WORKING GROUP ON BALANCING ECONOMIC, SOCIAL AND ECOLOGICAL OBJECTIVES IN INTEGRATED ASSESSMENTS (WGBESEO; outputs from 2022 meeting)

VOLUME 7 | ISSUE 93

ICES SCIENTIFIC REPORTS

RAPPORTS
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ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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ISSN number: 2618-1371

ICES Scientific Reports

Volume 7 | Issue 93

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Recommended format for purpose of citation:

ICES. 2025. Working Group on Balancing Economic, Social and Ecological Objectives in Integrated Assessments (WGBESEO; outputs from 2022 meeting).
ICES Scientific Reports. 7:93. 57 pp. https://doi.org/10.17895/ices.pub.30157585

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i Executive summary

Working Group on Balancing Economic, Social and Ecological Objectives in Integrated Assessments (WGBESEO) has two main objectives: (1) identifying objectives from legal and policy documents, and (2) understanding the implications derived from trade-offs among Economic, Social, Ecological and Institutional (ESEI) objectives. WGBESEO members are multidisciplinary professionals, including lawyers, political scientists, economists, and natural scientists, with diverse backgrounds ranging from early careers to experienced practitioners in various marine disciplines.

From 2020 to 2022, WGBESEO achieved several milestones, including developing a project plan, joining integrated ecosystem assessment (IEA) groups to enhance collaboration, updating management objectives for EOs, and engaging early career researchers through traineeships and a thesis.

A systematic review of peer-reviewed marine governance literature performed by WGBESEO found that little is documented on how objectives are derived from legislative mandates. A plurality of approaches was also observed: in addition to explicit management objectives found in official documents (the primary focus of the search), objectives are also derived from participatory processes like stakeholder workshops or consultations, often outside the public sphere. Most of the identified objectives relate to fisheries management, sustainability, or balancing multiple ESEI objectives. These findings were presented at ICES ASC 2021 and are being drafted into a journal manuscript.

A workshop hosted by WGBESEO at the MARE 2021 conference gathered insights on factors considered by authorities when deciding on conflicting ESEI objectives. The findings revealed that authorities often face an overwhelming amount of information and considerations. Additionally, there is not a single "authority" as authorities vary in institutional levels, contextual settings, and needs to respond to different requirements, making it impossible to refer to them as a homogeneous group. Using scenarios to observe consequences is useful, but the time scales for seeing these consequences—both intended and unintended—differ for ESEI objectives, and the time scale for recovery—if recovery is possible—also varies (e.g., the possibility of rebuilding a coral reef or a fishing-dependent community).

Discussions on attributes inherent to policy objectives are ongoing. Six dimensions are recognized, each set on a continuum: time, space, ambition, dimension, integration and force (obligation).

WGBESEO 2025 – 2027 work continues within the framework of its two main objectives.

ii Expert group information

Expert group name	Working Group on Balancing Economic, Social and Ecological Objectives in Integrated Assessments (WGBESO)
Expert group cycle	Multiannual fixed-term
Year cycle started	2020
Reporting year in cycle	3/3
Chair(s)	David Goldsborough, Netherlands
	Paulina Ramirez-Monsalve, Denmark
	Adelbert de Clercq, Belgium
	David Langlet, Sweden (2020 – 2022)
Meeting venue(s) and dates	15 - 16 April 2020, Online meeting 8 June 2020, Online meeting 30 September 2020, Online meeting 29 October 2020, Online meeting 26 November 2020, Online meeting
	14 January 2021, Online meeting 25 March 2021, Online meeting 27 May 2021, Online meeting 23 September 2021, Online meeting 25 November 2021, Online meeting
	3-7 October 2022, Copenhagen, Denmark

1 Introduction: Background, Initial aims, and Terms of Reference

1.1 Background

The working group on Balancing Economic, Social and Ecological Objectives (WGBESEO) of the International Council for the Exploration of the Sea (ICES) aims to bridge the knowledge gap that exists in Ecosystems Overviews (EOs) in terms of the identification and inclusion of high-level management objectives. A knowledge gap that ICES aims to bridge in the coming years as EO's are one of the three main products that support evidence for advice on Ecosystem Based Management (EBM), which has become an integral part of managing marine environments. The origin of WGBESEO stems from the Strategic Initiative on the Human Dimension in Integrated Ecosystem Assessments (SIHD) which has led to several new initiatives in ICES, such as the expert groups Working Group on Social Dimensions (WGSOCIAL) and Working Group on Economics (WGECON).

In addition, the creation of WGBESEO comes from a desire to support decision-making, which entails all important trade-off analyses, by linking management objectives to economic, social, ecological, and institutional objectives. A desire exists within ICES to add high level management objectives, as found, among others, in the United Nations Sustainable Development Goals (SDG's), the European Union's Marine Strategy Framework Directive (MSFD) and the EU Common Fisheries Policy (CFP) in an introductory part of a new generation of EOs. This inclusion can assist decision makers to place initiatives into a larger integrated management context. Additionally, there is a wish for these high-level objectives to be easily accessible to ICES working groups, supporting their operational activities.

This aspiration motivates WGBESEO members, a multidisciplinary group of professionals with diverse backgrounds (i.e., ranging from new to ICES, early career and experienced scientists within ICES, and practitioners in different marine disciplines) to generate science and analytical outcomes that can support ICES' evidence for advice. The aim of the WGBESEO group is also to do scientific research that can feed into other ICES working groups, but also that can contribute towards advances in the area of sustainable marine management.

We started this journey in Spring 2020, at the time that the Covid-19 restrictions started. It was motivating for WGBESEO members to engage in this challenge despite the restrictions brought by Covid-19 (i.e., no possibility for physical meetings and the dilemmas brought by having to work from home). However, as we ended the first Terms of Reference (ToR) term, we recognized that the impact of Covid-19 was considerable (See for example WHO (2022) "The impact of COVID-19 on mental health cannot be made light of" in here). We also saw, as we evaluated the outcomes of our work, that we were over-ambitious about what we could achieve as a newly formed group and under these specific working conditions. We report in this document what we managed to achieve in this first 2020-2022 term, and we explain how we would like to continue further.

The remainder of section 1 is dedicated to clarifying WGBESEO's objectives (section 1.2), describing the ToR from this first term (section 1.3), and clarifying a set of definitions and delimitations that framed WGBESEO work (section 1.4). Chapters 2, 3, and 4 document the progress achieved on three of the five ToR. The two ToR that were not addressed during the 2020-2022 term will be considered for the next WGBESEO research term. Chapter 5 briefly describes the work

developed by the early career researcher that joined us during WGBESEO 2021 – 2022 term. Chapter 6 presents reflections and valuable lessons learned from the initial terms of WGBESEO.

1.2 WGBESEO's objectives

As described in the previous section, two overarching objectives frame WGBESEO's work. The first one relates to the identification of relevant high-level management objectives derived from legal and policy documents. The second one relates to the support of decision-making processes that involve trade-off analysis.

1.2.1 Extracting high-level management objectives

A variety of economic, social, ecological, and institutional (ESEI[1]) objectives which are relevant for managing marine resources have been set out in legal and policy documents. The working group aimed to develop **a methodology (a framework) for identifying, classifying, and characterizing ESEI objectives** from a multi-level governance perspective, thus providing a tool for the practical integration of such objectives into future analysis and evidence for advice provided by ICES. The scope of advice ICES provides to its clients has been broadened in recent years. The advice now includes catch opportunities, fisheries overviews, aquaculture overviews, and ecosystem overviews (EOs), and viewpoints (ICES, 2020a)

The focus of the working group is on identifying ESEI objectives derived from legal and policy documents. These objectives tend to be dispersed over various documents. They also tend to be defined at a high level of abstraction and thus not be directly linkable to indicators.

The goal is then to develop a generic methodology (see Figure 1.1), a framework that could be applied repeatedly by various ICES groups and in different geographic settings, and that would contribute to the next generation of EO. The end goal is to help decision-makers place regional or local initiatives within a larger management context, including the associated indicators, instruments, and institutions, and thus support their decision-making process.

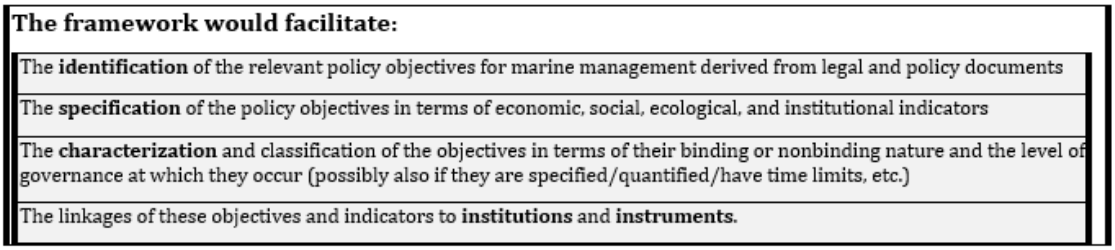

Figure 1.1 WGBESEO's envisioned framework for the identification and characterization of ESEI objectives. The developed framework would enable the identification of management objectives for specific ecoregions in line with the Ecosystem Overview 'pipeline process' as was envisioned in the findings from WKEO3 (ICES, 2019).

The development of such a framework requires the involvement of decision-makers. This exercise, that would need to be carried out in close consultation with ICES advisory processes (ACOM, SCICOM and ICES Secretariat), aims to ensure the practical relevance of the methodology, and to discuss and elaborate on the characterization and specification of the objectives.

To ensure that the methodology is also specific to regional seas and applicable in the ICES scientific community, close collaboration with ICES Integrated Ecosystem Assessment (IEA) expert

[1] WGBESEO started with ESE (economic, social, ecological) objectives in mind, but transitioned to ESEI (adding institutional ones). See section 1.4.1 for further explanation.

groups[2] is considered essential. Interviews, workshops, and case studies to develop and test the framework are part of the development path. As far as possible, the work could draw on the experiences of scientists with policy analysis expertise from several ICES member countries who are in close connection with WGBESEO members. The 2022 analysis of ICES IEA group work carried out by the working group on Maritime Systems (WGMARS) (ICES, 2022) can also provide useful input for designing the framework.

The development of the methodology is covered by three of the Terms of Reference (ToR): **Mapping** existing methodologies (ToR a), **developing** (ToR d), and **testing** the proposed methodologies (ToR e). Related to this process is ToR c which aims to identify, in dialogue with decision-makers a specific set of **characteristics** for the ESEI objectives. The main intended users of this methodology for identifying and synthesizing ESEI objectives are the IEA groups.

It is important to clarify that the mere identification and cataloguing of specific objectives at a given point in time is not sufficient. Due to shifting social and political priorities and ongoing institutional restructuring, ESEI objectives are dynamic. These objectives may change in terms of their substance, legal character, and the forms in which they are expressed, and will only be relevant within a specific timeframe. Therefore, WG**BESEO's product is a methodology, a framework** that IEA groups can use to derive the objectives for a defined geographical area. Using this methodology, and with the support of WGBESEO members (who would also be members of the respective IEA groups), lists of objectives would be developed based on a few regional examples (see section 2.2), serving both to test and refine the approach. This mapping process must be updated on a regular basis and as part of the ongoing efforts to revise the EOs.

1.2.2 Support to trade-off analysis

Special requests to inform discussions about trade-offs are also made by ICES clients. ICES' evidence for advice provides analysis and data on the trade-offs of different decisions. Such advice must consider the management context and relevant management objectives. Understanding and describing the management scope and context is crucial for designing a salient, legitimate, and credible advisory process and for the development of long-term management plans. Trade-off analysis work within ICES is currently being improved on topics that would integrate social, economic, environmental, and institutional aspects.

Having an across-the-board **comprehension of management objectives** and **information on potential implications among them** (**trade-offs)** enables decisions to be made with a better understanding of the societal consequences of alternative courses of action for ICES Ecoregions. It also enhances the potential for transparent communication about the significance of uncertainties and knowledge gaps.

The end goal of this ToR is to provide decision-makers with an inventory of the most common discussions on trade-offs linked to specific or integrated ESEI objectives, as well as to provide the indicators that could be used for understanding the potential implications. The information would assist authorities in their task of exploring possible options and consequences of decision-making.

[2] The ICES network coordinates a number of expert groups focused on IEA. These groups synthesize and evaluate information on physical, chemical, ecological, human and environmental processes affecting ecosystems. These expert groups focus on the development of IEAs in 11 regions. Many of the IEA expert groups synthesize scientific content for the peer reviewed ICES Ecosystem Overview advice products.

The compilation of this inventory of most common discussions on trade-offs linked to specific ESEI objectives is to be covered by ToR b. The main intended users are decision-makers at EU level and ICES member state (national) level.

1.3 Terms of Reference (ToR)

The following terms of reference (ToR) were put forward for WGBESEO's work for the term 2020 - 2022:

a) Synthesize existing information on social, economic and ecological management objectives, in particular **how these can be mapped and systematized**, from legislation, ICES expert groups, various marine research projects and the scientific literature.

b) **Identify**, in dialogues with relevant stakeholders[3] **the most relevant trade-offs** between ESE (Ecological, Social and Economic) objectives in selected geographical and regulatory contexts. This will be carried out in close consultation with ICES advisory processes (ACOM & secretariat).

c) **Identify**, in dialogues with relevant stakeholders[4], **distinctive characteristics of ESE objectives** as a basis for characterization/classification. This will be carried out in close consultation with ICES advisory processes (ACOM & secretariat).

d) **Develop a methodology** for carrying out the identification and characterization/ classification of ESE objectives in national and international/supra-national governance settings.

e) **Test the methodology** by identifying and characterizing/classifying ESE objectives in one or more relevant governance settings.

