Real-time camera observation in the Danish trawl fishery—technology based intelligent fishery (TEKNOFISK) (39579)

The aim of the project is to develop and commercially test an innovative real-time camera system on board Danish trawlers. The system will allow fishermen to observe, evaluate, and if relevant, actively react on information about the fishing process. A reaction could be to terminate the haul or to shift to alternative depth or fishing ground. Through innovative use and combination of existing technology, the project will develop a real-time tool for decision making. The tool will make the trawl fishery a more knowledge based process, where decisions can be made on better grounds.

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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06/12/2018 → 09/11/2020

Keywords: Research area: Fisheries Technology
Project: Research

Sustainable, cost-efficient, and responsive fishing gear solutions under the landing obligation (FAST TRACK II) (39578)

The project is a follow up on FAST TRACK I, where a functioning and innovative cooperation platform for industry, scientists, and managers is established. The aim of FAST TRACK II is to consolidate and further develop the FAST TRACK platform which serves as an efficient track from idea to implementation of selective gears. The project builds on a dynamic cooperation between all partners involved in the fishery and this setup ensures an efficient approval procedure according to the EU Common Fisheries Policy. The FAST TRACK platform thereby allows an ongoing development of specialized fishing gears which again ensures the fishermen the best possible economical and biological sustainability under the landing obligation.

In FAST TRACK II, special attention is given to two topics:
- To ensure that the FAST TRACK platform continuously facilitates an efficient development of innovative fishing gears.
- To establish regional and international networks to ensure knowledge sharing on selective gear solutions in specific fisheries. Furthermore, the networks will support a broad acceptance of the attained results.

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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01/06/2018 → 07/11/2020

Keywords: Research area: Fisheries Technology
Project: Research

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.
Smart fisheries technologies for an efficient, compliant and environmentally friendly fishing sector (SMARTFISH) (39523)

The objective of SMARTFISH is to develop, test and promote a suite of high-tech systems for the EU fishing sector, to optimize resource efficiency, to improve automatic data collection for fish stock assessment, to provide evidence of compliance with fishery regulations and to reduce ecological impact.

SMARTFISH exploits technological developments in machine vision, camera technology, data processing, machine learning, artificial intelligence, big data analysis, smartphones/tablets, LED technology, acoustics and ROV technology to build systems for monitoring, analyzing and improving processes for all facets of the fishing sector, from extraction, to assessment, to monitoring and control.

The SMARTFISH systems will:
- assist fishermen in making informed decisions during pre-catch, catching, and post-catch phases of the extraction process. This improves catch efficiencies and compositions in fisheries across the EU, leading to improved economic efficiency while reducing unintended fish mortality, unnecessary fishing pressure and ecosystem damage.
- provide new data for stock assessment from commercial fishing and improve the quality and quantity of data that comes from traditional assessment surveys. This provides more accurate assessment of currently assessed stocks and allow the assessment of data-poor stocks.
- permit the automatic collection of catch data to ensure compliance with fisheries management regulations.

The SMARTFISH systems are tested and demonstrated in several EU fisheries. This contributes to promoting the uptake of the systems by extraction sector and fisheries agencies.

An interdisciplinary consortium with technology developers and instrument suppliers, fishing companies, research and fisheries management institutes and universities will realize SMARTFISH. They are active at national and international levels and well placed to ensure the uptake of SMARTFISH systems by fishing industry and fisheries managers and stock assessment scientists.

The project is coordinated by SINTEF, Norway and is funded by EU through Horizon 2020 Framework Programme.

Caught and released: an overview of fishes’ sensitivity to being discarded as a tool to aid pursuing ecosystem-based management (COPE) (39416)

One main goal of the project is to provide a catalogue of the survival rates of different species subject to the landing obligation under the Common Fisheries Policy (CFP) regulation seen in relation to the discard ratios of different fisheries.
Another main goal is to obtain survival rates for selected important species and fishing gear. This information can, in the cause of high survival rates, be used in proposals for exemptions from the landing obligation. Species exempted from the landing obligation can be returned to the ecosystem as discards, and contribute to reproduction and recruitment, and thus productivity of the stock. Landings of unwanted catch may cause unintentionally increase in fishing mortality and unsustainable fishery.

Exemptions from the landing obligation may facilitate the implementation of the CFP, especially for small vessels in the mixed fishery for which there is a mismatch between the size of the deck area and the number of species and size groups in a catch that needs to be kept separately during sorting. Also, exemptions from the landing obligation can improve the economic viability of fisheries as the CFP does not allow landed catch below the minimum conservation reference size to be used directly for human consumption, which mostly limits the utility to low value products.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Ministry of Environment and Food of Denmark. Karlsen, J. D., Project Coordinator, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
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13/09/2016 → 31/12/2018
Keywords: Research area: Fisheries Technology
Project: Research

Seal-safe fishing (39421)
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12/09/2016 → 19/12/2018
Keywords: Research areas: Ecosystem Based Marine Management & Fisheries Technology
Collaborators: Swedish University of Agricultural Sciences
Project: Research

From science to innovation in the Nephrops fishery to comply with the Common Fisheries Policy: development of an optimal and flexible selection system for trawl by use of new technology and underutilized fish behaviour (VISION) (39375)
The aim of the VISION-project is to develop a new generation of trawl designs towards a targeted and controllable species and size selection in the mixed fisheries targeting Nephrops by improving vertical separation of the catch and gear selectivity. This will contribute to an economic viable fishery and sustainable use of resources under a landing obligation.

The mixed fisheries targeting Nephrops is one of the most economically important Danish fisheries. It is characterized by high proportions of discards and will have a low capitalization of the vessels’ quotas under a landing obligation.

