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Centre for Fishery Research (CVO)

Kennisbasis WOT Fisheries 2012- Maintaining Excellence and Innovation in Fisheries Research

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Summary

The KBWOT 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 KBWOT Fisheries programme for 2012 reflects the recent discussions on the research direction between IMARES, CVO and EL&I. One of the strengths of the structure of the KBWOT Fisheries programme was the bottom up approach to calls for projects to fulfil the research priorities, thus promoting innovation. This however was seen as giving the programme the potential to miss strategic needs of both the science development within IMARES and the research questions of EL&I, thus the programme now also contains a specific project request on an research subject relevant to IMARES and EL&I needs. The KBWOT Fisheries programme will fund 15 projects in 2012 which will focus on remote sensing of the pelagic system (acoustics, vessel monitoring, video imaging and satellites) and the interaction of ecology and fisheries. 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 EL&I will be continued into the trade-offs in FMSY targets for North Sea flatfish fisheries.

Samenvatting

Het KennisBasis programma voor Visserijonderzoek onderhoudt en ontwikkelt de expertise die nodig is om de WOT voor de visserij uit te voeren. De inhoud van het KBWOT programma voor 2012 weerspiegelt de recente discussies tussen IMARES, CVO en EL&I over de toekomstige richting van het onderzoek. Een van de sterke punten van de structuur van het KBWOT visserijprogramma was de bottom-up benadering om de onderzoekers van IMARES uit te nodigen om 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 EL&I, buiten de boot valt. Daarom bevat het programma ook verzoeken om specifieke projecten te ontwikkelen. De KBWOT visserij financiert in 2012 15 projecten die zich richten op remote sensing van de pelagische systeem (akoestiek, vaartuig monitoring, video imaging en gebruik van satelliet informatie) en de interactie tussen ecologie en visserij. Door het KBWOT 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. Een gerichte project over de trade-offs in FMSY doelstelling voor de Noordzee platvisvisserij zal worden voortgezet in 2012.

1 Introduction

The KBWOT 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 KBWOT 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 KBWOT Fisheries programme has an active policy of underpinning the key-expertise required to carry out the statutory tasks, and of encouraging the further development 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 EL&I, with more broad strategic research aimed at future policy development and research needs of EL&I. In the field of fisheries, many of these future needs come from existing or upcoming EU directives.

The structure of the KBWOT Fisheries programme is the result of collaboration between IMARES, CVO and EL&I 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 KBWOT fisheries themes.

The programme operates through long term projects (multiannual) and annual projects in response to scientific and societal needs. Examples of KBWOT areas of research include integrated assessments of the ecosystem (particularly the demersal and benthic communities of the southern North Sea), multispecies and maximum sustainable yield (MSY) 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 EL&I and circulate an annual report. This programme is part of the larger Kennisbasis programme carried out by Wageningen UR and has been developed in consultation with EL&I. 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, kennisbasis is classified in seven themes. The kennisbasis for the WOT related to 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 EL&I and the EU when developing the structure of the kennisbasis WOT programme. Importantly for the kennisbasis 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 2012 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 Kennisbasis 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 KBWOT 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 with potential contributions to Eranets too. 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 EL&I cover the WOT and with that the KBWOT.

The development of expertise programme for 2012 is financed by the research budget reserved for the kennisbasis 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 2012 for WOT programme 5 "Wettelijke Taken Visserijonderzoek" is € 621 000. This budget was expanded with additional funds from research programmes. However € 11 000 of this budget was reserved by WUR for general KB management.

The requests for kennisbasis WOT money in 2012 showed that the budget was already oversubscribed.

5 The programme for 2012

The programme for 2012 will have the following themes:

1. Ecosystem approach and fish descriptors in the MSFD
2. MSY targets for North Sea flatfish (a continuation of a project started in 2011)
3. Maintaining Quality
4. International Exchange

The programme is mostly populated with projects resulting from an annual call for proposals. KBWOT 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 KBWOT 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 MSY targets for North Sea flatfish

This theme was developed in close liaison with EL&I to address the science needs and expertise development for fisheries management in the southern North Sea. In order to exhibit the trade-offs in fisheries management aiming for a maximum level fishing mortality that will produce maximum sustainable yield (MSY) that result from the ecosystem complexities, various factors need to be assessed: the spatial dimension of target species, incidental bycatch, the North Sea habitats, and the fishery. The aim of the project is to develop a way to examine the trade-offs in fisheries management by linking a full ecosystem model, including the dynamics of the largest source of mortality for most species: the fishery. This should be carried out with respect to the five main flatfish species caught in the southern North Sea (plaice, sole, dab, turbot and brill) and the ecosystem approach. The project should exhibit the trade-offs in fisheries management aiming for MSY in the light of integrated food web interactions and fisheries dynamics. The project is also used to build collaboration with other DLO institutes, such as LEI. The project gains added value through the FP7 MYFISH, which specifically examines approaches beyond MSY such as maximum social yield, maximum economic yield and maximum ecological yield.

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 KBWOT 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 KBWOT programme management (with the input of the review team) to participate in groups that are considered within the KBWOT fisheries remit. By devoting a theme to international collaboration, KBWOT 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

19 proposals were submitted to the KBWOT 2012 call (see annex 1). Of those the following were funded.

Proposal No	Theme	Title	Project leader	Agreed Finance
18	-	Programme Management	Dickey-Collas	€ 24,000
10	1	Habitat quality of forage fish from acoustic multifrequency information	Fässler	€ 31,360
16	1	FACTS	Dickey-Collas	€ 0
11	1	Phytoplankton abundance and productivity impacts the distribution of pelagic fish and has consequences for fisheries	Gastauer	€ 40,120
14	1	Analysing AIS data to inform the usage of the sea	Hintzen	€ 17,000
15	1	(Re)moving The Goalposts	Miller	€ 40,000
4	1	DEB reproduction mackerel and horse mackerel	Van Damme	€ 32,340
1	1	Atlas of the fishes of the northern European shelf	Heessen	€ 14,900
12	1	Comparing DIDSON and SEAGIS video images from the acoustic blind zone	Gastauer	€ 24,520
Multi-annual	2	Understanding the trade-offs in FMSY targets for North Sea demersal fisheries with particular reference to flatfish	Poos	€ 120,000
9	3	Underpinning acoustics	Fässler	€ 35,000
2	3	Fish Ageing	Bolle	€ 40,000
6	3	Quality control of maturity staging and egg identification of marine fish	Van Damme	€ 31,720
3	3	Acoustic Shellfish Mapping": Application of Acoustic Techniques for the WOT Shellfish Surveys	Troost	€ 40,040
17	4	International Exchange	Dickey-Collas	€ 120,000
7	1	GES of commercially exploited shellfish populations	Craeymeersch	Reserve

The total budget thus being €611,000. Which when combined with the WUR charges fulfils the 2012 budget of €621,000. The project proposal 8 – Forage Fish Interactions (FACTS) will be part of KB WOT in 2012 but does not require funding for 2012. This project brings FP7 co-financing to KBWOT, and was partly funded in 2010 and 2011 through the KB WOT Fisheries programme.

6 Conclusion

The KBWOT Fisheries programme will fund 15 projects in 2012, holding one proposal in reserve. Last year's programme primarily investigated benthic and demersal processes, whereas this year's programme is more focused on remote sensing of the pelagic system (acoustics, vessel monitoring, video imaging and satellites) and the interaction of ecology and fisheries. 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 EL&I will be continued into the trade-offs in FMSY targets for North Sea flatfish fisheries. This research is performed within Kennisbasis Onderzoek (KB) / Beleidsondersteunend onderzoek (BO) / Wettelijke onderzoekstaken (WOT) of EL&I-programs,
Signature

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Head WOT, Centre for Fishery Research

Signature:

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7 Annex 1 – The Proposals submitted to the call KBWOT fisheries 2012

Title of project 1	**Atlas of the fishes of the northern European shelf**
Project leader	Henk Heessen
Theme	1
Participating partners (IMARES)	ex IMARES: Niels Daan
Participating partners (external)	CEFAS: Jim Ellis; colleagues from survey and assessment working groups
Duration	January-September 2011
The Problem	Research vessel survey data cost a fortune but are poorly used
Objectives of project	To publish a fish atlas, initially as a book, later the information should become available through the internet.
Broad description of the project including expected results	Gathering all necessary survey data (done) Extensive data quality checks (almost finished) Defining the general set-up of the species accounts (almost done) Contacting co-authors for species accounts Writing introductory chapters (started) Writing species accounts Collecting (photo)material for illustrations Review of contributions Editing the manuscript Contacts with publishers
Products to be delivered	A manuscript of about 500 pages by mid 2013
Dissemination of findings being addressed	A scientific publication, that is also interesting for the “intelligent” laymen.
Utility of the developed products and expertise	The atlas will provide relevant information for scientists working on the ecosystem approach, and also for those working on fish descriptors for the MSFD We will cover 3 Eco-regions (Celtic, North and Baltic Seas) and present results of analyses, partly by eco-region.
Likely impact of project	Our 1993 Atlas, and the material prepared in ICES-FishMap, is still being used. The new atlas will cover a much wider area, more species, and will provide much more detail. The atlas is expected to set a standard for many years.
Proposed budget	€ 25,000 (covering part of the hours of HH)
Why should this be funded by KB WOT?	The funds I am asking for will only cover part of the budget. The publication is a logical follow-up of the work done, and the money spent in our WOT-projects. The atlas will more fully utilize the poorly used survey data.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	One of the editors (Niels Daan) contributes for free to the project. After 1 October 2011 my own contribution will be for free as well. Funding by some of the major IMARES clients is being considered. We expect that the ministries of EL&I, I&M, and the Fish Product Board will be contributing to the project.
Connection to knowledge development at the University	None as yet, but further studies of habitat requirements of the different species would be a logical follow-up of the intriguing patterns revealed by the atlas
What are the potential risks to the project’s success?	None are foreseen
International Scientific network	We will approach several colleagues in the ICES area to contribute to different chapters and species accounts
International objective of research	Our atlas will be relevant for scientists and managers within the ICES area, and of interest for the intelligent laymen.
International Project results	Even in 2011, our 1993 Atlas is being used as an example: an atlas for the Barents Sea was published by Norwegian and Russian colleagues earlier this year, and was based on our 1993 atlas. With the new atlas we (IMARES and CEFAS) will be several steps ahead of the approach in 1993 and that taken by ICES-FishMap, and we will set a new international standard.
International or National Finance	CEFAS funds one of the three editors. Colleagues cooperating in the production of the species accounts will be paid for by their institutes.