WGBESEO opted for a fully online approach from the start, meaning that several short online meetings were organised during the year. This format ensured continuity and enabled participation by a relatively large group of WGBESEO members. In addition, participation from North American members was facilitated by scheduling meetings in the afternoon CET. A total of 11 online meetings took place as part of the WGBESEO 2020–2022 term, each lasting 2 hours and occurring every second month. Meetings were used as a space to exchange thoughts, ideas and progress (e.g. task forces reporting on progress, drafting the manuscript, discussing plans of action, and having dedicated meetings with other IEA groups). Finally, a hybrid meeting took place in October 2022, lasting five days, with the majority of WGBESEO members joining online.

In this report we document progress achieved in ToR a, ToR b, and ToR c (chapters 2, 3, and 4 respectively). ToR d and ToR e is something we expect to carry out in the next BESEO ToR term. Table 1.1 provides an overview of the progress and scientific milestones reached during WGBESEO 2020–2022.

[3] Here we understand ″stakeholders″ as ″decision-makers″

[4] Here we understand ″stakeholders″ as ″decision-makers″

Table 1.1 Summary of the progress and scientific highlights achieved in WGBESEO 2020 – 2022

WGBESEO year	Progress achieved and science highlights
2020	Primary focus was on attracting members to the WG, aiming for broad geographical representation and inclusion of IEA groups. In addition, WGBESEO group members have joined IEA groups to expand the human dimension in the group and support collaboration and integration. A project plan was developed and has been guiding the WGBESEO work[5] Work primarily focused on ToR a) (a systematic review of peer reviewed literature within the field of marine governance and aimed at identifying approaches for identifying and/or characterising policy objectives for marine management). Among the preliminary conclusions are[6]: There is little documentation in peer reviewed publications on how objectives are derived from legislative mandates. Most objectives relate to fisheries management, sustainability, or balancing multiple ESEI objectives. Results are often presented as categories of objectives. A plurality of approaches was also observed: in addition to explicit management objectives found in official documents (primary focus of the search), objectives are also derived from participatory processes like stakeholder workshops or consultations, often outside the public sphere. Decision to conduct pilot studies within IEA groups for assessing the usefulness of the proposed framework, and to gauge the groups' current engagement with management objectives. Relevant groups were identified, and discussions on their participation and pilot format began[7]
2021	Update of management objectives for EOs that were under revision. WGBESEO members participated in the June 2021 WGEAWESS meeting, where they provided feedback and additional comments on the Management Objectives section for the Celtic Seas Ecosystem Overview. Capacity building for WGBESEO members through presentations by ICES network members on the use of objectives in IEA. Exploring collaboration opportunities with WGICA. Preliminary findings of work under ToR a presented at the ICES ASC 2021[8]; Workshop hosted at the MARE 2021 conference on information for trade-off decisions. Among the key points collected were:[9] Authorities face an overwhelming amount of information and considerations There isn't a single "authority": not possible to refer to a homogenous group due to the various levels, requirements, and institutional contexts Articulating unintended consequences is valuable for informing political decisions, especially since most unintended consequences have been related to socio-cultural and institutional objectives

[5] Available at the WGBESEO SharePoint

[6] See section 2.1: *Subtask one: Mapping of existing approaches* for further information

[7] See section 2.2: *Subtask three and four: Pilots and identifying ESEI objectives within ICES IEA groups* for further information

[8] Already presented as part of the highlights for 2020 in this table

[9] See section 3.1: *Trade-offs panel at the MARE 2021 conference* for further information

WGBESEO year	Progress achieved and science highlights
	Using scenarios to observe consequences is useful, but the time scales for seeing these consequences—both intended and unintended—differ for ecological, economic, socio-cultural, and institutional objectives The time scale for recovery—if recovery is possible—from both intended and unintended consequences also varies (e.g., the possibility of rebuilding a coral reef; possibility to rebuild a fishing-dependent community…). Strong engagement with early career researchers (ECR) in terms of traineeships and thesis on topics related to the WG's work[10]
2022	Discussions on attributes that are inherent to policy objectives; six dimensions are recognized, each of them set in a continuum: time, space, ambition, dimension, integration and force (obligation) [11]. Advancing the draft journal manuscript that documents the review of scientific literature on approaches for identifying policy objectives (ToRa) [12]

It is also WGBESEO's vision to establish connections with other ICES Working Groups. As indicated in Table 1.2, between 2020 and 2022, the group participated in several meetings and presented their ongoing work.

Table 1.2 Sessions featuring WGBESEO presentations and discussions on connections with other ICES groups

WGBESEO year	Meetings where the ongoing WGBESEO work has been presented
2020	WGMARS (April)
2021	WGSOCIAL (January) SIHD knowledge share (May) WGICA (October)
2022	SIHD (January)

1.4 Definitions and delimitations

Given the novelty of the group and of these topics within ICES, as well as the breadth of these terms of reference, the group had initial scoping discussions that often focused on terminology and definitions. In fact, during meetings throughout the entire term of the working group, discussion on definitions were held. At the centre stage of such discussions were essentially the goals that would be reached in ToR a (methods for synthesizing ESEI objectives) and in ToR d (developing the methodology). Ultimately, a correct understanding of terminology and associated definitions leads to a better identification and understanding of the gaps in knowledge that

[10] See section 5: *Work with Early Career Researchers* for further information

[11] See section 4: *ToR c: Attributes of ESEI objectives* for further information

[12] The draft manuscript is available at the WGBESEO Sharepoint

need to be filled to reach the aims of the ToR. We bring in this section the top-five topics that were agreed as a result of these discussions and that served as the basis for the development of a common language of collaboration.

1.4.1 Management objectives: ESE vs ESEI

The initial outset of the WGBESEO group was to identify ESE objectives, that is, larger overarching objectives related to relevant economic (E), social (S), and ecologic (E) fields. However, initial meetings of the working group identified *institutional* as an additional objective that needed to be included in the working group's aims and methodologies. *Institutional* objectives cover subjects related to, among others, good governance structures, and effective decision-making processes (Stephenson et al., 2019).

The transition of including institutional objectives did invoke discussion on the level **of importance of institutional objectives** compared to economic, social, and ecological ones. Institutional objectives could be seen as not as important as the three other objectives because they may be vague or in other words lack specificity. Calls for participatory processes or transparency efforts are clues to the possible vagueness of institutional objectives. Studies such as Aguado et al. (2021) are a starting point for measuring participation and transparency aspects of effective decision-making, but much growth is still possible in this area of research.

Foley et al. (2020), presents two perspectives on how institutional objectives could be included in an objective analysis. The authors state that either *institutional* is a fourth column of objectives in parallel to economic, social, and ecological objectives, or *institutional* represents a lintel (cf. horizontal beam) that is supported by the other three columns. Clearly, institutional objectives can be a contentious pillar to include. However, the group felt that in any proper work the institutional pillar cannot be excluded. Managing social-ecological systems requires a full-spectrum or a four-pillar sustainability approach with economic, social, ecological, and institutional objectives. The collective of economic, social, ecological, and institutional objectives is being referred to in this document as ESEI objectives.

WGBESEO looked at the Canadian Fisheries Research Network (CFRN)[13] which has been studying requirements of ecosystem-based and integrated management approaches to sustainability. CFRN reviewed international obligations and agreements and Canada's policies to develop a comprehensive set of **candidates ESEI objectives** for a sustainable fishery and linked to performance indicators (Stephenson et al. 2018). WGBESEO committed to follow this Full Spectrum Sustainability approach and is evaluating the integration of this categorization of objectives within the methodology that aims to produce (ToRa, ToRd, ToRe). In addition, several IEA groups are familiar with the Ocean Health Index and thus are familiar with this type of approach.

1.4.2 Identifying objectives derived from legal and policy documents.

WGBESEO is interested in ESEI objectives set out in legal and policy documents. They include **binding as well as many non-binding texts** originating from a reasonably high-level body at the international, regional, or national level that aim to steer or guide the activities of public

[13] Interdisciplinary collaborative research that brings together industry, academia, and government in working towards a sustainable fishing industry and training the next generation of fisheries researchers and managers. www.cfrn-rcrp.ca. Integrating diverse objectives for sustainable fisheries in Canada. *Canadian Journal of Fisheries and Aquatic Sciences*, 2019, 76(3): 480-496, https://doi.org/10.1139/cjfas-2017-0345

agencies and official bodies. The importance of working with objectives derived from legal and policy documents is that IEA groups, the key target groups of this WGBESEO work, could start working with indicators that are linked to policies. In other words, to avoid the situation where indicators are only suggested as "nice to measure", or "can be measured", with limited value in the governance of marine ecosystems. Linking indicators with policy objectives is relevant as the Integrated Ecosystem Assessments (IEA) done by the IEA groups need to use management objectives.

On repeated occasions, different WGBESEO members manifested the importance and desire of working with objectives that originate outside the public sphere. Several discussions took place around this topic and the reached conclusion was that WGBESEO, being a formal part of ICES, cannot be perceived as pushing a political agenda, or venturing into political or normative topics. It was considered critical that the current work would focus on written objectives that have already been formalized, especially if the work of the WGBESEO was to be used and integrated into ICES' evidence for advice products. It was also discussed that once the methodology to identify official objectives was built, and understood by the final users of it, then the issue of including objectives from outside the public sphere could be tackled. Nevertheless, it is worth mentioning that, specifically referring to an IEA process, the inclusion of objectives originating from outside the public sphere is part of the scoping step (step 1 of the IEA cycle) where stakeholders, managers, and IEA scientists define the management objectives for the IEA (Levin et al., 2009; Samhouri et al., 2014; Levin et al., 2014; Harvey et al., 2017). Objectives derived from legal and policy documents are used to set and/or inform management objectives in this scoping step of IEA.

A challenge to be aware of in this process is that, although objectives are included in policy and legal documents, they may lack specificity, or there may not be a clear connection with indicators. WGBESEO members discussed that two levels of objectives could exist during the process of identifying objectives: a first level containing broad goals, and a second level containing more specific objectives. As an example, the SDGs of the UN contain the overall goal, and from these SDGs a set of more specific "targets" can be stipulated.

1.4.3 WGBESEO target groups

The WGBESEO working group has set forward intended target groups to focus on the group's work. The main **intended users of the overview of existing methodologies for identifying and synthesizing ESEI objectives** are the ICES' IEA groups. Once a good use and good practice within ICES is reached, other groups or users external to ICES can be targeted. The m**ain intended users of the inventory of most common discussion on trade-offs** linked to specific ESEI objectives, and the indicators that could be used for understanding the potential implications, are decision makers at the EU-level and the ICES member state (national) level on both sides of the North Atlantic.

1.4.4 Managing bias, interpretation, and communication

The working group launched with the mindset that members would each bring their own valued expertise, knowledge, and interpretation. Even if each member is objective in bringing their own interpretation, possible biases and differences should be managed. For example, interpreting a text from a policy document always entails some normative or subjective elements. Several measures were taken to manage these situations as much as possible.

- Working in smaller groups helped to guarantee or ensure that several perspectives were always present during discussions or in work processes.

- These perspectives were brought together in plenary discussions for the larger group to have input on.
- In most cases a general consensus was reached, and the needed time was allocated to ensure the subsequent steps would progress correctly.
- To keep work transparent and traceable, the decision-making process was tracked by collecting supportive evidence behind key decisions.

1.4.5 Glossary of social science definitions of use in ICES

A clear and understandable lexicon is essential for a transparent and constructive common dialogue. In order to ensure the consistency of the WGBESEO's work, as well as to improve the understandability of their products by the target groups, a list of social science-related definitions and terminology was compiled.

The work was developed as part of a student internship project (February-June 2021) and carried out by Lea Schönen from Van Hall Larenstein, University of Applied Sciences, Leeuwarden, the Netherlands. The glossary of definitions focussed on ICES topics related to social science and specifically focussed on the Strategic Initiative on the Human Dimensions (SIHD) and the expert groups falling under SIHD. The glossary (see Annex 3) is a living document that can enhance cross-disciplinary communication and understanding among groups. It supports the accurate use of words and highlights areas where clarification may be needed; the glossary is also of help when onboarding new members into the working group.

A brief overview on the process used for compiling this glossary is included in section 5.1 of this report. The terms included in the Glossary can be seen in Annex 3: Social Science Glossary.

Having clarified the WGBESEO's objectives, and the definitions and delimitations that frame WGBESEO's work, the next three chapters in the report proceeds on documenting the progress achieved in the term 2020 - 2022 for three out of five ToRs.

2 ToRa: Methods for synthesizing ESEI objectives - state of the art

A variety of ESEI objectives which are relevant for managing marine resources have been set out in legal and policy documents. As previously mentioned, it is the aim of WGBESEO to draft a methodology or framework that would allow the identification of such objectives (see Figure 1). Such a framework could be applied by the ICES IEA groups. Identification of ESEI objectives is one of the first tasks when doing an IEA. Having a systematic comprehension of such objectives will, among other aspects, suggest areas where conflicts are occurring, and assist the delimitation of boundaries for any proposed action as part of the IEA process.

ToR a) aimed to identify the state of the art for synthesizing ESEI objectives from legal and policy documents. These state-of-the-art included methods which have been both documented in the literature and carried out in practice by the IEA groups. Throughout this examination we aimed to set a baseline for our further work on designing a framework, a systematic approach for identifying, classifying, and characterizing ESEI objectives. It also allowed us to collect good practices, methods, and approaches that could be integrated into our framework.

Five subtasks were planned to arrive at such state of the art. The first subtask referred to the mapping of existing approaches which have been documented in peer-reviewed publications. The second aimed to explore, within policy theories, how such a process could take place. Third and fourth subtasks were on carrying out pilot cases with IEA groups and collecting the existing approaches used by these groups for identifying ESEI objectives. The fifth subtask aimed to clarify the expectations for the inclusion of ESEI objectives within the next generation of Ecosystem Overviews (EO).

