WAGENINGEN UR
For quality of life

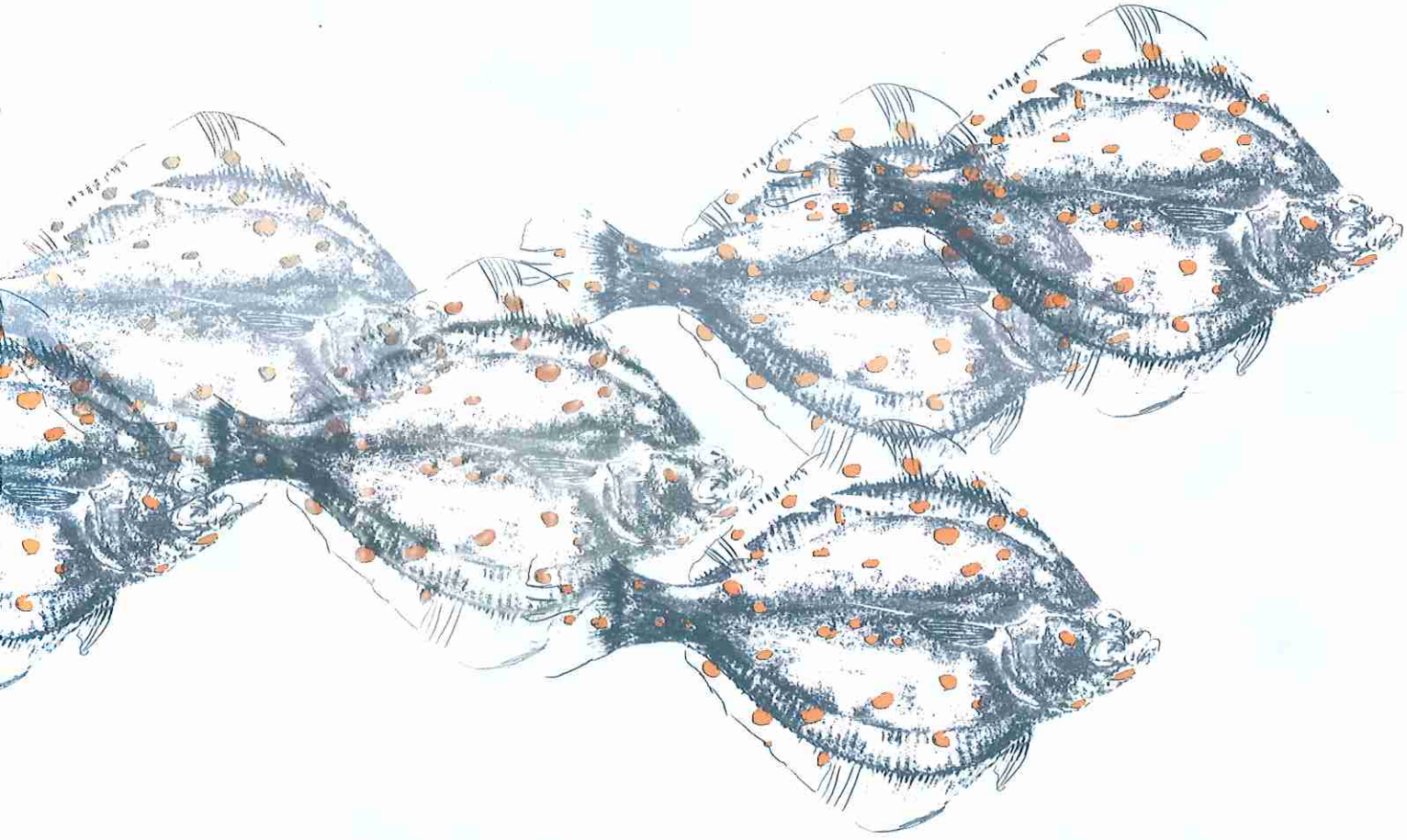
Stichting Wageningen Research
Centre for Fisheries Research (CVO)

KB WOT Fisheries 2018 – Maintaining Excellence and Innovation in Fisheries Research

C.J.G. van Damme & S.W. Verver

CVO Report 17.019

December 4th 2017



Centrum voor Visserijonderzoek (CVO)

Stichting Wageningen Research
Centre for Fisheries Research (CVO)

KB WOT Fisheries 2018 - Maintaining Excellence and Innovation in Fisheries Research

C.J.G. van Damme & S.W. Verver

CVO report: 17.019

Commissioned by:
Ministerie van LNV
Directie Agrokennis
Cluster Onderzoek en Kennisvalorisatie
Postbus 20401
2500 EK DEN HAAG

Project number: 4311300034
BAS code: KB-24-005-001

Publication date: 28 November 2017

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

Visitor address:
Haringkade 1
1976 CP IJmuiden

Digital Object Identifier (DOI): https://doi.org/10.18174/427138

De Stichting Wageningen Research-Centre for Fisheries Research is registered in the Chamber of commerce in Gelderland nr. 09098104,
VAT nr. NL 8089.32.184.B01

CVO rapport UK V07

Table of Contents

Summary

The KB WOT Fisheries programme is developed to maintain and develop expertise needed to carry out the Dutch statutory obligations in fisheries monitoring and advice. The KB WOT Fisheries programme developed for 2018 reflects the scientific and management needs of the WOT fisheries programme. The strength of KB WOT Fisheries lies in the top-down development of the programme while allowing bottom-up input, with calls for proposals, to ensure innovation and improvement. To avoid missing research priorities relevant to WOT and LNV needs, the programme is built from a closed call for proposals to WOT Fisheries project leaders. But these WOT project leaders are requested to seek input from other Wageningen Marine Research scientists to ensure innovation.
The KB WOT Fisheries programme will fund 17 projects in 2018 which will focus on monitoring and remote sensing of (shell) fish in marine and freshwater ecosystems, new methods and tools for surveys, discard and catch sampling and investigating the effects of fisheries. International exchange of new expertise and developments, as well as continuous quality assurance (for collecting, storage and analyses of data), forms a major part of the programme.

Samenvatting

Het KB WOT programma voor Visserijonderzoek is ontwikkeld om de expertise te onderhouden en ontwikkelen, welke nodig is voor de uitvoering van de Nederlandse Wettelijke Onderzoekstaken voor de visserij. Het KB WOT programma in 2018 is een weerspiegeling van de onderzoekbehoeften van het WOT Visserij programma. Het programma wordt ontwikkeld vanuit een top-down benadering, welke wel bottom-up inbreng vraagt via het indienen van projecten. Om voorkomen dat leemtes in kennisbehoeften, die van strategisch belang zijn voor een goede uitvoering van de Wettelijke Onderzoekstaken, niet beantwoord worden, wordt het programma ontwikkeld via een gesloten call aan WOT Visserij projectleiders. Deze WOT-projectleiders zijn gevraagd om andere Wageningen Marine Research onderzoekers te betrekken bij de projectvoorstellen, zodat het programma innovatief blijft.
Het KB WOT visserij programma financiert in 2018 17 projecten op het gebied van monitoring en remote sensing van vis en schelpdieren in marine en zoetwater ecosystemen, nieuwe technieken voor het uitvoeren van surveys en bijvangst en vangstbemonstering en onderzoek aan de effecten van visserij. Internationale uitwisseling van kennis en ontwikkelingen in het onderzoek vormt, samen met kwaliteitsborging (van verzameling, opslag en analyse van data), een belangrijk onderdeel van het programma.

1 Introduction

The expertise essential to conduct the Dutch statutory tasks in fisheries monitoring and advice on fishery management are maintained and developed in the KennisBasis (KB) WOT Fisheries programme. Although maintaining the core-expertise is the fundament, the programme is also pro-active and strives to respond to alterations and developments in the statutory obligations and policy needs and method innovations. As a result, the multiannual programme is flexible through yearly reviewed with clear objectives and deliverables.

The expertises in the KB WOT Fisheries programme are necessary for the needs of the fisheries research and advice as well as the fisheries Data Collection Framework (DCF), the Common Fisheries Policy (CFP) and the Marine Strategy Framework Directive (MSFD).

The KB WOT Fisheries programme is developed through a top-down approach, while at the same time allowing for bottom-up input. The bottom-up submission is ensured through a yearly call for project proposals. While the top-down decision on the themes of the programme guarantee that the programme remains focused on the fisheries statutory tasks. Areas of research include integrated assessments of the ecosystem (particularly the demersal and benthic communities of the North Sea), multispecies and maximum sustainable yield (MSY) considerations in fisheries management, development of acoustic survey practices, plankton 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. Turning existing standard surveys into more ecosystem monitoring expeditions is also stimulated.
The programme is a mix of both multiannual and annual projects, which respond to scientific and management needs. The innovative, supportive and exploratory programme also conforms to the wider Wageningen strategic approach of KennisBasis research. The KB WOT Fisheries programme is embedded in the Wageningen Research KB Programme System Earth Management (SEM) in the subtheme Marine Resource Management.

The KB WOT Fisheries programme is managed by a delegated programme leader and head of CVO, and is developed together with the ministry of Agriculture, Nature and Food Quality (LNV). The programme is part of the overarching KB programme carried out by Wageningen UR. The programme is reviewed by the delegated programme leader and head of CVO, supported by a scientific advisory committee. The programme produces two annual reports, 1) with the results of the previous year and 2) with the programme for the following year.

This report describes the framework for the 2018 programme and the proposed research which will be carried out in 2018.

2 The embedding of KB WOT Fisheries

One of the topics of the Wageningen Research KB 'System Earth Management' is sustainable use of natural resources and increasing the knowledge on marine resource management. The KB WOT fisheries programme fits into this overarching theme and thus operates within this KB theme. It is important to realise though that the KB WOT Fisheries programme main objective is to develop and maintain expertise to carry out the Dutch statutory tasks on fisheries monitoring and advice for management.

The expertise needed to carry out the statutory tasks for national and European fisheries policy are maintained in the KB WOT Fisheries programme. The existing and upcoming EU directives are the basis for the (future) policy needs. Thus, commitments for the Common Fisheries Policy (CFP), national freshwater policy, habitats directive, water quality directive and the Marine Strategy Framework Directive (MSFD) relevant for fisheries are included in the programme. Also long-term data collection programmes require the collection of information and data, while at the same time gaining a better understanding of the marine and freshwater environment and ecology is essential. A combination of these is the strong basis for delivering excellent science-based advice. For these tasks the KB WOT Fisheries programme is developed in such a way to balance between reacting to present needs and anticipating (inter)national fisheries policies developments.

Collecting high quality data is the essence for reliable science-based advice to develop fisheries management and policy. These data collections need to be achieved according to international agreed and developed scientific handbooks. This can only be achieved through science based on international collaboration and peer-review. For this scientists need to keep up with progress across the world. Also new developed techniques and methods need to be internationally evaluated. Therefore, a major part for the KB WOT Fisheries programme is (inter)national travel to exchange scientific developments both within and outside the Netherlands. Furthermore, international exchanges of staff are stimulated both within KB WOT Fisheries projects and statutory task monitoring.

3 International nature of KB WOT Fisheries

International exchange of scientific tools and methods developments and cooperation are necessary to achieve the statutory tasks for fisheries. Therefore, collaboration with national and international colleagues forms a major part of the KB WOT Fisheries projects. These cooperation's contribute a large amount of added value to the KB WOT programme, in the form of resources and expertise from other institutes.

One specific project with the KB WOT Fisheries programme is called 'International exchange' and is dedicated particularly for international collaboration and participation in meetings and workshops. This is a multiannual project, to ensure Wageningen Marine Research scientists remain at the centre of scientific developments in fisheries research. Exchange of science with in the KB WOT programme is strongly encouraged through peer-reviewed publications, presentations and developing new techniques for fisheries research as well as the exchange of scientists.

4 Structure of the KB WOT Fisheries programme

4.1 Management team

The KB WOT Fisheries programme is managed in close collaboration between CVO and Wageningen Marine Research, under responsibility of the head of CVO (Sieto Verver). The daily management of the programme is delegated to programme leader Cindy van Damme (Wageningen Marine Research) in close cooperation with CVO. Administrative support is provided by Rian Schelvis-Smit (Wageningen Marine Research).

4.2 Financing

The WOT Fisheries programme was evaluated in 2015 by the Ministry of LNV and it was agreed to continue to allocate an annual budget to this programme in order to maintain and develop expertise needed to carry out the WOT statutory tasks. The content of the WOT Fisheries and the conditions for expertise development are laid down in a long term agreement (Uitvoeringsovereenkomst) between Stichting Wageningen Research and the Ministry of LNV. The KB WOT Fisheries expertise programme in 2018 is financed from the research budget earmarked for the KB WOT programme. The available budget in 2018 for KB WOT fisheries is € 588.000,- (excluding VAT and excluding WUR charges amounting to €11.000 since 2013).

4.3 Reviewing of submitted proposals

The themes for the KB WOT Fisheries programme are decided by the management team. A certain part of the budget is available to scientists through a closed call for projects to WOT Fisheries project leaders and Wageningen Marine Research Support Teams (ST) with high relevance for WOT (STDATA & STBIOP). To keep the innovation and out-of-the-box thinking WOT project leaders are requested to seek input from other researchers. Although researchers are also highly encouraged to share their ideas with relevant WOT project leaders to be included in proposals.
The management team is supported by a scientific review team to advise which proposals could be granted through the programme. The evaluation criteria are published with the call. The final selection of the projects to be accepted is done by the KB WOT Fisheries management team.

All proposals are reviewed and judged for relevance for the WOT statutory tasks, development of relevant new methods and expertise and scientific relevance. The proposals receive a review from each reviewer for development of relevant new methods and expertise and scientific relevance. The KB WOT Fisheries management team also mark the proposals for relevance for the WOT statutory tasks. The means of these marks is then used to rank the submitted proposals, ensuring relevance for the WOT programme.

The review team for the KB WOT 2018 proposals consisted of:

- Sieto Verver, head of CVO
- Cindy van Damme, delegated KB WOT Fisheries programme manager, Wageningen Marine Research
- Johan Craeymeersch, senior scientist, Wageningen Marine Research
- Olvin van Keeken, scientist, Wageningen Marine Research

5 The KB WOT fisheries programme for 2018

5.1 Themes

The programme for 2018 has the following themes:

1. Evaluating, improving and underpinning the WOT Fisheries programme
2. International Exchange

The programme is a result of excellent projects which have been submitted to an annual call for proposals. The call called for annual and multi-annual project proposals. However, the KB WOT programme and projects will be reviewed on a yearly basis. Financing is therefore only guaranteed for 2018 and each project proposal is required to define clear objectives and deliverables for 2018. Multi-annual projects will be requested to update their proposal for 2019 and further.
International collaboration, exchange and teamwork are a high priority. Also projects that propose to publish their results in international peer reviewed literature are thought to be important.
The themes are described as follows:

5.1.1 Evaluating, improving and underpinning the WOT Fisheries programme

This theme was programmed based on a closed call to specific invited WOT project leaders in Wageningen Marine Research for projects that maintain the present expertise base and quality control routine techniques and skills. Wageningen Marine Research needs to maintain core competencies to deliver an internationally approved WOT programme. These core competencies include age reading, stock assessments, acoustic techniques, shellfish surveying, discards and biological data collection, but also developments of storage of these data. Courses, workshops and exchanges are an important part of maintaining and developing core skills.
Data needs to be collected and analysed according to international agreed and developed scientific protocols. This can only be achieved through science based on (inter)national collaboration and peer-review.

For a sustainable exploitation and protection of marine and fresh water resources reliable science-based advice for fisheries is vital. High quality data collection in integrated monitoring of marine and fresh water biota are essential to ecosystem and marine resource management. Novel and innovative integrated techniques, assessments, models and management strategies need to be developed. Innovative and exploratory research into integrated assessments of the ecosystem, multispecies and maximum sustainable yield (MSY) considerations in fisheries management is encouraged. Project proposals are invited that provide information or tools but also improving current methods and management.

5.1.2 International Exchange

Under this theme, budget is reserved to participate and exchange expertise in international research networks (primarily but not only ICES). Funds were allocated by the KB WOT programme management to participate in meetings and workshops that are considered important for the WOT Fisheries statutory tasks. With this theme KB WOT Fisheries ensures Wageningen Marine Research scientists stay up to date with international developments and participate in the international science developments by presenting their research. The value of KB WOT Fisheries programme is increased by project financing and technology or expertise transfer from international partners.

5.2 Proposals granted

In total, 21 proposals were submitted to the KB WOT 2018 call (see annex 1). Based on the evaluation described in section 4.3, the following 16 projects and 1 EU co-funding budget were granted. The EU co-funding will be used for co-funding the contribution to the MARE/2016/22 proposal "Strengthening regional cooperation in the area of fisheries data collection".

Proposal no	Theme	Title	Project leader	Agreed finance[1]
1	1	S6 model	N. Tien	€ 10.000[2]
2	2	International exchange	C. van Damme	€ 170.984
3		Programme management	C. van Damme	€ 29.290
4	1	From TAC to bottom	N. Hintzen	€ 29.080
7	1	Improving herring larvae surveys indices (HERLARS)	C. van Damme	€ 42.880
8	1	Ecosystem acoustics	B. Berges	€ 32.000
9	1	Utilising hidden information from WOT ichthyoplankton surveys	C. van Damme	€ 31.000
10	1	Remote Sensing of Intertidal Musselbeds	K. Troost	€ 13.000
11	1	Shellfish population shifts	K. Troost	€ 7.529
12	1	Migration of WOT shellfish database	I. de Boois, M. van Asch	€ 30.700
14	1	Incidental Bycatch	B. Couperus	€ 14.300[2]
15	1	Statistically sound sampling scheme	H. van Overzee	€ 34.980
16	1	Catch monitoring	E. van Helmond	€ 43.400
17	1	Discard valves	P. Molenaar	€ 18.200
19	1	eDNA and camera rivers	B. Griffioen	€ 23.800[2]
20	1	Fish ageing	L. Bolle	€ 46.460
	1	EU call co-funding	S. Verver	€ 10.000
		Extra VAT		€ 397
			Total	€ 588.000[3]

The other proposals were also of good quality and of direct relevance, but could not be granted because of limited resources.

[1] Amounts are excluding VAT.

[2] These projects also receive funding from other sources.

[3] The total budget thus being €588.000,-. Which when combined with the WUR charges fulfils the budget of €599.000,-.

6 Conclusion

The KB WOT Fisheries programme will fund 17 projects in 2017. This year the KB WOT fisheries programme is balanced with both marine and fresh water projects, using remote sensing (of both fish and shell fish) in the ecosystem. Also new techniques and methods for improving monitoring and assessment, such as genetics and camera's, effects of fisheries and trends in data are investigated. Data storage of routine sampling is to be further improved. Discards and catch sampling are still a hot topic and form a substantial part of the programme. Another major part is the exchange of knowledge and techniques with international scientists. These projects to be carried out in 2018 will in the future increase the ability of the WOT programme to ensure that fisheries advice is reactive to changes in the ecosystem.

Quality assurance

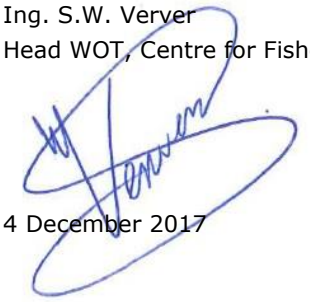
CVO utilises an ISO 9001:2008 certified quality management system (certificate number: 187378CC1-2015-AQ-NLD-RvA). This certificate is valid until 15 September 2018. The certification was issued by DNV GL Business Assurance B.V

Signature

CVO Report: 17.019
Project number: 4311300034

Approved by: Ing. S.W. Verver
Head WOT, Centre for Fisheries Research

Signature:



Date: 4 December 2017

Annex 1. The Proposals submitted to the call KB WOT Fisheries 2018

Approved proposal  Not approved proposal 

Project 	**1. S6 model**
Project leader	Nicola Tien (WOT Fisheries project leader - Ingeborg de Boois and Niels Hintzen)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1
Continuing project	No
Motivation and Project aims	
Lead	Improve the return of the WOT IJsselmeer survey as basis for advice for fisheries management, by creating a methodology that is capable of utilizing the survey in a more informative matter.
Problem definition	Within the ICES framework, catch advice for Data Limited Stocks (DLS) that have a representative, survey-based SSB-index falls within ICES-category 3. If F/F_{MSY} proxies can be estimated for such a stock, advice of category 3.1 can be given; this category has a MSY-objective. However, if these proxies cannot be estimated, advice of category 3.2 is given, with the precautionary approach as objective; 'no further decline in the stocks' is then the objective. Currently, there are no methods to estimate F/F_{MSY} proxies in line with the MSY approach for DLS commercially fished with fishing gears characterized by a *dome-shaped size selectivity*. Thus no catch advice with MSY-objective can be given for these stocks. The WOT IJsselmeer survey provides the SSB-index used as basis for our advice on IJsselmeer pikeperch and perch. However, since the fisheries of these stocks has dome-shaped selectivity, this survey currently cannot be used to its full potential in our advice on fisheries management.
Objective(s) of the project	To develop ICES category 3.1 methods for the IJsselmeer stock of pikeperch and perch, i.e. for stocks that are fished with fishing gears characterized by a dome-shaped size selectivity. In previous years the available ICES-methods have been examined for their applicability to IJsselmeer stocks. There is a promising model ('S6-model') that will be adapted to deal with dome-shaped selectivity. The performance of the adapted model and the estimated F/F_{MSY} proxy will be tested following ICES protocol. The results will be presented at the ICES-WKLIFE meeting in 2018.
Continuing project: Results from previous years	NA
Expertise needed	Knowledge of the S6-model and the IJsselmeer fisheries, WOT-surveys and market sampling programme.
Expertise developed	(i) Technical knowledge of the R-package that is built for the S6-model, and an adaptation of this package to include stocks fished with dome-shaped size selectivity. (ii) Expertise on the methods used in the ICES protocol for testing new DLS methods to estimate MSY proxy reference points. (iii) Knowledge on the fishing mortality of pikeperch and perch.
Relevance for WOT	The return on the WOT-survey in the IJsselmeer can be markedly improved, using a framework that uses the survey data in a more informative matter.

Project 	1. S6 model	
	Products developed in the project will also be useful for fisheries advice on other fisheries that have dome-shaped selectivity, such as purse seine.	
Why should this be funded by KB WOT?	It increases the usefulness of the IJsselmeer WOT survey as data source for advice on fishery management.	
What other potential funding sources have been considered?	Additional funds from the project concerning the 2019 management advice are also freed for this project (100 hrs). The advice on fishery management in IJsselmeer depends heavily on the ICES-framework and a fixed budget is reserved yearly (100 hrs) to make optimal use of the developments in the framework. However, the project does not have enough funds to develop new methods for the ICES framework by itself.	
International objective of research	Expand the types of stocks that can be analysed in ICES category 3.1	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	Pikeperch and perch in IJsselmeer are mainly fished with 101-mm gill nets. The size selectivity of this fishery is dome-shaped. Fisheries advice for these data-limited stocks is currently based on ICES-category 3.2: the trend in the WOT-survey biomass-index, with the objective of 'no further reduction in the stock'. It is the wish of the ministry to manage these stocks with more stringent objectives. The MSY-objective of category 3.1 would fit the LNV goals for these stocks better. However due to data limitations (mostly a dome shaped selectivity function for commercial catches-discards and lack of reliable catch estimates) there are no methodologies available for these stocks within category 3.1. The dome shape selectivity and the lack of reliable catch estimates is a situation very common in artisanal fishery, but also in some important marine commercial stocks fished with purse seine, and even with trawl gears. In ICES (WKLIFE) up till now most of the work done on category 3.1 has focused on developing methods that assume a *logistic shape* for fishing selectivity. Hence, there is important work to do to extend the application of the work that ICES is doing in relation to DLS to a higher number of stocks.	

