WAGENINGEN UR
For quality of life

Stichting DLO
Centre for Fishery Research (CVO)

KB WOT Fisheries 2013 - Maintaining Excellence and Innovation in Fisheries Research

Cindy van Damme and Frans van Beek

CVO report: 13.006

Ben Miller, USA

Commissioned by: Directie Kennis EZ
Postbus 20401
2500 EK DEN HAAG

Project number: KB WOT Fisheries 2013 Programme
BAS code: KB-14-012

Publication date: March 2013

Stichting DLO
Centre for Fishery Research (CVO)
P.O. Box 68
1970 AB IJmuiden
Phone. +31 (0)317-487418
Fax. +31 (0)317-487326

Visitor address:
Haringkade 1
1976 CP IJmuiden

CVO rapport UK V4

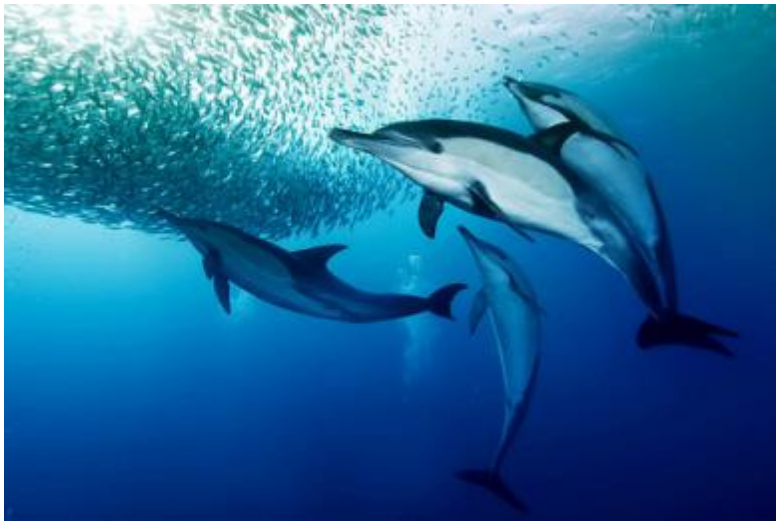
Table of Contents

Summary

The KB WOT Fisheries programme is fundamental to the maintenance and development of the expertise that underpins the statutory obligations of fisheries monitoring and advice for the Netherlands. The structure of the KB WOT Fisheries programme for 2013 reflects the recent discussions on the research direction between IMARES, CVO and EZ. One of the strengths of the structure of the KB WOT Fisheries programme is the bottom up approach to calls for projects to fulfil the research priorities, thus promoting innovation. However, this is seen as giving the programme the potential to miss strategic needs of both the science development within IMARES and the research questions of EZ, thus the programme also contains a specific project request on an research subject relevant to IMARES and EZ needs. The KB WOT Fisheries programme will fund 15 projects in 2013 which will focus on remote sensing of the pelagic system (acoustics, vessel monitoring, video imaging and satellites), the interaction of ecology and fisheries and new techniques for surveys and monitoring. The programme will increase the ability of the WOT programme to respond to changes resulting from a variable environment and ensure that fisheries advice is responsive to ecological change. Plus a targeted project specifically designed to research needs of IMARES and EZ will be the investigation into the effect of the proposed discard ban in fisheries.

Samenvatting

Het KB programma voor Visserijonderzoek onderhoudt en ontwikkelt de expertise die nodig is om de WOT voor de visserij uit te voeren. De inhoud van het KB WOT programma voor 2013 weerspiegelt de recente discussies tussen IMARES, CVO en EZ over de toekomstige richting van het onderzoek. Een van de sterke punten van de structuur van het KB WOT visserijprogramma is de bottom-up benadering om de onderzoekers van IMARES uit te nodigen projecten voor te stellen en de onderzoeksprioriteiten in te vullen en hiermee de innovatie te bevorderen. Een nadeel van deze benadering is echter dat het mogelijk is dat een kennisbehoefte, die van strategisch belang is, zowel voor de wetenschappelijk ontwikkeling binnen IMARES als voor EZ, buiten de boot valt. Daarom bevat het programma ook verzoeken om specifieke projecten te ontwikkelen. De KB WOT visserij financiert in 2013 15 projecten die zich richten op remote sensing van de pelagische systeem (akoestiek, vaartuig monitoring, video imaging en gebruik van satelliet informatie), de interactie tussen ecologie en visserij en nieuwe technieken voor het uitvoeren van surveys. Door het KB WOT onderzoek kan het WOT programma beter inspelen op ontwikkelingen die voortvloeien uit veranderingen in de omgeving en hiermee rekening houden bij de adviezen voor het beheer van de visserij. Er wordt in 2013 ook een gericht project uitgevoerd naar de effecten van de voorgestelde ‘discard ban’ in de visserij.



1 Introduction

The KennisBasis (KB) WOT Fisheries programme is a core to the maintenance and development of expertise to underpin the statutory obligations of the Netherlands in fisheries monitoring and advice. It is an annually reviewed multiannual programme with clear objectives and deliverables. As the WOT obligations of the Netherlands may change over time, the KB WOT fisheries programme remains flexible and responsive to developments and innovations in methods and policy needs. The core principles of the programme are maintaining expertise whilst being forward looking, ensuring value for money and strong collaboration with client ministries.

The KB WOT Fisheries programme has an active policy of underpinning the key-expertise required to carry out the statutory tasks, and encouraging the further development of the expertise needed to complete those tasks. The development and maintenance of this knowledge and expertise base is an integral part of the IMARES plan. The programme covers issues such as the fisheries data collection framework (DCF) but also considers the reform of the common fisheries policy (CFP) and the fisheries component of marine strategy framework directive (MSFD). It is hoped that the programme will combine operational research, aimed at some immediate challenges to EZ, with more broad strategic research aimed at future policy development and research needs of EZ. In the field of fisheries, many of these future needs come from existing or upcoming EU directives.

The structure of the KB WOT Fisheries programme is the result of collaboration between IMARES, CVO and EZ about the strategic and operational needs of fisheries research and advice. The current programme is developed to allow bottom up innovation and top down direction of research objectives. The result is a targeted programme of relatively large research projects and a complementary suite of smaller projects that fulfil the research objectives of the KB WOT fisheries themes.

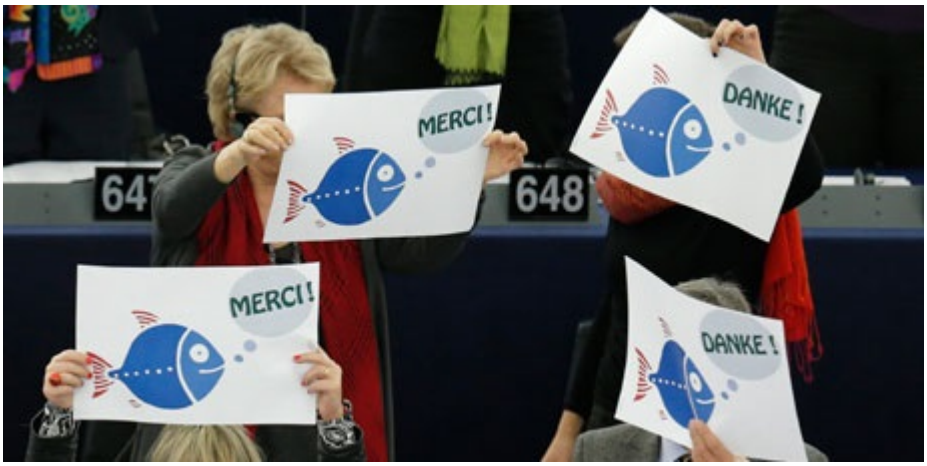
The programme operates through long term projects (multiannual) and annual projects in response to scientific and societal needs. Examples of KB WOT areas of research include integrated assessments of the ecosystem (particularly the demersal and benthic communities of the southern North Sea), multispecies and mixed fisheries considerations in fisheries management, development of acoustic survey techniques and fish aging, ecosystem change, remote sensing of the ecosystem, bycatch and discarding of marine organisms and the development of management plans for fisheries. The programme is administered by a panel of marine scientists, who review the programme each year, meet with civil servants from EZ and circulate an annual report. This programme is part of the larger KB programme carried out by Wageningen UR and has been developed in consultation with EZ. This document describes the strategic framework for the support of the knowledge base and the development of key expertise for the WOT programme.

2 The Broader Picture

Within DLO, KB is classified in seven themes. The KB WOT fisheries is positioned in theme 4: “groen-blauwe ruimte” which translates to use of the green and blue space. The core areas of this theme cover the sustainable use of the space in which we are living. Sustainable development covers both the maintenance of fisheries as well as the marine resources they exploit.

The fishery WOT tasks cover the advice and actions required to support the national and European fishery policy. They cover commitments to the CFP (Common Fisheries Policy), national freshwater policy, the Habitats Directive, the Water Quality Directive and the Marine Strategy Framework Directive where relevant to fisheries. The tasks include the collection of information and data, the development of understanding and the provision of evidence based advice. It is necessary to anticipate the future needs of EZ and the EU when developing the structure of the KB WOT programme. Importantly for the KB programme in 2012, the EU is attempting to move towards a gradual implementation of the ecosystem considerations into fishery management and the reform of the CFP. This is also true for the national policy. Thus KB WOT fisheries 2013 must respond to these needs.

When using science to advise policy, such as in fisheries management, it is necessary that the advice is based on credible and independent research of high scientific standards. This requires peer review of the science. Scientists must be aware of recent trends across the world in their research fields, any new developments in methodologies and must be internationally credible themselves. Thus KB money could also be used to support technology exchange and scientific communication with scientists and institutes outside the Netherlands too. In addition, staff swaps with other institutes are encouraged.



3 International nature of KB WOT Fisheries – added value

The majority of projects within the programme are carried out in collaboration with European and North American partners. This provides a large amount of added value to the programme, as resources and expertise from other countries contribute to the IMARES research strategy. In some cases, added value is also increased by combining KB funds with those from EU FP7 projects. There is a component of the programme devoted specifically to international collaboration. This ensures that IMARES stays at the cutting edge of scientific developments and at the centre of fisheries research in Europe. The programme also encourages exchange through publications, presentations and developing new methods or tools for fisheries research.

4 Financing

Long term agreements between DLO and EZ cover the WOT and with that the KB WOT.

The development of expertise programme for 2013 is financed by the research budget reserved for the KB programme. At the evaluation of the WOT programmes in 2004, it was agreed to allocate an annual budget to these programmes thus enabling key expertise to be maintained or developed to carry out the WOT. The available budget in 2013 for WOT programme "Wettelijke Taken Visserijonderzoek" is € 612.000,-. However € 11.000,- of this budget was reserved by WUR for general KB management.

The requests for KB WOT support for projects in 2013 showed that the budget was already oversubscribed.

5 The programme for 2013

The programme for 2013 will have the following themes:

1. Ecosystem approach and fish descriptors in the MSFD
2. Reducing discards
3. Maintaining Quality
4. International Exchange

The programme is mostly populated with projects resulting from an annual call for proposals. KB WOT fisheries sees international collaboration and teamwork as important. The programme also prioritises projects that publish their results in the international peer reviewed literature. Added value by offering co-financing opportunities with other projects is also seen as a strength by the programme. The four themes are described as follows:

5.1 Ecosystem Approach and fish descriptors in the MSFD

The ecosystem approach is core to the development of fisheries management in the Netherlands and the EU. This approach requires novel and innovative methods to address the interaction and impact of fisheries on the ecosystem. The KB WOT definition of ecosystem approach is broad and this will be reflected by the breadth of proposals funded through this theme (from ecosystem functioning, to impact of fisheries on the ecosystem, to the interaction of fisheries, the ecosystem and society). Project proposals were invited that provide information or tools for the ecosystem approach to fisheries management and also research projects that make the ecosystem approach operational. The use of innovative tools (acoustic, remote sensing, vessel monitoring systems) was encouraged. Proposal were also encouraged that explore the science and concepts behind the objectives relating to descriptors of Good Environmental Status (GES) as they apply to fish and shellfish.

5.2 Reducing discards

The aim of the EU is to reduce discards in the fisheries. One of the approaches to reduce discards which the EU is currently discussing is the obligation to land all catches (a complete discard ban). It is unclear what the effect of such a discard ban will be as this has never been quantified. Publications are available on discarding in the beam trawl fisheries, but especially in the pelagic trawling fisheries knowledge on discarding is limited.
This project will aim to quantify the discards in the different Dutch commercial fisheries, including the pelagic trawling fisheries. Furthermore the project will quantify the effect of the discard ban for the different fisheries and the sampling programmes to estimate discards. The findings of this project can be used to evaluate and possible amend the management plan for the reduction of discards in different fisheries. The expected deliverables of this project will be a report based on one (or more) paper(s) published in peer reviewed scientific journals.

5.3 Maintaining Quality

This is a closed call to specific invited expert leaders in IMARES for projects that maintain the present expertise base and quality control routine techniques and skills. IMARES needs to maintain core competencies to deliver and internationally approved WOT programme. These core competencies include

age reading, stock assessments, acoustic survey techniques, shellfish surveying and biological data collection. Courses, workshops and exchanges are an important part of maintaining and developing core skills. The choice of areas to receive funding is made by the KB WOT fisheries programme leadership.

5.4 International Exchange

Under this theme funds are allocated to participate in international networks of active research (primarily ICES). Funds will be allocated by the KB WOT programme management (with the input of the review team) to participate in groups that are considered within the KB WOT fisheries remit. By devoting a theme to international collaboration, KB WOT fisheries ensures that not only does the Netherlands stay at the cutting edge of scientific developments but also remains efficient through added value of project financing and technology or expertise transfer from international partners.

5.5 Call for proposals

28 proposals were submitted to the KB WOT 2013 call (see annex 1). Of those, the following were funded.

Proposal No	Theme	Title	Project leader	Agreed Finance
20	4	International Exchange	Damme, van	€ 118,508
19		Programme Management	Damme, van	€ 24,000
3	3	Underpinning acoustics	Fässler	€ 35,000
21	3	GEAR EFFICIENCY: assessment and inter-calibration of sampling gears	Troost	€ 35,200
1	3	Fish Ageing	Bolle	€ 50,000
12	1	BTS-Benthos: Survey data for ecosystem models	Teal	€ 35,840
17	3	Genomac - Genetics of mackerel and horse mackerel eggs	Van Damme	€ 40,240
9	1	Early warning 2	Wolfshaar, van de	€ 24,500
2	1	BLUEPOD (blue whiting population dynamics on the western shelf)	Fässler	€ 22,560
24	1	RSVP – statistically sound sampling of Dutch shrimpers	Helmond, van	€ 32,320
23	3	Gear efficiency: The forgotten part of the Down's herring larvae	Damme, van	€ 24,672
14	2	Implications of a discard ban for Dutch fisheries	Uhlmann	€ 48,120
8	1	DEB indeterminate spawners	Hammen, van der	€ 32,240
7	1	Ecosystem model IJsselmeer - Markermeer	Deerenberg	€ 50,900
28	1	Get the picture - Orientation on conducting a TV-Survey for Nephrops in the Netherland	Steenbergen	€ 26,800

The total budget thus being € 601,000,-. Which when combined with the WUR charges fulfils the 2013 budget of € 611,000,-.

6 Conclusion

The KB WOT Fisheries programme will fund 15 projects in 2013. Last year's programme was more focused on remote sensing of the pelagic system (acoustics, vessel monitoring, video imaging and satellites) and the interaction of ecology and fisheries. In 2013 the programme is balanced with still remote sensing and ecology but also new techniques for surveys and monitoring. The programme will increase the ability of the WOT programme to respond to changes resulting from a variable environment and ensure that fisheries advice is responsive to ecological change. The targeted project specifically designed to research needs of IMARES and EZ will be the investigation into the effect of the proposed discard ban. This research is performed within KennisBasis Onderzoek (KB) / Beleidsondersteunend onderzoek (BO) / Wettelijke onderzoekstaken (WOT) of EZ-programs.