Within the 2020-2023 term we mainly worked on subtasks one (mapping of existing methods) and five (clarifying expectations of ESEI inclusion within EO), and some progress was made on subtasks three and four (existing ESEI processes within IEA groups). Progress on these four topics is documented below. Given the need to optimize existing resources, subtask two (exploring within policy theories) was removed from the list of activities.

2.1 Subtask one: Mapping of existing approaches

The main question to address in this subtask was: Which approaches, documented in peer-reviewed manuscripts, have been used for identifying policy objectives?

A broad review of scientific literature, using the databases SCOPUS and Web of Science, was carried out by one of the WGBESEO chairs (David Langlet) and his research assistant (Martina Carlsson) in the second semester of 2020. Various search strings were explored, e.g., "fisheries + objectives" and "'maritime spatial planning + objectives". An initial assessment revealed that only a fraction of the retrieved documents were relevant to the aim of this task. Very few texts, less than 20, discussed explicitly, or revealed implicitly, some kind of methodology or order for identifying, sorting and/or characterizing ESEI objectives. Ten additional papers fitting the criteria were suggested by WGBESEO members. All papers were distributed among a subgroup of WGBESEO members interested in co-authoring a draft journal manuscript that would document the findings[14]. This group of people with diverse backgrounds, including lawyers, political

[14] The draft manuscript is available at the WGBESEO Sharepoint

scientists, economists, and natural scientists, analysed the manuscripts. Each text was analysed by two members of the group. The analysis aimed to answer two questions: 1) which methods are used to identify/extract the objectives? and 2) what are the extracted objectives about? Individual answers were collected for each of the questions and a discussion of these took place between the two participants. The agreed answers were documented in an excel spreadsheet[15].

Preliminary results were presented at the ICES ASC 2021 (Figure 2.1). Among the findings was that little is documented on how the objectives have been drawn from the existing legislative mandates. We hypothesise that most identification and syntheses of objectives have come from long processes that may not be reflected in peer-reviewed publications, yet they could be synthesized in grey literature. In terms of the nature of the objectives, most relate to fisheries management, sustainability, or a balance of multiple ESEI objectives. Results are often presented as categories of objectives. A plurality of approaches was also observed, that is, although the primary focus was on explicit management objectives that have found expression in official documents (international agreements, national legislation, and governmental action plans) some of the identified literature reported objectives being derived from other forms of participatory processes (e.g., stakeholder workshops or consultations) which often take place outside of formal processes.

Figure 2.1 WGBESEO presentation at the ICES ASC 2021

As discussed in section 1.4.2, our intended focus is on officially decided objectives set out in official documents. This is not to say that officially sanctioned objectives cannot be the result of participatory processes or that their implementation or operationalization may not involve such processes. We see these forms of participatory processes as systems that could, and have been used, to compensate for the "fussiness" of some of the policy objectives. Nevertheless, thoroughly addressing both perspectives in a methodologically consistent manner was deemed beyond what was doable for the working group considering the available resources. The reached agreement was then to focus on the 'officially decided objectives' and shortly convey the importance of participatory processes, by way of exemplifying important dimensions that are left out of the discussion when focusing only on official objectives.

[15] The excel spreadsheet is available at the WGBESEO Sharepoint

We maintained our focus on peer-reviewed literature, reserving the exploration of grey literature for a subsequent step, subject to the availability of resources among WGBESEO members. We also discussed the possibility of a potential collaboration with WGMLEARN to explore literature using machine learning or AI.

Being aware of the existing resources (time availability of WGBESEO members), the final draft manuscript, documenting how ESEI objectives have been identified and characterised in the existing peer-reviewed literature within fisheries and wider marine management, is expected to be completed as part of the upcoming WGBESEO work (first semester of 2026).

2.2 Subtasks three and four: Pilots and identifying ESEI objectives within ICES IEA groups

Part of the process for arriving at the framework for the identification and characterization of ESEI objectives includes WGBESEO members working together with members from the IEA group(s) in pilot cases. Synergies between members of these groups are important, as they help both groups to communicate effectively, contribute to mutual skill building, and understand the different perspectives.

The selection of the potential IEA group(s) to work with was done on the basis of two points (Table 2.1): indication that the IEA group was currently working with management objectives (e.g. sections in the EOs referring to management or governance aspects), and availability and interests of WGBESEO members. During WGBESEO's plenary discussions the awareness was also made that although the IEA groups will be receptive to the involvement of other disciplines, some of the groups might not have the capacity to start exploring management objectives at this point.

Table 2.1 ICES Ecoregions, associated IEA groups, existent EO and status on management section in Q1 2020. At the time of review (first semester of 2020) IEA groups were at different stages in terms of development of IEAs and EO (see for example WKCONSERVE (2019)[16] report. Notes: [1] The IEA group is already working with management or governance aspects; [2] The IEA group has shown their EO interest in working with management aspects; [3] IEA group of interest to WGBESEO members. To note that there is no IEA group for Oceanic Northeast Atlantic, and their EO resulted from a dedicated workshop; they also manage policies and objectives differently to the other IEA regions.

ICES Ecoregions	IEA groups	Ecosystem Overviews (EO)	
		EO (or report) available	Include a management section
(Central) Arctic Ocean	WGICA [2]	[report]	x
Greenland Sea	WGIEAGS	[report]	
Norwegian Sea	WGINOR [3]	x	
Barents Sea	WGIBAR	x	
Icelandic Waters		x	
Faroes			

[16] WKCONSERVE (2019). At the workshop some of the IEA groups made Roadmaps for action related to social science WGNARS (Northwest Atlantic), WGINOR (Norwegian Sea), WGINOSE (North Sea), WGEAWESS (Celtic Seas/Bay of Biscay/Iberian Coast) WGIAB (Baltic Sea).

ICES Ecoregions	IEA groups	Ecosystem Overviews (EO)	
		EO (or report) available	Include a management section
Greater North Sea	WGINOSE [2]	x	[Info from WK BESIO, 2017]
Baltic Sea	WGIAB [1]	x	x
Oceanic Northeast Atlantic	[1]	x	x
Azores	WGIAZOR	x	
Western European Shelf Seas (Bay of Biscay, the Iberian Coast. Celtic Seas)	WGEAWESS [1]	x	For Celtic seas: working draft
Western Mediterranean Sea	WGCOMEDA [2]	Report	[No management section yet but aim to integrate the socio-economic dimension as part of their work]
Ionian Sea and the Central Mediterranean Sea			
Adriatic Sea			
Aegean-Levantine Sea			
Black Sea			
Northeast Atlantic	WGNARS [1]		[Working with the Mid-Atlantic Fishery Management Council to develop text related to management information]
Northern Bering Sea – Chukchi Sea			

For several reasons, including limited time availability among WGBESEO members, the planned joint WGBESEO+IEA group efforts were only able to produce concrete outcomes for WGEAWESS (Celtic Seas), chaired by Debbi Pedreschi.

We can relate to the joint activities in two categories:

- Collaboration pre WGBESEO times:
  - Gerben Vernhout (Coastal and Marine Management, Van Hall Larenstein, University of Applied Sciences, The Netherlands) carried out an internship (November 2019-March 2020) at the Marine Institute in Ireland under the supervision of Debbi Pedreschi and in collaboration with David Goldsborough. During this internship economic, social, and ecological objectives in EU and Irish national legislation in relation to fisheries were identified[17].
  - The work was presented at one of the first WGBESEO meetings including the process followed to do such identification, as well as on the challenges of the exercise. The plenary discussion concentrated on the difficulties of linking overarching

[17] The excel pages containing these lists of objectives are included in the internal WGBESEO SharePoint

aspirational goals to indicators; that objectives and indicators can also be given in non-marine-related policies (e.g. by the International Labour Organisation - ILO); and on how countries can define or interpret international or EU objectives differently.

- Collaboration during WGBESEO times:
  - WGBESEO members Sonia Seixas, Romain López, and Gerben Vernhout joined the WGEAWESS meeting in the summer of 2021 and contributed to drafting the section on Management Objectives for the Celtic Seas EO. Comments on the text had previously been provided by Marta Ballesteros. For an overview of WGEAWESS work see their WGEAWESS page on ICES website.

2.3 Subtask five: Inclusion of ESEI objectives in Ecosystem Overviews

Subtask five had as a goal to clarify ICES' expectations on what information regarding management objectives is to be included in the EO.

As presented at WKTRANSPARENT (ICES, 2020b) EOs are advice products that -in line with EBM and IEA approaches, provide a description of the ecosystems, identify the main human pressures, and explain how these affect key ecosystem components. ICES' EOs describe the distribution of human activities and resultant pressures (in space and time) on the environment and ecosystem.

The workshop WKEO (ICES, 2019) identified a list of candidate products and sections to be considered for inclusion in the (the "pipeline process"). Views from representatives from DG-ENV, EEA, OSPAR, and HELCOM were considered for arriving at this list. Two of these products are related to WGBESEO's ToRs: Management objectives (to be included in EO in a time frame between 1-3 years), and trade-offs (to be included in EO in a time frame between 3-10 years).

Of the sections within an EO, the "Pressures" is the one that is of primary interest to the work of WGBESEO. Pressures derive from human activities (the activities are broadly similar across most ecoregions, although some pressures may be unique to a specific ecoregion). The thickness of the line indicates the severity of the human activity in the EO diagram (see for example in Figure 2.2, the interactive diagram for the Celtic Seas's EO). It was discussed that those were the activities susceptible to regional management.

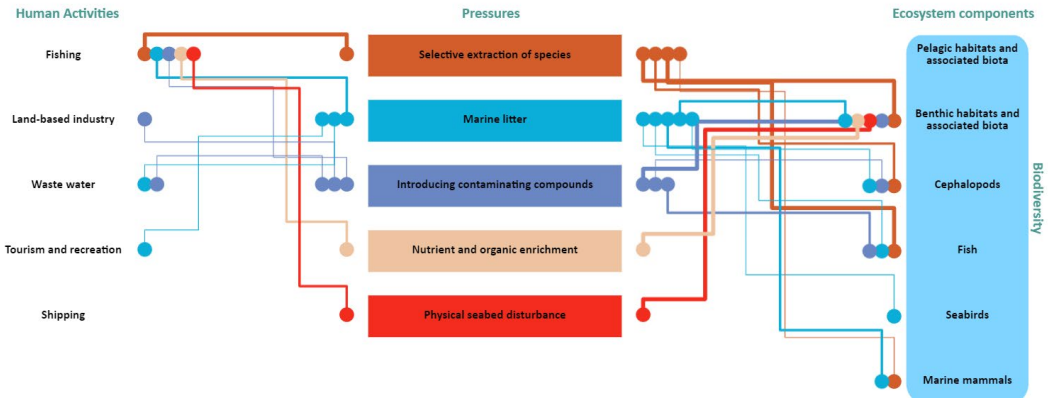

Figure 2.2 Interactive diagram from the Celtic Seas EO (ICES, n.d2)

Key points about EOs collected throughout our WGBESEO work have been:

- Groups working on EOs are evolving from documenting "all we know", into more strategic: "what is needed to know?"
- Key users of the EOs are managers: how will they use the information? What decisions will they make? And so, what do we (IEA group/WGBESEO/ICES) need to show?
- There is limited space in the EOs for these upcoming sections on management and governance aspects (i.e., 1-2 paragraphs).
- Priority for the use of this limited space could be for listing international/EU level objectives that the EO could refer to, and for highlighting conflicting objectives.
- Small and solid additions from WGBESEO's work that could be improved over time.
- The Canadian Fisheries Research Network framework, described in section 1.4.1, can be used as a structure to standardize the information on ESEI objectives to be included in the management section of the EOs.
- Take into consideration the calendar of EOs updating (e.g., which EOs are planned to be updated in 2025 – 2027) for planning WGBESEO's work.

The results obtained in the work by Schönen L. (2022) (section 5.2) also give an indication of expectations of inclusion of ESEI objectives as part of the EOs, especially the operational objectives which are sought after by stakeholders who design EBM plans.

3 ToR b: Identifying the most relevant trade-offs between ESEI objectives

The ambition of ToR b was to provide an **inventory of the most common discussion on trade-offs** linked to specific ESEI objectives, and the indicators that could be used for understanding the potential implications. The creation of these products -for selected geographical and regulatory contexts- would be in close dialogue with decision-makers and carried out in close consultation with ICES advisory processes (ACOM & secretariat). The inventory and list of indicators should be of added value for their process of trade-off analysis i.e., to show how issues are connected and affect each other. The five subtasks planned as part of this ToR can be seen in Table 3.1.

Note that initially, the word "stakeholders" was used to describe ToR b-3 and ToR b-4. However, this created confusion as it was assumed we were referring to users of the resources or NGOs. We specifically refer here to decision-makers in the EU and ICES member states who are the ones making the final decision after having a discussion on trade-offs.

It is also important to clarify that what we were looking for evidence of how the selection between trade-offs has been taking place, and which arguments were given. Practical means or measures to pursue one objective may have unintended, negative consequences on other objectives. We aimed to document what has been reported regarding trade-offs (and synergies) between objectives; if there are measures that would permit achieving the objectives and being less problematic for achieving other objectives. Among the literature and examples we are looking for are cases that report ways to avoid making difficult policy choices through negotiations and compromises, instead aiming to foster greater synergies. In addition to academic analysis of trade-offs between ecosystem-services, there are some papers on trade-offs between SDGs. Guidance from those discussions could be taken as well.

As to our collaboration with decision-makers in this process, it is not our intention to explore their value system but rather find out what it takes for them to find the inventory useful. Ground-truthing exercises with decision-makers are expected to validate: (i) the inventory of trade-offs, (ii) the indicators, and (iii) their needs when engaging in that process.

