

WORKING GROUP ON MARITIME SYSTEMS (WGMARS)

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i Executive summary

The overarching focus of Working Group on Maritime Systems (WGMARS) has been on understanding the conceptualisation and implementation of Integrated Ecosystem Assessments (IEAs) in ICES and more broadly. From 2017-2019, the Working Group reviewed academic literature and ICES documents, interviewed the chairs of the ICES Regional Seas Working Groups (which are charged with conducting IEAs), and heard member reports on the relationships among IEAs, Ecosystem-Based Management, and Marine Spatial Planning in various European nations, the EU, and the US. We have also examined how IEAs are used in management and attempted to use behavioural economics to think about the types of regulations that might be most effective in specific situations. WGMARS also highlighted the importance of having multiple disciplines from the natural and social science, and the humanities (e.g. history), contributing to conceptualisation and implementation of IEA, as well as stakeholders who are likely to be impacted by changes in regulations (e.g. industries, communities, and local, regional, and national government bodies other than those implementing the regulations in question). To foster this type of multidisciplinary (i.e. involving natural and social science, as well as the humanities) and transdisciplinary (i.e. involving stakeholders) work, we have held workshops with other ICES Working Groups and with government officials from the US (the New England and the Mid-Atlantic Fisheries Management Councils) and the Netherlands (officials of Rijkswaterstaat, the Dutch national body responsible for roads, waterways, and water systems and part of the Ministry of Infrastructure and Water Management).

Our findings suggest that the research work on and for IEAs is still very much a work in progress with strong variance in the way IEA work is approached. Different Regional Seas Working Groups, for instance, are at very different points in moving toward full IEA, especially regarding their inclusion of social sciences and humanities and their inclusion of and types of collaboration with stakeholders. Moreover, structural conditions to create a demand and underlying science varies significantly between different regional seas regions.

ii Expert group information

Expert group name	Working Group on Maritime Systems (WGMARS)
Expert group cycle	Multi-Annual Fixed Term
Year cycle started	2017
Reporting year in cycle	3/3
Chair(s)	Patricia M. Clay, USA
	Johanna Ferretti, Germany (from February 2019)
	Christine Röckmann, Netherlands (until February 2019)
Meeting venue(s) and dates	22-26 May 2017, Woods Hole, USA, (13)
	19-23 February 2018, The Hague, Netherlands, (11)
	27-31 May 2019, San Sebastián, Spain, (15)

1 Terms of Reference Defined

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 its key priority. IEAs play an important role in supporting Ecosystem understanding and enable understanding effects of trade-offs between resource users.	2.7, 3.6, 5.3, 5.4, 6.1, 6.2, 6.6, 7.4, 7.5	3 years	Two annual reports and a final report with our findings will be presented to ICES.
A	Understanding of IEAs, definitions, framing	Review of existing IEA reports from the relevant ICES groups; interact with ICES IEA groups to follow developments.	3.6, 5.3	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?	6.2, 6.6, 7.4	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. Case studies will be used starting with an analyses of WGMARS IEA work in the North-west Atlantic with key stakeholders	2.7, 5.3, 6.1	3 years	Collaborative reporting in the WGMARS report
D	Analyse interactions between resource users, the governance system and the complex social-ecological marine system with Behavioural Economics	How can findings from Behavioural Economics be applied to marine ecosystem management settings, including fisheries management. Illustrate how these findings can increase alignment of individual behaviour with societal aims	3.6, 5.4, 7.5	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	5.3, 6.2, 7.5	Each year 1 workshop	Collaborative reporting in the WGMARS report

2 List of Outcomes and Achievements of the WG in the 2017-2019 ToRs period

Tor A: Understanding of IEAs, definitions, framing

Existing IEA reports of the eight Regional Seas groups were reviewed in the context of preparing for interviews with co-chairs of all Regional Seas WGs and the then ICES science coordinator for ecosystem-based management, Mark Dickey-Collas. The interviews, as well as internal and external webexes related to the interviews, served to interact with and follow developments of regional seas WGs in relation to IEAs. Data collection on IEA use for the review paper (interviews, literature reviews etc.) has been finalized. The work for the review paper originally envisioned has been completed. However, rather than write the review paper, this work was expanded to a full research article to be completed under a ToR in the upcoming WGMARS period, 2020-2022.

Annual Reports were submitted in 2017 (ICES 2017b) and 2018, along with a formal workshop report for WGINWA in 2017 (ICES 2017c). The results of an informal workshop with officials of Rijkswaterstaat (the Dutch national body responsible for roads, waterways, and water systems and part of the Ministry of Infrastructure and Water Management) are presented as an appendix to the 2018 Annual Report.

