

WGMARS 2018 REPORT

ICES INTEGRATED ECOSYSTEM ASSESSMENTS STEERING GROUP

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Interim Report of the Working Group on Maritime Systems (WGMARS)

19-23 February 2018

The Hague, The Netherlands



ICES
CIEM

International Council for
the Exploration of the Sea

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Contents

Executive summary	1
1 Administrative details	2
2 Terms of Reference a) – e)	3
3 Summary of Work plan	5
4 List of Outcomes and Achievements of the WG in this delivery period.....	6
5 Progress report on ToRs and work plan	7
5.1 Progress on ToRs a, b, c	7
5.2 Progress on ToR d.....	8
5.3 Progress on ToR e	9
5.4 Changes/ Edits/Additions to ToRs:	10
5.5 Cooperation with other WGs:	10
5.6 Cooperation with Advisory structures:	10
5.7 Science Highlights:	10
6 Revisions to the work plan and justification.....	12
7 Next meeting.....	13
Annex 1: List of participants	14
Annex 2: Recommendations	15
Annex 3: Report of the Stakeholder workshop on management objectives and analysis for Integrated Ecosystem Assessments	16

Executive summary

The Working Group on Maritime Systems (WGMARS) held its annual meeting 2018 on 19–23 February 2018 in The Hague, The Netherlands.

Continuing its work on “understanding IEAs”, WGMARS prepared the structure and story line for its planned IEA manuscript on IEAs in concept and in practice, with the practice section focusing on the work of the ICES regional IEA WGs. Our discussion and conclusions will be based on a review of IEA literature and ICES IEA documents, as well as findings from semi-structured interviews of the regional IEA WG chairs (draft interview protocol in preparation) and a case study of the Working Group on Integrated Assessments of the North Sea (WGINOSE).

The presentation and discussion of the Working Group on the Northwest Atlantic Regional Sea (WGNARS) IEA process in the Workshop on IEA in the Northwest Atlantic (WKINWA; during the 2017 WGMARS meeting) has stimulated WGINOSE (WGINOSE chair Andrew Kenny was in attendance) to also follow a more inter- and transdisciplinary IEA approach. As a first step toward this IEA approach, WGINOSE needs to involve social scientists in their interdisciplinary science and begin discussions on management objectives with stakeholders to move toward a transdisciplinary approach to IEA.

WGMARS therefore organized and co-chaired the embedded WGMARS-WGINOSE workshop during the WGMARS 2018 meeting, with a focus on IEA in the North Sea. The workshop successfully carried out its three interrelated goals: (1) to advance our understanding of Integrated Ecosystem Assessments (IEA) by incorporating social, economic and institutional aspects: What are the driving management questions – on national and EU level ; 2) to explore the use of two possible conceptual modelling tools for facilitating a truly interdisciplinary approach to integrated ecosystem assessments; and 3) to discuss the tools’ usefulness with both stakeholders and working group members. Conclusions of the workshop are reported under #5 scientific highlights.

WGMARS also, between our 2017 and 2018 annual meetings, initiated, co-chaired and participated in a variety of ICES workshops and meetings designed to advance the current state of knowledge available for IEAs in Europe in general and the North Sea in particular.

1 Administrative details

Working Group name

Working Group on Maritime Systems (WGMARS)

Year of Appointment within the current cycle

2015

Reporting year within the current cycle (1, 2 or 3)

Year 2

Chairs

Christine Röckmann, the Netherlands

Patricia M. Clay, USA

Meeting venue

The Hague, the Netherlands

Meeting dates

19–23 February 2018

2 Terms of Reference a) – e)

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
	Understanding the implementation of Integrated Ecosystem Assessments (IEAs) in ICES	ICES has identified Ecosystem Understanding as their key priority. IEAs play an important role in supporting Ecosystem understanding and enable understanding effects of trade-offs between resource users.	1.1, 1.2, 2.1, 3.2, 4.1	3 years	Two annual reports and a final report with our findings will be presented to ICES. Review paper
a	Understanding of IEAs, definitions, framing	Review of existing IEA reports from the relevant ICES groups; interact with ICES IEA groups to follow developments.	1.1, 1.2	year 1	Review paper
b	Identifying IEA end-users and the required extended peer community	IEAs are seen as an important tool that enable evaluation of trade-offs and sustainable marine management. How do IEAs fit in contemporary governance and management systems?	2.1	year 2	Collaborative reporting in the WGMARS report
c	How have IEAs evolved and how should they be integrated in management advice.	For ICES to provide meaningful IEAs for regional seas or selected marine areas close collaboration between many ICES expert groups and the ICES secretariat is anticipated. Cases studies will be used	2.1, 4.1	3 years	Collaborative reporting in the WGMARS report

		starting with an analyses of WGNARS IEA work in the Northwest Atlantic with key stakeholders.			
d	Analyse interactions between resource users, the governance system and the complex social-ecological marine system with Behavioural Economics	Which findings from Behavioural Economics can be applied to marine ecosystem management settings, including fisheries management. Illustrate how these findings can increase alignment of individual behaviour with societal aims.	1.2, 2.1	3 years	Collaborative reporting in the WGMARS Report
e	Stimulate transdisciplinary research by organizing workshops involving scientists from different fields and stakeholders	Practical exercises and case studies for WGMARS transdisciplinary consultation on how to best integrate available knowledge, including stakeholder knowledge, into IEAs	1.1, 1.2, 2.1, 3.2, 4.1	Each year 1 workshop	Collaborative reporting in the WGMARS report