Table 3.1 Envisioned subtasks part of ToR b on identifying in dialogues with relevant stakeholders the most relevant trade-offs between ESEI objectives in selected geographical and regulatory context

	Subtask	Output
ToR b-1	Search for and summarize from existing scientific literature* how trade-off discussions on ESEI objectives can or have taken place *literature: journal manuscripts, scientific reports.	Inventory of the most common discussions on trade-offs found in literature, that tend to occur when referring to ESEI objectives
ToR b-2	Explore in policy theories how this process could take place	Description of how such process of discussing trade-offs among ESEI objectives could take place, according to policy theories
ToR b-3	Feedback from decision-makers (part a)**	Understand the needs of decision-makers when engaging in discussions about trade-offs

	Subtask	Output
ToR b-4	Feedback from decision-makers (part b)**	Ground truth the inventory and the type of indicators
ToR b-5	Journal manuscript (tentative topic: description of the most common discussions on trade-offs associated to ESEI objectives)	Draft journal manuscript

** To be done in close consultation with ICES advisory processes (ACOM & secretariat).

Two concrete activities related to this ToR took place during the WGBESEO 2020 – 2022 term. One was the hosting of a panel at the MARE 2021 conference (June 2021); the second was collecting ideas on how to implement this ToR through a brainstorming exercise during the internal WGBESEO meetings in September 2021.

3.1 Trade-offs panel at the MARE 2021 conference

WGBESEO members hosted a panel at the MARE 2021 conference entitled "Informing trade-offs for a Sustainable Blue Growth" (Figure 3.1). The objective of the panel was to collect insights on which factors were considered by the authorities when exploring decisions made for the sake of Blue Growth.

Figure 3.1 WGBESEO panel at the MARE 2021 Conference.

The presented argument is that within the Blue Growth discourse, trade-off discussions take place about competing uses of the sea, as well as across objectives (within a use). The usual approach would assume that there can be an optimal solution for multiple users of the sea. Decision support frameworks may be useful for resolving potential trade-offs on uses of the sea when the objectives and priorities are clear (e.g. optimization, synergies), and also for informing political decisions when objectives are vague or when there is no obvious preferred solution.

However, when there is no obvious "best" solution, trade-off discussions are still relevant in informing decisions about the often-conflicting ESEI objectives. Decisions are often made without explicit weighing of objectives, a situation that tends to arise because some objectives (i.e., social or institutional) are often implicit and hardly operationalised in the marine realm. Decision-makers concerned with coastal and ocean governance would benefit from having

information, or at least a better comprehension, of the implications of alternative courses of action when making decisions on conflicting objectives.

The panel was targeted to an interdisciplinary audience who had explored, worked with, or were interested in general issues surrounding trade-offs discussions, and who could contribute with information on:

- Different methodologies to explore trade-offs.
- Different methodologies to articulate social and institutional objectives.
- Indicators that could be used for understanding the implications.
- Cases where synergies between objectives have been achieved.
- Uptake and use of trade-off tools in decision making processes.

The panel ran as a workshop, with three 10-minute presentations that kicked off the session, followed by three sub-questions used as conversation starters for the breakout groups. A case study was also proposed as a way to target the exchange of thoughts. The proposed case study was on the consequences of placing a new wind farm in an area of traditional activities such as fishing. Groups worked for an hour and reported back to plenary three key points on the question of: ***What do authorities need to know when taking a decision on conflicting ESEI objectives?*** The key points from the plenary discussion are summarized in Figure 3.2.

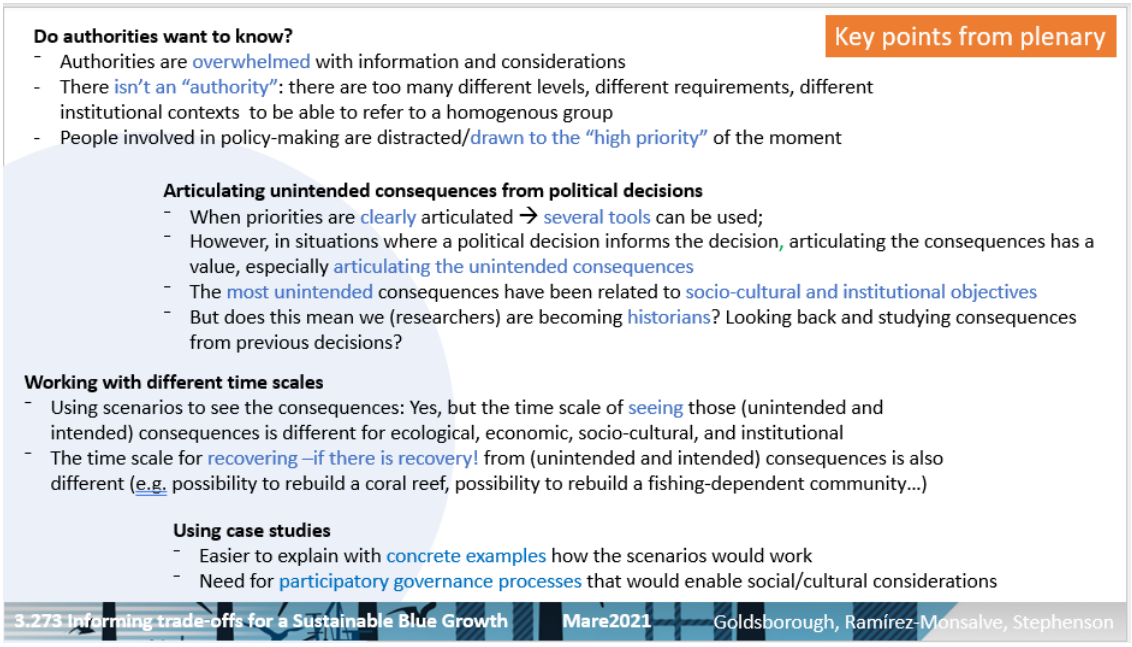

Figure 3.2 Key points from the plenary discussion part of WGBESEO's panel at the MARE 2021 Conference

Ideas, thoughts, and comments on how this ToR could be implemented were collected during a brainstorming exercise in September 2021. Among the key messages collected were:

Three **topics on trade-offs could be explored**: i) identifying trade-offs, ii) resolving (or avoiding) trade-offs, and iii) informing trade-offs.

- Trade-offs have been identified among objectives, and between activities (or users), e.g. under an EBFM or multi-species management, trade-offs are no longer among users, but within users (e.g. fishers targeting different species in the same fisheries)
- What is the appropriate institutional structure or process for discussing and resolving trade-offs/conflicts?

- What information do authorities need to ensure that the decision-making process is rational and well-considered? (a follow-up to the topic discussed at the MARE 2021 conference)

Regarding the **working approach**, suggestions included a case study method focusing on a few key trade-offs with identifiable stakeholders, and working backwards using a chain-referral approach to expand the research.

Due to limited resources, i.e. time availability of WGBESEO members, the work on trade-offs did not continue further. As part of activities in 2025-20287, WGBESEO aims to address the topic of trade-offs, with a focus on developing a framework and illustrating the framework with best practices.

4 ToR c: Attributes of ESEI objectives

The user of the envisaged WGBESEO's framework for the identification of ESEI objectives derived from legal and policy documents would need to understand the attributes of an objective. These attributes include, among others, the level at which the objective originates (international, EU, national); its temporal and/or spatial limitations; and its binding/non-binding specifications. It is the intention of this ToR to provide a framework in which the wide range of types of ESEI objectives could be systematically organized for purposes of comparison, evaluation, and guidance.

The literature across disciplines emphasises that setting objectives in implementable and traceable ways is a key for successful policy-making. In addition, how objectives are framed, identified, selected, defined and included in policy instruments shapes not only their efficiency but also their legitimacy and relevance to tackling environmental and societal challenges. Evidence indicates that policy objectives in the field of marine policies are often formulated in ambiguous and vague ways (Kirkfeldt et al. 2020).

What an objective is and/or what it should be (descriptive and normative approaches) is generally known (Long et al. 2015). However, analytical attempts to identify the core components have somehow largely been missing.

Inspired by Crawford and Ostrom (1995), we reflected on the attributes that are inherent to objectives. We suggest that **all objectives share six dimensions, each of them set in a continuum**: time, space, ambition, dimension, integration and force (obligation) (Table 4.1).

This initial proposal is intended to frame future discussions both of WGBESEO and more broadly within and beyond ICES. For example, to better understand the discussions, the plan was, at a later stage, to identify examples of the extremes of the continuum The necessary interactions with decision-makers and the ICES ACOM and SCICOM provisioned in the original plan must continue to be an integral plan of this process. It is also intended to continue elaborating on the first draft report produced during the October 2022 WGBESEO meeting.

Table 5. Examples of attributes of objectives.

Dimension	Continuum From…(example)	To… (example)
Time	Specified and reasonably short term (will have been achieved by the end of this two-year management plan)	Open-ended commitment or wholly unspecified (any objective in a binding agreement that does not have an expiration date on the agreement)
Space	Specified and "local" (a single bay or the range of a single stock)	Global or wholly unspecified (any objective in an agreement adopted by all Parties to a global process – like the UN Fishery Resolutions)
Ambition **Inclusiveness**	A specific status for a single feature of a single dimension of Nature and Humanity (intended biomass of a specific fish stock, or revenue/yield for a particular industry sector_	A single sweeping statement about the status / well-being of all the dimensions addresses ("healthy and prosperous" or "fully sustainable"-

Dimension Inclusiveness	Objective addresses features of only a single dimension of Natural and Human Well-being (ecological OR Social OR Economic	Objectives about well-integrated views of humanity and Nature
Integration	Only one sector is affected by the objective	Objective necessarily requires all economic and social sectors to engage, and the outcome is for entire socio-ecological system.
Obligation /Force	Voluntary and adopted by body with no legal authority	Included in legislation or binding international agreement

After detailing the accomplishments from 2020 to 2022 on three of the five ToRs, the report now briefly summarizes the contributions made by the early career researcher during this term. The report concludes with some reflections and final considerations.

5 Work with Early Career Researchers

During our 2020 – 2022, Lea Schönen from Van Hall Larenstein, University of Applied Sciences, Leeuwarden, the Netherlands, joined us first as a WGBESEO trainee, and later she developed her bachelor thesis on a topic relevant to the WG. Gerben Vermhout -also associated with WGEAWESS, and Emem Malcolm Meko, also from Van Hall Larenstein, were also associated with WGBESEO in their theses, particularly with the sub-group working within the North Sea context. Gerben focused on fisheries management in the North Sea, while Emem explored the effects of offshore wind parks on the marine environment. While we appreciate the relevance of their work, we bring in this report the research that was more aligned with WGBESEO's general priorities.

5.1 Glossary of social science definitions of use in ICES

As mentioned in section 1.4.5, a specific list of definitions used within ICES on topics related with social science was compiled as part of Lea Schönen's internship from February to June 2021.

Developing such a list would ensure the consistency of the WGBESEO's work and improve the understandability of WGBESEO's products by the target groups. The definitions focussed on the terminology used within the Strategic Initiative on the Human Dimensions (SIHD) and by the expert groups falling under SIHD.

A summary of the process used for compiling this glossary is presented next, and the full protocol used for arriving at the glossary has been added as Annex 4.

The first step aimed at arriving at a first outline of the terms to include in the glossary. A mapping of the ICES structure, and content analyses of key ICES documents such as the ICES Strategic Plan, the ICES Science Plan, and the ICES Advisory Plan took place in this process. It was also important to understand the mechanisms behind the ICES website's advanced search engine. WordClouds software, displaying the most frequently used words and relating the size of the word to the frequency of use, allowed visualization of this first glossary.

A second step aimed at increasing the specificity of the search so that a dedicated social science glossary could be built. Reports from the different subgroups of SIHD, which includes WGBESEO, WGMARS, WGSEDA, WGRMES, WGHIST, WGECON, and WGSOCIAL were analysed applying the same methodology utilized in the previous step. The more detailed search revealed that definitions were within certain ranges, and overlapping with definitions from other terms. The terms identified in WordClouds were searched in the reports, and the background information that surrounded the terminology was extracted. This allowed the construction of a boundary around the definitions.

The third step aimed for a sorting of definitions. Some were to remain in the social science glossary, and others would be included in a more general category. A panel of three independent participants would first score the definitions and after discussion and consensus agreements, the words were placed in either category. A total of 43 words were included in the social science glossary, and 50 words in the general one.

The final step elaborated further on the terms included in the social science glossary. Each term was searched in the previously mentioned reports produced by the SIHD groups and other relevant documents. Some of the collected definitions were used differently by different groups or subgroups. This range of definitions was included in the glossary in order to increase the

understanding and comprehension of how the term is used within the ICES community. As previously mentioned, the terms included in the Glossary can be seen in Annex 3.

A series of follow-up questions could be used if we aim to progress this work. For example, does a lack of definition mean the term is clear to everyone? What does it mean if there are no conflicting definitions of a term? Could the habitual use of terms, potentially influenced by a knowledge gap among group members, result in a uniform yet incorrect usage of the term over time?

5.2 Ecosystem Overview's role in sustainable marine management

Lea Schönen also carried out her bachelor thesis for WGBESEO (January-July 2022) researching the role of ICES ecosystem overviews in sustainable marine management (Schönen, L., 2022).

As mentioned earlier in section 2.3, ICES' Ecosystem Overviews (EOs) are intended to advance the delivery of geographically-based integrated advice, taking account of the effects of multiple human pressures on the environment and the most influential environmental and ecosystem processes, while considering multiple objectives (ICES 2020a, n.d). ICES describes an EO as an advice product that helps towards supporting EBM, in particular "helping policy developments by providing impartial evidence" (ICES 2020c, p12).

EOs are independently peer-reviewed following the ICES advisory framework and principles. They are formally approved for publication by the ICES Advisory Committee (ACOM) as ICES advice. The overviews are continuously evolving, periodically reviewed, addressing issues relevant to regional managers, and incorporating new knowledge on regional trends in the ecosystem. EO complement other recurrent advice and special requests focused on fisheries and aquaculture.