In the VISION-project, a horizontally divided codend developed in the FishValue-project (vaerdifisk.dk) will be refined to increase the vertical separation of cod, flatfish and small fish in general from Nephrops. The project will combine new technology and knowledge of fish behavior in an innovative way to develop new selection principles and thus gear designs with an increased species and size selectivity. Furthermore, the project seeks to provide solutions for a highly flexible fishery so fishermen can change their gear to match the selective properties with the current fishing situation.

The project is coordinated by DTU Aqua and is funded by the European Maritime and Fisheries Fund (EMFF) and the Ministry of Environment and Food of Denmark.
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19/01/2016 → 08/08/2019
Keywords: Research area: Fisheries Technology
Project: Research
**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.

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

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

**Project:** Research

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**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.

**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, L’Institut Français de Recherche pour l’Exploitation de la Mer, NAYS Ltd, Irish Department of Communications, Marine and Natural Resources, University of Bergen, Universite de Bretagne Occidentale, Matís 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-Tecnalia

**Documents:**
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).

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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

Understanding and predicting size selectivity and escape mortality in commercial zooplankton fisheries: Case study on Antarctic krill (SILF) (39245)

Antarctic krill is an important fisheries resource, regarded as one of the most under-exploited fisheries in the world. Concern is expressed regarding the future sustainability of harvesting and the impact this may have on dependent predators. This is associated with the cumulative pressure from ongoing environmental changes, which modify abundance, distribution and life cycle of krill.

Due to large gaps in knowledge about this marine ecosystem and potential negative effects caused by fishery activities, both the Commission and Scientific Committee of CCAMLR strongly request knowledge about the effects of different fishing gear on krill escape and the indirect mortality on the krill stock. Indirect fishing mortalities include organisms that die after escaping from fishing gear due to injury.

CCAMLR is currently improving their management system, by establishing feedback management procedures and Small Scale management Units. They recommend members to have scientific observers on board to enhance control measures and Marine Protected Areas around the continent is established with various degrees of allowing for exploratory fishing and rational use. It is highly uncertain to establish such a management regime without scientific knowledge about the impact of fishing on the ecosystem. There is an urgent need to address these questions, also for the sake of the development of other new and exploratory fisheries.

A pilot study (NEAT) using both mathematical modeling techniques and practical experiments on size selection of krill shows that escape occurs even from some of the smallest commercial meshes used in the fishery. In this study, we will assess different trawl designs sizes selectivity and establish predictions of sizes selectivity of krill in any given trawl design.

We will also perform experiments to examine the rate of escape mortality of krill in trawls and couple this to full gear sizes selectivity to allow evaluation and optimization of trawls in the commercial krill fishery. The developed methods are directly transferable to similar fisheries e.g. fisheries targeting species lower in the food chain. This project is coordinated by the Institute of Marine Research, Norway.

The project is funded by the Research Council of Norway.

Krag, L. A., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

01/01/2015 → 31/12/2017
Discard survival (DISCO) (39152)

This project has developed methods and accumulated competencies and facilities, to be able to estimate discard survival and generate knowledge about the factors that affect this. The focus was on two commercially important species, plaice and Norway lobster. These species are relevant because there is a likelihood of a substantial survival.

The first trial was conducted from November to March from a less commercial trawler with Hirtshals as port. There was fishing for plaice with a consumption trawls and towed time was 3 hours. Test plaice were collected at four different time periods exposed to air on the deck, with a half-hour intervals up to one and a half hour. Furthermore, control plaice were collected from hauls with short duration. Plaice was stored in tanks on the vessel and transported to storage tanks on land at the North Sea Science Park in Hirtshals. Here, they were observed for 10 days. On the vessel were also carried out tests of reflexes and damage. The overall mortality rate increased by residence time on the deck of 0% and up to 24% after one and a half hours on the deck. The total mortality was estimated to 11%. Most plaice was above the minimum landing size. Reflexes decreased with increased time on the deck. There was no mortality in the control group. There were also carried out measurements of physiological stress indicators comparing with a reference group.

Another plaice study was conducted in Norway lobster fishing from Skagen in June and July from the same vessel. The plaice was stored in the same way at the vessel as the first experiment, and was transported in a pickup from Skagen to observation side in Hirtshals. Most plaice was below the minimum size. Mortality was totally 86% for test plaice and 0% to 16% for the control groups.

A final test was conducted to determine the mortality of lobsters. It was estimated to be from 100% to 52% of the individual hauls. Overall the mortality was 84% after 8 days here except experiments where there the refrigerated container was not functioning. Had these individuals been included, the mortality would have been lower. However, there were also deaths in the control group (total 18%) and generating more uncertainty for the estimates.

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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01/03/2014 – 23/05/2015

Keywords: Research areas: Fisheries Technology & Aquaculture

Project: Research

Environmentally friendly fisheries (Skånfisk) (39161)

The project consists of two sub-projects:

Ecosystem Approach to Danish gill- and trammel nets

Although the fleet has reduced since the mid-1990s, Danish gill- and trammel nets are still of importance and are likely to gain increasing interest as environmentally friendly practices. However, such a development may only happen if the ecosystem approach is guaranteed. There is limited knowledge about ecosystem impacts, such as for example physical damage to habitats or discards, and their minimization may require development of alternative practices. With regard to the upcoming challenges of an Ecosystem Approach to Fisheries, the project aims at (1) studying the sweeping behavior of nets and their effect on the seabed; (2) quantifying invertebrates and fish discards and understanding how the capture process can influence discard behavior; (3) developing technical innovation that could improve catch quality and therefore maximize the production. Trials are conducted on gill- and trammel nets within the Danish coastal waters.