3 **Summary of Work plan**

Year 1	Focus on understanding of IEAs
Year 2	Focus on understanding expectations of IEA end-users
Year 3	Focus on advancing IEA in management advice

4 List of Outcomes and Achievements of the WG in this delivery period

- Draft structure of a review paper on IEA, including a list of tasks assigned to participants present at the meeting and a plan for including other active members who were unable to attend but wish to participate. (ToR a)
- Preliminary critical review of IEA literature for conceptual evolution and integration with management advice. Content organized under three headings: (1) definitions and goals, (2) implementation process characteristics, and (3) authors' main statements, conclusions, and recommendations. Results will be included in the review paper. (ToR a,b,c)
- Preliminary review of ICES documents concerning an IEA framework with regard to: (1) definitions and goals and (2) elements of an ICES IEA framework (e.g. ICES requirements for IEAs, tasks of regional IEA groups). Results will be included in the review paper. (ToR a,b,c)
- Draft interview protocol to interview the regional IEA WG Chairs. Questions cover: (1) scope of the group/purpose/mandate/objectives/goals, (2) basic group composition/representation, (3) group process and scope for acquiring and evaluating data, and (4) groups for whom the data are expected to be useful. Findings will be included in the review paper. (ToR a,c)
- Plan to analyse the evolution of IEA science and implementation of IEAs in the North Sea through a case study of WGINOSE. Findings will be included in the review paper. (ToR a,c)
- Decided to submit an abstract to 2018 ICES ASC based on the review paper (Note: abstract was submitted 19 March). (ToR a)
- Decided to organize an informal meeting at the ASC with Mette Mauritzen (ICES IEASG Chair) and the regional IEA WG chairs to discuss preliminary findings from our literature review, ICES document review, and the IEA WG chairs interviews, so as to inform them of our progress and get their input and feedback to our work, to ensure mutual learning of all IEA Steering Group (IEASG) members. (ToR a)
- Organized and co-chaired WGMARS-WGINOSE Stakeholder Workshop on Management Objectives and Analysis for IEA, on 22 February 2018, The Hague, NL. (ToR e –also related to ToR b,c), and are in the process of finalizing the workshop report, which is to be shared with the workshop participants per their request that both the report and the workshop presentations be shared with them and their network.
- Co-chaired and organized Intersessional meeting of WGINOSE, on 6–7 December 2017, The Hague, NL, with the goal to agree upon the scope and approach for developing North Sea ecosystem models (including economic, social and institutional (ESI) objectives) to support ecosystem-based management advice in the context of ICES regional IEA WG activities. (ToR e,b,c)
- Co-chaired and co-organized [WKSIED-BESIO](#), on 29 November – 1 December 2017, The Hague, NL, with a focus on economic, social and institutional (ESI) objectives. (ToR c)
- Co-chairs of WKSIED-BESIO (SIED+WGMARS chairs) submitted an abstract to IIFET, based on WKSIED-BESIO. (ToR c)
- Presentations and discussions on behavioural economics and social science by Katell Hamon and Marloes Kraan. (ToR d)

5 Progress report on ToRs and work plan

5.1 Progress on ToRs a, b, c

Below, we report jointly on ToRs a, b, and c, as they all focus on understanding IEAs, though from different perspectives:

ToR a: Review IEA literature and understand work of ICES IEA WGs;

ToR b: IEA End-users and their needs;

ToR c: Evolution of IEAs and their use in management advice.

IEA review manuscript

These aspects form the basis of **our planned IEA review manuscript**.

As planned under ToR a, we have continued work on a proposed paper on IEAs in concept and in practice. The practice section will focus on the work of the ICES regional IEA WGs. We agreed on a draft structure of this paper, including a list of tasks assigned to participants present at the February 2018 meeting and a plan for potentially also including other active WGMARS members who were unable to attend but wish to participate. (ToR a)

The idea for this focus of the manuscript and the proposed title arose based on our work and discussions related to the IEA literature and ICES document reviews as well as the preparation of the protocol for the regional IEA WG chairs interviews.

For the critical review of IEA literature with special attention to evolution of structure and process, and integration with management advice, we started organising the content under three headings:

- (1) definitions and goals of IEA;
- (2) characteristics of implementation process; and
- (3) authors' main statements, conclusions, recommendations.

For the review on understanding and use of IEAs in ICES, based on ICES documents, we started organising our conclusions under two headings: (1) definitions and goals and (2) elements of an ICES IEA framework, e.g. ICES requirements for IEAs, tasks of IEA groups.