Signature

Report number CVO 13.006
Project number: 4301900358

Approved by: Drs. F.A. van Beek
Head WOT, Centre for Fishery Research

Signature:

Date: March 2013

7 Annex 1 – All Proposals submitted to the call KB WOT fisheries 2013

approved projects: ☺ not approved projects: ☹

Title of project 1 ☺	**Fish ageing**
Project leader	Loes Bolle
Theme	3. Maintaining quality
Participating partners (IMARES)	Ineke Pennock, André Dijkman-Dulkes, Jan Beintema, Marcel de Vries, Peter Groot, Kees Groeneveld, Betty van Os-Koomen, Gerrit Rink, Thomas Pasterkamp, Corrina Hinrichs
Participating partners (external)	Age readers and age reading coordinators from laboratories in Europe
Duration	1 January – 31 December 2013
The Problem	Age reading is an expertise that requires maintenance and (international) calibration. The WOT projects in which age determinations are carried do not fund maintenance and calibration. Therefore KB WOT funding is required.
Objectives of project	Maintaining quality of age determinations
Broad description of the project including expected results	The following three activities are essential for maintenance of the expertise fish ageing: • International calibration by participation in international exchanges and workshops (2013 exchanges: brill, turbot, sole, dab, sprat, herring, mackerel. 2013 workshops: WKARBLUE*, WKARNARC2) • Training of new age readers (a total of 4 trainees will start, continue or complete their education for a total of 7 fish species in 2013) • Development and implementation of (inter)national QA procedures * Participation of our trained reader (Pasterkamp) is included in the KB WOT - international exchange proposal; participation of our trainee (Os-Koomen) is included in this proposal. Please note that participation of a trainee in an international workshop greatly increases the speed and quality of the training process.
Products to be delivered	1) ICES reports of exchanges and workshops to be held in 2013 2) Update and elaboration of IMARES manuals on procedures and quality control
Dissemination of findings being addressed	ICES reports of international exchanges and workshops are disseminated through the ICES Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS)
Utility of the developed products and expertise	Almost all population dynamic research carried by IMARES, whether for scientific publications or for fisheries management advice, is age structured. Hence maintenance of the expertise fish ageing is of great importance to IMARES.
Likely impact of project	n.a.
Proposed budget	training 172 hours cat 4 — 77€ — 13,244 exchange & workshops 184 hours cat 3 — 77€ — 14,168 workshop 44 hours cat. 3 — 94€ — 4,136 handbook 80 hours cat 4 — 77€ — 6,160 handbook 100 hours cat 3 — 94€ — 9,400 materials — 2,892 total — 50,000

Why should this be funded by KB WOT?	IMARES needs to maintain its expertise in fish ageing to deliver an internationally approved WOT programme. However, activities crucial for the maintenance of this expertise, such as international calibration, training and QA procedures, are not covered by WOT funding and have therefore been funded by KB-WOT since 2004.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	WOT programme
Connection to knowledge development at the University	No
What are the potential risks to the project's success?	Insufficient prioritisation within institute
International Scientific network	PGCCDBS calls for international workshops and exchanges when considered necessary. Furthermore PGCCDBS facilitates international collaboration and tuning of protocols for procedures, training and quality control
International objective of research	Improve quality of age data used in international stock assessment working groups
International Project results	Besides improvement of the quality of age data used for international advice on fisheries management, this project contributes to the establishment of internationally agreed ageing manuals and reference collections.
International or National Finance	None

Title of project 2 ☺	**BLUEPOD (blue whiting population dynamics on the western shelf)**
Project leader	Sascha Fässler
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sven Gastauer Niels Hintzen
Participating partners (external)	Ciaran O'Donnell (MI), Åge Hoynes (IMR), Jan Arge Jacobsen (FAMRI), Valery Ignashkin (PINRO), Hjálmar Hátún (FAMRI)
Duration	1 year
The Problem	The Northeast Atlantic blue whiting stock has undergone striking changes in abundance in the last 15 years. The stock increased in the late 1990s due to a succession of eight unusually strong year classes and dropped again after 2005 when the recruitment collapsed to former levels. It has been shown that this occurred nearly simultaneously with unusual changes in the North Atlantic ecosystem and oceanography, which suggests a causal linkage and the possibility of forecasting recruitment and spawning stock distribution.
Objectives of project	Over the past 9 years the International Blue Whiting Spawning stock Survey (IBWSS) has collected simultaneous fish abundance and environmental data. The data of the multinational survey are centrally stored and so far not been utilised. Exploring these data would allow a first investigation, beyond simple correlations, into mechanisms linking oceanography, environmental variables and the distribution and abundance of adult blue whiting. Improved understanding would not only facilitate survey planning but also increase our understanding of the ecosystem on the western shelf which supports commercially and environmentally important fish stocks.
Broad description of the project including expected results	To draw mechanistic links between environmental variables (temperature, salinity), oceanographic features (sub-polar gyre) and biological components (fish stocks, plankton), with an emphasis on the Northeast Atlantic blue whiting population. These will then be used in models to predict the effect of environmental changes on the blue whiting abundance and spawning distribution in the ecosystem on the western shelf.
Products to be delivered	• Time series of fleet distribution maps during blue whiting fishing season. • Combined data on environmental parameters, blue whiting abundance/distribution, and oceanographic features since 2004. • Predicted distribution of blue whiting based on GAM modelling and identification of important parameters. • Spatial variability in blue whiting distribution from geostatistical analysis
Dissemination of findings being addressed	Scientific publications & presentations at ICES working group meetings
Utility of the developed products and expertise	The project will enhance data usage from (existing) survey data thereby improving their potential use for ecosystem modelling. The findings will contribute towards the broad concept of the ecosystem approach to fisheries management by producing answers to how changes in the ecosystem affects abundance and distribution of fish populations. Identified important environmental variables that affect one of the most important fish stocks on the western shelf will be key to the MSFD and definition of GES. Outcomes will improve planning of a statutory survey that is part of the DCF and for which the Netherlands is currently tasked with coordination.

<table>
<tr><td>Likely impact of project</td><td>The project will make use of a rich database that has so far not been utilised to its full extend. This would allow to give IMARES a leading role in understanding and developing causal links of the ecosystem functioning on the western shelf. Results will trigger further applications of concurrent acoustic and environmental data collection to be used in ecosystem modelling – for example from fishing vessels.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>240 hours cat. 3</td><td>94€</td><td>22,560</td></tr>
<tr><td>total costs</td><td></td><td>22,560</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This project clearly underpins the expertise required to execute one of the statutory task surveys: this by facilitating planning and identifying additional environmental data whose collection may be beneficial in an integrated ecosystem survey.
Additionally, predictability of fish population sizes and distributions is vital in defining GES and a key descriptor of the MSFD. Improving understanding of the underlying mechanisms determining blue whiting spawning distributions and biomass represents an important part in making the ecosystem approach to fisheries management operational.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>-</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>-</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>No specific risks</td></tr>
<tr><td>International Scientific network</td><td>Members of the ICES WGIPS group involved in the IBWSS.</td></tr>
<tr><td>International objective of research</td><td>The IBWSS is an international survey coordinated by the Dutch member of the ICES WGIPS group. This project would allow to take a lead in describing functional links between the environment and the blue whiting stock size and distribution and therefore greatly help survey planning.</td></tr>
<tr><td>International Project results</td><td>The analysis of the international IBWSS data will be of interest to other countries participating in the monitoring and fishery of the blue whiting stock.
If mechanisms can be identified to link blue whiting stock size and distribution with spatial environmental dynamics then these will be of international relevance in the study of the western shelf ecosystem.</td></tr>
<tr><td>International or National Finance</td><td>-</td></tr>
</table>

Title of project 3 ☺	**Underpinning acoustics**
Project leader	Sascha Fässler
Theme	3. Maintaining quality
Participating partners (IMARES)	Bram Couperus Sven Gastauer Peter van der Kamp Klaus Lucke Karin Troost
Participating partners (external)	Partners at e.g. IMR, MS, Cefas, MI, IFREMER and NOAA
Duration	1 year
The Problem	Acoustic methods are an important tool to deliver data for stock assessment, habitat mapping, marine mammal monitoring and ecosystem modelling purposes. In order to maintain the quality of the information provided by acoustics, it is important to invest into the development of the methods and explore alternative ways of usage.
Objectives of project	Maintenance and expansion of hydro acoustic work within IMARES
Broad description of the project including expected results	The project will support on-going maintenance and development of the acoustic expertise at IMARES. Methods to extract, analyse, store and maintain data from statutory survey tasks will be improved. Effort will be put into building and maintaining links within IMARES and with other national and international institutes in order to enhance acoustics research output and develop current methodologies. Additionally, alternative ways of enhancing and applying the current inventory (hardware, e.g. upside-down towed body, DIDSON; and software, e.g. EchoView, LSSS and Comsol) will be explored. In line with the shift in survey focus towards a more holistic 'ecosystem approach', attempts will be made to utilise acoustic survey data for providing answers to research questions that are not directly related to classical stock assessment.
Products to be delivered	• Continuation of the "IMARES Acoustic Symposium" to identify common ground and develop ideas for collaboration within the hydro acoustic work covered at IMARES and other institutes within the Netherlands. • Maintenance and expansion of the previously developed R library "acousa" to add special functions and libraries that are specific for different ICES surveys and data bases (repository hosted at: http://code.google.com/p/acousa/). Contact will be sought with French colleagues who started a similar initiative. • Development of an echosounder testing system that can be used during surveys and other projects involving active acoustics to identify system faults at an early stage. • Improving the WUR web presence of acoustic work done at IMARES to increase the profile and make us more approachable to interested customers. • Implementation of acoustic backscattering models in R and the state of the art software "Comsol Multiphysics". • Participation in ad hoc research relevant to ongoing WOT survey tasks together with international partners to be presented at meetings and conferences (e.g. WGFAST) – this includes work on ongoing papers to lift scientific output of the fisheries acoustics section.
Dissemination of findings being addressed	• Dissemination of "IMARES Acoustic Symposium" highlights • Scientific publications from collaborations with international partners • ICES WG presentations • Publicly available R code library (http://code.google.com/p/acousa/)
Utility of the developed products and expertise	The project contributes to the strategic areas highlighted by the KB WOT team

<table>
<tr><td>Likely impact of project</td><td>The project will improve the quality of acoustic data deliverance, analysis and storage. Analysis methods of internationally coordinated acoustic surveys will be standardised. At the same time, links to colleagues within IMARES and partners at institutes in the Netherlands and abroad will be strengthened and extended, leading to valuable collaborations.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>340 hours cat. 3</td><td>94€</td><td>31,960</td></tr>
<tr><td>Travel & Material</td><td></td><td>3,040</td></tr>
<tr><td>total costs</td><td></td><td>35,000</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>‘Underpinning acoustics’ is part of a multiannual project that fundamentally aims to maintain and develop acoustic survey techniques. Apart from improving data collection, analysis and storage, the project will also serve to answer ad hoc research questions. It will keep the methods at the most current state and explore alternative ways to assist in-house research.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>-</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>-</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>No specific risks</td></tr>
<tr><td>International Scientific network</td><td>Contact will be maintained with relevant researchers in already existing well-known networks at e.g. IMR, MSS, Cefas, MI, IFREMER and NOAA to exchange and develop ideas for future research projects</td></tr>
<tr><td>International objective of research</td><td>-</td></tr>
<tr><td>International Project results</td><td>The project will contribute towards standardisation approaches to analysing internationally coordinated acoustic survey data</td></tr>
<tr><td>International or National Finance</td><td>-</td></tr>
</table>

Title of project 4	**The status of Twaite shad (*Alosa fallax*) in the Netherlands**
Project leader	Ingrid Tulp
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Ingrid Tulp, Erwin Winter
Participating partners (external)	Willy Baeyens & Jacques Navez, Vrije Universiteit Brussel, Dept. Analytical & Environmental Chemistry, Pleinlaan 2, B-1050 Brussels, Belgium
Duration	one year
The Problem	Twaite shad Alosa fallax has disappeared as spawning population from the Netherlands due to fisheries, river regulation and destruction of spawning and nursery habitat. Even though recently it has shown an increase in numbers, the status of the population remains unclear. Because of its niche as a migratory species inhabiting both rivers, estuaries and the open sea it is chosen as an indicator species within the European Water Framework Directive. It is also a target species within the Natura 2000 Habitat Directive, is categorised as 'disappeared as spawning population' on the Dutch red list of endangered species and it is listed in annexes II and V of the EU Habitats and Species Directive, Appendix III of the Bern Convention, and as a Priority Species in the UK Biodiversity Action Plan. Currently there are indications that twaite shad might be spawning again in The Netherlands, but its status remains unknown. A strange situation for a species with such a strong conservation value.
Objectives of project	In order to understand the status of twaite shad in the Netherlands we want to investigate if twaite shad is a self-sustaining population and/or if it is closely connected to spawning populations elsewhere. Twaite shad has an anadromous life style. In spring adult fish enter estuaries and lower reaches of large unpolluted rivers to spawn Twaite shad often spawn at or just above the tidal limit. After hatching, the young fish gradually move into estuaries until the end of their second summer, when they move into coastal waters. In autumn of the year of birth or the year after the juveniles migrate seaward where they stay until they are mature after 3-4 years. Recent genetic work in the UK and in south-west Europe, the western Mediterranean and North Africa has shown that populations differ strongly, suggesting that fidelity to breeding grounds is strong and that twaite shad might even home to natal origins. The relationship with spawning locations in north-western Europe for this species is however unknown. With respect to the pronounced status the species has within Natura2000, it's relatively obscure state is in sharp contrast. The objectives of the proposed project are: identify the status (self-sustaining population or not?) of twaite shad in the Netherlands and trace back the origins of juvenile twaite shad caught in The Netherlands.
Broad description of the project including expected results	Otolith microchemistry is one available tool for reconstructing previous habitat use of adult fishes during the early life history, thus facilitating the identification of nursery habitats. Otoliths of juvenile twaite shad will be collected in different ongoing programs both nationally (sampling Kornwerderzand, DFS survey, SNS survey) and internationally (through contacts in Germany and Denmark). Information on background values will be collected as well. Microchemistry analyses of a suite of isotopes will be carried out on the otoliths after preparation in the IMARES lab. In combination with background samples from different possible rivers of origin, origins can be traced through multivariate analyses. This method has been applied successfully in other species (for example (Hobbs et al. 2010; Tanner et al. 2012)
Products to be delivered	Data made available to all Natura2000-related projects publication in a peer reviewed journal

<table>
<tr><td>Dissemination of findings being addressed</td><td>publication in a peer reviewed journal</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>Strengthening international collaboration with partners in Belgium, Germany and Denmark. Further use of and experience in otolith microchemistry.</td></tr>
<tr><td>Likely impact of project</td><td>Incorporation of knowledge in Natura2000-related projects</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>40 hours cat. 2</td><td>74€</td><td>2,400</td></tr>
<tr><td>80 hours cat. 3</td><td>94€</td><td>7,520</td></tr>
<tr><td>80 hours cat.4</td><td>120€</td><td>9,600</td></tr>
<tr><td>Travel & Material</td><td></td><td>2,500</td></tr>
<tr><td>total costs</td><td></td><td>22,020</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>There is a need for more information on species with a special status in the directives within Natura2000 legislation. Diadromous fish species are important indicators of the connectivity between fresh water and the marine environment. These species play a role in the implementation of the Marine Strategy Framework Directive (MSFD) in the Netherlands (Boon et al. 2012)</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes, the lab in Brussels is experienced with microchemistry analyses. Both applicants are experienced with processing these kind of data and the last KB WOT proposal (2010) resulted in a submitted manuscript (Tulp et al. MS subm)</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>-</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>Given our previous experience the risks are limited. We know that the method works well. We do depend on samples of twaite shad to be collected in different programs. Catches may be lower than envisaged beforehand reducing the sample size or the number of locations.</td></tr>
<tr><td>International Scientific network</td><td>Dept. Analytical & Environmental Chemistry, Brussels: otolith analyses
Detlev Ingendahl Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen: delivery of otoliths from Germany</td></tr>
<tr><td>International objective of research</td><td>The results will be applicable in the implementation of the Marine Strategy Framework Directive.</td></tr>
<tr><td>International Project results</td><td>Twaite shad is a migratory fish. More clarity on the stock structure will also contribute to the knowledge of the status of the species our neighbouring countries.</td></tr>
<tr><td>International or National Finance</td><td>The lab in Belgium has provided the analyses for free in the past and can do so in this project (in exchange for a publication)</td></tr>
</table>

Title of project 5	**Behaviour of smelt and predating birds in the Lake IJsselmeer**
Project leader	Sven Gastauer
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sascha Fässler, Bram Couperus, Dirk Burggraaf
Participating partners (external)	Marieke Keller (Wageningen University)
Duration	1 year
The Problem	The smelt population in the IJsselmeer is known to be in decline since 1990. Smelt plays an important role in the Natura-2000 area IJsselmeer. Low concentrations of smelt can have a direct effect on water birds populations, such as waterfowl (largest overwintering population in Europe) who rely on smelt as a main food source. Trivially the abundance of smelt also has an effect on the population of predators in the area such as pikeperch and perch. In order to improve current management and advice on smelt in the lake IJsselmeer, we are in need of basic knowledge on the behaviour of smelt and its predators.
Objectives of project	1) Get an accurate target strength measurement of smelt in the lake IJsselmeer to allow an improved assessment 2) Record, analyse and understand the diving and predation behaviour of birds and higher trophic fish in the lake IJsselmeer 3) Understand the vertical migration pattern of smelt in the lake IJsselmeer Make an abundance estimate of smelt in the Lake IJsselmeer
Broad description of the project including expected results	Acoustic data will be recorded from an upwards looking, stationary, high frequency echosounder, mounted on the bottom of Lake IJsselmeer. Data should be recorded 24 hours for an entire week. Additionally, the high-frequency acoustic camera (DIDSON) will be used for qualitative identification purposes. Smelt are known to show a strong daily vertical migration, although the true driving factors for this migration remain unclear. Acoustic data allows a direct observation of this pattern, coupled with additional data on other occurring prey and predator species. Additionally these could be linked with environmental information, such as turbidity, temperature and salinity, received from CTD measurements. Such data would give us a new insight into the behaviour of smelt and the key driving factors of its migration. In a step further, through the computation of a more exact target strength and the collection of multiday data, a biomass estimate of smelt for the Lake IJsselmeer can be made. Moreover if birds are diving to prey on smelt, they will be visible on the echogram and information about their diving speed, depth, track, timing and success can be made. Such information would be very vital for any quantified estimation of smelt consumed by predating birds and give us an improved insight into the predating behaviour of birds and its influence on smelt.
Products to be delivered	1 scientific publication 'The behaviour of smelt and predating birds in Lake IJsselmeer'
Dissemination of findings being addressed	Peer reviewed literature, WG and conference presentations
Utility of the developed products and expertise	The project will identify areas of application for IMARES owned equipment currently not used to its full potential. The project will provide in situ data for parts of the ecosystem where generally only modelled data is available. It will also provide an estimate of the distribution and behaviour of smelt and its predators, hence contribute to a better understanding of the functioning of the ecosystem IJsselmeer and the dynamics of smelt. Findings will be particularly important towards a better understanding of the lake IJsselmeer ecosystem and the role of smelt within it. The project has direct relevance for several descriptors of Good

<table>
<tr><td></td><td>Environmental Status (biodiversity, commercial fish, and freshwater food webs).</td></tr>
<tr><td>Likely impact of project</td><td>Extending the traditional use of acoustics towards a tool for behavioural studies is a rapidly growing field of research, especially with regards to the ecosystem approach. Considering the novel insight into the interaction between prey and predator species in the lake IJsselmeer this study will have a strong impact on other studies concerned with the lake IJsselmeer and on the management of the area. The project would raise the status of IMARES in the field of observation technologies and behavioural studies. Additionally, new insights into the acoustic properties of smelt will facilitate concurrent acoustic data collection and analysis during standard smelt trawl surveys taking place in IJsselmeer.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>240 hours cat. 3</td><td>94€</td><td>22,560</td></tr>
<tr><td>Travel</td><td></td><td>1,000</td></tr>
<tr><td>Material</td><td></td><td>5,000</td></tr>
<tr><td>total costs</td><td></td><td>28,560</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This project holds promise to be one of the first to gather in-situ data of smelt and its interaction with prey and predators directly. In order to allow for a good management plan to be installed, a thorough knowledge of the species distribution, behaviour and interaction with other co-occurring species is vital, especially with regards to the ecosystem approach.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes, the technical equipment, expertise, and trained personnel are available.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>/</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>PhD Marieke Keller, ANT SMELT (Autonomous Negative Trends) , WUR/IMARES</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>/</td></tr>
<tr><td>International Scientific network</td><td>Named project partners have a wealth of experience setting up acoustic experiments, analysing acoustic data and/or the ecology/biology of smelt and its predators in the lake IJsselmeer. Collaboration will raise the profile of IMARES within this upcoming field of research and lead to further projects.</td></tr>
<tr><td>International objective of research</td><td>Contribute to a better understanding the role of smelt in freshwater to brackish lakes around Northern Europe</td></tr>
<tr><td>International Project results</td><td>/</td></tr>
<tr><td>International or National Finance</td><td>/</td></tr>
<tr><td></td><td></td></tr>
</table>

