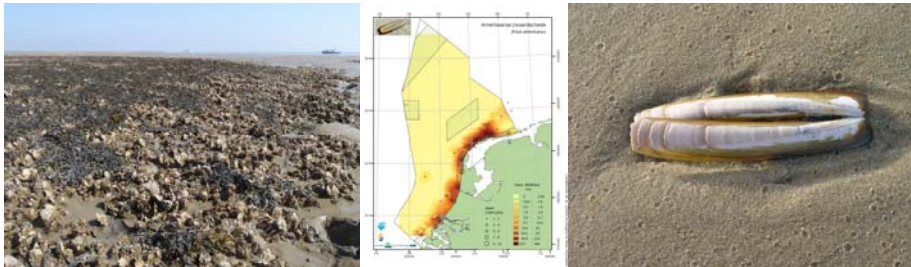


# Invasive aquatic species: market/scientific opportunities for IMARES?

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en J. Wijsman

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# 1 Introduction

The recent creation of the “Team invasive exoten” by LNV, as well as the importance assigned to invasive exotic species in the Marine Strategy Framework Directive<sup>1</sup> has underlined the importance of identifying and assessing the impacts of invasive species in the Netherlands, and its territorial waters. IMARES has the potential to be a key player in many aspects of invasive species research in the future, as we have 1) an intimate knowledge of species trends in freshwater and marine environments, across many species and species types. In addition we 2) have broad qualitative and quantitative biological expertise, and 3) a network of observers in the field allowing us to go beyond a reporting of trends towards research on mechanisms and implications of invasive species. In this project we aim to synthesize data on invasive species trends, link these with both biotic and a-biotic data and address hypotheses on invasion and invasibility of ecosystems.

In spite of the importance of invasive species in policy and research, IMARES as a whole has no coordinated strategic vision on both policy and research relevant aspects of aquatic invasive species, and key knowledge remains fragmented across locations and departments. In this proposal we seek to address this gap by coming together to integrate this knowledge across all IMARES “blood groups”, and develop a vision on how IMARES could strengthen its position with regards to invasive species.

In this project we addressed several aspects of invasive species through 2 intensive workshops, where participants brought together both taxonomical as well as process knowledge to

- 1) identify the strengths and weaknesses of invasive species research within IMARES,
- 2) develop strategies, both for addressing gaps in knowledge, as well as exploiting our strengths.
- 3) Identify key stakeholders for invasive species policy advice and research,
- 4) identify key potential funding bodies for this advice/research both in the near and far future. (see also point 3 above) .

## 2 Assignment

This research is part of the strategic research program "Sustainable spatial development of ecosystems, landscapes, seas and regions" and is funded by the Dutch Ministry of Agriculture, Nature Conservation and Food Quality. The original KBWOT proposal can be found in Appendix 1.

## 3 Methods

This document is the output of a day’s workshop on 16 June 2009 and half a day’ s workshop on 10 November 2009. Ingeborg de Boois, Henk Heessen, Reinier Hille Ris Lambers and Jeroen Wijsman attended the first workshop. Ingeborg de Boois, Henk Heessen, Reinier Hille Ris Lambers, Diana Slijkerman and Jeroen Wijsman attended the second meeting. This section also describes the methods used in the workshops, as these were perceived as useful for these type of studies.

### 3.1 Definition of an invasive species

A list of key definitions were collected for discussion in the first workshop. The main topics for discussion were

- a) which part of the definition critical for us and
- b) how can we agree on a definition without creating a complete new one.

Information on invasive species

Based on a list of aquatic invasive species collected before the workshop, participants made an inventory of species for which there was known information. Subsequently, this list was extended, discussed and categorized into different stages of invasion (as shown in figure 2). This resulted in table 1.