Title of project 2	**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
Participating partners (external)	Age readers and age reading coordinators from laboratories in Europe
Duration	1 January – 31 December 2012
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 KBWOT 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 of otolith sets and comparison of age readings and workshops • Training of new age readers • Development and implementation of (inter)national QA procedures
Products to be delivered	1) ICES reports of exchanges and workshops to be held in 2012 (brill exchange, turbot exchange, sprat exchange, horse mackerel workshop and exchange) 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.
Proposed budget	Staff €37.040 Other costs €2.960 Total €40.000
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 standardization of age reading techniques
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 3	**"Acoustic Shellfish Mapping"**: Application of Acoustic Techniques for the WOT Shellfish Surveys
Project leader	Karin Troost
Theme	3
Participating partners (IMARES)	Johan Craeymeersch, Kees Goudswaard (possibly Bram Couperus and/or Peter van der Kamp in the data analysis stage, and for comparison with techniques used for acoustic fish surveys)
Participating partners (external)	MUMM (Management Unit of the North Sea Mathematical Models and the Scheldt estuary of the Royal Belgian Institute for Natural Sciences): Dr. Vera van Lancker
Duration	2012
The Problem	For the survey of shellfish in the Dutch coastal zone (WOT Ensis), a fixed stratified sampling grid is used. Stratification is based on expectation of occurrence, for which previously observations by Spisula fishermen were used. *Spisula subtruncata* has largely disappeared and was replaced by *Ensis sp*. However, the stratified sampling grid is still mainly based on expected occurrence of Spisula. The quality of the data would be improved with an entirely independent basis for the stratification. Acoustic techniques are increasingly applied for seafloor mapping and optimum allocation techniques for stock assessments. In order to optimize the sampling strategy, and develop a new and possibly more efficient technique within IMARES, the application of acoustic techniques should be studied.
Objectives of project	Objectives of the project are: 1- study the ability to discern different types of seafloor (e.g. mud, sand, gravel, shellfish beds infaunal and epifaunal) using multibeam acoustic sounding system; 2- assess the applicability of multibeam for stratified sampling in the coastal zone: will it optimize the sampling strategy and enhance efficiency? 3- determine what will is needed to develop this innovative technique within IMARES and to apply it for stock assessments of shellfish and possibly other benthic communities (expertise, software, etc.) 4- determine with whom to cooperate in future regarding availability of multibeam equipment and analysis techniques
Broad description of the project including expected results	Planned activities: 1- January – February 2012: Funded by KBWOT, an international workshop on improvement of shellfish stock assessments is held in November (3-4) 2011. Recommendations for improvement and what is needed for a successful adoption of acoustic multibeam techniques will be used to optimally design this proposed project; 2- April – June 2012Comparative fishing: during 1 week in 2012 a section of North Sea seafloor will be mapped using multibeam and sampled with our own 'traditional' survey methods. Multibeam sampling will be done (and financed) by Dr. Vera van Lancker (MUMM), probably with the oceanographic research vessel 'Belgica'. The traditional sampling for validation will be part of a running survey (probably the WOT coastal Ensis survey, or another program if the timing and area fit better to the programme of the Belgica). Minor adjustments / supplementary samples may need to be done/taken for an optimum validation; 3- the data will be analyzed in cooperation with MUMM; 4- the multibeam seafloor map will be validated using the traditional survey results; 5- software needed, as well as time needed for analysis will be assessed, and this will contribute to 5; 6- costs (ship time, analyses) and benefits (enhanced efficiency and accuracy) involved in application of this technique to the IMARES shellfish surveys will be assessed. Expected results: 1- Validation of multibeam seafloor mapping, which will lead to 2; 2- Estimated costs and benefits of application of the multibeam technique; 3- If application of the technique seems profitable and feasible: A plan how to incorporate multibeam mapping in the IMARES shellfish (en benthos) surveys and how to develop this innovative technique within IMARES; 4- a durable cooperation with MUMM (or Deltares??) in a joint improvement of this technique.
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 and to other parties if requested. 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	Efficiency and accuracy of the surveys will be optimised, and the project will contribute to keeping IMARES in a leading position in stock assessments worldwide. 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	An improved accuracy of stratified sampling grids will increase the efficiency of the WOT surveys and will also increase the confidence level of stock assessments. This will benefit management of shellfish stocks and fishery and will also enhance the reliability of environmental impact assessment studies. The project is also expected to lead to a higher level of cooperation regarding acoustic techniques with international partners. IMARES will maintain its leading position in shellfish stock assessments.
Proposed budget	- No extra funding for field sampling necessary. - Analysis of multibeam images and validation: OASS 300 hrs. (22,200), JONDZ 100 hrs. (9,300) - Report: OASS 40 hrs. (2,960) JONDZ 60 hrs. (5,580) Total budget: €40,040
Why should this be funded by KB WOT?	Multibeam seafloor mapping is a means to obtaining a more reliable stratified sampling grid for the coastal WOT Ensis survey. The present grid is still based on Spisula occurrence and urgently needs updating. Developing multibeam techniques may offer the perfect solution and will result in an increased efficiency and accuracy of the WOT shellfish surveys in general. The level of expertise in shellfish stock assessments at IMARES will be maintained at one of the highest levels internationally.
Is the appropriate capacity available?	Yes. The IMARES participant have enough capacity in 2012, and there will also be enough technicians available with the right expertise and skills to develop expertise in the analysis of multibeam data in close cooperation with the participants.
What other potential funding sources have been considered?	None, since the research questions are of particular interest for the WOT surveys. We do get additional funding from the annual WOT programme, since the existing surveys allow for the needed field sampling (as a part of the annual programme).
Connection to knowledge development at the University	No
What are the potential risks to the project's success?	No special risks other than adverse weather conditions and malfunction of equipment.
International Scientific network	We will cooperate closely with MUMM (Belgium): Dr. Vera van Lancker and colleagues. They will do the multibeam measurements and cooperate in analysing the data.
International objective of research	Funded by KBWOT an international workshop on survey techniques is organised in November (3-4) 2011. New methods such as multibeam will be discussed here, together with Dr. Van Lancker. This international group will be most interested in the applicability of multibeam techniques. Results will be disseminated to this group, and IMARES may VOORBEELDROL/VRAAGBAAK
International Project results	The results may lead to innovations in stock assessment techniques internationally.
International or National Finance	None from international funds. Nationally, 1-2 weeks ship time (Rijksbrede Rederij: Isis) and field assistance (100-200 hrs. OASS) from the regular WOT coastal Ensis survey may be used.

Title of project 4	**DEB reproduction mackerel and horse mackerel**
Project leader	Cindy van Damme
Theme	3
Participating partners (IMARES)	Lorna Teal, Tessa van der Hammen
Participating partners (external)	Bas Kooijman, VU, Netherlands; Alberto Murta, IPIMAR, Portugal; Ander Thorsen, IMR, Norway; Teunis Jansen, DTU Aqua, Denmark
Duration	One year
The Problem	IMARES, IMR and IPIMAR are involved in an international triennial egg survey on mackerel and horse mackerel covering the north-eastern Atlantic. The survey data is the only fishery independent data available and the basis for the assessment of mackerel and the harvest control rule for the management of the western horse mackerel stock. In the years between the surveys no egg production or fecundity data are available. Accurate estimates of fecundity are necessary for the conversion of egg production to spawning stock biomass. So far for both species there is no direct evidence showing the fecundity type but recent studies suggests both species are indeterminate spawners. For this project the reproductive part of the DEB modelling would be parameterised for both mackerel and horse mackerel using the time series of the egg surveys. The DEB model would give the opportunity to model the effect of changes in environmental and biological parameters on reproduction and fecundity and how these may develop over time, within and over years. This would give more insight in the fecundity type of mackerel and horse mackerel. Also, with the DEB model it would be possible to predict forward and backwards the individual fecundity and egg production in the years where no surveys are carried out. Thus in the years between the surveys the model can provide insight in the yearly variation in fecundity and egg production, providing for the management and idea of whether the next egg survey will show an increased, decreased or stable stock.
Objectives of project	• Develop the reproductive part of the DEB model for mackerel and horse mackerel • 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 a full DEB model for both mackerel and horse mackerel. 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 parameterisation will be carried out in collaboration with prof. Bas Kooijman (VU University) and based on information from available survey and experiments 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 may provide a better insight into the fecundity type (determinate and indeterminate). 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 mackerel and horse mackerel and peer reviewed paper
Dissemination of findings being addressed	Results will be published in a peer reviewed paper and contribute to the expansion of the IMARES DEB library currently being assembled.
Utility of the developed products and expertise	The reproductive part of the DEB model has only been developed for anchovy. This project would give IMARES the expertise on this specific DEB part as one of the few institutes. It would be easy once the development is carried out to also add this to the DEB models of other fish species, provided the reproductive parameters are available. The model would be developed together with colleagues at VU, IPIMAR, IMR and DTU Aqua which would aid to the international calibration between the two 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?	MEECE (an European FP7 project)