Danish seine - ecosystem effects of fishing

The amount of scientific studies on Danish seineing is rather low. Therefore, the current study “Danish seine – Ecosystem effects of fishing” investigates various topics to increase the knowledge of impacts, Danish seines have on the environment and further to give advices to potentially improve selectivity characteristics and efficiency of the gear. We compared catch profiles of Danish seines and bottom trawls based on a perennial observer dataset. Furthermore, we carried out two sets of experimental trials on commercial vessels. The first set in 2014 looked at codend selectivity as well as direct interactions the gear has on the benthic and demersal fauna. The second set of trials in 2015 allowed us to create detailed descriptions of the fishing process in terms of geometry and forces acting between net and rope and furthermore, to evaluate the behavior of fish in relation to the gear and to evaluate impacts of the gear on the sea bottom. This project is coordinated by DTU Aqua.

The project is funded by the Danish Ministry of Food, Agriculture and Fisheries through a special governmental Funding for sustainable fisheries (“Bæredygtighedsopljen”).

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01/01/2014 – 31/03/2017

Keywords: Research area: Fisheries Technology
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 (FDF), including cameras. Collected data were analyzed to investigate differences in landings, discards, discard ratio, CPUE, VPUE and DPUE, between conventional (control) and new gears (test). The results showed a varying degree of success, depending both on area and on choices made by the individual fisher. The best results were observed in the Baltic Sea, where relaxing technical rules led to major improvements in fishing patterns. But gear changes did not contribute much in fisheries where initial discards rates were already low. Interviews realized with the skippers around the end of the trial were performed and analyzed to investigate (i) their experiences with “free” choice of gear, (ii) the processes that they followed for developing their gears and (iii) their tools for evaluating the efficiency and selectivity of their trial.

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

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

This project was coordinated by DTU Aqua.

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

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01/01/2014 → 15/07/2015

Keywords: Research areas: Fisheries Management & Fisheries Technology & Marine Living Resources
Collaborators: Danish Fishermens Producers Organization
Project: Research

Optimizing the value of fish caught in the Danish mixed fishery – Improved quality and selectivity as a consequence of gear development (FishValue) (39033)

In the FishValue project (VærdiFisk) the main goal was to increase the biological and economical sustainability of the Danish Mixed fishery by increasing the gear selectivity and improve the quality of whole and processed fish. A horizontally divided codend was developed in the project to separate four fish species from Nephrops (Nephrops norvegicus) in an upper and lower compartment, respectively, to avoid physical contact between fish and animals with hard or spiny body surfaces. Focus was given to design and placement of a grid in the lower compartment to obtain an effective separation. Square meshes of different mesh sizes in the upper and lower compartment were used to investigate if it is possible to customise the selection of fish and Nephrops separately while retaining the most valuable catch. Quality assessments of the catch were performed to measure whether catch from the two compartments increased quality of whole fish and fish fillets, compared with the standard codend in which the catch components were mixed.

Design and placement of a grid in the lower codend gave an effective separation of all the species investigated when compared to the first version of the experimental codend. Catch from the upper compartment showed a significant quality improvement for whole fish, fillets and Nephrops compared to the standard codend. It was possible to customize the selection of fish and Nephrops separately and at the same time retain the most valuable catch using different mesh sizes of square meshes in the upper and lower codend. In fact, the horizontally divided codend had 10% higher catch rate of Nephrops compared to the standard codend. This more efficient fishery gives less fuel consumption per kilogram Nephrops caught, and may, if evaluated over longer time periods, imply less impact on the sea bottom than when fishing with the standard codend.

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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Project: Research
Benthic ecosystem fisheries impact study (BENTHIS) (39021)

There is general concern about the adverse impact of fisheries on benthic ecosystems, 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 new methods 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 geochemistry. The new 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.
BALTIFIMPA generic tool (39001)
The objective of the BALTIFIMPA project (Managing Fisheries in Baltic Marine Protected Areas) was to develop a generic
decision making assisting tool to give guidance and advice on impacts of different fishing practices and gear on protected
habitats and species in the Baltic Sea. This was based on a comprehensive review of the existing literature. The tool has
the form of a matrix of fishing gear types against habitats and species, and includes a generic level, a detailed level and a
technical level in addition to a list of the relevant literature. At the generic and detailed levels impacts are scored in traffic
light categories (red, yellow, green), whereas the technical level includes summaries of actual impacts.
The project was lead by DTU Aqua.
The project was funded by the Helsinki Commission (HELCOM).

Economically sustainable fishery for Nephrops in Skagerrak and Kattegat (ØBJ-FISK) (38865)
Optimizing the exploitation of the resources of the sea areas Skagerrak and Kattegat is central to promote an
economically sustainable development in the region. Norway lobster or Nephrops is one of the economically most
important resources for the majority of the commercial fishery in the Kattegat-Skagerrak (KASK)-region where the annual
first value was app. 350 million DKR in 2011. Nephrops are mainly caught in bottom trawls (95 % of the total landings),
where other species such as cod and sole constitute part of the by-catch. A minor fishery with creels – partly commercial
and partly recreational – takes place along the Swedish and Norwegian coast in areas that are generally inaccessible to
the trawlers. Taking into account the majority of the Nephorps landings in the KASK region are sold directly to the local
fish processing industry or are sold directly in the local areas, the total socio-economic value is much higher than the first
value.
In later years, there has been a shift towards an ecosystem-based management e.g. through the NATURA2000
regulations or the Community Action in the field of Marine Environmental Policy. The consequence of this shift is that the
focus is no longer on the state of single species but on the entire marine ecosystem. This has led to regulations aiming at
reducing discard of unwanted catch as well as reducing the impact of fishing on vulnerable habitats. Regulations that
among other things include a discard ban (implemented for Skagerrak by Norway, Denmark and Sweden in 2013), area
closures, reductions in number of days at sea, and minimization of unwanted by-catch, have caused uncertainty in the
fishing industry and limits the possibilities of exploiting the resource maximally. To ensure an economically sustainable
growth of the Nephrops fishery in the KASK region, an increased collaboration between science and industry is needed as
is innovation in the design of low impact fishing gears and a reliable stock assessment.
The project aimed at:
- Establishing a platform where the industry, the science, and the managers could work together to identify the challenges
  that restrain an optimal exploitation of the Nephrops resource
- Establishing a knowledge based collaboration to identify low impact fishing methods that may lead to future economically
  sustainable growth in the KASK region
- Improving the biological knowledge on which the stock assessment is based - Increasing the reliability of the stock
  assessment.
The project was coordinated by DTU Aqua.
The project was funded by EU, InterReg (regional collaboration).