---

<sup>1</sup> In Annex I: **Qualitative descriptors for determining good environmental status** “Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems”

## 3.2 Vision on role of IMARES

To achieve a commonality in vision, all participants were asked to draw<sup>2</sup> their personal vision for IMARES' role in invasive species research on an A4 piece of paper. Each participant was then asked to present and explain their drawing. This resulted in a vision on invasive species research in IMARES as outlined in 4.3

## 3.3 Strategy

Drafting an invasive species strategy covered the major part of the workshop. The main question for the strategy brainstorm was on how to concretize the vision. The brainstorm was conducted in three phases, following the Disney strategy, (see Figure 1). This strategy separates thinking into three phases: the "dreamer", "Realist" and "Critic" phases. In the first phase, the Dreamer is allowed to put all, i.e. any ideas forward without any qualifications on achievability or realism. In the second phase, the "Realist" finds ways to realize these dream(s), but does not critique them. In the third phase, the "Critic" finds gaps in these dreams or realizations thereof. The circle can be repeated several times if necessary. In this workshop, the participants all started as a dreamer and all dreams (a total of 29) were collected on a flip over. The participants then collectively assumed the role of the "Realist", carrying the brainstorm over to the second phase where the focus was on ways to fulfill the dreams. The third phase was carried out individually, by scoring all ideas on a scale from 1 ('good idea, carry out immediately') to 3 (either 'good idea, but not the right time' or 'bad idea'). The highest scoring ideas scoring 4 or 5 points (4 participants), were taken into account as first priority ideas, and listed in 4.3 All other ideas were collected, and listed in Appendix A.

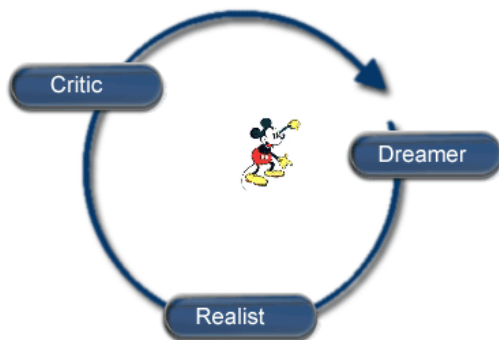


Figure 1. Disney cycle

## 3.4 Work plans

Based on the prioritization of ideas work plans were made in two groups of two participants each. These work plans were presented in plenary.

## 3.5 Evaluation of the report

In November 2009, a second meeting was organized in order to:

- review the report of the first meeting and identify open ends;
- place the subject of invasive species in a policy context;
- finalize proposals from the first meeting and, if possible, add proposals;

---

<sup>2</sup> Visualizing, i.e. drawing the vision addresses another (non verbal) way of thinking, which coupled with a verbal presentation gave a more complete representation of ideas.

## 4 Results

### 4.1 Definition of an invasive species

There are many definitions on invasive, exotic and non-indigenous species. Our discussions on this resulted in our acceptance of the following definition (based on the EU definition):

*“Invasive species (IS) are non-native species that are outside their natural habitats where they establish, proliferate and spread in ways that cause damage to biological diversity”*

The most important terms in this definition are: invasive (expanding exponentially), damage.

It is important to realize that this definition is not clear on a number of issues. For example: What is damage? What is a natural habitat? How is biological diversity characterized? These terms are still vague. We decided to keep this, as no better definitions appear in various management documents (e.g. Descriptions of good environmental status). In the future, pragmatic choices based on the definition will be necessary. It is important to realize that damage caused by invasive species might present opportunities for IMARES as well.

### 4.2 Information on invasive species

A number of invasive species have been noted in the regular monitoring programs done by IMARES. Some species have been present in the ecosystem for a longer time, while other species have only recently incurred. These different conceptual phases of invasion are shown in Figure 2.