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.
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.
International or National Finance	None

Title of project 5	**MIK herring larvae sampling**
Project leader	Cindy van Damme
Theme	1
Participating partners (IMARES)	Ralf van Hal, Ingeborg de Boois, Kees Bakker, Ruben Hoek, Ineke Pennock, Dijkman, Os
Participating partners (external)	MIK-IBTS partners
Duration	One year
The Problem	The MIK herring larvae index is an important index used for the assessment of the herring spawning stock in the North Sea. The MIK-index is used to predict forward the recruitment of juvenile herring. IMARES has been participating in the annual IBTS-MIK sampling (*Method Isaac Kitt* net sampling for herring larvae) since the 1980s. The MIK sampling program is planned by the IBTSWG. However, IMARES has never been able to sample all the stations that were assigned. To realize the complete assigned program, the MIK-sampling needs to be prolonged from sampling until midnight to sampling during the whole night, as sampling can only be carried out at night. In the past it was not possible to continue sampling on board the RV Tridens due to Tridens staffing problems. However, Tridens management has changed and allows prolonged sampling, enabling IMARES to realize the complete program. Currently the IMARES crew consists of 5 crew members, who in the first place are needed during the daytime for fish and CTD sampling. From 19:00 to 24:00, 2 IMARES crew members would do the MIK sampling, as was done in earlier years. If the sampling continues until 8:00 the next morning an extra IMARES crew member is needed to ensure enough resting hours for all. If an extended program would be successful it might be possible to adjust the IBTS budget and planning to incorporate an extended program in later years.
Objectives of project	Sample all MIK stations assigned to IMARES by the IBTSWG, in order to supply the ICES assessment WG with useful data on herring MIK larvae.
Broad description of the project including expected results	During the five weeks of the IBTS-MIK survey in 2012 one extra IMARES crew member will join the survey. This will allow for a continuous MIK-sampling during the whole night, also improving the use of Tridens ship time, as else Tridens is out at sea just floating waiting for daylight.
Products to be delivered	A better coverage of the North Sea with herring larvae samples which will be able to increase the accuracy of the MIK-index and by that the accuracy of the assessment of NS herring.
Dissemination of findings being addressed	Results will be presented at the ICES HAWG and IBTSWG and reported in the reports.
Utility of the developed products and expertise	IMARES is involved in the assessment of different commercial species, including North Sea herring. The better coverage of the North Sea will improve the MIK-index and the assessment of North Sea herring, especially since Tridens covers the Southern Bight.
Likely impact of project	The extra MIK samples will ensure a better coverage of the North Sea and improve the MIK-index and thus improve the North Sea herring assessment.
Proposed budget	RV Tridens is already out at sea, so this would only cost extra IMARES staff time. Total cost 23,400 euro (only personnel costs)
Why should this be funded by KB WOT?	The MIK sampling is part of the ICES coordinated IBTS-MIK surveys already financed by WOT and DCF. The MIK-index is an important part of the assessment of North Sea herring used to predict the recruitment of juvenile herring.
Is the appropriate capacity available?	Technicians with the knowledge to carry out the correct MIK-sampling are available at IMARES.
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?	If the weather is bad the MIK-sampling cannot be carried out, but the RV Tridens is already out at the North Sea for the IBTS survey.
International Scientific network	The IBTS-MIK survey is an international ICES coordinated sampling.
International objective of research	The MIK-index will be improved with a better sampling coverage of the North Sea, thus improving the herring assessment.
International Project results	MIK-index is used for the North Sea herring assessment.
International or National Finance	None

Title of project 6	**Quality control of maturity staging and egg identification of marine fish**
Project leader	Cindy van Damme
Theme	3
Participating partners (IMARES)	Loes Bolle, Ingeborg de Boois, Sieto Verver, Edwin van Helmond, Sebastian Uhlmann and technicians
Participating partners (external)	Part of international ICES workshops
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), 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. IMARES is obliged to participate in multiple ICES coordinated international WOT surveys, market and discard sampling. For these different sampling project we are asked to deliver data on sexual maturity stage and egg identification and staging of different fish species. Some IMARES technicians have been identifying and staging for many years but have never participated in international maturity staging workshops. Other technicians need to do identification and staging but haven't had a proper training. In 2012 two ICES international flatfish maturity staging workshops (Workshop on sexual maturity staging of sole, plaice, dab and flounder WKMSSPDF and Workshop on sexual maturity staging of turbot and brill WKMSTB) will be organised, both chaired by Ingeborg de Boois and Cindy van Damme. WKMSSPDF will be hosted by ILVO, Oostende and WKMSTB by IMARES. Also an ICES workshop on egg identification and one on fecundity and atresia estimation in mackerel and horse mackerel (WKFATHOM) will be held in 2012. The egg identification workshop will be hosted by IMARES, the second one by IEO in Vigo, both chaired by Cindy van Damme. It is important for IMARES technicians to participate in these international workshops. At the 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. At the identification workshops validated eggs are used to check the identification of each participant. Participating in the workshops would give the technicians a good education as well as ensures the high quality of the work carried out by IMARES during the WOT and other routine samplings.
Objectives of project	• Quality control and maintaining the high standard of maturity staging, egg identification and fecundity estimation of the routine samplings carried out by IMARES. • Ensuring a good education of technicians in maturity staging, egg identification and fecundity estimation
Broad description of the project including expected results	IMARES technicians will participate in the international ICES workshops (WKMSSPDF, WKMSTB, WKFATHOM) and get a good education and validation of the maturity staging, egg identification and fecundity estimation. IMARES will have the evidence of the quality and standard of these WOT routine data collections for quality control purposes.
Products to be delivered	Workshop reports with results of each participant.
Dissemination of findings being addressed	Results will be published in the 3 ICES workshop reports.
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 and egg identification.
Proposed budget	Personnel (3 technicians participating in the WKMSSPDF and 2 technicians in each of the remaining 3 workshops) €27.720 Travel expenses €4000 Total €31.720
Why should this be funded by KB WOT?	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.
Is the appropriate capacity available?	Yes, technicians are available to participate in the workshops
What other potential funding sources have been considered?	None

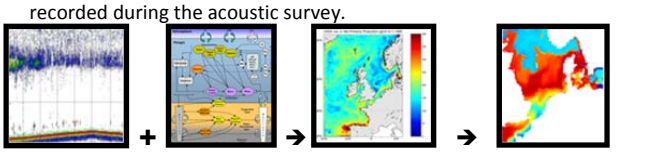
Connection to knowledge development at the University	None
What are the potential risks to the project's success?	No risks, technicians are available and willing to get educated
International Scientific network	These workshops are organised by ICES.
International objective of research	The surveys and samplings during which IMARES is obliged to carry out the maturity staging, egg identification and fecundity estimation 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 7	**"GES of commercially exploited shellfish populations":**
Project leader	Johan Craeymeersch
Theme	3
Participating partners (IMARES)	Kees Goudswaard , Karin Troost, Gerjan Piet, Diana Slijkerma, Aad Smaal
Participating partners (external)	-
Duration	2012
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
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 2012: study and reporting about the ability to use indicators applied to fish populations; development of alternative indicators, applicable to commercially exploited shellfish populations; description of initial condition based on these indicators 2- Start May 2012: internal workshop to discuss the result of points 1 and 2; 3- May 2012: further development based on results of workshop 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 EL&I 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 EL&I 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.
Proposed budget	Personnel: OASS 60 hrs. (5,820), JONDZ 160 hrs. (19,360), OND 60 hrs. (9,120), SOND 24 hrs. (4,272) Travel : 1,000
Why should this be funded by KB WOT?	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. ELI will ask advice at IMARES and, therefore, IMARES should be prepared.
Is the appropriate capacity available?	Yes. The IMARES participants have enough capacity in 2012.
What other potential funding sources have been considered?	EL&I already realises that these criteria will have to be developed. EL&I asked IMARES for a proposal to be realized this year. It is yet unclear if the proposal will be granted.
Connection to knowledge development at the University	No
What are the potential risks to the project's success?	No special risks.
International Scientific network	We will discuss developments with colleagues in Europe,.
International objective of research	Proposal to be used by all European countries.
International Project results	The results may lead to stock assessments internationally.
International or National Finance	-