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

Economically sustainable fishery for Nephrops in Skagerrak and Kattegat (ØBJ-FISK) (38865)
Optimizing the exploitation of the resources of the sea areas Skagerrak and Kattegat is central to promote an
economically sustainable development in the region. Norway lobster or Nephrops is one of the economically most
important resources for the majority of the commercial fishery in the Kattegat-Skagerrak (KASK)-region where the annual
first value was app. 350 million DKR in 2011. Nephrops are mainly caught in bottom trawls (95 % of the total landings),
where other species such as cod and sole constitute part of the by-catch. A minor fishery with creels – partly commercial
and partly recreational – takes place along the Swedish and Norwegian coast in areas that are generally inaccessible to
the trawlers. Taking into account the majority of the Nephorps landings in the KASK region are sold directly to the local
fish processing industry or are sold directly in the local areas, the total socio-economic value is much higher than the first
value.
In later years, there has been a shift towards an ecosystem-based management e.g. through the NATURA2000
regulations or the Community Action in the field of Marine Environmental Policy. The consequence of this shift is that the
focus is no longer on the state of single species but on the entire marine ecosystem. This has led to regulations aiming at
reducing discard of unwanted catch as well as reducing the impact of fishing on vulnerable habitats. Regulations that
among other things include a discard ban (implemented for Skagerrak by Norway, Denmark and Sweden in 2013), area
closures, reductions in number of days at sea, and minimization of unwanted by-catch, have caused uncertainty in the
fishing industry and limits the possibilities of exploiting the resource maximally. To ensure an economically sustainable
growth of the Nephrops fishery in the KASK region, an increased collaboration between science and industry is needed as
is innovation in the design of low impact fishing gears and a reliable stock assessment.
The project aimed at:
- Establishing a platform where the industry, the science, and the managers could work together to identify the challenges
  that restrain an optimal exploitation of the Nephrops resource
- Establishing a knowledge based collaboration to identify low impact fishing methods that may lead to future economically
  sustainable growth in the KASK region
- Improving the biological knowledge on which the stock assessment is based - Increasing the reliability of the stock
  assessment.
The project was coordinated by DTU Aqua.
The project was funded by EU, InterReg (regional collaboration).

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01/08/2012 → 01/04/2013
Keywords: Research areas: Ecosystem based Marine Management & Coastal Ecology & Fisheries Technology
Collaborators: Helsinki Commission - Baltic Marine Environment Protection Commission
Project: Research
Collaboration between the scientific community and the fishing sector to minimize discards in Baltic cod fisheries (38918)
The main aim of this study was to identify technical solutions, both economically and biologically sustainable, to mitigate the discards of cod in the Baltic Sea cod fishery.
The aim of the project was divided into three main tasks:
- Assessing the present knowledge on discards and causes of discards in the Baltic cod fishery, and exploring the temporal and spatial distribution patterns of discard sensitive size classes of cod and of the fishery effort.
- Identifying technical solutions and suggesting final technical measures to further mitigate discards in the trawl fishery for Baltic Sea cod.
- Evaluating the possible impacts of the proposed technical solutions and technical measures on the stock and on the economy of the fisheries concerned.
These tasks were undertaken through a desktop study, a technical study and an impact study.
In order to engage trawl fishermen in the project, a questionnaire was sent in spring 2012 to active fishermen in Sweden, Denmark, Germany and Poland. The aim was to establish a dialogue with the industry on selectivity, gear selection, discard patterns and management options, and to collect their views, problems and potential solutions to mitigate discards. This questionnaire was the basis for further discussions with the industry during a workshop.
This project was coordinated by Swedish University of Agricultural Sciences.
The project was funded by EU, Calls for proposals/tenders (Mare/2010/11 LOT 1 programme).

Net escapement of Antarctic krill in trawls (NEAT) (38919)
The pelagic trawlers involved in the Antarctic krill harvest apply different trawl systems and fishing gear. There were many unknown parameters on which to estimate the catch efficiency of the different trawls that were used.
The aim of the project was to establish morphology based description of the selection process of Antarctic krill in towed fishing gear (FISHSELECT). This knowledge lead to optimizations of trawl designs in the krill fishery and was used to quantify the consequences in terms of catch efficiency, potential escape mortality and catch loss of using different gear designs of different population structures. Such information is valuable both for managers and the industry exploiting the resource. We performed a study including morphology based mathematical modeling (FISHSELECT) of different krill sex and maturity groups, from data acquired through AKES (Antarctic Krill and Ecosystem Studies). The FISHSELECT method has previously been used to describe and predict size selection of fish and crustaceans. The methodology was used to describe and predict size selection of krill in trawl gear. The model was used to predict basic selective characteristics of different netting designs. The results from these calculations were used to quantify the theoretic catch efficiency and escape mortality in different nets and to construct a net configuration with optimal mesh size and shape in order to minimize escape mortality. Finally, we constructed design guides, which described the basis selective properties for krill in different mesh shapes and sizes.
This project was coordinated by DTU Aqua.
The project was funded by the Research Council of Norway.