Project	1. S6 model	
	Previous work by Alfonso has shown that an adaptation of the S6model is the most feasible for the IJsselmeer pikeperch. This model uses as input the length-frequency distribution of the commercial catches (as estimated from market sampling data) and biological keys for the stock (estimated from the WOT survey and the historical WOT market sampling). By defining the size selectivity of the fisheries (currently as being logistic shaped), the model can subsequently estimate how far the fishing pressure F is removed from F_{MSY}. This model can be adapted to be applicable to stocks with dome-shaped selectivity. This work will be done together with the creator of the S6-model. The performance of the adapted model and the estimated F/F_{MSY} proxies will be tested in a Management Strategy Evaluation MSE framework, using 'DLM'-tools or 'FLR'. These tools will be used to perform simulations to test whether the Harvest Control Rules designed by ICES for category 3 stocks (WKMSYCat34, 2017), still perform properly with F/F_{MSY} estimated from the adapted S6-model. If the results are positive, they will be presented to ICES at WKLIFE in October 2018. The ultimate goal would then be to support the acceptance of this methodology by ICES.	
Activities and time schedule	March-May: Understand the S6-model and the R-package developed by A. Kokkalis (DTU Aqua). June-September: adapt the R-package for dome-shaped selectivity (if needed, at DTU Aqua), analyse IJsselmeer data and run FLS-simulations. If results are positive: present the work at WKLIFE in October.	
Output/deliverables	-Create method for estimating F/F_{MSY} of data-limited stocks that are fished	Fisheries advice for IJsselmeer pikeperch and perch with MSY-

Project	1. S6 model	
	with dome-shaped selectivity, as an expansion of the methods available in ICES category 3.1. -Estimation of F/F_{MSY} for IJsselmeer pikeperch and perch using this method. -Determine whether method is appropriate for these stocks, as determined by ICES. -If appropriate; Presentation of the results at ICES (WKLIFE)	objective, once market sampling data for a number of years is available. & Scientific article on this method.
Dissemination of findings being addressed	-Expand the R-package concerning the S6-model to be applicable to stocks fished with dome-shaped selectivity. -Test the pikeperch and perch market sampling data with this model; achieve a first estimate of the F/F_{MSY} for these stocks and determine whether the model is appropriate for these stocks.	Catch advice for pikeperch and perch in ICES-category 3.1
Utility of the developed products and expertise	Fisheries advice with MSY-objective, for the IJsselmeer stocks (based on WOT survey) and other data-limited stocks fished with dome-shaped selectivity.	
What are the potential risks to the project's success?	-Too busy schedules of Alfonso and Alexandro. Nicola will free time and work under their supervision. -Changes in the WOT survey with beam trawl and electro trawl. If the survey methodology is changed without knowledge of the effect on the SSB-indices, the fisheries advice will be compromised. However, this also applies to the current advice (in category 3.2). Good communication between the WOT project leader and the fisheries advice project leader is essential – and already in place. -Ending of the (BO) market sampling programme. Without the market sampling programme, the model cannot be applied to the IJsselmeer data. However, this programme is very unlikely to be cancelled, as the ministry wishes to move it to WOT. -Following the DLM/FLR analysis, the conclusion might be that the adapted S6 model does perform properly for the IJsselmeer stocks. However, this result would also likely be interesting and shed light on the stock dynamics. Plus, the model would still be useful for other stocks.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Alfonso Perez Rodriguez (DLS and S6-model), Nicola Tien (IJsselmeer fisheries, stocks, surveys and management advice)	

Project	1. S6 model
Is the appropriate capacity available?	yes
Involvement parties within WUR (names and expertise)	-
Involvement parties outside WUR (names and expertise)	Alexandro Kokkalis (DTU Aqua): Developer of S6-model and R-package.

Relevance	
What is the market/ target audience	Ministry of Economic Affairs. Perhaps ICES.
Economical relevance	Sustainable fisheries on the IJsselmeer
Social relevance	Sustainable fisheries on the IJsselmeer
Scientific relevance	Development of methods to determine F and F_{MSY} for data-limited stocks
Relevance to ministry LNV	It is the wish of the ministry that Wageningen Marine Research uses the WOT survey in the IJsselmeer to give fisheries advice with more stringent objectives than the precautionary approach.
Summary (UK)	There are currently no models to estimate F/F_{MSY} for data-limited stocks that are commercially fished with dome-shaped length selectivity. Thus no catch advice in ICES-category 3.1 - with MSY objective - can be given for these stocks. An existing methodology will be expanded to be applicable to such stocks. With an F/F_{MSY} estimate from this model, and the biomass index from the WOT IJsselmeer survey, catch advice with MSY-objective can ultimately be given for the IJsselmeer stocks of pikeperch and perch. Thus, the return on the WOT survey can markedly be improved.
Samenvatting (NL)	Momenteel bestaan geen methoden om de F/F_{MSY} te schatten voor data-gelimiteerde bestanden, die bevist worden met koepelvormige selectiviteit van de lengtes. Hierdoor kan geen vangstadvies in ICES-categorie 3.1 (met MSY-doelstelling) gegeven worden voor zulke bestanden. Een bestaande methodiek zal worden uitgebreid, om toepasbaar te zijn op zulke bestanden. Met een F/F_{MSY}-schatting vanuit dit model, en met de biomassa-index uit de WOT IJsselmeer monitoring, kan uiteindelijk vangstadvies met MSY-doelstelling worden gegeven voor snoekbaars en baars in het IJsselmeer. Op deze manier kan de opbrengst van de gegevens verzameld in de WOT survey sterk verhoogd worden.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	200	20.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel	20.000			0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	1000,-	
Project equipment		
Other material costs		
Total Material Costs	1000,-	0,-
Total project budget needed	21.000,-	0,-
Financing through other resources -/-	11.000,-	
Finance needed from KBWOT	10.000,-	0,-

Project	2. International exchange	
Project leader	Cindy van Damme	
Theme	2. International exchange	
Expected duration of the project (years)	Continuous	
Continuing project	Yes	
Motivation and Project aims		
Lead		
Problem definition	By its nature fisheries research is international. Therefore, international collaboration and exchange of scientific development are vital to accomplish the statutory tasks in Fisheries. The KB WOT Fisheries projects are for the major part carried out in cooperation with (inter)national colleagues. Through these collaborations also a large amount of external value is added to the programme, as resources and expertise from other institutes contribute to the KB WOT Fisheries. This project aims specifically for international collaboration, participation in meetings and workshops. This is a yearly recurring project, which ensures Wageningen Marine Research scientists participation in international (ICES) science networks.	
Objective(s) of the project	To participate in meetings and workshops that are considered important for the WOT Fisheries statutory tasks. With this project Wageningen Marine Research scientists stay up to date with international developments and participate in the international science developments by presenting Wageningen Marine Research research. Value of WOT Fisheries increases by technology or expertise transfer from international partners.	
Continuing project: Results from previous years	Results from previous years are published in Wageningen Marine Research nota's and ICES working group reports.	
Expertise needed	Expertise needed to carry out the WOT Fisheries programme.	
Expertise developed	Expertise needed to carry out the WOT Fisheries programme.	
Relevance for WOT	Through participation in international networks and ICES meetings, expertise needed to carry out the WOT Fisheries programme is maintained and developed.	
Why should this be funded by KB WOT?	These groups are core to the development of KB WOT Fisheries and maintenance of Wageningen Marine Research as centre of excellence and an institute for innovation and leader in fisheries research. The network provided by these groups provides great added value to the KB WOT resources.	
What other potential funding sources have been considered?	WOT and Wageningen Marine Research R&D funds, but these are the groups that most require KB WOT funding.	
International objective of research	Maintain Wageningen Marine Research at the centre of fisheries research in Europe and project our skills to arenas beyond the EU.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	To fund participation in international science networks and ICES meetings. In 2018 participation in 25 working groups and workshops will	For the future Wageningen Marine Research scientists will participate in different ICES working groups and workshops. Participation will depend

	be funded (see the summary for group names).	on the resolutions of the working groups. The resolutions are agreed by ICOM and ACOM in October each year. A group consisting of KB WOT management, WOT project leaders, SCICOM and ACOM members decides which groups Wageningen Marine Research will participate in.
Activities and time schedule	See ICES calendar for meeting dates http://www.ices.dk/news-and-events/meeting-calendar/Pages/default.aspx	
Output/deliverables	Formal working group's reports, internal Wageningen Marine Research reports and collaborative manuscripts for peer reviewed journals.	See 2018.
Dissemination of findings being addressed	Through the ICES website, ICES theme sessions, symposia and through the ICES advisory system.	See 2018.
Utility of the developed products and expertise	Maintaining and developing expertise to carry out the WOT Fisheries tasks through international exchange in international (ICES) networks.	See 2018.
What are the potential risks to the project's success?	Over-commitment of staff.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	I. de Boois, A. Rijnsdorp, B. Berges, T. Brunel, K. van der Wolfshaar, G. Piet, C. van Damme, P. Molenaar, S. Sakinan, J. Craeymeersch, R. van Hal, T. van Kooten, R. Verkempynck, N. Hintzen, E. Blom, I. Pennock, M. Kraan, A. Perez-Rodriguez and C. Chen.	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	None	
Involvement parties outside WUR (names and expertise)	Mostly across the North Atlantic marine science community but also with FAO and with scientists from countries involved in PICES (Japan, Korea, China).	

Relevance	
What is the market/ target audience	International science networks and ICES.
Economical relevance	
Social relevance	
Scientific relevance	Added value by participating in collaborative international projects and groups.
Relevance to ministry	These groups are core to the development of KB WOT Fisheries and the

LNV	network provided by these groups provides great added value to the KB WOT resources.
Summary (UK)	This project is specifically to fund participation in international networks and ICES meetings. These groups are core to the development of KB WOT Fisheries. The network provided by these groups provides great added value to the KB WOT resources. In 2018 participation will be funded in: Data and Information Group (DIG), WG on Fisheries-Induced Evolution (WGEVO), WG on the Value of Coastal Habitats for Exploited Species (WGVHES), WG on Fishing Technology and Fish (WGFTFB), WG on Fisheries Acoustics and Technology (WGFAST), WG on Integrating Surveys for the Ecosystem Approach (WGISUR), WG on cod and plaice eggs surveys in the North Sea (WGEGGS2), WG on Biological Parameters (WGBIOP), WG on Integrative Physical-biological and Ecosystem Modelling (WGIPEM), WG on Electrical Trawling (WGELECTRA), WG on Integrated Assessments of the North Sea (WGINOSE), Benthos Ecology WG (BEWG), ICES-ICCAT Methods Working Group (MGWG), Working Group on the Ecosystem Effects of Fishing Activities (WGECO), Working Group on Zooplankton Ecology (WGZE), Working Group on Methods for Estimating Discard Survival (WGMEDS), Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT), Workshop on Co-existence and Synergies in Marine Spatial Planning (WKCSMP), Workshop on Integration and Visualisation Technology of ICES Data under DIG (WKINVITED), Working Group on Atlantic Fish Larvae and Eggs Surveys (WGALES), Workshop on Egg staging, Fecundity and Atresia in Horse mackerel and Mackerel (WKFATHOM), Workshop for Advancing Sexual Maturity Staging in Fish (WKASMSF), Workshop on mackerel biological quality indicators (WKMACQI), Workshop the development of spatio-temporal models of fishery catch-per-unit-effort data to derive indices of relative abundance and Working Group on Maritime Systems (WGMARS). Results will be published in formal working group's reports, internal Wageningen Marine Research reports of groups and collaborative manuscripts. Results will be disseminated through the ICES website, theme sessions at the ICES Annual Science Conference and international symposia.
Samenvatting (NL)	In dit project worden internationale uitwisseling en samenwerking gestimuleerd en wordt specifiek deelname aan onderzoeksnetwerken en ICES groepen gefinancierd. Deze groepen zijn belangrijk voor de ontwikkeling van het KB WOT Visserij programma. In 2017 wordt deelname gefinancierd aan: Data and Information Group (DIG), WG on Fisheries-Induced Evolution (WGEVO), WG on the Value of Coastal Habitats for Exploited Species (WGVHES), WG on Fishing Technology and Fish (WGFTFB), WG on Fisheries Acoustics and Technology (WGFAST), WG on Integrating Surveys for the Ecosystem Approach (WGISUR), WG on cod and plaice eggs surveys in the North Sea (WGEGGS2), WG on Biological Parameters (WGBIOP), WG on Integrative Physical-biological and Ecosystem Modelling (WGIPEM), WG on Electrical Trawling (WGELECTRA), WG on Integrated Assessments of the North Sea (WGINOSE), Benthos Ecology WG (BEWG), ICES-ICCAT Methods Working Group (MGWG), Working Group on the Ecosystem Effects of Fishing Activities (WGECO), Working Group on Zooplankton Ecology (WGZE), Working Group on Methods for Estimating Discard Survival (WGMEDS), Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT), Workshop on Co-existence and Synergies in

	Marine Spatial Planning (WKCSMP), Workshop on Integration and Visualisation Technology of ICES Data under DIG (WKINVITED), Working Group on Atlantic Fish Larvae and Eggs Surveys (WGALES), Workshop on Egg staging, Fecundity and Atresia in Horse mackerel and Mackerel (WKFATHOM), Workshop for Advancing Sexual Maturity Staging in Fish (WKASMSF), Workshop on mackerel biological quality indicators (WKMACQI), Workshop the development of spatio-temporal models of fishery catch-per-unit-effort data to derive indices of relative abundance and Working Group on Maritime Systems (WGMARS). Resultaten van de bijeenkomsten zullen worden gerapporteerd in de formele werkgroep rapporten, interne Wageningen Marine Research rapporten en wetenschappelijke manuscripten. Resultaten worden verspreid via de ICES website, sessies op de ICES jaarvergadering en symposia.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	100	8.000,-	
CAT III	100.00	1306	130.600,-	
CAT IV	124.00	216	26.784,-	
CAT V	144.00	50	7.200,-	
CAT VI	175.00			
Total Personnel			172.584,-	110.000,- (per year)

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs		
Travel costs	27.250,-	
Project equipment		
Other material costs		
Total Material Costs	27.250,-	40.000,- (per year)
Total project budget needed	199.834,-	150.000,- (per year)
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	199.834,-	150.000,- (per year)

Project 	3. Programme management	
Project leader	Cindy van Damme	
Theme	Programme management	
Expected duration of the project (years)	Continuous	
Continuing project	Yes	
Motivation and Project aims		
Lead		
Problem definition	To manage and develop the KB WOT Fisheries theme.	
Objective(s) of the project	Manage and develop the KB WOT Fisheries programme. Participate in the KB theme System Earth Management (SEM).	
Continuing project: Results from previous years	Each year an excellent programme underpinning, maintaining and developing the WOT Fisheries programme is carried out. Results are published in the KB WOT Fisheries year reports.	
Expertise needed	Background in the WOT Fisheries programme.	
Expertise developed		
Relevance for WOT	The KB WOT programme is essential to maintain and develop expertise to carry out the WOT Fisheries programme.	
Why should this be funded by KB WOT?	Management of the theme is fundamental to an effective and inovative programme.	
What other potential funding sources have been considered?	None	
International objective of research	Maintain Wageningen Marine Research at the centre of fisheries research in Europe and project our skills to arenas beyond the EU.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	To manage and develop the KB WOT Fisheries theme. Reporting on the 2017 programme and a description and rationale for the 2019 programme.	To manage and develop the KB WOT Fisheries theme. Reporting on the previous year programme and a description and rationale for the programme for the coming year.
Activities and time schedule	Q1: Write report on the results of the 2017 programme. Host a minisymposium on 23rd January 2018 were KB WOT projects will present the results from the 2017 programme for Wageningen Marine Research and the Mininistry of LNV. Q3: New call for proposals for the 2019 programme Q4: Establish new programme for 2019 from submitted proposals and write report with the programme description and rationale for 2019.	See 2018.
Output/deliverables	2 reports – reporting on the 2017 programme and a description and rationale for the 2019 programme.	See 2018.
Dissemination of	Through a range of media and 2	See 2018.

findings being addressed	reports – reporting on the 2017 programme and a description and rationale for the 2019 programme. Minisymposium with the findings of the 2017 programme.	
Utility of the developed products and expertise	A review of the functioning of KBWOT fisheries was carried out in 2015. This found that the programme was forward looking, viewed high quality innovative science as important and yet maintained the direction considered important by the Ministry of LNV. Thus the KBWOT programme appears to utilise the expertise available on fisheries and look to the future research needs of society.	See 2018.
What are the potential risks to the project's success?	Potential risks are minimal. Over-commitment of staff is a possibility, but this is a high-priority project and has a higher priority compared to other projects.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Sieto Verver (head CVO), Ingeborg de Boois (deputy head CVO), Rian Schelvis (BAPS and MyProjects), 3 senior scientists from Wageningen Marine Research for independent review of the KB WOT proposals received and Cindy van Damme (KB WOT programme leader).	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	Close links to the KB programme. KB WOT Fisheries functions within the KB theme System Earth Management (SEM).	
Involvement parties outside WUR (names and expertise)	Close links through ICES, the EU STECF, PICES and FAO. Plus a network of marine researchers in institutes and universities across Europe, North America and Australia.	

Relevance	
What is the market/ target audience	Ministry of LNV.
Economical relevance	
Social relevance	
Scientific relevance	To manage and develop the KB WOT Fisheries theme.
Relevance to ministry LNV	The review by LNV found that the programme was forward looking, viewed high quality innovative science as important and yet maintained the direction considered important by LNV. Thus the KB WOT programme appears to utilise the expertise available on fisheries and look to the future research needs of society.
Summary (UK)	This project is specifically to manage and develop the KB WOT Fisheries theme within WUR KB programme. We will report on the 2017 programme carried out and publish a description and rationale for the 2019 programme. The functioning of KB WOT Fisheries was reviewed in 2015. This found that

	the programme was forward looking, viewed high quality innovative science as important and yet maintained the direction considered important by the Ministry of LNV. Thus the KB WOT programme appears to utilise the expertise available on fisheries and look to the future research needs of society.
Samenvatting (NL)	Dit project is er specifiek op gericht om het KB WOT visserij thema binnen WUR KB programma te beheren en te ontwikkelen. In 2018 wordt er gerapporteerd over het programma dat in 2017 is uitgevoerd en wordt er een rapport gepubliceerd met de beschrijving van het programma voor 2019. In 2015 is de functionering van het KB WOT visserij programma geëvalueerd. Deze evaluatie liet zien dat het programma vooruitstrevend was met hoog kwalitatief onderzoek, maar ook de richting had die het ministerie van LNV noodzakelijk achtte. Het KB WOT programma lijkt dus de visserij expertise die beschikbaar en nodig is te leveren en vooruitstrevend te blijven om toekomstige vragen te kunnen beantwoorden.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	240	24.000,-	
CAT IV	124.00	36	4.464,-	
CAT V	144.00	4	576,-	
CAT VI	175.00			
Total Personnel			29.040,-	30.000,- (per year)

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs		
Travel costs	250,-	
Project equipment		
Other material costs		
Total Material Costs	250,-	250,- (per year)
Total project budget needed	29.290,-	30.250,- (per year)
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	29.290,-	30.250,- (per year)

Project	4. From TAC to bottom
Project leader	Niels Hintzen
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1
Continuing project	No
Motivation and Project aims	
Lead	Niels Hintzen
Problem definition	Our main recipients of advice, being the Dutch government and the EU, request for ecosystem advice in addition to the single species advice. ICES scientists however struggle substantially on how to provide this advice and make it operational such that managers can balance trade-offs between ecosystem impact and economic result from fish exploitation. New quantitative methods need to be developed to provide these ecosystem impacts of fishing in one go together with the single species advice. One of these impacts is seafloor impact, caused by bottom trawling and hereby reducing benthic biomass and abundance of long-lived species. Illustrating the trade-off between single species quota and seafloor integrity is one type of ecosystem advice for which the knowledge is available, but a standardized method to perform the underlying calculations is lacking.
Objective(s) of the project	1) Create a standardized method to calculate the change in bottom impact, expressed in terms of biomass & longevity distribution of the benthic community under year-to-year changes in TAC of demersal fish species in the North Sea 2) Show the trade-off between TAC change and seafloor integrity (seafloor integrity is here synonymous for benthic biomass / community and the relative change in biomass & longevity are indicators of seafloor integrity, scaling between 0 and 1 (resp. completely depleted – virgin condition) for the 2017 advice
Continuing project: Results from previous years	No continuation but builds on work done in WGSDF, WKFBI, WKTRADE, EU FP7 BENTHIS
Expertise needed	VMS + Logbook + Benthic impact + ecosystem modelling
Expertise developed	Gaining experience in linking parts of ecosystem advice to single species advice, operationalize and build towards ecosystem advice, understanding the variability in seafloor integrity
Relevance for WOT	WOT supports extensively work that results in either developing the ecosystem approach for fisheries management or single species advice. Linking these two together results in a more coherent WOT programme and provides managers with operationalized ecosystem advice.
Why should this be funded by KB WOT?	Creating the link between the three levels of advice (ecosystem, fisheries and single species) is core to WOT but requires investment in developing tools to do so. Wageningen Marine Research can take a leading role in ICES/EU when this methodology is developed and presented in ICES fora.
What other potential funding sources have been considered?	-
International objective	Wageningen Marine Research can take a leading role in ICES/EU when this

of research	methodology is developed and presented in ICES fora.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	We'll analyse North Sea bottom fisheries distribution and provide a method to predict fleet distribution changes under a TAC change. We evaluate the change in distribution on the benthic community, calculating the change in benthic biomass and longevity distribution of the community, together representing seafloor integrity, and show the trade-offs in terms of gained / lost TAC vs gained / lost seafloor integrity	
Activities and time schedule	1) Analyse fleet distribution in recent 5 years and stability herein, by gear-type and year (Q1) 2) Predict fleet distribution under an increase / decrease in TAC (Q2) 3) Convert fleet distribution to fishing intensity at spatial locations in the North Sea (Q2) 4) Evaluate biomass / longevity change due to increase/decrease in fishing intensity (Q2) and convert this an indicator of seafloor integrity (ranging from 0-1) 5) Calculate change in TAC vs change in biomass / longevity (Q3)	
Output/deliverables	- Generic R-script that links the activities listed above - Presentation showing the trade-offs	
Dissemination of findings being addressed	Presentation at the ministry. Presentation at WGSFD Presentation at ICES WK meeting	
Utility of the developed products and expertise	Allows NLD to produce part of the requested ecosystem advice	
What are the potential risks to the project's success?	Predicting fleet distribution is core to our approach here. Although we benefit from 3 different methodologies we can build upon (fleet dynamics, spatial modelling, mechanistically modelling) results may be questioned and therefore adoption may be delayed	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Niels Hintzen, Jacco van Rijssel, Tobias van Kooten, Jurgen Batsleer, Jan Jaap Poos, Adriaan Rijnsdorp	
Is the appropriate capacity available?	Yes	
Involvement parties	-	

within WUR (names and expertise)	
Involvement parties outside WUR (names and expertise)	-

Relevance	
What is the market/ target audience	Ministry of LNV, Ministry of I&M, EU DG-Mare, stakeholders, NGOs
Economical relevance	The trade-off between ecosystem goals and exploitation goals needs to be founded on best available science. The result of this project should lead to improved understanding and management of the economic and ecological goals.
Social relevance	This project delivers a quantitative links between nature conservation and fisheries exploitation, both topics that are highly relevant in common day society.
Scientific relevance	Showcasing how partitioned science can be combined to provide one set of integrated advice on both fisheries and ecological goals is necessary to advance discussion on how to implement ecosystem advice to fisheries management
Relevance to ministry LNV	WOT supports extensively work that results in either ecosystem advice or single species advice. Linking these two together results in a more coherent WOT programme and provides both the ministry of LNV and ministry of I&M with operationalized ecosystem advice.
Summary (UK)	Providing ecosystem advice is complex as there are many different stressors, one of them being fisheries. Science is available to link fishing effort to bottom impact, hereby establishing a clear link between single species management and an important part of ecosystem management. This project develops the standardized methodology to convert changes in TAC on an annual basis to changes in seafloor integrity. The results can be used by managers and stakeholders to showcase the trade-off between economic and ecological targets.
Samenvatting (NL)	Het voorzien in ecosysteem advies is complex omdat er veel verschillende factoren een rol spelen, waarvan visserij er een is. De kennis is echter paraat om visserij inspanning te vertalen naar bodemimpact, en hiermee de relatie tussen visstand beheer en een belangrijk onderdeel van ecosysteem beheer te leggen. Dit project ontwikkeld de gestandaardiseerde methodologie om jaarlijkse veranderingen in quota te vertalen naar verandering in zeebodemimpact. De resultaten kunnen door beheerders en belanghebbenden gebruikt worden om de afweging tussen economische en ecologische doelen inzichtelijk te maken.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	200	20.000,-	
CAT IV	124.00	50	6.200,-	
CAT V	144.00	20	2.880,-	
CAT VI	175.00			
Total Personnel			29.080,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs		
Project equipment		
Other material costs		
Total Material Costs	0,-	0,-
Total project budget needed	29.080,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	29.080,-	0,-