The main question explored in the bachelor thesis was *what is the role of the ICES EO's in marine management?* Four sub-questions (SQ) were also analysed by means of a desk study (see Table 5.1); the fourth sub-question was supplemented with results of a survey. Details on the methodology can be read in Schönen L. (2022). A summary of the collected answers is given below.

Table 5.1 Research questions used for exploring the overarching question of *What is the role of the ICES EO's in marine management?* (Schönen L., 2022).

SQ1: Which requirements for EO are needed to successfully fulfil the ICES objective of supporting ecosystems-based management?
SQ2: In what way does ICES define the role of EO?
SQ3: How is the concept of ecosystem-based management implemented in ecoregions?
SQ4: To what extent and by whom are EO used as a tool within the ecoregions?

ICES defines the role of EOs in their 2021 Strategic Plan (ICES, 2021). EOs are tailored towards an improved understanding of the marine ecosystem, so that this understanding may ensure benefits for human activities, the so-called ecosystem services. The resulting EOs help to support the implementation and recognition of EBM by highlighting core aspects that are useful in implementing this management approach. ICES is committed to use scientific data and appropriate analyses to map human activities, pressures, and impacts, including social, cultural, and economic information. Although the latest EOs can fulfil for the most part the ICES objectives, the

objectives themselves are on a high level and remain rather vague as to leave enough range and flexibility to fulfil the set-out objectives.

Analysis results for SQ3 found that the definition of EBM into which EOs feed is unclear and differs depending on the source. Six different definitions of EBM were referred to in the explored EOs: those are the Convention of Biological Diversity (CBD), The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), the United Nations Environmental Programme (UNEP), the non-profit organisation SeaWeb, the Protection of the Arctic Marine Environment working group (PAME) and the U.S. Commission on Ocean Policy. The use of different ranges of definitions on EBM leads to a range of different interpretations and thus to different objectives and approaches for marine management. For example, only three of the six definitions imply that making a management plan is one of the objectives of EBM (CBD, OSPAR, U.S. Commission) whereas the other three definitions do not relate to a management plan as an objective of EBM. Another definition brings the concept of *adaptive management strategies* and defines *trade-offs* at the basis of EBM (SeaWeb). Two of the definitions emphasize that human population and socio-economic systems are part of the ecosystem (UNEP) and even the political and sectoral realm (PAME). Nevertheless, one common impression obtained from all definitions and interpretations is that EBM -and by consequence also EOs, are focussed on better understanding the ecosystem.

The analysis of two EOs (Central Arctic Ocean and Celtic Seas, 2022) confirmed the focus of EOs information on the biological and physical ecosystem. Noteworthy was the statement on the Celtic Seas EO that a number of European research projects provided a platform to consider different perspectives in developing EBM; they have no legal standing, and there is no legal requirement to follow up on specific recommendations that would come from EBM frameworks (O'Higgins et al., 2019, p55).

From analyses of the survey results developed to answer SQ4 was that sectors on environment and fisheries were the most common users of an EO within their ecoregion. Most stakeholders using the EO were researchers, scientists, and, to a lesser extent, advisors and policy makers. A statement was made that the EO does not provide enough information to be a useful tool for advisors and policy makers. This comes down to the lack of 'operational' advice that is included in the EO. However, the EO does not aim to include 'operational' advice but is aimed to be an advice tool used in combination with or in parallel to other advice tools.

Finally, one of the conclusions brought by Schönen L. (2022) is that although EOs appeared to be well received by ICES members and stakeholders directly involved with EOs, a lack of knowledge still exists on how EOs are used, who uses and who could use EOs, and how well known the existence of the EOs is.

It is the intention of WGBESEO to continue exploring possibilities of collaboration with Early Career Scientists (ECR). The group welcomes bachelor and master students interested in developing traineeships or theses within the goals of WGBESEO. Further information on the ECR program within ICES can be found here https://www.ices.dk/community/groups/Pages/SI-IECS.aspx.

6 Concluding remarks

Based on an analysis and discussion, including a Jamboard session with WGBESEO members during the October 2022 meeting, we made some observations about the first term of WGBESEO and provided suggestions for the upcoming term.

Learning to work together: The diverse disciplinary backgrounds, methodological traditions, and expectations of the group members sometimes posed challenges. Allowing sufficient time to define common ground was essential for establishing a solid base for successful collaboration.

Narrowing the scope and focus: 'Less is more' when it comes to maintaining a clear direction. It's important to be mindful of the limited resources, including human capacity and time. Since we can only rely on voluntary effort, we need to be realistic about the amount of work that can be carried out.

In terms of working approach:

- Focus should now be on drafting and documenting, and then circulating for feedback and revisions to maintain a lasting record of discussions.
- Enhance continuity in achieving objectives by forming smaller working groups with specific tasks and timelines.
- A call was also made to continue the work with ECR

In terms of working across other WGs

- Leverage synergies with other WGs by organizing joint sessions to address common issues
- Explore the possibility of developing common ToRs with WGs where clear links exist, such as similar objectives, common members, or existing relationships
- Foster strategic links with WGSOCIAL, WGECON, and SIHD to enhance collaboration

In terms of content

- Two potential themes: 1) what spectrum of objectives / values do we need to consider, 2) what could/should future full spectrum ESEI advice look like
- Stay informed about new developments in the global policy landscape

In terms of the advisory role of WGBESEO, a few questions were raised: Can WGBESEO provide recommendations to ICES? How can we contribute to ICES advice and establish links with policymakers?"

These insights have been used to formulate a new set of ToR for 2025-2027, while also taking stock of the produced material, much of which is still in draft form.

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Annex 2: Resolutions

2019/FT/IEASG10 The **Working Group on Balancing Economic, Social, and Ecological Objectives in Integrated Assessments (WGBESEO)**, chaired by David Goldsborough, Netherlands, Adelbert De Clercq*, Belgium, and Paulina Ramirez-Monsalve, Denmark, to work on ToRs and generate deliverables as listed in the Table below.

YEAR	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2020	15-16 April	Online meeting		
	8 June	Online meeting		
	30 September	Online meeting		
	29 October	Online meeting		
	26 November	Online meeting	ICES Scientific Report by 20 December 2020	
Year 2021	14 January	Online meeting		
	25 March	Online meeting		
	27 May	Online meeting		
	23 September	Online meeting		
	25 November	Online meeting	Interim E-eval	
Year 2022	3-7 October 2022	ICES HQ, Copenhagen, Denmark	Final ICES Scientific Report by 18 November 2022	Due to unforeseen circumstances David Langlet was replaced by Adelbert De Clercq in 2022. This change is acknowledged in retrospect.

ICES is broadening the scope of advice that it provides to its clients. The advice now includes catch opportunities, fisheries overviews and ecosystem overviews. Special requests to inform discussions about trade-offs are also made by clients. ICES advice provides analysis and data on the trade-offs of different decisions and the advice must take into account the management context and relevant management objectives. Understanding and describing the management scope and context is crucial for designing a salient, legitimate and credible advisory process and for the development of long-term management plans.

A variety of social, economic, and ecological (SEE) objectives which are relevant for managing marine resources have been set out in legal and policy documents. Having a systematic comprehension of such objectives and information on potential trade-offs among them enables decisions to be made with better comprehension of the societal implications of alternative courses of action. It also enhances the potential for transparent communication about the significance of uncertainties and knowledge gaps.

The Working Group forms part of a broader aim, following the Strategic Initiative on the Human Dimension (SIHD) Roadmap, to integrate the consideration and use of SEE objectives into ICES work in an effective manner, strengthening the overall societal relevance of ICES advice. The

working group answers the call for identifying and including management objectives in Ecosystem Overviews (EO) as reported in WKEO3[18].

The Working Group aims to develop a methodology for identifying and characterizing/classifying SEE objectives in a multi-level governance setting, thus providing a tool for the practical integration of such objectives into future analysis and evidence for advice provided by ICES. The mere identification and cataloging of specific objectives is not sufficient since such objectives change over time, as do their legal character and the forms in which they are expressed. Any mapping will thus soon become outdated. This necessitates the focus on development of a generic methodology that can be applied repeatedly by various ICES groups and in different geographic settings. However, the group's work will involve identifying and cataloging objectives as a means of evaluating proposed methodologies. The work requires involvement of stakeholders, including decision makers, to ensure the practical relevance of the methodology and the resulting "landscape" of objectives. This work will be carried out in close consultation with ICES advisory processes (ACOM & secretariat).

The focus of the Working Group is on identifying social, economic, and ecological objectives derived from legal and policy documents. Unfortunately, these policy objectives tend to be dispersed over various documents, and/or be defined at a high level of abstraction and thus not being directly linkable to indicators. Therefore the group will develop a framework to facilitate (1) the elicitation of the relevant policy objectives for marine management, (2) characterize/classify the objectives in terms of their binding or nonbinding nature and the level of governance at which they occur (possibly also if they are specified/quantified/have time limits, etc.), (3) support specification of the policy objectives in terms of social, economic and ecological indicators and (4) link these objectives and indicators to institutions and instruments.

Developing this framework relies on interaction with decision makers to discuss and elaborate on the identified and characterized objectives. To ensure that the objectives are specific and applicable in the ICES scientific community close collaboration with ICES expert groups is essential.

Developing and finalizing the framework will require several sessions conducted in collaboration with IEA groups, as well as with other ICES expert group, and with the involvement of decision-makers[19]. Interviews, workshops and case studies will be used to develop the framework. As far as possible, the work should also draw on the experiences of scientists with policy analysis expertise from several ICES member countries.

The framework as eventually developed should be applicable to regional seas and provide the required input to contribute to the next generation of ecosystem overviews. The end goal is being able to provide decision makers with a suit of management options including the associated implications for relevant objectives that will support their decision-making process.

Considering the core and well-established role of fisheries in all ecoregions (ICES Fisheries overviews), fisheries policy is a logical starting point for an analysis of policy objectives. This will then be further expanded to other important human activities in eco-regions. In developing the framework, we will draw on Integrated Ecosystem Assessment (IEA) experience from others areas, such as North America. The current Working Group on Maritime Systems (WGMARS) analysis of ICES IEA group work will also provide useful input for designing the framework.

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[18] ICES. 2019. Workshop on the design and scope of the 3rd generation of ICES Ecosystem Overviews (WKEO3). ICES Scientific Reports. 1:40. 46 pp. http://doi.org/10.17895/ices.pub.5445

[19] Involvement of decision-makers will be done in close consultation with the ACOM leadership, SCICOM, and ICES Secretariat.

Workshops with regional seas groups and ICES Expert Groups to develop and test the framework would be the preferred development path. The developed framework will enable the identification of management objectives for specific ecoregions in line with the ecosystem overview 'pipeline process', and as envisioned in the findings from WKEO3 (ICES, 2019).

ToR descriptors

ToR	Description	Background	Science Plan Codes	Duration	Expected deliverables
a	Synthesize existing information on social, economic and ecological management objectives, in particular how these can be mapped and systematized, from legislation, ICES expert groups, various marine research projects and the scientific literature	Lots of information exists on policy objectives, but this info is scattered over many different sources, and thus inconvenient to use for IEA scoping studies. It is important to explore the extent to which methods for identifying and systematizing such objectives also exist.	6.3 6.4	1st year	Overview report: availability of objectives and existence of methodologies, schemes for systematization. Overview of existing governance work within ICES ecoregion WGs.
b	Identify, in dialogues with relevant stakeholders the most relevant trade-offs between SEE objectives in selected geographical and regulatory contexts. This will be carried out in close consultation with ICES advisory processes (ACOM & secretariat).	It is important that the development of a working methodology for identifying and characterizing/classifying SEE objectives enables addressing the most relevant trade-offs encountered by decision makers and that any scheme for characterization/classification corresponds to stakeholder needs.	6.3 6.4	1st – 2nd year	Overview Report: description of most relevant trade-offs identified and the associated SEE objectives.
c	Identify, in dialogues with relevant stakeholders, distinctive characteristics of SEE objectives as a basis for characterization/classification. This will be carried out in close consultation with ICES advisory processes (ACOM & secretariat).	Relevant characteristics may include legally binding/non-binding; policy level where the objective is formulated (subnational, national, EU, international), etc.	6.3 6.4	1st – 2nd year	Overview report: where appropriate, list of distinctive characteristics of SEE objectives as a basis for characterization/classification applicable to ICES IEA regions.
d	Develop a methodology for carrying out the identification and characterization/classification of SEE objectives in national and international/supra-national governance settings.	The system for characterization/classification of SEE objectives should incorporate the characteristics identified under (c) and be adjustable to different regional/regulatory contexts.	6.3 6.4	2nd and 3rd year.	Overview report: description of draft methodology.
e	Test the methodology by identifying and characterizing/classifying SEE objectives	The methodology needs to be tested to verify that it is simple and robust enough to be applied by different users	6.3 6.4	3rd year.	Overview report: description of methodology, including result of its testing.

	in one or more relevant governance settings.	and yields a result that will be practically relevant.