Development of a sorting grid for the Danish Norway pout fishery (38954)
The objective of the project was to ensure a sustainable Danish fishery for Norway pout through the development of a sorting grid that minimizes unwanted by-catch.
Through a series of grid designs and tests the project:
- developed a durable and easy-to-handle grid which can sustain the large strains on gear and decks equipment typical of the Norway pout fishery.
- identified an optimal bar spacing for the grid, that reduces by-catch to the extent possible without jeopardizing the rent ability of the fishery through large losses of target species.
As a consequence of the scientific work in the project a sorting grid-system was made mandatory in the Danish trawl
Design optimization of SELTRA 180 (38908)
After implementation, the industry was concerned that a newly developed selective codend (SELTRA codend) was causing relative large losses of the economically important Nephrops. The aim of the project was to optimize the geometry of a 2-panel and 4-panel version of the SELTRA codend through extensive monitoring of their global geometry in the flume tank in Hirtshals. The global geometry was monitored with optic stereo-system techniques over a gradient of catch weights. The final design was demonstrated in the flume tank for the industry for further discussion. The project delivered detailed design specifications for the Nephrops fishery in Kattegat. Further, the test conducted in the project delivered a detailed understanding of the effect of changing design parameters like panel construction, selvedges, codend construction (number of panels, meshes in circumference, tension lines during the catch build-up).

The changes in the design is today implemented in the technical legislation in the Kattegat and Skagerrak and there were no problems or difficulties raised by the industry during the commercial take-up process.

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

Keywords: Research areas: Fisheries Technology & Observation Technology
Collaborators: Danish Fishermen's Association
Project: Research

Documentation of the selective effect of SELTRA 180 in Kattegat (38917)
The cod stock in Kattegat was at a critical low level. A selective SELTRA codend concept was developed to reduce the fishing mortality of cod in the Nephrops directed fishery in Kattegat. A version of the SELTRA design, SELTRA 180 was developed directly for the Kattegat situation and optimized through flume tank tests. The aim of the project was to document the selective effect of SELTRA 180 codend, which was made mandatory in Kattegat in 2011, and to compare it with the standard 90 mm gear used in Kattegat. The SELTRA design was developed to getting an efficient selection of cod while retaining Nephrops. Results from an increased commercial onboard monitoring of the catch composition obtained with the SELTRA codends were compared with results obtained from experimental fishing.
The project demonstrated that the 90mm codend with a SELTRA escape panel obtained similar selectivity for cod as a 120 mm standard codend. This documentation led to the implementation of the SELTRA codend in Skagerrak in 2011.
The project was coordinated by DTU Aqua.
This project was funded by the Danish Minestry of Food, Agriculture and Fisheries and the European Fisheries Fund (EFF).

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

Optimal sustainable exploitation of Nephrops norvegicus in Kattegat and Skagerrak (38909)
The scientific advice on management of fisheries is primarily aiming at avoiding overfishing of the fish and shellfish stocks and only to a very limited extend addresses how the utilisation of the resources can be optimised within a sustainable ecosystem framework. An example is the regulation of the demersal trawl fisheries in the Skagerrak and the Kattegat which to protect the cod stock is sub-optimal in relation to the utilisation of the Norway lobster (Nephrops) stocks. The project takes a new approach to the management and aims at optimising the utilisation of Nephrops stocks without compromising the protection of cod.

The Nephrops fishery is one of the economically most important fisheries in Denmark. In the Kattegat and Skagerrak,
Nephrops catches accounted in 2010 for 53% and 25% of the total value of fish and shellfish, respectively, landed by Danish fishermen. Cod is taken as by-catch in the Nephrops fishery and it has been necessary to introduce measures to limit the by-catches of cod, which is currently below agreed reference points for stock size. These measures have had a negative impact on Nephrops catches.

The project addressed four objectives: (i) development of advice on the fishing mortality for the Nephrops stocks, which is consistent with maximum sustainable yield; (ii) mapping of the distribution of Nephrops in Skagerrak and Kattegat; (iii) development of a new trawl concept optimising the catchability on Nephrops while limiting the by-catches of cod and impact on the sea bed; and (iv) evaluating alternative fishing methods for Nephrops including fishing with pots.

The project was coordinated by DTU Aqua.

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

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01/01/2011 → 31/12/2014
Keywords: Research areas: Fisheries Management & Fisheries Technology & Marine Living Resources
Collaborators: Danish Fishermen's Association
Project: Research

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 was conducting 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.

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10/10/2010 → 31/12/2012
Keywords: Research areas: Fisheries Technology & Fisheries Management
Collaborators: Municipality of Frederikshavn, SINTEF, Herman Trawl
Project: Research

Bycatch and discards: Management indicators, trends and location (BADMINTON) (38714)
In the EU there is intensive data collection of by-catch and discard onboard commercial vessels, but until now there have been few attempts to describe the general patterns in these data, and still less to understand the factors that determine what and how much is discarded. However, the latter step is key if we are to develop operational indicators and propose mitigation tools for fisheries management. There is especially a need to investigate the effectiveness of mitigation methods that have been implemented in the past, primarily as technical regulations, including gear modification. This has to be done at the scale of the fishery: many gear modifications showed to make a difference in field trials, however there have been few studies about the way fishers used these modified gears, and the real impact it had on catch and discards on the fleet scale.

The project developed along five main steps:
- A descriptive analysis of total catch in terms of species and size composition, based on the data collected onboard EU vessels under the Data Collection Regulation. This included a quantification of spatial and temporal distribution and abundance of discards.
- The development of indicators of discard issues: indicators of discard state (amounts and characteristics of discards), of the pressures that determine discards (selectivity of fishing), and of the management responses to this issue.
- An analysis of the factors that determine discard amounts, including environmental settings, year-class strength, community composition, and fishing practices. This included an examination of the efficiency of technical regulations currently in force, and retrospective analyses of the efficiency of such measures in the past.
- An analysis of socio-economic and institutional drivers and incentives that influence fishers' behaviour in regard to selectivity and discard.
- Based on all previous steps, the elaboration of potential mitigation measures. Beyond technical measures, integrated approaches that will remove or at least reduce incentives to discard were explored.