To understand what the ICES regional IEA WGs are doing with respect to IEA in practice, WGMARS is finalizing an interview protocol to guide us in conducting interviews with all regional IEA WG Chairs. The survey questions cover the following themes:

- (1) scope of the group/purpose/mandate/objectives/goals;
- (2) basic group composition/representation;
- (3) group process and scope for acquiring and evaluating data; and
- (4) groups for whom the data are expected to be useful.

Our plan is to carry out these interviews by June 2018, to allow time to analyse and draw preliminary findings for discussion with Mette Mauritzen and all IEASG (Steering Group) members at the ICES ASC in September 2018 in Hamburg, Germany.

We have submitted an abstract for this manuscript to be presented in Theme Session H: "Preparing for change; challenges for fisheries governance" at the 2018 ICES ASC.

WKSIED-BESIO

WGMARS members agreed at the 2017 meeting that IEAs, in order to have an impact, need to be linked to actual management contexts including to management objectives. As the human dimension is integral part of IEA's this requires the inclusion of Economic, Social and Institutional (ESI), and Physical and Biological objectives. Physical and Biological objectives are often more explicit, therefore in 2017, WGMARS made a first start by creating a preliminary overview table of ESI marine management objectives, specifically focusing on the North Sea. This preliminary overview served as a start for intense collaboration between WGMARS and the Strategic Initiative of the Human Dimension (SIHD), resulting in the Workshop on Balancing Economic, Social, and Institutional Objectives in Integrated Assessments (WKSIED-BESIO) that took place from 29 November to 1 December 2017 in The Hague, Netherlands, co-chaired by WGMARS (Christine Röckmann) and SIHD (Jörn Schmidt and Alan Haynie). Based on an initial examination of relevant EU policies and the existing scientific literature on marine management, policy and governance, the experts attending WKSIED-BESIO started a process of identifying objectives and conducting initial scoping on potential indicators related to the ESI aspects of marine management. A summary table lists marine management objective categories, objectives, and potential indicators, both (a) generically for the EU, as well as (b) specifically for two EU Member states (Sweden and the Netherlands) (see Annex 6 of the [WKSIED-BESIO Report](#), and WGMARS sharepoint, subfolder "BESIO-tables-abstract-ppt").

5.2 Progress on ToR d

ToR d focuses on understanding stakeholder interactions and the usefulness of behavioural economics for both understanding and responding to these interactions

Katell Hamon gave an introduction to the theory of Behavioural Economics. Human behaviour has been claimed to be the key source of uncertainty in fisheries management (Anderson *et al.*, 2010; Fulton *et al.*, 2011). Different policy instruments exist to manage human activities, such as regulations, information dissemination, incentives, nudging; however, they all have disadvantages/caveats concerning human freedom of choice (e.g. limiting, maintaining, and rearranging). In contrast, behavioural economics insights can trigger human change without negative side effects by making these changes Easy, Attractive, Social and/or Timely (EAST) (Valatin *et al.*, 2016). A first trial of this approach is ongoing in the Netherlands, applying EAST in a Dutch effort to reduce marine litter.

Marloes Kraan continued by reflecting on marine ecosystems and social science insights, zooming into fisher behaviour as an example. The importance of including social science methods and insights in EBM/IEA work is based on three key points:

1. Ecosystems include humans, meaning understanding the ecosystem requires knowledge of the economic, social, and institutional aspects of the system.
2. ICES work is applied science, science for policy. Policy aims to manage *the use* of the oceans; two aspects are relevant here:
 - a) What are the objectives for management?
 - b) What do we understand of the 'users' or stakeholders: who is involved, what do they do, how do they react, and why?
3. Management centres around wicked problems: high stakes, uncertainty, yet decisions need to be made. That requires stakeholder involvement in science and policy.

As an example of 2.b), Marloes zoomed in to a project she is involved in that seeks to better understand fisher behaviour. Fisher behaviour is influenced by many aspects, of which the non-strategic aspects (e.g. values, culture, habit, worldview, experience) are as important, though less understood, as strategic incentives like profit.

References

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- Fulton, Elizabeth A., Anthony D.M. Smith, David C. Smith, and Ingrid E. van Putten. "Human behaviour: the key source of uncertainty in fisheries management." *Fish and fisheries* 12, no. 1 (2011): 2-17. (first published online in 2010)
- Valatin, Gregory, Darren Moseley, and Norman Dandy. "Insights from behavioural economics for forest economics and environmental policy: Potential nudges to encourage woodland creation for climate change mitigation and adaptation?." *Forest Policy and Economics* 72 (2016): 27-36.

5.3 Progress on ToR e

ToR e focuses on facilitating transdisciplinary research/ workshop.