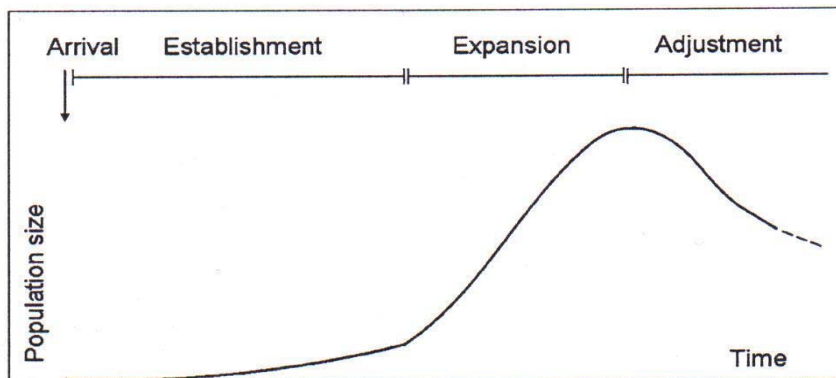


Figure 2. Phases of invasion during the introduction of invasive species. From Reise *et al.* (2006).

The selection was made by focusing on species IMARES has information/expertise on. The sources used were [www.nobamis.org](http://www.nobamis.org) and DAISIE. The aquatic invasive species from those lists were used as a starting point. The list was extended with species which the workshop members considered to be potentially invasive.

The complete list of selected species, potential sources of information and our assessment on its phase of invasion is listed in Table 1.

Table 1. Selection of invasive species IMARES has information on

Scientific name	Dutch name	Information available from	Phase of invasion (see figure 1)
<i>Anguilicola crassus</i>	Zwemblaasworm	?	?
<i>Entelurus aequoraeus</i>	Adderzeenaald	BTS, HERAS	?
<i>Mnemeopsis leidy</i>	Amerikaanse ribkwal	-	Expansion
<i>Ensis americanus</i>	Amerikaanse zwaardschede	Spisula/Ensis survey	Adjustment

<i>Orconectes limosus</i>	Amerikaanse zoetwaterkreeft	Diadromous fish survey, FGRZ	Adjustment
<i>Helicolenus dactylopterus</i>	Blauwkeeltje		?
<i>Eriocheir sinensis</i>	Chinese wolhandkrab	FGRF, FGRA, Diadromous fish survey, FGRZ	Adjustment
<i>Dreissena polymorpha</i>	Driehoeksmossel	?	Adjustment
<i>Goneplax rhomboides</i>	Goneplax	BTS	Arrival/Establishment
<i>Sparus aurata</i>	Goudbrasem	Veerse Meer, Wadden Sea	Arrival
<i>Crassostrea gigas</i>	Japane oester	Wadden Sea, Scheldt estuary	Expansion
<i>Urosalpinx cinerea</i>	Japane oesterboorder		Arrival
<i>Corbicula fluminea</i>	Korfmosseel	?	Adjustment
<i>Crepidula fornicata</i>	Muiltje	Historic data Yerseke	Adjustment
<i>Lutraria lutraria</i>	Otterschelp	Spisula/Ensis survey	Expansion
<i>Gobio albipinnatus</i>	Witvingrondel	FGRF, FGRA	Arrival/Establishment
<i>Neogobius melanostomus</i>	Zwartbekgrondel	FGRF, FGRA	Arrival/Establishment

## 4.3 Vision on role of IMARES

### 4.3.1 Future role of IMARES

IMARES has the ambition to be a key institute in research on strategic and applied marine ecology. Our vision on the role of invasive species research in this is motivated by the inclusion of the descriptor for good environmental status in the MSFD, the creation of the COIE, and the various policy frameworks in which reference is made to invasives. With this in mind feel MARES could play a central role in the future questions on causes and consequences of Invasion, further developing and applying the descriptor for GES under the MSFD, and in developing risk assessments for the potential for invasion. We envision IMARES as a key institute for the study of processes of invasion of exotic species. Specifically, questions such as “what makes a species invasive” are key questions both from a fundamental as well as an applied research focus: thus having the potential for both high quality scientific output as well as market relevance. IMARES focus on this should be on long term market influence, through high quality (scientific) output, with special relevance given to networking and influence on policy and stakeholders.

IMARES has good databases, taxonomic expertise as well as national visibility, making IMARES a potential first stop (i.e. “loketfunctie”, such as stichting ANEMOON’s strand wg) for fieldworkers in the first detections of invasive species.