The project was coordinated by Hellenic Centre for Marine Research, Greece.

The project was funded by EU, MariFish, ERA-NET.
Development and test of a sorting grid for the fishery on Norway lobster (38742)
Goal of the project was to develop and test a sorting grid for the Norway lobster fishery in Kattegat and Skagerrak, with the aim to improve both the size selectivity for Norway lobster and allow high escapement of cod. A second requirement was, that the sorting can be deployed from smaller vessels and is easy to handle.

Within the project, a flexible sorting grid was developed which can be hauled directly on the net-drum and can be handled on small fishing vessels. The grid was designed and tested with different set-up of bars and colors.

As an alternative for a sorting grid, a sorting frame was developed to be inserted in the upper panel of the cod end was tested in comparison.

The project is coordinated by DTU Aqua.

Improving the selectivity for cod in Danish trawl fisheries (38887)
The aim of the project was to develop and test more selective fishing gear for three major Danish fisheries:
- The demersal trawl fishery in the North Sea (120 mm)
- The demersal trawl fishery in Kattegat and Skagerrak (90 mm)
- Improve the selection range (SR) in the BACOMA codend used in the Baltic Sea

The new and more selective fishing gears were developed under consideration of the economy in the fishery. The project delivered three new selective gear solutions of which two were tested during experimental fishery. Technical descriptions of the new designs were delivered. Furthermore, an economical model to quantify the economic consequences of using the new selective fishing gears compared to existing standards was developed.

Experiments were conducted in the Baltic Sea cod fishery demonstrating that the selection range (SR) could be reduced by using a larger diamond mesh in the lower sheet of the BACOMA design. Further the project demonstrated the efficiency of legal selective escape panels in Skagerrak/Kattegat and the effect of varying design parameters in both the panel section and the trawl body. Finally, the project demonstrated that active stimulating fish behavior around selective escape panels significantly can improved the escape panels' selectivity.

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).

Selective trawls for the North Sea (38740)
The goal of the project was to design, develop and test a selective trawl, which reduces the by-catch of cod, while still retaining high catch rates of flatfish, Norway lobster and anglerfish. A second requirement was that the trawl should be simple and fast to deploy and recover.

The project tested different possibilities to improve the selectivity of a cod end with a 140 mm sorting panel, as implemented in the fishing regulations. This included changes in mesh size of the panel and changes in panel position. For different combinations of panel mesh sizes and panel positions, size selectivity functions were determined, to allow for designing the optimal configuration for different mixed fisheries.
Test and demonstration of a selective topless trawl (38699-1)

The cod stock in Kattegat was at a critical level and ICES recommended a 0-TAC for cod. In the economically important fishery for primary Nephrops and flatfish in Kattegat cod were caught as by-catch. The aim of the project was to develop and test a cod selective topless trawl design in the Nephrops directed fishery in Kattegat to allow an economically feasible fishery with a minimal by-catch of cod. The design idea was based on utilizing behavioral differences between the species, specifically that most fish stay low in the trawl, whereas gadoids like cod raise further aft in the gear and therefore can escape above the cut-back headline. The top of the trawl was cut 10-20 meters back, which allowed cod to escape above the headline. The catch of flatfish and Nephrops were not expected to be affected by the change in design due to their strong preference for the lower part of the gear.

The results of the project led to the implementation of a topless trawl design into the technical legislation in Kattegat.

Test and demonstration of a selective topless trawl in the North Sea (38699-2)

The aim of the project was to develop and test a selective topless trawl to improve selectivity of cod in the demersal mixed species fishery in the northern North Sea. The design idea was based on utilizing behavioral differences between the species, specifically that most fish stay low in the trawl, and that gadoids, like cod, raise further aft in the tapered section of the gear and can escape above the cut-back headline. An improved species selectivity of cod in the North Sea can allow and economically feasible mixed fishery without further exhausting the cod stocks.

In addition to the topless design, a SELTRA sorting box was installed in codend to compare the selective effect between a relatively large design modification in the forward part of the trawl with a relative small change in codend where the behavioral differences between species is less expressed.

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-multiplet fleet (mixed) fisheries and evaluate on a scale of very high resolution in time and space. This computer based management evaluation tool and simulation model can evaluate economic cost-benefits, biological impacts according to fish stock sustainability, as well energy efficiency according to catch in weight and value per fuel volume consumed and/or in relation to total fuel costs for different management scenarios. The implementation of the IBM model involves additionally development of advanced statistical and computer based models and methods for coupling information from logbook databases with information from VMS tracking (satellite monitoring) databases on vessel and fishing trip basis. Furthermore, it involves development of a web-based questionnaire and platform to obtain information from the Danish fishery on cost dynamics with focus on fuel costs and effort allocation.

The project is coordinated by DTU Aqua.
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01/01/2008 → 31/12/2012

Scientific advice concerning the impact of the gears used to catch plaice and sole (GUPS) (38115)
The aim of the project was to:
- collect information on the fishing fleets that target plaice and sole in the North Sea
- collect information on the main fish stocks and ecosystems impacted by these fleets
- evaluate the performance of these fleets in terms of economic, ecological and social sustainability
- list the problem fisheries-list alternatives that reduce adverse impacts
- estimate the improvement in economic, ecological and social terms caused by adopting these alternatives.

The work program was structured into four tasks:

In Task 1, basic data were collected on fleets and effort, fish stocks, discards and selectivity. The scientific and grey literature, project reports and existing databases was consulted to collect the basic information. This information was aggregated along a common methodology. Sub-fleets or métiers were defined and an evaluation was made of the performance of the different fleets in economic, ecological and social terms.