Inspired by the collaboration with WGNARS in 2017 and WGNARS IEA experiences and lessons learned, WGMARS agreed in 2017 to focus on the North Sea for the coming year 201–2018 in order to help WGINOSE with its IEA work. WGMARS has organized and co-chaired three related workshops specifically focused on the North Sea:

1. SIHD Workshop on Balancing Economic, Social, and Institutional Objectives in Integrated Assessments (WKSIED-BESIO), The Hague, Netherlands, 29 November – 1 December 2017, to identify and synthesize economic, social, and institutional (ESI) marine management objectives, in particular zooming in on the North Sea.
2. Intersessional WGINOSE-WGMARS workshop, The Hague, Netherlands, 6–7 December 2017, to agree on the scope and approach for developing North Sea ecosystem models, exploring Mental Modeler and Bow Tie Analysis as potential tools.
3. WGMARS-WGINOSE Stakeholder Workshop on Management Objectives and Analysis for IEA. The main goals of this stakeholder workshop were: (1) Advance our understanding of Integrated Ecosystem Assessments (IEA) by incorporating economic, social, and institutional aspects: What are the driving management questions – on both national and EU level?, (2) Test two tools for such interdisciplinary analysis (Conceptual modelling using "Mental Modeler" (MM) software, and Bow Tie Analysis (BTA)), and (3) Discuss the tools' usefulness and the relationship between IEA and marine spatial planning (MSP).

WGINOSE will, based on the workshop, continue to explore the use of MM and BTA in conceptual models for the various WGINOSE-defined subregions of the North Sea. Setting boundaries will be very important with respect to which stakeholders should be included, but also with respect to what set of goals are to be included in any given workshop. Different goals pertain to different geographical areas. All these efforts will be included in the WGINOSE case study for our WGMARS review paper. See Annex 3 for the workshop report.

5.4 Changes/ Edits/Additions to ToRs:

None.

5.5 Cooperation with other WGs:

WGINOSE, WKBESIO, SIHD, IEASG, WGCHAIRS.

5.6 Cooperation with Advisory structures:

(1) Decided to organize an informal meeting at the 2018 ASC with Mette Mauritzen and the regional IEA WG chairs to discuss preliminary findings from our literature review, ICES document review, and the regional IEA WG chairs interviews, and to inform them of our progress and solicit their input to our work. (ToR a)

(2) Provided WGMARS comments on the Science Priorities document.

5.7 Science Highlights:

As our IEA literature analyses are still ongoing, here we limit the reporting of science highlights to those coming out of the WGMARS-WGINOSE stakeholder workshop.

Both tools (Mental Modeler (, MM) and Bow Tie Analysis, (BTA)) were considered very useful, in particular for the visual representation aspect of conceptual models and especially for communication with stakeholders. Conceptual models also provide insights into connections between model nodes/ecosystem components that may not have been identified before and help both scientists and stakeholders understand how to proceed in further analysis. The conceptual model tools were moreover not seen as competition to the “MSP challenge”, the spatial game to explore MSP, as this game is foremost an educational tool.

Further, the process of building conceptual models is considered useful for facilitating the discussion between, and integration across, multiple disciplinary and sectoral viewpoints. It can also help to identify available management options, thus helping in scenario development. Identifying model components, interactions between the “nodes,” and their directions and strengths for different management options (scenarios) can help both scientists and stakeholders to make assumptions explicit and to visualize the potential consequences of the different scenario choices, i.e. trade-offs.

Thus, the process of building such conceptual models can give clear direction of where an IEA can/should go and what issues are most important in a management context, thus leading IEA to a practical application. At the moment IEAs in ICES are rather abstract and constrained by computational complexities (Atlantis type models) and limited with regard to including economic and, especially, social and cultural data.

WGINOSE will continue to further explore the use of these tools and aims to potentially build several conceptual models, one for each of the WGINOSE-defined subregions of the North Sea. In the future, WGINOSE plans to repeat similar stakeholder workshops with a more diverse group of stakeholders; the particular stakeholder composition for each workshop will depend on the concrete management questions which are chosen beforehand as the focus. Focusing on specific questions is important to prevent getting caught up in overly complex details. One idea for a future focus was to explore multiple-use questions. Having a specific topic/question sets boundaries that aid in identifying which stakeholders to invite/ include and what set of goals to discuss in any given participatory IEA scoping workshop, since different stakeholders and goals often pertain to different geographical areas.

The conceptual modelling tools are also useful purely from a scientific perspective, to identify knowledge gaps and thus contribute to the research agenda. Clearly, there are knowledge gaps concerning the social, cultural, and economic aspects of the North Sea ecosystem and its management. Note that the stakeholder workshop did show, however, that on the policy side work has been done on the economic aspects. However, publication channels are different for policy and science; efforts to increase research cross-fertilization are needed. Transdisciplinary workshops are thus also an important opportunity to exchange knowledge and information.

One important final note: Once science engages with stakeholders it is important to maintain a relationship, to keep up the contact and keep each other informed. IEA work will take many rounds with a wide variety of stakeholders over a period of several years.

6 Revisions to the work plan and justification

None

7 Next meeting

AZTI in late winter-early spring 2019.