Title of project 6 ☹	**Distribution and behaviour of mesopelagic fish species - the deep scattering layer- West of the British Isles**
Project leader	Sven Gastauer
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sascha Fässler, Bram Couperus, Dirk Burggraaf
Participating partners (external)	Matthias Schaber (vTI, Germany), Eric Armstrong (FRS, Scotland), Joe Freisjer (Naturalis, Netherlands), Edward Farrell (Marine Institute, Ireland)
Duration	1 year
The Problem	Mesopelagic fish species are widely distributed all over the world's oceans, and they do have an important role in every ecosystem they occur in. Furthermore as commercial fisheries are looking for alternatives to the traditionally targeted species, mesopelagic species are often being mentioned. However we still lack even the most basic understanding of what is happening in the depths greater than 500 m. The deep scattering layer can often be observed as a prominent layer on acoustic recordings, compromised of a multitude of species, during the blue whiting survey. Therefore, hydroacoustic data could be vital in getting a first insight into the diurnal vertical migration pattern of these species and their interaction with commercially important species such as blue whiting. Further it would allow us to get an insight into the true distribution of these species off the British Isles. The combination of optical and acoustic methods would allow a better insight into the density, distribution and species composition of the deep scattering layer.
Objectives of project	1) Get an overview of the distribution of mesopelagic species west of the British Isles 2) Better understand and quantify the diurnal pattern often observed for mesopelagic species 3) Get an improved insight into the species composition of these mesopelagic schools
Broad description of the project including expected results	Acoustic data was recorded continuously over a 24 hour period during the blue whiting surveys west of the British Isles from 2004 onwards. The deep scattering layer containing mesopelagic fish is a prominent feature on the echograms that can be distinguished from other organisms and classified with high accuracy. Acoustic information allows a detailed insight into the diurnal vertical migration pattern of mesopelagic fish species and their distribution in general. Coupled with catch data, information about the distribution and composition of the mesopelagic deep scattering layer will be gained. CTD (Conductivity, Temperature, Depth) measurements carried out regularly from the surface to the bottom (downcast) during the blue whiting survey will be equipped with an optical camera system and an artificial light source to allow the reception of optical footage of the entire water column down to 1000m and enhance species identification capabilities. Combining hydrographical information with optical identifications and acoustic recordings allows us to couple information of the environment (salinity, temperature, depth) with biological information (species composition, acoustic density and distribution). This will give a better insight into the behaviour and the composition of mesopelagic fish schools and their interaction with both, predator and prey species. The findings should be summarised in a statistically validated model, explaining the occurrence or avoidance of certain areas and the vertical migration pattern.
Products to be delivered	1 scientific publication

<table>
<tr><td></td><td>‘The distribution and behaviour of mesopelagic fish West of the British Isles’</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Peer reviewed literature, WG and conference presentations</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The project will identify areas of application for IMARES owned equipment and data currently not used to its full potential. The project will provide in situ data for parts of the ecosystem that does not gain any focus during the acoustic survey which is currently primarily focussed on the “target fish species”. It will also provide an estimate of the distribution, behaviour and composition of this deep scattering layer, hence contribute to a better understanding of the functioning of the ecosystem and the dynamics of fish stocks. Findings will be particularly important towards a better understanding of pelagic ecosystems and the role of the vastly distributed mesopelagic species within it. The project has direct relevance for several descriptors of Good Environmental Status (biodiversity, commercial fish, and marine food webs).</td></tr>
<tr><td>Likely impact of project</td><td>Combining the fields of acoustics and optical techniques is a new and expanding field of research. Considering the novel aspects, combining acoustic with video imaging and hydrography measurement techniques to explore the deep scattering layer, will have a high impact for studies focussing on species that are abundant in the deeper areas of the water column and especially species with a prominent diurnal migration pattern. The project would raise the status of IMARES in the field of observation technologies and therefore increase possibilities for future collaboration with partner institutes.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>240 hours cat. 3</td><td>94€</td><td>22,560</td></tr>
<tr><td>Travel</td><td></td><td>1,000</td></tr>
<tr><td>Material</td><td></td><td>5,000</td></tr>
<tr><td>total costs</td><td></td><td>28,560</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This project holds promise to be one of the first to gather optical data from the deep scattering layer which is currently lacking from existing WOT acoustic surveys. In light of a transition towards the ecosystem approach, it is vital to extend observation fields during surveys to encompass habitats previously not or under-monitored.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes, the technical equipment, expertise, and trained personnel are available.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>/</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>/</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>/</td></tr>
<tr><td>International Scientific network</td><td>Named project partners have a wealth of experience analysing acoustic data and/or identifying mesopelagic fish species. Collaboration will raise the profile of IMARES within this upcoming field of research and lead to further projects.</td></tr>
<tr><td>International objective of research</td><td>Contribute to a better understanding of the deep scattering layer and the role of mesopelagics in the marine ecosystem.</td></tr>
<tr><td>International Project results</td><td>/</td></tr>
<tr><td>International or National Finance</td><td>/</td></tr>
</table>

Title of project 7 ☺	**Ecosystem model IJsselmeer-Markermeer**
Project leader	Charlotte Deerenberg
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Karen van de Wolfshaar, Bert Brinkman/Marcel Machiels (advice on models), Ben Griffioen / Nicola Tien (data), Daniel Benden (Java programming)
Participating partners (external)	This project will add to the projects and advises commissioned by EZ (EZ) in 2012 and the ANT-project commissioned by RWS-WD (and coordinated by DELTARES) about changes in fish, fisheries and birds in IJsselmeer and Markermeer. This suite of projects are linked closely and use to a large extent the same basal datasets, but all in different manners. Mennobart van Eerden (RWS-WD) has data on bird numbers and Ruud Noordhuis has assembled many other time series, on e.g., nutrients, plankton, mussels, etc. They already share their data in the ANT- and Herziening spieringprotocol projects.
Duration	One year
The Problem	IJsselmeer and Markermeer are large inland lakes with a regionally relevant fishery targeting several species, viz. eel, smelt and percids. Fishery management up to today comprises restricting licenses, (gear) and open periods. Whilst nutrient loads, fish biomass, yields and bird numbers have decreased since the 1990s, and species diversity has changed and increased, the guiding principles of the fishery management have not been questioned until this year. With the designation in 2009 of both lakes as Natura 2000-areas subject to the strict regulation of Nature Conservation Act ("Natuurbeschermingswet"), the interaction between prey fish, piscivorous fish and birds as well as the potential carrying capacity of the lakes have become subject of discussion, that is driven by hypotheses only and lacks integration of knowledge. The ecosystems of the lakes are characterized by a plethora of complex relations, that are far from understood. An existing ecosystem model focussing on fish and fishery is used (by people outside IMARES) to explore the role of the fishery in causing the observed declines, without similarly exploring the role of other factors. The economically weak fishery has become the focal point of the discussion and tends to receive the blame, partly driven by the observation that the fishery is one of the few – if not the only – influences on the system that can be managed (read: diminished) easily.
Objectives of project	To identify the main influences that determine the abundance and dynamics of the key prey fish species, the smelt. Underlying objectives: To have our own IMARES-model of the lake ecosystems, that appreciates all main determinants of the fish (i.e. smelt) biomass and their interrelationships; To suggest and develop up-to-date management strategies for the smelt and percids fishery, based on the model results.
Broad description of the project including expected results	This project focusses on constructing an integrative ecosystem model based on OSMOSE for IJsselmeer-Markermeer. The quantitative relationships to construct this model (e.g., temperature-dependent growth of fish, food requirement of the various piscivorous bird species, based on energetics (e.g., DEB model) or diet observations (prey species and their sizes) , fishing effort and selectivity) will be based on published sources, and will build on the results of the project "Herziening spieringprotocol". In the recently started project "Herziening spieringprotocol" an inventory of relevant components and relationships in the lake ecosystems has been made and integrated into an ecosystem diagram. The broad key relationships (effects of carrying capacity, consumption by birds and fishery) are to be explored with simple models or multidimensional graphical

<table>
<tr><td></td><td>analyses. To this end, existing data and knowledge of the system will be compiled, valued and – if necessary and feasible – analysed.

Expected results:
In-depth statistical analyses of existing data to provide quantitative relationships as input for OSMOSE; description of method and results. E.g.,
temporal consumption of smelt (biomass and size classes) by main piscivorous bird species, predatory fish and fishery;
estimates of fecundity (literature research);
calibration data: temporal production of smelt biomass (growth corrected for mortality or starvation, based on food availability (input from external model, ANT-project) or observations of variation in sizes);
Model parameterization;
Model description;
Model runs to calibrate the model against observed (past) dynamics;
Conclusions on the relative importance of carrying capacity, abiotic influences and fishery on the biomass and dynamics of the fish populations in IJsselmeer and Markermeer..</td></tr>
<tr><td>Products to be delivered</td><td>A parameterized and calibrated ecosystem model centred around the annual changes in smelt biomass that comprises the most important influences on and their relative contributions to smelt population dynamics.
Planning (tentative):
Jan. 2013: Start-up and decision on what type of model(s) will be pursued (all)
Jan.- Feb. 2013: Assembling required data (Ben or Nicola)
Feb.-Apr. 2013: Analysing relationships (Ben or Nicola)
May-Jun. 2013: Filling model(s) and calibration runs (Daniel, Karen/Bert and Ben/Nicola)
Jul. 2013: Technical model description (Karen/Bert and Ben/Nicola)
Note: We will identify and assign exact tasks at the start-up meeting.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Fishery and conservation management advice
Scientific publication (IF the model is sufficiently developed) – not included in current estimate of costs.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The model uses allows scenario studies and forecasting and thereby assists in guiding ideas to develop management rules for sustainable smelt fisheries and conservation to achieve viable fish and bird populations.</td></tr>
<tr><td>Likely impact of project</td><td>The model will be the foundation for i) new management rules for (smelt) fisheries in the area and ii) for new and realistic conservation aims for birds in the areas.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>350 hours cat. 3</td><td>94€</td><td>32,900</td></tr>
<tr><td>150 hours cat.4</td><td>120€</td><td>18,000</td></tr>
<tr><td>total costs</td><td></td><td>50,900</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>Within the framework of long-term survey data of the fish and fisheries of IJsselmeer and Markermeer, a model to integrate the available knowledge to provide a science-based (rather than rule-of-thumb based) management rule is long overdue. If we don’t develop this model ourselves, we will continue to be overruled by others without the opportunity to support our criticism in their work with alternative (i.e. better) approaches or work.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>Rijkswaterstaat (they already finance the ANT-project); EZ (they already finance the “Herziening spieringprotocol”-project</td></tr>
</table>

Connection to knowledge development at the University	Marieke Keller (Imares) and Jochem 't Hoen (WUR-Aquat Ecol & Water Mgmt); both ANT-AIO's) MK will have data on growth, development and temperature-dependence of smelt, JtH will have outputs from other models, that will have to be used as input for this model (Delft3D up to the algal-level, PCLake up to the fish-level).
What are the potential risks to the project's success?	Too complicated to arrive at a sufficiently developed model; insufficient data about or knowledge on essential relationships (but their effects on the population dynamics may explored using scenario's).
International Scientific network	--
International objective of research	The proposed research will become a key example of how to set conservation aims and judge effects of activities in Natura 2000-areas in a changed/changing environment.
International Project results	--
International or National Finance	This work is an extension of explorative work started in the project "Herziening spieringprotocol" funded by the Ministry of EZ Fisheries.

Title of project 8 ☺	**Fecundity regulation in indeterminate spawners using DEB**
Project leader	Tessa van der Hammen
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Lorna Teal, Cindy van Damme
Participating partners (external)	Bas Kooijman, VU, Netherlands; Alberto Murta, IPIMAR, Portugal; Anders Thorsen, IMR, Norway
Duration	One year
The Problem	Healthy fish stocks are a requirement under GES (descriptors 1 diversity, 3 populations of commercial fish, 4 elements of marine food webs) and understanding how to achieve healthy stocks is vital. One aspect of this is understanding the reproductive output and processes affecting it. The environment plays a key role for the reproductive output of species. It has been argued that the spawning type (determinate vs indeterminate) may also be determined by temperature and food availability. Knowledge about the spawning type of a species is required for stock assessments which make use of egg survey data. Both mackerel and horse mackerel are assessed using egg survey and fecundity data. These methods are based on the assumption that both mackerel and horse mackerel are determinate spawners. However, recent studies show that some species that were previously thought to be determinate are in fact indeterminate. This is the case for horse mackerel and the same is likely to be true for mackerel. In a 2012 KB WOT project (DEB reproduction mackerel and horse mackerel) the reproductive part of a DEB model was parameterised for both mackerel and horse mackerel using egg survey data. The DEB model gives the opportunity to model the energy allocated to reproduction under different temperature and feeding assumptions. However, the model is still based on one reproductive output per year, whereas the egg survey is initially based on a determinate spawning type. Because of this, it is difficult to validate the model with the egg survey data. In order to obtain more insight in the indeterminate spawning type we have to adjust and extend the model to include more detail. This would enable us to model predictions on shorter temporal scales. This would also make the model more relevant to applied questions and could potentially be used to model the North Sea Horse mackerel stock for which no egg survey is present.
Objectives of project	• Develop a DEB model for indeterminate spawners • The DEB model would give the possibility to model reproduction in the years between the egg surveys

Broad description of the project including expected results	The key part to the project is parameterising the fecundity DEB model to fit indeterminate spawners. This involves extending our current DEB framework for fish to describe the energy flow within the reproductive buffer of the DEB model, which has previously been treated as a 'black box'. The further developments will be carried out in collaboration with prof. Bas Kooijman (VU University) and based on information from available survey and experimental data (e.g. GSI, fecundity, egg production) and literature on the biology of the species. The parameterisation will be validated by comparing predicted DEB output with observed egg productions from the triennial egg surveys. The validation will give more insight in the nature of spawning type of both mackerel and horse mackerel. Once completed, the full DEB models for each species will be used to consider expected changes in reproductive output in relation to different environmental conditions. Using environmental data and past egg survey data the "gaps" in egg survey data will be filled in using DEB predictions, providing a continuous annual trend.
Products to be delivered	DEB model for indeterminate spawners and peer reviewed paper
Dissemination of findings being addressed	Results will be published in a peer reviewed paper and presented at the DEB symposium (NIOZ, 2013).
Utility of the developed products and expertise	No egg survey is currently conducted for the North Sea horse mackerel stock and therefore this stock does not have an analytical assessment. This work could give more insight into processes affecting reproduction. DEB is expanding as a useful tool in fundamental and applied marine science. This project would give IMARES unique expertise on reproductive modelling in fish using DEB. It would be easy once the development is carried out to also apply the model to other fish species, provided the reproductive parameters are available. The model would be developed together with colleagues at VU and IPIMAR which would aid to the international calibration between the institutes.
Likely impact of project	IMARES would be one of the few institutes with the unique DEB fish reproduction expertise.
Proposed budget	Personnel €32.340
Why should this be funded by KB WOT?	This should be funded by KB WOT because it would aid the ICES assessment of mackerel and horse mackerel based on the WOT surveys. Once it is developed it could also be used for other species, such as plaice, for which ICES egg surveys are also conducted
Is the appropriate capacity available?	Yes, Lorna and Tessa have followed a course and have experience with DEB models, Cindy has knowledge and expertise on the mackerel and horse mackerel egg survey and fecundity estimates.
What other potential funding sources have been considered?	VECTORS FP7 (call: TEMPO)
Connection to knowledge development at the University	None
What are the potential risks to the project's success?	The DEB model depends on the availability and accuracy of the data on mackerel and horse mackerel. Reproductive parameters and biological and environmental data of mackerel and horse mackerel are available for the years the egg survey is carried out. Also experiments have been carried out by IMR and IPIMAR on both mackerel and horse mackerel providing biological data. In the in-between survey years environmental data may be gotten from the ERSEM model.
International Scientific network	Project would be carried out in conjunction with the VU, IMR, IPIMAR and DTU Aqua and results can be used by ICES assessment groups

International objective of research	The egg surveys and assessment of mackerel and horse mackerel are carried out by many different European countries and both species are internationally important commercial species. Knowledge about the status (and biology) of the North Sea horse mackerel stock is severely lacking. This project may contribute questions raised by WGWIDE and work to be done in BO 12.04-001-036 (Category11 species).
International Project results	The reproductive part of the DEB model can be used for other species and results on mackerel and horse mackerel can be used by the ICES assessment groups (WGWIDE).
International or National Finance	Some co-funding through VECTORS may be possible. A proposal in the FP7 call TEMPO will soon be submitted, which includes DEB work on the western mackerel stock.