In Task 2, the critical effects on the marine environment was identified for the different fisheries evaluated in Task 1. Based on comparative indicator tables, the problem areas were listed in order to best focus the review and selection of alternative gears and vessels.

In Task 3 a review was made of possible ways to reduce the adverse effects by fisheries selected in Task 2. These were
technical alterations to existing gears, alternative fishing methods for vessels designed for a specific method or fishing methods not yet applied on a large scale in the North Sea.

In Task 4, predictions were made on the effects of a possible modification of existing sole and plaice fisheries in the North Sea based on the following criteria:

- possible reduction in discards through an improved selectivity—benefits for the spawning stock biomass and the landings
- reduction in the environmental impact of the fishing activity
- improvement of the socio-economic performance of fishing fleets.

Based on the results obtained in Task 4, conclusions and recommendations were formulated on the feasibility and effectiveness of the alternatives for existing fisheries targeting sole and plaice in the North Sea.

The project was coordinated by Institute for Agricultural and Fisheries Research (ILVO), Belgium.
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01/01/2007 → 31/12/2009
Keywords: Research area: Fisheries Technology
Collaborators: Wageningen IMARES, Agricultural Economics Research Institute, Cefas Weymouth Laboratory, Institute for Agricultural and Fisheries Research
Project: Research

Development of fishing gears with reduced effect on the environment (DEGREE) (38222)
The DEGREE project main objectives were to (i) develop new gears and fishing techniques with a lower impact on benthic habitats, (ii) to quantify the potential reduction of the physical impact as well as the negative effects on benthic communities caused by the innovations and (iii) to weigh the socioeconomic consequences of these changes against those of alternative management measures, such as the closing of areas. The project consisted of six work packages (WPs), focusing on management and coordination, modelling and quantification of benthic impacts, otter trawl modifications, beam trawl and dredge modifications, economics, dissemination and implementation of knowledge. The DEGREE project fulfilled its primary objectives and combined expertise of the technology, biology and economy sectors.

A number of alternative fishing gears and gear modifications were developed, with the potential to lower mortality of benthic invertebrates and non-target demersal fish. The bottom impact of the new gear designs and practices were assessed by modelling effects on sediments, comparative fishing experiments, observing tracks made on the sea bed. The economic consequences of using the new gear were analyzed for a number of cases. Among the gears tested and demonstrated to have reduced seabed impact were otter trawls with light weight doors and low impact ground gear, pulse trawls, light beam trawls and low impact oyster dredges. It was recommended to further work on the project findings through the development of innovative tools to enable an integrated evaluation of ecosystem effects of the developed alternative fishing gears, which were designed to decrease the impact on marine ecosystems and contribute to sustainable fisheries.

The project was coordinated by IMARES, Wageningen UR, The Netherlands.
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01/01/2006 → 31/12/2009
Keywords: Research area: Fisheries Technology
Collaborators: Ireland’s Seafood Development Agency, University of Aberdeen, Wageningen IMARES, Institute of Marine Research, University of Liverpool, Marine Scotland, Centre for Agriculture research – Sea Fisheries Department, Institute of Marine Sciences, Marine Fishery Section, Cefas Weymouth Laboratory, L’Institut Français de Recherche pour l’Exploitation de la Mer, University of Portsmouth
Project: Research
Development of selective trawls for important Danish fisheries (4313)
The project was structured in following sub-projects:

1) Development of a North Sea haddock trawl: to design a trawl with reduced by-catches of cod.

2) Improved size-selection of the Norway lobster trawl used in Kattegat: to reduce the catch of undersized Norwegian lobster.

3) Improved species-selection in Norway lobster trawl used in Kattegat: to design a trawl that selectively catches Norway lobsters while letting cod and other unwanted by-catch escape.

4) Improved size selection in Baltic cod trawls: test of T90 meshes in the cod end in comparison to BACOMA trawl.

The cod stock in the North Sea is on a low level, with little signs of recovery during the most recent 20 years. By-catch of cod in different fisheries is a problem at this low stock size and therefore technological modifications of gears used in fishing fleets with significant by-catch of cod are requested. Sub-project 1 aimed at the development of a haddock trawl with reduced catchability of cod. Making use of the different behavior of haddock and cod during the catching process, modifications of the trawl groundrope were tested for their effect on cod catchability.

The Norway lobster population in the Kattegat is doing well, and the Norway lobster fishery is the most economically important fishery in the Kattegat. However, there is a substantial catch of undersized Norway lobster in the fishery and improving the size selectivity of the trawl in use was the goal of sub-project 2. This included designing and testing of different mesh sizes and sorting mechanisms.

In contrast to Norway lobster, the cod population in Kattegat has declined severely in the last 20-30 years. Without reducing the by-catch of cod through a more selective trawl, the Norway lobster fishery would have to be reduced significantly in order to protect the cod. Within sub-project 3, the aim was to develop a trawl with significantly improved selectivity, allowing enhanced escapement of cod. The traditional round cod end was replaced with a cod end shaped like a square mesh box. This box proved to be more stable in the water enabling to take advantage of the different behavior of cod and Norway lobster. While cod tend to move up-wards in the tunnel of a cod-end, Norway lobster remains passive at the bottom. Placing a 180 mm escape panel into the upper panel of the box, allowed to improved escapement of cod.

A simple way to increase the mesh opening in a cod-end is to turn the mesh 90° (T-direction, henceforth T90) because the knots will determine the initial mesh bar angle. A T90 cod end was introduced in the legislation for the Baltic Sea cod fishery and the aim of sub-project 4 was to test for differences in cod selectivity in comparison to the standard BACOM (having a sorting window in the top-panel of the cod end).