Annex 1: List of participants

Name	Affiliation	E-mail
Ana Fraga	National Maritime Authority Portugal	anaritafraga@gmail.com
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Marloes Kraan	WMR The Netherlands	marloes.kraan@wur.nl
Patricia Clay (via WebEx)	NOAA USA	Patricia.M.Clay@noaa.gov
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Gerjan Piet	WMR The Netherlands	gerjan.piet@wur.nl
Leyre Goti (via WebEx, Monday)	Thünen Hamburg Germany	leyre.goti@thuenen.de
Jörn Schmidt (absent due to illness)	Uni Kiel Germany	jschmidt@economics.uni-kiel.de

Additional participants at the stakeholder workshop

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Annex 2: Recommendations

Recommendation	Adressed to
1. IEA WG chairs respond to WGMARS interview	IEA WG chairs, IE- ASG
2. IEA WG chairs to participate in IEASG meeting planned at ICES ASC in Hamburg	IEA WG chairs, IEASG

Annex 3: Report of the Stakeholder workshop on management objectives and analysis for Integrated Ecosystem Assessments

WGMARS-WGINOSE
Thursday 22 February 2018, 9h00-17h00
The Hague, Netherlands

Introduction

The joint WGMARS-WGINOSE workshop on management objectives and analysis for Integrated Ecosystem Assessments took place on 22 February 2018 at Wageningen Economic Research in The Hague, The Netherlands. Members of [ICES](#), [WGMARS](#), [WGINOSE](#), and stakeholders attended the workshop, including the chairs of both WGMARS and WGINOSE. At this still relatively early stage of interdisciplinarity regarding IEA for the North Sea, the workshop organizers had decided to initially target interested North Sea stakeholders from the management side only, rather than a broader, cross-sectoral audience of marine/maritime practitioners. This because managers need to be on board, otherwise there can be little progress made. Therefore, stakeholders came primarily from Rijkswaterstaat, which is the Dutch national body responsible for roads, waterways, and water systems and part of the Ministry of Infrastructure and Water Management. A list of attendees is attached.

There were three, interrelated goals for the workshop: 1) to advance our understanding of Integrated Ecosystem Assessments (IEA) by incorporating social, economic and institutional aspects: What are the driving management questions – on national and EU level?; 2) to explore the use of two conceptual modelling approaches (tools) that may be used to facilitate a truly interdisciplinary approach to integrated ecosystem assessments; and 3) to discuss the models usefulness with both stakeholders and working group members. Because the workshop conveners sought to capture the knowledge and frank assessments of the stakeholders, the workshop was conducted under “Chatham House rules”, that is to say, stakeholders were advised that comments would not be attributed to any particular speaker.

The workshop began with a welcome by host and WGMARS co-chair Christine Röckmann, briefly outlining the ICES strategic view in relation to regional IEAs. WGMARS co-chair Patricia M. Clay spoke about the benefits of including social and economic sciences and involving stakeholders in integrated assessments, highlighting that all management is based on societal objectives (social, cultural, economic, environmental); she also provided examples of economic, social and cultural objectives. This was followed by a presentation by Gerjan Piet about the “AQUACROSS Linkage Framework” of the marine Social-Ecological System; then WGINOSE chairs Andrew Kenny and Erik Olsen on “Developing Integrated Ecosystem Assessment in Support for Management Advice: A Roadmap for the North Sea”; Erik Olsen who provided “A brief introduction to the tools and methods of IEA, showing the synergies to MSP”; and Daniel Wood who provided an overview of the “Bow Tie” method. Through these presentations, participating stakeholders were acquainted with the goal of making Integrated Ecological Assessments (IEAs), the difficulties that this presents for ICES groups (and others) and the approaches that WGINOSE was using to deal with these challenges. Erik Olsen subsequently led the workshop in using the Mental Modeler tool to identify key management goals (as drivers) and the linkages between those goals, human activities related to those goals and the interactions among human activities. Daniel Wood then led the workshop in trying out the “Bow Tie” Analysis. The day ended with a discussion of the usefulness of the tools.

Mental Modeler

The Mental Modeling session led by Erik Olsen led to a particularly lively discussion. The focus of the group was the southern North Sea. Stakeholders themselves identified the key objectives/drivers in their management system, anchoring these in six priorities of the Dutch North Sea policy: Oil and gas, CCS (CO₂ Emission Reduction), safe shipping, sand exploitation for coastal safety/protection, renewable energy production, and defence/ military use. An additional priority from The North Sea 2030 process was also entered into the model: sustainable food provisioning. Stakeholders pointed out that fisheries as such were not a priority goal in their work, because fisheries make up only a small part of the Dutch economy. Nevertheless, they recognized the importance of fisheries for specific communities and employment. Several priority human activities were identified: Military Activities, Cables and Pipelines, Sand Extraction, MPAs, Fisheries, Aquaculture, Wind Farms, Shipping, Oil and Gas. Wind Farms and Sand extraction (to enhance coastal security) stood out as particularly important activities, Fisheries and Aquaculture as significantly less so. Attempts were made to explore the effects of these activities on some ecosystem components such as benthic habitats, biological species, and physical components of the area. Some preliminary links were made to social and economic dimensions, although the workshop ran out of time to explore these further. It was clear that “economic” and “social” dimensions needed further specification (as did other ecosystem components), but there was not enough time to do this. The mental modeler approach allows for specifying the strength of relationships and for the characterization of the degree of certainty with respect to the relationship and its strength, and preliminary efforts were made to specify the strength of relationships in particular. In exploring the model, some time was spent discussing the exact terminology (objectives, priorities, drivers, activities) and the level of precision needed to establish the strength of the linkages between model nodes (1 or 0.5 – what does it mean, how can it be remembered, etc.).