Presentations on the paper were given at the 2018 and 2019 ICES Annual Science Conferences:

Christine Röckmann, Patricia M. Clay; Jennifer Bailey, Dorothy Dankel, Geret DePiper, Johanna Ferretti, Ana Rita Fraga, Sarah Gaichas, Susan Gardner, David Goldsborough, Leyre Goti, Rolf Groeneveld, Katell Hamon, Andrew Kenny, Marloes Kraan, Sebastian Linke, Sean Lucey, Angela Münch, Gerjan Piet, Patricia Pinto da Silva, Marina Santurtún, Jörn Schmidt. Integrated Ecosystem Assessments for marine management from concepts to practice in ICES. 2018 ICES Annual Science Conference, Hamburg, Germany.

Patricia M. Clay, Johanna Ferretti, Christine Röckmann,; Jennifer Bailey, Dorothy Dankel, Geret DePiper, Ana Rita Fraga, Sarah Gaichas, Susan Gardner, David Goldsborough, Leyre Goti, Rolf Groeneveld, Katell Hamon, Andrew Kenny, Marloes Kraan, Sebastian Linke, Sean Lucey, Kåre Nørdlie Nielsen, Isa Olalekan Elegbede, Gerjan Piet, Patricia Pinto da Silva, Marina Santurtún, Jörn Schmidt. Integrated Ecosystem Assessment Implementation in the ICES Regional Seas Working Groups: Conceptualizations, Practice, and Progress. 2019 ICES Annual Science Conference, Göteborg, Sweden.

ToR B: Identifying IEA end-users and the required extended peer community

The question of how IEAs fit in contemporary governance and management systems was addressed at the WGMARS annual meeting in 2019 through presentations on IEA and governance in the US and Europe (both at the EU level and within a subset of individual European member states). Individual nation reports are complete and being compiled into a combined report; results will also be included, where appropriate, in the paper discussed under ToR A. Research will continue under a related ToR in the upcoming WGMARS period, 2020-2022.

ToR C: How have IEAs evolved and how should they be integrated in management advice

We created and refined an interview protocol and then interviewed via webex co-chairs of all eight ICES Regional Seas groups. These interviews revealed how IEA work has evolved within the ICES Regional Seas groups and how it is and is not integrated into management advice, as discussed in the upcoming IEA paper described at the end of ToR A, above, that has been extended by a new ToR for 2020-2022. These interviews have been transcribed, uploaded into MaxQDA qualitative data analysis software, and coded. Informal analyses have been conducted and formal analyses have begun.

ToR D: Analyse interactions between resources users, the governance system and the complex social-ecological marine system with Behavioural Economics

Three presentations were held at WGMARS annual meetings:

WGMARS annual meeting 2018: **i)** Katell Hamon presented an “Introduction to the theory of Behavioural Economics.” **ii)** Marloes Kraan reflected on “Marine ecosystems and social science insights, zooming into fisher behaviour as an example.”

WGMARS annual meeting 2019: **iii)** Andries Richter presented on: “What has Behavioural Economics to offer to inform management of Marine Systems?”

In addition, WGMARS member Ingrid van Putten gave a keynote speech at the 2018 ASC on aspects of behavioural economics, “Unexpected outcomes and unpredictable managers, fishers and scientists.”

ToR E: Stimulate transdisciplinary research by organizing workshops involving scientists from different fields and stakeholders

In 2017, WGMARS co-organized the Workshop on IEA in the Northwest Atlantic in conjunction with WGNARS (Working Group for the Northwest Atlantic Regional Sea) and WGINOSE (Working Group on Integrated Assessments of the North Sea). Attendees included Andy Loftus and Richard J. Seagraves (U.S. Mid-Atlantic Fishery Management Council), and Matt McKenzie (U.S. New England Fishery Management Council). WGINWA used WGNARS’ experience with conceptual modelling as an aid to increasing multidisciplinary within the Working Group to provide this tool to WGINOSE for similar purposes. Conceptual modelling results were then discussed with external WGNARS stakeholders to demonstrate the use of conceptual modelling to transdisciplinarity with stakeholders.

In 2018, building on WGINWA, WGMARS and WGINOSE co-organized an informal North Sea Workshop with officials of Rijkswaterstaat (the Dutch national body responsible for roads, waterways, and water systems and part of the Ministry of Infrastructure and Water Management) to explore with them conceptual modelling and the related tool of bow-tie analysis as tools for IEA.

In 2019, WGMARS held a joint webex meeting with co-chairs of WGCOMEDA and WGEAWESS to explore options for future collaborations. In addition, Debbi Pedreschi, co-chair of WGEAWESS, attended the 2019 WGMARS annual meeting and has subsequently joined WGMARS as a member.