Title of project 8	**Evaluating the distribution, abundance and potential impact of gelatinous zooplankton on fisheries by using local knowledge**
Project leader	Sebastian Uhlmann (Junior researcher)
Theme	1
Participating partners (IMARES)	Kristina Raab (PhD candidate) Ingrid Tulp (Senior researcher)
Participating partners (external)	Lodewijk Walraven (PhD candidate, NIOZ) Victor Langenberg (Senior researcher, DELTARES)
Duration	1-year
The Problem	Blooms of gelatinous zooplankton (hereafter "jellyfish") are naturally occurring and infrequent events, but may become more regular due to human activities (i.e. fishing, eutrophication, etc.). Even though jellyfish blooms are known to affect aquaculture and tourism industries, the order of magnitude of the impact on wild-fisheries catches is virtually unknown in the North Sea but may be significant. This gap of knowledge also exists for the potentially invasive species, *Mnemiopsis leidyi* (Amerikaanse ribkwal, American comb jelly); a species which has previously thinned out fish stocks in the Black and Caspian Sea by preying upon fish eggs and larvae.
Objectives of project	a) Estimate the encounter rates between jellyfish and fishers and their temporal and spatial trends based on a questionnaire survey of fishers b) Provide information on parameters for an socio-economic impact model of *M. leidyi* in the North Sea (in-kind contribution to the 'MEMO' project)
Broad description of the project including expected results	Long-term trends in the temporal and spatial distribution and abundance of jellyfish species in the North Sea are not well known. Jellyfish are currently inconsistently registered as part of existing WOT surveys, either because the surveys are conducted outside the peak abundance periods, or jellyfish species (or their remains) are not properly registered and identified. Therefore, a semi-quantitative questionnaire survey of commercial fishers may bridge this knowledge gap and gauge the order of magnitude of jellyfish-fisheries interactions. Questions will be asked on the temporal and spatial patterns, frequency and magnitude of encounters with jellyfish species. Jellyfish ID cards will assist in the correct nomination of species of interest. Options to mitigate impacts will also be included in the questionnaire. The results will help to delineate spatially explicit zones of where, when and what species of jellyfish aggregate. The results may also feed into a 3-year EU-funded project (MEMO: ***M****nemiopsis leidyi* **E**cology, **M**odelling and **O**bservation). Existing scientific survey records and output maps from a combined plankton ecosystem model (developed as part of the MEMO project) can be used to validate the findings from the questionnaire survey. Furthermore, results from the questionnaire survey will help to parameterize a socio-economic model (developed by MEMO partners) which will be used to predict the impact of *M. leidyi* at different densities on energy (i.e. power plants), aquaculture, fisheries, tourism and recreational industries.
Products to be delivered	1 scientific publication, 1 report
Dissemination of findings being addressed	Scientific publication, IMARES report, MEMO international workshop
Utility of the developed products and expertise	Contributing to the knowledge of the largely understudied genera of jellyfish which play a potentially significant role in food web dynamics of the Dutch coastal zone. Enhance the collaboration with NIOZ and DELTARES.
Likely impact of project	
Proposed budget	Total cost: 17 110 Researchers: 15 240 Meetings: 1 500 Reporting: 360
Why should this be funded by KB WOT?	Despite an ecosystem approach to fisheries management, the role and impacts of jellyfish species in the North Sea are poorly understood. This project will shed some light on the order of magnitude of the interaction and its potential impact on fisheries and other sectors. In providing information on how to mitigate the level of interaction, important recommendations will be made for a more sustainable use of marine resources.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	None
Connection to knowledge development at the University	PhD title: "Natural and anthropogenic impact on North Sea gelatinous zooplankton population dynamics: implications for ecosystem structure and functioning." Lodewijk van Walraven, PhD candidate, NIOZ
What are the potential risks to the	Low response rate as part of the questionnaire survey or low correspondence between

project's success?	questionnaire results and scientific survey results.
International Scientific network	Yes, this work will contribute to an ongoing international research project on the ecology and evolution of *Mnemiopsis leidyi* invasion in the North Sea (MEMO project). Experts from Belgium, UK, France and The Netherlands take part in this project.
International objective of research	The abundance and spread of jellyfish can be tightly linked to hydro-climatic (temperature) changes. Current climate change predictions suggest a warming of the waters in the Northeast Atlantic and North Sea. The mixing of warmer waters in nutrient and food-rich coastal waters may promote jellyfish blooms that can have costly socio-economic effects. Thus, understanding the nature of the interaction with fisheries is of international importance.
International Project results	Yes, the results from this study will directly contribute to a North Sea wide socio-economic model with relevance to EU member states. It will be published in an international journal (e.g. ICES Journal of Marine Science).
International or National Finance	None

Title of project 9	**Underpinning acoustics**
Project leader	Sascha Fässler
Theme	3 – Maintaining quality
Participating partners (IMARES)	Bram Couperus, Sven Gastauer, Peter van der Kamp
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 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 fisheries acoustic work and expertise 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. New acoustic backscatter models and species identification algorithms will be applied to analyse survey data. Effort will be put into building and maintaining links with other 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 put acoustic survey data in a format to provide answers to research questions that are not directly related to classical stock assessment.
Products to be delivered	• Maintenance and expansion of the previously developed R library "acousa" (repository hosted at: http://code.google.com/p/acousa/) to facilitate analysis of ICES coordinated surveys. • Implementation of acoustic backscattering models in the newly acquired, state of the art software "comsol Multiphysics". • Ad hoc research with international partners to be presented at meetings and conferences (e.g. WGFAST)
Dissemination of findings being addressed	• 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 KBWOT team
Likely impact of project	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 partners at institutes abroad will be strengthened and extended, leading to valuable collaborations.
Proposed budget	Total costs: € 35,000 Hours: 347 x €98 (JONDZ) = € 34,006 Travel: € 994
Why should this be funded by KB WOT?	'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
Is the appropriate capacity available?	yes
What other potential funding sources have been considered?	-
Connection to knowledge development at the University	Marieke Keller, PhD project "ANT" smelt, IMARES fish department
What are the potential risks to the project's success?	No specific risks
International Scientific network	Contact will be maintained with relevant researchers at e.g. IMR, MS, Cefas, MI, Ifremer and NOAA to exchange and develop ideas for future research projects
International objective of research	-
International Project results	The project will contribute towards a standard approach to analysing internationally coordinated acoustic survey data
International or National Finance	-

Title of project 10	**Habitat quality of forage fish from acoustic multifrequency information (HAQUAFAMI)**
Project leader	Sascha Fässler
Theme	1 – Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Lorna Teal
Participating partners (external)	Piet Ruardij (NIOZ, NL), Paul Fernandes (Aberdeen University, UK), Susan Lusseau (Marine Scotland Science), Klaus Huebert (Hamburg University)
Duration	1 year
The Problem	Climate change is currently one of the main drivers behind changes in species distributions affecting the suitability of a species habitat both in terms of the environment (temperature) and available food. To enable better predictions of the likely changes in spatial dynamics, it is therefore necessary to establish mechanistic links between changes in primary production and higher trophic levels. This requires a combination of data from different trophic levels, an understanding of species physiological requirements and specific modelling exercises to establish the links. A vast amount of acoustic data are being collected every year during statutory surveys. These data are notoriously under-utilised and serve primarily to deliver an index of biomass of a specific "target" fish species. Over the last 10 years, some of these surveys have collected acoustic data synoptically at several frequencies. This delivers more information about encountered organisms, allowing for a better classification and identification of them. Layers of planktonic organisms usually feature prominently on echograms recorded during surveys, e.g. in the North Sea. If these layers can be appropriately classified, acoustic multifrequency data may be used to produce high-resolution distribution maps and abundance estimates of lower secondary production. Recent work in the Bay of Biscay has demonstrated simple ways to extract abundance and distribution of macrozooplankton from acoustic multifr equency data (Lezama-Ochoa et al., 2011; Ballón et at., 2011). Such information is vital for the development of ecosystem models which can be used to describe habitat quality and energy sources of organisms at higher trophic levels – e.g. forage fish.
Objectives of project	To infer abundance of planktonic organisms from acoustic multifrequency data; use plankton production in combination with a physiological model (DEB) to model habitat quality of organisms at higher trophic levels; to investigate the link between annual variability in production, habitat quality (based on DEB) and realised spatial dynamics of forage fish (acoustic data). Herring will be used as an example forage fish species.
Broad description of the project including expected results	• phase I: Development of multifrequency "plankton extraction" algorithm. Backscatter models will be developed to deliver a species-specific frequency response used in the algorithm. • phase II: Compare plankton extraction from acoustics with satellite data and ERSEM model based on statistical analyses (e.g. GAM). • phase III: Use DEB model with temperature data and high-resolution plankton data from acoustics as input to map changes in herring habitat quality (growth potential) in the northern North Sea between 2002-2010 and compare these to actual herring abundance recorded during the acoustic survey.  Acoustics + ERSEM → Plankton distribution → Habitat quality
Products to be delivered	• acoustic "plankton extraction" algorithm • plankton distribution map from in situ data, northern North Sea 2002 - 2010 • DEB model for North Sea herring • Herring habitat quality in the North Sea 2002 – 2010 • Peer reviewed publications (1: algorithm; 2: herring DEB and habitat quality)
Dissemination of findings being addressed	Scientific publications, presentations at ICES working group meetings, conference presentations
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 ecosystem functioning. Habitat quality descriptors resulting from the project are key to the MSFD and definition of GES.