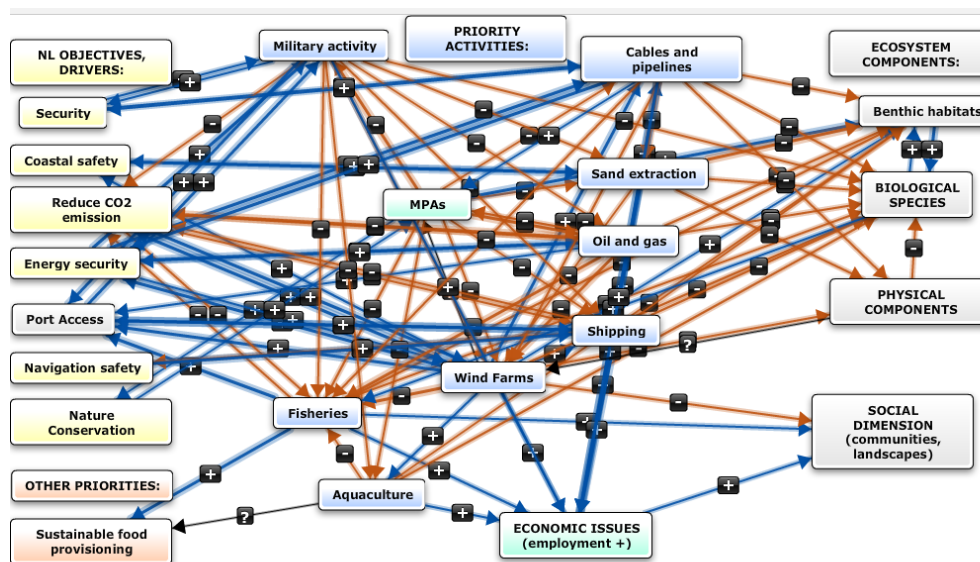


Figure 1. Mental Model produced in workshop with Dutch government stakeholders.

Stakeholders noted the links and interactions between the priority goals and associated human activities: the importance of wind farms in the area became particularly evident, in particular when the North Sea 2030 process was taken into account. As noted, sand extraction was important to coastal security. It was clear that aquaculture is a

minor use at present, and stakeholders did not seem to worry much about the military use of the area: it seems to be relatively unobtrusive with respect to other uses of marine space.

Bow Tie Analysis

Daniel Wood led the work session on Bow Tie Analysis. This approach is intended to “untangle cumulative effects”. It starts by identifying a top event, and then, identifying “threats” to (displayed on the left) and consequences (displayed on the right) of the top event. “Escalators” can be added with respect to threats, and “barriers” that affect consequences can also be added. In this way, the factors affecting and affected by top events and associated activities can be followed in detail. The mapping of individual “top events” can be subsequently connected via variables/factors that different “top events” have in common.

The Bow Tie workshop session began with two “top events” as the starting point for the discussion: (1) meeting the offshore wind energy target for Energy security, and (2) meeting the MPA target for nature conservation. Since top events in Bow Tie Analysis are described as hazards that one wants to prevent, the phrasing in the Bow Tie is negative, i.e. NOT meeting the target. Stakeholders actively worked to identify threats and consequences relating to these two top events. The discussion about energy security covered wide variety of issues around offshore wind farms, such as the length of the licensing process, noise levels from construction and whether wind farms can work to protect the sea floor. It was quickly noted that limits set, for example, for underwater noise were social constructs. The discussion on the creation of MPAs revealed the complexity of the task: the success of MPAs depends on who creates them and for what reason. One of the complexities is that species are often distributed in different areas at different life stages.