Currently IMARES has expertise in risk analysis, and questions on management and advice for invasive species. The expansion of these activities with research on species ecology, the processes of invasion and the potential impacts of invasive species, would lead to a more complete, and cross-institute research and market agenda. At the moment there are small projects on invasion, coordination of these activities, and cooperation with outside parties would reinforce IMARES expertise on general ecology, and present a more complete market profile to the outside world. In section we have also presented some ideas based on brainstorm as outlined in Section 4.4 for further solidifying IMARES expertise in invasive species. It should be noted that these have various reasons for inclusion in this document, based on both scientific and market reasons.

### 4.3.2 Strengths of IMARES in invasive species research

IMARES expertise on invasive species is relatively broad. IMARES incorporates many different points of view within the organization, which is a welcome relict of the individual nature of the various component locations. These different points of view within the organization (e.g. nature conservation, productivity, ecological processes, management/policies), make a multidisciplinary approach to understanding, managing and prediction possible.



- IMARES is increasing its within-institute synergy through the modeling network, which aims to provide a platform for advice and research both for within IMARES, as well as to potential contractors. This modeling experience within IMARES is broad, and across all locations and departments. Current expertise in both tactical and strategic models can be used to model processes (e.g. in food webs) to predict and understand invasions and effects.
- IMARES is also well versed in survey design, implementation and execution; this expertise could be used to set up monitoring programs for invasive species, especially in conjunction with statistical expertise present within IMARES.
- IMARES has already conducted risk analysis on invasive species (see Wijsman & Smaal 2006, Wijsman et al. 2007a, b, Wijsman & De Mesel 2008, Wijsman & De Mesel 2009) . This coupled with statistical expertise from the modeling network, could be a strong selling point of IMARES.
- IMARES has a strong record of translation of science to management advice.

## 4.4 Strategy

### 4.4.1 First priority ideas

1. Mesocosm experiments: translocation of *Crassostrea gigas*. More than one PhD. project. See below.
2. Create experts and expertise via PhD. proposal. Main topic: analysis of IMARES data and the factors for decline of invasive species. For proposal: see below. Important is to get the PhD. working at IMARES. By doing this, the knowledge will be more likely to stay within IMARES. PhD. might be done in collaboration with Marten Scheffer. See Annex 3.
3. Write a small book on invasive species, to use as a relational gift. First publication on IMARES intranet. See Annex 1.
4. Presentation of the results of the workshop and report at IMARES. Make a tour to North, Centre and South and invite NIOZ/Ecomare (north), LNV/COIE (centre), NIOO (south). To be done when the report of the meeting is finalized. Invite MT members and director specifically to be present at one of the locations.
5. Join ICES WG's: Working Group on Ballast and Other Shipping Vectors (WGBOSV; Diana Slijkerman/Edwin Foekema) and Working Group on Introduction and transfers of Marine Organisms (WGITMO; Jeroen Wijsman/Reinier Hille Ris Lambers). Firstly, communicate to Mark Dickey-Collas and afterwards to the heads of department.
6. Organize a theme session on ICES ASC 2011 on invasive species (via Mark Dickey-Collas). Theme sessions on other symposia might be organized in 3-7 years.
7. Risk assessment: use own statisticians to evolve risk-assessment studies. They may become more quantitative and other methods might be (more) suitable.
8. KB financing to create a "window-project": research which might create more sources of money. This project might be a workshop with external experts, too.
9. Join in EU proposal. Doug Beare is working on a proposal in which the invasive species might be taken up. (note
10. Create fact sheets for the different invasive species in a consistent format (De Mesel 2007, Van den Brink and Wijsman in prep)

## 5 Policies and other frameworks

Invasive species are present in a number of (inter)national policies:

- Marine Strategy Framework Directive: concrete there was a meeting in November with the RWS, and it is now clear that IMARES is dealing with the topic of invasive species, in cooperation with other parties.
- Natura 2000: this policy covers some research already carried out by IMARES, like risk analysis of invasive species (Wijsman & Smaal 2006, Wijsman et al. 2007a, b, Wijsman & De Mesel 2008, Wijsman & De Mesel 2009) and MVII monitoring. The MVII monitoring is not designed to study invasive species, but might be influenced by the invasive species *Ensis directus*. Apart from research already carried out, within Natura 2000 the effect of invasive species on (1) species characterizing the protected habitat and/or (2) the (biodiversity of) habitats will be a topic worth studying.