Title of project 9 ☺	**Early warning signals in plaice and sole; evidence for alternative stable states?**
Project leader	Karen van de Wolfshaar
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Loes Bolle, Ralf van Hal, Ingrid Tulp
Participating partners (external)	Dr. Vasilis Dakos (Estacíon Biológica de Doñana, Sevilla, Spain)
Duration	One year
The Problem	Marked changes in density and growth have occurred in recent years in juvenile sole and plaice in the Dutch coastal waters. Are these changes due to a switch to alternative stable states in the coastal ecosystem?
Objectives of project	The objective is twofold. 1: to analyse trends in densities and sizes of sole and plaice in the estuarine and coastal areas as well as water temperature, in search of early warning signals and tipping points. 2: to work with the newly developed Early Warnings Toolbox developed by the group of Marten Scheffer among others.
Broad description of the project including expected results	Planned activities, and milestones Sole (*Solea solea*) and plaice (*Pleuronectes platessa*) larvae settle in shallow coastal and estuarine waters to spend the first one to two years of their demersal life in these food rich and protected environments. Recent studies indicate that plaice densities in the Wadden Seas are decreasing, while in the Scheldt estuary an increase in densities is observed (Van der Veer et al. 2011; Tulp et al. 2008). For sole no clear trends were observed. Teal et al. (2008) showed a positive relationship between water temperature and growth of young of the year for sole, but not for plaice, suggesting sole benefits from increased water temperatures. They suggest that plaice growth may even be negatively affected with a further increase in water temperatures, because of the increased need for food (induced by higher temperatures) at times of the year when food becomes limited. Van der Veer et al. (2011) demonstrated that the average size of plaice present in the Wadden Sea has decreased, likely due to migration of larger individuals to cooler, less nutritious, waters. These studies together suggest an increase in water temperature, regional differences in density trends, a species-specific relationship between temperature and individual growth, and a decrease in average plaice size. The annual Demersal Fish Survey (DFS) is designed to monitor juvenile sole and plaice. The survey registers catch rates and individual sizes per haul. Any structural changes in young of the year sole and plaice density and size in the estuaries and coastal zones, as observed in this survey, may cause a change in recruitment and hence in population density and eventually catch when individuals have reached harvestable sizes. With increasing water temperatures a shift in relative abundance between plaice and sole could occur due to differences in temperature preferences. If so, the Dutch estuarine and coastal zone could eventually lose their significance as one of the major nurseries for North Sea plaice, while gaining importance as nursery for sole. The data allow for both temporal as well as spatial pattern analyses; the survey covers coastal and estuarine waters from the Belgian-Dutch border to the German Bight and has been carried out from 1970 onwards, providing a times series of 41 years. The analysis will focus on potential changes in densities and sizes of sole and plaice. In addition, changes in temperature and related variables as duration of the growth season will be analysed. The spatial and temporal resolution of temperature data is obtained from MWTL data (Monitoring Waterstaatkundige Toestand des Lands) provided by the Dutch Government. Trends in

<table>
<tr><td></td><td>densities and sizes of sole and plaice in the estuarine and coastal areas as well as temperature will be analysed in search of early warning signals and tipping points (Dakos et al. 2012). For this purpose the Early Warning Toolbox (Dakos et al. 2012) will be used. The tools have shown to be able to detect early warning signals and tipping points towards an alternative stable state in biological (marine) data (Lindegren et al. 2012, Scheffer et al. 2012 Science).</td></tr>
<tr><td>Products to be delivered</td><td>Paper in peer reviewed journal, Imares knowledge on the latest, valuable, tools for early warning signals for alternative stable states</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Scientific publication in peer reviewed journal. If insights are gained to aid management, these findings will be communicated with (IMARES) colleagues and members of ICES WGNSSK and WGBEAM.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The results contribute to ‘Sustainable management of resources’, ‘biodiversity’ and ‘instruments for integration’</td></tr>
<tr><td>Likely impact of project</td><td>Possibly high. With this project knowledge on alternative stable states and the latest tools on early warning signals within IMARES will be developed. Finding early warnings, and/or alternative stable states, within the DFS monitoring data calls for a different management approach of plaice and sole stocks, and possible the management of the coastal zone.</td></tr>
<tr><td>Proposed budget</td><td>Total cost, plus breakdown by staff and other costs (ship time is not funded)

<table><tr><td>230 hours cat. 3</td><td>94€</td><td>21,620</td></tr><tr><td>20 hours cat.4</td><td>120€</td><td>2,400</td></tr><tr><td>total costs</td><td></td><td>24,500</td></tr></table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>IMARES is one of the leading European institutes with regard to data collection and data management of long-term time series of monitoring data. However, the utilisation of this wealthy source of information is limited. This project will not only use the extensive DFS time series, but it will also apply tools for detecting early warning signals which are the latest in this field. With these tools in house at IMARES we will be at the front of the development and application of such tools in applied sciences and it will strengthen the (inter)national position of IMARES.
Although the results will not be directly applicable for stock management, early warning signals and alternative stable states in plaice and sole stocks could serve as a wakeup call for ICES, the fishing industry and management of these species and the North Sea ecosystem in general.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>Connected to this research is the Aquatic Ecology group of Marten Scheffer who are at the core of the development of the toolbox. In particular, Ingrid van de Leemput, PhD at Aquatic Ecology, has expressed her interest and offered assistance in getting started with the toolbox.</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>The potential risk is that no early warning signals are apparent in the data analysed. This reduces the scope for a publication, but does not affect the knowledge gain, both on the tools themselves, which can be applied to other data series, and on the ecological information within the DFS time series.</td></tr>
<tr><td>International Scientific network</td><td>We will be working together with dr. Vasilis Dakos (Estación Biológica de Doñana, CSIC, Spain)</td></tr>
</table>

	one of the developers of the tools for early warning signals.
International objective of research	The proposed tools for detecting early warning signals are the latest in this field. With these tools present at IMARES we will be at the front of the development and application of such tools in applied sciences and it will strengthen the (inter)national position of IMARES.
International Project results	The North Sea flatfish stocks are of international importance and any alternative stables states occurring in one of the main nursery areas are hence of international interest.
International or National Finance	none

Title of project 10	**Alternative resources and catastrophic collapses of cod**
Project leader	Tobias van Kooten
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Tim Schellekens Karen v.d. Wolfshaar
Participating partners (external)	Possibly a student
Duration	one year
The Problem	The North Atlantic Cod population near Canada has collapsed due to overfishing, and has not recovered since a moratorium has been introduced in the 90'ties. Current knowledge ascribes the lack of recovery to the existence of alternative stable states. Overfishing has pushed Cod from one stable state, in which it was prevalent, to another state where it is rare. In contrast, however, Cod in the North Sea has always been heavily fished, but has not shown a collapse. Why not? The stocks have been hypothesized to have different diets (de Roos, pers. comm.), North Atlantic Cod having a more simple diet than cod in the North Sea. Could a difference in diet of Cod in these two stocks explain the presence or absence of alternative stable states? Is the threat of a catastrophic collapse present in Cod at all locations, or can alternative resources prevent a collapse?
Objectives of project	To evaluate the possibility of a catastrophic collapse of cod in other ecosystems than the North Atlantic.
Broad description of the project including expected results	The management of marine resources is increasingly shifting from a system where exploitation boundaries are calculated on species in isolation, to a system where the ecological interactions of the marine environment are being taken into account (ecosystem approach). The science behind this advice has to catch up with this paradigm shift (Mackinson et al., 2009). Most species compete with others for food. Some species, like cod also show strong density dependence in growth, while others do not (Lorenzen & Enberg, 2002). The combination of density-dependent growth and resource competition can in theory give rise to unexpected effects of harvesting mortality such as catastrophic collapses of species (De Roos et al., 2008). Using a model that is a combination of simultaneous stage-structured population dynamics of multiple species, feeding on a limited number of resources, we aim to show how the dynamics of the system and the occurrence of alternative stable states are altered when ecological interactions – in this case competition for alternative resources – are taken into account. We will first study a simple food web configuration exemplifying the ecosystem in the North Atlantic, in which cod functions as both the predator (when adult) and competitor of haring, while both rely on a basal resource. This type of food web configuration is expected to show alternative stable states (for example Hin et al., 2011). We will compare the occurrence of stable states in this system with that in a system that exemplifies the ecosystem in the North Sea, adding an alternative basal resource with a new competitor/prey: plaice. When for cod the importance of both energy pathways, through haring and plaice, becomes comparable the presence of alternative stable states and therefore the possibility of a catastrophic collapse due to overfishing is expected to be weakened. Fisheries mortality, however, can ameliorate competition between cod and its competitor(s), thereby promoting the presence of competitively inferior species (Van de Wolfshaar et al. under review). If fishing thereby alters the importance of either energy pathway for cod this can affect the possibility of a catastrophic collapse of cod. A fundamental understanding of how the effect of fishing

<table>
<tr><td></td><td>changes when we consider the target species as part of one ecosystem, compared to another, is crucial if we are to develop an integrated management approach to cod exploitation.</td></tr>
<tr><td>Products to be delivered</td><td>This work will result in a publishable manuscript about the effect of alternative resources and competition for these resources on the occurrence of alternative stable states, including considerations for management.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Dissemination is assured by the scientific publication.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The results contribute to ‘Sustainable management of resources’, ‘biodiversity’ and ‘instruments for integration’ and an ecosystem approach to fisheries management.</td></tr>
<tr><td>Likely impact of project</td><td>This proposal shows how fishing pressure on a multi-species system works out if those species have a certain degree of diet overlap and its influence on the occurrence of alternative stable states. It will provide knowledge needed for an ecosystem approach to marine management and provides fundamental new insights which are needed for an integrated multi-species management plan for North Sea cod.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>150 hours Tim Schellekens</td><td>94€</td><td>14,100</td></tr>
<tr><td>150 hours Karen van de Wolfshaar</td><td>94€</td><td>14,100</td></tr>
<tr><td>100 hours Tobias van Kooten</td><td>94€</td><td>9,400</td></tr>
<tr><td>total costs</td><td></td><td>37,600</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The paradigm shift of moving from single species advice focusing on individual fish stocks to advice on fisheries and their effects on the ecosystem is ongoing. This research combines our knowledge of ecological interactions in food webs and fleet dynamics, two areas at which Wageningen IMARES is at the forefront. Although the results will not be immediately applicable in day-to-day advice, the long term consequences of fishing on food webs has proven to be a powerful tool in the communication with the fishing industry.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>none</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>If we can find a student to do a substantial part of the work, the project can be carried out for a lower than estimated budget. This student could be from Wageningen University, e.g. Aquaculture and Fisheries, Mathematics or Aquatic Ecology; but also from other universities such as UvA, from Theoretical Ecology led by Prof. De Roos.</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>The immediate link to advisory work is not strong. However, the long term consequences of fishing on food webs has proven to be a powerful tool in the communication with the fishing industry.</td></tr>
<tr><td>International Scientific network</td><td>No explicit international collaboration in this project. The issue of ecosystem based management, however, connects well with several ongoing EU projects in which TvK and KvdW are involved (particularly MEECE and the TEMPO call currently being developed).</td></tr>
<tr><td>International objective of research</td><td>The new insights from this project will, in all likelihood, be applicable to other mixed fishery systems. The envisioned scientific paper will reflect this.</td></tr>
<tr><td>International Project results</td><td>Fisheries in the North sea is not an exclusively Dutch operation. Hence, the knowledge developed in this project will be valuable in an international context.</td></tr>
<tr><td>International or National Finance</td><td>none</td></tr>
</table>

References	de Roos, A. M., T. Schellekens, T. Van Kooten, and L. Persson. 2008. Stage-specific predator species help each other to persist while competing for a single prey. proceedings of the National Academy of Sciences of the USA 105:13930-13935. Lorenzen, K., and K. Enberg. 2002. Density-dependent growth as a key mechanism in the regulation of fish populations: evidence from among-population comparisons. Proceedings of the Royal Society of London Series B-Biological Sciences 269:49-54. Hin, V., Schellekens, T., De Roos, A.M., and Persson, L., 2011. Coexistence of predators and prey in intraguild predation systems with ontogenetic niche shifts. American Naturalist 178, 701-714. Mackinson, S., Deas, B., Beveridge, D., and Casey, J., 2009. Mixed-fishery or ecosystem conundrum? Multispecies considerations inform thinking on long-term management of North Sea demersal stocks. Canadian Journal of Fisheries and Aquatic Sciences 66, 1107-1129. Van de Wolfshaar, K.E., T. Schellekens, J.J Poos and T van Kooten. Interspecific resource competition effects on fisheries revenu. Under Review at PLOS-One.

Title of project 11	**"GES of commercially exploited shellfish populations":**
Project leader	Johan Craeymeersch
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Kees Goudswaard , Karin Troost, Gerjan Piet, Diana Slijkerman, Aad Smaal
Participating partners (external)	-
Duration	2013
The Problem	Criteria for the assessment of the health of populations of commercially exploited fish species have been developed or are being developed at present (2010/477/EU; descriptor 3). It is doubtable that these criteria can be applied to shellfish species. This has, however, not been examined thoroughly and, if someone has, certainly not been published. Neither have alternative indicator been developed.
Objectives of project	Objectives of the project are: 1- study the ability to use the primary and secondary indicators applied to assess the health of commercially exploited fish populations, and report the outcome of this exercise; 2- if not applicable, propose alternative indicator; and 3- the goals and/or limits 4- description of the initial condition
Broad description of the project including expected results	Planned activities: 1- March 2013: study and reporting about the ability to use indicators applied to fish populations; 2- April 2013: development of alternative indicators, applicable to commercially exploited shellfish populations; description of initial condition based on these indicators 3- Start May 2013: internal workshop to discuss the result of points 1 and 2; 4- May 2013: further development based on results of workshop 5- June 2013: finalising and reporting Expected results: 1- A thoroughly worked out proposal on indicators and limits to assess the health of commercially exploited shellfish populations 2- A basis to advise the Ministry of EZ on WFD descriptor 3, if asked for
Products to be delivered	The proposed activities will result in a report that will include all steps taken.
Dissemination of findings being addressed	The report will be shared within IMARES to be applied in future shellfish population research. If the contents allow for it, the results will be shared with the international scientific community by means of a peer-reviewed paper.
Utility of the developed products and expertise	The results could be the basis for then Ministry of EZ to discuss implementation on an European scale. The results of this project will contribute to theme 4 of the IMARES research programme ("Sturing en beheer van living marine resources") and theme "Maintaining Quality" of the IMARES development plan.
Likely impact of project	IMARES proposals might be the basis for future assessment of shellfish population health on a European scale.

<table>
<tr><td>Proposed budget</td><td><table>
<tr><td>62 hours cat.2</td><td>77€</td><td>4,774</td></tr>
<tr><td>160 hours cat.3</td><td>94€</td><td>15,040</td></tr>
<tr><td>60 hours cat.4</td><td>120€</td><td>7,200</td></tr>
<tr><td>24 hours cat.5</td><td>150€</td><td>3,600</td></tr>
<tr><td>Travel</td><td></td><td>1,000</td></tr>
<tr><td>total costs</td><td></td><td>31,614</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>At present no European countries seem not to develop descriptor 3 for shellfish populations. However, as the Commission Decision explicitly mentions shellfish populations, and likely under pressure of NGOs, national governments will be asked for criteria and standards. The Ministry of EZ will ask advice at IMARES and, therefore, IMARES should be prepared.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes. The IMARES participants have enough capacity in 2013.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>The Ministry of EZ already realises that these criteria will have to be developed. EZ asked IMARES for a proposal to be realized in 2011. They postponed it to 2012, but then decided not to have money to fund it.</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>No</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>No special risks.</td></tr>
<tr><td>International Scientific network</td><td>We will discuss developments with colleagues in Europe, in order to ensure that the scientific basis of the proposed indicators enjoys wide support.</td></tr>
<tr><td>International objective of research</td><td>Proposal to be used by all European countries.</td></tr>
<tr><td>International Project results</td><td>The results may lead to stock assessments internationally.</td></tr>
<tr><td>International or National Finance</td><td>-</td></tr>
</table>

Title of project 12 ☺	**BTS-Benthos: Survey data for ecosystem models**
Project leader	Lorna Teal
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Ingeborg de Boois, Ralf van Hal, Tobias van Kooten, Jack Perdon
Participating partners (external)	(Janna Jileson, MSc student)
Duration	1 year
The Problem	Current research and management questions are focussed increasingly at the ecosystem level and to this end ecosystem models are being developed to consider interactions between species and trophic levels in the environment. Food-web models are a valuable tool to look at how changes at one level can affect other species and/or levels and can help to assess how changes in productivity can translate up through the food-chain. In order to provide more realistic scenarios using food-web models, knowledge is needed on the availability of prey items and the energy requirements of predators. Furthermore, understanding temporal and spatial variations in prey availability in relation to prey selection is key when considering distribution changes of organisms for example in relation to climate change. To gain better insights into the connections within the ecosystems, traditional fisheries surveys are moving towards an ecosystem survey setup and data collection and usage should extend beyond the traditional single-species assessments. The Dutch Beam Trawl survey can provide an effective sampling tool for both flatfish and epibenthic bycatch but the benthic data collected remains underutilised (see IMARES internal report 12.003).
Objectives of project	Here we aim to conduct a first in depth analysis of the benthic data collected on the beam trawl survey to explore its value in providing spatial and temporal trends in benthic communities of the North Sea. Using the MAFCONS data (collated during the BTS using a 2m beam trawl) we aim to identify some key benthic species, which are valuable prey items for fish, but also caught in reliable quantities to make them amenable for further analysis. Based on more in depth data collection of these species during the 2013 BTS and knowledge gained from stomach sampling of fish within other on-going programmes, we aim to consider the importance of these species as prey items for fish and how this may vary in space and time. The focus will be on the energy the different benthic items can provide and how changes in benthic communities (in space and time) may affect the translation of energy through the food chain.
Broad description of the project including expected results	Step 1: Analysis of BTS benthos data with focus on spatial differences in communities → *Maps of epibenthos on ICES rectangle scale, definition of communities, temporal trends* Step 2: Use existing BTS benthos data (including Mafcons sampling) and link tp stomach sampling data to establish which species (abundant or important prey) should be selected for further exploration. → *Knowledge on what is eaten versus what is available, list of species to be measured/collected on BTS* Step 3: Data collection on board BTS Tridens (2013): → *Length-frequency, length-weight relationships, sample collection for AFDW/energy content determination in lab* Step 4: Connect step 3 with step 1 for better description of communities in space → *Maps of spatial distribution of potential energy available to benthivorous fish.*
Products to be delivered	- In-depth analysis of BTS benthos data, reporting its use for ecosystem related work. - Peer-reviewed publication - Student MSc thesis

<table>
<tr><td>Dissemination of findings being addressed</td><td>The project will result in a scientific publication in the peer-reviewed literature and sampling protocols and knowledge gained from the additional sampling will be disseminated through ICES survey groups.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The project has clear connections with underpinning an ecosystem approach to marine management in terms of how regular fisheries surveys can provide valuable information for ecosystem type analysis, e.g. food web models. Output provides information which can be incorporated in IMARES-developed models such as OSMOSE, but also compared/provide validation against ecosystem model output (e.g. ERSEM).</td></tr>
<tr><td>Likely impact of project</td><td>Enhanced use of data collected on board the BTS which is currently underutilised (benthos data). Input of knowledge to food-web models, feeding into other on-going projects/calls.</td></tr>
<tr><td>Proposed budget</td><td>
<table>
<tr><td>40 hours statistician</td><td>94€</td><td>3,760</td></tr>
<tr><td>40 hours laboratory assistance</td><td>94€</td><td>3,760</td></tr>
<tr><td>80 paper writing</td><td>94€</td><td>7,520</td></tr>
<tr><td>40 hours student supervision</td><td>94€</td><td>3,760</td></tr>
<tr><td>160 hours main work, data assembly and analysis</td><td>94€</td><td>15,040</td></tr>
<tr><td>laboratory costs for bomb calorimeter use</td><td></td><td>2,000</td></tr>
<tr><td>total costs</td><td></td><td>35,840</td></tr>
</table>
</td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The project aims to explore the use of data which has already been and is regularly collected on board the beam trawl survey. Exploring the use of data which is collected during fisheries surveys is necessary for moving traditional fisheries surveys in line with desired ecosystem surveys. The knowledge gained should help improve food-web models which are key for answering relevant ecosystem level questions.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes. Ingeborg de Boois is project leader of surveys and manages all the BTS data. Lorna Teal will be BTS cruise leader next year and has relevant statistical knowledge. Ralf van Hal and Tobias van Kooten have the relevant knowledge on stomach data and food web models. A suitable MSc student has already been identified. Janna Jilesen joined the BTS last year. Laboratory assistance can be provided by Jack Perdon. Equipment-wise a bomb calorimeter is available only at NIOZ which is why some additional costs for sample analysis were included.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>-</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>The project would allow an MSc student to be taken in which will benefit the student with sea-going experience, practical work, statistical analysis and paper writing.</td></tr>
<tr><td>What are the potential risks to the project's success?</td><td>The project relies on the acquisition of suitable data on the 2013 BTS survey, but this can be considered a very minor risk as long as there is a student available to do the work on board.</td></tr>
<tr><td>International Scientific network</td><td>The project aims to deliver data which are directly relevant for projects such as BENTHIS and VECTORS where food web models are being developed and applied, and potentially also the EU CALL on MSFD as well as being of interest to ICES working groups (e.g. survey and modelling groups)</td></tr>
<tr><td>International objective of research</td><td>Highlighting the BTS and the value of the additional data collected will help bring the BTS to the attention of European or International-scale initiatives that may further utilise the data and IMARES expertise in this area.</td></tr>
<tr><td>International Project results</td><td>Results will help improve and further develop food-web models, highlighting also how traditional surveys can be enhanced to help to feed the type of data required for improving modelling initiatives.</td></tr>
</table>

International or National Finance	None. Although project could work in parallel to the EU MARE tender on stomach content analysis for efficient exchange of knowledge, equally so, projects such as BENTHIS and VECTORS where food web models are being developed and applied.