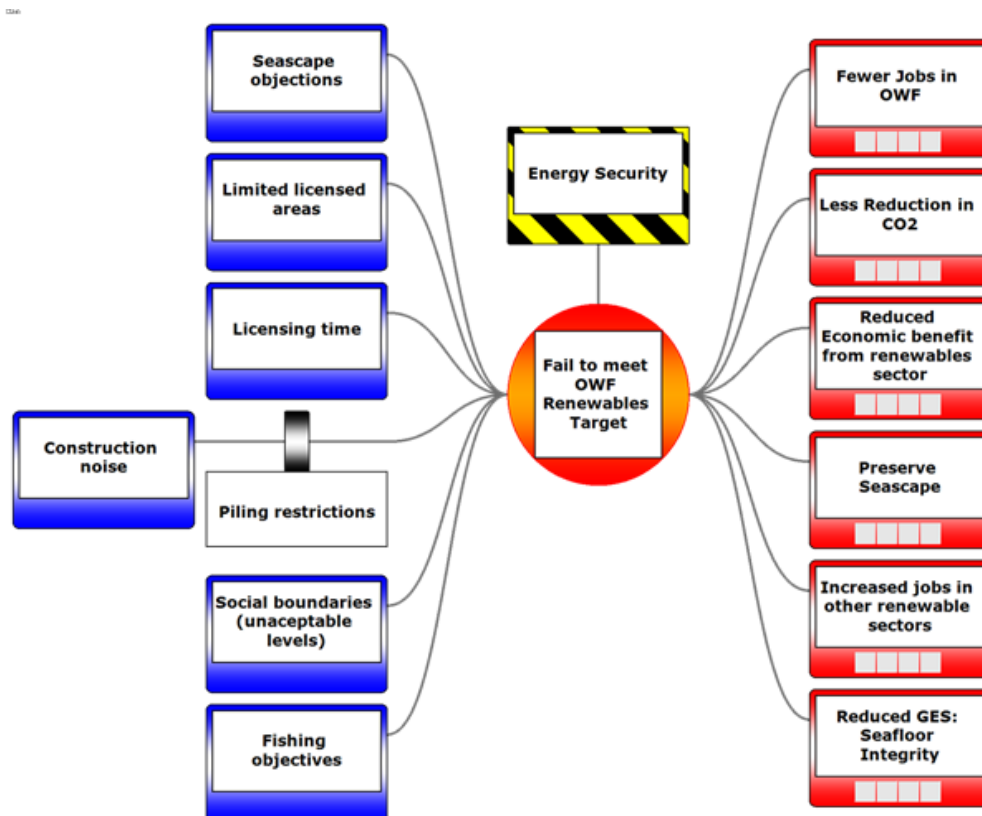


Figure 2. «Bow Tie» created in workshop with Dutch government stakeholders. “OWF” refers to “Offshore Wind Farm”- “Threats” are found to the left of the model, consequences to the right.

Conclusions

Stakeholders engaged actively throughout the workshop, suggesting and jointly discussing potential components and interactions between them for building the conceptual models. They gained an appreciation for how the two models worked, how WGINOSE proposed to use them and how they might use them themselves.

Both tools (Mental Modeler (MM) and Bow Tie Analysis (BTA)) were considered very useful in particular for the visual representation aspect of conceptual models, as they help to organize and create an overview of the more - and less important components/drivers in the system. Both tools are considered attractive for communication with stakeholders, in particular using them in a “screening exercise” or for assessing consequences of scenarios. Conceptual models are useful to provide insights into connections (between model nodes/ecosystem components) that may not have been identified before and help the different stakeholders to understand how to proceed in further analysis. If carried out systematically, a participatory process of building a conceptual model is a useful scientific method/tool from the social sciences to systematically gather perceptions, information, knowledge, etc. If the links/interactions between the model nodes/components that are created can be ‘backed up’ by scientifically established facts (i.e. triangulation of information/data), conceptual models become even useful as product in itself. However, they might probably end up too complex to understand as a stand-alone end product. The stakeholders pointed out that the final “picture” of a participatory conceptual model building process should rather not be used as a communication tool on its own, since the communication value lies in the participatory process of building the model together, and not in presenting the final outcome.

The scientific depth of a conceptual model certainly depends on the time limit for developing it, as well as on the expertise present in the group developing the model. Outcomes of a conceptual model cannot and should not be compared to highly specific, quantitative models/model results, but they are useful to identify areas for further analysis, e.g. more in-depth (quantitative) modelling. The conceptual model tools were not seen as competition to the “[MSP challenge](#)”, a spatial game to explore MSP, as this game is foremost an educational tool.

Further, the process of building conceptual models is considered useful for facilitating the discussion between, and integration across, multiple disciplinary and sectoral (or departmental – within government) viewpoints. It can also help to identify available management options, thus helping in scenario development and for assessing consequences of scenarios. Identifying model components, interactions between the “nodes,” and their directions and strengths for different management options (scenarios) can help both scientists and stakeholders to visualize the potential consequences of the different scenario choices, i.e. trade-offs.

As such, the process of building such conceptual models can give clear direction of where an IEA can/should go and what issues are most important in a management context, thus leading IEA to a practical application. At the moment IEAs in ICES are rather abstract and constrained by computational complexities with long run times (Atlantis type models) and limited economic and, especially, social, and cultural data.

Stakeholders appreciated the fact that the Mental Modeler software does allow for characterizing the degree of certainty about the relationships it captures. However, this can lead to too much focus on the existence of quantifiable data at the expense of relative relationships and possibly the downgrading of qualitative data. The stakeholders furthermore expressed preference for a visual geographic presentation of multi-use conflicts (maps); feedback loop versions of these models were seen to be too complex. Modellers noted that this is also possible and that linkages between maps and MM were possible (to explore linkages). In addition, it was mentioned that in the Dutch context, a small country with many stakeholders who meet each other regularly, application of these modelling tools was not seen as necessary in most cases. However, at the regional level or in meetings with new stakeholders (for instance relatively new departments, due to restructuring of government) the modelling tools were seen as a useful approach. It was also suggested to combine to use of MM and BTA – MM could be used for the first screening step, to construct a holistic overview; BTA could be used to zoom in into a few specific interactions of the holistic overview, to identify and analyse all relevant linkages in more detail.