Summary of the Work Plan

Year 1	Repository set up, general White paper
Year 2	Workshops with stakeholder involvement, peer reviewed publication, white paper on evaluation schemes
Year 3	Elaboration of methodology, peer reviewed publication

Supporting Information

Priority	High. This Working Group is seen as a key strategic element of the SIHD in IEAs and the IEA Steering Group to expand the knowledge base for supporting comprehensive integrated advice containing social, economic and ecological considerations.
Scientific justification	A lot of work has been done on trade-off analyses, social, economic and other objectives and issues; however, the knowledge basis is not available in a structured and organized way for ICES. In addition, there is a need for a robust methodology for identifying and characterizing/classifying SEE objectives in different governance settings. Relevant ICES working groups should be able to apply the methodology when called for by their work and also to repeat the identification and characterization/classification of SEE objectives regularly to ensure that the objectives they incorporate in their work are relevant and current.
Relation to Strategic Plan	The group will directly feed the work of the IEA working groups as well as feed into the ecosystem, fisheries and aquaculture overviews.
Resource requirements	The group will rely on ongoing international and national research projects with active involvement of ICES IEA groups and supporting WGs, such as WGSOCIAL and WGECON. The proposed repository will be set up on a working group ICES SharePoint.
Participants	Interested scientists, IEA group chairs or members, IEASG chairs, SIHD chairs, WGMARS, WGECON, WGSOCIAL, WGINOSE, WGSEDA, WGRME, WGHIST, EU project leaders (e.g. GAP1 and GAP2, JAKFISH, MEFEPO, ODEMM, MESMA, SOCIOEC, MYFISH, AQUACROSS, CERES), ICES Secretariat
Secretariat facilities	SharePoint site, secretariat support for reporting, for facilitating the WebEx meetings (three to four a year) and for hosting physical meetings (at least two per year). Active support by the scientific officers to link the work with relevant initiatives within ICES desired.
Financial	None
Linkages to advisory committees	ACOM
Linkages to other committees or groups	IEASG, SIHD, all IEA groups, WGIMM, WGSA, WGMARS, WGSEDA, WGHIST, WGRME, SICCME, WGSOCIAL, WGECON.
Linkages to other organizations	North Pacific Marine Science Organization (PICES) Human Dimension Group, International Institute of Fisheries Economics & Trade (IIFET), National Oceanic and Atmospheric Administration (NOAA), Protection of the Arctic Marine Environment Working Group (PAME), Integrated Marine Biosphere Research (IMBeR), Ecosystem Studies of Subarctic and Arctic Seas (ESSAS), European Union institutions and bodies involved in the IMP (Integrated Maritime Policy) .

Annex 3: Glossary of social science definitions of use in ICES (February – June 2021)

By Lea Schönen

Key Term	Preliminary definition
(Social) Carrying Capacity	The Social Carrying Capacity relies on the output from the previous three categories of carrying capacity analysis (see Figure A3.1). The aim is to develop a comprehensive integrated management strategy based on trade-offs between all stakeholders to maximize benefits and meeting the demands of both the population (socioeconomic factors such as traditional fisheries, employment and recreational use) and the environment (WGEIM, 2005). An example in context of fish stocks was mentioned by WGMME: Carrying capacity is the "population size that would theoretically be reached by a population in the absence of bycatch"(WGMME, 2013). The above-mentioned information was retrieved from non-SIHD groups.

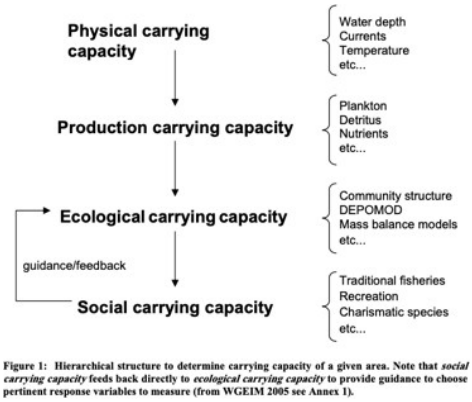

Figure 1: Hierarchical structure to determine carrying capacity of a given area. Note that *social carrying capacity* feeds back directly to *ecological carrying capacity* to provide guidance to choose pertinent response variables to measure (from WGEIM 2005 see Annex 1).

Figure A3.1 concept of carrying capacity. Retrieved from WGMASC, 2005

Community	A community (usually) describes people who belong to a group categorized by a combining factor. This factor can be location- or topic- related. Examples are "ICES community", "Fishery community" and "Science community" (Retrieved from (ICES, 2021-b) and (ICES, 2021- c)). No differences in usage could be found between the IEASG document and the guideline on ecosystem overviews.

Cumulative Effect Assessment	"Cumulative effect assessments (CEAs) are defined as holistic evaluations of the combined effects of human activities and natural processes on the environment and constitute a specific form of environmental impact assessments. The aim of the CEA is to assess the vulnerability of the ecosystem and its components to the cumulated pressures of the combined human activities. Management is aimed at mitigating the pressures such that vulnerability is reduced which increases the likelihood that a healthy ecosystem is achieved. While a decrease in vulnerability should ultimately result in an improved eco- system status there is no direct relationship between the two." (WGMARS, 2017)
	One IEASG subgroup, namely WGINOSE has included an CEA in the IEA scoping phase. More info can be found in the Interim Report of WGMARS, May 2017 (WGMARS, 2017). WGCEAM elaborates on the country's perspective of the use and the need for CEA in decision making in more detail. In addition, one can find a CEA terminology attached in the report of WGCEAM (2019). No conflicting definitions could be found, however not referred to by SIHD.
Data Collection Framework	The Data Collection Framework (DCF) is a tool that was put in place by the European Union to collect and manage fisheries data. Member states collect, manage and provide data that is processed in scientific advice (WGRDBES-GOV, 2021). For further information, see the website by European Commission/JRC. No information on different usage between SIHD and other groups could be found.
Decision maker	Decision maker was referred to as "End-user" by a non-SIHD group (WGMHM, 2005). Further definitions could not be found.

Downscaled approach	A downscaled approach describes a reduced method, for example one that has been limited/minimised in its scope or factors. The IEASG referred to it in the context of models (ICES, 2021-b), the EOSG in the context of factors and indicators (ICES, 2020-a).

Ecoregions	Ecoregions refer to an area. ICES ecoregions are (see Figure A3.2): ○ Arctic Ocean ○ Greenland Sea ○ Norwegian Sea ○ Barents Sea ○ Icelandic Waters ○ Faroes ○ Celtic Seas ○ Greater North Sea ○ Baltic Sea ○ Oceanic Northeast Atlantic ○ Azores ○ Bay of Biscay and the Iberian Coast 

Figure A3.2 Overview of ICES ecoregions. Retrieved from (ICES, n.d.-a).

Ecosystem-based management (EBM)	ICES sees Ecosystem-based Management (EBM) as the primary way of managing human activities affecting marine ecosystems. It is an "integrated approach to management that considers entire ecosystems, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive, and resilient condition so that it can provide the services humans want and need. EBM differs from current approaches that usually focus on a single species, sector, activity or concern. It considers the cumulative impacts of different sectors." Further information can be found in the EBM-document by ICES (2020-b; WGMPCZM, 2011).

Food security	In line with ICES' interests to address the challenge of protecting and restoring the structure and function of oceans, the improvement of food security is strived for that could benefit people's lives and livelihoods (ICES, 2021-a). WGSOCIAL give the examples of "Coastal fisheries [that] deliver a certain security though a sense that local food will be available in case of food shortages or crises" (WGSOCIAL, 2021). According to the references, both SIHD groups and ICES have the same sense of understanding.
Integrated Ecosystem Assessment (IEA)	Integrated Ecosystem Assessment (IEA) is a tool for implementing Ecosystem-based management. It was described as a process for "formal synthesis and quantitative analysis of information on relevant natural and socio-economic factors, in relation to specified ecosystem management objectives" (ICES, 2021-b).
Integrated Socio- ecological Assessment	An Integrated Socio-ecological Assessment is a research methodology that considers culturally relevant social indicators and analyses that support Ecosystem-based Management (EBM). It is sometimes referred to as 'Integrated Socio-ecological Evaluations' (WGSOCIAL, 2021). WGECON adds that in support of EBM, economic indicators and analysis can be part of Integrated Socio-ecological Assessment as well (WGECON, 2021). Depending on the focus on expert groups within SIHD, it can be either more related to social aspects or more related to e.g., economic aspects.

Integrated Trend Analysis (ITA)	An Integrated Trend Analysis (ITA) is a method to support Integrated Ecosystem Assessments (IEA). ITA provides ways to summarize available (informative and) quantitative information (ICES, 2019-a).
Joint Research Council (JRC)	The Joint Research Council (JRC), also referred to as 'Joint Research Centre', is a science and knowledge service by the European Commission. Scientist are employed to carry out research that results in independent scientific advice. For further information, see Joint Research Council. Together with ICES working groups, the JRC "establishes criteria and standards which will ensure consistency and comparability in the determination of the Good Environmental Status (GES)" (WGBOSV, 2010; WGECO, 2010). The term Joint Research Council was used by non-SIHD groups, WGHIST however referred to it as 'Joint Research Centre' (WGHIST, 2017).
Management Strategy Evaluation (MSE)	Management Strategy Evaluation (MSE) means to test the performance of management plans and harvest control rules. Tools to test the performance of e.g., fisheries management are seasonal/ area closures or gear regulations that are an integral part of the MSE framework (WGMARS, 2012). ACOM mentioned a specific need for MSE in a broader sense, meaning opening up the scale to include more interests than fisheries (WKEDU, 2021). Influential criteria such as 'Stakeholder participation', 'Property rights', 'Monitoring, control, and surveillance', and 'Economic efficiency' are of great importance for a MSE or recovery strategy, but at the same time difficult to measure and to define. Ways of dealing with these becomes critical and can be found back in the report of WGMARS (WGMARS, 2012). Further information and examples can be found back in the report of IBPSprat report of 2021, see IBPSprat.
Overview	ICES offers different types of overviews: Ecosystem Overview (EO) and Fisheries Overviews (FO): Ecosystem Overviews are central to ICES approach to support evidence- based Ecosystem Based Management, the primary way of managing human activities affecting marine ecosystems. The specific sections of Ecosystem Overviews describe: - location, scale, and the management and assessment boundaries of the ecoregion; - distribution of human activities and resulting pressures on the environment and ecosystem;

- state of the ecosystem

They link the key pressures and trends, including climate change, to changes in different ecosystem components.

Fisheries overviews summarize fishing activities at ICES ecoregion-level, including which countries are catching what species, the various fishing methods being used, and how stocks are managed.
The purpose of Fisheries Overviews is to describe:

- national fishing fleets in the ecoregion, including their fishing gears and spatio-temporal patterns;
- status of the fisheries resources and the level of exploitation relative to the agreed objectives and reference points;
- mixed-fisheries considerations of relevance to the management of the fisheries;
- impacts of fishing gear on the ecosystem in terms of the seabed and the by-catch of endangered, protected and/or threatened species.

Further information can be found online (ICES, 2021-b) (ICES, 2021-b).

Partner

Examples of scientific partners are PICES, CIESM, IOC, FAO, AMAP; IASC, GFCM.
The goal is to exchange knowledge and expertise through collaborative projects, networks and training to shape and advance marine science and advice and meet joint scientific goals (ICES, 2020-c).

Qualitative approach

A qualitative approach is based on expert solicitation. WGCEAM refers to it as follows: Expert solicitation "would depend on the current knowledge of causal pathways that could also consider evidence from other similar situations" (WGCEAM, 2020).
No information of SIHD groups could be found.
An overview of qualitative, semi-qualitative and quantitative approach can be seen in Figure A3.3.

Table 1. Characterisation of qualitative, semi-quantitative, and quantitative CEA assessments depending on the availability of data (in relation to the exposure of an ecosystem component to a pressure), evidence (in relation to sensitivity and recovery of an ecosystem component from the disturbance by a given pressure) and knowledge (in relation to the severity of the identified pathways of risk).

	Data	Evidence	Knowledge
Qualitative	✗	✗	✓
Semi-quantitative	✗	✓	✓
Quantitative	✓	✓	✓

Figure A3.3 Overview of Quantitative, Semi-quantitative and Qualitative approaches. Retrieved from WGCEAM (2020).

Quality Assurance

PGDATA stated following in 2018:
"Although a Quality Assurance Framework (QAF) is generic by principle,
PGDATA was tasked to develop a QAF on collection and processing of

Framework (QAF	data needed for assessment and advice, i.e., issued from scientific surveys, commercial and recreational catches and exploited species. The expected benefits of developing a QAF are: - quality improvement by reducing errors, developing coordinated tools, - transparency in data flow from the collection on the field to the submission of data to end-user, - better value for money with optimized and fit-for-purpose sampling plans, following dedicated analyses like e.g., sensitivity of data variability to assessment precision, - better accessibility to guidelines and good practices, - capacity building and assistance to data collectors, - standardisation of tools which can enable analyses that are currently impossible/impractical, - address the needs of the Transparent Assessment Framework (data and input) Other fields of science may also benefit from the QAF for data collection for assessment and advice, such as transparency of assessment framework (items model and outputs), data collected for MSFD, and regional coordination." (PGDATA, 2018). Furthermore, it is referred to as, e.g., "Assuring quality is a key element of the ICES advice plan, the RDBES will function as an essential tool in the overall quality assurance framework" (ICES, 2021-d).
Quantitative approach	A quantitative approach is based on data research. The aim is to "generate the evidence of the effect potential based on the spatial and temporal distribution of the pressures". The semi-quantitative approach can be seen as an intermediate step. In here, "pre-established criteria and tabulation techniques are used, initially developed through expert solicitation that would be applicable to the specific area or species" (WGCEAM, 2020). No overview of SIHD groups could be found. An overview of qualitative, semi-qualitative and quantitative approach can be seen in Figure A3.3.
Regional Database(RDB) / Regional Database & Estimation System	The Regional Database & Estimation System (RDBES), which is currently in development, is meant to replace the ICES InterCatch (tool for stock assessment) (ICES, 2014) and the Regional Database (RDB). Its goal is to create transparency and improve the quality of stock assessments within ICES. RDB is mainly used by Regional Coordination Groups (RCGs) and gets sometimes requested by ICES expert groups. The RDBES on the other hand will be used by RCGs as well, but expert groups will be involved more strongly in the production of advice (WGRDBES-GOV, 2021).