- Marine Spatial Planning: stepping stones for invasive species. This topic is already addressed in various risk analyses and impact assessments.
- Regulations on swimming water quality: e.g. the invasive of *Mnemiopsis leidyi* and its parasite. See chapter 7.4.

Apart from (inter)national policies and frameworks, we decided to incorporate the theme 'Invasive species' in the theme group 'Ruimte en habitat'. A theme group session on invasive species will be planned in the beginning of 2010.

## 6 Current and recent research on invasive species

At IMARES, research relevant to invasive species has been carried out on invasive species. In this chapter, the known research is listed.

- The invasion of *Urosalpinx cinerea* (Yerseke)
- DEB models *Ensis directus* (Ijmuiden, Yerseke)
- Development of *Ensis directus* along the coast in relation to sand extraction (Waterdienst)
- Risk analysis on exotic species associated with shellfish transport
- Ecoprofiel *Mnemiopsis leidyi*
- Quick scan Non-indigenous species in context of Marine Strategy Framework Directive
- EU projects .....

## 7 Work plans

### 7.1 Invasion characteristics of different strains of *Crassostrea gigas*

Research question: Are there genotypic/phenotypic differences between strains from different areas and do the result in differences in life history traits with regard to growth and competition.

Hypothesis: In regions where *C. gigas* has become invasive, the strain has a better growth and reproductive performance than strains in area where no harmful invasion occurred. In regions where *C. gigas* is introduced long ago, the differences with the "original" population is largest.

#### Approach

Different genotypes (Japan, the Netherlands, France, Pacific NW, New Zealand) of *C. gigas* in different environments (Total max n=5 locations) are kept in monoculture and mixtures at different densities (low, middle and high) in "Common garden experiments". Parameters to be measured are: GSI, larva, growth, production, filtration rates. Genetic differences, especially those that can be related to competitive traits will be analyzed.

The differences will be modeled in DEB models and upscaled to physiologically structured population models. These models will be used to test various hypothesis on competitive ability and invasion potential.

First estimation is that this requires partners in 3-5 different countries. Each partner should have at least one PhD. Specific PhDs are required for the genetic analysis and the model development. From the IMARES point of view the interest is mainly in a PhD on the modeling part.

Total budget needed for IMARES:

PhD: 200 kEuro

Potential funding: EU (Interreg), producers organizations (France, Ireland), Japan???

## 7.2 Factors of decline and stabilization of invasives

The pattern of invasions is characterized by different phases (Reise *et al.*, 2006): (1) introduction (2) establishment (3) expansion (4) adjustment. The adjustment can have different dynamics. The study should be focused on the dynamics and processes causing this decline. This will be studied using theoretical concepts and models on population dynamics. This should be worked out further in the future.

## 7.3 Work plan book on invasive species

Concrete goals in 2010: small book which might be used as a gift to relations

Language: Dutch (and English?)

Way of publication: IMARES intranet (monthly) → book

Table of contents

Month 1: introduction (definition of invasive species, threats, chances, research, dangers) and first species

Month 2-11: a species per month, randomly ordered

Month 12: overview (graph of invasive phases)

Size of chapters: 1-2 A4 size papers including figures.

List of species (priority will follow)

Adderzeenaald

Amerikaanse ribkwal

Amerikaanse zwaardschede

Blauwkeeltje

Driehoeksmossel (+Korfmosseel?)

Goneplax

Goudbrasem

Japane oester (+Japanse & Amerikaanse oesterboorder?)

Kamtschatca krab

Muiltje

Zwartbekgrondel (+Witvingrondel?)

Contents per chapter:

Life history

Native distribution

Current distribution

Causes of invasion (introduction, change in migration obstacles)

Available data

Threats, dangers

References

Possibilities to record occurrences????

