak?
- Can fishermen’s anecdotic knowledge on the distribution of cod be used?
- Which role does mechanistic process knowledge play in determining critical spatial dynamics of cod?
- Taking also gear technology into account then how can we best produce e.g. a useful cod avoidance tool?

A new advanced geostatistical tool GeoPop was introduced in order to use all available survey data in the maximum likelihood estimation of temporal and spatial dynamics of the size distribution of the stock. Real time closures, future disallowance of discards etc. put the perspective of OSKAR into focus.

The development of GeoPop in this fishermen-scientist project has proven valuable (see Jansen et al 2016, Fish. Res. 179: 156-167 and refs herein). The method was published in 2013 (Kristensen et al 2013, Can. J. Fish. Aquat. Sci. 99: 1-19). Particular attention in GeoPop is paid to correlation between size classes within each trawl haul due to clustering of individuals with similar size. Extracting this nugget effect produces clearer population signals and allows e.g. following cohorts in space and time and determining stock structures. Although GeoPop today is fully TMB operated it is the present computer capacity which sets the limits to exploring e.g. the impacts of spatial heterogeneity on fishery stock assessment.

The project was coordinated by DTU Aqua.

The project was funded by the Danish Ministry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).
Survey of existing bio-economic models (S12.507729)

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, BEMMFISH, BIRDMOD (Including Aladym), MEFISTO, AHF, EMMFID, 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.

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.

Ulrich, C., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

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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, IFREMER

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 fishermen’s 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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01/01/2006 → 31/12/2009

Keywords: Research area: Fisheries Management

Collaborators: European Commission - Joint Research Center, Wageningen IMARES, Marine and Food Technological Centre, University of Copenhagen, Hellenic Centre for Marine Research, Marine Scotland, Spanish Institute of
**Management plans and Danish fishery (2245)**

The objectives of the project were with reference to the EU Commissions proposals on multi-annual management plans, to deliver high quality advice on management of the fishing effort in Danish fisheries in the Baltic Sea, the North Sea, the Skagerrak and the Kattegat.

To be able to deliver the advice the project addressed the need for detailed and accurate data on catches, effort and economical performance in the main demersal Danish fisheries in the concerned areas and the need for accurate stock assessment of the economically most important fish and shellfish stocks. The project also developed a systematic method to give a qualified prediction of the selectivity of a trawl based on information on the trawl design.

The project included seven work packages: (i) Description of development in catches, fishing effort and economical performance of the main demersal Danish fisheries including creation of a single database; (ii) Develop a reference fleet system to collect detailed information on catches and fishing effort; (iii) Development of a software to be used to simulate trawl selectivity; (iv) Establish a fisheries independent monitoring survey on Norway lobster in the Skagerrak and the Kattegat; (v) Provide advice on a fishing effort management system for the demersal fisheries in Kattegat including proposal for enhancement of the cod selectivity in trawl fisheries; (vi) Provide advice on fishing effort in form of days at sea by métier; and (vii) Evaluate the impact of the effort management system in the Baltic Sea on the Danish fishery and the stocks.

The project was coordinated by DTU Aqua.

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01/01/2006 → 31/12/2008

**Keywords:** Research areas: Fisheries Management & Fisheries Technology

**Collaborators:** University of Copenhagen

**Project:** Research

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**Comparative evaluations of innovative solutions in European fisheries management (CEVIS) (38105)**

CEVIS is an FP6 project that assessed potential innovations for European fisheries management regimes with respect to four general management objectives: biological robustness, economic efficiency, the cost effectiveness of management activities, and social robustness. CEVIS examines four types of regime-level innovations: the use of participatory approaches to fisheries governance, rights-based regimes, effort-control regimes and decision rule systems. These innovations are assessed in respect to four general management objectives: biological robustness, economic efficiency, the cost effectiveness of management activities, and social robustness. The four regime level innovations measured against the four general management objectives define the CEVIS research's conceptual framework. The conceptual framework is tested against four European test cases. However, before these case studies begin, the research will take a close look at international cases of innovative fisheries management in other developed countries. Visits will be made to four places outside the EU that have similar fisheries and have implemented these four types of innovations.
The project has built further on the networks and platforms produced under EU FP6 EFIMAS project (38094) which DTU Aqua coordinated, and the DTU Aqua team associated to the project has produced several peer reviewed journal papers under CEVIS and been co-authors to a book published by Elsevier in relation to CEVIS. Besides this, CEVIS has two final products. The first is an Innovation Evaluation Framework made up of indicators of inputs and outcomes in relation to the four general management objectives. This is an aid to fisheries managers wishing to assess the suitability of possible changes in EU fisheries management practice. The second is a report based on the case studies that evaluates this specific set of potential regime-level innovations for use in EU fisheries management. The developed framework makes it possible for managers to evaluate the extent to which any given management system will contribute positively to attaining Common Fisheries Policy objectives. A range of options for implementing cost-effective and participatory management systems have been provided and finally, the CEVIS project helps fishery managers to be better informed about the ecological, social and economic consequences of implementing any particular management regime.