The main use was summarized in the data policy of RDB in 2020 (ICES, 2020-d):

1) Availability of data for coordination of regional fisheries data sampling plans

2) Regional estimation system (in which statistical estimates of quantities of interest can be produced from sample data)

3) Production of fisheries management advice and status reports

4) Increase awareness of fisheries data collected by the users of the RDBES and the overall usage of these data

A new system (RDBES) was developed to:

- "Provide a regional estimation system for ICES stock assessments
- Give RCGs access to detailed data in the way it was collected
- Support the collection of design-based data collections
- To increase the data quality, documentation of data, and transparency of estimations
- To facilitate the production of fisheries management advice and reports
- To increase the awareness of fisheries data collected and the overall usage of these data." (WGRDBES-GOV, 2021).

A detailed comparison between RDB and RDBES can be seen in Figure A3.4.

Functionality	RDBES	RDB
Support statistical sound sampling schemes (4S)	Yes	No
Store statistically collected sample data with statistical information	Yes	No
Store collected data the way it was collected, which support some conclusions	Yes	No
Statistical estimations can be made from the data stored including uncertainties	Yes	No
Support regional sampling	Yes	No
Storing regional sampling data from different countries under the same sampling scheme	Yes	No
Fully support landing obligations categories	Yes	No

Figure A3.4 Functionality between RDBES and RDB. Retrieved from WGRDBES-GOV (2021).

No information of SIHD groups could be found.

Social coding

Social coding is a research computing skill. It was mentioned during a workshop breakout group as one 'competence' that could be useful in an expert group for a quantitative biology/ modelling type. Other skills could be reproducibility in scientific workflow, open data science, etc.

Further background information can be found in the report of WKEDU (WKEDU, 2021).

Social Impact Assessment (SIA)

Next to the Environmental Risk Assessment, the Social Impact Assessment (SIA) combines quantitative and qualitative uncertainties into a single assessment. It can vary from only being expert/ science based (WGMARS, 2012) to including all stakeholder (WGAQUA, 2015). SIA is used to establish a knowledge basis for decision making (WGMARS, 2012).

The understanding of this term seems to be similar between SIHD and other expert groups.

Social indicator

The following examples from different expert groups were compiled from the Workshop on Challenges, Opportunities, Needs and Successes for Including Human Dimensions in Integrated Ecosystem Assessments (WKCONSERVE) in 2019.
Social indicators can be used to represent social characteristics of e.g., fishing dependent communities. An example is the 'NOAA Fisheries Community Social Vulnerability Indicators' (CSVIs) show.
WGNARS' goal is to test and evaluate indicators against the background of changing environment, especially human behaviour. The challenge is to identify relevant indicators in respect to woman, low income, indigenous people, as well as lacking cultural indicators. Those qualitative indicators can be facilitated by literature review and possible interviews.
WGEAWESS is guided by the example of CSVI's by NOAA for the area of Bay of Biscay and the Iberian Coast (BoB/IC). They express the necessity for specialists in this field (ICES, 2020-e).
No information could be found from groups outside of SIHD.

Social Network Analysis (SNA)

The Social Network Analysis is a tool to assess the connectivity within the ICES network, next to the preparedness to address IEA's and the ICES Science Plan. This statistical analysis follows the theory that the ecosystem and sustainability science depend on strong connections among ICES expert groups. The following measures are examined: degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality; with a link to IEA's. Hereby, the SNA will be connected to the IEA (WGMARS, 2020).
Further information on the measures can be found in Figure A3.5.

Table 1: Summary of different measures of connectivity used in social network analysis. Adapted from https://cambridge-intelligence.com/keylines-faqs-social-network-analysis/ by Andrew Disney

Degree centrality	It tells you how many connections each node has to other nodes in the network. You use it when you want to find very connected nodes, popular nodes, nodes that are likely to hold the most information, and nodes that can connect quickly to the wider network.
Betweenness centrality	Measures the number of times a node lies on the shortest path between other nodes. It shows which nodes are bridges between nodes in a network. It does this by identifying all the shortest paths and then counting how many times each node falls on one. It is used for finding nodes who influence the flow around a system. It is important to identify if a high betweenness value means the node holds authority over disparate clusters in a network, or just that is it at the periphery of both clusters.
Closeness centrality	Scores each node based on their "closeness" to all other nodes in the network. The measure calculates the shortest paths between all nodes, then assigns each node a score based on its sum of shortest paths. It is used to find nodes who are best placed to influence the entire network most quickly. It can help find a good "broadcaster", but is more useful to find influencers in a single cluster. The more central a node is, the closer it is to all other nodes.
Eigenvector centrality	A measure of the influence of a node in a network. It assigns relative scores to all nodes in the network based on the concept that connections to high-scoring nodes contribute more to the score of the node in question than equal connections to low-scoring nodes.

Figure A3.5 Summary of different measures of connectivity used in SNA, Retrieved from WGMARS (2020).

WGMARS conducted a SNA on ICES expert group. Results will be presented during the 2021 Science Conference (ICES, 2015; ICES, 2020- c).
No information could be found from groups outside of SIHD.

Social Science	(Marine) Social Science describes the field in which society and marine environment meet. It includes understanding the effects of human activities on the ecosystem and its services, generating evidence and advice to help sustain sufficient seafood supply, help managers to set and meet objectives, and evaluate contributions of the sea to livelihoods, cultural identities and recreation (ICES, 2021-a). Usually, it is referred to without further explanation as to be seen in the example by WKEDU: "strengthening social sciences" (WKEDU, 2021).
Social System	Social systems can incorporate Human Dimensions (ICES, 2021-b). In a CRR report of 2013, social systems were mentioned in the context of political systems: "The political or social system describes the actors, conflict areas and causes for conflicts, the arenas for political activity and discussions, and the power and tools available to actors when addressing their interests. The political system is the study arena for social science" (Cormier, Davies, & Kannen, 2013). In most cases, it is referred to without further explanation, like to be seen in the report of the ICES/ PICES Workshop on Political, Economic, Social, Technological, Legal and Environmental scenarios used in climate projection modelling (WKPESTLE): "Identify the major domains of the oceanic social system considered" (ICES, 2019-b).
Social vulnerability	Social vulnerability describes "how resilient a coastal community is when confronted by external stresses or drivers on human wealth and health. These stressors can range from natural or human-caused disasters to disease outbreaks. By reducing social coastal vulnerability, we can decrease both human suffering and economic losses to economic activities" (WGRMES, 2019). No information could be found by non-SIHD groups or how to assess social vulnerability in detail.
Socio-cultural value	Concepts of socio-cultural value were analysed in detail during the WKCES. Resulting, a framework was developed that is based on the idea of 'ecologically and biologically significant areas': the framework "culturally significant areas" (CSA). Further information can be found within reports by the Working Group for Marine Planning and Coastal Zone Management (WGMPCZM) (2018). Socio-cultural values were conducted within a case study of the Netherlands by the Working Group on Social Indicators (WGSOCIAL). Examples can be cultural heritage, social wellbeing, social cohesion, identity, fisheries dependence, and socio- cultural capital (WGSOCIAL, 2021).

(Marine) socio-ecological system	Socio-ecological systems were mentioned by SIHD groups like WGECON, WGEAWESS, WGCEAM, WGMARS, etc. in context of methods/tools that need to be applied. Further explanation could not be found, however it was mentioned in the context of IEA's "IEAs in their purest form intend to take a comprehensive multi-sectoral, multi-pressure ecosystem view of the entire social-ecological system, involving stakeholders to identify management objectives." (ICES, 2021-b). The MSEAS 2021 symposium will also focus on "Marine Socio-Ecological Systems: Navigating global change in the marine environment", see MSEAS 2020. A detailed description of "Social transformations of marine social- ecological systems" can be found here.
Socio-economic trade-off	To perform Socio-economic trade-offs, WGSOCIAL mentioned that there is not enough expertise and members of social, economic or institutional areas in the moment, therefore it will be worked on in the coming months/years (WGSOCIAL, 2021). A non-SIHD group stated the example of socio-economic trade-offs "between fast and slow rebuilding" (ICES, 2020-f). Further definitions could not be found.
Stake-holder	"In some cases, stakeholders are seen as providing guidance on what areas of research are important, while in other cases stake-holders are seen as a source of data for scientific research" (WGMARS, 2020). It is also referred to as knowledge holder (WGSEDA, 2020). Other non-SIHD groups stated information on e.g., the Q methodology to perform surveys of stakeholder (WGRFS, 2020). In most cases, the term 'stakeholder' is referred to without further explanation as to be seen in the Science Plan code document: "Identify, design and make use of opportunities for public participation in observation and exploration through citizen-science; and identify and make use of opportunities for marine industries and other stakeholders to contribute to research design, data gathering and interpretation." (ICES, n.d.-b). In June 2021, a workshop on stakeholder engagement strategies will be held, WKSHOES, see here.
Trade-off (analysis)	A Trade-off analysis can be described as balancing objectives and targets that, for example, do not have the same positive effect at the same time. It occurs when "an action, for example a management decision, improves one aspect to the detriment of another, or improves both but unequally". The goal is to analyse the relation between units, not monetizing the benefits. There is a difference between trade-off analysis (which includes the understanding of a trade-off in a socio-ecological system that helps to provide relevant information for the decision) and a trade-off decision. Other forms of trade-off analysis are trade-offs among/between objectives, trade-offs among/between activities," trade-offs over a time-scale, along a spatial scale, between risk and performance, in terms of reversibility, or between governance types." (WGSOCIAL, 2021). Further information can be found in reports by WGSOCIAL (2021). No differing definitions by other expert groups could be found.
Transparent Assessment	The Transparent Assessment Framework (TAF) functions as online open resource of ICES stock assessments of each year (ICES, n.d.-c). It "provides end-to-end quality assurance that encompasses best practice

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Annex 4: Protocol for arriving at the glossary of using social science definitions of in ICES

By Lea Schönen, 1 June 2021

Introduction

Background

The International Council for the Exploration of the Sea (ICES) is an intergovernmental organization. With the help of experts from different international institutes and organizations, forming the ICES network, they provide scientific-based advice in which the current state of ecosystems is examined. In addition, needed conservation and management approaches are instructed on behalf of clients to guarantee sustainable use of seas and oceans. A clear definition of core concepts and terms is therefore of paramount importance for efficient cooperation.

Issue

There is a demand in and around ICES for a consistent set of definitions, including within ecological- and social sciences, that are used in many different groups and contexts. An up- to-date glossary is currently not available. This can lead to misunderstandings and questions among people involved internally within or externally to the ICES network.

Goal

The goal is to provide a broad scale, detailed 'living' document that is accessible to the ICES network and externals. The final version out of the current work can be handed in as a pdf- file (Version 1 – June 2021) which can be used to build on in the future.

The ICES network itself could benefit from such a uniform and all-encompassing glossary. It could function as a tool to improve communication and understanding among groups, as a support for the accurate use of words, and it could highlight possible need for improvement in clarification. Also, externals or people in general who are unsure about certain terms could quickly look them up.

Methodology

Social-Science Glossary

Step 1 – Compiling words for "general glossary"

In order to reach a broad overview of possible important key terms for the glossary, it was necessary to start by clearly outlining the structure of ICES, including thematic fields and the responsible groups. The goal of this step was to understand which responsibilities ICES has, how ICES works and how the tasks and subject areas are distributed within the ICES network. For this purpose, summaries and resolutions of steering groups and respective subgroups (referred to as expert groups/working groups) available on the ICES website and on the ICES SharePoint were consulted. Next to resolutions and reports of expert groups, key documents were the ICES Strategic Plan, Science Plan and Advisory Plan, see Figure A4.1.

Figure A4.1 Graphical presentation of step 1, social science glossary

These can be found and downloaded on the ICES website, see ICES Plans. Reading into the organisational structure of ICES on the website also serves to familiarise yourself with the website itself, especially the search function, the library, and other tools.

With the help of programmes such as WordClouds, frequently occurring keywords can be highlighted. Files such as Word documents (docx), pdf documents or copied texts can be inserted into the programme. Unfortunately, not all at once. Many of these WordClouds can be saved and analysed for single word frequency (see Figure A4.3). The text of the above-mentioned general ICES reports (Strategic Plan, Science Plan and Advisory Plan) was placed into this programme as well as descriptions of steering groups from the webpages (see Figure A4.2). The results of this approach can be found in the Appendix - D.

Figure A4.2 Example webpage of IEASG. See, (ICES - IEASG, n.d.)

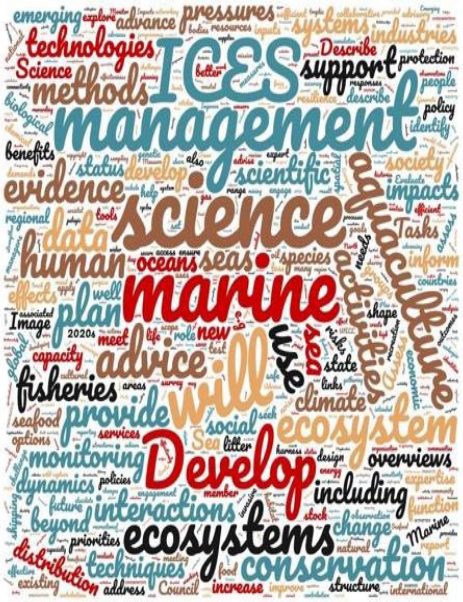

Figure A4.3 Example WordClouds for ICES Science Plan

Webpages were used because reports were not available at that time for every group. All terms were collected in a table in Word, with the name "general glossary". Table A4.1 shows the layout of such a table, in this case about key terms that are relevant for ICES in general. In preparation for the next steps, basic key information and sources were pasted in the table.