Introduction: summary of the meeting (Dutch/English)

Species per person. Find an editor (NB: readability, consistency in graphs/figures): Ingeborg, Ingrid

Financing? Hans Bothe, website development. KNNV Uitgeverij?

## 7.4 Work plan *Mnemiopsis leidyi* and *Edwardsiella*

Reference to the idea:

RWS Zeeland reported complaints of bathers (swimmers itch) in the Grevelingen, last week of June 2009. IMARES was contacted to search for possible causes to these complaints.

Besides the reporting of swimmers itch, bathers and divers reported the presence of large quantities of *Mnemiopsis*. *Mnemiopsis* is an invasive species in the NE-Atlantic since several years. The relation between the swimmer itch and *Mnemiopsis* could not be confirmed as the jellyfish does not have stinging attributes to humans. However, the jellyfish could have been infected by a larvae of another invasive species, called *Edwardsiella* sp. *Edwardsiella* is related with swimmers itch. Infected *Mnemiopsis* were reported recently in the Baltic region (Selander et al 2009). In case this infection has been spread to the Grevelingen, this could be a suitable explanation to the reported swimmers itch last summer.

Collected jellyfish (a week later) did not show any infection and the cause of the swimmers itch was not identified.

Invasion of *Mnemiopsis* and *Edwardsiella* in Dutch coastal waters, could thus result in an impacted bathing industry.

However, traits of *Mnemiopsis* could impact other sectors as well. The jellyfish feeds on planktonic larvae, and it is unknown how much larvae (fish and shellfish) are eaten by *Mnemiopsis*.

Objective: To assess the impact of invasion by *Mnemiopsis* on larvae stock, and secondly, the impact of *Mnemiopsis* and *Edwardsiella* on swimmers.

Hypothesis 1: *Mnemiopsis* can alter the stock of fish larvae and oyster larvae

Hypothesis 2: *Mnemiopsis* in the Dutch coastal zone is infected by *Edwardsiella* and causes swimmers itch.

First research questions to be answered:

1. What is the abundance and dynamics in the number of *Mnemiopsis* in the Dutch coastal zone?
2. What is the abundance and dynamics in the number of *Edwardsiella* in the Dutch coastal zone?
3. What is the relation between *Mnemiopsis* and the number of fish and shellfish larvae?

Approach:

1. Complement the ecological profile of *Mnemiopsis* (De Mesel, 2007) with monitoring data. Data could be obtained by Lodewijk van Walraven, AIO at NIOZ (Henk van der Veer). He monitors *Mnemiopsis* in the Waddenzee and has "year-round" data. Based on these data and in consultation with NIOZ a Dutch monitoring protocol and proposal should be set up. Maybe Ajren Kikkert (RS NH) has complementary ideas regarding actual monitoring. In this protocol *Edwardsiella* should be taken into account as well (see 2).

**Work load:** 2 days in total (in case data are present and made available)

2. a. Draw an ecological profile of *Edwardsiella*, and describe the potential prevalence (nr of infections) including its criteria. (could be a student topic).  
b. Include the relation with *Mnemiopsis*  
c. Conclude the ecological profile with a synthesis on potential risk for invasion in Dutch coastal waters.  
d. Discuss the need for monitoring, and conclude with a monitoring proposal and protocol (see 1 as well).

**Workload** 5 days in total

3. a. Literature review on the relation between *Mnemiopsis* and planktonic larvae (dynamics etc)  
b. Field and laboratory research on *Mnemiopsis* and stomach/gut content  
c. Model analysis on abundance and spreading of both *Mnemiopsis* and larvae, e.g. GIS based

**Workload** review 3 days, other topics unknown, but could be PhD work

Potential client to this work is RWS Zeeland and Provincie Zeeland (for 1&2). For research question 3 no client is identified yet.