Title of project 13	**SPI-FISH (Sediment Profile Imaging – benthic impacts of fishing trawls)**
Project leader	Lorna Teal
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Adriaan Rijnsdorp, Ingrid Tulp
Participating partners (external)	Ruth Parker, Nigel Lyman, John Pinnegar (Cefas), Hans Polet (ILVO)
Duration	1 year
The Problem	Benthic organisms, in particular infauna, interact with the sediment on or in which they live. This mixing of the sediment , "bioturbation", plays an important role for the marine ecosystem as it contributes significantly to sediment biogeochemical cycling processes and thus influences the magnitude of benthic nutrient fluxes and carbon and nutrient regeneration to the water column. The relationship between ecosystem process (bioturbation) and function (biogeochemical cycling) is complex but also strongly affected by human impacts such as trawling. Trawling changes benthic communities as well as the sediment itself (e.g. particle sorting) and can thus impact on sediment function which could have severe consequences for the ecosystem, in particular slowing benthic-pelagic coupling of nutrient cycles. Understanding the mechanisms by which trawling can affect sediment function through impacts on benthic organisms is therefore vital in underpinning a true ecosystem approach to fisheries management.
Objectives of project	The objective of this project is to establish the effects of trawling on the sediment mixing depth, which is determined by sediment profile imaging (MDI; Teal et al. 2010). and serves as a proxy for sediment function (Carbon and nutrient cycles). An increase/decrease in sediment mixing depth can be associated with an increase/decrease in the magnitude of benthic nutrient fluxes/carbon cycling. Immediate impacts of trawling will be studied following experimental trawl tracks and longer term impacts will be studied in more chronically affected areas to determine the importance of temporal intensity of fishing. The fieldwork is made possible through larger EU projects (e.g. BENTHIS). Linking SPI image data along with infaunal mortality data and biogeochemical profiles will allow processes and mechanisms of trawl impacts to be better understood and in turn also validate the use of SPI as a rapid tool of impact assessment.
Broad description of the project including expected results	The project is based on fieldwork which will be carried out under BENTHIS or other projects (set up currently under construction) and measure the following: - Image-derived mixing depth MDI (as per Teal at al. 2010) at a non-impacted site - MDI immediately after experimental trawling - MDI a few days after experimental trawling - MDI at a comparable chronically trawled site Dependant on opportunities arising from other projects, the same process can be carried out where possible for different fishing gears. Image analysis allows the change in sediment mixing depth at different stages of trawling intensity to be established and compared between fishing gears whilst also linking these changes/differences in depths to infaunal and biogeochemical data. The combined approach allows processes and mechanisms of impact to be better understood and follows the chain of events from impact to changes in benthic community, benthic process and finally ecosystem function. Once the details are understood, the usefulness of using the MDI as a rapid assessment measure can be validated.
Products to be delivered	- The project will deliver data that can be a valuable contribution to other IMARES projects (BENTHIS, Effects of shrimp fisheries in Natura2000 areas, VIBEG). - Publication in peer-reviewed literature

<table>
<tr><td>Dissemination of findings being addressed</td><td>The project will result in a scientific publication in the peer-reviewed literature and contribute to the various project reports under which the fieldwork was done. The findings may be presented at the 2014 ICES symposium on: “Effects of fishing on benthic fauna and habitat: Change in ecosystem composition and functioning in response to fishing intensity, gear type and discard”</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>MDI is a way of rapid assessment of benthic function and habitat quality descriptors are key to the MSFD and definition of GES. The project tests the use of MDI as such a descriptor in relation to trawling impacts.
Strong collaborations with international colleagues at Cefas will be established and developed.</td></tr>
<tr><td>Likely impact of project</td><td>The usefulness of SPI as a tool for rapid impact assessment will be tested and validated. Within Europe, Cefas and IMARES are developing unique expertise in this field.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>200 hours cat 3</td><td>94€</td><td>18,800</td></tr>
<tr><td>Hire/preparation/transport of SPI from UK to fieldwork locations in NL (estimated for 15 sampling days, incl. field assistance)</td><td>94€</td><td>16,000</td></tr>
<tr><td>total costs</td><td></td><td>34,800</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The project has clear connections with underpinning an ecosystem approach to marine management with a focus on effects of human use on the marine environment. Establishing the processes governing the MDI in relation to trawling intensity by different gears allows the MDI to be used as a rapid assessment of benthic habitat function which can provide a useful tool for assessing GES.
The project also provides a series of valuable links between on-going international work such as e.g. the BENTHIS or Effects of shrimp fisheries in Natura2000 areas projects.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes. Lorna Teal and Ruth Parker are experienced with the use of SPI in connection with biological and biogeochemical sampling.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>-</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>-</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>The project relies on (a) successful fieldwork campaign(s) and functional technology (SPI).</td></tr>
<tr><td>International Scientific network</td><td>The project will be carried out in collaboration with Cefas, who will provide the technology (SPI camera) with personnel for the fieldwork, as well as additional biogeochemistry knowledge to strengthen the science. The work may serve as matched funding for the EU BENTHIS project and link with project partners within this network (e.g. Cefas, ILVO, Bangor University).</td></tr>
<tr><td>International objective of research</td><td>Impacts of fishing gear on benthic communities is a hot topic which concerns all trawling activities worldwide. A better understanding of such impacts on the seabed and ecosystem functioning is therefore vital and makes this project interesting for an international audience.</td></tr>
<tr><td>International Project results</td><td>Results should help better define the measures of seabed function useful for e.g. the MSFD and where impacts of trawling are most evident.</td></tr>
<tr><td>International or National Finance</td><td>Co-funding will be available through “BENTHIS” and “effects of shrimp fisheries in Natura2000 areas”. Each of these provides opportunities for field sampling and complimentary data collection.</td></tr>
</table>

Title of project 14 ☺	**Implications of a discard ban for Dutch fisheries**
Project leader	Sebastian Uhlmann
Theme	2. Reducing discards
Participating partners (IMARES)	Sebastian Uhlmann Harriet van Overzee Edwin van Helmond David Miller Aukje Coers Adriaan Rijnsdorp
Participating partners (external)	Thomas Catchpole (Cefas), Harriet Condie (Cefas), Jordan Feekings (DTU Aqua)
Duration	One year
The Problem	The potential impact of the proposed discard ban together with the introduction of catch quotas are not explicitly known for some of the economically most relevant Dutch demersal and pelagic fisheries. Using WOT at-sea monitoring data from both demersal and pelagic fisheries and based on a quantification of the relative contribution of the inferred drivers of discarding, the consequences of possible discard ban scenarios will be estimated and ranked by respective fishery. The risk of actually increasing total fishing mortality by overestimating catch quotas will be estimated using stock assessment techniques together with estimates of species-specific selectivity and survival.
Objectives of project	a) Apply an existing, simple model (Catchpole et al., in submission) to data from Dutch discard monitoring programmes to establish the relative contribution of different, inferred drivers of discarding. b) Evaluate the effects of the proposed discard ban scenarios on various demersal and pelagic fisheries c) Simulate in scenarios the effect of different selectivity, discard and natural mortality parameters on stock assessment outputs d) Evaluate the effects of the proposed discard ban on the sampling procedures of these fisheries for discards
Broad description of the project including expected results	The Common Fisheries Policy (CFP) Reform lists in article 15 a number of fish species which will fall under a discard ban. By grouping fish into either non- or CFP-listed species, numbers-at-length of discarded fish will be used from the WOT observer monitoring programmes to classify for each trip all discarded fish into four categories: i) fish under MLS; ii) fish under minimum marketable size and species that have no market; iii) fish with an associated quota and which were discarded above MLS; and iv) fish with no quota and which were discarded above MLS. This will provide a categorisation of all fish discards according to the inferred reasons of discarding. For example, this allows for inferences whether legislations (MLS and quota) were the driving forces behind the observed discard pattern as opposed to mismatches between the selectivity of the fishing practice and the absence of a market. By knowing for each fishery (and relevant species) the relative importance of each of these drivers, the consequences of a discard ban can be evaluated. For example, a fishery, where the majority of fish discards is driven by an absent or inconsistent market may be less affected than a fishery where the majority of discards are <MLS of a quota-managed, CFP-listed species. Stock assessments require estimates of the total removals from the population. If catch quotas are overestimated under a transition from landings quotas following a discard ban, total fishing mortality may differ from what was intended. Likewise, if selectivity is not improved (i.e. shifts away from discarded sizes), and the survival proportion of discards is not accounted for, inappropriate quotas may be set in the transitional years. This could adversely

<table>
<tr><td></td><td>affect fish stocks. By taking plaice as a case study species, different catch quota, selectivity, and survival scenarios will be assessed against changes to the stock assessment outcome and short term impact on stock development .

Such results will be discussed in relation to earlier work where the looming introduction of a discard ban have been discussed (LEI report, discard ban and mixed fisheries). One of the key aims of a discard ban and catch quotas is to promote more selective fishing and that way minimising discards. Applying estimates of changes in selectivity from IMARES-led and international gear trials will allow for predictions of the potential economic benefit of adopting more selective fishing practices.</td></tr>
<tr><td>Products to be delivered</td><td>Report based on at least 1 scientific publication</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Scientific publication, relevant meeting between sector and ministry representatives.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>In addressing objective a), this project will provide an overview of what the main drivers of discarding are for each fishery based on the known composition of discards. In addressing objective b), together with existing evidence, the effects of a discard ban scenarios will be anticipated for different, relevant fisheries.</td></tr>
<tr><td>Likely impact of project</td><td>Considering that the discard ban proposal is currently up for debate at the European parliament, the results from this project will be very timely for both the industry and ministry to gauge its consequences and possibly prepare for them.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>160 hours cat.3 Data compilation, analyse report and publication 1</td><td>94€</td><td>15,040</td></tr>
<tr><td>160 hours cat.3 Data compilation, analyse report and publication 2</td><td>94€</td><td>15,040</td></tr>
<tr><td>80 hours cat.3 Advice and coordination 1</td><td>94€</td><td>7,520</td></tr>
<tr><td>80 hours cat.3 Advice and coordination 2</td><td>94€</td><td>7,520</td></tr>
<tr><td>20 hours cat.5 Advice and project mentoring</td><td>150€</td><td>3,000</td></tr>
<tr><td>total costs</td><td></td><td>48,120</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>Relevance in addressing the open call “Reducing discards”</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>Yes, Adriaan Rijnsdorp</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>Failure by the EU to accept the discard ban proposal in its current terms.</td></tr>
<tr><td>International Scientific network</td><td>We will be drawing upon some expertise (existing and working R code) from overseas (UK, Cefas) that has been written to analyse observer-based discard data and which is directly applicable to IMARES data.</td></tr>
<tr><td>International objective of research</td><td>Yes, implications of a discard ban are relevant for at least all member States of the EU.</td></tr>
<tr><td>International Project results</td><td>Findings will be relevant to other fisheries where the main driving forces of discard behaviour are similar than those that are going to be described here.</td></tr>
<tr><td>International or National Finance</td><td>None</td></tr>
</table>

Title of project 15	**Improving estimates of fishing mortality: developing reflex impairment indices for flatfish as a surrogate measure of discard mortality**
Project leader	Sebastian Uhlmann
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sebastian Uhlmann Hans van de Vis Bob van Marlen Adriaan Rijnsdorp
Participating partners (external)	Adam Barkley (USA); Steve Cadrin (USA)
Duration	One year
The Problem	Survival of discards is an important point of discussion in relation to the European discard ban proposal, because there is a risk to increase overall fishing mortality if fish were landed that would have otherwise survived the discarding process. But under a discard ban and for stock assessment, 100% mortality is assumed. Furthermore, existing historic survival estimates of plaice and sole were gleaned from fish that were caught-and-discarded by tickler-chain equipped, heavy conventional beam trawls at high speeds (Beek et al., 1990). Since then, fishing practices underwent some revolutionary changes in favour towards reduced capture stressors by using lighter gears (e.g. sumwings and pulse trawls) and towing with reduced speeds. But so far, the potentially less deleterious consequences on discarded organisms (especially those of commercial value such as plaice and sole) have not been assessed on an experimentally-rigorous scale across a number of different fisheries and gears. Therefore, it is important to develop a technique that allows for a reliable estimation of the proportion of flatfish discards that will survive the catch-and-discarding process. This pilot study will develop a rapid assessment technique for predicting discard mortality based on the response rate of live flatfish to several reflex tests. If successful, a protocol will be developed which allows for further testing under conventional fishing conditions which eventually leads to the establishment of rapid RAMP collection routines during existing monitoring programmes.
Objectives of project	a) Develop reflex impairment tests on live flatfish (sole, plaice, and dab) and measure their delayed discard mortality during laboratory trials

<table>
<tr><td>Broad description of the project including expected results</td><td>During pilot laboratory trials, response rates to various established reflex indicators will be measured for two commercially-valuable (plaice and sole) and one non-commercially-valuable species (dab). Ideally, response rates to reflex tests describe a (non)linear relationship over a gradient of one capture (i.e. burst swimming) and post-capture stressor (i.e. air exposure) stressor. A manipulative, factorial design will be used to increase the power of inferences. Reflexes will be tested for replicated numbers of both restrained and free-swimming fish following the methods described by Davis (2007, 2009) and Barkley (2011) before and after experimental treatment. Treated fish will be monitored together with untreated controls for any delayed mortality. All experiments will be conducted at the aquaria facilities in IJmuiden with small-sized fish that were either sourced from nearby aquaculture facilities (sole) and short shrimp trawl deployments (plaice and dab). In line with other flatfish species for which reflex tests were successfully carried out (e.g. yellow-tail flounder; Barkley, 2011), it is expected that delayed mortalities follow a sigmoid curve as a function of the reflex action mortality index (RAMP) across the gradient of the capture and post-capture stressors.</td></tr>
<tr><td>Products to be delivered</td><td>Report based on at least 1 scientific publication</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>1 scientific publication,1 presentation at a relevant industry-ministerial meeting (e.g. Onderzoekssamenwerking).</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>In addressing objective a), this project will develop and test a cost-effective method for estimating flatfish survival without requiring the cost-intensive monitoring of delayed impacts. Its utility will be broad, because rapid reflex impairment data may eventually be collected from a relatively large number of live fish during existing monitoring cruises. If this pilot is successful and RAMP scores can be calculated for North Sea flatfish species, field trials should be carried out. Ideally, such a relationship curve will allow for predictions of discard mortality, if a RAMP index can be quantified.</td></tr>
<tr><td>Likely impact of project</td><td>Considering that the discard ban proposal is currently up for debate at the European parliament, the results from this project will be very timely for both the industry and ministry to gauge its consequences and possibly prepare for them.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>Set-up, experimental design, analysis and write up; 240 hours cat 3</td><td>94€</td><td>22,560</td></tr>
<tr><td>Advice and assistance with experimental design and results interpretation; 100 hours cat 5</td><td>150€</td><td>15,000</td></tr>
<tr><td>Experimental design and maintenance; 100 hours cat 2</td><td>77€</td><td>7,700</td></tr>
<tr><td>Material</td><td></td><td>1,000</td></tr>
<tr><td>total costs</td><td></td><td>46,260</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>Relevance in addressing both open calls “Reducing discards” and ”Ecosystem approach”</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>Yes, Adriaan Rijnsdorp</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>1. Failure by the EU to accept the discard ban proposal in its current terms
2. Lack of sensitivity of selected flatfish species to easily-testable reflex impairment tests
3. Difficulty to source and keep flatfish species in the aquaria facility</td></tr>
<tr><td>International Scientific network</td><td>Yes, we will be drawing upon expertise developed and published in the USA</td></tr>
</table>

International objective of research	Develop a testing framework which allows for transferability and reproducibility with other species and/or in another setting.
International Project results	If a reflex impairment index for the above flatfish species can be derived, this work will become very relevant for any other European fishery where either of these species are commonly caught and discarded.
International or National Finance	None
References	Barkley, A. S. 2011. Discard mortality estimation of yellowtail flounder using reflex predictors. MSc thesis. University of Massachusetts. Beek, F. A. v., Leeuwen, P. I. v., and Rijnsdorp, A. D. 1990. On the survival of plaice and sole discards in the otter-trawl and beam-trawl fisheries in the North Sea. Netherlands Journal of Sea Research, 26(1): 151-160. Davis, M. W. 2007. Simulated fishing experiments for predicting delayed mortality rates using reflex impairment in restrained fish. Ices Journal of Marine Science, 64: 1535-1542. Davis, M. W. 2009. Fish stress and mortality can be predicted using reflex impairment. Fish and Fisheries: 1-11.

