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Executive summary

The Workshop on Benchmarking Integrated Ecosystem Assessments (WKBEMIA), chaired by Steve Cadrin, USA, and Christian Möllmann, Germany, met at ICES Headquarters, Copenhagen, Denmark, 27–29 November 2012.

Progress in each regional seas programme (Baltic Sea, North Sea, Northwest Atlantic, and Western Shelf Seas) was reviewed to identify common approaches, results and challenges for integrated ecosystem assessment. The workshop agreed to use a framework previously developed by FAO, ECO and the US (Levin et al. 2009). Methods, models results, and requirements for each component of the framework were identified.

The participants of WKBEMIA suggest that results from integrated ecosystem assessments can be used by ACOM for improving issue-based advice, providing ecosystem context for issue-based advice and possibly identifying new issues. More integrated advice can be supported by considering results from integrated ecosystem assessments. Procedurally, there are two linkages between integrated ecosystem assessment and the ICES advisory process: 1) assessment groups can consider ecosystem states in their analytical decisions (e.g. assumptions about future recruitment, growth, etc.), and 2) advice drafting groups can develop integrated advice by considering regional ecosystem state, impacts and utilities in the ICES response to issue-based requests. Logistically, the linkages between integrated ecosystem assessments and single species assessments can be facilitated by concurrent meetings of regional sea and ecoregion assessment expert groups, with some joint sessions. Such joint-meetings can take advantage of regional expertise and promote cross-discipline collaborations.

The SCICOM Steering Group on Regional Seas Programmes is planning a series of benchmarking meetings for integrated ecosystem assessments. This first benchmark workshop will be followed by a second benchmark workshop in 2014, with greater input from ACOM (e.g. co-chaired by ACOM and SCICOM representatives). A third benchmark meeting is planned for 2016 that will invite stakeholders. Throughout the benchmarking process, integrated ecosystem assessments will transition from SCICOM to an intermediate position in the ICES organization between SCICOM and ACOM.

The WKBEMIA and SSGRSP have taken part in development of the proposal of a new ICES Strategic Plan and Science Plan.

The plan for continued benchmarking and integration into advice is congruent with the desire for a focal point on integrated ecosystem assessments and consequent integrated ecosystem advice. However, it is not clear what the remit will be for the IEA Expert Groups and how further development should be achieved without some main restructure within ICES. The suggested Science plan does not propose any supporting activities which will increase the achievements from a status quo level in the foreseeable future. SSGRSP and WKBEMIA advocate that Integrated Ecosystem Assessments form a strategic initiative between ACOM/SCICOM.

1 Opening of the meeting

The co-chairs Steve Cadrin (SC) and Christian Möllmann (CM) welcomed the participants at the ICES Headquarters and Jannica Haldin and introduced the local facilities.

CM introduced the Terms of Reference (ToRs) and the planned structure of the meeting. The ToRs for WKBEMIA were:

The Workshop on Benchmarking Integrated Ecosystem Assessments (WKBEMIA), chaired by Steve Cadrin*, USA, and Christian Möllmann*, Germany, will work by correspondence and will meet at ICES Headquarters, Copenhagen, Denmark, 27–29 November 2012 to:

Starting a process on how to Benchmark Integrated Ecosystem Assessment (IEA) based on results in ongoing Integrated Ecosystem Assessments Expert Groups;

- a) Make a brief review on the various concepts of Integrated Ecosystem Assessments including an evaluation of suitability to ICES needs in terms Science and Advice;
- b) Review the Integrated Ecosystem Assessments in the ongoing Regional Expert Groups, with regards to methods, models and results;
- c) Identify a common framework which will act as a guideline for Integrated Ecosystem assessments performed in ICES;
- d) Based on ToR c identify the need of supporting data, processes and products.

2 Adoption of the agenda

The agenda (see Annex 2) was adopted by the group after a short discussion.

3 Summary of progress towards the ToRs

- a) **Make a brief review on the various concepts of Integrated Ecosystem Assessments including an evaluation of suitability to ICES needs in terms Science and Advice;**
- b) **Review the Integrated Ecosystem Assessments in the ongoing Regional Expert Groups, with regards to methods, models and results;**

ICES needs in terms of IEA have been reviewed and discussed. Chapter 4 gives a summary of presentations and discussions. IEA concepts and the work of the regional groups have been reviewed and described in Chapter 5.