Project 	5. Quality of nurseries (Wadden Sea, coast and Delta) for marine juvenile fish	
Project leader	Ingrid Tulp (WOT Fisheries project leader – Ingeborg de Booijs)	
Theme	1. Improving and underpinning the WOT Fisheries programme	
Expected duration of the project (years)	1	
Continuing project	No	
Motivation and Project aims		
Lead	WGVHES value coastal habitats for exploited species-TORs	
Problem definition	The coastal areas are considered important nursery areas for a number of commercial fish species. The functioning of the shallow coast and the Wadden Sea for juvenile fish has however changed considerably. While in the past both 0 and 1 group flatfish used the area, nowadays only the 0 group is still present. One of the main determinants of the quality of a nursery habitat is the potential for fish to grow here relatively fast. Fish growth is usually fast in early summer, but during late summer growth is retarded, probably due to food limitation related to density dependence. In 2017 we investigated whether a method based on RNA/DNA analysis is suitable to evaluate growth and condition of fish in different nursery areas along the coast in the middle of the growing season (June). The method proved successful. The variation in growth rates in June along the coast was limited. Therefore we want to apply this successful method to evaluate the growth potential in different nursery areas along the coast and in the Wadden Sea at the time of year when fish growth becomes limited (late summer) and variation in growth will be detectable. This will provide insight into why certain areas have lost part of their function as nurseries.	
Objective(s) of the project	To evaluate why the nursery function of the coastal areas for flatfish is changed. In the standard surveys we only measure densities of fish in nurseries, but not the functioning of the system. Measuring growth provides a direct measure of the habitat quality in our nurseries.	
Continuing project: Results from previous years	This is a follow up of the project under KB-SEM 2017.	
Expertise needed	Genetic analyses, statistical analyses	
Expertise developed	Genetic analyses	
Relevance for WOT	Insight in one of the vital rates (growth) determining the value of coastal habitats for exploited species	
Why should this be funded by KB WOT?	Because this project will build on the understanding of the functioning of nursery areas. For many species this is where the strength of the older year classes of commercial species is determined.	
What other potential funding sources have been considered?	KB-SEM, Ecologisch Gericht Suppleren (EGS)	
International objective of research	This project will fall under the Swimway initiative, a trilateral (Germany, Denmark) umbrella research initiative in which the aim is to underpin management advice with a better knowledge of the functioning of the Wadden Sea for fish	
Work plan	**2018**	**2019 and further**
Broad description of	During the DFS survey individuals of	

the project including expected results	all fish species that are collected for age determination (plaice, dab, sole, flounder, turbot and brill) will be frozen and brought to the lab. Fish will be collected both in the Wadden Sea and in the coastal zone. RNA/DNA ratios will be determined following the protocol that was developed in 2017 using the Qubit kit. Results will be compared across the different locations and related to abiotics such as water depth, temperature, salinity and (if possible) sediment characteristics.	
Activities and time schedule	Spring 2018: hiring a student with the appropriate background. In 2017 we had a choice of students interested in the subject. Aug-Sept: collection of field material Oct-Nov: lab work Dec: writing report A part of the budget will be used to cover lab costs. Hours allocated in the budget are meant for survey preparation and for data analyses/reporting/, no extra hours are needed for on board sampling.	
Output/deliverables	A student report, and if possible a first draft of a manuscript to be submitted to a scientific journal	
Dissemination of findings being addressed	Manuscript and in consultation with the WUR public relations officer, attention on social media and other WUR dissemination channels	
Utility of the developed products and expertise	We profit from the experience gained in the 2017 KB-SEM project and in this project we will further build on expertise in this field where we combine genetics with an ecological question	
What are the potential risks to the project's success?	-not finding a student. In 2017 we were very lucky in finding a very suitable candidate. And there were more interested students -WOD permits will not be a problem, because these are already applied for within the survey frame	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Karen van de Wolfshaar, Ralf van Hal, Loes Bolle	

Is the appropriate capacity available?	We will search for a student with an interest in both genetics and marine ecology. Richard Crooijmans is willing to supervise the student on the genetics part, like he did in 2017
Involvement parties within WUR (names and expertise)	Animal Breeding and Genetics (Richard Crooijmans)
Involvement parties outside WUR (names and expertise)	All parties involved in Swimway Initiative

Relevance	
What is the market/ target audience	Scientific world, Wadden Sea management community
Economical relevance	Functioning of nurseries is important for commercially exploited fish species
Social relevance	The Wadden Sea fish fauna currently receives a lot of attention and people are worried about declining fish. Improved insight into the functioning of the system will directly feed into this discussion.
Scientific relevance	Insight into the functioning of nursery areas may help to understand the change in nursery functions we currently see
Relevance to ministry LNV	LNV has indicated that the Swimway initiative and all related projects is core for their research agenda.
Summary (UK)	Coastal areas (shallow north sea coast and Wadden Sea) are traditionally nursery areas for many commercially exploited fish species. The functioning of these areas has changed greatly. In contrast to the pre 2000 situation, currently only 0 group flatfish use the area and older fish (>1+) migrate further offshore at an earlier stage than they used to. This has resulted in a large reduction in fish using the Wadden Sea. In this project we will use a DNA based method to quantify fish growth in different parts of the nursery areas during the period of year (late summer) when growth is known to become limited. We will relate growth to abiotics and thereby try to understand why the nursery function of the area has changed.
Samenvatting (NL)	Ondiepe kustgebieden zijn van oudsher goede opgroeigebieden voor commercieel beviste vissoorten. Recentelijk is die functie echter sterk veranderd. Vis groeit er nog wel op in het eerste levensjaar maar verlaat het gebied veel eerder dan voorheen. Een van de mogelijke oorzaken hiervoor is dat de mogelijkheden om er goed op te groeien veranderd is. Daarom willen we met een beproefde genetische methode (de verhouding tussen RNA/DNA in spierweefsel, die een indicatie geeft van de instantane groeisnelheid) analyseren hoe snel vissen kunnen groeien in verschillende delen van de opgroeigebieden en hoe dat afhangt van de lokale omstandigheden. Dit willen we doen in een periode waarvan bekend is dat de groeisnelheid beperkt raakt (einde zomer). Daarmee kunnen we achterhalen waarom de kinderkamerfunctie van onze kustgebieden veranderd is en deze kennis kan dan gebruikt worden voor beheer adviezen.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	80	8.000,-	
CAT IV	124.00	80	9.920,-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			17.920,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs	17.500,-	
Travel costs	500,-	
Project equipment		
Other material costs	500,-	
Total Material Costs	18.500,-	0,-
Total project budget needed	36.420,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	36.420,-	0,-

Project 	6. Hotspots	
Project leader	Ingrid Tulp (WOT Fisheries project leader – Ingeborg de Boois)	
Theme	1. Improving and underpinning the WOT Fisheries programme	
Expected duration of the project (years)	1	
Continuing project	No	
Motivation and Project aims		
Lead	WGVHES value coastal habitats for exploited species-TORs	
Problem definition	The fish fauna of our coastal areas and Wadden Sea went through great changes in the past decades. In our coastal survey we collect information on fish densities. However, we have very little insight in what determines local variation in fish densities. Knowledge on changes in distributions observed during fieldwork is lost during the reporting of survey findings in which observations within subareas are often pooled. For fish the geographical position (close to fresh water, tidal flats or the North Sea, in a deep or shallower gully) may be as important as local abiotic conditions (temperature, sediment characteristics).	
Objective(s) of the project	To get better insight into local use of fish in shallow coastal areas	
Continuing project: Results from previous years	NA	
Expertise needed	Analytical skills	
Expertise developed	Better insight into geographical use of the area and possible changes thereof	
Relevance for WOT	The DFS survey provides an ideal data set to study shifts of fish distributions. The relevance for WOT is that we will gain insight in one of characteristics (distribution of fish in relation to abiotics and physical location) determining the value of coastal habitats for exploited species	
Why should this be funded by KB WOT?	Because this project will add to the understanding of the functioning of the Wadden Sea and coastal areas.	
What other potential funding sources have been considered?	none	
International objective of research	This project will fall within the framework of the Swimway initiative, a trilateral (with Germany, Denmark) umbrella research initiative in which the aim is to underpin management advice with a better knowledge of the functioning of the Wadden Sea for fish.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	We aim to gain a better understanding of annual differences in area use. Do certain species have preferred sites and are these constant over years? And if so, can we find an explanation why certain areas are preferred more than others? And if not, or if local hotspots have changed over the years, can we pinpoint driving forces	

	for these changes? We think this project will result in a better description of the area used by fish and will result in identification of potential causes for observed changes	
Activities and time schedule	Jan-March: data exploration: selection of study species. We can profit from several map visualisation tools have already been developed April-July: data analysis of selected species August-Oct: writing up	
Output/deliverables	Manuscript to be submitted to peer-reviewed scientific journal	
Dissemination of findings being addressed	Manuscript and in consultation with the WUR public relations officer, attention on social media and other WUR dissemination channels	
Utility of the developed products and expertise	A better understanding of the system through inclusion of spatial and habitat related processes.	
What are the potential risks to the project's success?	We will only use data that is already collected. This is a very low-risk project, because we do not depend on data collection or external parties	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Karen van de Wolfshaar, Loes Bolle	
Is the appropriate capacity available?	Yes, analytical skills	
Involvement parties within WUR (names and expertise)	none	
Involvement parties outside WUR (names and expertise)	All parties involved in Swimway Initiative	

Relevance	
What is the market/ target audience	Scientific world, Wadden Sea management community, ICES
Economical relevance	Functioning of the coastal areas is important for several commercially exploited fish species
Social relevance	The Wadden Sea fish fauna currently receives a lot of attention and people are worried about declining fish. Improved insight into the functioning of the system will directly feed into this discussion.
Scientific relevance	A contribution to the understanding of fish use of coastal areas.
Relevance to ministry	LNV has indicated that the Swimway initiative and all related projects is core

LNV	for their research agenda. We will capitalise the currently still underused data potential stored in our survey data to investigate the importance of geographic locations
Summary (UK)	The use of coastal areas, including the Wadden Sea, by fish species previously found in high numbers has declined strongly. Despite availability of spatial data through the DFS survey from the 1970s onwards, spatial analysis on habitat use has never been conducted. In this project we will explore the development in coastal nursery habitat use on a tidal basin level over time to investigate where the largest changes have taken place. Are there specific hotspots, are these constant in time and what makes these hotspots attractive?
Samenvatting (NL)	Het gebruik van gebieden als de Waddenzee en de kustzone, traditioneel gebieden waar veel vissoorten opgroeiden, is sterk afgenomen. Alhoewel we de beschikking hebben over de DFS survey waarin al sinds 1970 de verspreiding van vis wordt vastgelegd in een hoge ruimtelijke resolutie, zijn die data nooit op een ruimtelijke manier geanalyseerd. We willen de ontwikkeling van het gebruik van de kinderkamers analyseren in de tijd, waarbij duidelijk wordt of en in welke gebieden de grootste veranderingen hebben plaatsgevonden. Zijn er specifieke hotspots en zijn die constant in de tijd en waardoor worden dergelijke hotspots veroorzaakt?

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	160	16.000,-	
CAT IV	124.00	160	19.840,-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			35.840,-	0,-

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs		
Travel costs		
Project equipment		
Other material costs		
Total Material Costs	0,-	0,-
Total project budget needed	35.840,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	35.840,-	0,-

Project	7. Improving herring larvae surveys indices (HERLARS)
Project leader	Cindy van Damme (WOT Fisheries project leader - Ingeborg de Boois)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	2-3
Continuing project	Yes (year 2)
Motivation and Project aims	
Lead	ICES WKHERLARS
Problem definition	Recruitment is one of the main drivers of fish stock dynamics. Getting a correct perception of recruitment is therefore essential for fisheries management. Estimating recruitment too low will result in the loss of fishing opportunities (and distorted relationship between managers, stakeholders and science), estimating recruitment too high will result in overfishing. Recruitment strength is also one of the most difficult parts in fish stock dynamics to estimate, even if dedicated surveys are in place to sample larvae or juveniles. Even so for North Sea herring where two dedicated surveys (IHLS and IBTS-MIK) target herring larvae to improve the knowledge on the recruitment strength. But the information that is extracted from it is only of limited value to the stock assessment. This because the samples collected do not cover the entire herring stock, but only the autumn spawning part of it (IBTS-MIK), and show a lack in coverage of the spawning components (i.e. only part of the spawning season is covered during the IHLS for all components). There is an urgent need to improve on this aspect to justify the survey effort and improve on estimating recruitment strength in the assessment that leads to TAC advice. Although the science to support this topic is scattered, it is available (mostly) in-house and requires a relatively small effort to make it operational.
Objective(s) of the project	The study has 5 objectives 1. Predict, on a yearly basis, the area where autumn spawned herring larvae can be found during the timing of the IBTS-MIK survey (hereby providing a flexible boundary to exclude the English channel (Down's) herring larvae that cannot be sampled appropriately [Down's larvae are too small at the timing of the IBTS-MIK survey to provide information for a recruitment index], but does add noise to the current practice in generating the MIK recruitment index used in the assessment) 2. Predict the area where Down's larvae may appear as late larvae (indicator of recruitment) in the southern North Sea along the coastline 3. Estimating the impact of reducing the survey effort in the IHLS survey on the assessment outcomes (anticipating a displacement of IHLS survey effort to a Down's recruitment survey) 4. Trial a survey dedicated to monitor Down's recruits 5. Evaluate usability of small IBTS-MIK larvae (currently unused) as a supplement to the IHLS survey data to improve the newly hatched survey time-series The linkage and need for these objectives is provided below in the work plan

Continuing project: Results from previous years	In 2017 the project focused on objectives 1, 2, 3 and 5. 1. Through larval distribution modelling geographical boundaries of newly hatched Down's larvae, by year for the years 2003-2011, can be set to improve the calculation of the MIK-index in January-February. 2. Geographical boundaries by year on the distribution area of larger Down's larvae for the years 2003-2011. From December till June for each year distribution of Downs's larvae by length is modelled for the Southern North Sea. 3. The SSB deviation and /or bias under reduced survey effort has led to decision that the IHLS survey effort in the English Channel can be reduced with one survey in favour of developing recruitment survey for Down's herring. 5. The newly hatched Down's larvae in the IBTS-MIK samples are in the same development stage as the ones sampled during the IHLS survey. With the information from the 2014 KB WOT HERCATCH project where the catchability of the different gears was compared, it was possible to complement the IHLS index with the newly hatched IBTS-MIK larvae. This dataset will be presented at that data collection workshop for the North Sea herring benchmark, to be incorporated in the herring assessment.	
Expertise needed	Larval distribution modelling, ichthyoplankton monitoring experience, larval identification experience, stock assessment experience	
Expertise developed	Larval distribution modelling, expanding knowledge in stock assessment modelling	
Relevance for WOT	Participation in the IHLS and IBTS surveys is an integral part of the WOT programme, as is the core role as stock assessors for North Sea herring. Evaluating efficiency and accuracy of the surveys and the way the data is used in the assessment is core to the execution of the program and effectiveness of the programme to support the ministry.	
Why should this be funded by KB WOT?	It builds up knowledge on how to best use the newest techniques and survey sampling designs to provide good quality recruitment indicators for fish stocks, applicable to the entire WOT programme. The science is available but needs to be brought together and tested in a comprehensive way, to see whether it is robust against the demands of fisheries management. The objectives exceed the activities of the WOT programme but are in such a developed stage that it can be put into practice in the short run.	
What other potential funding sources have been considered?	None	
International objective of research	To improve the international activity on monitoring herring larvae and improve the way larval survey data are being used in stock assessments. The programme is part of on-going work within ICES related to the larval surveys and identification, IBTS-MIK survey and benchmark of North Sea herring. It therefore has a strong EU character and other scientists, on their own funding source, will contribute.	
Work plan	**2018**	**2019 and further**
Broad description of the project including	The project links all research levels from environmental drivers, to	4) Trial a survey for Down's recruits in spring 2019 (currently missing

expected results	survey observations to stock assessment and advice to improve our understanding of recruitment strength. In 2018 the focus will be on objective 4 of the project. 4) Trial a survey for Down's recruits in spring 2018 (currently missing from all datasets). The planning of this survey is based on the distribution area (and variability herein) provided by the larval distribution modelling carried out in 2017. In cooperation with international herring larvae survey experts the gear and sampling method will be decided upon. The survey will last for one week in het 2nd half of April and is a replacement of the IHLS survey in January. Expected results: **new recruitment index representative of the entire North Sea herring stock**	from all datasets). The new recruitment survey needs to be carried out at least in two consecutive years, to be able to test the usability and year-be-year variation in a Down's recruitment index. Expected results: **new recruitment index representative of the entire North Sea herring stock**
Activities and time schedule	4) Running survey in Q2, analysing data in Q2-3, evaluating results in Q4	4) Running survey in Q2, analysing data in Q2-3, evaluating results in Q4
Output/deliverables	See 'broad description' in bold	
Dissemination of findings being addressed	To the herring assessment working group (HAWG) and various ICES ichthyoplankton survey expert groups (WGEGGS2, WGALES). Survey report and Wageningen Marine Research and CVO website.	
Utility of the developed products and expertise	Understanding of recruitment – assessment – environment interactions is core to continue to use these surveys for fisheries management. Products will be incorporated directly into the herring assessment. Expertise developed is essential to have in-house.	
What are the potential risks to the project's success?	Bad weather might prevent the survey from being carried out. The proposed gear to be used for sampling will be very similar to the mid-water ring trawl used for the IBTS-MIK survey. Wageningen Marine Research scientists and Tridens crew have long-lasting experience with this gear, including sampling in bad weather circumstances.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Cindy van Damme (larval surveys, larvae ID), Ineke Pennock (larvae ID) and Ewout Blom (larvae ID) and Niels Hintzen (stock assessment)	

Is the appropriate capacity available?	Yes
Involvement parties within WUR (names and expertise)	None
Involvement parties outside WUR (names and expertise)	Richard Nash (IMR, Norway) and Matthias Kloppmann (Thünen, Germany)

Relevance	
What is the market/ target audience	Audience is managers (for efficient WOT programme and effective management), industry (for higher reliability on predicted fisheries opportunities), NGOs (for more effective management being at target) and science (to illustrate how larval survey data can be used in assessments), in the order of importance.
Economical relevance	Attaining MSY on a more frequent basis with less variability. More efficient use of resources spend.
Social relevance	Increase in trust in science as key player in fisheries management.
Scientific relevance	Improved understanding on how variability in larvae distribution can be treated more scientifically robust for assessment purposes.
Relevance to ministry LNV	Less variable advice (higher prediction – confirmation rate) results in attaining MSY and related Fmsy at a more frequent basis. More effective use of resources spend in the WOT programme.
Summary (UK)	Recruitment is the main driver of fish stock dynamics. It is also one of the more difficult parameters in biology to get a good grip on. Within the North Sea, two surveys are on-going that sample herring larvae and can be used to generate a proxy of recruitment. Improvements to the way the data that is collected is used for assessment purposes is however necessary. We propose a combination of larval distribution modelling, using formerly unused data in existing time-series to improve accuracy and simulation modelling to test if the changes have a positive effect on the efficacy of fisheries management
Samenvatting (NL)	De geboorte en opgroeien van jonge vis (jonge aanwas) is één van de voornaamste drivers van vispopulatiedynamica. Het is tegelijkertijd ook één van de lastigste biologische processen om een goed beeld van te krijgen. In de Noordzee zijn er twee monitoringsprogramma's actief om haringlarven te bemonsteren om zo een beeld te krijgen van de jonge aanwas. Echter zijn er verbeteringen nodig in de methodiek die gebruikt wordt om deze bemonstering om te zetten in een schatting van jonge aanwas. In dit project stellen we, om dat doel te bereiken, een aantal activiteiten voor, te weten: modelleren van de verspreiding van larven, het gebruik van tot nu toe ongebruikte larve gegevens om tijdseries over larven-aantallen te verbeteren en het gebruik van simulatiemodellen om te evalueren hoe bovenstaande punten het beheer ten positieve verbeteren.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	256	25.600,-	
CAT IV	124.00	116	9.280,-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			34.880,-	25.000,-

Material costs	2018		2019 and further
Facilities			
Specific costs			
Travel costs			
Project equipment	New gear	9000,-	
Other material costs			
Total Material Costs		9000,-	1.000,-
Total project budget needed		42.880,-	26.000,-
Financing through other resources -/-		0,-	0,-
Finance needed from KBWOT		42.880,-	26.000,-

Project	8. Ecosystem acoustics
Project leader	Benoit Berges (WOT Fisheries project leader - Ingeborg de Boois)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	3
Continuing project	Yes (This proposal is for year 2)
Motivation and Project aims	
Lead	Ecosystem acoustics
Problem definition	Active acoustic monitoring methods during WOT surveys are an important source of information for: (1) standard stock assessment; (2) monitoring purposes of the state of the wider ecosystem. With respect to these two aspects, this project will tackle the following problems: • The EK80 echosounder in Continuous Wave (CW) mode (i.e. narrowband) is due to replace the historical EK60 echosounder for acoustic surveys. This is because the EK60 echosounder is no longer produced and supported by Simrad. However, several studies and Wageningen Marine Research investigations showed inconsistency of the system during calibration and survey operation. • Species identification of observed fish during surveys is important for delivering accurate input for biomass calculations (input to stock assessments). The scrutinizing of acoustic traces often rely upon a combination of biological sampling and subjective interpretation of acoustic signatures and school morphology. However, single beam echosounders used during surveys are only capable of producing school shapes in two dimension (2D). Based on this type of acosutic reccords, the scritinising exercise is difficult when the acoustic signatures are similar. In that context, Multi-Beam fisheries EchoSounders (MBES) are able to provide school shapes in 3D and have potential to overcome this limitation. Furthermore, when combined with video recordings carried out during the trawl hauls, species identification can be further improved. Despite promising results of the previous experimental work on these two methods, they have not been fully developped and implemented as a standard methodology yet. The overarching question here is how these MBES and video recognition methods can be incorporated into standard postprocessing procedures.
Objective(s) of the project	In the project, the following objectives will be pursued: (A) Investigate performances of the EK80 echosounder in Continuous Wave (CW) mode: 1. Comparison EK60\EK80 CW 2. Quality assessment of EK80 CW calibration results (B) Further develop the use of the ME70 multi-beam echosounder for 3D fish school imaging. Develop workflow for ease of use during acoustic surveys to aid scrutinizing exercise. Investigate shape, size and position of ground thruthed (i.e. around trawl operations) fish schools imaged with the ME70 MBES in comparison to single beam echosounders (i.e. 2D imaging). (C) Further develop collection and automatic processing of video data during

	trawling operations. In turn this processed data could be compared with trawl samples and aid scrutinizing.	
Continuing project: Results from previous years	During 2017, the following was conducted (see KBWOT ecosystem acoustics report for further details): • Software improvement for 3D fish school imaging using the ME70 • Software improvement for trawl camera image processing	
Expertise needed	Acoustic data processing, acoustic scattering theory, data analysis, algorithm development, electromechanical engineering.	
Expertise developed	Automatic image processing, multibeam echosounder processing.	
Relevance for WOT	Monitoring of the pelagic ecosystem is a key component of the statutory tasks (WOT) to deliver data underpinning policy drivers such as MSFD and CFP. The continuing project this year aims to: (1) further develop ecosystem monitoring techniques; (2) investigate the potential use of the EK80 CW echosounder for acoustic surveys.	
Why should this be funded by KB WOT?	Given the clear relevance to WOT (see above), KBWOT is the most obvious funding instrument for this programme underpinning project activities and to make use of new capabilities available on the national research vessel (Tridens).	
What other potential funding sources have been considered?	None	
International objective of research	To maintain and raise the level of excellence at Wageningen Marine Research in the field of ecosystem monitoring (with a strong emphasis on active acoustics) at an international level.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	*(A)/1. EK80 CW investigation:* The historical EK60 single beam echosounder is no longer manufactured by its manufacturer Simrad and is expected to be replaced by the EK80 in the future. However, while the EK60 system has been used for years, only few studies investigated the performances of the EK80 CW during routine tasks. Here, this will be studied through 2 components: i. EK60/EK80 CW: Direct comparison of EK60 and EK80 CW data. This will use data collected ping to ping during HERAS 2018. ii. EK80 CW calibration: Discrepancies were recently found in the calibration of the EK80 CW. One will investigate this through the analysis of raw calibration data. *(A)/2. ME70 fisheries mode:* Further develop software for ME70 water column data processing. Develop workflows for the extraction	*(A)/2. ME70 fisheries mode:* Run analysis, comparing single beam echosounders (EK60 or EK80 CW) data to ME70 data. This would allow one to: (1) see the miss from single beams compared to multi-beam; (2) perform species identification. Publication of results *(A)/3. Net camera processing:* Algorithm improvement.

	of fish school descriptors. *(A)/3. trawl camera processing:* Develop image processing algorithms for: (1) detection of individual fish; (2) identification of fish species (machine learning) if resolution allows. Previous iteration of this project's component made of use of data collected using a custom made camera system (GoPro cameras). One aims to use the Simrad FX80 on board R/V Tridens if testing is successful.	
Activities and time schedule	*Q2:* algorithm development for ME70 water column data. *Q3/Q4:* algorithm development for image processing of trawl camera data. Analysis of EK80 CW data (calibration and comparison with EK60 data).	
Output/deliverables	Report with collocation of results and development description from different tasks. More specifically: *(A)/1. EK80 CW investigation:* Workflow and software for EK80 CW calibration analysis. Results from EK80 CW/EK60 comparison. Results from EK80 CW calibration investigation. *(A)/2. ME70 fisheries mode:* Manual for ME70 school features extraction software. *(A)/3. Net camera processing:* Software for further developed algorithm. Description of developments.	Generally: • Advanced ecosystem characterisation from multiple advanced acoustic sensors and technologies (broadband, multifrequency, multibeam, sonar, Didson). • Integrated methodology to extend existing routine WOT surveys with sampling of pelagic fish by means of acoustics and shallow water trawling. • Streamlined data pathways and dissemination
Dissemination of findings being addressed	Presentation and networking at ICES WG and at bioacoustics day where potential stakeholders are present. Peer-reviewed papers.	
Utility of the developed products and expertise	(A) Developed methods will be used during pelagic WOT ecosystem surveys and potential future projects (e.g. WOZEP). They will help attracting potential external project and allow Wageningen Marine Research to improve its ecosystem monitoring capability.	
What are the potential	Electrical engineering expertise and knowledge about working with new	

risks to the project's success?	acoustic technology on R/V Tridens is now only available in two people (D. de Haan, D. Burggraaf). The fixing of the FX80 camera system on board R/V Tridens is key to task (A)/4. And it is in currently in discussion. If not fixed, one will rely on custom made system (i.e. GoPro camera system).
Project organisation	
Involvement Wageningen Marine Research (names and expertise)	Benoit Berges (underwater acoustics, data processing), Serdar Sakinan (fisheries acoustics, data processing), Bram Couperus (fisheries acoustics, data processing), Dirk Burggraaf (electrical engineering), Dick de Haan (acoustics), Daniel Benden (software).
Is the appropriate capacity available?	Yes
Involvement parties within WUR (names and expertise)	None
Involvement parties outside WUR (names and expertise)	IFREMER (multibeam acoustics), Leiden University (Bioacoustics Day), partners from DISCLOSE projects (Delft University, Groningen University).