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

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01/01/2005 → 31/12/2009
Keywords: Research area: Fisheries Management
Collaborators: Netherlands Institute for Fisheries Research, European Commission - Joint Research Center, Institute of Marine Research, Sea Fisheries Institute, Marine and Food Technological Centre, University of Copenhagen, Marine Scotland, UiT The Arctic University of Norway, Aalborg University, Luleå University of Technology, Öko-Institut
Project: Research

Creation of multi-annual management plans for commitment (COMMIT) (2212)
The objective of COMMIT was to provide a sound scientific basis for the long-term planning of fisheries management consistent with sustainable development, while also identifying any short-term biological and socio-economic consequences. This was done through the evaluation of multi-annual management plans that reduce annual fluctuations in exploitation strategy and ensure commitment of the stakeholders to the plan. Strategies were based upon harvest rules and developed explicitly recognizing uncertainty due to process, measurement, estimation, model and implementation error. In particular a socio-economic analysis identified mechanisms affecting the commitment of key stakeholders and hence the level of implementation error. Robust strategies were designed that explicitly took this into account. Stocks chosen are those of interest to the community (Baltic salmon, North Sea flatfish and Northern hake) and in particular those exploited in mixed fisheries, although the methods developed are generic and applicable to other stocks.

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

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01/01/2004 → 31/12/2007
Keywords: Research area: Fisheries Management
Collaborators: Imperial College London, Wageningen IMARES, Marine and Food Technological Centre, Marine Scotland Science, Wageningen University & Research, University of Tartu, Finnish Game and Fisheries Research Institute, National Research Institute for Agriculture and Fisheries, Cefas Weymouth Laboratory, University of Portsmouth
Project: Research

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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European advisory system evaluation (EASE) (2194)

The overall objective was to set up the basis for more appropriate data collection and analysis programs in order to support existing and emerging fishery management issues. The present data and advisory structures have developed by a process of evolution and involve considerable commitment of human and financial resources. In general these resources are in short supply and may be declining. It is no longer clear whether present systems can be maintained or whether they are appropriate for emerging issues, notably those relating to a more holistic approach to fishery management.

The first objective of the concerted action was to understand the current balance between resources devoted to data collection and value of these data in the provision of advice. This required the evaluation of the range of advice requested on fishery management and the data needs to perform the science to support it. Of particular importance is the basic fisheries data on catch composition according to species, size or age and commercial catch per unit of effort (CPUE) according to fleet since these are used in almost all analyses. However other types of necessary data have also been included, e.g. research vessel CPUE, stock structure according to size or age, weight and maturity at age.

The second objective was to quantify the quality of the scientific outputs derived from the data inputs. Since much advice is qualitative and relies on expert judgement, this objective was focussed to quantifying the reliability of routine annual stock assessments upon which advice is formulated.

The third objective was to identify alternative uses of data and alternative analytical methods which could support present fishery management needs as well as those which could address new and emerging issues, such as multi-annual decision rules and mixed fisheries issues.

The fourth and final objective was to analyse ways of re-deploying existing resources in order to support a modern fishery management system. With focus on where data collection should be improved and rationalisation of the deployment of current resources to improve efficiency scope for re-deployment of resources to address emerging management advisory needs, such requirements of effort management systems and the implementation of the ecosystem approach to fisheries management.

The project was coordinated by DTU Aqua.
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01/01/2002 → 31/12/2006

Cooperative agreement between Greenland Institute of Natural Resources and DTU Aqua (38085)

DTU Aqua supports the Greenland Institute of Natural Resources (GINR) within general fisheries biology, assessment, survey planning and evaluation and education and support of young scientists. The scientists are also engaged in formulation of advice to the Greenland Government in several ICES Expert Groups such as North Western Working Group (NWG) and Working Group for Widely Distributed Stocks (WGWIDE), North East Atlantic Fisheries Commission (NEAFC) and North West Atlantic Fisheries Organization (NAFO). ICES and NAFO are further the platforms where important assessment issues such as stock ID, assessment methods and survey techniques are discussed and applied in the advisory service. Further scientists acts as appointed experts at the Self-Governments bilateral fisheries meetings and costal state meetings.
During the years DTU has recruited eight scientists from GINR while one scientist has been recruited from DTU Aqua to GINR.
The project is coordinated by DTU Aqua.
The project is funded by the Greenland Institute of Natural Resources.
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01/01/2001 → …
Keywords: Research areas: Fisheries Management & Marine Living Resources
Collaborators: Greenland Institute of Natural Resources
Project: Research