Likely impact of project	The project will address the value of acoustic multifrequency methods to deliver data for the ecosystem approach. This is a relatively novel approach and would place IMARES at the forefront of this particular field of research. Results will trigger further applications of multifrequency acoustic data to be used in ecosystem modelling.
Proposed budget	Total costs: € 31,360 Hours: 320 x €98 (JONDZ) = € 31,360
Why should this be funded by KB WOT?	This project makes steps towards enhancing the use of acoustic data for ecosystem level questions and will highlight the value of multifrequency data for this purpose. The project also provides a series of valuable links between current ongoing international work such as e.g. the VECTORS or MEECE projects.
Is the appropriate capacity available?	Yes, Sascha Fässler is experienced in the analysis of acoustic data; Lorna Teal has experience of DEB and linking to ecosystem models/other input data.
What other potential funding sources have been considered?	The parameterisation of the herring DEB model will be carried out under the IMARES theme "instruments for integration" which is compiling a library of DEB parameters for a number of species (~ 30 hours dedicated to herring).
Connection to knowledge development at the University	-
What are the potential risks to the project's success?	No specific risks
International Scientific network	Some of the results of this research will feed into the FP7 VECTORS project. Collaboration within the project will strengthen links between IMARES, VU, Aberdeen University, Marine Scotland and Hamburg University.
International objective of research	There is currently much effort going into designing surveys to satisfy monitoring requirements for the EAFM. Multifrequency acoustics is a prime candidate for providing relevant data (high resolution water column observations covering large areas within a short time period). Research such as this project may underpin the definition of "minimum requirements" to standardise equipment during internationally coordinated acoustic surveys.
International Project results	• The "acoustic plankton extraction" algorithm will be a valuable tool that facilitates standard collection and use of "complementary" data during acoustic surveys. • If mechanisms can be identified to link production with spatial dynamics then these will be of international relevance in the study of environmental change.
International or National Finance	-

Title of project 11	**Phytoplankton abundance and productivity impacts the distribution of pelagic fish and has consequences for fisheries.**
Project leader	Sven Gastaeur
Theme	Theme 1- Ecosystem Approach (EA) and fish descriptors in MSFD
Participating partners (IMARES)	Mark Dickey-Collas; Narangerel Davaasuren; Niels Hintzen; Thomas Brunel; Sven Gastauer; Chris Klok
Participating partners (external)	DTU Aqua – National Institute of Aquatic Resources, Denmark
Duration	January 2012- December 2012
The Problem	Almost all fishery stock assessments are carried out assuming a bounded spatial distribution of the exploited resource; little time or expertise is devoted to understanding the spatial dynamics of the fish populations. However, from VMS and survey data, we know that fisheries change and fish change their distribution and migration patterns. This has impact on the assessments and management of stocks (e.g. mackerel moving into new management areas, herring leaving the survey area, anchovy populations exploding at their north limit). At IMARES few on-going projects take the ecology and exploitation of the fish into a truly spatial context. Also very few studies show causal relations between fisheries (e.g. catches) and the dynamic pelagic ecosystem, despite ecological studies suggesting that there must be a relationship.
Objectives of project	This project will provide insight into the spatial and temporal variability of phytoplankton standing stock and associated primary production in the ocean and its impact on exploitation and management of fish. It will use information from MODIS AQUA,ENVISAT MERIS and NOAA satellites. Existing knowledge of the spatial dynamics of the fish populations, satellite observations, VMS and survey data will be combined to explore interactions between primary producers, fish and fisheries. The project will thereby assess the roles of both phytoplankton standing stock and primary production in delimiting the distribution and migrations of the feeding fish and the areas fished.
Broad description of the project including expected results	The proposed research is novel in combining satellite observations and VMS data with current knowledge on species spatial behaviour and life-history within a fisheries management context. Zooplankton is assumed to directly track phytoplankton. Two pelagic planktivores, North Sea herring and Atlantic mackerel, will be used as a case study species, both of which feed on zooplankton in one or more of their life stages. We will test whether the distribution of primary production and/or phytoplankton standing stock, delimits the distribution and seasonal migrations of these fish species. Furthermore, we will estimate what can be the implications for the areas fished and quotas. This work will be a first step to understand the spring and summer migrations of pelagic fish and provide valuable information for future modelling of the full life cycle of exploited living resources in a variable ecosystem. 1.The following parameters of spatial production of the sea can be derived and monitored using satellite data: •Chlorophyll-a, concentration in the upper water column, derived from reflectance ratios which is the most important variable; Euphotic depth from Chlorophyll concentration; Sea surface temperature SST- to parameterize the photosynthetic potential of the primary production and Phytoplankton Functional Types, estimated from ocean colour, SST and functional information. 2.VMS and survey information (in situ measurements). The in situ measurements will be using acoustic survey and VMS data on fishing vessels efforts to understand the spatial dynamics of the fish populations, spring and summer migrations of pelagic fish, their occurrence or avoidance of certain areas and from there deduce migration patterns. The in situ measurements will include the catches or biological sampling, to provide information about the size, length, weight, age and sex distribution of the analysed species. The acoustic data on pelagic fish stocks in the North Sea is collected annually during the HERAS survey, assessing the distribution and biomass of herring. Even though acoustics are recognised as being one of the most promising tools in the ecosystem approach, studies combining acoustic data with auxiliary environmental information remain relatively scarce. The method: The seasonal spatial and interannual variability of fish and fisheries will be related to spatial patterns of primary productivity and standing stock estimated using satellite data, with VMS fishing vessels efforts and the acoustic survey. Literature data and expert knowledge of the life-history and migration routes of the case study species will be collected and compared to the assembled spatial data. Space and time overlap of plankton and fish will be interpreted using ecological concepts (e.g. metapopulation theory Hanski). Expected results: Spatial distribution of spring/summer catches of herring and mackerel related with primary

	production, verified by VMS fishing vessels efforts and in situ measurements in acoustic survey.
Products to be delivered	- Project report; build maps of spring/summer catches of herring and mackerel; Primary production build maps from MODIS AQUA,ENVISAT MERIS and NOAA satellite data; Spatial productivity maps showing the distribution of pelagic fish stocks
Dissemination of findings being addressed	-Scientific publication submitted to a peer-reviewed journal -Presentation at the SEAWORK conference- June 11-12, 2013, UK.
Utility of the developed products and expertise	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.
Likely impact of project	The project aims at generating new expertise by combining innovation methods in ocean surface monitoring with acoustic survey and auxiliary data from VMS- fishing vessels efforts and in situ biological sampling. IMARES already leads Europe in terms of VMS analysis and this project will build on our expertise. The impact from the project is understanding how the spatial productivity affects the seasonal and interannual variability of fish and fisheries and whether the distribution of primary production or standing stock delimits the distribution of the feeding fish, the areas fished and the seasonal migrations.
Proposed budget Total cost, plus breakdown by staff and other costs (ship time is not funded)	Hours / Budget Narangerel Davaasuren 200 € 18,564 Mark Dickey-Collas 20 € 2,734 Niels Hintzen 10 € 928 Thomas Brunel 10 € 928 Sven Gastauer 80 € 7,426 Chris Klok 5 € 581 staff costs € 31,161 Data € 8,000 Conf. travel € 1,000 TOTAL: € 40,161
Why should this be funded by KB WOT?	The proposed project is excellent fit with the KB WOT objective in fisheries monitoring and advice, in particular on provision of advice on fisheries management. Especially in species which migrate through management areas.
Is the appropriate capacity available?	The capacity and expertise to execute the project is available
What other potential funding sources have been considered?	This project is very specific to developing IMARES expertise and at present no other funding sources have been explored.
Connection to knowledge development at the University	An MSc student will be involved from AFI at WUR (already appointed).
What are the potential risks to the project's success?	The time frame of the project is relatively short to be affected by rise in overall costs in project administration and data.
International Scientific network	The international research group consist from partners of IMARES and National Institute of Aquatic Resources, Denmark.
International objective of research	The objective of the research is international, since it is addresses the emerging issues in fishing stocks management and area designations in relation to Ecosystem change and variability.
International Project results International application of the results of this project?	The international application of this project can be used in the EU fisheries management plan, as one of the tools for the fisheries management.
International or National Finance	It is anticipated that funding will come from the KBWOT fisheries 2012 programme.