Conceptual tools such as MM or BTA are useful in particular at the beginning of carrying out an IEA. Note that once the important nodes that make up the conceptual model have been identified/ defined, such that they resonate with the stakeholders, the scientific knowledge to characterize/ weight the linkages between the nodes to reflect their relative importance has to be checked and elaborated.

WGINOSE will continue to further explore the use of MM and BTA in participatory stakeholder workshops, and aims to potentially build several conceptual models, one for each of the WGINOSE-defined subregions of the North Sea. Setting boundaries will be very important with respect to which stakeholders should be included, but also with respect to what set of goals are to be included in any given workshop. Different goals pertain to different geographical areas. Also, marine areas can contain “pockets” with distinctly different characteristics and/or use: it would be important to be able to bring these into the analysis as well.

Focusing on specific questions is important to prevent getting caught up in overly complex details. One idea for a future focus was to explore multiple-use questions. Having a specific topic/question sets boundaries that aid in identification of which stakeholders to invite/include and what set of goals to discuss in any given participatory IEA scoping workshop, since different stakeholders and goals often pertain to different geographical areas.

The conceptual modelling tools are also useful purely from a scientific perspective, to identify knowledge gaps and thus contribute to the research agenda. Clearly, there are knowledge gaps concerning the social, cultural, and economic aspects of North Sea management. Note that the stakeholder workshop did show, however, that on the policy side, lots of work has been done on these aspects (especially economics). However, publication channels are different for policy and science; efforts to increase research cross-fertilization are needed. Transdisciplinary workshops are thus also an important opportunity to exchange knowledge/findings/facts.

One important final note: Once science engages with stakeholders it is important to maintain a relationship, to keep up the contact and keep each other informed. IEA work will take many rounds with a wide variety of stakeholders over a period of several years.

Annexes

List of participants

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Links to workshop presentations

Christine Röckmann

North Sea Stakeholder workshop on management objectives and analysis for Integrated Ecosystem Assessments (IEAs) – Welcome and brief intro to ICES strategic view

Patricia Clay (WGMARS)

Insights into stakeholder management interactions for IEA

Gerjan Piet

Integrated Ecosystem Assessments – The socio-ecological system (EU AQUACROSS)

Erik Olsen

Tools and methods of IEA and synergies with MSP
 Link to Prezi: https://prezi.com/mkfev1woqsgs/msp-and-iea-wgmars-wginor-wk-feb-2018/?utm_campaign=share&utm_medium=copy

Andrew Kenny and Erik Olsen

Developing ICES IEAs in Support of Management Advice – A roadmap for the North Sea (ICES, WGINOSE)

Daniel Woods

Untangling Cumulative Effects with Bow Ties

Workshop agenda

WGMARS-WGINOSE, Thursday 22 February 2018, 9h00-17h00

09:00 – Welcome, brief intro to ICES strategic view, introductions (Christine Röckmann)

Introduction to concepts and goals

09:20 – What benefits can inclusion of social and economic sciences bring? (Patricia Clay)

9:35 –AQUACROSS linkage framework (CEA and Social-ecological system approach) (Gerjan Piet)

09:45 –Developing Integrated Ecosystem Assessment in support for management advice. A roadmap for the North Sea (WGINOSE) (Andy Kenny and Erik Olsen)

10:00 – A brief introduction to the tools and methods of IEA, showing the synergies to MSP (Erik Olsen, Daniel Wood)

10:15 Coffee break

A North Sea case study– interactive discussions facilitated by Mental Modeler

10:45 – What are the important drivers and management objectives for the North Sea? Linking to the Dutch North Sea strategy 2030 (Moderator: Andy, Christine, Erik)

- Management /policy objectives
- Relevant human activities
- Drivers: social, economic, environmental, and institutional
- others

12:00 – Lunch break

13:00 – Setting up the NS mental model to the management objectives (selecting the model components from the pre-lunch brain-storm) (Andy, Erik)

- Connecting the components and setting the direction and strengths of their connections (defining the model structure)
- Defining management scenarios
- Generate results from management scenarios

14:30 – Coffee break

15:00 – Setting up and carrying out a comparable bow-tie analysis (Daniel, Erik, Andy)

16:00 - Discussing results from the mental model and the bow-tie analysis (Andy, Erik, WGMARS)

16:45 – Way forward

17:00 - Meeting close

Main workshop goals

1. Advance our understanding of Integrated Ecosystem Assessments (IEA) by incorporating social, economic and institutional aspects:
 - What are the driving management questions – on national and EU level?
2. Test two tools for such interdisciplinary analysis:
 - a. Conceptual modelling using the “Mental modeler” software
 - b. Bow Tie Analysis
3. Discuss the tools’ usefulness, and the relation between IEA and marine spatial planning (MSP).

The ICES Working Group on Integrated Ecosystem Assessments for the North Sea (WGINOSE) serves as our case study; WGINOSE will use the workshop’s outcomes to set the scope and focus of its future IEA work.