Title of project 16	**The forgotten commercial fishes**
Project leader	Tessa van der Hammen
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Tessa van der Hammen, Adriaan Rijnsdorp, Jan Jaap Poos, David Miller
Participating partners (external)	Arni Magnusson (HAFRO, ICELAND)
Duration	1 year
The Problem	Healthy fish stocks are a requirement under GES (descriptors 1 diversity, 3 populations of commercial fish and 4 elements of marine food webs). Currently, we lack insight in the fishing pressure on and stock status of some commercially important flatfish species, e.g. turbot and brill. This results in fisheries management advice that is based solely on trends in surveys. Improving our knowledge on the exploitation of these flatfish would allow providing advice based on an analytical assessment and therefore give a better insight in the status of the stock.
Objectives of project	Conduct a stock assessment for brill, based on catch information and survey data.
Broad description of the project including expected results	The project will deliver a stock assessment for brill. To this end we: 1) Review existing survey data, including the recently provided age sampling 2) Update LPUE series from the Dutch beam trawl fleet, as in van der Hammen and Poos (Report C109.11, 2011) 3) Conduct an analytical stock assessment based on the data sources above, in cooperation with Arni Magnusson. 4) Include results in peer reviewed paper that is currently being drafted by participants. Goal is to get this paper included in International Flatfish Symposium issue of Journal of Sea Research (spring 2013). 5) Participate in WGNEW to discuss and disseminate stock assessment method and its results
Products to be delivered	Analytical stock assessment of brill Peer reviewed paper (Journal of Sea Research (spring 2013). This paper is a review combining the biology and the status of the turbot and brill stocks.
Dissemination of findings being addressed	As described above, we plan to submit a paper to the flatfish symposium issue of the Journal of Sea Research. The deadline for this issue is 15 March 2013. A visit to WGNEW will disseminate our findings in the ICES expert group.
Utility of the developed products and expertise	The assessment of Brill may be included in WGNSSK and the assessment will be used for TAC advice.
Likely impact of project	Our project will improve our role as leaders in ICES when it comes to providing advice for exploitation of marine resources.
Proposed budget	Personnel € 23.040
Why should this be funded by KB WOT?	This should be funded by KB WOT because it would aid the ICES assessment of brill based on the WOT surveys. Once the methods are fully developed, it could potentially in the future also be used for other flatfish species, such as dab or flounder. Turbot and brill are important bycatch species for the Dutch flatfish fisheries. Improved knowledge on the population dynamics of these species will improve the scientific advice for sustainable harvesting of North Sea flatfish stocks.
Is the appropriate capacity available?	Yes, the human resources are available.

What other potential funding sources have been considered?	The project benefits from a BO 2013 project on cat 11 species (BO 12.04-001-036). However, the budget in this project for brill is too small to conduct an analytical assessment. Hence, by combining this KB WOT money with the BO project, we can deliver a higher quality product and finalize a peer review paper on both turbot and brill.
Connection to knowledge development at the University	No.
What are the potential risks to the project's success?	The final product depends on a number of data descriptions and explorations. All data required are available (for example, the brill otoliths have only recently been aged and imported into our database). No serious problems are expected that may jeopardize the project.
International Scientific network	The work will be used in WGNEW and potentially in WGNSSK. Importantly, we have support from Arni Magnusson at Hafro in Iceland who also provided valuable input in the assessment for turbot.
International objective of research	The management advice of species in the North Sea is inherently internationally important
International Project results	The project results will be presented in ICES (WGNSSK and WGNEW).
International or National Finance	The BO 12.04-001-036 (Category 11 species) has around 10.000 euro available for turbot and brill work.

Title of project 17 ☺	**Genomac - Genetics of mackerel and horse mackerel eggs**
Project leader	Cindy van Damme
Theme	3. Maintaining quality
Participating partners (IMARES)	Hilde van Pelt
Participating partners (external)	Senkenberg Instituut, Duitsland, WUR Animal Breeding and Genomics Center
Duration	One year
The Problem	Every three years a extensive international mackerel and horse mackerel egg survey is carried out covering the whole spawning area (Portugal-Iceland) and season (January-July). The spawning stock biomass estimation of mackerel based on the egg survey and the egg production of horse mackerel from the survey is used in the ICES assessment of the species. It is very important that the eggs collected in the samples are correctly identified to species and the development stage is assigned correctly. The eggs of the egg survey are currently identified and staged by the expert eye. This is a time and thus money consuming process which is still prone to mistakes. An important parameter for identification of fish eggs is egg diameter. There is a lot of overlap in egg diameter between species. Furthermore, egg diameter varies within a species between different areas and is also dependent on the size of the female that spawned the eggs. Results of the last workshop showed that the identification for mackerel eggs was correct for 95% of the validated mackerel eggs and for horse mackerel only 64% (ICES, 2009). Other eggs were also mistaken for mackerel or horse mackerel, since overall 85% of the eggs were correctly identified. For the assignment of the egg development stage agreement between participants was 77% for mackerel and 81% for horse mackerel (ICES, 2009). Currently it is possible to genetically identify fish (EU project Fishtrace) and it is possible to also do this from formaldehyde fixed samples (Lelievre et al. 2010). For eggs PCR primers have been used recently to identify cod eggs. But species- specific primers have the disadvantage that they only identify a certain species and they are not available for mackerel or horse mackerel. Universal primers are available for the amplification of Cytochrome b fragments in marine teleosts. Based on the sequences of these fragments individual eggs can be identified, on species level. Furthermore, sequence technologies have been developed to identify all species simultaneously in a sample. This technology is used by IMARES to identify species in benthos samples. Currently protein profiles have been used to determine the development stage of Ciona intestinal eggs. es egg (Nomura et al. 2009). This technology has not been developed yet for fish eggs, but could be very interesting for high-throughput analysis in future. In this project individual and mixed samples of eggs from the survey will be genetically identified to confirm the expert identification. The use of genetics for egg identification and staging will not only be useful for the mackerel egg survey but can be used in other ichthyoplankton surveys, such as the North Sea egg surveys, that are regularly carried out by IMARES and other international institutes. In the future the use of molecular technologies will improve the identification and staging of fish eggs as well as, with the costs of genetic analyses currently reducing, reduce the cost involved in carrying out such extensive ichthyoplankton surveys.
Objectives of project	To confirm the egg identification of samples in the mackerel and horse mackerel egg survey. For the short term this will improve the egg production estimation of mackerel and horse mackerel for the assessment. For the future the egg production estimation of ichthyoplankton surveys will be improved when species identification and staging can be done automatically.

<table>
<tr><td>Broad description of the project including expected results</td><td>In 2013 a triennial mackerel and horse mackerel egg survey will be carried out. Egg samples will be collected and fertilizations carried out during the survey. All eggs will be identified and staged by experts. We plan to analyse 50 mixed samples to confirm the species identification. Results will be presented at the ICES ichthyoplankton WGs, a fisheries related conference and in a peer reviewed publication.</td></tr>
<tr><td>Products to be delivered</td><td>Confirmation of egg identification and staging. Peer reviewed publication</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Peer reviewed publication and presentations for the ICES ichthyoplankton WGs and a relevant symposium.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>Ensuring and maintaining quality of core competences that need to be delivered in the WOT routine sampling program. In the long term reducing costs of ichthyoplankton surveys.</td></tr>
<tr><td>Likely impact of project</td><td>IMARES will have validation of the egg identification and staging of the mackerel and horse mackerel egg survey. Rather than identifying one species (as with PCR primers) this will give a tool to identify all species in the egg samples providing accurate information of all species rather than the key species mackerel and horse mackerel. Since this method is not species specific it can be used for all ichthyoplankton surveys.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>360 hours Technician cat.2</td><td>77€</td><td>27,720</td></tr>
<tr><td>80 hours Scientist cat.3</td><td>94€</td><td>7,520</td></tr>
<tr><td>Travel</td><td></td><td>5,000</td></tr>
<tr><td>total costs</td><td></td><td>40,240</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This should be funded by KB WOT because the maturity staging, egg identification and fecundity estimations are core to the data collected in the WOT routine samplings.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes. Samples will be collected during the mackerel and horse mackerel egg survey.
Hilde has the expertise and equipment to carry out the identification analysis.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>Call FP7 TEMPO: development of protein or metabolite profiles for fish egg developmental stages.</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>WUR-Animal Breeding and Genomics Group in Lelystad, Prof. M. Smits and L. Kuyt, have expertise in the identification of protein and metabolite profiles.</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>Risks for the collection and fertilization of the eggs are minimal. The survey will be conducted next year under the WOT program and since 2004 successful fertilizations have been carried out during the egg surveys. Genetic analysis on formaldehyde fixed samples have been carried out before. Moreover, the technology to identify species simultaneously in a sample has been developed at IMARES for benthic species.</td></tr>
<tr><td>International Scientific network</td><td>This survey is part of the ICES coordinated international mackerel and horse mackerel egg surveys. But results of this project are of use for all ICES and other ichthyoplankton surveys.
The Senkenberg institute develops methods for the identification of fish species using protein profiles. We can use their knowledge to identify profiles for fish eggs</td></tr>
<tr><td>International objective of research</td><td>Mackerel and horse mackerel are internationally important commercial species. The survey is an ICES coordinated survey and results are used in the assessment of mackerel and horse mackerel. The use of genetic analysis to identify fish species in mixed samples will be interesting for all fish species worldwide</td></tr>
<tr><td>International Project results</td><td>Results can be used by all institutes involved in the mackerel and horse mackerel egg surveys. But the method can also be used in other ichthyoplankton surveys.</td></tr>
<tr><td>International or National Finance</td><td>None</td></tr>
</table>

Title of project 18	**Quality control of maturity staging**
Project leader	Cindy van Damme
Theme	3. Maintaining quality
Participating partners (IMARES)	Ingeborg de Boois, Sieto Verver and technicians
Participating partners (external)	None
Duration	One year
The Problem	The maturity stage is an important biological parameter to be used in the calculation of maturity ogives (and therefore of Spawning Stock Biomass and used in assessment models), for the definition of the spawning season of a species, for the monitoring of long-term changes in the spawning cycle, and for many other research needs regarding the biology of fish. To facilitate the needs for assessment purposes, the European Data Collection Framework indicated maturity as one of the key variables to collect on individual fish on a species by species basis. In the last years IMARES participated in several maturity staging workshops. At these maturity workshops the macroscopic staging is validated with microscopic identification, so participants know immediately if their macroscopic staging is correct. The microscopic validation is expensive and thus not carried out during the IMARES routine sampling. Participating in the workshops gave the technicians a good education and better understanding of the reproductive biology of fish to make it easier to assess the correct maturity stage. However it also showed that some of the IMARES technicians have problems in assessing the correct maturity stage and are uncertain about their staging. It would aid the quality of the maturity staging if some samples of which the technicians are in doubt, are checked microscopically.
Objectives of project	To microscopically validate maturity staging samples and enhance the macroscopic staging.
Broad description of the project including expected results	For females it is possible to take smears of the oocytes in the fresh ovary and check the development of the oocytes under the microscope directly. For males it is necessary to prepare histological slides to microscopically assess the maturity stage.
Products to be delivered	Confirmation of the macroscopic assessed maturity stage.
Dissemination of findings being addressed	Results will be published in an internal IMARES report.
Utility of the developed products and expertise	Ensuring and maintaining quality of core competences that need to be delivered in the WOT routine sampling program.
Likely impact of project	IMARES will have the validation and proof of the quality of the routinely assessed maturity stages.
Proposed budget	Personnel: 7,000 Material: 500 total costs: 7,500
Why should this be funded by KB WOT?	This should be funded by KB WOT because the maturity stagings are core to the data collected in the WOT routine samplings.
Is the appropriate capacity available?	Yes, knowledge and equipment for the microscopic validation are available.

What other potential funding sources have been considered?	None
Connection to knowledge development at the University	None
What are the potential risks to the project's success?	None, knowledge and equipment for the microscopic validation are available.
International Scientific network	Maturity staging is core for the data collection coordinated by ICES.
International objective of research	The surveys and samplings during which IMARES is obliged to carry out the maturity stagings are ICES coordinated international samplings.
International Project results	The maturity staging, egg identification and fecundity estimations are used by multiple ICES assessments groups for assessing SSB. The validation results will give a good estimate of the variation in the collected data.
International or National Finance	None

Title of project 19 ☺	**Programme Management**
Project leader	Cindy van Damme
Theme	Management
Participating partners (IMARES)	Rian Schelvis, Frans van Beek
Participating partners (external)	
Duration	One year
The Problem	
Objectives of project	To manage and develop the KB WOT Fisheries theme within WUR KB theme 4.
Broad description of the project including expected results	To manage and develop the KB WOT Fisheries theme within WUR KB theme 4.
Products to be delivered	2 reports – reporting on the 2012 programme and a description and rationale for the 2013 programme
Dissemination of findings being addressed	Through a range of media and 2 reports – reporting on the 2012 programme and a description and rationale for the 2013 programme
Utility of the developed products and expertise	A review of the functioning of KB WOT fisheries was carried out in 2010 (see report 10.IMA0283.mdc) which involved LNV (directorates AKV and Kennis), CVO, WUR and IMARES. This found that the programme was forward looking, viewed high quality innovative science as important and yet maintained the direction considered important by LNV. Thus the KB WOT programme appears to utilise the expertise available to DLO on fisheries and look to the future research needs of society.
Likely impact of project	See utility of the developed products and expertise.
Proposed budget	€24,000,-
Why should this be funded by KB WOT?	As this is core to an effective and innovative programme.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	None
Connection to knowledge development at the University	Close links through KB 4.
What are the potential risks to the project's success?	Minimal
International Scientific network	Close links through ICES, the EU STECF, PICES and FAO. Plus a network of marine researchers in Universities across Europe and North America.
International objective of research	Maintain IMARES at the centre of fisheries research in Europe and project our skills to arenas beyond the EU.
International Project results	Almost all projects within the programme are international.
International or National Finance	A mixture of funding mechanisms and partnerships.

Title of project 20 ☺	**International exchange**
Project leader	Cindy van Damme
Theme	4. International exchange
Participating partners (IMARES)	de Boois, Bolle, Teal, Miller, Hintzen, Röckmann, Rijnsdorp, van Marlen, Fässler, van Damme, van Hal, Slijkerman, IMARES MT
Participating partners (external)	The ICES, PICES and FAO-fisheries community
Duration	One year
The Problem	To fund participation in international science networks and ICES meetings.
Objectives of project	To fund participation in international science networks and ICES meetings.
Broad description of the project including expected results	To fund participation in international science networks and ICES meetings. Data and Information Group (former WGDIM), Working Group on Integrative Physical-biological and Ecosystem Modelling, Working Group on Fish Ecology, Working Group on Fisheries-Induced Evolution, Workshop on the Value of Coastal Habitats for Exploited Species, Working Group on Multispecies Assessment Methods, Working Group on Fishing Technology and Fish, Working Group on Fisheries Acoustics and Technology, Working Group on Integrating Surveys for the Ecosystem Approach, Working Group on Integrated Assessments of the North Sea, Workshop on DATRAS data Review Priorities and checking Procedures, Workshop on the identification of clupeoid larvae, Working Group on Cod and Plaice egg surveys in the North Sea, Workshop on the Age Reading of Blue whiting.
Products to be delivered	Formal working groups reports, internal IMARES reports of participants of the meetings and collaborative manuscripts for peer reviewed journals.
Dissemination of findings being addressed	Through the ICES website, ICES theme sessions, symposia and through the ICES advisory system.
Utility of the developed products and expertise	Products and expertise central to the development and research of fisheries in the Netherlands.
Likely impact of project	
Proposed budget	Personnel: 100,000 Material: 18,508 total costs: 118,508
Why should this be funded by KB WOT?	These groups are core to the development of KB WOT and the maintenance of IMARES as not only a centre of excellence but also an institute for innovation and world leader in fisheries research. The network provided by these groups provides great added value to the KB WOT resources.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	WOT, IMARES R&D funds, etc. and these are the groups that most require KB WOT funding.

Connection to knowledge development at the University	Little
What are the potential risks to the project's success?	Over commitment of staff
International Scientific network	Mostly across the North Atlantic marine science community but now also with FAO and with scientists from countries involved in PICES (Japan, Korea, China).
International objective of research	Maintain IMARES at the centre of fisheries research in Europe and project our skills to arenas beyond the EU.
International Project results	
International or National Finance	Added value by participating in collaborative international projects and groups.

Title of project 21 ☺	**GEAR EFFICIENCY: assessment and intercalibration of sampling gears**
Project leader	Karin Troost
Theme	3. Maintaining quality
Participating partners (IMARES)	Johan Craeymeersch, Jeroen Jansen
Participating partners (external)	None
Duration	one year
The Problem	For the WOT Shellfish surveys in Dutch coastal water we use different types of gear: suction dredges, towed bottom dredges and (hydraulic) grabs. For most of the gears efficiency has never been tested. Differences in efficiency between gears have never been tested, except for a small scale comparison between the towed bottom dredge (benthos schaaf) and the prototype Ensis dredge. Within the framework of a large monitoring project (PMR compensatie; J. Craeymeersch) the bottom dredge (benthos schaaf) has been adjusted and improved significantly, but the increased efficiency has not been quantified, and in the WOT survey we still use the 'old' dredge. We cannot improve the stock assessment in the WOT survey by using the adjusted dredge as long as we do not know the difference in efficiency because this would lead to a break in the trend. So, we need to quantify (differences in) efficiencies in order to optimise stock assessments (of direct importance for WOT) and to be better equipped to integrate different surveys (to answer to an increasing demand from the ministry).
Objectives of project	The objective is to quantify the efficiency of different gear types for target species and to compare efficiencies between gear types with the aim of: - Improving accuracy of stock assessments; - Being able to apply the improved bottom dredge in all surveys thereby increasing accuracy; - Being able to compare results obtained with different gear types in order to: 1) improve stock assessments, 2) combine results of different surveys (by IMARES and others) in analyses..
Broad description of the project including expected results	By means of comparative fishing we mean to compare the efficiencies of different gear types. By fishing in intertidal areas we will assess the fishing efficiency per gear type by manually digging out all bivalves from a known surface area (assumed to be 100% efficient). We will focus on the following sampling gears: - Towed benthos dredge (benthos schaaf): old and adjusted; - Ensis dredge (still prototype, establish usefulness); - Suction dredge ('zuigkor' and 'stempelkor'); - Boxcore; - Hydraulic grab (1m2); - Van Veen grab; - Manual cockle dredge ('kokkelschepje'/'-schuifje'). Where possible, efficiencies will be tested in different sediment types. Target species are the bivalves: *Ensis sp.*, *Spisula sp.*, *Mytilus edulis*, *Cerastoderma edule*, *Crassostrea gigas*, *Mya arenaria*, *Macoma balthica*. Field work will be carried out in the period May-August. Results will be analysed statistically and efficiencies calculated and compared. Specifically for the WOT shellfish survey in the coastal zone we will determine how to apply the adjusted dredge with increased efficiency without causing a break in trend: in other words how we should correct for a change in gear efficiency. For surveys in which multiple gear types are used (cockle survey Wadden Sea) we will determine the effect of corrections for different efficiencies on the stock assessment (and confidence intervals).