Title of project 12	**Comparing DIDSON and SEAGIS video images from the acoustic blind zone**
Project leader	Sven Gastauer
Theme	1
Participating partners (IMARES)	Sebastian Uhlmann Martin de Graaf Sascha Fässler Dirk Burggraaf Bram Couperus
Participating partners (external)	Jeroen van der Kooij (Cefas), Eric Armstrong (Marine Scotland Science), Nils Olav Handegard (IMR)
Duration	1 year
The Problem	Acoustics are considered as the best available tool to observe and monitor pelagic fish stocks, but fail to detect fish in the surface layer, in the near-field of the sonar beam or above the transducer. Consequently, species composition, their biomass, and sizes remain cryptic for the near-surface layer. However, such information would be desirable, especially for species showing a strong diurnal migration pattern. To quantify the organisms that are missed within this blind zone during acoustic surveys, strategies to monitor this upper layer have to be developed.
Objectives of project	a) Develop methods to survey the acoustic blind zone b) Evaluate the performance of the acoustic DIDSON camera and the SEAGIS stereo video camera system (recently acquired by IMARES; www.seagis.com.au) in our area of application
Broad description of the project including expected results	Trials will be carried out in the upper surface layer during existing surveys and specific 'mini surveys'. These trials will test the DIDSON versus the SeaGIS imaging techniques under different conditions (salinity, light availability, towing speed, turbidity, and underwater noise). Apart from comparisons in freshwater and saltwater environments, and at day and night, measurements of both techniques will be recorded simultaneously under gradient profiles of, for example, towing speed and underwater noise. Effects of the following environmental conditions on the imaging quality and resolution will be examined during the trials: - Different salinities: fresh- versus saltwater, high versus low turbidity - Different temporal conditions (day/night, here a special infrared light will be used in the SeaGIS system) - Different noise levels (use vessel at different speeds, including the creation of a noise profile using an echosounder in passive mode). In a longer trial lasting several days, the system will be tested during the North Sea herring acoustic survey (in the south and north, where a turbidity gradient is to be expected). Both data sets will be compared in light of different criteria (number of detections, possibility of quantifying the data, length measurements, species identification), to create a data quality profile for both systems. This will highlight the benefits of using one over the other technique under a given condition.
Products to be delivered	1 scientific publication Situation specific optical observation method of the acoustic surface 'dead zone'.
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 observations of parts of the water column not covered by traditional acoustic surveys. It will also provide an estimate of the importance of this upper layer, hence contribute to a better understanding of the functioning of the ecosystem and the dynamics of fish stocks. Findings will be particularly important for acoustic surveys in shallow water where the acoustic 'dead zone' comprises a significant part of the total water column. The project has direct relevance for several descriptors of Good Environmental Status (biodiversity, commercial fish, and marine food webs).
Likely impact of project	Combining the fields of acoustics and optical techniques is a new and expanding field of research. Considering the novel aspects in comparing the performance of acoustic with video imaging techniques to explore the acoustic 'dead zone', the project will have a high impact for studies focussing on species that are abundant in the near-surface layer. The project would raise the status of IMARES in the field of observation technologies and therefore increase possibilities for future collaboration with partner institutes.
Proposed budget	Total costs: € 24,520 Hours: 240 x €98 (JONDZ) = € 23,520 Travel: € 1000

Why should this be funded by KB WOT?	This project holds promise to be one of the first to gather optical data from the acoustic 'dead zone' 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.
Is the appropriate capacity available?	Yes, the technical equipment, expertise, and trained personnel 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?	No specific risks, other than equipment failure.
International Scientific network	Named project partners have a wealth of experience in setting up short trial surveys and designing and using optical/acoustic observation techniques. Collaboration will raise the profile of IMARES within this upcoming field of research and lead to further projects.
International objective of research	Contribute to higher accuracy of acoustic surveys.
International Project results	Findings will be relevant to other pelagic acoustic surveys, potentially contributing to higher accuracy. Results will also be relevant for a proposed FP7 proposal (INTOGES) that aims at developing new monitoring techniques to observe biological diversity and will raise the contribution (and budget) allocated to IMARES within this project proposal.
International or National Finance	None

Title of project 13	**Juvenile forage fish dynamics in Dutch coastal waters**
Project leader	Sascha Fässler
Theme	1 – Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Sven Gastauer Bram Couperus
Participating partners (external)	-
Duration	one year
The Problem	Very little is known about the distribution, behaviour and general dynamics of forage fish in the Dutch coastal waters. IMARES has collected a wealth of (generally under-utilised) data on forage fish (sprat, herring, sardine or anchovy) during surveys as part of contract work (wind park, ZKO) over the past few years. Acoustic surveys in these waters are generally sparse if not non-existent. In order to plan future surveys and expand the expertise in coastal acoustic surveys, there is a need to find out more about how these fish are distributed in relation to environmental parameters (e.g. temperature, tides), their abundances and migration.
Objectives of project	Develop methods to optimise acoustic surveys in shallow coastal waters.
Broad description of the project including expected results	Analysis of acoustic data sets: Flyland & Wind park projects: 1) Temporal differences within (relatively small) reference area over time 2) Distribution in relation to temperature and salinity Marsdiep: 1) Distribution over full tidal cycle 2) Distribution in relation to temperature and salinity 3) Temporal differences spring/autumn and inter-annual
Products to be delivered	Description of pelagic fish communities in the Dutch coastal zone in terms of migration, composition and relation to environmental parameters. Peer reviewed paper.
Dissemination of findings being addressed	Peer reviewed literature, conference presentations
Utility of the developed products and expertise	The project will make use of existing survey data and contribute towards developing methods to survey typical nursery areas of important forage fish populations. Findings will contribute towards a better understanding of ecosystem functioning and habitat use of juvenile forage fish in coastal waters. Knowledge of the often neglected pelagic realm of shallow coastal seas is vital for several descriptors of Good Environmental Status (biodiversity, commercial fish, marine food webs).
Likely impact of project	Findings may lead to further survey work (also as part of existing surveys) to get more insight into (diel, vertical) migration and habitat use in relation to environmental parameters.
Proposed budget	Total costs: € 23,520 Hours: 240 x €98 (JONDZ) = € 23,520
Why should this be funded by KB WOT?	The proposed project will contribute to a better understanding of pelagic fish in shallow coastal areas, areas which are heavily used by humans in many different ways and hence require a robust management. Any successful management plan in compliance with the ecosystem approach requires a thorough understanding of the underlying system.
Is the appropriate capacity available?	yes
What other potential funding sources have been considered?	Work done in the original projects (e.g. windpark: abundance inside/outside area) will also feed into the overall picture and contribute to the papers.
Connection to knowledge development at the University	-
What are the potential risks to the project's success?	No specific risks
International Scientific network	-
International objective of research	The project will allow to build in-house expertise and therefore raise our competence in relation to international partners. Various other countries share similar coast types (Denmark, Germany, Belgium) and will profit from findings, which could then build the basis for further collaboration.
International Project results	Findings will be relevant to other areas with similar coast types in e.g. Germany, Denmark or Belgium. Investigated components of forage fish populations also have their nursery areas partly in coastal waters of these countries.
International or National Finance	-

Title of project 14	**Analysing AIS data to inform the usage of the sea**
Project leader	Niels Hintzen
Theme	1
Participating partners (IMARES)	Peter van der Kamp Gerjan Piet
Participating partners (external)	None
Duration	1st January – 31st of December 2012
The Problem	The spatial and temporal usage of the sea is most often only approached from a fisheries perspective, primarily because for a long time only detailed information was available for fishing vessels that are equipped with a GPS device that sends their position to a satellite, also known as VMS data. IMARES has taken a pioneer and also leading role in VMS analyses for a long time. However, most fisheries institutes around the world nowadays publish on fishing and fleet behaviour based on VMS data and the true novelty has diminished although its use in spatial planning has only increased over the past years. In these spatial planning projects however the use of only VMS data is providing a skewed view as only one core group of users is reflected. Marine shipping however is unaccounted for as information on their spatial and temporal distribution was missing. AIS data (Automatic Identification System), recently introduced to IMARES as a new source of information on spatial and temporal distribution of all marine 'traffic' could inform habitat disturbances both inside as outside the 12 mile zone and provide support for marine spatial planning.
Objectives of project	The project aims at gaining insight into the use of AIS data for spatial planning, benthic impact, fishing behaviour and further understanding of the usage of the sea by a multiple group of users. The project will investigate how the data can be used within IMARES to enhance our understanding of the interaction between marine shipping, fishing and the associated use of the sea related to habitat disturbance and spatial planning. As many small vessels, often fishing within the 12 mile zone, are not equipped with GPS devices, but do submit AIS signals, our understanding of these fisheries will increase tremendously and will result in better estimates of fishing behaviour and (benthic) impact these fisheries have on the ecosystem.
Broad description of the project including expected results	The project will start by importing the AIS data in the VISSTAT database. From there, tools to analyse the AIS data will be developed, which will be embedded within the VMStools software (developed and published in-house and has been acknowledged by ICES as the preferred software to deliver spatial-temporal information to the ICES data centre). An analyses of spatial and temporal coverage by user group will be executed to judge the usability of this data source for ecosystem studies and marine spatial planning. Personal meetings will be held with IMARES project leaders on ecosystem studies and marine spatial planning to investigate how best to use this new data source within the on-going but also future projects. A final report will be written containing the results of the analyses and personal meetings and maps of spatial use by user group will be presented.
Products to be delivered	Project report including estimates on coverage, usability within on-going projects and maps of spatial usage
Dissemination of findings being addressed	To current knowledge of the partners on this proposal, no AIS work has been published so far. Hence, the partners are keen to write a scientific paper to ensure a leading role of IMARES within this field. However, this is a first attempt to use AIS data and the outcomes are unsure.
Utility of the developed products and expertise	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, ecosystem management and spatial planning.
Likely impact of project	The project aims at generating new expertise in the use of spatial temporal data and achieving more detailed information on marine activities. In many studies executed for the ministry of EL&I, VMS analyses have taken of place to estimate the habitat usage by fisheries only. Including other users will have a clear impact on our understanding of who is using the marine habitat, where they interact, how important certain areas are for different users, what the impact on the coastal area could be and how this can be combined to support studies in the field of Marine Strategy Framework Directive, Ecosystem Approach and Spatial Planning.
Proposed budget	Proposed budget: 17 000 euros 100 hours Peter van der Kamp 60 hours Niels Hintzen 8 hours Gerjan Piet
Why should this be funded by KB WOT?	The demand for spatially resolved information and the impact of fishing vessels but also other vessels will only increase in the upcoming years. However, an exploratory analysis is needed to see whether and how we can use this new data source within projects and to build up a