Relevance	
What is the market/ target audience	Ecosystem monitoring scientists, Fisheries scientists/industry, behavioral ecologists (fish) and broader marine ecology and biological oceanography.
Economical relevance	hydroacoustics is becoming increasingly relevant as one of the primary tools for integrated ecosystem monitoring to aid management.
Social relevance	monitoring to guarantee GES and sustainable resource exploitation (MSFD, CFP)
Scientific relevance	acoustic methods are vital for ecosystem monitoring. Combined acoustic and auxilliary sampling techniques will improve our understanding of the marine ecosystem and make interpretations more efficient.
Relevance to ministry LNV	guarantee quality of pelagic monitoring work (WOT, DCF)
Summary (UK)	Ecosystem Acoustics is a multiannual project to strategically improve and develop integrated acoustic ecosystem monitoring capabilities at Wageningen Marine Research. First, following concerns for the accuracy of future acoustic survey operations, the consistency of the EK80 echosounder CW mode is investigated during calibration and through direct comparison with the EK60 echosounder. Second, processing methods for MBES are developped in order to derive improved fish school morphological descriptors. Last, image processing of video reccording during trawling operations is developped.
Samenvatting (NL)	Ecosystem Acoustics is een meerjarig project met het doel om de voor Wageningen Marine Research beschikbare geïntegreerde akoestische (echo- en sonar) technieken voor de WOT te verbeteren. In de eerste plaats wordt de consistentie van het nieuwe EK80 echolood onderzocht tijdens de kalibratie en door middel van vergelijking met de huidige EK60. In de tweede plaats worden analysemethoden voor de Multi Beam Echosounder (MBES) ontwikkeld met als doel een verbeterde herkenning en beschrijving van visscholen. In de derde plaats wordt de technieken van visherkenning door middel van video-opnames tijdens het vissen verbeterd.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	(A)/3. Video data processing (100)	8.000,-	
CAT III	100.00	(A)/1./i. EK60/EK80 comparison (80) (A)/1./ii. EK80 calibration (40) (A)/2. ME70 processing (120)	8.000,- 4.000,- 12.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			32.000,-	35.000,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs		
Project equipment		
Other material costs		
Total Material Costs	0,-	0,-
Total project budget needed	32.000,-	35.000,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	32.000,-	35.000,-

Project	9. Utilising hidden information from WOT ichthyoplankton surveys
Project leader	Cindy van Damme (WOT Fisheries project leader - Ingeborg de Boois)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1
Continuing project	No
Motivation and Project aims	
Lead	ICES HERLARS, WKSAND, WGEGGS2 and WGNSSK
Problem definition	The future in monitoring is conducting ecosystem surveys. The IBTS-MIK and IHLS surveys are carried out in winter, when many winter spawning fish species are reproducing. Herring is the target species for these surveys and up to now only the data on herring is utilised by ICES. The same samples also contain information on spawning and/or recruitment for important commercial species such as sandeel, lemon sole and eel and many other species. In addition the IBTS-MIK is an excellent platform, filtering a high volume of water and sampling the whole water column, to collect data on floating marine litter (particles of 500 µm and larger), which is a gap in OSPAR litter indicators. Sandeels are species with a restricted migration and fisheries occurs in restricted areas. The assessment therefor should ideally be carried out for the different spawning grounds separately. The IHLS winter and IBTS-MIK surveys are carried out at the time of hatching of sandeels and can therefor provide information on sandeel spawning stock biomass (SSB) per spawning area. The MIK-net itself is too large to accurately sample newly hatched sandeel larvae, but the attached MIKeyM net (mesh 335 µm) and Gulf VII (mesh 280 µm) used in the IHLS are ideal. Results of the sandeel larvae distribution were presented at the sandeel benchmark (WKSAND) and this information was seen as highly import for the sandeel assessment. A formal request to collect the sandeel larvae data on a regular basis is put forward by WKSAND and WKHERLARS. Lemon sole is currently treated in the assessment as a data limited stock (category 3 species). The plankton surveys are carried out when lemon sole larvae have reached the metamorphosis stage. This means that high early life mortality has already occurred, therefor this data on the lemon sole larvae can provide information on future recruitment to the adult stock. Whereas currently assumptions based on simulated data are used in the forecast for the lemon sole advice. Lemon sole is due to be benchmarked in 2018. WGNSSK wants to invest in the use of lemon sole larvae data in the advice at the benchmark.
Objective(s) of the project	The main objective is to make better use of ichthyoplankton samples already collected, making better use of expensive ship-time, delivering information on the ecosystem. More specifically the study has 3 sub-objectives 1. Provide data on newly hatched sandeel larvae for SSB indices per spawning ground. 2. Provide data on lemon sole larvae to be used in a forecasting recruitment index. 3. Provide information on marine litter in the water column in the

	North Sea. IHLS, IBTS-MIK and MIKeyM samples have been collected in the recent years and will be collected in the coming years. These samples will be sorted for the other larvae and marine litter. Larvae will be identified to species, counted and measured. There will be no extra effort needed on the sampling part. Plankton samples from IBTS-MIK and IHLS are already carefully sorted to collect the target species, the clupeoids, therefor the collection of other larvae and litter from these samples is expected to cost limited extra time. MIKeyM samples have been collected but still need to be sorted. Identification, counting and measuring of the other larvae will require extra time compared to the standard plankton survey work.	
Continuing project: Results from previous years	NA	
Expertise needed	Ichthyoplankton surveys, larval identification experience, marine litter identification experience.	
Expertise developed	Larval distributions and spawning of winter spawning fish species, other than the target species herring. Sandeel SSB per spawning ground and lemon sole recruitment. Marine litter in the water column.	
Relevance for WOT	Sandeel and lemon sole are important commercial species. The extra information gained from the ichthyoplankton surveys can aid to provide a better assessment of these species. Marine litter is an MSFD indicator, not directly relevant for the WOT. However, as floating litter is a gap in current list of OSPAR indicator, there is a likely possibility of getting additional funding for sorting the samples from other sources than the WOT.	
Why should this be funded by KB WOT?	Good SSB and recruitment indicators are vital for a reliable assessment and providing advice for management of stocks. The proposed project provides data for SSB and recruitment indices on species which currently lack data provision. These data are collected from samplings which are already carried out in the WOT Fisheries programme and with little extra effort the hidden data of these surveys can provide information on other than the target species as well. The objectives of this project go beyond the activities of the WOT programme but they can be made operational quickly.	
What other potential funding sources have been considered?	Rijkswaterstaat has proposed the work on marine litter from the plankton samples in the OSPAR ICGML-group, for international acceptance.	
International objective of research	To improve stock assessments for species which have limited data available and where assumptions are made on recruitment. The project is part of internationally coordinated ICES surveys and stock assessments and other scientists will provide added value and funding. Without the Dutch data on these species, the international effort on this will be of low values, as the Dutch data is vital for creating indices.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	IHLS, MIK and MIKeyM samples have been collected on a yearly basis and will continued to be collected. IHLS and MIK samples are already sorted for fish larvae, with	

	the other species kept separate from the clupeoids (target species) and the remainder of the plankton. MIKeyM samples have been collected since 2014 and fish eggs were collected and sorted in 2014 but all samples still need to be sorted for fish larvae. All larvae other than the target species will need to be identified, counted and measured. A dataset in the ICES ichthyoplankton database format will be made available for the various assessment and benchmark groups. The data will also be made publicly available through the ICES ichthyoplankton database. Marine litter will be collected when samples are sorted for fish larvae and data will be provided to the ICES litter database.	
Activities and time schedule	Q1 and 4: Collect IHLS, IBTS-MIK and MIKeyM samples in the standard WOT Fisheries surveys. Q1 and 2: Analyse IHLS, MIK and MIKeyM samples from the past years up (2014-2017) for fish larvae Q3: provide dataset for the assessment and benchmark groups. And the litter data for ICGML. Q4: provide dataset for the ICES ichthyoplankton database through the survey coordinators.	
Output/deliverables	Dataset in ICES ichthyoplankton database format with fish larvae data for other species than clupeoids. Numbers of newly hatched sandeel larvae on the spawning grounds for SSB estimation. Numbers and distribution of metamorphosing lemon sole larvae for recruitment forecasting. Dataset with marine litter.	
Dissemination of findings being addressed	Presented at various ICES groups (WGEGGS2, WGALES, WGNSSK, and IBTSWG), a report, and if time is available: a draft manuscript with international partners.	
Utility of the developed products and expertise	Understanding of reproduction, spawning and recruitment is	

	essential for reliable assessment and advice in fisheries management. Data will be used in the benchmark for lemon sole in 2018 and in the assessment of sandeel.	
What are the potential risks to the project's success?	Samples have been collected and will be collected through the standard WOT ichthyoplankton surveys. Therefor risks are minimal. Limited expertise is available for identifying the other fish larvae. Effort, within this project, is placed on getting more persons with this expertise, this will also aid the regular WOT ichthyoplankton surveys.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Cindy van Damme (ichthyoplankton surveys and larvae identification), Ineke Pennock (analyses of plankton samples and larvae identification) and Ewout Blom (analyses of plankton samples), Ralf van Hal (IBTS-MIK) and Ruben Verkempynck (WGNSSK)	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	None	
Involvement parties outside WUR (names and expertise)	Richard Nash (IMR, Norway), Matthias Kloppmann and Norbert Rohlf (Thünen, Germany), Christophe Loots (IFREMER), Bastian Huwer (DTU-Aqua) and Coby Needle (MSS, Scotland)	

Relevance	
What is the market/ target audience	The target audience are fisheries managers and ministry of LNV (utilising hidden data from WOT Fisheries standard surveys for improving assessment and advice), fisheries (for providing extra information for a more reliable assessment of commercial stocks with limited data input) and science (showing the use of hidden data in standard ichthyoplankton surveys in assessment for other species). Furthermore, Rijkswaterstaat and OSPAR filling a gap in their Marine Litter indicators.
Economical relevance	At relative low extra cost WOT Fisheries standard ichthyoplankton surveys can also provide information for the assessment of commercial important species (other than the target species).
Social relevance	The data of this project will improve the assessment of commercial species which have currently limited data available the social relevance lies in the improved advice of these stocks and probably improved trust of the fishing industry in the management of these stocks.
Scientific relevance	This project will show how extra data gained from standard surveys on other than the target species can be utilised to add in the assessment and management of non-target commercial species.
Relevance to ministry LNV	At relative low cost hidden information in standard ichthyoplankton surveys carried out under the WOT Fisheries programme can by utilised to improve the assessment of commercial species with limited data available, other than the target species (herring).
Summary (UK)	In winter many (commercial) fish species are reproducing and spawning. The IBTS-MIK and IHLS surveys are carried out in winter, targeting one of these spawners, herring. Up to now only the data on herring is utilised, but

	these surveys can also provide data on spawning and/or recruitment for important commercial species such as sandeel, lemon sole and many other species. From these standard WOT ichthyoplankton surveys data on newly hatched sandeel larvae on the various spawning grounds will be utilised to provide an SSB index for sandeel per spawning area. Also large metamorphosing lemon sole larvae are caught. These larvae have passed the high variable mortality stages and therefor represent an index of future recruitment to the lemon sole adult stock. Utilising these hidden data in the ichthyoplankton surveys will improve the assessment and management of these commercial stocks. In addition the IBTS-MIK sampling is also an excellent platform to provide data on the MSFD descriptor marine litter. The MIK-net filters a high volume of water and as one of the few gears it samples the whole water column.
Samenvatting (NL)	Veel (commerciële) vissoorten planten zich voort in de winter. De IBTS-MIK en IHLS surveys worden uitgevoerd in de winter en zijn gericht op een van die winterpaaiers, haring. Tot nu toe wordt er van deze surveys alleen de data van haring gebruikt. Maar deze surveys kunnen ook data leveren over paaien en/of recruitment voor andere commerciële soorten zoals zandspiering, tongschar en veel andere soorten. In dit project worden de gegevens van net uitgekomen zandspiering larven verzameld op de verschillende paaigronden, om gebruikt te als een SSB index voor zandspiering. Daarnaast worden gegevens van gemetamorfoseerde tongschar larven verzameld. Deze larven hebben de ontwikkelingsstadia met hoge mortaliteit overleefd en leveren dus een index voor recruitment van tongschar. Gebruik van deze tot nu toe verborgen data in de ichthyoplankton surveys zal het assessment en management van deze commerciële visstocks verbeteren. Tot slot is de IBTS-MIK survey een ideale bemonstering om data te leveren voor de MSFD descriptor marine afval. Het MIK-net filtert een groot volume water en is een van de weinige tuigen welke de gehele waterkolom bemonsterd in een trek.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	250	20.000,-	
CAT III	100.00	100	10.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			30.000,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs		
Project equipment		
Other material costs	1000,-	
Total Material Costs	1000,-	0,-
Total project budget needed	31.000,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	31.000,-	0,-

Project	10. Remote Sensing of Intertidal Musselbeds	
Project leader	Karin Troost	
Theme	1. Improving and underpinning the WOT Fisheries programme	
Expected duration of the project (years)	2	
Continuing project	Yes (year 2 of 2)	
Motivation and Project aims		
Lead	Innovative Survey Techniques: Development and Implementation	
Problem definition	The distribution of bivalve shellfish is typically highly clustered. In order to save shipping time it is therefore necessary to focus field work on the actual beds. Epifaunal beds in the intertidal (e.g. musselbeds) are visible by eye, but epifaunal beds in the subtidal are not, and beds of infaunal species are even more difficult to locate. Because field work on bivalve shellfish beds is highly time consuming, there is a high potential for improvements in efficiency by using innovative remote sensing techniques such as satellite images, UAV ('drone') images, side scan and multibeam sonar and underwater video/photography.	
Objective(s) of the project	To test, develop and implement remote sensing techniques in the regular WOT stock assessment programme for shellfish.	
Continuing project: Results from previous years	In 2016 promising results were obtained from analyses of satellite and UAV images. In 2017 more images and field reference data were obtained and analysed. Analysis and writing of the report is currently still in progress. We already conclude that UAV is currently not suitable enough for the WOT shellfish surveys and this part will therefore not be continued in 2018. The satellite part needs further development and implementation in the survey.	
Expertise needed	Analysis of satellite images (multispectral, hyperspectral, LiDAR, and thermal), shellfish bed dynamics and mapping.	
Expertise developed	Analysis and application of remote sensing in stock assessment and potentially in other projects within Wageningen Marine Research.	
Relevance for WOT	There is a high potential for remote sensing to increase the efficiency of field work by improving the localization and mapping of shellfish beds and their composition. This may eventually result in less time needed to locate the beds and/or a higher precision of the stock estimate through an improved stratification of the sampling grid.	
Why should this be funded by KB WOT?	Because of the high relevance for WOT as stated above.	
What other potential funding sources have been considered?	None, since the project is specifically designed to improve the WOT shellfish stock assessments.	
International objective of research	For Wageningen Marine Research to not lag behind in applying innovative techniques. Techniques developed may be used in other countries (e.g. mussel bed research by Germany and Denmark).	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	In 2018 the work done in 2017 will be continued. Additional reference information is collected within the WOT survey and used to improve the satellite maps. Training of	

	Wageningen Marine Research staff by WEnR is continued and finalized. The expected result is a fully in WOT implemented remote sensing tool to localize intertidal beds of mussels and oysters (and potentially also sandmason worms (*Lanice conchilega*) that are presently entirely missed in all surveys but ecologically important).	
Activities and time schedule	Implement map made in 2017 in the survey of 2018. Collect reference information during WOT field survey in April-May. Analysis of these data and training of Wageningen Marine Research by WEnR in July-September. Reporting in November-December.	
Output/deliverables	Addendum to the full report written in 2017 in the form of a management summary.	
Dissemination of findings being addressed	The management summary will be written in English and shared on the CVO website. Results and implications for WOT are discussed with CVO and LNV.	
Utility of the developed products and expertise	Implementation of satellite imagery as a tool in WOT and expertise in Wageningen Marine Research.	
What are the potential risks to the project's success?	Continuous cloud cover during low tide hampers good acquisition of optical data. There may be no suitable images for a prolonged period of time.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Karin Troost (project leader WOT Shellfish, stock assessment techniques, shellfish stock and distribution), Douwe van den Ende (WOT shellfish stock assessment and survey logistics)	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	Wageningen Environmental Research: Sander Mücher (satellite & UAV image analysis), Henk Kramer (image analysis & UAV pilot)	
Involvement parties outside WUR (names and expertise)	NIOZ: Daphne van der Wal (remote sensing specialist)	

Relevance	
What is the market/ target audience	Ministry (LNV), colleague researchers, fisheries and nature policy makers (Natura 2000)

Economical relevance	Higher efficiency and accuracy, may result in lower costs for shellfish bed mapping in future.
Social relevance	None
Scientific relevance	Develop new and innovative scientific expertise within Wageningen Marine Research. As side effect: development of technique suitable for mapping of sand mason worm reefs.
Relevance to ministry LNV	Increased efficiency in intertidal mapping of beds.
Summary (UK)	The goal is to explore and implement satellite remote sensing in locating and mapping intertidal mussel/oyster beds. Work started in 2016 and continued in 2017 needs further development and implementation in the WOT shellfish surveys. The aim is to finalize this project in 2018.
Samenvatting (NL)	Doel van het voorgestelde project is om remote sensing middels satellietbeelden te implementeren in de WOT schelpdiersurveys. Onderzoek hieraan gedaan binnen KBWOT in 2016 en 2017 wordt gerapporteerd eind 2017. Duidelijk is dat de methodiek goed bruikbaar is in de schelpdiersurveys. Er moet echter nog aanvullend werk gedaan worden in 2018, om de precisie van automatische generatie van kaartbeelden met mossel- en oesterbank verspreiding te verbeteren. Dit wordt gedaan door in het veld referentie informatie te verzamelen tijdens de jaarlijkse WOT survey, en deze informatie te verwerken in de analyse. Zo wordt steeds duidelijker welk signaal in de satellietbeelden hoort bij welke bodemsamenstelling (bijv. oesterbank, mosselbank, *Lanice* veld, zeewier, schelpgruis). WEnR (voormalig Alterra) zal Wageningen Marine Research medewerkers trainen in het zelf uitvoeren van de beeldanalyses. Doel is om dit project in 2018 te finaliseren en de techniek per 2019 in de WOT survey te implementeren.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	40	3.200,-	
CAT III	100.00	40	4.000,-	
CAT IV	124.00	40	4.960,-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			12.160,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	240,-	
Project equipment		
Other material costs	600,-	
Total Material Costs	840,-	0,-
Total project budget needed	13.000,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	13.000,-	0,-

Project[4] 	11. Shellfish population shifts
Project leader	Karin Troost
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1 year
Continuing project	No
Motivation and Project aims	
Lead	Explaining shellfish population shifts in Dutch coastal zone as observed in the **WOT shellfish stock assessments**.
Problem definition	Shellfish stock assessments are carried out in the Dutch coastal zone since 1994. Apart from the target species, *Spisula subtruncata* and *Ensis directus,* all shellfish species are registered. In 24 years' time dramatic shifts in population sizes are observed, the most notable being the collapse of *S. subtruncata* around 2001, the strong increase of *E. directus* since 2002, and the extreme increase in stock size of *S. subtruncata* in 2017: from 39 million kg fresh weight in 2016 to 1283 in 2017. At the same time we see strong increases in stock size of several species, such as *Lutraria lutraria*, *Chamelea striatula* and *Donax vittatus*. Overall the total biomass of bivalve filter feeders appears to increase, which may have consequences for the carrying capacity for bivalves in not only the coastal zone but also the Wadden Sea and Ooster- and Westerschelde estuaries. The problem is that we do not know how to explain the observed changes, e.g. whether it is related to changes in food composition and/or abundance, or changes in abiotic conditions in the coastal zone. More insight in causes of shifts in shellfish population sizes is a necessary knowledge base for researchers working on stock assessments and population studies of shellfish. Such insight is crucial in the management of marine resources in the coastal zone and adjacent marine and brackish waters, in the evaluation of management decisions and in impact assessment studies.
Objective(s) of the project	To find correlations and (testable hypotheses for) causal relationships between trends and distribution patterns of shellfish stocks and environmental biotic and abiotic parameters, with the aims to explain observed shifts in population sizes and to identify the main factors driving population sizes and perhaps even community composition.
Continuing project: Results from previous years	
Expertise needed	Expertise in the set-up of the WOT shellfish data collection and structure of the database, ecology of shellfish, time series analyses, ecosystem of the coastal zone.
Expertise developed	Reinforce our knowledge base on factors driving shellfish stocks, more insight in relationships between shellfish population sizes and (a)biotic parameters in the coastal zone.
Relevance for WOT	The expertise developed is necessary for the broader role in advising the ministry on issues related to shellfish fisheries and policy in relation to