- c) Identify a common framework which will act as a guideline for Integrated Ecosystem assessments performed in ICES;

A first step vs. an operational IEA for ICES has been discussed and is described in Chapter 6. WKBEMIA follow-up workshops will have to develop more detailed steps for IEAs in ICES.

- d) Based on ToR c identify the need of supporting data, processes and products.

Due to time-constraints the workshop was not able to discuss the need of supporting data, processes and products. This will have to be tackled during a follow-up workshop.

4 Integrated Assessments – what does ICES want and need?

During the first day of the meeting WKBEMIA reviewed progress in each regional sea programme (Baltic Sea, North Sea, Northwest Atlantic, and Western Shelf Seas) to identify common approaches, results and challenges for integrated ecosystem assessments.

Before the actual work of WKBEMIA started Adi Kellermann (Head of Science Programme) and Manuel Barange (Head of SCICOM) introduced the latest developments with regard to the renewal of the ICES Strategic Plan. Besides presenting the roadmap and the state of the present discussion in the Council they outlined initial thoughts on the new ICES Science Plan (ISP). The new ISP should be narrower than the old one, but not have a limiting but rather a more ecosystem centered focus. Integrated Ecosystem Assessment (IEA) should be one central task in the overall objective to move towards the Ecosystem Approach. A first outline of a structure was presented that put IEAs and Integrated Surveys into the centre of ICES science. It was emphasized that reaching the goals of the new ISP needs to be an incremental and stepwise process. Nevertheless, there were some doubts by participants of WKBEMIA, that there is enough knowledge and acceptance in the ICES community towards IEAs. Furthermore, it was unclear who would be doing IEAs within the ICES structure. It was eventually recommended that if IEAs will be central to ICES funding should be provided to support this.

In addition to the discussion about the incorporation of IEAs into the ICES structure, Poul Degnbol (Head of the Advisory Programme) presented a road map for ICES advice and the knowledge base required for advice (see Annex 3). He defined integrated advice to include:

- considerations of environmental drivers on specific issues,
- considerations of wider ecosystem impacts of options for societal action,
- considerations of interactions with other human activity of relevance for the issue,
- if requested – trade-off between losses and gains for relevant stakeholder groups.

He furthermore described that integrated advice should be

- informed by integrated assessments supplemented with specific assessments regarding the issue in question,
- produced through a participatory process exploring “what – if” questions regarding outcomes of options for societal action.

He described 2 types of integrated advice: 1) issue advice and 2) systems advice, and summarized ICES expertise for it. In conclusion, he anticipated that increasingly ICES will be requested for putting advice on specific issues in context of ecosystem drivers, ecosystem impacts and interactions with other issues /sectors.

5 Integrated Ecosystem Assessments – definitions and aims

After the initial presentations on the importance of IEAs within the ICES framework, originally planned presentations by WKBEMIA participants followed. Presentation files can be found on the ICES SharePoint. Below some presentations and the discussions during the meeting are summarized:

5.1 Introduction and background of the workshop – SSGRSP and the development of Integrated Assessments (Yvonne Walther – Outgoing chair of the SCICOM Steering Group on the Regional Seas Programme)

The SCICOM Science Steering Group on Regional Seas Programmes (SSGRSP) is currently overarching five Expert Groups working with Integrated Ecosystem Assessments (IEAs) in different regions. WKBEMIA is a part of the peer network created, with purpose to develop and nurture the process of producing IEAs. The idea of a benchmarking group was planted early in the process as a forum for sharing experiences and harmonizing activities.

As WKBEMIA now is reality we conclude that the group do fill a need in the peer network to take a moment to halt and think of what we have achieved in the IEAs and mores so where we want to go. The Expert Groups have a need for strategic positioning within ICES towards the production of operational advice as well as in a wider societal context.