Also in 2019, WGMARS, WGEAWESS, WGIAB, and WGCOMEDA jointly submitted a grant proposal to EuroMarine to conduct a workshop that would transfer skills and knowledge from social science experts and practitioners to ecological/fisheries scientists in order to develop a common methodology (conceptual modelling) that can be applied throughout European seas (and beyond) to inform integrated ecosystem assessment (IEA). Unfortunately this proposal was not funded, but we plan to continue to seek funding for such a workshop as we believe it would advance IEA within ICES and elsewhere.

WGMARS co-chaired and co-organized WKBESIO in conjunction with SIHD in 2017. In follow-up, at the 2019 meeting, WGMARS was asked by David Goldsborough and Jörn Schmidt to provide input on a proposal to turn WKBESIO into WGBESIO. Opinions within the meeting attendees were split. We provided a written summary of the pro and con opinions and asked for a more detailed proposal to allow WGMARS to provide a second, more informed response.

The organizers and chairs of WKCONSERVE were all both SIHD chairs and WGMARS members (except for Mette Mauritzen) and the 2018/2019 WGMARS chairs also participated in its planning.

WGMARS has also presented informally on our IEA-focused work at both the 2018 and 2019 IEASG meetings, held in conjunction with the 2018 and 2019 ASCs. Lively discussions ensued.

3 Progress Toward Completion of Each ToR

Tor A: Understanding of IEAs, definitions, framing

Tor B: Identifying IEA end-users and the required extended peer community

Tor C: How have IEAs evolved and how should they be integrated in management advice

These three ToRs are in many ways overlapping and interdependent. Thus we will report on progress toward these ToRs together. Both ICES in Europe (ICES 2005, ICES n.d., Dickey-Collas 2014, ICES 2017a) and NOAA in the US (NOAA 1987, EPAP 1999, Busch et al. 2003, Murawski and Matlock 2006, NOAA 2018), to provide two examples, have adopted Integrated Ecosystem Assessments (IEAs) as a key tool for implementing Ecosystem-Based Management (EBM), long seen a critical concept for understanding and managing the natural environment. In our 2017 annual report, we noted: “There are two main challenges for ICES: How can we show the value of an inter- and transdisciplinary IEA process: 1. to our single-disciplinary scientific expert colleagues, and 2. to ICES clients, managers/ policy-makers/ practitioners? An iterative process incorporating dialogue and the willingness to learn new languages and common terminology in order to understand each other is crucial. This awareness and willingness is prerequisite for IEA groups to move beyond disciplinary comfort zones, where needed and appropriate, and to produce increasingly valuable integrative products for EBM” (ICES 2017b:8).

To engage in this transdisciplinary process, we first need to understand the meaning of that term. In WGMARS we have discussed and come to a common understanding of transdisciplinarity as involving not only scientists from multiple disciplines (both natural and social science) but also involvement of stakeholders (from affected industries and communities, and affected and implementing governments -- local to regional to national to EU) (see Paterson et al. 2010, Röckmann et al. 2015, Chuenpagdee and Jentoft 2018, Firl et al. 2018 on transdisciplinarity in general and Wiber et al. 2004, Röckmann et al. 2012, Msomphora 2015, Harvey et al. 2017 on the specific importance of including stakeholders in management processes).

For IEA implementation more broadly, the “Levin cycle” (referencing a diagram in Levin et al. 2009), and variations thereof (Foley et al. 2013, Link and Browman 2014, Levin et al. 2014, Samhoury et al. 2014) proposes steps for implementing IEAs. Through reviews of the scientific literature and official ICES documents, explorations of various national and supra-national governing frameworks for marine areas, and in interviews with chairs of the ICES Regional Seas Groups, we have explored the implementation of IEAs in multiple settings (WGMARS 2018:7).

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 [created] 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.

Furthermore, 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. Physical and biological objectives are often the most explicit, therefore in 2017, WGMARS made a first start in raising the profile of social science and management objectives by creating a preliminary overview table of such 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 2017 SIHD-BESIO Workshop (on Balancing Economic, Social, and Institutional Objectives in Integrated Assessments), co-chaired by WGMARS (Christine Röckmann) and SIHD (Jörn Schmidt and Alan Haynie, both of whom are also WGMARS members). A follow-up to WKBESIO, WKCONSERVE (on Challenges, Opportunities, Needs and Successes for including human dimensions in IEAs) was held in 2019. The organizers and chairs of WKCONSERVE were all both SIHD chairs and WGMARS members (except for Mette Mauritzen) and the 2018/2019 WGMARS chairs also participated in its planning and current co-chair, Patricia M. Clay attended. In both of these workshops WGMARS has sought to assist in expanding and improving the use IEAs in ICES by focusing on what is often their least developed area, the human dimension.