[4] Only part of this project is financed

	nature conservation goals and policy.	
Why should this be funded by KB WOT?	Because the project proposed will strongly improve the underlying knowledge base for the WOT shellfish surveys and therefore the ability to adequately advise the ministry on matters related to shellfish stocks.	
What other potential funding sources have been considered?	Direct funding by ministry of LNV (S. Braaksma), that expressed an interest in knowing causes for the increase in *S. subtruncata* in relation to nature conservation goals for common scoters (*Melanitta nigra*). No funding has yet been found.	
International objective of research	Shellfish recruitment is a subject with wide international interest.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	Main species of interest are *S. subtruncata*, *E. directus*, *L. lutraria*, *C. striatula* and *D. vittatus*. An initial literature study should complete a list of factors potentially influencing recruitment and survival of these species. We will also determine what elements of these factors to study (e.g. sea water temperature: what is the critical period, what are known threshold temperatures, etc.). Based on the results, a plan for further analysis is made and discussed among the team and other experts. Data are then compiled and analysed. If correlations or even causal relationships are found, results are published in a peer-reviewed manuscript. If results are not conclusive enough they will be published in a CVO report. The results are disseminated among end users within LNV in the form of a management summary.	
Activities and time schedule	Initial review and discussion of research plan with experts in Jan-Feb. Compilation of data in Feb-April. Analysis in May-Sep. Writing in Oct-Dec.	
Output/deliverables	Peer-reviewed paper and management summary	
Dissemination of findings being addressed	Scientific community: peer-reviewed paper. Government and other stakeholders: management summary. Results will also be discussed where relevant in the WOT reports and in presentations at meetings.	
Utility of the developed	Wageningen Marine Research needs	

products and expertise	to reinforce its knowledge base on factors driving shellfish stocks, in order to improve its advising role and to show that Wageningen Marine Research is the expert on shellfish stock assessment and ecology. We should understand what we monitor.	
What are the potential risks to the project's success?	1) Unavailability of necessary data. 2) Shellfish recruitment is complex and not well understood. We may not find any publishable correlations yet, in which case a peer-reviewed publication will be replaced by a CVO report and further funding will be sought to continue this research in 2019.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Johan Craeymeersch (shellfish stock assessment and ecology; community, time series and statistical analyses; coastal zone ecosystem), Ingrid Tulp (population and time series analyses, coastal zone ecosystem), Karin Troost (shellfish stock assessments and ecology, WOT shellfish project leader), Margriet van Asch (shellfish database specialist).	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	None	
Involvement parties outside WUR (names and expertise)	None	

Relevance	
What is the market/ target audience	Ministry of LNV (Fisheries and Nature); I&M (Rijkswaterstaat); (inter)national scientific community. ICES Benthic Ecology working group.
Economical relevance	None
Social relevance	None
Scientific relevance	Important for Wageningen Marine Research to show that we do not only monitor, we can also explain what we find, and publish the results in a peer-reviewed journal. The project reinforces our scientific position and will add to the international knowledge on what drives shellfish population sizes and shifts.
Relevance to ministry LNV	For LNV it is important to be able to explain sudden shifts in species composition and strong increases and collapses in populations of commercially important species. Understanding driving factors is crucial in the management of coastal resources and evaluation of policy measures.
Summary (UK)	Although shellfish stocks in the coastal zone are monitored since 1994, causes for observed strong increases and declines in population sizes are unknown. Being able to explain sudden shifts and long-term changes is important for Wageningen Marine Research as part of its knowledge base on shellfish ecology and stock assessments, and important for LNV and other government parties involved in fisheries and nature management in evaluations of policy measures. We will analyse correlations between shellfish data from the WOT survey and data on environmental (a)biotic parameters to identify which driving factors caused the observed changes in

	abundance of *S. subtruncata*, *E. directus*, *L. lutraria*, *C. striatula* and *D. vittatus*.
Samenvatting (NL)	Hoewel Wageningen Marine Research sinds 1994 jaarlijks de schelpdierbestanden in de Nederlandse kustzone inventariseert, en we daarmee veel kennis hebben over de ontwikkeling van schelpdierbestanden, weten we vrijwel niet door welke factoren geobserveerde veranderingen veroorzaakt zijn. In de kustzone vinden zeer opvallende veranderingen plaats, zoals het instorten van de spisula (*S. subtruncata*) bestanden rond 2001, de opkomst van mesheften (*Ensis directus*) na 2002, de explosieve toename van spisula in 2017 en de gestage toename van otterschelpen (*L. lutraria*), venusschelpen (*C. striatula*) en zaagjes (*D. vittatus*) in de afgelopen jaren. Het is nodig om meer inzicht te hebben in de onderliggende oorzaken, om onze kennisbasis op het gebied van schelpdier populaties en ecologie te versterken met als tweeledig doel: vanuit deze versterkte kennisbasis het ministerie beter te kunnen adviseren betreffende zaken rond schelpdieren en schelpdiervisserij en serieuzer genomen te worden als wetenschappelijk instituut door de nationale en internationale wetenschappelijk gemeenschap en potentiele opdrachtgevers. Doel van het project is om causale verbanden te vinden tussen omgevingsfactoren en de ontwikkeling van schelpdierbestanden. Omdat rekrutering van schelpdieren een complex en slecht begrepen fenomeen is, is succes niet gegarandeerd en hopen we op zijn minst om correlaties te vinden en testbare hypotheses voor causale verbanden op te kunnen stellen, en daar in een vervolg studie aan verder te werken.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	60	4.800,-	
CAT III	100.00	140	14.000,-	
CAT IV	124.00	150	18.600,-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			37.400,-	0,-

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs	Data acquisition 2.000,-	
Travel costs		
Project equipment		
Other material costs		
Total Material Costs	2.000,-	0,-
Total project budget needed	39.400,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	39.400,-	0,-

Project	12. Migration of WOT shellfish database
Project leader	Ingeborg de Boois/Margriet van Asch (WOT Fisheries project leader – Karin Troost)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	3 years
Continuing project	Yes (year 2 of 3)
Motivation and Project aims	
Lead	Migration of WOT shellfish database to Oracle database FRISBE
Problem definition	Wageningen Marine Research (Wageningen Marine Research) has a large database in which data from shellfish monitoring (mainly WOT) is stored (the 'CSO database'). The current database has almost reached its maximum storage capacity. Once that happens it will not only become impossible to store additional data into the database, but there is also an increased risk of instability (i.e. risk to the present data stored). To guarantee data preservation and availability the data needs to be stored in another type of database. At Wageningen Marine Research there is already another database available that meets these criteria: FRISBE. At present this database contains predominantly data from fish surveys (including all WOT fish survey data. Incorporating the shellfish data into the same database as the fish (WOT) survey data has the added benefit that it improves availability of this data to other (Wageningen Marine Research) researchers, and allows for easier analysis of multiple datasets. Although both databases contain similar types of survey data, several steps are needed before the shellfish data can be successfully migrated to FRISBE, ensuring all relevant data is indeed stored and accessible. A first impact assessment has already been performed (unpublished document by De Boois & Van Asch), outlining all the separate steps involved as well as potential problems. Before migration, and in addition to technicalities, other aspects need to be taken into account as well, such as: how to deal with confidential data, how to ensure correct use and interpretation of the data by colleagues if the data become accessible to everyone within Wageningen Marine Research without first having to consult the project leader, and to inform and get support from project leaders making use of the CSO database.
Objective(s) of the project	A stepwise migration of CSO data into FRISBE database, and to identify and address potential problems arising from the migration. The focus of this proposal is on guaranteeing a continued safe storage of the shellfish data. New data is collected continually. For the time being, this data will still be originally stored in an access database. Developing procedures to import these directly into FRISBE are specifically not included within this proposal. However, once we have the scripts working to migrate everything, we plan to use these to transfer the new data on specific times (e.g. at the end of each year) into FRISBE. In a next step we could then develop procedures to do this automatically as well (e.g. similarly as import from Billie files).
Continuing project: Results from previous years	In 2017 the following achievements were made: • an overview of the information for the reference tables (e.g. gear codes, programme codes, ...) has been created and this information has been

	added to FRISBE; • SAS code to create FRISBE format files has been developed for the variables that could be migrated; • the output file from the SAS script has been tested by importing in the FRISBE test database; • impact analyses have been made for the open actions with respect to database modifications; • a full overview of the translation of all shellfish database variables to FRISBE variables has been created.	
Expertise needed	Oracle and SAS programming skills, knowledge of both FRISBE and CSO database as well as a thorough awareness of the different survey designs.	
Expertise developed	Integration of datasets into one database using SAS scripts.	
Relevance for WOT	Guaranteed long-term safe storage of data from WOT shellfish stock assessments.	
Why should this be funded by KB WOT?	Migration to and Oracle database is of vital importance for safe storage of the WOT shellfish data collected since 1990.	
What other potential funding sources have been considered?	WOT05 18 Schelpdiermonitoring (€6000,-), Opleidingsbudget/Algemeen databeheer Wageningen Marine Research (3x40 hours CAT2), to be arranged November 2017 action Margriet	
International objective of research	None	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	**Transfer data** Import of all WOT data in the FRISBE database (2018) and all other CSO datasets (2019) into the FRISBE database. During the further import of different datasets further (minor) adaptations to both import procedures and database tables are expected (since surveys vary in design and thus in data that have been collected). Furthermore, writing of new scripts in order to extract the data once more, using existing FRISBE data-extractions formats together with the scripts currently used in shellfish data extraction (2018) and analysis (2019).	
Activities and time schedule	• (re)write and adapt SAS and R scripts to extract data • Consistency-check with original extraction and results for the migrated data • Check: comparing results of standard data manipulations on data extracted from both FRISBE and Access	• (re)write and adapt scripts to extract data and to further manipulate data i.e. calculation of time-series of shellfish stocks, length frequency distributions etc.) • each script check for consistency with original extraction and manipulation results, and adapt

		till it fits
Output/deliverables	• All WOT shellfish data available in FRISBE; • Standard scripts available to export WOT data; • Checks on output from Access database and imported data in FRISBE.	All shellfish data from CSO available in FRISBE (2019), standard scripts available for analysis.
Dissemination of findings being addressed	Inform frequent users of the CSO database in a meeting. The Note will be published on the CVO web space and shared with Wageningen Marine Research colleagues.	
Utility of the developed products and expertise	Guaranteed safe data storage on long term, development and maintenance of database expertise within Wageningen Marine Research.	Guaranteed safe data storage on long term, development and maintenance of database expertise within Wageningen Marine Research.
What are the potential risks to the project's success?	Loss of information in specific smaller projects with separate additional information (needs to be checked for each dataset that is imported). This is particularly the case for (non-WOT) surveys with a separate survey design. Availability of the expertise needed. The database infrastructure can only be modified by two people. Only one person has sufficient expertise of the current CSO database.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Margriet van Asch (shellfish database, shellfish survey design, importing data in FRISBE, extracting data from FRISBE), Ingeborg de Boois (FRISBE database, SAS scripts), Eugene Rurangwa (running SAS scripts, importing data in FRISBE, extracting data from FRISBE), Carola van Zweeden (shellfish database, shellfish survey design, extracting data from FRISBE) Peter van der Kamp/Daniel Benden (database structure and procedure adjustments)	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	None	
Involvement parties outside WUR (names and expertise)	None	

Relevance	
What is the market/ target audience	LNV, CVO, Wageningen Marine Research researchers
Economical relevance	Guaranteed safe storage of long-term datasets collected with public money
Social relevance	None
Scientific relevance	Enhanced efficiency of several datasets at once (shellfish and fish) strongly facilitates analyses and modelling by all Wageningen Marine Research researchers. Also better/more efficient exchange with data portals (combinations of for instance various WOT datasets)

Relevance to ministry LNV	Migration is vital for safekeeping of WOT shellfish data since currently used Access database will cease to be supported by Microsoft.
Summary (UK)	Wageningen Marine Research (Wageningen Marine Research) has a large database in which shellfish data are stored (the 'CSO database'). This current database has almost reached its maximum storage capacity. In order to guarantee data preservation and availability the data needs to be stored in another type of database. At Wageningen Marine Research there is already another database available that meets these criteria: FRISBE. Incorporating the shellfish data into this existing database is the logical step forward. Although both databases contain similar types of survey data, several steps are needed before the shellfish data can be successfully migrated to FRISBE, ensuring all relevant data is indeed stored and accessible. The first of these is to adapt database tables and import procedures in such a way that they become usable for the shellfish data. The next step is to try and import a test-dataset into the FRISBE database structure. This will be done in a test environment where it is possible to check whether everything that needs to be imported can be imported. Once this has been tested, the next step (starting 2018) will be to migrate all CSO datasets to FRISBE.
Samenvatting (NL)	De schelpdiergegevens worden op dit moment in Yerseke opgeslagen in een Access database ('CSO'). De grootte van de database is echter dusdanig dat er naar een andere database moet worden overgegaan. Dit om zowel bestaande als toekomstige (WOT) data blijvend goed opgeslagen en beschikbaar te houden. Overgang naar de bestaande Wageningen Marine Research-Oracle database FRISBE is de meest logische optie. Dit voorstel vormt de basis voor een stapsgewijze aanpak om deze migratie van gegevens uit te voeren. Hierbij wordt in eerste instantie de nodige aanpassingen gedaan aan de bestaande FRISBE tabellen en import software. Vervolgens zal er testdataset geïmporteerd worden. Dit zal gebeuren in een testomgeving, zodat er voldoende gecheckt kan worden of dit proces ook echt goed en volledig verloopt. Zodra dit goed verloopt kan daarna (vanaf 2018) geleidelijk alle schelpdierdata gemigreerd worden naar FRISBE.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	500 (KBWOT 305)	40.000,- (24.400,-)	
CAT III	100.00	60 (KBWOT 60)	6.000,- (6.000,-)	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel	560 hours / 46.000,- KBWOT 365 hours / 30.400,-			0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	300,- (3 people travelling to Yerseke for 2 physical meetings)	
Project equipment		
Other material costs		
Total Material Costs	300,-	0,-
Total project budget needed	46.300,-	0,-
Financing through other resources -/-	15.600,-	0,-
Finance needed from KBWOT	30.700,-	0,-

Project 	13. The role of natural and constructed tidal wetlands as nurseries for fish
Project leader	Tom Ysebaert / Ingrid Tulp (WOT Fisheries project leader – Ingeborg de Boois)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	2
Continuing project	No
Motivation and Project aims	
Lead	WGVHES value coastal habitats for exploited species-TORs, BO11 17 Waddenzee Trilateraal. The project also relates to the Swimway initiative, an international initiative in which Wageningen Marine Research is involved and that studies the population dynamics of fish species by encompassing the entire life cycle and identifying the bottlenecks in population dynamics. Finally, Wageningen Marine Research is involved in several saltmarsh restoration projects in the SW Delta. All above projects are related to questions on the functioning of these coastal habitats as nurseries for exploited species.
Problem definition	Tidal wetlands such as saltmarshes are increasingly recognized for the many ecosystem services these habitats provide, ranging from coastal protection to carbon sequestration and food production. Their role as nursery for juvenile (commercial) fish is often mentioned, but is not yet quantified for Dutch saltmarshes. The DFS monitor fish stocks in the tidal channels and areas>5 m deep along the Dutch coast, Wadden Sea and Delta, but DFS does not address the potential role saltmarshes may play for commercial fish species such as seabass, herring, mullet, etc. Currently tidal wetlands are increasingly restored or constructed, for nature restoration but also to increase the resilience against flooding. One example is managed realignment (or managed retreat), that allows an area that was not previously exposed to flooding by the sea to become flooded by removing coastal protection. In the SW Delta several projects are being established, both in the Westerschelde (Perkpolder, Hedwige) and Oosterschelde (Rammegors). Constructed wetlands differ from natural ones, and their ecological role is still largely unknown, especially the role these wetlands may have for fish as nurseries. In several of these saltmarshes, we already monitor the development of vegetation, elevation, birds and benthic fauna. Studies in the US and Europe have shown that natural saltmarshes provide a nursery, sheltering, and feeding area for economically important species and that fish actually feed in salt marshes. In France it was even shown that the grazing regime by sheep had a direct impact on the nursery quality of tidal creeks (Laffaille et al 2000). Here we propose a pilot study to evaluate the role of saltmarshes as nursery areas for commercial fish species in the Netherlands.
Objective(s) of the project	Pilot study to investigate and quantify the importance of natural and constructed tidal wetlands as nurseries for (commercial) fish species.
Continuing project: Results from previous years	-
Expertise needed	Saltmarsh ecology, fish biology, analytical skills

Expertise developed	We acquire expertise on the nursery function of natural and constructed tidal wetlands.	
Relevance for WOT	With the DFS we get information on the presence of commercial fish species in Dutch coastal waterbodies, but DFS monitoring is restricted to the deeper parts of these systems. We lack information on other habitats which also was identified within the trilateral Swimway initiative. Saltmarshes are often mentioned as important nursery for several commercial fish species but this has never been quantified.	
Why should this be funded by KB WOT?	- lack of knowledge about the subject, in the DFS we miss out on a large part of the habitat, which is likely crucial for several commercial species - will provide Wageningen Marine Research with new expertise / projects - delivers useful information for policy makers and managers -lastly: we know other parties (RUG) have plans in this direction and it would be very unfortunate if we miss out in this new field	
What other potential funding sources have been considered?	KB-SEM 2018: not granted	
International objective of research	A similar project started in Germany by Andreas Dänhardt from University of Hamburg and a comparison can be made with available information from other European countries.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	We propose a pilot study investigating the fish fauna in tidal creeks in salt marsh areas using seine and fyke nets in the Westerschelde and Oosterschelde. We will do this in several sites: Saefthinge (natural marsh, Westerschelde), Perkpolder (recent managed realignment site, Westerschelde), Sint-Annaland (natural marsh Oosterschelde), and Rammegors (recent managed realignment site, Oosterschelde). In all of these areas we already have monitoring programs in place. During the field visits, we will expand the program with sampling of fish in saltmarsh creeks. We will study species composition, abundance and biomass in selected creeks. This will enable us to quantify the relative importance of natural and constructed wetlands as nurseries for fish.	In 2018 we focus on the collection of the data, in 2019 on the analysis of the data. Within the same project we also aim to quantify the amount of salt marsh available as nursery areas using satellite photographs. In combination with the proposed fieldwork and in comparison with other nursery habitats, this will enable to quantify the relative importance of salt marshes as nurseries in The Netherlands.
Activities and time schedule	Sampling will take place three times during the growing season (April-Sept) in selected tidal creeks in the study sites. Fyke nets will be set at low tide and emptied and taken down	

	the next low tide and/or seine nets will be used. The budget is based on 3 sampling occasions, 4 areas, 2 days per sampling by 2 people. With a smaller budget the program can still be carried out in a more limited manner.	
Output/deliverables	Report and publication dealing with the role of natural and constructed tidal wetlands as nurseries for fish.	Report and publication dealing with the importance of Dutch tidal wetlands as nurseries for fish. Similar projects started recently in Germany (A. Dänhardt from Univ Hamburg) and a comparison can be made with available information from other European countries.
Dissemination of findings being addressed	Results will be presented to LNV and RWS and other interested stakeholders (NGOs) during regular project meetings Wageningen Marine Research is participating in. We will also present results internally at Wageningen Marine Research and on relevant fora/symposia. We will also explicitly relate our project to the Swimway initiative.	See 2018.
Utility of the developed products and expertise	Insight into the contribution of such widespread habitats to populations of commercially exploited species can contribute greatly to the ecosystem approach to marine management. More in particular, we will try to incorporate fish as an essential monitoring element in the future Hedwige/Prosperpolder project.	See 2018.
What are the potential risks to the project's success?	None. Wageningen Marine Research already monitors most of the proposed study areas for benthos and birds, and therefore has access to underlying data and information, and also knows the areas very well.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Tom Ysebaert: marine ecology, nature-based solutions, Ingrid Tulp: fish ecology, Brenda Walles: benthic ecology, Kelly Ellschot: saltmarsh ecology, Fish sampling: IJmuiden & Yerseke assistants	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR	-	
Involvement parties outside WUR	Andreas Dänhardt from University of Hamburg (fish ecology and foodwebs)	

Relevance	
What is the market/ target audience	LNV, RWS, Provinces, NGO's, ICES LNV and Rijkswaterstaat are in need of scientifically sound information about the impact of their measures on the Natura2000 and WFD goals, and how nature-based designs can help to improve the nature value of these areas.
Economical relevance	Many exploited fish and macroinvertebrates that utilize the coastal zone have declined. Degradation of essential habitats has resulted in habitats that are no longer adequate to fulfil nursery, feeding, or reproductive functions. Yet the degree to which coastal habitats are important for exploited species has not been quantified (Seitz et al. 2014). With this study we will evaluate the importance of tidal wetlands as potential fish nursery area, a role which was hitherto not acknowledged in management. Our findings will aid in defining key habitats for protection and restoration and provide baseline information needed to define knowledge gaps for quantifying the habitat value for exploited fish and invertebrates.
Social relevance	Coastal ecosystems like tidal wetlands are increasingly recognized for the many ecosystem services they provide and their role in climate change adaptation and mitigation.
Scientific relevance	Quantification of the importance of tidal wetlands as nurseries for fish will provide insight into the contribution of such widespread habitats to populations of (commercially exploited) fish species and will contribute greatly to the ecosystem-based approach to marine management.
Relevance to ministry LNV	Evaluating the importance of a habitat as potential fish nursery area, a role which was hitherto not acknowledged in management
Summary (UK)	Our information on fish nursery areas that we obtain in the DFS survey is largely limited to subtidal and generally deeper areas. However we know that for several species the habitat provided by saltmarshes is important. In SW Netherlands many saltmarshes are restored or constructed for nature conservation or to increase water capacity. In several of these projects we carry out extensive monitoring programmes where vegetation, plants, birds and benthos are monitored throughout the growing season. In this project we propose to expand these programmes for fish to be able to: 1. Evaluate differences in nursery function between natural and manmade salt marshes and 2. Estimate total potential nursery area provided by salt marsh creeks.
Samenvatting (NL)	Onze informatie over opgroeigebieden voor vis is beperkt tot de DFS survey. Die bestrijkt slechts alleen de diepere delen van de NL kustgebieden en estuaria. Voor veel soorten zijn juist de ondiepere delen in schorren en kwelders van belang als opgroeigebied. In de ZW Delta worden momenteel schorren en slikken hersteld of zelfs heraangelegd. Dat gebeurt in het kader van natuurherstel of om het waterbergend vermogen te vergroten. In diverse van deze projecten volgen we de ontwikkeling in vegetatie, benthos en vogels. In dit project willen we deze lopende monitoringprogramma's uitbreiden met vis. De zo verzamelde informatie willen we gebruiken om: 1. De functie als opgroeigebied te vergelijken tussen natuurlijke en door mensen aangelegde kwelders en 2. Het totale beschikbare areaal kwelders als opgroeigebied en daarmee de functie voor jonge vis te kwantificeren.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	384	30.720,-	
CAT III	100.00	40	4.000,-	
CAT IV	124.00	80	9.920.-	
CAT V	144.00			
CAT VI	175.00			
Total Personnel			44.640.-	29.950,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	1.750,-	
Project equipment	3.000,-	
Other material costs	600,-	
Total Material Costs	5.350,-	1.500,-
Total project budget	49.990.-	31.450,-
Financing through other resources -/-	0,-	0,-
Finance from KBWOT	49.990,-	31.450,-

References

Laffaille, P., J.-C. Lefeuvre, and E. Feunteun. 2000. Impact of sheep grazing on 0-group sea bass *Dicentrarchus labrax* L., in tidal salt marshes. *Biological Conservation* 96:271–277.

Seitz RD, Wennhage H, Bergstrom U, Lipcius RM, Ysebaert T. 2014. Ecological value of coastal habitats for commercially and ecologically important species. ICES Journal of Marine Science 71: 648-665.