	knowledge base on AIS data. The main client for VMS data analyses so far has been the ministry of EL&I, it is therefore expected that the use of AIS will be asked for by the same ministry. Hence, an exploratory analyses fits well within the scope of KennisBasis as WOT.
Is the appropriate capacity available?	Yes. GerJan is the partner on the list with the tightest schedule. He will serve as a consultant in this project with limited practical input
What other potential funding sources have been considered?	No other funding sources have been considered given the exploratory nature of the project
Connection to knowledge development at the University	-
What are the potential risks to the project's success?	As the study has an exploratory nature, no guarantee on success can be given in advance. Data delivery is secured , but official use in publications is still under investigation. The nature of the data is unknown, hence, the usefulness within projects cannot be estimated in advance. If the data has a similar function as the known VMS data, the success can be very large because not only better understanding on the small scale fisheries in the coastal area will become more clear, also the other users in the marine environment can be mapped
International Scientific network	We participate in the ICES Study Group on VMS data, which looks not only into VMS data, but also AIS data. Functionality developed to analyse AIS data at different institutes will be shared and expertise exchanged.
International objective of research	There is a close link to the work executed under the MSFD framework where good practices are exchanged and analyses can be combined to represent the full North Sea
International Project results	Embedding of the analyses tools in the VMStools software which is currently used by most EU countries.
International or National Finance	It is anticipated that funding will come from the KBWOT fisheries 2012 programme.

Title of project 15	**(Re)moving The Goalposts**
Project leader	David Miller
Theme	1 - Ecosystem approach and fish descriptors in the MSFD
Participating partners (IMARES)	Researchers with interests in fisheries management and knowledge of the techniques that would be used in this work (e.g. Niels Hintzen, Mark Dickey-Collas, Jan Jaap Poos)
Participating partners (external)	Links with WGMIXFISH and Clara Ulrich (DTU Aqua).
Duration	One year
The Problem	The use of target reference points (e.g. Fmsy) in fisheries management is fraught with problems. While the theoretical basis for such targets may be sound, there are numerous obstacles to using them: 1. Defining/calculating reference points is difficult, especially when trying to incorporate the known uncertainties. 2. The unknown uncertainties may invalidate chosen values. 3. Reference points are usually defined for single stocks even though these may not be valid in an ecosystem context. 4. Single species targets for stocks caught in mixed fisheries are often in conflict. 5. Fisheries management in ICES tends to call for fixed target reference points though as ecosystems and fisheries change, so to do the reference points. In an ecological context, defining a fixed target in a changing ecosystem makes little sense. Likewise, continually redefining reference points (moving targets) is an inefficient form of management. In a mixed fishery context, it is challenging to balance progress towards targets of the mixed fish stocks as changes in the fishery (e.g. gears, locations, markets) change the relative pressure on each stock from year to year. As fisheries management attempts to move to a multispecies ecosystem approach, fisheries managers continue to hold on to single species targets, trying to adapt these given multispecies considerations. This is also an invalid approach, as environmental impacts and changes in community structure will change how single species targets are impacted through ecosystem interactions. Therefore adapting single species targets to ecosystem interactions only serves to add another dimension of uncertainty to the calculation of reference points that were already difficult to define in a single species context.
Objectives of project	Simplify fisheries management. Propose an alternative to short term management in relation to long term single species target reference points.
Broad description of the project including expected results	Managing stocks on the basis of how uncertain assessment results relate to uncertain and changing target reference points, further blurred by uncertainty in stock interactions and reactions to environmental changes is too complicated. Fisheries management needs to get simpler to be more applicable, not more complicated. The reasons for persisting with single species target reference points relate to agreements on managing stocks towards specific long term objectives (e.g. MSY). Being internationally agreed does not equate to making scientific sense. Even so, having long term objectives does not necessitate the need to manage in the short term on the basis of long term reference points. Long term sustainability could equally be achieved in the absence of target reference points. Limit reference points (especially lower bounds e.g. PA limit points) can still be of use as a warning system to ensure stocks are kept above a minimum sustainable status (note: the poor application of the PA approach in the past does not invalidate the importance of keeping stocks above low standing stock levels). Stocks react to the ecosystem, environment and the fishery. We can observe this reaction (e.g. change in abundance of a species, or change in an ecosystem indicator), even if we don't understand the causes and the actual change in the ecosystem (e.g. environmental change, ecological change, oceanographic change - or a complex mix). This all suggests potential benefits in an approach of managing on the basis of stock or ecosystem trends, while being careful to maintain stocks (well) above limit reference points. Not managing on the basis of targets makes management in relation to several indicators (such as would be required in ecosystem based management) easier, because there is no requirement to balance often conflicting targets. Aiming for relative improvements (or at the very least no decline in status) can more easily be achieved for multiple stocks. Meaningful indices would be central to this work, as well as knowing which trends are better (increase, steady or decrease) given the prevailing index states. There has been much work related to this, but little of which has yet to find an appropriate management outlet to become applicable. Ecosystem indices should be identified in a literature review and an examination of EU project results (e.g. MEFEPO). Indices would need limit levels (i.e.

identification of negative states) and for various ranges of the index, a determination of what the desired trend would be. E.g. for a large fish index (LFI), when the index is low, an increasing trend would be preferable, though above a certain point a flat trend may be acceptable. A direct relationship between index value and 'ecosystem' health would be too much to expect and would ignore the numerous uncertainties associated with such indices. The North Sea demersal stock complex would provide a good case study for this project, given that these ICES stocks and fisheries have good, readily available stock data and the historical record of the basis for management is well documented. Additionally the existing conditioned Fcube model (WGMIXFISH) has been conditioned on the best available stock and fleet data.

The first step (and possibly all this project could cover) would be a backward-looking approach, to see how the approach would have compared to both single species trend management and the management that actually occurred (also single species). This would require:

1. Starting 20 years ago, identifying the prevailing management objectives (broadly, i.e. not specific targets but what it was aimed to achieve e.g. not "an F of 0.25" but rather, "prevent overfishing" or "simultaneously achieve high catch and a sustainable ecosystem").

2. Determine what reasonably could have been expected from the stocks in terms of yield and growth given the history actually observed (including recruitment anomalies, fleet capacity etc.)

3. For each year determine what a 'good' management action would have been, considering the known stock trajectories following this (qualitative) and the values calculated above (quantitative). This will be tricky.

4. One year at a time (or in 3 year steps) check the ICES historical assessment results and other ecosystem data (potentially from a model of the period) and do management on the basis of:

    a. Single species indices (i.e. SSB and F)

    b. An index suite approach - various trend based rules looking at all single species indices and including ecosystem indices (calculated from data on all of the stocks and fleets), applying management on a fleet/ecosystem level.

5. Score these against the qualitative and quantitative determinations of 'good' management.

6. Compare outcomes and management scores between these two approaches and what management was actually applied.

Identifying what would have been good management at the time and applying both single species trends and an index suite approach to compare with actually management should help disentangle the effects of observation/model error, HCR used and environmental effects on productivity. This work will look specifically at short term management options, comparing a trend based method with the method of aiming for specific long term targets. The idea is that managing in order to prevent indices from moving in a negative direction would implicitly take care of the long term considerations. The index suite approach will have the following characteristics:

1. Comprise single species and community/ecosystem indicators (e.g. Large Fish Index, level of seafloor impact etc.). Ideally a parallel ecosystem dynamics model of the same period would be used to derive some of the ecosystem indices, but may not be possible without further collaboration.

2. Scenarios of weightings for each index would be developed. Weightings would vary through a constant factor (relative 'importance' – to fishery and ecosystem) and a time varying factor determined by the proximity of the current index value to a lower (or upper) precautionary limit. E.g if an indicator is declining towards a limit, its weighting factor is increased to reflect the urgency to turn the trend around.

3. A strictly quantitative and a semi-quantitative approach could be applied to look at recent trends (trend duration depending on the particular index, but 3-5 years, maybe 10 in some cases). The semi-quantitative approach would use a classification system to determine whether the trend is increasing, flat or decreasing (potentially non-flat trends dividing into 'steeply' or 'gradually'.

4. This prevailing trends will be compared with desired trends given the status of each index to determine what action is required on the basis of each index.