<table>
<tr><td>Products to be delivered</td><td>All results will be published in a report that will be made available via the CVO website. Future reports on work carried out with these gear types should refer to this report regarding fishing efficiency.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>The report will be written in English and shared with the international network of shellfish stock assessment experts that was set-up with the KB WOT budget of 2010. Further dissemination will be through availability on the CVO website and citations in IMARES reports and scientific publications.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>Knowing the fishing efficiency of sampling gears is of primary importance for an institution with expertise in stock assessments. This project will therefore fill an important gap in the knowledge base of IMARES regarding stock assessments of shellfish and other macrobenthic fauna. The results of this project therefore contribute directly to theme 4 of the IMARES research programme (“Sturing en beheer van living marine resources”) and theme “Maintaining Quality” of the IMARES development plan</td></tr>
<tr><td>Likely impact of project</td><td>The results of this project will:
Allow IMARES to apply improved sampling gears in annual surveys in which the accuracy of stock assessments is of key importance;
Improve the accuracy and estimation of confidence intervals of stock assessments;
Make a direct comparison possible between results obtained with different sampling devices, not only within IMARES but also between IMARES and other institutions such as NIOZ and the University of Hull (if they also quantified sampling efficiency for certain target species);
Therefore also contribute directly to the possibility for integrated monitoring in Dutch coastal waters.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>Field work and preparations (OASS): 2 persons x 70h</td><td>77€</td><td>10,780</td></tr>
<tr><td>Management, analyses & report (OND): 60h</td><td>94€</td><td>5,640</td></tr>
<tr><td>Analyses and report (OASS): 150h</td><td>77€</td><td>11,550</td></tr>
<tr><td>Materials (rent gears, repairs)</td><td></td><td>6,200</td></tr>
<tr><td>Travel</td><td></td><td>1,030</td></tr>
<tr><td>total costs</td><td></td><td>35,200</td></tr>
</table>
Shipping time: approximately 2 weeks of shipping time is needed. This is not part of the proposed budget. We will either works something out with the Ministry of EZ to use a ship of the Rijksrederij (funded by EZ or against a negotiated reduced rate from other projects) or we will find funding from other projects to hire the same charter ship we perform the WOT shellfish surveys on the Wadden Sea with. Costs may range from €0 (funding Rijksrederij by EZ)to €25,000 (charter).</td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The results will directly contribute to the quality and credibility of the WOT shellfish stock assessments. It fills in an essential knowledge gap in the shellfish stock assessments.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None since this is a subject specifically relevant for WOT.</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>No</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>The only risk may be funding of shipping time. But we expect that we can either work something out with EZ/Rijksrederij or that we can fund these costs from other projects. We will integrate the program as tight as possible with the ongoing WOT shellfish surveys.</td></tr>
</table>

International Scientific network	In this particular project we will not cooperate with international partners. We will share the results within the international network on shellfish stock assessments (that was initiated through a workshop funded by KB WOT in 2011).
International objective of research	Not really, but it will contribute towards integrated monitoring in the North Sea which may be developed increasingly in the (near) future.
International Project results	See above.
International or National Finance	None.

Title of project 22	**North Sea herring habitat suitability during the summer feeding season**
Project leader	Thomas Brunel
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sven Gastauer, Sascha Fässler, Lorna Teal
Participating partners (external)	Susan Lusseau (Marine Scotland), Karl-Johan Staer (DTU-Aqua), Cecilie Kvamme (IMR), Matthias Schaber (vTI), Piet Ruardij (NIOZ), Morten Skogen (IMR),
Duration	1 year
The Problem	During the summer feeding season, North Sea herring store lipids in their muscles and guts. Habitat suitability during this period is crucial, as it determines the amount of energy stored, which in turn influences individual annual growth and reproductive output. Hence, for a better understanding of the interaction between herring biology and its environment (which is a prerequisite for the ecosystem approach to fisheries management), it is crucial to understand the influence of environmental factors, such as plankton abundance and temperature, and density dependent processes (intra specific competition for food) on the suitability of summer habitat. The amount of the energy stored during the feeding season a good proxy for habitat suitability and can easily be approximated by the condition index, indicating whether a fish of a given length is heavier or lighter than the norm. Habitat suitability can also be predicted using a dynamic energy budget (DEB) model, in which surplus energy (the balance between energy acquisition and energy consumption for maintenance) is a direct measure of net habitat suitability . Using these two approaches to habitat suitability, the realised one and the theoretical one, this project will identify the sources of variability in summer habitat suitability.
Objectives of project	1) Look for (spatial and temporal) patterns in condition variability, which would be indicative of the existence of a determinism in habitat suitability 2) Investigate the effects of environmental factors and check for density dependence effect on condition and compare with the theoretical expectation from the DEB model. 3) Compare the realized habitat suitability, as represented by the distribution of “fat” versus “lean” herring, with prediction from the DEB model

Broad description of the project including Expected results	Data used : - Condition index will be calculated on an individual basis, based on length and weight measurements taken during the North Sea herring acoustic survey, for the period 1998-2012. - Plankton and pelagic fish biomass measured by acoustics during this survey will be used to describe food availability and the intensity of intra-guild competition for food. - Environmental data will come from ecosystem models (ERSEM ,NORWECOM), satellites and in situ data collected during surveys Plankton and physical data from different sources will be compared to check for consistency. Analysis of condition variability Characterization of the spatio-temporal variability in fish condition : semi-variograms will be used to investigate if there are spatial patterns in the variation of condition. Variance decomposition techniques will be applied to test for significant differences in condition among classes (being defined as geographical units and age class) or if most of the variability occurs at an intra-class / inter-individual level. Modelling condition: using GLM or GAM, condition will be modelled as a function of temperature, chlorophyll, zooplankton abundance (as environmental drivers), and pelagic fish abundance (for density dependent effects). Comparison with and validation of the DEB model The effects of the environment and of fish abundance on habitat suitability, empirically estimated by the analysis of condition data, will be compared with the theoretical expectations from the DEB model. The DEB will also be used to predict habitat suitability maps, based on output from ecosystem models. The distribution of condition can then be compared to the projections of the model on where the most suitable habitats for growth are. These two comparisons will serve as much better validation of the DEB modelling approach than has so far been possible as it gives detail not only on presence of herring but also their physiological state.
Products to be delivered	- P1 : Statistical model of herring condition - P2 : A DEB model for North Sea herring validated by the comparison with in situ data - P3 : An algorithm to filter out plankton biomass from the acoustic signal (can be made available on the web for use by survey groups). - P4 : A short report of the work, material for writing manuscripts to be submitted to a peer reviewed journal.
Dissemination of findings being addressed	Peer reviewed literature, WG and conference presentations
Utility of the developed products and expertise	P1 : Condition is biologically meaningful (influencing growth and fecundity) and economically relevant (fat content makes the value of the fish on some markets). P1 will bring some insight on the factors controlling condition. This could also lead to improvement in the herring stock assessment. P1 and P2 : these models can be incorporated in herring population dynamics models or in ecosystem models to better represent the influence of habitat suitability on herring biology. P3 : applicable in many situations (on research surveys, but also on data collected from fishing vessels) to provide high resolution measurement of plankton abundance in the water column.

<table>
<tr><td>Likely impact of project</td><td>This study should give indication about whether there is some determinism in the fish condition (whether it is linked to environment or population dynamics). This should indicate if it is worth putting more effort in understanding condition and its implication for stock management (for reasons mentioned above), or if it should be taken as a randomly varying parameter.
Getting a better insight into the condition of North Sea herring will contribute to our general understanding of North Sea herring biology and ecology.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>T Brunel (160 h): Analysis of condition</td><td>94€</td><td>15,040</td></tr>
<tr><td>Gastauer (50h): Preparation of Chlorophyll a data from satellite images</td><td>94€</td><td>4,700</td></tr>
<tr><td>Fässler (60h): Estimation of fish and plankton abundance from acoustic data. Preparation of environmental data</td><td>94€</td><td>5,640</td></tr>
<tr><td>Teal (50h): DEB model applications</td><td>94€</td><td>4,700</td></tr>
<tr><td>total costs</td><td></td><td>30,080</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This project combines innovative marine acoustics techniques, advanced statistical modelling and physiologically-based growth modelling. It is likely to lead to important results for the ecosystem approach : it will identify how the environment and the abundance of pelagic fish influence key components (growth and reproductive output) of the productivity of North Sea herring. Currently little in known on the subject. The project would build up the knowledge base within IMARES and provide a strategic advantage.
The study will also develop tools to assess habitat suitability and can hence potentially provide descriptors for the Good Environmental Status of the Marine Environment.
Additionally, plankton abundance derived from data collected on standard acoustic surveys may very likely become a vital tool for future integrated whole-ecosystem surveys.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes, all expertise is covered by the participants of the project.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>No other direct financing of this project.</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>None or very little, since the data is already collected and ready to be analysed and the plankton filter algorithm and the DEB model have been tried and tested in previous 2012 KB WOT projects “HAQUAFAMI” and “Herring and chlorophyll”.</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>none</td></tr>
<tr><td>International Scientific network</td><td>The acoustic survey data is provided by 5 research institutes (IMR, Norway; Marine Scotland, DTU-Aqua, Denmark, vTI, Germany and IMARES). Ecosystem model data is provided by IMR (Norway) and NIOZ (NL). Relevant people from each institute will be associated to this study.</td></tr>
<tr><td>International objective of research</td><td>1) the data is from different nations involved in an ICES coordinated survey, each of which will be associated with this work and interested in the outcome, 2) potential findings are relevant to the international scientific community. 3) the project addresses questions around habitat quality which is a descriptor in the MSFD</td></tr>
<tr><td>International Project results</td><td>A better understanding of North Sea herring biology and open access to the plankton extraction algorithm within a commonly used software</td></tr>
<tr><td>International or National Finance</td><td>none</td></tr>
</table>

Title of project 23 ☺	**Gear efficiency: The forgotten part of the Down's herring larvae**
Project leader	Cindy van Damme
Theme	3. Maintaining quality
Participating partners (IMARES)	Ralf van Hal, Ineke Pennock, Ruben Hoek, Andre Dijkman-Dulkes, Betty van Os-Koomen
Participating partners (external)	Richard Nash, IMR, Norway, Matthias Klopmann, vTI, Germany, Christophe Loots, IFREMER, France, Peter Munk, DTU, Denmark
Duration	One year
The Problem	Recently the Down's herring stock has expanded and spawning in the English Channel currently is extended until February. The international herring larvae surveys (IHLS) that sample the newly spawned herring larvae continue until the end of January. Thus all larvae hatching in February are not sampled in the IHLS. The MIK herring larvae sampling is carried out in February. The MIK-net is developed to sample the larger herring larvae. But the last year large numbers of newly hatched Down's larvae are also found in the MIK-samples. These newly hatched larvae are currently ignored in the herring assessment because the efficiency of the MIK-net for sampling newly hatched larvae is unknown. The ICES expert groups Standards in Ichthyoplankton Surveys (SGSIPS) and Herring Assessment Group (HAWG) have requested to investigate to compare the efficiency of the MIK-net to the GULF VII plankton sampler used in the IHLS surveys, in order to be able to include this forgotten part of the Down's herring larvae in the assessment. During the 2013 MIK-survey at the MIK stations in the southern North Sea and English Channel a comparing haul with the GULF VII will be carried out. This can be carried out without losing any sampling for the regular MIK sampling. The herring larvae in both the MIK and GULF VII samples will be measured, counted and identified. Added value of this sampling is the comparison of the GULF VII sampler with the newly developed MIKey net. In 2012 the MIKey net was developed and tested during the 2012 MIK-survey. The MIKey net is an extra net with small mesh size that is attached to the MIK-net in order to simultaneously carry out the MIK-larvae sampling and fish egg sampling of winter spawning species. The MIKey net sampling was carried out successful in 2012. However, in the 2004 and 2009 North Sea egg surveys sampling was carried out with the GULF VII sampler. In order to continue this series a comparison between the GULF VII and the new MIKey net is necessary. This project would give the opportunity to get this comparison.
Objectives of project	To assess the efficiency of the MIK-net to sample newly hatched herring larvae. This will supply the numbers of the missing part of the Down's herring larvae and contribute to the accuracy of the North Sea herring assessment. Added value is to assess the efficiency of the newly developed MIKey net for the sampling of fish eggs.

<table>
<tr><td>Broad description of the project including expected results</td><td>The MIK-sampling takes place in February after that the samples of the GULF VII will be analysed in the laboratory.
The comparison of the MIK and Gulf VII numbers of newly hatched larvae will give the efficiency of the MIK-net for the sampling of newly hatched larvae.
The comparison of the MIKey and Gulf VII numbers of newly hatched larvae will give the efficiency of the MIKey net for the sampling of fish eggs.
The results on the efficiency of the MIK and MIKey net will be presented to the various ICES EG's SGSIPS, HAWG and IBTSWG. The results will also be published in a peer reviewed manuscript.</td></tr>
<tr><td>Products to be delivered</td><td>• Efficiency of MIK-net in sampling newly hatched larvae.
• Efficiency of MIKey net in sampling fish eggs.
• Manuscript on the comparison of the MIK and MIKey nets versus the GULF VII plankton sampler.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>The results on the efficiency of the MIK and MIKey net will be presented to the various ICES EG's SGSIPS, HAWG and IBTSWG. The results will also be published in a peer reviewed manuscript. Results will also be presented at a relevant international symposium (e.g. Larval Fish symposium)</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>IMARES has a long standing involvement in herring larvae surveys and herring assessment. This project will increase the accuracy of the herring assessment.</td></tr>
<tr><td>Likely impact of project</td><td>When the efficiency of the MIK-net for sampling newly hatched larvae is available the number of newly hatched larvae from the MIK-samples can be used in the calculation of the herring larvae index. This will improve the assessment of the spawning stock biomass of the Down's herring stock
Comparisons of MIK en MIKey nets with GULF VII are not available at the moment and these efficiencies will also give the possibility to combine data series of all three nets on fish eggs and larvae.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>200 hours cat.2</td><td>77€</td><td>15,400</td></tr>
<tr><td>88 hours cat. 3</td><td>94€</td><td>8,272</td></tr>
<tr><td>material</td><td></td><td>1,000</td></tr>
<tr><td>total costs</td><td></td><td>24,672</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The herring larvae survey (IHLS) and MIK survey are long running surveys coordinated by ICES and carried out under the WOT program. This project will give extra possibilities for the utilisation of the data collected in these surveys. Furthermore it will improve the herring assessment carried out by ICES.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes, the survey will be carried out during the standard IBTS-MIK survey. At IMARES we have the knowledge to analyse and identify the larvae and eggs in the samples.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>None</td></tr>
<tr><td>What are the potential risks to the project's success?</td><td>Risks are limited. The IBTS-MIK survey is carried out under the WOT programme. Bad weather conditions during the survey might reduce the number of samples that can be taken.</td></tr>
</table>

International Scientific network	The ICES expert groups Standards in Ichthyoplankton Surveys (SGSIPS) and Herring Assessment Group (HAWG) have requested to investigate to compare the efficiency of the MIK-net to the GULF VII plankton sampler used in the IHLS surveys. The project will be carried out in cooperation with other institutes involved in the MIK-sampling, IMR (Norway), vTI (Germany), DTU (Denmark) and IFREMER (France).
International objective of research	The ICES expert groups Standards in Ichthyoplankton Surveys (SGSIPS) and Herring Assessment Group (HAWG) have requested to investigate to compare the efficiency of the MIK-net to the GULF VII plankton sampler used in the IHLS surveys. With the efficiency of the MIK-net known it will be possible to utilise the newly hatched herring larvae data of the MIK-sampling in the Down's larvae index. This will improve the assessment of North Sea herring. Comparisons between MIK and MIKey nets with the GULF VII sampler in catching fish eggs and larvae will be used in other international ichthyoplankton surveys.
International Project results	The results of this project will increase the accuracy of the herring larvae index and thus improve the North Sea herring assessment.
International or National Finance	None

Title of project 24 ☺	**RSVP (répondez s'il vous plaît) – statistically sound sampling of Dutch shrimpers**
Project leader	Edwin van Helmond
Theme	3. Maintaining quality
Participating partners (IMARES)	Josien Steenbergen Rosemarie Nijman Peter van der Kamp / Twan Leijzer Chun Chen
Participating partners (external)	Uwe Krumme (Institute of Baltic Sea Fisheries, Rostock, Germany) Alastair Pout (Marine Scotland FRS Marine Lab)
Duration	one year
The Problem	The Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS) of 2012provided a clear road map to regional coordination and a focus on for developing statistically sound sampling schemes for at-sea monitoring programmes of commercial fisheries. Fundamental to these schemes is a move away from ad hoc, non-random, quota based sampling schemes where a sampling event is conditional on where and how a vessel is going to fish, which is, currently, common in all national sampling programmes within the European Data Collection Framework (DCF). In line with the road map of PGCCDBS, the Study Group on Practical Implementation on Discard Sampling Plans (SGPIDS) drafted a guide line to develop unbiased sampling frames and random vessel selection procedures. Subsequently, a number of members states have revised their sampling schemes and moved towards a random, and regional, approach. To keep up with these current international developments, IMARES should give the highest priority to revise her at-sea-monitoring programmes and start with the implementation of a statistical sound sampling schemes, e.g. define unbiased sampling frame and implement random vessel selection procedures.
Objectives of project	Implement a statistical sound sampling scheme for the commercial Dutch shrimp fishery.
Broad description of the project including expected results	Planned activities, and milestones: 1) Define sampling frame for Dutch shrimp fleet: Define number of unique vessels in total population, study population and predicted number of trips in total population. Investigate if population needs to be stratified in time and space, distinctions between sub-sets should be clear, consistent and predictable. 2) Implement random vessel selection procedures based on sampling frame: Randomization is the key element in the selection process. Each sampling unit (e.g. vessel, trip) must have an equal probability of selection in the frame. Representative samples leads to unbiased estimators of the population parameters of interest. Expected result is a random vessel selection tool and standard contact protocol. 3) Monitoring vessel selection process (recording success rates): Recording the response or results of a selection (e.g. vessel, trip) is necessary to monitor the success and quality of the sampling scheme. Refusal (or success) rate is an important quality indicator. Expected result is a 'vessel contact summary table', including a contact log and the calculation of non-response and refusal rates. *4)* Evaluate implementation sampling scheme: Report on results of implemented sampling scheme, feedback from ministry and industry and international research networks (SGPIDS).
Products to be delivered	Report; Random vessel selection tool and success rate recording protocol.
Dissemination of findings being addressed	Meetings with shrimp fishers, Product Organisations (PO's) and ministry representatives. Feed back to bi-lateral agreement with vTI, Germany.
Utility of the developed products and expertise	IMARES needs to maintain core competencies to deliver and internationally approved WOT programme.