Project	14. Incidental bycatch
Project leader	Bram Couperus (WOT Fisheries project leader – Harriet van Overzee)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	3
Continuing project	Yes
Motivation and Project aims	
Lead	Implementation of monitoring of protected species in the WOT observer programme under the revised DCF
Problem definition	In the new EU MAP it is mandatory to monitor protected species for all at sea going observer trips. The list of protected species is several hundreds. The current Wageningen Marine Research sampling programme for protected species is hampered by (1) Lack of cooperation by crews and related poor motivation by observers towards sampling rare species on board. (2) A low sampling coverage, leading to low numbers of observations. (3) Unfamiliarity of the observers with the new bycatch-monitoring protocols for on board sampling. (4) Incompatible data storage handling system.
Objective(s) of the project	Improve recording of bycatch of protected and/or rare species and alter/improve data handling systems to ensure that bycatch records are stored and are made accessible for ICES and EU related reporting. Without good communication with crews and acceptance of monitoring of incidental bycatch, recording will not take place. Therefore, the focus of this project is to improve communication with and explain importance of incidental bycatch monitoring to fishermen.
Continuing project: Results from previous years	1. Internal guidance and education on on-board sampling within the WOT discard sampling, resulting in integration of sampling of rare species: An impact analysis has been made for the adaptation of the FRISBE database. A temporal solution for the registration has been created for the collection of data in Billie in order to be able to store the data in the database. 2. In order to improve communication with crews, a plan has been developed amongst the team members to investigate the communication on the topic. At the end of the year a student-observer will join a pelagic trawler to make an analysis of the questions and issues in incidental bycatch 3. A self-sampling scheme of rare fish species proposed to the Pelagic Freezer Association (PFA); it was agreed with the PFA that it will fund a photo guide of mesopelagic fish in the catch of pelagic trawlers. A student currently prepares photo fact sheets as basis for this guide
Expertise needed	Discards- and incidental bycatch sampling, social science in regard to improve cooperation by fishers, database design and programming.
Expertise developed	Implementation of innovative sampling designs, technology and methods (e.g. comprehensive protocols on bycatch monitoring).
Relevance for WOT	The implementation of sampling of protected species is a requirement in the new EU MAP
Why should this be	The implementation of sampling of protected species is a requirement in the

funded by KB WOT?	new EU MAP	
What other potential funding sources have been considered?	The PFA: see "Continuing project: Results from previous years" point 3. The PFA has good reasons to cooperate with Wageningen Marine Research to monitor protected species, because they have signed a MoU with Greenpeace in 2016 on sustainable fishing. They cooperate closely in this project.	
International objective of research	Statistical sound sampling under the new EU MAP	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	1. Internal guidance and education on on-board sampling 2. On-going communication with commercial fishermen to change the attitude towards monitoring bycatch of protected and rare species 3. If possible: trial with newly developed monitoring methodologies 4. Adjust Billie, data handling and database design. 5. Back-storage of data on incidental bycatch in the database	6. On-going internal guidance and education on on-board sampling 7. On-going communication with commercial fishermen to change the attitude towards monitoring bycatch of protected and rare species 8. If possible: trials with newly developed monitoring methodologies 9. Adjust Billie, data handling and database design. 10. Back-storage of data on incidental bycatch in the database
Activities and time schedule	• Organize an internal meeting with sea going observers to evaluate the on board monitoring of protected and rare species in 2018. • Write articles in "Visserijnieuws" in order to inform fishermen on the proceedings and to keep the topic "hot". • Publish a photo guide with mesopelagic species that are incidentally caught by pelagic trawler for crews and observers • Store data on incidental bycatch from forms, from the period 2016-2017 • Regular communication with fishermen by means of bilateral meetings (e.g. in port). • A social sciences student will	Continue similar activities as described for 2018 in order to make further steps on this topic.

	investigate attitude of crew towards incidental bycatch a/b trawler	
Output/deliverables	• Better cooperation of fishers and improved attitude of sea going observer towards by-catch sampling • Billie and database adapted to new DCF requirement to sample rare species • Articles in "Visserijnieuws" on sampling of rare species. • Self-sampling scheme on rare fish species • Photo guide on mesopelagic fish for crew-members and observers.	• New method to increase sampling coverage of bycatch of protected and rare species on board fishing vessels that are sample under the WOT.
Dissemination of findings being addressed	Presentation of sampling approach in WGCATCH and WGBYC	
Utility of the developed products and expertise	The developed monitoring methods will be of continuous use in the EU MAP sampling, nationally and internationally	
What are the potential risks to the project's success?	A continuing bad cooperation by crews due to external developments	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Bram Couperus (incidental bycatch), Harriet van Overzee (discards), Edwin van Helmond (REM), Peter van der Kamp (database), Daniel Benden (Billie), Marloes Kraan (social science), Oscar Bos (photo guide)	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	TTEM, PTWOT	
Involvement parties outside WUR (names and expertise)	PFA and (possibly) Vissersbond, VisNed. The focus is on the pelagic fishery.	

Relevance	
What is the market/ target audience	
Economical relevance	Improved monitoring in a cost effective manner.
Social relevance	Improved cooperation with crews and fisheries
Scientific relevance	Increased insight in incidental bycatch of protected species
Relevance to ministry LNV	Obligation to monitor bycatch of protected and rare species

Summary (UK)	In the new EU MAP it Is mandatory to monitor protected and rare species. However, the current Wageningen Marine Research sampling programme for protected species needs improvement. The aim of this study is to improve and innovate recording, data handling and storage systems of bycatch of protected and rare species. This includes the removal of the current taboo on the registration of protected species bycatch and to work towards a more open, transparent attitude in crews of fishery vessels and in on board observers. This project includes the writing of articles in Visserijnieuws to stimulate fishermen, to interest them in the topic and to inform them on the proceedings. Crews of some vessels are and will be contacted to develop methods to collect useful information on incidental bycatch on board reference vessels. Internal at Wageningen Marine Research, observers will be guided to integrate the monitoring of incidental bycatch in EU MAP sampling.
Samenvatting (NL)	In de nieuwe EU MAP is de monitoring van incidentele bijvangst van beschermde soorten opgenomen. De bemonstering binnen Wageningen Marine Research moet hiervoor worden aangepast. Het doel van deze studie is om de registratie, databeheer- en opslag van de bijvangst van beschermde soorten te verbeteren. Hierbij is een belangrijk onderdeel het wegnemen van het taboe van registratie van beschermde diersoorten en het bereiken van een transparante grondhouding, zowel bij bemanningen van visserijvaartuigen als bij waarnemers aan boord. In het kader van dit project worden artikels gepubliceerd in Visserijnieuws om de interesse in dit onderwerp te vergroten, bemanningen te stimuleren om mee te werken en hen te informeren over de voortgang. Bemanningen van enkele schepen worden en zullen benaderd worden om mee te werken aan het opzetten van een waarnemingssysteem waarbij de schepen in kwestie als referentie-schip functioneren. Intern bij Wageningen Marine Research, zullen waarnemers actief begeleid worden om de monitoring van incidentele bijvangst te integreren in de routinematige discardbemonstering.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II communication with skippers	80			
CAT II meetings with PFA	80	16	1.280,-	
CAT II supervising photo	80	16	1.280,-	
CAT II project coordination	80	8	640,-	
CAT III Supervising student photo guide	100	8	800,-	
CAT III Supervising student social sciences	100	8	800,-	
CAT III adapting database	100	80	8.000,-	
CAT III writing articles for Visserijnieuws	100			
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			12.800,-	30.000,-

Material costs	2018	2019 and further
Facilities		
Estimated costs for print of mesopelagics photo guide	6.000,-	
Travel costs to and from trawlers/cutters	500,-	
Project equipment		
Printing new catch forms	800,-	
Other material costs	200,-	
Total Material Costs	1500,-	0,-
Total project budget needed	20.300,-	30.000,-
Financing through other resources (PFA for photo guide)	6.000,-	6.000,-
Finance needed from KBWOT	14.300,-	24.000,-

Project	15. Statistically sound sampling scheme
Project leader	Harriet van Overzee (WOT Fisheries project leader – Sieto Verver and Harriet van Overzee)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1.5 year
Continuing project	No
Motivation and Project aims	
Lead	In the European Union (EU) the collection and management of fisheries data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). The DCF states which information should be collected, managed and made available by the Member States (MS) for scientific advice regarding the Common Fisheries Policy (CFP). For this purpose all MS are obliged to submit a work plan for data collection on a multiannual basis. In 2017 Council Regulation 199/2008 describing the DCF was repealed by Council Regulation 2017/1004 stating that data collection needs to be regionalised. This regionalisation means that MS sharing a fishing area should work together in collecting, managing and making fisheries data available for scientific advice. Furthermore the accompanying Commission Decisions 2016/1701 and 2016/1251 indicate that MS need to implement a sampling design that is established according to statistical sound principles, while covering all fractions of the catch. The correct implementation of a statistically sound sampling scheme should reduce any potential bias in the data and therefore increase the representativeness of the biological data of the catch for the entire fleet. Ideally, a vessel is randomly selected from the sampling population when sampling its bycatch or landings.
Problem definition	At present biological data is collected through on-shore and at-sea sampling. Historically this work has been divided and carried out within two WOT projects, namely WOT *Marktbemonstering zeevisserij* (i.e. marsam project) and WOT *Monitoring bijvangsten* (i.e. discards project). Where the marsam project generally focuses on commercial landings and the discards project focuses on discards. Both projects provide essential information for stock assessment working groups. Methods that are used within the projects have been optimised throughout the years according to the fisheries that are sampled. In practice this has led to four different sampling designs, namely (i) on-shore sampling of the demersal fisheries based on auction sampling of landings, (ii) at-sea sampling of the demersal, shrimp and pelagic fishery through observers, (iii) at-sea self-sampling[5] of the active demersal fishery, and (iv) at-sea self-sampling[5] of the pelagic fishery. The introduction of the landing obligation has led to considerable adjustments in the sampling designs in the last few years. We are currently in the position that sampling designs need to be (further) adjusted according to the revised DCF (also known as the DCF recast) and

[5] In this context self-sampling means that commercial vessels collect samples, and measurements are carried out by Wageningen Marine Research

	the continued gradual implementation of the landing obligation in the demersal fisheries. Through time the selection procedure of the vessels or landings to be sampled has mostly been non-random. Therefore, the adjustments that need to be made are expected to be considerable when the ideal sampling design is realised, i.e. a fully statistically sound sampling design where the different catch components (i.e. landings, below minimum size landings (bms), and discards) are sampled, (non-)responses to sampling request are recorded and all sampling targets are reached. Ultimately, this will result in a uniform sampling design with the potential of merging collected data within the Netherlands and with other MS as well as merging the operational aspects of data collection within the Netherlands. The results of this project will be implemented in the WOT programme; this will be the biggest adaptation in the WOT programme since the sixties.	
Objective(s) of the project	The aim of this KBWOT project is to design a statistically sound sampling scheme under the landing obligation for the collection of Dutch biological data of catches by commercial vessels that is practically and financially feasible and results in quantitative valuable data that can be used by the end-user (e.g. ICES, STECF, Ministry Economic Affairs).	
Continuing project: Results from previous years	Not applicable.	
Expertise needed	Knowledge on (i) biological sampling, (ii) the Dutch commercial fishing fleet, (iii) statistics, (iv) Dutch data raising procedures and (v) European legislation (i.e. DCF, landing obligation and CFP).	
Expertise developed	Implementation of statistically sound sampling scheme including recording response rates.	
Relevance for WOT	The implementation of a statistically sound sampling scheme is a requirement in the most recent Commission Decisions (2016/1701 and 2016/1251) that accompany the DCF recast (2017/1004).	
Why should this be funded by KB WOT?	This project aims at developing new methodology and working procedures to be implemented in current WOT activities. However, the development of a new statistically sound sampling scheme for biological sampling of commercial landings spanning two, already complex, WOT projects goes beyond the regular activities in these projects.	
What other potential funding sources have been considered?	None	
International objective of research	Statistical sound sampling under the DCF. Internationally we need to work towards Regional Work Plans. It is the role of the Regional Coordination Groups (RCGs) to develop, implement and maintain such plans. The results of this project (i.e. a uniform sampling design) will be incorporated in these plans.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	Besides reporting, this project consists of five steps. The first four steps will be carried out in 2018: 1. Critically review the DCF recast and determine what is exactly requested. 2. Summarize related work that	The last step of this project will be carried out during the first half of 2019: 5. Trial and fine-tune the sampling scheme that has been created in step 4 in the field. This step

	has been done in the past in the different fora on statistically sound sampling (e.g. ICES WGs such as WGCATCH, RCGs, VisNed, and CEFAS). 3. Create the ideal (theoretical) sampling scheme based on the output of steps 1 and 2 in combination with an out-of-the box session where for example innovative sampling strategies are discussed. 4. Create and describe, based on the output of step 3 and statistical analysis of the current sampling designs, a practically feasible sampling scheme where all strengths and weaknesses are described and that can be executed within the assigned WOT budget.	includes finalisation of the description of the scheme as well as the practical sampling procedures.
Activities and time schedule	The activities are described above. Q1: Step 1 Q2: Step 2 Q3-Q4: Steps 3-4	Q1-Q2: Step 5
Output/deliverables	- A practical and financially feasible sampling scheme for the collection of biological data that will be incorporated in the Dutch EU work plan for data collection in the fisheries and aquaculture sectors 2020-2022. This consequently means that the sampling scheme will be adopted in the field from 2020 onward. - Sampling scheme descriptions - Description of practical sampling schemes - Insight in required software adaptations	
Dissemination of findings being addressed	Presentation of findings (i.e. ideal sampling approach vs. feasible sampling approach) to ICES WGCATCH.	
Utility of the developed products and expertise	The developed sampling approach will be of continuous use in the DCF sampling.	
What are the potential risks to the project's success?	Risks are minimal as all theoretical and practical expertise needed for this project is available in-house. Where and when needed, international consultation can easily be arranged. Risks in having full access to vessels and landings go beyond the scope of this project.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Chun Chen (Statistics), Edwin van Helmond (Discard monitoring), Harriet van Overzee (Discard monitoring), Ruben Verkempynck (Discard monitoring), Sieto Verver (Market monitoring)	
Is the appropriate	Yes	

capacity available?	
Involvement parties within WUR (names and expertise)	PT WOT Visserij
Involvement parties outside WUR (names and expertise)	None

Relevance	
What is the market/ target audience	The end-user (e.g. ICES, STECF, Ministry of Economic Affairs).
Economical relevance	Statistically improved monitoring in a cost-effective manner
Social relevance	As the data that is collected within the DCF is funded by public sources, it is essential that it is executed as accurate, precise and cost-effective as possible.
Scientific relevance	Data collection under the DCF should be based on end-user needs, both in quantitative as qualitative aspects. The data collected under the DCF is used for further analyses within the scientific community (e.g. in stock assessment). It is therefore essential that the data is collected through a statistically sound scheme.
Relevance to ministry LNV	Obligation for biological sampling
Summary (UK)	We are currently in the position that sampling designs within the WOT *Marktbemonstering zeevisserij* (i.e. marsam project) and WOT *Monitoring bijvangsten* (i.e. discards project) need to be (further) adjusted according to the revised Data Collection Framework (DCF) and the continued gradual implementation of the landing obligation in the demersal fisheries. The aim of this project is therefore to design a statistically sound sampling scheme for the collection of Dutch biological data of the different catch fractions (i.e. landings, discards and below minimum size (bms)) from commercial vessels that is practically and financially feasible and results in quantitative valuable data that can be used by the end-user (e.g. ICES, STECF, Ministry of Economic Affairs).
Samenvatting (NL)	De herziene versie van de Data Collectie Verordening (DCF) in combinatie met de graduele invoering van de aanlandplicht hebben als gevolg dat de bestaande WOT bemonsteringsprogramma's *Marktbemonstering zeevisserij* en *Monitoring bijvangsten* (ook wel het markt en discards project genoemd) aangepast moeten gaan worden. Het doel van dit project is om een statistisch betrouwbaar, praktisch en financieel haalbaar bemonsteringsprogramma te ontwerpen voor het monitoren van de biologische gegevens van de Nederlandse commerciële vangsten. Met als doel om bruikbare kwantitatieve waardevolle gegevens te verzamelen voor de eindgebruiker (bijv. ICES, STECF, Ministerie van LNV).

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	16	1.280,-	
CAT III	100.00	337	33.700,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			34.980.-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs		
Project equipment		
Other material costs		
Total Material Costs	0,-	0,-
Total project budget needed	34.980,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	34.980.-	0,-

Project	16. Catch monitoring
Project leader	Edwin van Helmond (WOT Fisheries project leader – Harriet van Overzee)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	4
Continuing project	Yes (2nd year)
Motivation and Project aims	
Lead	A key element in the reformed CFP is the gradual introduction, from 2015 to 2019, of a landing obligation. The introduction of the landing obligation will have an effect on the 'discard' sampling programme on-board commercial fishing vessels. Since, discarding will be forbidden for species with quota limitations, and, allegedly, will not occur anymore, sampling methodologies will have to change from discard sampling programmes to catch sampling programmes. In this study several different methodologies to facilitate this change are tested in two case studies: 1) digital camera technology to record catch composition on board; 2) dockside/harbour onshore monitoring of landed unwanted catches.
Problem definition	**Case study 1** Within the pelagic fishery catch is transported over a processing belt where it is automatically sorted into different lanes, i.e. market size categories. To get a representative view of the unsorted total catch a sample should be taken before this automated sorting process. However, due to technical modifications on-board the vessels it is increasingly difficult for the observers to take unsorted catch samples on board pelagic trawlers. It is increasingly difficult to reach conveyer belts, hoppers and buffers. Fast running conveyer belts with larger and higher railings, increase the risk of getting stuck when taking a sample of the catch. Another issue that derives from shifting discard-sampling to catch-sampling is that unsorted catch includes more catch components than just discards. To get a representative sample of all components of the catch, including the former discards, it is necessary to increase sample sizes. Increasing the sample size in a more challenging environment requires new sampling methods. **Case study 2** In the demersal fishery catches are dumped in the hopper and then they are transported over a conveyor belt where the crew members sort the landings manually. Under the landing obligation landings consist of marketable landings of many commercial species and below minimum size landings of certain species that fall under the landing obligation (BMS fraction). The rest of the catch is discarded at the end of the conveyor belt. Previously only samples were taken at the end of the conveyor belt. Since the BMS fractions needs to be landed from now on, this calls for a sampling program of this fraction onshore (in the auctions) since it is not possible to sample all the BMS on-board.
Objective(s) of the project	**Case study 1** The aim of this study is to develop an electronic monitoring system that helps observers to improve catch recording on pelagic trawlers. This system enables observers to take pictures form the unsorted catch during transport

	over the conveyer belt to the sorting machine. These pictures provide a digital 'snap-shot' of catch compositions. A series of pictures, e.g. 50 – 100 snap shots, during the total duration of catch processing, will provide an accurate estimate of the catch composition. Compared to the current protocol, where observers sample only one or two baskets of fish form the total catch, digital snap shots provide a higher sampling density, and therefore, a more representative sample of the catch. In addition, the risks of taking digital pictures with a camera that can be controlled by a laptop from a distance will be considerably less, than taking a physical catch samples form a fast running conveyor belt. **Case study 2** The aim of this study is to compare on-board and onshore sampling of BMS and to develop an alternative method to sample the BMS fraction of catches in the demersal fleet. So that the time series of catches used in the assessments of several commercial species is safeguarded. **Common objective** From both case studies best practices will be learned so that both methodologies being developed in the pelagic and demersal fleet can be used in the other fleet as well.
Continuing project: Results from previous years	**Case study 1** Two test runs, with successful results, pictures of catch composition. This result describes an important milestone of the project: conformation that it is possible to monitor catch with our self-build electronic monitoring system. **Case study 2** - In 2016 the project results described a sampling scheme to monitor the BMS landings in the auctions. The sampling scheme closely resembled that of the market-sampling of commercial landings. - In 2017 the project was put on hold due since only little BMS was being landed. Focus and planning is shifted to 2018.
Expertise needed	Knowledge on the fisheries and sampling design on commercial fisheries. Specific for **Case study 1**: Computer vision technology, software development. Specific for **Case study 2**: Sampling design statistician, market-sampling fieldworkers, software development.
Expertise developed	Innovative sampling methods. Specific for **Case study 1**: Expertise in computer vision. Expertise in electronic monitoring. Specific for **Case study 2**: Expertise in sampling design and efficient sampling (combining several sampling schemes), electronic monitoring.
Relevance for WOT	Optimization of the catch sampling protocol on commercial fisheries.
Why should this be funded by KB WOT?	Catch data of commercial fishing vessels are monitored under the DCF. This project will be valuable in further adjustment/development of the former discard sampling programmes after the implementation of the landing obligation.
What other potential funding sources have been considered?	WOT Discards monitoring programmes. However, the capacity to test new methods within these projects is very limited.
International objective of research	Presenting/delivering catch information of Dutch commercial fleet, e.g. input for stock assessments (ICES working groups), international study groups (both ICES and STECF).

Work plan	2018	2019 and further
Broad description of the project including expected results	**Case study 1** - In 2018 one completely operational system will be ready. Observers will be able to quickly install the camera above any catch transporting conveyer belt on any pelagic trawler. - A GUI (Graphical User Interface) is developed allowing an observer to control settings and record data with the system. - Starting with the development of computer vision software to 1) automatically count fish; 2) identify species and measure lengths (For length measurements a stereo camera system will be developed). - Establish relationship with Plant Science Group (PSG) of Wageningen University, expert group for computer vision technology. **Case study 2** - In 2018 BMS samples from observer trips and self-sampling trips, and BMS fractions collected in the auctions will be compared. - The expected amount of BMS landings, estimated by raising total discard fractions, is compared to total realised BMS landings from in the field.	**Case study 1** Implementation of video monitoring system into WOT at sea monitoring programmes. Train observer of pelagic trawlers how to operate the system. Recording of footage by on board observers. Start planning to use technology in demersal fisheries. **Case study 2** In 2019 the raising procedures of the BMS fraction of catches are investigated. The raised results of BMS fractions from both programmes are compared and possible differences are investigated. If changes need to be made to the sampling programmes these will be implemented. In 2019 the onshore programme is rolled-out for all species under the landing obligation. It is expected that changes will need to be made to the onshore programme. Also the applicability of this methodology in the pelagic fleet is investigated.
Activities and time schedule	**Case study 1** *Month 1-6:* (i) Improve hard ware installation of system, (ii) Finalized GUI (Graphical User Interface) for users (scientific observers), (iii) Meeting with Plant Science Group (PSG) of Wageningen University, to discuss project outputs and discuss possibilities for further development of system, (iv) Test runs on board vessels *Month 6-12:* (i) Report outcomes/draft manuscript, (ii) Make plan to implement system in WOT monitoring programme. **Case study 2** *Q1 – Q2:* collect samples of BMS landings from observer and self-sampling programme, and collect	**Case study 1** *Month 1-6:* Complete implementation in WOT Scientific publication *Month 6-12:* Computer vision software package.