The development of Ecosystem Based Management (EBM) and policies e.g. the Marine Strategy Framework Directive (MSFD) indicates that there is a need for scientific tools such as IEAs and consistent scientific evaluation of indicators and targets that are created for management purposes. The actual process of development of indicators and targets for MSFD has mainly been a technical process. The indicators are not tested on how they interact at the target levels suggested. The problem identified seems to be that the policies and managerial side development is fast and not fully integrated with scientific development.

Hence SSGRSP believes that the network of IEAs created and under development is useful to enhance the communication between science and management. The Expert Groups are currently able to provide a state-of-the-art ecosystem status overview but the step of actually answering questions that are useful for managers is not complete. The process of joining the scientists and managers should enable managers to ask meaningful questions and scientists should learn how to give a comprehensive yet clear answer. Starting this process would be a true breakthrough towards a Marine Ecosystem Based Management.

The road map of SSRSP includes a series of benchmarking meetings for integrated ecosystem assessments. The WKBEMIA being the first benchmark workshop will be followed by a second benchmark workshop in 2014, with more focus on input from ACOM (e.g. co-chaired by ACOM and SCICOM representatives). A third benchmark meeting is planned for 2016 that will invite stakeholders. Throughout the benchmarking process, integrated ecosystem assessments will transition from SCICOM to an intermediate position in the ICES organization between science and advice, SCICOM and ACOM.

5.2 Development of Integrated Assessments within ICES based on experience with the ICES/HELCOM Working Group on Integrated Assessments (Christian Möllmann)

Three aspects have been discussed, (i) the history, definition and goals of Integrated Assessments (IA), (ii) the goals and the state of the work conducted by the „ICES/HELCOM Working Group on Integrated Assessment of the Baltic Sea (WGIAB)“, and (iii) an outline for a future Integrated Ecosystem Assessment (IEA) – based fish stock advice for the Baltic Sea.

IA rooted in scientific and public policy efforts to understand and control acid deposition in the 1970s in Europe and North America, when it was recognized that traditional forms of knowledge integration, such as books, expert panels and advisory bodies combining monodisciplinary assessments were too slow and too inflexible to fulfil all the needs of the dynamic and issue-driven policy process. In the early period of the development of the field (that is from the early 1980s till the mid 1990s), the label IA was often used to refer to the technical analytical methods used in the process, with integrated assessment models (IAMs) and scenario development as the dominant tools. Nowadays, it is widely recognized that IAM is not a complete IA methodology, it is one set of analytical tools for integration used in conjunction with other methods of integration in a broader participatory assessment process. In principal IA addresses three goals (Weyant et al. 1996):

- a) coordinated exploration of possible future trajectories of human and natural systems;
- b) development of insights into key questions of policy formulation;
- c) prioritization of research needs in order to enhance our ability to identify robust policy options.

Eventually IA can be commonly defined as „an interdisciplinary process of combining, interpreting and communicating knowledge from diverse scientific disciplines, in such a way that the whole set of cause–effect interactions of a problem can be evaluated. IAs have two characteristics:

- 1) added value compared to single disciplinary assessment; and
- 2) provide useful information to decision-makers.

The work of WGIAB initiated in 2007 was partly based on this background and included 3 goals:

- 1) conducting trend and status assessments of different subsystems of the Baltic Sea integrating over all trophic levels and evaluating the importance of various anthropogenic drivers on the ecosystems;
- 2) conducting ecosystem modelling to anticipate future ecosystem developments under different scenarios of natural and human-induced change;
- 3) contributing to and developing ecosystem-based management strategies for the Baltic Sea.

While goals 1 and 2 are considered to be well developed, WGIAB is currently in the phase to develop its work on goal 3 according to the framework of Levin et al. (2009).

It was outlined how the approaches and tools developed by WGIAB can be combined into an IEA strategy that facilitates the implementation of EBFM for the Baltic Sea. The strategy includes three components: (1) the transition from existing single-species to a multispecies stock assessment, (2) an ecosystem assessment that feeds environ-

mental information into the single-/multispecies assessment, and (3) a strategic component that conducts long-term management strategy evaluation using coupled model systems. Hence, the strategy accounts for both the short-term needs of annual fish stock assessments, conducted for most of the European fish stocks, but also the long-term needs of future strategic ecosystem-based management advice.