The project was coordinated by DTU Aqua.
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01/01/2006 → 31/12/2008
Keywords: Research area: Fisheries Technology
Collaborators: Different fishing companies and net producers, Danish Fishermen’s Association
Project: Research

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

**Nephrops and cetacean species selection information and technology (NECESSITY) (38623)**

The project objectives were to develop effective and acceptable:

- gear modifications (by-catch reduction devices) and alternative fishing tactics in cooperation with the fishing industry to reduce the by-catch and mortality of non-target fish species in European Nephrops fisheries, and determine the biological effects and socio-economic repercussions of using these.

- gear modifications (by-catch reduction devices and acoustical deterrents) and alternative fishing tactics in cooperation with the fishing industry to reduce the by-catch and mortality of cetaceans in European pelagic fisheries, and determine the biological effects and socio-economic repercussions of using these.

With specific objectives:

- To develop novel species-selective gear prototypes and alternative fishing tactics in cooperation with the fishing industry for use in the European Nephrops fisheries.

- To review the current status of knowledge of cetacean by-catches in pelagic fisheries, using existing data sources and oncoming data collection programmes, and to collect additional biological data (age, year of maturity, causes of death) of landed cetaceans.

- To develop novel species-selective gear prototypes and alternative fishing tactics in cooperation with the fishing industry for pelagic trawl fisheries where cetaceans by-catch may occur (pair trawling on bass, pair trawling on albacore, single boat and pair pelagic trawling on herring, mackerel and horse mackerel, fishery with high opening bottom trawls and midwater pair trawls on hake).

- To compare the effectiveness of commercial available acoustic deterrents (pingers) on cetaceans.

- To develop an interactive pinger in cooperation with a manufacturer.
To evaluate the potential biological and economic impacts of the technologies and tactics developed above.

To disseminate the results to relevant sectors in the fishing industry, and contribute to implementation of the technologies and tactics developed above.

In total there are 22 partners in the project. The project is coordinated by Wageningen University, The Netherlands.

Madsen, N., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

Keywords: Research area: Fisheries Technology
Project: Research

Test and demonstration of a selective Nephrops trawl (4307)

This aim of this project was testing a newly developed and more selective fishing gear onboard a smaller vessel in the Danish Nephrops directed fishery in Kattegat and Skagerrak. The selective effect of different selective devices can vary with the type and size of the vessels using the gear. The Danish fleet operating in Kattegat and Skagerrak covers very different vessels, both with regards to size and type. The aim of this project was to test the applicability of a selective sorting panel, developed and tested on larger vessels using larger trawls, on a small vessel and compare selective effect across different vessel sizes.

The project was coordinated by DTU Aqua.

Krag, L. A., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Madsen, N., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Frandsen, R., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

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

Research on effective cod stock recovery measures (RECOVERY) (4304)

The cod stock in some European waters is at critical levels. The project aimed at developing more selective gears for the three most relevant fisheries that take cod with the highest number of discards and total catches. The otter trawl (and seine) fishery has the highest catches of cod and greatest level of discard of all fisheries, followed by the beam trawl fishery. The Nephrops fishery has a high discard rate and this is a fishery which the fleet often will switch to when fisheries for fish species are restricted. The main objective was to develop novel species-selective gear prototypes for the three prominent mixed-species demersal trawl fisheries in the North and Irish Sea, where cod is an important catch component. The development of novel species selective fishing gears is intended to reduce the fishing mortality rate on cod of all ages/sizes, to enhance the recovery of cod stock, and at the same time permit the continued exploitation of other species taken in the same fisheries as cod.

The project was coordinated by DTU Aqua.

Krag, L. A., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
Madsen, N., Project Participant, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management

Keywords: Research area: Fisheries Technology
Collaborators: Queen's University Belfast, Sea Fish Industry Authority, ConStat, Wageningen IMARES, Institute of Marine Research, Marine Scotland, Institute for Agricultural and Fisheries Research
Project: Research

An assessment of mortality in fish escaping from trawl cod ends and its use in fisheries management (SURVIVAL) (4305)

The survival of fish escaping from towed fishing gears is essential if selective devices are to be used as a practical conservation tool. Several studies have attempted to test this principle and assess the mortality of escaping fish. Unfortunately, these early endeavours have been shown to be fundamentally flawed in methodology so there are currently no reliable estimates of escape mortality. This project developed methods for accurate assessment of escape mortality. The work covered development of techniques to sample fish escaping from a trawl cod end, without introducing biases into the mortality estimates. These techniques were then applied in the field to estimate mortality in cod and haddock.
under various circumstances including escape at depth and surface, in high intensity fisheries and at different times of the year.

The objectives of the project were:

- to develop sampling techniques that overcome current biases in escape mortality estimation
- to test these techniques directly against previous protocols in order to establish the validity of the new methods
- to develop a methodology to compare the cod end selectivity, and survival, of gadoid fish escaping at the surface in a side-trawler fishery with that of fish escaping at depth
- to estimate the number of repeated encounters with trawls on intensively fished grounds
- to study the effect of repeated gear encounters on escape mortality
- to determine if gadoid escape mortality varies throughout the year and identify its cause
- to report the project work and results to the fishing industry, the public and the European Commission.

The contribution of DTU Aqua centered around:

- testing the validation of the new cover design against previous designs
- investigating the seasonal variation in escape mortality of gadoids through surface selectivity
- investigating the seasonal variation in total escape mortality.

The project was coordinated by Institute of Marine Research, Norway.
Madsen, N., Project Manager, National Institute of Aquatic Resources, Section for Ecosystem based Marine Management
01/01/2002 → 31/12/2006
Keywords: Research area: Fisheries Technology
Collaborators: Institute of Marine Research, Marine Scotland Science, North Sea Museum
Project: Research