	BMS samples from the auction. *Q3:* analyse results collected BMS samples, raise discard to estimate expected BMS landings *Q4*: report comparison collected BMS samples, request data on landed BMS from auction, compare with estimated expected BMS landings, report findings.	
Output/deliverables	**Case study 1** Camera technology to monitor catches of commercial fisheries consisting of electronic software system, open source software package to control system, open source software to analyse footage. Described system in peer reviewed scientific journal (submitted draft). **Case study 2** - Comparison of collected BMS landings from different sources - Comparison of BMS fractions from all discard programmes is described in manuscript - Comparison of expected and landed BMS	**Case study 1** Scientific manuscript
Dissemination of findings being addressed	**Case study 1** Presentation of the results at (i) Wageningen Marine Research and to German colleagues (already expressed their interest in the results), (ii) WGCATCH 2018 and International Fisheries Observer and Monitoring Conference (IFOMC) 2018 in Vigo, Spain. **Case study 2** Presentation at WGCATCH and IFOMC 2018.	
Utility of the developed products and expertise	Monitor commercial fisheries under de WOT.	
What are the potential risks to the project's success?	**Case study 1** Not possible to take high quality pictures from the catch (still a risk, so far pictures are sufficient for manual review, however the potential of computer vision is still under investigation). **Case study 2** BMS landings are in such a state that determination to species level and other characteristics is not possible anymore.	
Project organisation		
Involvement Wageningen Marine	**Case study 1** Edwin van Helmond (Fisheries expert and project management), Daniel	

Research (names and expertise)	Benden (Software development and computer vision), Dirk Burggraaf (Technology). **Case study 2** Ruben Verkempynck (Discards and project management), Edwin van Helmond (Fisheries expert), Chun Chen (Statistician), Sieto Verver (Fisheries expert and market sampling), Marcel de Vries/Ronald Bol (Market sampling fieldworkers), Michiel Dammers (Coordinator discard observer programme)
Is the appropriate capacity available?	Yes
Involvement parties within WUR (names and expertise)	**Case study 1** Agro Food Robotics/ Plant Science Group: computer vision
Involvement parties outside WUR (names and expertise)	**Case study 1** Pelagic Freezer-trawler Association (PFA): research cooperation on trawlers
Relevance	
What is the market/ target audience	Ministry, fishing industry, research institutes.
Economical relevance	Good cost effective catch monitoring programmes provide good data and eventually better fisheries management.
Social relevance	Good cost effective catch monitoring programmes provide good data and eventually better fisheries management.
Scientific relevance	Good cost effective catch monitoring programmes provide good data and eventually better fisheries research.
Relevance to ministry LNV	Good cost effective catch monitoring programmes provide good data and eventually better fisheries management.
Summary (UK)	The introduction of the landing obligation will effect on the 'discard' sampling programme on-board commercial fishing vessels. Sampling methodologies have to change from discard sampling programmes to catch sampling programmes. Two case studies are proposed to facilitate this process: 1) A case study where camera technology is used to monitor catches of commercial fisheries, with the aim to increase sampling intensity and make it safer for observers on board. A series of digital snap shots provide a higher sampling density, and therefore, a more representative sample of the catch. 2) A second case study were BMS fraction of catches are sampled onshore and on-board and the best methodology to monitor these fractions is determined.
Samenvatting (NL)	De invoering van de aanlandplicht zal gevolgen hebben voor de bestaande monitoringsprogramma's aan boord van commerciële visserijschepen. Bestaande monitoringsmethoden zullen moeten worden aangepast. Er zal een transitie moeten plaatsvinden van discardmonitoringsprogramma's naar vangstmonitoringsprogramma's. Om dit te bewerkstelligen worden hier twee casestudies voorgesteld: 1) Een case waarbij cameratechnologie wordt gebruikt om de vangstsamenstelling op commerciële schepen te kunnen bepalen. D.m.v. deze technologie kan gemakkelijker en veiliger een representatief monster van de vangst genomen worden. 2) Een tweede case waarbij zowel een methodologie om de BMS fractie van de vangsten aan boord als aan de wel te monitoren wordt ontwikkeld. Binnen het project wordt onderzocht welke uiteindelijk de beste manier is om deze BMS fractie te monitoren.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	CS1: 200 CS2: 60	CS1:16.000,- CS2: 4.800,-	
CAT III	100.00	CS1: 80 CS2: 120	CS1: 8.000,- CS2:12.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			40.800,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	CS2: 600,-	
Project equipment	CS1: 2.000,-	
Other material costs		
Total Material Costs	2.600,-	0,-
Total project budget needed	43.400,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	43.400,-	0,-

Project 	17. Discard valves
Project leader	Pieke Molenaar (WOT Fisheries project leader – Harriet van Overzee)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1 year
Continuing project	Yes, sequel of *Discard Valves (KB-24-005-018)*
Motivation and Project aims	
Lead	This project aims to further improve a discard valve system that was developed within the KBWOT project Discard valves in 2016. The system can be used to accurately measure discard quantities on board of demersal fishing vessels. It solves the problem of (highly) inaccurate discard estimates when total catches are badly estimated based on traditional methods (i.e. optical estimation). Within the 2016 Discard valves project a prototype of the discard valve was manufactured and tested on board of a commercial vessel. Testing was promising. However, further development and testing of the discard valve is essential for its application and wide-spread integration in the WOT discard sampling program. Ultimately, this project will result in a more efficient discard monitoring. Results will be disseminated in the scientific community and the fishing industry.
Problem definition	The Wageningen Marine Research discard monitoring programme has been and is criticized by some people in the Dutch fishing industry. This criticism is mainly focused on the estimated discard quantities that follow through a possible biased estimation of the total catch. The problem becomes clearly apparent when the current discard monitoring protocol is applied on fisheries with small discard rates (e.g. twin trawling for plaice, fly shooters, …). During these trips it has occurred several times that the estimation of the total catch was lower than the sum of the landings and fish discards indicating an inaccurate total catch estimate. The total catch estimate is currently essential within the discard monitoring programme as it is used: 1. as subsampling factor to raise sub-samples of fish catch or discards to haul level. Where for the first total catch is directly used as subsampling factor and for the latter total catch is used in combination with total landings to calculate a specific discards subsampling factor. 2. to calculate benthos, where benthos discards = total catch – (landings + fish discards) and (ii) calculate the sub-sampling factor for the fish discards. We think it is essential that methods are developed to either accurately measure total catch or the total amount of discards. We believe that a redesigned discard valve system is appropriate for this.
Objective(s) of the project	i) Improve discard data quality and accuracy using a measuring device for discards. ii) Further improve design and test the prototype on board commercial vessels during demersal discard sampling programs. iii) Implement discard valve in WOT demersal discard sampling schemes. iv) Evaluate the potential of using the discard valve system in other WOT discard programmes.

Continuing project: Results from previous years	The 2016 KBWOT project Discard valves designed and produced a prototype of discard valves for discard sampling on board of demersal vessels. The prototype has been tested on land and on board of a commercial vessel. Further fine-tuning and development are necessary before the valve can be implemented in the WOT discard sampling program.
Expertise needed	Technical development, software programming, sea-state compensating software
Expertise developed	Accurate semi-automatic discard sampling method
Relevance for WOT	Improving discard data quality, developing expertise in discard monitoring
Why should this be funded by KB WOT?	Improving data accuracy is highly relevant for the WOT demersal discard program, for both the self-sampling and observer trips.
What other potential funding sources have been considered?	Industry contributions, however first a proof of concept is needed to convince industry partners to invest in this sampling tool.
International objective of research	The challenges of measuring and quantifying discards in fisheries is a persistent subject in fisheries conferences held worldwide (ICES FAO WGFTFB, IFOMC, and MARTEC). The development of the discard valve enables research institutes and fisheries to improve data quality and deliver more accurate discard estimates for stock assessments. The results can furthermore improve selectivity experiments and provide more precise discard quantities for policy advising under the landing obligation.
Work plan	**2018**
Broad description of the project including expected results	This project will consist of five steps: 1. The project team will fine-tune the prototype discard valve system v1.0. This will result in a final prototype version. Besides initial contacts with companies providing sea state compensated weighing software will be established. 2. Testing of final prototype on a selected group of vessels. 3. The prototype resulting from phase 1 will be customized with sea-state compensated weighing software. 4. Discard valve system (v2.0) will be tested to ensure that all the software is working properly and no software or hardware errors occur. 5. Discard valve v2.0 will be fine-tuned where needed after which it is ready for use within the WOT demersal discard sampling program. 6. Reporting and description of discard valve system
Activities and time schedule	January-March: Step 1 April-May: Step 2 June-September: Step 3 October-November: Step 4 December: Step 5 and 6
Output/deliverables	A sea-state compensated version of the discard valve (v2.0) that can be used within the WOT demersal discard sampling.
Dissemination of findings being addressed	i) Article in "Visserijnieuws" informing industry of innovative discard valve system ii) Presentation at ICES FAO WGFTFB & IFOMC09 iii) Manuscript of the development and design of the system for submittal to scientific journal.
Utility of the developed products and expertise	High; Currently fish and benthos discards are calculated from the total catch estimate: This can be avoided through implementation of the discard valve system in

	the WOT discards sampling program. This expertise would strengthen Wageningen Marine Research as a leading expert in discard research
What are the potential risks to the project's success?	A potential risk of the project is that the sea-state compensated software needs additional funding. Although contacts for obtaining sea state compensated weighing software are established in the first phase of the project, this may software may delay the development if it's not available in the 3th phase. The budget is based on the existing prototype, damage or loss of the prototype on board of commercial vessels may affect project costs.
Project organisation	
Involvement Wageningen Marine Research (names and expertise)	Pieke Molenaar, Michiel Dammers, Ruben Verkempynck, Harriet Overzee
Is the appropriate capacity available?	Yes, the WOT demersal discard sampling program includes 10 trips on-board commercial vessels, this enables researchers and observers to test the discard valve on several trips.
Involvement parties within WUR (names and expertise)	none
Involvement parties outside WUR (names and expertise)	Dammers VOF for further development and programming v2.0. A second party (Marel, Marelec or comparable party) will be involved to include sea-state compensated weighing software.

Relevance	
What is the market/ target audience	Scientific discard monitoring at Wageningen Marine Research and similar international institutes. This device may even be deployed for industry use in the estimation of discards under de landing obligation.
Economical relevance	Accurate discard measurements resulting in more efficient and quality-rich monitoring.
Social relevance	i) Less stress for observers, no need for inaccurate catch estimations ii) Improved trust from industry in discard monitoring results, stock assessments and related subjects depending on discard data.
Scientific relevance	Improving discard data quality, developing expertise in discard monitoring
Relevance to ministry LNV	High with the increasing need for discards data due to the introduction of the landing obligation
Summary (UK)	This project aims to develop a second improved version of the discard valve system. This system can be used to accurately measure discard amounts on board of a fishing vessel. It solves the problems with uncertain discard estimates (fish and benthos) resulting from uncertain total catch estimates. The first prototype of the discard valve that was developed in 2016 will be improved with sea compensated software. This project will result in a sea state compensated version of the discard valve that can be used to accurately estimate discards. Results will be disseminated in the scientific community and fishing industry.
Samenvatting (NL)	Dit project heeft als doel een verbeterede tweede versie van de discardklep te ontwikkelen. Dit systeem kan gebruikt worden om precieze discards metingen uit te voeren aan boord van bedrijfsschepen. Het lost het probleem van onnauwkeurige discardschattingen op, die het resultaat zijn

	van een onzekere schatting van de totale vangst. In dit project zal de eerste prototype van de discardklep aangepast worden met zee-staat gecompenseerde software. De aangepaste discardklep levert betere en accuratere discardschattingen op. De resultaten worden uitgedragen in de visserijsector en de wetenschappelijke community.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	40	3.200,-	
CAT III	100.00	50	5.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			8.200,-	0,-

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs	3.500,-	
Travel costs	500,-	
Project equipment	5.000,-	
Other material costs	1.000,-	
Total Material Costs	10.000,-	0,-
Total project budget needed	18.200,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	18.200,-	0,-

Project 	18. Understanding the uptake of innovation in fisheries monitoring
Project leader	Marloes Kraan (WOT Fisheries project leader - Niels Hintzen)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	1
Continuing project	No
Motivation and Project aims	
Lead	Marloes Kraan
Problem definition	Accurate and reliable data collection programmes are essential for sustainable management of marine resources. Inaccurate estimates lead to imprecise and potentially biased stock assessment models. With the establishment of the Common Fisheries Policy (CFP) of the European Union (EU) collecting data, initially effort and landing information, of commercial fisheries became a compulsory requirement in 1983. Later, awareness was raised of the importance of discards estimation, and observer programs and at-sea-control were established in the frame of the European Data Collection Framework. However, observer programmes are expensive and time consuming, resulting in imprecise estimates due to low sampling coverage. Although, alternative methods and high technology products, such as GPS, large data storage capacities, cellular network communication, image recognition software are more and more available, monitoring programmes have not evolved much since 1983. All member states still depend on observer programmes, largely using subsamples of catches where fish are manually measured one by one on a measuring board and often recorded with pencil and paper. In 2009, the Netherlands implemented a discard self-sampling programme in cooperation with the fishing industry to increase sampling coverage of at-sea observations. The sampling intensity of the demersal fisheries increased from 10 to more than 160 trips annually, resulting in more accurate estimates, and an improved relationship with the industry. Although, the discard estimates are accepted in ICES working groups and used in stock assessments, there is no uptake of this method by the other member states, still contemplating on continuation of the observer programmes. A similar situation is observed with Remote Electronic Monitoring (REM). Within the last decade, REM has emerged as a cost-efficient alternative approach for documenting catches in fisheries. REM systems consist of various activity sensors, GPS, and CCTV, which allow for the monitoring and complete documentation (100% coverage) of catches and detailed fishing effort estimation without requiring additional on-board personnel. The three major benefits of REM are: 1) cost-efficiency, 2) the potential of REM to provide much wider (and more truly random) coverage of the fleet than any observer programme will ever achieve, and 3) REM registration of fishing activity and position of much greater detail. In spite of the possibilities of REM, member states have so far remained reluctant to use REM in monitoring programmes. Compared to the use of REM elsewhere, the European trials are still in a pilot stage. Current REM programmes in e.g. the Pacific, Alaska, British Columbia, and Chile are already well developed with

	comprehensive monitoring programmes covering 100% of fleets, in some cases involving over 200 vessels, 1,200 trips, 10,000 days at-sea and 20,000 fishing events annually. Even more, REM currently seems to be the only viable alternative to on-board monitoring under the forthcoming European landing obligation, yet still managers are reluctant in the implementation of this monitoring tool. In this project we will study the introduction of new monitoring techniques making use of two social science theories: the multi-level perspective (MLP) of transition theory (Geels 2004) and the social practices theory (Reckwitz 2002, Huttonen and Oosterveer 2016). Monitoring technologies or methods are seen as social practices as it allows for integrating technology and individual actors (and their values, knowledge and skills). At the same time the uptake of new practices not only depends on the actors active with the monitoring method itself (in the niche were it is developed) but also on landscape and regime developments (as explained in MLP). We observe the social practices (standard method and innovations), and interview the actors involved throughout the data chain (responsible for the monitoring being performed, people performing monitoring, dealing with the data, the fishermen on whose vessels monitoring is performed etc.). All data will be analysed using a qualitative analysis program ATLAS TI and we will write up the manuscript.
Objective(s) of the project	Better understanding the processes behind (non-)acceptance (and implementation) of new monitoring techniques will help to promote and implement our expertise and experiences, or help improve us doing so, in the regionalisation process.
Continuing project: Results from previous years	NA
Expertise needed	Knowledge about monitoring techniques & social science
Expertise developed	Understanding the way in which we discuss, introduce, promote monitoring techniques that deliver better results
Relevance for WOT	Over the last 8 years Wageningen Marine Research/CVO invested intensively in the implementation of a self-sampling under the national sampling programme. Wageningen Marine Research recently successfully established 4 years of REM pilot studies in the Dutch commercial fisheries. With the latest reform of the CFP, regionalisation of monitoring programmes between member states is a prominent goal under the DCF. Coordinating programmes and synchronizing sampling methodologies will be a prominent role of the recently implemented Regional Planning Groups. The slow uptake of new monitoring techniques in general (by other members states) will feed a conservative approach in the regionalisation process and creating the risk of not fully exploit the possibilities of monitoring fisheries, and consequently in (again) imprecise catch estimations. Besides, this process is jeopardizing the advantages and investments made by Wageningen Marine Research in the last decade, when planning groups agree to use less advanced monitoring strategies.
Why should this be funded by KB WOT?	Innovation of monitoring techniques is essential for WOT on the long run.
What other potential funding sources have	Non

been considered?		
International objective of research	Sharing our expertise and experience & improving WOT monitoring methods	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	2 cases, 12 (semi-structured) interviews with researchers (throughout the data chain: collecting data, using data, advising), at sea observers, fishers, policy-officers	NA
Activities and time schedule	Month 1-8: Interviews and documentation Month 9-12: Analysis of interviews and reporting.	NA
Output/deliverables	Manuscript	NA
Dissemination of findings being addressed	Presentation of findings in Regional Planning Groups and ICES working and expert groups i.e. WGCATCH. MARE conference. MSEAS conference.	NA
Utility of the developed products and expertise	Expertise will be used in Regional Planning Groups and for further innovation of monitoring within WOT and Wageningen Marine Research.	NA
What are the potential risks to the project's success?	Cooperation of colleagues abroad (whom might not prioritise cooperating in this project)	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Edwin van Helmond Niels Hintzen Marloes Kraan Interviews will be held with colleague researchers and field assistants	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	No	
Involvement parties outside WUR (names and expertise)	Interviews will be held with researchers from ILVO and ICES scientists	

Relevance	
What is the market/ target audience	National DCF coordinators, Regional Planning groups, Ministries, High-level groups (e.g. Scheveningen group).
Economical relevance	Support innovation in monitoring
Social relevance	As the data that is collected within the DCF is funded by public sources, it is essential that it is executed in the best possible way.
Scientific relevance	Better understanding the processes behind (non-)acceptance (and implementation) of new monitoring techniques will help the international

	scientific community to improve data collection.
Relevance to ministry LNV	Improving WOT
Summary (UK)	This project will help us improve WOT by contributing to a better understanding of the processes behind (non-)acceptance (and implementation) of new monitoring techniques. We will study two cases of new monitoring techniques / practices with different uptake trajectories: remote electronic monitoring and self-sampling. We are interested to understand why self-sampling is taken up in the Netherlands, and the data is accepted in ICES groups, used for advice, but self-sampling is not used in other countries & why REM is a possible technique but not used in the Netherlands. We will have 12 semi-structured interviews with all involved actors in these 2 cases (researchers, at sea observers, fishers and policy-officers) and analyse the data by making use of two social science theories (social practice theory and the multi-level perspective of transition theory) resulting in a manuscript. We will present the outcomes for the relevant actors.
Samenvatting (NL)	Met dit project willen we een bijdrage leveren aan de verbetering van de WOT door onderzoek te doen naar de achterliggende processen van (non-) acceptatie (en implementatie) van nieuwe monitoringstechnieken. We zullen 2 case-studies doen naar nieuwe monitoring technieken / praktijken met diverse 'uptake' paden: remote electronic monitoring and self-sampling. We willen begrijpen waarom self-sampling in NL geïmplementeerd is maar niet in andere landen rondom de Noordzee, terwijl de data wel in ICES geaccepteerd en gebruikt wordt. En waarom REM een mogelijk monitoringstechniek is maar deze in NL niet ingezet wordt. We zullen 12 semigestructureerde interviews houden met diverse groepen betrokken actoren (onderzoekers, waarnemers, vissers en beleidsmakers) en we analyseren de data door gebruik te maken van 2 sociaalwetenschappelijke theorieën (sociaal practice theory and the multi-level perspective of transition theory) hetgeen resulteert in een manuscript. Aan de hand van deze analyse zullen we de resultaten bespreken in de diverse fora waar dit nuttig is.

Proposed budget	2018			2019 and further
Personnel	**Tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	272	27.200,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			27.200,-	0,-

Material costs	2018	2019 and further
Facilities		
Specific costs		
Travel costs	1.700,-	
Project equipment		
Other material costs		
Total Material Costs	1.700,-	0,-
Total project budget needed	28.900,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	28.900,-	0,-

Project	19. eDNA and camera rivers
Project leader	Ben Griffioen (WOT Fisheries project leader – Ingeborg de Boois)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	2
Continuing project	No (If yes, add which year in the cycle)
Motivation and Project aims	
Lead	Is environmental DNA (eDNA) an applicable monitoring technique for fish species composition in the Dutch rivers?
Problem definition	Wageningen Marine Research executes several fish monitoring programs in the (large) Dutch rivers and lakes for the ministry of economic affairs (LNV, WOT) and Rijkswaterstaat (RWS, MWTL). The programs use passive fishing gears (traps) especially for rare diadromous fish (e.g. eel, salmonids, lampreys) which presence in the lakes and rivers is limited to migration periods. Local fisherman are contracted to collect catch data according to provided protocols. Since these fisherman are contracted to catch fish for scientific purposes there are strict regulations and agreements (e.g. fish must be quickly released into the water after counting and length measurements). These regulations and agreements are part of each (formal) communication between fishermen and Wageningen Marine Research. A fisherman will be excluded from further collaboration with Wageningen Marine Research if he does not meet the regulations and agreements. Since most fisherman have unique fishing rights in 'their' waters, an exclusion of a specific fisherman will automatically also include a loss of a monitoring location. Furthermore, potential replacement of a fisherman is hampered by the prescription that the fisherman that has fishing rights in a specific water, has to give permission to a potential third party to catch fish. Past years have proven that multiple fisherman violated regulations and were excluded from the monitoring programs. Yet, Wageningen Marine Research has found alternatives to continue monitoring at most of the locations were fisherman were excluded. However, Wageningen Marine Research expects within 3-5 years alternatives are lacking which threatens reliable trend monitoring or monitoring diadromous fish at all.
Objective(s) of the project	On the 10th of October 2017 a meeting and discussion had taken place between Wageningen Marine Research, LNV and RWS. This meeting resulted in the agreement to focus on two main topics: a. a better control of current monitoring activities b. innovative monitoring techniques as an alternative for trend monitoring. This includes: 1. environmental DNA (eDNA) for species composition 2. video techniques for fish numbers and length estimations. This proposal is about b "innovative monitoring techniques as an alternative for trend monitoring using eDNA (1) and video techniques (2). *eDNA* The is use of eDNA for species composition is a well-developed method in lakes. Also in small brook systems the first eDNA samples and species composition are promising (pers.comm. R. Brys, INBO). However to use

	eDNA technique in (large) rivers have not been used yet. Moreover, there are several questions whether this technique is applicable at all as an alternative for traditional trap monitoring. For example: what is the retention time of DNA in the water? How many samples are needed to prevent any false negatives? Where samples are need to be taken (shores, depth, etc.). In order to meet some of these questions a few eDNA samples are taken in spring 2016. These eDNA samples are collected by DATURA (own initiative). In 2016 these samples are analysed and compared to trap monitoring data. These results of this brief analyses are presented by Wageningen Marine Research (Ben Griffioen) at a symposium[6]. Within this project it is proposed to further analysis of the data and to report the results in a report and secondly to advise LNV or RWS whether this technique is applicable as alternative for trap monitoring. The requested budget is in addition to a separate requested fund from RWS that is willing to further investigate this technique as alternative for (traditional) trap monitoring. *Video monitoring* Traps are used to catch fish. Therefore, fish needs to be taken out of the water, counted, measured and released subsequently. Besides the already mentioned sensitivities about violation (poaching) within monitoring programmes, this process also causes fish mortality. Video techniques may be used as an alternative for counting and measuring fish. Fish are not caught, but guided through a 'video tunnel' which register the 'catch' by video. Internationally there are video techniques available for fish pass evaluation (e.g. VAKI). These techniques are expensive and not always applicable in turbid waters. In the Netherlands a newly developed camera fish detection system (IR camera, Kroes Consultancy) may potentially be used as an alternative to count and measure fish. This project explores the possibility to use an "open trap" with additional video techniques to count and measure fish. A camera will be attached to a trap and it will register fish once fish is 'caught' in the trap. This experiment will explore the possibility the use of video registration as alternative for traditional trap monitoring. Eight traps will be installed: four control traps (A1-A4) and four traps with camera systems (B1-B4). Traps will be installed close to each other at comparable locations. During the experiment traps will be emptied after 2 days for 16 days in total (n=8 in duplo). Furthermore, treatment per trap (with or without camera) will be randomly assigned during the experiment. The catch of A will be counted and measured (cm). The films of B will be analysed[7] on species composition, numbers of fish. Software for automatic counting, species recognition or length estimations is expensive, not useful for length estimations or limited available (licence). However, in a previous project video software of TOPIC have been used for DIDSON analysis (Smit et al. 2016[8]). Within this

[6] https://www.regelink.net/weblog/mini-symposium-edna-in-ecologisch-onderzoek/

[7] Possibly with the help of students: internship or (master) thesis

[8] Smit *et al*. (2016) Tidal Energy fish Impact – method development to determine the impact of open water tidal energy converters on fish. MIIP005 Nederland Maritiem Land

	proposed project the use of existing software with possible adaptations will be explored for automatic analysis.	
Continuing project: Results from previous years	NA	
Expertise needed	eDNA: Knowledge on already carried out monitoring data. Knowledge on fish fauna in the Dutch rivers, analytical expertise. Video monitoring: Image analyses, experience with machine learning, knowledge on fish fauna.	
Expertise developed	eDNA: Knowledge on the feasibility whether eDNA is applicable as an alternative for traditional trap monitoring for species composition. Video: Knowledge on machine learning and visual analysis, insight in the possibility to use this methodology as alternative for traditional trap monitoring.	
Relevance for WOT	The development (or replacement) of traditional trap monitoring is needed to continue trap (trend) monitoring in Dutch rivers and lakes.	
Why should this be funded by KB WOT?	The KB-WOT is used as co finance in the mentioned combined project (LNV/RWS). Species composition is relevant for LNV as for RWS, while length measurements are especially relevant for LNV as part of the eel management plan.	
What other potential funding sources have been considered?	RWS innovation. It is unknown whether this fund will be available. In the second half of November RWS and Wageningen Marine Research will have meetings to further discuss the possibility of funding both projects (eDNA and video).	
International objective of research	Silvereel monitoring is part of the DCF and has therefore international interest.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	Analyses of already collected data. Insight whether eDNA is applicable for species composition in large rivers Different explorative meetings and software programming for length estimations. Experimental setup using trap and video registration.	
Activities and time schedule	eDNA January – data analyses February - March – writing report Video Feb: working group with Kroes consultancy, Wageningen Marine Research, Visserij Service Nederland. June – Sep: field experiments Oct: data analysis	

	Nov: writing report	
Output/deliverables	Report which describes findings and will give advice on the potential of using the technique as alternative	
Dissemination of findings being addressed	A written report presenting results and (first) advice of potential use of this technique.	
Utility of the developed products and expertise	Evaluation of the traditional monitoring techniques	
What are the potential risks to the project's success?	*eDNA* None. There is no risk of this project since the data is already available. The requested budget is used for further analysis and report the results. *Monitoring* LNV especially is interested in silver eel escapement. Therefore field experiments are limited to migration period. However to ensure successful completion of the project, earlier experiments are needed with the risk of missing silver eel. However, data collection of other fish (including yellow eel) will also give enough insight in the application of the technique.	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Ben Griffioen, Kees van Bochove (DATURA), Erwin Winter, Daniel Benden, Olvin van Keeken, Sander Glorius	
Is the appropriate capacity available?	Yes	
Involvement parties within WUR (names and expertise)	-	
Involvement parties outside WUR (names and expertise)	RWS, Kroes Consultancy, Visserij Service Nederland, DATURA	

Relevance	
What is the market/ target audience	Ministry LNV and Rijkswaterstaat
Economical relevance	Eel is a commercial fish species, but mainly biological relevance
Social relevance	Both eDNA and video registration are used as alternative for species composition and length estimations, there is no need to catch fish which prevents mortality of fish.
Scientific relevance	The scientific relevance of the proposed project is limited since data is limited (eDNA). However, the results will give insight in the necessity of further scientific research. Video registration is not being used in freshwater trend monitoring and therefore a relevant innovation for freshwater monitoring and research.
Relevance to ministry LNV	Proceeding the data collection in the large rivers. Current methods with traditional traps have limitations as it comes to collaboration with fisherman.