5.3 The NOAA (US) Integrated Ecosystem Assessments (Steve Cadrin, with major contributions from Becky Shuford and Jason Link, NOAA)

IEAs are a US National Priority within the new National Ocean Policy. Three objectives have relevance to NOAA's development and implementation of IEAs:

- 1) Ecosystem-based Management: adopt EBM as foundational principle for comprehensive management of the ocean, our coasts, and the Great Lakes.
- 2) Inform Decisions and Improve Understanding: Increase knowledge to continually inform and improve management and policy decisions and the capacity to respond to change and challenges. Plans for this priority should address requirements for routine IEAs and forecasts including impacts related to climate change, to address vulnerability, risks and resiliency, and inform trade-offs and priority-setting.
- 3) Coastal and Marine Spatial Planning: Implement comprehensive, integrated, ecosystem-based coastal and marine spatial planning and management in the US. Efforts would identify and fill key national information needs and develop CMSP decision-support tools, forecasting, and routine integrated ecosystem assessments.

IEAs are also a priority in NOAA's Next Generation Strategic Plan to reach the long-term goal of healthy Oceans and the objective of improved understanding of ecosystems to inform resource management decisions. Over the next 5 years "Evidences of Progress" toward this objective includes an increased use of ecosystem information (including Integrated Ecosystem Assessments) in natural resource decisions in marine, estuarine, Great Lake, and riverine systems.

Another priority of NOAA is to promote ecosystem-based management and to provide the scientific basis for EBM, NOAA must create a science framework that improves our understanding of ecosystems and of interactions between human and natural systems on a regional and international scale. One of several efforts underway is the development of regional IEAs.

NOAA defines IEAs according to Levin et al. (2009) as **"a synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives"**. IEAs are a framework for organizing and synthesizing science to inform multi-scale, multi-sector EBM and have the objective to provide evaluation of management strategies and advice, through:

- Comprehensive integration of diverse ecosystem information and best-available science,
- Incorporating economic and social science data,
- Evaluating benefits and risks to social and ecological sectors posed by management actions,
- Continuous performance evaluation and review.

5.4 MSFD and the "I" word – Integrated ecosystem fisheries surveys, Integrated Ecosystem Assessment and Integrated Fishery/Ecosystem Management (Dave Reid – Incoming chair of the SCICOM Steering Group on the Regional Seas Programme)

The need for IEAs was demonstrated by the multiple pressures on and the multiple components of an ecosystem. Four "IEA-approaches were discussed to holistically assess an ecosystem: 1) the REGNS-Kenny et al (2009) approach, 2) OSPAR Quality Status Report (2010)– Robinson et al approach, the Ocean Health Index (Halpern et al 2012) and Bayesian Belief Networks (Stelzenmüller 2011). A summary of these approaches can be found in chapter 5.

5.5 Reflections on the current direction of the Integrated Ecosystem Assessment Groups (Mark Dickey-Collas)

Mark Dickey-Collas presented a personal reflection on the drive to develop integrated ecosystem assessments within ICES. In particular it considers how the current working groups under SSGRSP are thinking and operating while providing tools, insight and frameworks for integrated assessments of the ecoregions. The document contains a brief review of integrated assessment concepts and methods, a consideration of the remit of the groups and a personal review of their annual reports.

Overall there have been some significant advances in the development of integrated ecosystem approaches in the ICES area. All groups are very active. They have made progress on building datasets and considering monitoring needs. None have actively scoped for operational objectives and all appear to face challenges when investigating indicators and thresholds. Most groups prefer to only consider fisheries impacts on exploited populations. There is little work on biodiversity, space, habitats or non-fisheries anthropogenic pressures. Risk based tools are being developed to explore trade-offs or the decision process. The human dimension appears remarkably absent from the analyses and there is little evidence of participatory techniques in method development. There is only limited engagement with economists and social scientists. Indicators are generally not seen as tools for the science/policy interface. All groups report a struggle to work across sectors and highlight that governance structures limit their effectiveness in research or implementation of findings. He ends the report with six challenges for ICES to continue the development of integrated ecosystem assessments and suggest that some groups need to be re-focused.