(Original) word	Analysis	Final definition
Extracted from website, reports, articles via ICES search engine, etc.	Quotes and examples of context/ usage of word by different groups	Summary of findings, included links to important groups/sources

Table A4.1 Used format for Word document. Can be applied to all glossaries

Step 2 – Definition of Social-Science/compile words for "social-science glossary"

The creation of a general glossary can function as a useful tool to understand the structure of ICES. Looking into social science related terms and the SIHD group (Strategic Initiative on Human Dimensions), however, is of main interest to WGBESEO. As Social Science itself is a broad term the group, consisting of the intern and two supervisors, agreed to say:

"(Marine) Social Science describes the field in which society and marine environment meet. It includes understanding the effects of human activities on the ecosystem and its services, generating evidence and advice to help sustain sufficient seafood supply, help managers to set and meet objectives, and evaluate contributions of the sea to livelihoods, cultural identities, and recreation (ICES, 2021-a)."

Before looking into reports, the term 'Social Science' needs to be clearly defined, meaning understanding its scope, what words are included, and where and how this term does overlap with similar terms, e.g., 'socio-economic'. As SIHD is not a steering group in its own but included in the Steering Group on Integrated Environmental Assessments (IEASG), a detailed examination of the subgroups was performed (subgroups SIHD: WGMARS, WGSEDA, WGRMES, WGHIST,

WGECON, WGSOCIAL, WGBESEO (ICES, n.d.-b)). This examination included reading into reports, resolutions and familiarising with social-science related terms.

WordClouds could be used again to extract relevant terms, however, in this case the research within this step was conducted using content analysis by reading into relevant documents. Although the ICES Science Plan, the Advisory Plan, the Strategic Plan and information of Steering groups can function as baseline material, the analysis was focussed on documents of SIHD groups were analysed in particular, see Figure A4.4. This choice of analysing documents in a detailed manner was made because it allows to analyse the context rather than only a single word frequency. When using the ICES search engine one can find all papers, expert group reports, workshop reports, articles, etc. per group based on, e.g., publication date or search terms ("Advanced Search"). To search for specific terms in a document, the search function (CTRL+F) was used. This downscaled approach of only looking into seven expert groups in particular enabled to broadening of the scope of this analysis. A second glossary ("social-science glossary") was established in which all relevant terms were explained using only the information found in ICES' documents. The layout can be seen in Table A4.1.

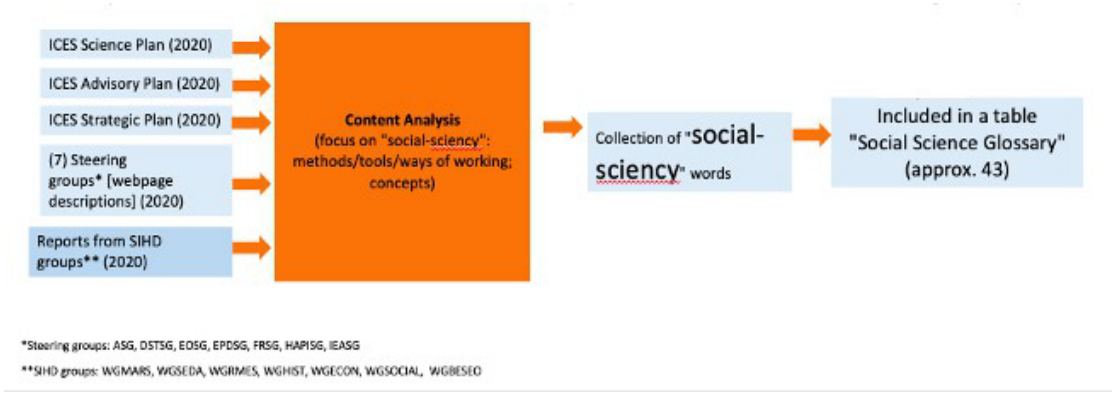

Figure A4.4 Graphical presentation of step 2, social science glossary

Step 3 – Inserting relevant words of general glossary into social-science glossary

Once the second glossary was created, the general glossary was reviewed again to extract terms with relevance to social science or SIHD. Another column was added, and an 'X' was placed next to the chosen words. To use an independent and scientific approach, one can ask as many participants as possible, in this case Paulina Ramirez-Monsalve, David Goldsborough and the intern looked at it and decided for terms to add to the second glossary, see Figure A4.5. The decision was made by consensus. Compiling a list of terms for the general glossary can be seen as a redundant work, however, this step has proven to be very useful in understanding the thematic scope of the ICES network and its work.

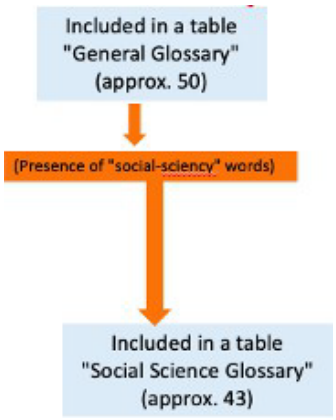

Figure A4.5 Graphical presentation of step 3, social science glossary

Step 4 – Content Analysis of words in social-science glossary

Once all relevant terms were compiled in the social-science glossary, the terms were analysed and defined in more detail. These terms need to be sufficiently understandable for both internal and external users without extensive prior knowledge. At this point, little information especially of SIHD groups (in form of quotes, summaries, and pictures) was already inserted in the table. Step 2 (definition and compiling words for social science glossary) functioned as a starting point of what follows. The Content Analysis of key terms included a detailed literature search of the usage and definition within SIHD groups and, as next step, other expert groups of ICES. The ICES search engine (and/or Advanced Search) was used by typing in the redecided key terms. The aim was to collect and compare the information. If enough information was available, it was checked if non-SIHD groups refer to social-science related terms in different ways or even if SIHD groups have a consensual understanding of a specific term. An overview of affiliations within ICES can be found in Appendix - D, which includes information on the steering groups and which expert groups they cover. To determine the affiliation of an expert group to a steering group, one can look it up in this list. All definitions, even when conflicting, were included in the glossary. As every term is unique in occurrences and understanding of groups, this task may seem to be endless. In this current project, the scope was framed to 20 documents on average per key term, depending on the availability of data. Only information that referred to a kind of definition or showed how it was understood were put into the table. The social-science glossary is a presentation on how expert groups use and define key terms, based on only written material. Sources and additional guiding documents were included in the final layout.

The outcome will support the process of understanding ICES, meaning its organisation, their work content and how they work. Words such as 'client' or 'stakeholder' were defined in a way that every member of the network or externals can use it in the same sense of meaning. This reduces the chance of misunderstandings or extra work that would be necessary to define the words asked for. The methodology combined in one picture can be seen in Figure A4.6.

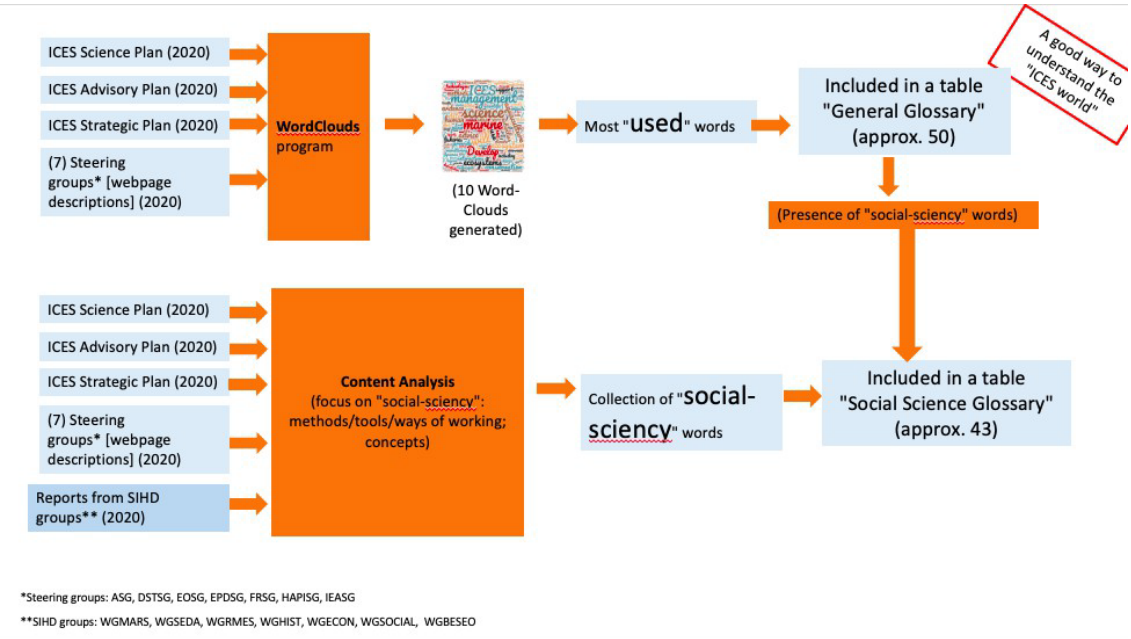

Figure A4.6 Summary of methodology to create social science glossary

Downscaled Social-Science Glossary

Step 1 – Downscaling of social-science glossary in preparation for Content Analysis

The first part of neutrally presenting the information given by ICES and its expert groups (social-science glossary) should be finished before any subsequent steps can be undertaken. The latter includes a downscaled analysis of terms that, during the previous step, did reveal a need of further elaboration. As this project was a pilot attempt, only five terms were chosen. Requirements were their variety of characteristics, e.g., method, tool, indicator; and a range of aspects, e.g., potential positive or negative trend over time, need for evaluation or uncertainties mentioned by expert groups, see Figure A4.7. The five chosen terms were 'Stakeholder', 'Social Carrying Capacity', 'Ecosystem-based management', 'Integrated Trend Analysis' and 'Integrated Socio-ecological Impact Assessment'. It is possible to decide collaboratively on a set of terms to further analyse. In this case, consensus was reached between three participants, Paulina Ramirez-Monsalve, David Goldsborough in addition to the intern.

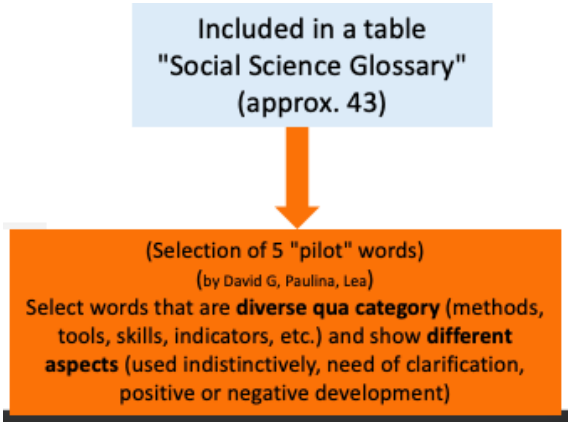

Figure A4.7 Graphical presentation of step 1, downscaled social science glossary

Step 2 – Content Analysis of words in "downscaled social-science glossary"

Those five terms were placed into a new Word file (e.g., "downscaled glossary"), in which all information (sources, quotes, pictures, etc.) was gathered. The goal of this step was to highlight the development of a term, its importance in context of SIHD, potential aspects of evaluation or recommended further analysis in the future. It involves a larger degree of interpretation and drawing conclusions from results compared to the prior neutral reproduction of information (see 2.1 Social Science Glossary). One tool that was used is the Data Mining tool on the ICES website that shows occurrences of terms over the years and/or per Acronym of expert groups with documents attached. A second tool was the ICES Search Engine, similarly, used as in the prior steps. The outcome can highlight the development of a term and certain needs of recommended evaluation. Examples of, e.g., good development can serve as a guideline for other concepts.

Step 3 – Presentation of findings to group & processing feedback

Next to this, key members from relevant groups were asked for their input, needs and wishes for the new glossary. The five terms and the methodology were presented to them after a few months' time into the project. It is important to constantly process and adapt feedback and suggestions from the people involved in ICES. In this way, the glossary fulfils the greatest possible benefit, as it is adapted to the needs of its users in the best possible way.

Potential further steps

The work that ICES does results in Fisheries Advice and more recently in Ecosystem and Fisheries Overviews. The Ecosystem Overviews focus on the state of ecosystems under the pressures of human activities, developed for the following ecoregions: Azores, Baltic Sea, Barents Sea, Bay of Biscay and the Iberian Coast, Celtic Seas, Greater North Sea, Greenland Sea, Icelandic Waters, Norwegian Sea, and the Oceanic Northeast Atlantic (see Figure A4.8). After extracting general ICES key terms and the ones referring to social-science or SIHD, a glossary per ecoregion could be created as certain unique terms refer to names or regional interests. A potential downscaled approach can be seen in Figure A4.9.

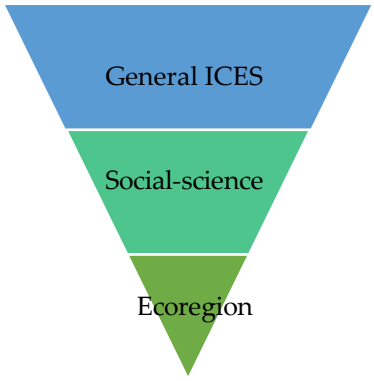

Figure A4.8. Downscaled approach of potential glossary in three steps.

Figure A4.9. Overview of ICES ecoregions. Retrieved from (ICES, n.d.-c)

Furthermore, many terms that are not of relevance to SIHD or social science, e.g., fish stock assessments, ecological aspects or the others were not included in the final social science glossary. There can, however, be included when working on a future glossary with another focus. This depends on the need and the demand. Due to time issues, terms like 'expert' or 'client' were also not included in this final version. Those two examples are very time consuming to analyse because it is (widely) used but poorly defined or explained. The proceeding of this glossary and the expansion onto other aspects could be part of an internship work.

The social science glossary with its case study on an in-depth analysis gave new insights in possibilities for effective communication and pinpointing recommendations. The results should be used and understand as a valuable experience where one could extract lessons learned from.

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