	If violations of fisherman will proceed, there is a very risk that locations will not be monitored in the (near) future. Alternative methods are needed to proceed monitoring fish and diadromous fish in particular.
Summary (UK)	Wageningen Marine Research executes several fish monitoring programs in the (large) Dutch rivers and lakes for the ministry of economic affairs (LNV, WOT) and Rijkswaterstaat (RWS, MWTL). The programs use passive fishing gears (traps) especially for rare diadromous fish (e.g. eel, salmonids, lampreys) which presence in the lakes and rivers is limited to migration periods. The monitoring program are under pressure due to violations of contracted fisherman and alternatives need to be evaluated. This projects evaluates two techniques: Environmental DNA (eDNA) and video registration. eDNA may be an alternative for traps in monitoring species composition in Dutch rivers and lakes. This project uses existing eDNA data collected in large rivers (4 locations and multiple samples) to compare results to traditional trap data (species composition). Also, video techniques may be a good alternative for counting fish and to measure fish length. Traps are still needed to guide fish to a video registration system. However, fish can proceed migration after being registered. This project evaluates the possibility of video registration for, species identification, fish counts and length measurements.
Samenvatting (NL)	Wageningen Marine Research voert diverse monitoringsprogramma's uit voor LNV en RWS in het kader van de WOT en MWTL monitoring. Veelal worden voor de monitoring van diadrome vissen (vb. aal, zalmen, prikken) fuiken gebruikt om een grotere vangkans te hebben met een relatief lage inspanning. Echter, deze programma staan onder druk door overtredingen van ingehuurde beroepsvisserij en de daaropvolgende uitsluiting van het project. Voor de voortzetting van trend monitoring en de evaluatie van soortsamenstelling is het van belang om op zoek te gaan naar alternatieven. eDNA is mogelijk een techniek om de soortsamenstelling van vis vast te stellen. Dit project gebruikt bestaande eDNA data om een vergelijking te maken met fuiken data in de soortsamenstelling. Het geeft een eerste inzicht in de toepasbaarheid van eDNA op de grote rivieren. Een tweede alternatief is videoregistratie. Videotechnieken kunnen worden ingezet om vissen te registeren, te tellen en op te meten (lengte). Na de registratie kunnen de vissen doorzwemmen om hun migratie voort te zetten. Dit project exploreert de mogelijkheden om videotechnieken in te zetten als alternatief voor traditionele fuiken monitoring.

Proposed budget	2018			2019 and further
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00	80	6.400,-	
CAT III	100.00	140	14.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			20.400,-	0,-

Material costs	2018	2019 and further
Facilities	3.000,-	
Specific costs		
Travel costs	400,- (travel to RWS)	
Project equipment		
Other material costs		
Total Material Costs	3.400,-	0,-
Total project budget needed	23.800,-[9]	0,-
Financing through other resources -/-	RWS funding, amount and availability still unknown. RWS is willing to invest in alternative techniques. However, when no RWS funding will be available, the eDNA evaluation will still successfully be completed with KBWOT funding. The video registration project will be limited to a comparison of trap catchments (fewer and fewer traps) and manual video analysis by students (numbers and species composition). When RWS budget is available, the project will be extended with more data collection and extensive video registration analysis. Moreover, with RWS budget, automatic software analysis will be (better) examined.	0,-
Finance needed from KBWOT	23.800,-	0,-

[9] Excluding RWS Budget

Project	20. Fish ageing
Project leader	Loes Bolle (WOT Fisheries project leader - Sieto Verver)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	Part A: annual Part B: 2nd year of 3 years
Continuing project	No/yes (see above)
Motivation and Project aims	
Lead	
Problem definition	**PART A: Maintaining key expertise** Age reading is a key expertise in fisheries research. Maintaining this key expertise requires training, exercise, international calibration, quality assurance and quality control. Maintenance of this expertise is an ongoing issue. From 2018 onwards, international calibration, quality assurance and quality control will be funded through WOT. This leaves only training and exercise within KBWOT. **PART B: Innovation ("Masterplan fish ageing")** The process of fish ageing consists of several sequential activities. After collection, the otoliths (or other calcified structures) are processed, using different techniques for different species. Some techniques, such as (stained) transverse sections are complex and consist of several steps. The processed material is subsequently aged by experienced age readers. The age readings are then digitised using the input programme "Billie", which means that each sample has to be re-opened to add the ages. Finally, the age data is uploaded to FRISBE and the material is stored. The whole process, from the collection of material up to the databased ages and stored material will be reviewed. Potential innovations and improvements will be listed and, if possible, implemented. The goal is improvement of the quality and especially of the efficiency of fish ageing to ensure a state of the art production line for the ten thousands of age determinations we perform on an annual basis. This improvement and innovation plan, referred to as "masterplan fish ageing", will be developed and implemented in 3 years (2017-2019).
Objective(s) of the project	(A) Maintaining the key expertise of age reading (B) Improving the quality and efficiency of the whole process of fish ageing
Continuing project: Results from previous years	(PART B only) The whole process has been reviewed to determine where efficiency and quality can be improved. A major improvement in efficiency is expected if image analysis software is used for automated data entry of (reader determined) ages, despite the additional time required for image digitisation. This innovation is also expected to improve quality due to reduced error risk, additional products (growth increment measurements) and enhanced quality control (recording of interpretations by means of annotated images). Other improvements include advancements in processing of material (such as a semi-automatic sawing machine), re-evaluation of the cost-effectiveness of various processing techniques (such as break-burn vs stained sections) and a reorganisation of the lab facilities.

	Some potential innovations such as digital techniques for tracking of material (e.g. Q-codes) have been examined, but were rejected as a substantial improvement of the processing line.	
Expertise needed	(1) Scientists with expertise and contacts in the field of fish aging (2) Experienced age readers (3) Database expertise (4) Software development expertise	
Expertise developed	(1) Maintenance and improvement of the quality of age data (2) Improvement of the efficiency of whole fish ageing process (3) Growth increments as standard product of the age reading procedures (4) Automated data entry of (reader determined) ages and increments (5) A database with annotated images, accessible to all users, underpinning the age determinations and growth increment measurements	
Relevance for WOT	This is of great relevance for WOT as age-based data from market, survey and discard sampling are used in the stock assessments.	
Why should this be funded by KB WOT?	Wageningen Marine Research (Wageningen Marine Research) needs to maintain its expertise in age reading to deliver an internationally approved WOT programme. However, activities crucial for the maintenance of this expertise are not covered by WOT funding and have therefore been funded by KBWOT. From 2018 onwards, international calibration, quality assurance and quality control will be funded through WOT. However, the training of new age readers is not covered by WOT. Training is an annual reoccurring issue due to staff changes and the large number of species we age. Further development and innovation of the whole process of fish ageing is desirable to improve quality and especially efficiency. This issue is not covered by the WOT programme either.	
What other potential funding sources have been considered?	WOT programme	
International objective of research	Maintain and improve the quality of age data used in international stock assessment working groups.	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	**PART A: Maintaining key expertise** KBWOT fish ageing used to include 3 activities crucial for maintenance of the key expertise age reading (training, international calibration and quality assurance/control). From 2018 onwards, the WOT programme will cover international calibration and quality assurance/control. The training of new age readers remains within KBWOT. This is urgently needed to enable replacement of several experienced readers who have retired or are nearing retirement. Furthermore, we aim at 2 age readers per species to ensure continuity and to avoid any delays in supplying age data.	**PART A: Maintaining key expertise** As in 2018 (ongoing activities)

	PART B: Masterplan fish ageing In the 1st year (2017) cost-effective innovations for improved efficiency and quality were documented and already partly implemented. In the 2nd year improvements and innovations will be (further) implemented. The main focus will be on customisation of an existing image analysis programme (SmartDots) to provide maximum quality and efficiency of age reading within the Wageningen Marine Research process. SmartDots has been developed by ILVO and has already been adopted by ICES as follow-up for WebGR. Customisation is required to enable automated data entry of age and increment measurements. The lab facilities for the preparation of material (otoliths and other calcified structures) and for image acquisition need to be improved and elaborated. This is necessary mainly to enhance efficiency, but also to improve quality and ARBO work conditions. The aim is to complete the renovations and innovations of the lab facilities in 2018. NB: This KBWOT proposal covers the hours needed to develop and implement the masterplan. The direct costs will have to be funded through Wageningen Marine Research's investment scheme.	**PART B: Masterplan fish ageing** The final improvements and innovations of the masterplan will be implemented in the 3rd year. Image acquisition and analysis will become an integral part of routine age determinations. This includes automated data entry of (age reader determined) ages in increment sizes. This also includes an image data base with "1 click away" access to (annotated) images for age readers and data-users. Digitisation of images is not only foreseen as part of the national masterplan, it is already an important aspect of international calibration exercises.
Activities and time schedule	**PART A: Maintaining key expertise** Training: Throughout year. Experienced readers train new readers. Progress is pushed and tested by coordinators. **PART B: Masterplan fish ageing** (1) Image database: Created and filled with images ≤ 2017. (2) Image acquisition: further optimised and documented (3) Image analyses: (a) Design phase, (b) SmartDots2FRISBE customisation and (c) test phase completed in 2017. (4) Renovations and innovations of the lab facilities completed	**PART A: Maintaining key expertise** As in 2018 **PART B: Masterplan fish ageing** (1) Image database operational and accessible to all users (2) Image analysis operational and implemented for most fish species
Output/deliverables	Progress report.	Progress report.
Dissemination of findings being	Dissemination through WGBIOP	ditto

addressed		
Utility of the developed products and expertise	Most population dynamic research carried out by Wageningen Marine Research, whether for scientific publications or for fisheries management advice, is age structured. Hence maintenance and improvement of the expertise fish ageing is of great importance to WOT and Wageningen Marine Research. The utility of the masterplan is mainly increased efficiency, but it will also contribute to data quality.	ditto
What are the potential risks to the project's success?	Insufficient prioritisation	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Peter van der Kamp & Daniel Benden (software development & database) Sieto Verver, Ruben Hoek, Eric Visser (facilities) André Dijkman, Jan Beintema, Marcel de Vries, Betty van Os, Peter Groot, Ruben Hoek, Thomas Pasterkamp, Maadjieda Tjon-Atsoi, Erika Koelemij, Andrea Sneekes, Norie van Meeren, Tim Huijer (age readers, preparation) Ineke Pennock & Loes Bolle (age coordinators)	
Is the appropriate capacity available?	yes	
Involvement parties within WUR (names and expertise)	NA	
Involvement parties outside WUR (names and expertise)	Age readers and age reading coordinators from laboratories throughout Europe	

Relevance	
What is the market/ target audience	Relevant for all (WOT) projects involving fish ageing
Economical relevance	Sound fisheries advice
Social relevance	Sound fisheries advice
Scientific relevance	Age structured research (population dynamics, growth studies, etc.)
Relevance to ministry LNV	Almost all stock assessment models are age structured
Summary (UK)	The key expertise age reading is of crucial importance for all age-structured population dynamic research, such as fish stock assessments for management advice. Maintenance and improvement of this key expertise is therefore of paramount importance for both WOT and Wageningen Marine Research. This project furthermore aims at innovation of the whole fish ageing process (from the collection of material to databased ages and storage of material) to improve both the quality and the efficiency of fish ageing.
Samenvatting (NL)	De kernexpertise leeftijdsaflezingen is van essentieel belang voor leeftijds-

	gestructureerd populatie dynamisch onderzoek, zoals de toestandsbeoordelingen van visbestanden en daarmee de visserijadviezen. Onderhoud en verbetering van deze kernexpertise is daardoor erg belangrijk voor zowel WOT als Wageningen Marine Research. Dit project heeft bovendien tot doel het hele proces van leeftijdsbepalingen bij vissen te innoveren om zowel de kwaliteit als de efficiency van leeftijdsbepalingen te verbeteren.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00	32	1.920,-	
CAT II	80.00	378	30.240,-	
CAT III	100.00	138	13.800,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			45.960,-	40.000,-

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs		
Travel costs	500,-	
Project equipment		
Other material costs		
Total Material Costs	500,-	500,-
Total project budget needed	46.460,-	40.500,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	46.460,-	40.500,-

Project 	21. Developing tools to incorporate ecosystem considerations into management
Project leader	Thomas Brunel (WOT Fisheries project leader – Niels Hintzen)
Theme	1. Improving and underpinning the WOT Fisheries programme
Expected duration of the project (years)	2
Continuing project	Yes, applying for the second year
Motivation and Project aims	
Lead	
Problem definition	The ecosystem approach to fisheries management EAF has been widely recognised as a need for the proper management of fisheries resources and ecosystems. However, there is a remarkable lack of projects supporting the development of practical tools of direct application in the management advice. The EAF deals with the evaluation of the impact of fishing in the ecosystem and in turn, with the assessment of ecosystem influence in the exploited resources. On this regard, the EAF is based on the idea that stocks are part of an ecosystem, and that their productivity and therefore the optimal levels of sustainable exploitation (i.e. Fmsy) depend on other ecosystem factors (abundance of other species, environmental conditions). Hence, far from being constant, the reference level of sustainable exploitation will vary over time, depending on the potential productivity of the ecosystem, the state of other species in the system and the environmental conditions. The new EU Multi annual plan (MAP) framework, explicitly states that reference points used for management may be adapted based on ecosystem consideration, but yet there is no concrete method defined. A range of tools have been used to develop an understanding of ecosystem effects, but they are designed for research purpose, not for providing advice. Therefore we need to build on the existing knowledge to develop tools more directly designed for advice, which can be used to test management rules in which ecosystem effects are taken into account. Blue whiting *Micromesistius poutassou* and Hake *Merluccius merluccius* are two important commercial species in the North east Atlantic for the Dutch pelagic fleet (one as target and one as bycatch (choke) species). In the last decade an increase in population size and a northward movement in the spatial distribution have been observed for these stocks. The climate change and global warming has been presented as a plausible explanation by favouring recruitment episodes as well as an increasing habitat availability. Trophic interactions among these two species are very strong, with blue whiting being up to 60% of diet of hake in the Celtic sea. All these factors together with the extensive scientific knowledge makes hake and blue whiting an ideal case study to develop a framework that brings more ecological information about trophic interactions and environmental effects into the determination of reference points and HCRs.
Objective(s) of the project	Define and develop methods to incorporate knowledge on ecosystem into the management process, by proposing management targets that respond to environmental changes as well as changes in other components of the ecosystem. Using the case study proposed (blue whiting-hake), the potential gain of such an ecosystem based management can be illustrated for

	different scenario of management goals (e.g. maximising the yield of blue whiting, maximising the yield of hake, maximising the combined yield). The project is distributed over two years, with the first year being devoted to review previous work and design of the simulation model. The final definition of environmental and management scenarios, testing the simulation performance and key dissemination activities will be conducted in the second year. The main reasons for this division is to link with on-going work in the EU (linking to H2020 which are not active yet, but will become so in1-year time) and time needed to accurately deal with the complexity of this project.
Continuing project: Results from previous years	A multispecies (hake/blue whiting) model has been set up, in which the recruitment of blue whiting for the simulation of future years, follows an alternation of good and poor regimes. Based on this model different sets of management reference points have been estimated (following ICES guidelines) : - Species specific constant Fmsy : based on a perception of the resource where stocks are not interacting and in which there is not climate related recruitment regime (while in reality, there is both species interaction and climate effect) - Species-specific adaptive Fmsy : based on a perception in which species do not interact, but in which different climate related recruitment regimes are identified for blue whiting (leading to a Fmsyhigh and Fmsylow for blue whiting) - Multi-specific adaptive Fmsy: based on a perception in which both species interact and there are climatic regimes (leading to a joint Fmsyhigh and Fmsylow for both species). Based on the current model configuration, results indicate that the multi-species Fmsy results in yields corresponding to around 95% and 75% of the species specific MSY for hake and blue whiting respectively. Furthermore, the combined Fmsy value for blue whiting is not very sensitive to the environmental regime, while for hake, Fmsy is higher when condition are favourable for blue whiting (i.e. to get the most of both stocks, the blue whiting stock needs to be larger and therefore hake should be exploited a bit harder). Furthermore, the model has been set up to simulate (and compare) different management scenarios : based on the 3 sets of Fmsy listed above, to assess the benefits of taking into account 1) environmental regimes in the definition of management targets, and 2) multi-species interactions. Final results have not been fully analysed yet.
Expertise needed	Multispecies modelling, environmental time series analysis, fish stock assessment
Expertise developed	Implementation of ecosystem based fisheries management/advice
Relevance for WOT	Develop tools to start implementing the ecosystem approach, with special relevance in the EU MAPs (e.g. pelagic)
Why should this be funded by KB WOT?	This project develops an expertise which will be used to advice the ministry on how to concretely implement the MAPs (especially the one on pelagics) that are currently under discussion. Given the speed at which the EU is implementing MAPs, advice following EAF will become practice in only a few years, without having the tools available yet to do so. This project covers the gap in knowledge needed for WOT in the very near future and the

	implementation of the MAPs.	
What other potential funding sources have been considered?	Overlap with project on multi-species model on Flemish Cap (NAFO area)	
International objective of research	This project will require and promote interaction with scientific institutions from other countries. The project will use as a case study stocks which are distributed and managed internationally. The methods developed can be potentially applied within all regional EU MAPs	
Work plan	**2018**	**2019 and further**
Broad description of the project including expected results	The project will make an overview of the existing or proposed management strategies based on ecosystem considerations. The model will be used to test these rules through simulation.	
Activities and time schedule	Exploration, by simulation testing, of the response of management reference points. Evaluation of the performance of management rules incorporating ecosystem considerations by comparing with current management. Description of the management trade-offs when species interactions are taken into account.	
Output/deliverables	Simulations testing the performance of different management strategies incorporating ecosystem considerations, with special attention to the effects of climate change.	
Dissemination of findings being addressed	Presentation of the outcome at WGWIDE, possible at the ICES ASC if it fits in a relevant theme session. These results will be communicated to LNV as well, as a suggestion of potential management strategies to be used in the context for EU MAPs	
Utility of the developed products and expertise	Facilitate management decisions more in accordance with ecosystem trade-offs.	
What are the potential risks to the project's success?	None	
Project organisation		
Involvement Wageningen Marine Research (names and expertise)	Alfonso Perez. Thomas Brunel	

Is the appropriate capacity available?	Yes
Involvement parties within WUR (names and expertise)	
Involvement parties outside WUR (names and expertise)	The names below are persons in our network and will be consulted given their expertise, but are not expected to contribute to the exact deliverables of this project : Mark Payne (DTU Aqua Denmark): environmental conditions-recruitment relationship, Morten Vinter (DTU Aqua Denmark) : blue whiting assessment and multispecies approach in ICES area, Daniel Howell (IMR Norway): multispecies modelling with gadget and stock assessment, Santiago Cerviño (IEO Spain): hake assessment, Fran Velasco (IEO Spain): hake assessment and trophic interactions hake-blue whiting

Relevance	
What is the market/ target audience	National government, EU commission, scientific community
Economical relevance	Sustainable economic activity adapted to variations in the ecosystem productivity
Social relevance	Promoting a more sustainable and stable fishing activity
Scientific relevance	Bringing the current knowledge on trophic interactions and environmental effects on fish stocks into the advice framework.
Relevance to ministry LNV	Anticipate the need to implement the ecosystem approach in the future EU multi-annual plans
Summary (UK)	Far from being constant, the sustainable level of exploitation of marine populations varies over time in response to changes in natural mortality and environmental conditions. This project deals with the development of a simulation framework that allows calculating the magnitude of changes in productivity of exploited stocks in response to these factors, enabling the estimation of varying reference points that support more ecosystem sounded management decisions. Hake and blue whiting are taken as a case study due to their high importance from a fishing perspective, their known strong interactions and high impact of climate change in their abundance and distribution. This project will develop ecosystem based management plans based in simulated scenarios which could be put forward to the managers as potential strategies to be used within the context of the future EU MAP on pelagic or demersal species.
Samenvatting (NL)	Het duurzaam niveau van exploitatie van de mariene populaties is verre van constant en varieert in de tijd in reactie op veranderingen in de natuurlijke sterfte en omgevingsfactoren. Dit project gaat over de ontwikkeling van een simulatie framework die het mogelijk maakt om veranderingen in de productiviteit van de beviste bestanden te schatten, waardoor de schatting van verschillende referentiepunten mogelijk is die ecosysteem beheer ondersteunt. We gebruiken Heek en blauwe wijting als case studie omdat deze soorten van groot belang zijn voor de Nederlandse visserij. Hun sterke interactie met elkaar en andere soorten, en de grote impact van de klimaatverandering op de bestandsontwikkeling maken het interessante soorten voor deze studie. In dit project ontwikkelen we op ecosysteem

	gebaseerde management strategieën die door beheerders ingezet kunnen worden als mogelijke strategieën van de toekomstige EU-MAP op pelagische soorten of demersale soorten.

Proposed budget	**2018**			**2019 and further**
Personnel	**tariff**	**hours**	**amount**	
CAT I	60.00			
CAT II	80.00			
CAT III	100.00	320	32.000,-	
CAT IV	124.00			
CAT V	144.00			
CAT VI	175.00			
Total Personnel			32.000,-	0,-

Material costs	**2018**	**2019 and further**
Facilities		
Specific costs		
Travel costs	2.000,- (to cover presentation in a conference)	
Project equipment		
Other material costs		
Total Material Costs	2.000,-	0,-
Total project budget needed	34.000,-	0,-
Financing through other resources -/-	0,-	0,-
Finance needed from KBWOT	34.000,-	0,-