Fisheries are economic activities, which are dependent on and interact with the ecosystem in which they take place. Management decisions are driven not only by changes in the environment but the economic activity itself. The impact of fisheries on the marine ecosystem and on its development could only be assessed and predicted using integrated ecological-economic models, which incorporate the feedback of the ecosystem on the fishery and vice versa. This system will be even more integrated and complex if not only target species of the fisheries are of concern, but also the ecosystem as a whole e.g. protected habitats, protected species, productivity, biodiversity, trophic cascading or ecosystem services like water clearance. A further step in integration would also considerate interactions between the catch sector and other sectors on a regional and wider socio-economic scale when performing fisheries management evaluation.

5.6 Integrated ecological–economic modelling – status, progress and wider future perspectives views of SGIMM on integrated assessments (Jörn Schmidt)

The Study Group on Integration of Economics, Stock Assessment and Fisheries Management (SGIMM) aims on exploring the technical basis and possibilities for integrating and linking biological and economic models including:

1. Integrated Multistock-Multi-Fisheries bioeconomic evaluation
 - a. Multistock based evaluation
 - b. Economic fleet and fisheries based evaluation
 - c. Fisheries technical interactions
 - d. Broader socio-economic and regional evaluations
2. Integrated Ecosystem evaluation on regional basis also involving fishery
 - a. Ecosystem and multispecies based evaluation (biotic components)
 - b. Environmental impacts (abiotic components)
 - c. Integrating fishery harvest (F besides M)
3. Hopefully future development of Broader Integrated Cross Sectoral and Regional Marine Spatial Planning and Management Evaluation?

Discussions of the group included:

- Highlighting the economic component of coupled models,
- Focus on pros and cons of increasing model complexity,
- Level of detail needed to capture realism in relation to management. This included consideration of trade-offs by using fully integrated and highly detailed dynamic models compared to models less integrated and detailed or not fully dynamic.
- Develop and parameterize the models,
- The trade-offs such as inability to quantify uncertainty or model human behaviour,
- The needs for management and management questions to be addressed,
- Longer term strategic nature of the model use and integration according to complexity and management needs.

6 Developing OPERATIONAL IEAs for ICES advice

This section summarizes the discussions during WKBEMIA and should outline first steps towards IEAs within the ICES framework. First, IEAs will be defined and it will be discussed how they might be implemented. Next, the important scoping step in IEAs is discussed. Eventually potential changes needed in the ICES structure to achieve IEAs are indicated.

6.1 What is an Integrated Ecosystem Assessment (IEA) and how should this work in ICES?

Conceptually, IEA is a mechanism for taking a holistic view of the marine ecosystem in specific ocean areas. This should encompass the full range of ecosystem characteristics (foodwebs, biodiversity, habitats, endangered species etc.), the full range of sectors (fishing, renewable, shipping, oil and gas, gravel extraction, tourism etc.), the full range of pressures exerted by those sectors (species removals, habitat damage, contaminants, eutrophication etc.). It should also integrate the three pillars of sustainability; ecological, economic and social. No single technical approach has been developed that can do this, although there are a number of methods that make considerable steps towards this. One key area of development that is needed is the understanding of interactions among different pressures. These can be additive, and are often treated as such, but can also clearly be synergistic or antagonistic.

Levin et al. (2009) proposed a framework within which IEA could be carried out. The framework is broader than an analytic IEA and includes; scoping, indicators, risk analysis, assessment of ecosystem status (probably where most people see IEA methods), Management Strategy Evaluations, and finally monitoring. **WKBEMIA agreed that this framework would be useful in defining the scope of activities and how to bring them together in one structure. It was also seen that there may be modifications needed for this framework in the ICES context.**