5. From this an overall weighted desired change in 'ecosystem' trend will be calculated. Or rather the required change in 'mixed fishery' trend could be established using only the indices

	impacted by each fleet (or weighting the indices differently for each fleet). 6. This will be used to determine the management actions for the fleets. Probably in terms of allowable effort changes (input management) based on the historic selectivity of each fleet effort. 7. Output management could also be used by directly adjusting TACs on the basis of the overall desired change in mixed fishery trend (potentially combining single species trend considerations). The use of future projection simulations to compare alternative management strategies is well established, clear methodologies and analyses have been identified and several (potentially vital) assumptions that need to be made have been tested and are commonly accepted . Retrospective comparisons have been less frequently applied and have a number of issues that have not been fully worked out yet (generally to do with predicting what would have happen had management actions been different). Assumptions need to be made that have not be fully scrutinised. This work could provide a useful step forward in that regard. This is will be challenging, but recent works exist with which to compare approaches. The second step (though perhaps a bridge to far for this project) would be a simulation study of multiple stocks in an ecosystem with changing productivity (i.e. environmental/ecosystem change) and a changing mixed fishery (i.e. selectivity, q). This next step would use a projection model (e.g. the WGMIXFISH Fcube model) to test alternative trend-based (ecosystem and single species) HCRs vs traditional single species management. As a case study, the ICES application of Fmsy reference points would serve as a good example: - Current basis for European fisheries management - Fmsy is difficult to estimate, and likely to change due to the environment and ecological interactions - Pressure to select single fixed values by ICES, though it is best not thought of in a single species way (depends on other species in the ecosystem too, and the productivity of the ecosystem - which changes all the time). - Values also depend on the selectivity of the fishery - changes with fisherman behaviour e.g. flatfish example.
Products to be delivered	A peer reviewed paper
Dissemination of findings being addressed	Results will be published in a peer reviewed paper.
Utility of the developed products and expertise	This project would lead to a better approach to handling the complex problem of multispecies management in a changing ecosystem.
Likely impact of project	At a minimum, generate discussion over the utility of the current approach to fisheries management and suggest ideas for easing the implementation of ecosystem based management.
Proposed budget	**Research hours:** € 40 000 Scale 10-11: 420 hours (€ 95 per hour)
Why should this be funded by KB WOT?	This approach can facilitate the movement away from single species management and single species targets. By removing single species targets it is easier to shift management to a broader context. By showing that short term management on the basis of target reference points may not necessarily be superior to a simple trends based approach.
Is the appropriate capacity available?	Yes.
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?	No known risks. Data is available, and methods for evaluating proposed alternatives exist.
International Scientific network	Though not directly involved in this work,
International objective of research	Results would apply to global fisheries management and analyse the appropriateness of internationally agreed management objectives.
International Project results	Results could be considered by ICES and the EU as attempts are made to move towards a broader approach to fisheries management.
International or National Finance	None.

Title of project 16	**Forage Fish Interactions (FACTS) – Cofinancing EU FP7 project**
Project leader	Mark Dickey-Collas
Theme	Ecosystem Approach
Participating partners (IMARES)	Geert Aarts, Tobias van Kooten, Tim Schellekens, Thomas Brunel, Meike Scheidat, Sophie Brasseur, Kristina Raab
Participating partners (external)	The EU 7th framework project FACTS.– 15 institutes from 8 different European states; Denmark, Germany, Norway, UK, France, Spain, Norway, Finland.
Duration	Third of three years
The Problem	Moving to a multispecies context for forage fish is a challenge currently requested by the EU that has little science to underpin its advice.
Objectives of project	FACTS will develop and disseminate advice on the consequences of various forage fish harvest strategies to the ecosystem including their economic implications. FACTS research focuses on seven forage fish species (anchovy, herring, capelin, Norway pout, sardine, sandeel and sprat) that are a major natural resource to the European community and represent key elements in the functioning of marine ecosystems.
Broad description of the project including expected results	FACTS will eliminate critical gaps in knowledge that currently exist concerning the impact of variations in forage fish populations (due to various drivers such as climate and fishing) on the trophodynamic structure and function of different European marine ecosystems. The North Sea is a case study, being lead by IMARES. FACTS will answer the following questions: 1. What are the major short- and long-term drivers of changes in commercially and ecologically important forage fish populations within European waters? 2. What are the biological and economic consequences of changes in forage fish populations in terms of their prey, their competitors and their predators? 3. What are the biological and economic consequences of changes in predator populations on forage fish populations and their fisheries? FACTS will develop new operational models that estimate the biological and economic trade-offs associated with various exploitation strategies of forage fish stocks in major European fisheries. Moreover, as the main providers of advice on forage fish in the North Atlantic, FACTS partners are also able to translate these model outputs into urgently needed advice on how best to move beyond the single-species approach of current fishery assessments and adopt ecosystem-oriented management.
Products to be delivered	Reports and published manuscripts as part of EU FP7 project; A series of scientific papers, symposia, technology transfer from across Europe to IMARES.
Dissemination of findings being addressed	The findings will be published, and a major international symposium is planned for 2012.
Utility of the developed products and expertise	Applicable to considerations of Good Environmental Status and direct links into the advisory system via CFP and MSFD.
Likely impact of project	The project feeds directly into fisheries advice
Proposed budget	Cofinancing : €70,000 over three years. **Total cost for 2012: € 23,500**
Why should this be funded by KB WOT?	This is a core part of WOT, as FACTS is specifically focused towards improving management advice for forage fish. KB WOT will gain added value by the €300,000 funding from the EU and €30,000 from the IMARES directorate for two remaining years of a PhD..
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	The majority of costs come from other sources with large added value from other institutes: This is an EU funding project which requires 3 years of cofinancing. The EU provide €300,000 and IMARES directorate €30,000. The total international budget is €4 million. FACTS also has ICES and PICES backing with planned joint symposia for 2011 and 2012. (PICES is Pacific ICES).
Connection to knowledge development at the University	This project is directly linked to a WIAS PhD student.
What are the potential risks to the project's success?	The project is medium risk and most deliverables are shared between various staff.
International Scientific network	Yes, through ICES, STECF, and the project consortium
International objective of research	Addresses major research objectives set forth by the revised Common Fisheries Policy, the Marine Strategy Directive (2008/56/EC) and EU Marine and Maritime Research Strategy. It also has the potential to inform scientist in North America & East Asia via ICES and PICES
International Project results	The results of the project will be disseminated through an ICES theme session at the 2011 ASC and through an ICES/PICES symposium in 2012.
International or National Finance	Yes through FP7 and links to ICES

Title of project 17	**International Exchange**
Project leader	Mark Dickey-Collas
Theme	International Exchange
Participating partners (IMARES)	de Boois, ter Hofstede, Miller, Hintzen, Pastoors, Röckmann, Rijnsdorp, van Marlen, Fässler, van Damme, Slijkerman, IMARES MT
Participating partners (external)	The ICES, PICES and FAO-fisheries community
Duration	1 year
The Problem	The International Fisheries/Marine science research effort is heavily carried out through working groups. IMARES must attend these to obtain both insight and added value for the Dutch research input.
Objectives of project	The allow participation of active researchers in the appropriate international working groups relevant to KBWOT aims and objectives.
Broad description of the project including expected results	To fund participation in international science networks and ICES meetings. Including WK on Statistical Analysis of Biological Calibration Studies, WK on Sexual Maturity Staging of Sole, plaice, dab and flounder, A WK on Sexual Maturity Staging of turbot and Brill, WG on Data and Information Management , The WK on Quality Flagging, Strategic Initiative on Stock Assessment Methods, WG on Integrative Physical-biological and Ecosystem Modelling, WG on Fish Ecology, WG on Small Pelagic Fishes, their Ecosystems and Climate Impact, WG on Fisheries-Induced Evolution, WK on the Value of Coastal Habitats for Exploited Species, WG on Methods of Fish Stock Assessments, WG on Multispecies Assessment Methods, WG on Maritime Systems, WG on Fishing Technology and Fish, Study Group on Electrical Trawling , Study Group on Standards in Ichthyoplankton Surveys, WG on Fisheries Acoustics and Technology, Study Group on Calibration of Acoustic Instruments in Fisheries Science, WK on Mackerel and Horse mackerel Egg Staging and Identification, WK on Mackerel and Horse mackerel Egg Staging and Identification, WG on Integrating Surveys for the Ecosystem Approach, WG on Integrated Assessments of the North Sea.
Products to be delivered	Formal working groups reports, internal IMARES reports of groups and collaborative manuscripts for peer reviewed journals.
Dissemination of findings being addressed	Yes 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	The project feeds directly into the ICES Science and advisory programme
Proposed budget	€130,000
Why should this be funded by KB WOT?	These groups are core to the development of KBWOT 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 KBWOT resources.
Is the appropriate capacity available?	Yes
What other potential funding sources have been considered?	Yes (WOT, IMARES R&D funds etc.) and these are the groups that most require KBWOT 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	The results are all international
International or National Finance	Added value by participating in collaborative international projects and groups.

Title of project 18	Programme Management
Project leader	Mark Dickey-Collas
Theme	Management
Participating partners (IMARES)	Rian Schelvis, Frans van Beek
Participating partners (external)	Communication with WUR KB team and EL&I, Kees Verbogt
Duration	1 year
The Problem	N/A
Objectives of project	To manage, develop and administrate the KBWOT Fisheries theme within WUR KB theme
Broad description of the project including expected results	A successful KBWOT fisheries programme
Products to be delivered	A programme of research in 2012, and preparations for 2013
Dissemination of findings being addressed	Through a range of media and 2 reports – reporting on the 2011 programme and a description and rationale for the 2012 programme
Utility of the developed products and expertise	A review of the functioning of KBWOT fisheries was carried out in 2010 (see report 10.IMA0283.mdc) which involved EL&I (directorates AKV and DKI), 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 EL&I. Thus the KBWOT programme appears to utilise the expertise available to DLO on fisheries and look to the future research needs of society
Likely impact of project	Efficient and cost effective running of the programme
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 WUR
What are the potential risks to the project's success?	None
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.