## 8 Recommended literature/websites

### Literature

- ICES 2005. Vector Pathways and the Spread of Exotic Species in the Sea. Coop. Res. Report 271, 25 pp.
- Mesel, I. de 2007. Profielschets *Mnemiopsis leidyi*. IMARES rapport C126/07, 15 pp.
- Stefan Nehring, Karsten Reise, Norbert Dankers & Per Sand Kristensen 2009. QSR Wadden Sea 2009, chapter 7: ALIEN SPECIES. Final Draft.
- Reise, K., Olenin, S. and Thieltges, D.W. 2006. Are aliens threatening European aquatic coastal ecosystems? Helgoland Marine Research, 60: 77-83.
- Rilov, Gil and Jeffrey A. Crooks (eds) 2010. Biological invasions in marine ecosystems. Ecological studies v204. Springer-Verlag Berlin.
- Troost, K. 2009. Pacific Oysters in Dutch estuaries. Causes of success and consequences for native bivalves. PhD Thesis. ISBN: 978-90-367-4034-
- Wijsman JWM, De Mesel I (2008) Risk analysis on the import of mussels from the Limfjord and the Isefjord (Denmark) to the Oosterschelde. Report No. C068/08, Wageningen IMARES, Yerseke
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- Wijsman JWM, Smaal AC (2006) Risk analysis of mussels transfer. Report No. C044/06, Wageningen Imares, Yerseke
- Wijsman JWM, Tamis JE, Kaag NHBM, Karman CC, Foekema EM, Smaal AC (2007a) Risk analysis on the import of mussels from Norway into the Wadden Sea. Report No. C102/07, IMARES, Yerseke
- Wijsman JWM, Tamis JE, Kaag NHBM, Karman CC, Foekema EM, Smaal AC (2007b) Risk analysis on the import of mussels from the west coast of Sweden into the Wadden Sea. Report No. C103/07, IMARES, Yerseke

### Websites

[www.nobamis.org](http://www.nobamis.org)  
[www.europe-aliens.org](http://www.europe-aliens.org)  
[www.europe-aliens.org](http://www.europe-aliens.org)

## 9 Quality Assurance

IMARES utilises an ISO 9001:2000 certified quality management system (certificate number: 08602-2004-AQ-ROT-RvA). This certificate is valid until 15 March 2010. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

## Appendix A. These ideas didn't make it.

- Get money from a number of IMARES projects to finance studies on invasive species
- Write a paper in Nature on invasive species
- Create strategic alliances with other partners
- Employ an IMARES employee at the COIE
- Organize a conference on invasive species
- Eat your invasives: write a cook book. Ask Pierre Windt, Niels Daan and Wouter Klootwijk to join.
- Cooking program on television (see cook book)
- Informative television program (VPRO Noorderlicht, RVU, Llink) on the topic: 'invasive species are all around'
- Create information material for school children (via nature centres)
- Find partners to do joint research (e.g. bureau Waardenburg, Aquasense, etc.)
- Publish research in non-scientific magazines (like Waddenbulletin, H2O, Visionair, Zeepaard,...) and carry out research that is publishable in those magazines.
- Focus on the factors causing the decline of invasive species
- Find someone to 'sell' invasive species research. Martin Scholten would be a good candidate because of his network.
- Create a chair (leerstoel) 'Invasive species'
- Create a website to register invasive species
- Put a regular message on invasive species on Need/nice to know (IMARES intranet)
- Specific monitoring program on invasive species