<table>
<tr><td>Likely impact of project</td><td>This project will improve all at-sea sampling programmes of IMARES. By postponing, or cancelling, the project IMARES will, ultimately, fail to keep up with our regional partners within the renewed Data Collection Framework and will not be able to deliver an internationally approved WOT programme.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>80 hours cat. 3</td><td>94€</td><td>7,520</td></tr>
<tr><td>100 hours cat.3</td><td>94€</td><td>9,400</td></tr>
<tr><td>200 hours cat.2</td><td>77€</td><td>15,400</td></tr>
<tr><td>total costs</td><td></td><td>32,320</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>Relevance in addressing “Maintaining Quality” (theme 3).</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes.</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>No.</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>No.</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>Not accepting the proposed sampling scheme by industry.</td></tr>
<tr><td>International Scientific network</td><td>SGPIDS, PGCCDBS.</td></tr>
<tr><td>International objective of research</td><td>Yes, implementation of statically sound sampling frames are relevant for at least all members states of the EU.</td></tr>
<tr><td>International Project results</td><td>Findings will be relevant to other fisheries in DCF, members states of the EU.</td></tr>
<tr><td>International or National Finance</td><td>None.</td></tr>
</table>

<table>
<tr><th>Title of project 25</th><th>Pelagic fish upside down in the Marsdiep area</th></tr>
<tr><td>Project leader</td><td>Bram Couperus</td></tr>
<tr><td>Theme</td><td>1. Ecosystem approach and fish descriptors in the MSFD</td></tr>
<tr><td>Participating partners (IMARES)</td><td>Sascha Fassler, Sven Gastauer, Dirk Burggraaf, Martin Baptist</td></tr>
<tr><td>Participating partners (external)</td><td>Henk de Haas, Henk van der Veer (NIOZ)</td></tr>
<tr><td>Duration</td><td>Half year: March – September 2013</td></tr>
<tr><td>The Problem</td><td>The role of pelagic fish in the Waddenzee is badly understood. The “ZKO Waddensea” project has shown that pelagic fish is extremely abundant in the Marsdiep area: the biomass of pelagic fish in the Waddensea exceeds the biomass of demersal fish to a high degree (different order of magnitude). Trials on board the TESO ferry and acoustic surveys has shown that 90 % of the fish school are within 10m of the surface. As a result a lot of schools are missed by ship operated echo sounders. A better approach would be to detect schools from the bottom towards the surface. A fixed echosounder near the NIOZ fish trap could be operated relatively cheap.</td></tr>
<tr><td>Objectives of project</td><td>Explore a long-term index on pelagic fish in the Waddenzee area by means of echosounder of sonar</td></tr>
<tr><td>Broad description of the project including expected results</td><td>1. One day trial with echosounder (EK60; 333/200 kHZ) and acoustic camera (DIDSON) in the vicinity of the NIOZ fish trap
2. Investigate the possibility to apply a fixed echosounder or sonar in the vicinity of the NIOZ fish trap: costs, location, logistics and possible other applications in other studies/projects like “Building with Nature: ”Vismigratie rivier”</td></tr>
<tr><td>Products to be delivered</td><td>Report and PP presentation</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>PP and /or poster presentation on (inter)national symposia (i.e. Noordzeedagen)</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>1. The knowledge can be used to develop an long-term index of pelagic fish in the Waddensea area
2. Long-term cooperation with NIOZ
3. Experience with the fixed upside down deployment of echo sounders</td></tr>
<tr><td>Likely impact of project</td><td>This will add to the knowledge of the role of pelagic fish in the Waddensea area.</td></tr>
<tr><td>Proposed budget</td><td>
<table>
<tr><th></th><th>hour rate</th><th>hours</th><th>costs</th></tr>
<tr><td>cat 2 prep</td><td>77</td><td>20</td><td>1,540</td></tr>
<tr><td>cat 2 trial</td><td>77</td><td>12</td><td>924</td></tr>
<tr><td>cat 3 prep</td><td>94</td><td>8</td><td>752</td></tr>
<tr><td>cat 3 trial</td><td>94</td><td>12</td><td>1,128</td></tr>
<tr><td>cat 3 reporting</td><td>94</td><td>54</td><td>5,076</td></tr>
<tr><td>material</td><td></td><td></td><td>500</td></tr>
<tr><td>travel costs</td><td></td><td></td><td>100</td></tr>
<tr><td>total costs</td><td></td><td></td><td>10,020</td></tr>
</table>
</td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>This is an investment in creating new experience and knowledge with fixed deployment applications in (fishery) hydro acoustics.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>None</td></tr>
</table>

Connection to knowledge development at the University	...
What are the potential risks to the project's success?	None.
International Scientific network	No
International objective of research	...
International Project results	The – future - application of a long-term index on pelagic fish in a coastal area is new and therefore appealing for clients outside the Netherlands
International or National Finance	None

<table>
<tr><th>Title of project 26</th><th>Improvement of species recognition of Gobiidae and Ammodytidae- and in coastal surveys</th></tr>
<tr><td>Project leader</td><td>Bram Couperus</td></tr>
<tr><td>Theme</td><td>3. Maintaining quality</td></tr>
<tr><td>Participating partners (IMARES)</td><td>Cindy van Damme</td></tr>
<tr><td>Participating partners (external)</td><td>Hilde van Pelt</td></tr>
<tr><td>Duration</td><td>1 January – 31 December, 2013</td></tr>
<tr><td>The Problem</td><td>The recognition of species and hence the recording of Gobiidae and Ammodytidae in IMARES surveys is problematic. In Gobiidae two species – Pomatoschistus minutus and P. lozanoi are very similar in appearance and are most likely, regularly not identified correctly on board survey vessels. In addition new species of which researchers on board survey vessels are not familiar, appear in the coastal zone (i.e. Neogobius melanostomus). Within the family of Ammodytidae the identification of Ammodytes marinus and A. tobianus causes problems on board.
Species description in common field guides do not usually cover juveniles.</td></tr>
<tr><td>Objectives of project</td><td>To make clear species description of Ammodytidae and Gobiidae which can be encountered in Dutch marine waters.</td></tr>
<tr><td>Broad description of the project including expected results</td><td>1. Produce clear descriptions of Ammodytidae and Gobiidae, including juveniles, for the use on board survey vessels.
2. Where necessary, test macroscopic identification - against microscopic marks.
3. Test the relation between P. minutus and lozanii by comparing DNA samples</td></tr>
<tr><td>Products to be delivered</td><td>To small field guides as internal IMARES reports of Gobiidae and Ammodytidae in Dutch waters.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>If the findings indicate that P. minutus and lozanii cannot distinguished by means of macroscopic mark and/or DNA tests: the findings will be published in a paper.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>Better quality of surveys.</td></tr>
<tr><td>Likely impact of project</td><td></td></tr>
<tr><td>Proposed budget</td><td>
<table>
<tr><th></th><th>hour rate</th><th>hours</th><th>costs</th></tr>
<tr><td>cat 3 lit study</td><td>94</td><td>40</td><td>3,760</td></tr>
<tr><td>cat 3 micr vs macr test</td><td>94</td><td>16</td><td>1,504</td></tr>
<tr><td>cat 3 preparing field guides</td><td>94</td><td>80</td><td>7,520</td></tr>
<tr><td>materiaal</td><td></td><td></td><td>100</td></tr>
<tr><td>cat 3 DNA test</td><td></td><td></td><td>3,000</td></tr>
<tr><td>total costs</td><td></td><td></td><td>15,884</td></tr>
</table>
</td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>Improvement of the quality of IMARES surveys. It is not expected that external funders can be found because they are not interested in the difference between sandeel- or gobies species. However, the knowledge gained would improve the quality of ecosystem models. In addition it opens the possibility to biological sampling of commercial interesting species A. marinus and A. tobianus: taking biological samples is only possible if species can be identified.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>WOT surveys.</td></tr>
</table>

Connection to knowledge development at the University	
What are the potential risks to the project's success?	No potential risks.
International Scientific network	
International objective of research	
International Project results	
International or National Finance	

Title of project 27	**Mapping productivity hotspots**
Project leader	Narangerel Davaasuren
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Narangerel Davaasuren, Karin Troost, Jeroen Jansen, Chris Klok
Participating partners (external)	Department of Environmental Sciences, Earth System Science and Climate Change group, Wageningen
Duration	January 2013-December 2013
The Problem	The existing monitoring methods are currently limited in spatial context. Additionally, moving from single species monitoring towards gathering field information required to study the impact of fisheries on the ecosystem is a major challenge. Application of acoustic techniques (such as sidescan sonar) to identify biodiversity – or productivity-hotspots is an important step forward in the classification of habitats. So far, the use of remote sensing techniques to map the distribution of single species proved difficult, but recent advances in sonar analysis within IMARES indicate relations between sonar output and the abundance of benthic fauna and fishes. In order to improve this analysis and to upscale this method to larger areas (Wadden and the North Sea). High-throughput data-information pipeline needs to be developed and tested on available sonar data and ground truth information available within IMARES.
Objectives of project	This project aims to couple satellite, sonar and hydrographical information to identify biodiversity and productivity hotspots in the Dutch coastal zone. The project aims to develop a method (tool) for high-throughput of satellite radar and sonar data. The project aims to compare the results with known distributions and migrations of fish .
Broad description of the project including expected results	The proposed research is novel in using combination of sonar and satellite radar data, and the ambition to automatize the data-processing. Sidescan sonar date with be analysed by quantifying and mapping seafloor structure (patchiness), using Moran's I statistical distribution model, developed in the PRODUS project. Ground truth data for benthos (provided by shellfish surveys) will be used to analyse the predictability of species abundances based on sonar data. Satellite data and hydrographical data (such as chlorophyll and salinity) will be used as additive ecosystem information. For this we will use the RADARSAT-2 data that proved useful in change detection in mussel beds. Literature data and expert knowledge of the life-history and ecosystem changes will be collected and compared with assembled data. This work will be a first step to map productivity- and biodiversity hotspots over larger areas. Expected results: Spatial distribution of Biodiversity hot spots and potential productivity areas in the Dutch coastal zone, verified by in-situ biological sampling on distribution of mussel beds, fish species and sediments.
Products to be delivered	Project report; build maps of Biodiversity hot spots and potential productivity areas; algorithm and method for setting up the monitoring system.

<table>
<tr><td>Dissemination of findings being addressed</td><td>The results will be communicated with on-going EU ‘Benthis’ project and Caribbean Netherlands. The algorithm and methods on monitoring can be further extended to EU and Caribbean Netherlands islands of Bonaire, Saba and Sint Eustatius, as well as arctic regions of interest.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>The developed products and expertise will contribute to IMARES and WUR strategic goals by extending the expertise on new innovative methods for the ocean sciences perspective and fisheries management.</td></tr>
<tr><td>Likely impact of project</td><td>The project aims in generating new expertise by combining the innovation methods using the combination of sonar and satellite imaging of sub littoral and sub and intertidal areas, providing in depth picture about changes in the ecosystem. The impact from the project is understanding the relationship of biodiversity and productivity hot spot with changes in the ecosystem.</td></tr>
<tr><td>Proposed budget</td><td>
<table>
<tr><td>Narangerel Davaasuren: 200 hours</td><td>94€</td><td>18,800</td></tr>
<tr><td>Karin Troost: 40 hours</td><td>94€</td><td>3,760</td></tr>
<tr><td>Chris Klok: 20 hours</td><td>94€</td><td>1,880</td></tr>
<tr><td>Jeroen Jansen: 20 hours</td><td>94€</td><td>1,880</td></tr>
<tr><td>Dr.ir. Dirk H. Hoekman (WUR) 20 hours</td><td>94€</td><td>1,880</td></tr>
<tr><td>other costs</td><td></td><td></td></tr>
<tr><td>total costs</td><td></td><td>28,200</td></tr>
</table>
</td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>The proposed project is excellent fit with the KB WOT Ecosystem Approach (EA) and fish descriptors in MSFD, in particular on provision of advice on fisheries management.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>The capacity and expertise to execute the project is available</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>Exploring the potential funding source in case if project will be not selected for funding is subdivision of the tasks and incorporating into other on-going projects. However, considering the innovation and complexity side of the proposed project, such measures would be not desirable</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>The 2 intern students to assist in data analysis will be involved- one student from marine biology of WUR .</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>The time frame of the project is relatively short to be affected by rise in overall costs in project administration and data.</td></tr>
<tr><td>International Scientific network</td><td>The international research group consist from partners of IMARES and WUR</td></tr>
<tr><td>International objective of research</td><td>The objective of the research is international, since it is addresses the emerging issues in fishing stocks decline in the North Sea.</td></tr>
<tr><td>International Project results</td><td>The international application of this project can be used in the North Sea EU fisheries management plan, as one of the tools for the fisheries management.</td></tr>
<tr><td>International or National Finance</td><td>It is anticipated that funding will come from the KB WOT fisheries 2013 programme.</td></tr>
</table>

Title of project 28 ☺	**Get the picture - Orientation on participation in TV-Surveys for Nephrops by the Netherlands**
Project leader	Josien Steenbergen
Theme	1. Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	David Miller Dirk Burggraaf Dick de Haan
Participating partners (external)	Ana Leocadio (Cefas) Hans Polet en Els Torreele (ILVO) Pim Visser (VisNed)
Duration	1 year
The Problem	In recent years the Dutch Nephrops fisheries has increased. The two most important areas for Dutch Nephrops fisheries are Horns Reef and Botney Gut-Silver Pit, and in 2011 the Dutch took the largest share from these areas (ICES, 2012): -Botney Gut (FU5): 480 tons, followed by Great Britain with 350 tons of a total of 1053 tonnes. -Horn's Reef (FU33): 403 tonnes, followed by Denmark with 396 tonnes of a total of 1191 tons. Information on the status of the stock is important for management. A method to estimate the stocks of Norwegian lobsters is through a so called TV Survey. During these surveys an underwater video camera is towed over the sea bed for around on a purpose built sledge. By counting the number of holes of Nephrops in the seabed are a density estimate can be made of Nephrops in a certain area. This method is already widely used on Scottish and Irish fishing grounds. Recently Cefas has started implementing this survey in Botney Gut as well. Off Horn reef is until now not being monitored. If a country is one of the largest users of a stock, this country obviously has a responsibility for the monitoring of that stock. Logically, therefore, the Netherlands would take a role in monitoring of Nephrops in the North Sea. Also in international fora, in which surveys are coordinated by Member States, it was discussed that in the future surveys for stocks should be organised and financed together by those countries with the greatest interest (pers. comm. Frans van Beek: RCM DCMAP). Although Cefas has started carrying out a TV-survey in Botney Gut in 2010, the continuation of this survey is rather uncertain. During a tri-lateral(informal) meeting with Cefas and ILVO in May 2012, Ana Leocardio (responsible for the implementation of all TV-Surveys in Cefas) expressed the wish to cooperate Cefas is facing financial problems and most likely in the future there will be no money for the Botney Gut Survey. Also the Dutch fishing industry finds it important that the Netherlands gets involved in the monitoring of Nephrops. Pim Visser (VisNed) wrote in an e-mail on 2 August 2012: "... Gezien het toenemende NL kreeftjes belang lijkt het me belangrijk om hieraan bij onderzoekssamenwerking aandacht te schenken. Onze NL betrokkenheid is belangrijk. Zo ook bij Off Horns Rev (vlgs mij 'De Paal') waar nog geen onderzoek gaande is.... op die manier, vraag ik jullie om dit onderwerp met prioriteit op jullie onderwerpenlijst te zetten. ". As a response Henk Offringa (Ministry EL&I) stated that funding this research is negotiable if the DCF reveals that Netherlands has a responsibility here (research cooperation, September 3, 2012, Rijswijk). Referenties: ICES, 2012. Ecoregion North Sea, Stock Nephrops in Subarea IV (North Sea), Advice June 2012.

<table>
<tr><td>Objectives of project</td><td>Study the possibilities of the implementation of a TV-Survey for Nephrops.</td></tr>
<tr><td>Broad description of the project including expected results</td><td>This project focusses on the possibilities of establishing a TV-Survey for Nephrops in two important fishing areas. By the end of the project we aim to have:
a complete picture of the practical implementation of a TV-Survey for monitoring Nephrops including an overview of possible improvements. To do so we will join one cruise (of Cefas) in 2013 and visit one other lab that is experienced in carrying out TV-Surveys (Marine institute in Gallway or Marine Scotland).
identified the possible role of IMARES and the Dutch industry in implementing a TV-survey for Nephrops norvegicus in Botney-gut and Off Horn Reef and decide to what extend IMARES involvement is desired (internal IMARES and between involved parties in the Netherlands)
established cooperation between Cefas and ILVO and an action plan for carrying out the TV-surveys in Botney gut and Off horn Reef in 2014 and following years, where roles and responsibilities per country are clearly defined.</td></tr>
<tr><td>Products to be delivered</td><td>An action plan for the monitoring of Nephrops in Botney Gut and Off Horn reef in 2014 and following years.</td></tr>
<tr><td>Dissemination of findings being addressed</td><td>Feedback with the fishing industry and ministry representatives (e.g. in the 4 monthly cooperation platform (OSW)).
Feedback to the WGNSSK in ICES.</td></tr>
<tr><td>Utility of the developed products and expertise</td><td>IMARES can use its existing expertize on using underwater camera techniques, image analyses and increase knowledge on how to use these techniques for the monitoring of Nephrops.</td></tr>
<tr><td>Likely impact of project</td><td>When monitoring of Nephrops in both Botney gut and Off Horn reef are secured, management advice for these stocks will be improved.</td></tr>
<tr><td>Proposed budget</td><td><table>
<tr><td>100 hours cat. 3</td><td>94€</td><td>9,400</td></tr>
<tr><td>200 hours cat.2</td><td>77€</td><td>15,400</td></tr>
<tr><td>travel</td><td></td><td>2,000</td></tr>
<tr><td>total costs</td><td></td><td>26,800</td></tr>
</table></td></tr>
<tr><td>Why should this be funded by KB WOT?</td><td>It is likely that (contributing to) the monitoring of Nephrops will become part of the Dutch WOT obligations in the future, as Nephrops fisheries is increasingly important fisheries in the Netherlands.</td></tr>
<tr><td>Is the appropriate capacity available?</td><td>Yes</td></tr>
<tr><td>What other potential funding sources have been considered?</td><td>The Dutch Fishing industry</td></tr>
<tr><td>Connection to knowledge development at the University</td><td>No</td></tr>
<tr><td>What are the potential risks to the project’s success?</td><td>No funding available for IMARES for implementing Nephrops surveys in the near future.</td></tr>
<tr><td>International Scientific network</td><td>Close cooperation with Cefas and ILVO.</td></tr>
<tr><td>International objective of research</td><td>Increased collaboration between European research institutes on Nephrops monitoring.</td></tr>
<tr><td>International Project results</td><td>Input for ICES advice on Nephrops</td></tr>
<tr><td>International or National Finance</td><td>We approached the Dutch fishing industry for co-funding of this project. They did not confirm to provide this funding yet, but – based on previous communications with fisheries representatives – it is likely that they will.</td></tr>
</table>