Finally, our interviews with chairs of all eight ICES Regional Seas Working Groups suggest that IEAs are still very much a work in progress with strong variance in the way IEA work is approached. Different Regional Seas WGs, for instance, are at very different points in moving toward full IEA, especially regarding their inclusion of social sciences and humanities and their inclusion of and types of collaboration with stakeholders. Moreover, structural conditions to create a demand and underlying science varies significantly between different regional seas regions. Informal analysis based on reading the transcripts and initial coding shows that commonalities across the groups include:

- No group feels it has truly done a full IEA and some consider that they are primarily still doing ITA (Integrated Trend Analysis), though all aspire to IEA; and
- Except for WGNARS and WGICA, each with caveats, groups are not directly asked for information that would feed into official advice or decisions, at ICES, national, or EU levels;
- Most groups don't feel connected to advice processes. Their role is seen as solely developing the science and methods behind EBM and IEA;
- Few groups have social scientists and many aren't clear how they would bring added value or how to work with them;
- To conduct regular IEAs, groups feel they would need more resources from ICES – similar to the support received by stock assessment groups.

On the other hand, areas where differences are found include:

- Some have regular coordination with other WGs or other groups, while others do not;

- Some involve stakeholders while others do not, and the presumed role of stakeholders varies. In some cases, stakeholders are seen as providing guidance on what areas of research are important, while in other cases stakeholders are seen as a source of data for scientific research; and
- Most are heavily involved in modelling, while one distrusts models and indicators and prefers pure description.

The result of the formal analysis in MaxQDA will tell us more and some of these initial findings may change.

Tor D: Analyse interactions between resource users, the governance system and the complex social-ecological marine system with Behavioural Economics

Though WGMARS has had multiple presentations both within WGMARS and to the broader ICES community and some publications on this topic by our members which were not related to WGMARS work (e.g. Jensen et al. 2019, Kraak and Hart 2019, Link et al. 2017, van Putten et al. 2017, Nielsen et al. 2018, van Putten et al. 2018, Onwezen et al. 2019, Steins et al. 2019, van Hoof et al. 2019; WGMARS authors are highlighted in the references for these publications), this ToR was never fully realized due to a variety of factors including simply scheduling conflicts. However, a new ToR on this general topic has been included in the ToRs for the upcoming WGMARS period, 2020-2022, with a clear research project to which a subgroup of WGMARS researchers have already committed and begun coordinating and planning efforts.

Tor E: Stimulate transdisciplinary research by organizing workshops involving scientists from different fields and stakeholders

We have held both formal and informal workshops with other ICES Working Groups (WGNARS, WGINOSE), members of U.S. Fishery Management Councils, and officials of the Dutch Rijkswaterstaat, which is responsible for roads, waterways, and water systems and part of the Ministry of Infrastructure and Water Management. We have held webex meetings with chairs of WGEAWESS, WGCOMEDA, and WGIAB, and have jointly submitted a grant proposal with these three groups. We have presented on our work at IEASG meetings to get feedback from the broader IEASG community.

4 Degree of success and future of the WG

4.1 Degree of success

All ToRs, with the exception of ToR D were completed. Several ToRs were expanded to build upon existing work in the upcoming WGMARS period, 2020-2022. ToR D has been refined and added to the ToRs for the upcoming WGMARS period, 2020-2022, with a clear research project to which a subgroup of WGMARS researchers have already committed and begun coordinating and planning efforts.

4.2 Future plans

WGMARS will continue to function. Patricia M. Clay is still a chair for one more year, and Johanna Ferretti has three years left (having been confirmed just before the 2019 annual meeting). Our draft ToRs for the next three-year cycle are:

- A. Behavioural economics with view to IEA/EBM implementation
- B. Conceptual modelling assistance for Regional Seas WGs
- C. Understanding the current use of IEAs in ICES
- D. Understanding of Social Network Analysis as applied to ICES EGs as a tool to assess network connectivity and preparedness to address IEAs and the ICES Science Plan
- E. Implementation and linkages of IEA/EBM/MSP and fisheries in the EU, individual European member states, and the US

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(Authors who are, or include, members of WGMARS are bolded)

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Annex 2: Resolutions

New ToRs for 2020-2022:

- A. Behavioural economics with view to IEA/EBM implementation
- B. Conceptual modelling assistance for Regional Seas WGs
- C. Understanding the current use of IEAs in ICES
- D. Understanding of Social Network Analysis as applied to ICES EGs as a tool to assess network connectivity and preparedness to address IEAs and the ICES Science Plan
- E. Implementation and linkages of IEA/EBM/MSP and fisheries in the EU, individual European member states, and the US