## Appendix 1: Project Proposal for KB WOT funding 2009

<b>Research priority Area:</b>	A B C D
<b>Title of project</b>	An IMARES wide -vision for Invasive aquatic species in dutch waters.
<b>Number of project</b>	
<b>Project leader</b>	Reinier Hille Ris Lambers
<b>Participating partners</b>	Ingeborg de Boois Joep de Leeuw Jeroen Wijsman Henk Heessen Reinier Hille Ris Lambers , Diana Slijkerman
<b>Duration</b>	01/01/2009- 31/12/2009
<b>Broad description of the project</b>	<p>The recent creation of the “Coördinerend orgaan invasieve exoten” by LNV, as well as the importance assigned to invasive exotic species in the KRM (kader richtlijn marien) has underlined the importance of identifying and assessing the impacts of invasive species in the Netherlands, and its territorial waters. IMARES has the potential to be a key player in many aspects of invasive species research in the future, as we have 1) an intimate knowledge of species trends in freshwater and marine environments, across many species and species types. In addition we 2) have broad qualitative and quantitative biological expertise, and 3) a network of observers in the field allowing us to go beyond a reporting of trends towards research on mechanisms and implications of invasive species. In this project we aim to synthesise data on invasive species trends, link these with both biotic and a-biotic data and address hypotheses on invasion and invasibility of ecosystems.</p> <p>In spite of the importance of invasive species in policy and research, IMARES as a whole has no coordinated strategic vision on both policy and research relevant aspects of aquatic invasive species, and key knowledge remains fragmented across locations and departments. In this proposal we seek to address this gap by coming together to integrate this knowledge across all IMARES “blood groups”, and develop a vision on how IMARES could strengthen its position with regards to invasive species.</p> <p>In this project we will address several aspects of invasive species through intensive workshops, where participants will bring together both taxonomical as well as process knowledge to</p> <ol style="list-style-type: none"> <li>1) identify the strengths and weaknesses of invasive species research within IMARES,</li> <li>2) develop strategies, both for addressing gaps in knowledge, as well as exploiting our strengths.</li> <li>3) Identify key stakeholders for invasive species policy advice and research,</li> <li>4) identify key potential funding bodies for this advice/research both in the near and far future. (see also point 4 above) .</li> </ol>
<b>Why should this be funded by KB WOT?</b>	Key knowledge on invasive species exists within IMARES, but is fragmented across different locations and groups. IMARES has the potential to be a key player in invasive aquatics, but must first consolidate knowledge and expertise. KB WOT funding will provide the first step towards establishment of an IMARES-wide vision on invasive species, which is currently lacking.
<b>How does this relate to the IMARES development plan*</b>	Invasive exotic species are named as a potential key driver of ecosystem shifts both within the context of current policy (KRM, creation of COIE) as well as within several EU projects within which IMARES is or will participate (MEECE FEUFAR, etc) Ultimately this is the first step on the road to a IMARES broad vision which will be able to address key aspects of invasive species policy and research in the future.
<b>Products to be delivered?</b>	A Strategy document recommending IMARES' vision on invasive species.
<b>How is dissemination</b>	Presentation and document (see above)

<b>of findings being addressed?</b>	
<b>Proposed budget</b>	<p>Budget consists of 2 all day brainstorm/meetings plus dinners and travel costs. In addition 62 hours are allocated for coordination planning, writing and editing.</p> <p>Research hours by scale:  Oass 16  Jondz 96  Ondz 16  Sondz 16</p> <p>Additional Expenditure: 1500 travel/dinner</p> <p style="text-align: right;">Total cost: € 17000</p>
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<b>What other potential funding sources have been considered?</b>	None as yet. Project will consolidate knowledge and expertise on invasive species within IMARES and will position IMARES as source of expertise for future projects, funded by LNV and/or others, and is at a too early stage for this: KB WOT is thus the best source of funding at this stage.
<b>What are the potential risks to the project's success?</b>	Logistic: unplanned incapacitation of a majority of the team players might be detrimental to the success of this project. These risks are minimal. We propose to perform the majority of the work in the beginning of 2009 when time schedules of people are less tight than later in the year.

\* The IMARES development plan (ontwikkelplan) has 4 themes (climate, pressure on the ecosystem, sustainable marine production and marine policy). The KBWOT priority areas are clearly subsets of the IMARES themes. To ensure that the KBWOT programme provides value to IMARES please state how the proposed KB WOT project also fits into the IMARES themes.

**Also complete the following matrix with regard to your proposal**

(fill appropriate rectangles with an X, and ensure that the reasoning is described in the proposal form above).

Research priority area		Quality	Innovation	Dissemination	Integration of understanding
A	influence of changes in the environment on marine ecosystems	X	X	X	X
B	impact of the fishery on ecosystems				
C	changing fishery management				
D	maintenance and international exchange of key WOT expertise				