WKBEMIA looked briefly at a number of methodologies for IEA; The Robinson et al. (2010; OSPAR QSR 2010) approach, modified for the ODEMM approach (Knights et al. 2012); the REGNS approach (Kenny et al. 2009); the Ocean Health Index (OHI, Halpern et al 2012), and the use of Bayesian Belief Networks BBN (Stelzenmüller et al 2011). The four approaches can conceptually divide into two grouping; quantitative numerical approaches (REGNS and BBN) and expert judgement based (OSPAR QSR and OHI). The REGNS approach is probably the most objective, as it is largely data driven, but is also data hungry and requires good time-series of data to work well, it can also miss addressing ecosystem aspects for which such data do not exist. BBN are less data hungry, in that they can be used on quite sparse data support, but the choices and linkages may be more subjective. The two expert judgement approaches have the value of being able to address any or all ecosystem components and DPSIR linkages, but in many cases this expert judgement component will be backed by little or no empirical or model data to support conclusions. Evaluation of ecosystem component status is generally categorical in the QSR approach, though it is more continuous in the OHI approach. Finally, the OHI has the advantage of including the human, social and economic dimension and can illustrate conflicts and trade-offs well. BBN can also be used to evaluate trade-offs. Arguably, the only method that potentially allows for non additive pressure effects is the BBN, where the linkages between elements can take any linear or non linear form.

The outlined approaches have often been seen as competing, however, WKBEMIA felt that they are in fact more complementary than competing. Each can bring useful elements to the aim of an Integrated Ecosystem Assessment, using quantitative numerical approaches where data allows, moving possibly to BBN where data are sparse, and then to expert judgement for those sector/pressure/component interactions where little or no empirical data exist.

While many feel that IEA are important and should be carried out, there is also the question of how these should be applied to management and policy advice. In general we perceived that currently such advice would be largely issue based, for example in the context of LTMP, CZM, MPAs etc. The role of IEA was seen as providing the wider context to providing such issue based advice. This could be both in terms of external influences that could modify the chances of achieving an issue based objective, as well as the likely wider impacts of reaching such objectives. The inclusion of social and economic elements in the IEA would potentially widen the basis of these. IEA could also be used to highlight additional issue based questions where these showed up as critical within the IEA, i.e. in terms of potential impact, or impacts on ecosystem components of particular importance, e.g. endangered species or habitats.

6.2 Objectives for Integrated Ecosystem Assessments in ICES

The aim of ICES is to have working groups able to consider IEAs for each ecoregion. These IEA groups must be able to provide advice on the generality and specific issues and challenges faced by those managing the anthropogenic impacts on the marine ecosystem. **To develop a framework within the Levin approach, these IEA teams must use recurrent scoping to re-examine management objects (both higher and lower order objectives, Jennings and Rice 2011). Scoping is required to determine and prioritize objects and trade-offs. It is also crucial to set boundaries; geographic, disciplinary and sectoral. The approach of using IEA will be uniform across ecoregions, but groups should expect the management objectives to vary by ecoregion.**

Scoping is about the “balance of diverse societal objectives” (FAO 2003). This is no mean feat as the perceived reality of any stakeholder will be based on a different understanding of the functioning of the system and be driven by different concepts of social norms (Verweij and van Densen 2010). Each stakeholder will probably have a different notion of the impact of a management action on their activity (Delaney and Hastie 2007). Scoping is largely a political or social step that is focused around policy discussions of higher order strategies or lower order tactical objectives (Tallis et al 2010). Stakeholder participation may in some circumstances, also aid the decisions about indicators and targets. Scoping must involve a two way communication, build a common language between stakeholders and be educational as well as exploratory. Engaging with stakeholders will probably increase buy-in to the management process. In ICES, a wealth of experience exists in exploring and constructing objectives through participatory modelling of single stock fisheries management plans and marine spatial planning (e.g. Schwach et al 2007, Degnbol and Wilson 2008, Mackinson et al 2011, Dankel et al 2012, Röckmann et al 2012). **However there is no formal institutional structure for scoping for integrated ecosystem management in ICES.**

Part of the scoping exercise is the setting of boundaries to the area being covered by the integrated assessment, the factors that will be integrated and the objectives that will be included. It also must consider the range of relevant time-scales for short-term goals and longer term objectives. The developers of integrated ecosystem assessments must be aware of the multiple spatial and temporal scales at which they operate (De Young et al 2008).

Many in ICES are experiencing the impact of scoping fatigue across the various stakeholders. Thus scoping should be carried out carefully with clear targeting of stakeholders, and often based on informal communication supplementing formalized stakeholder consultations. No scoping exercise will be perfect and by its very nature it will be iterative. Scoping must be recurrent and IEA groups must accept that the goal posts will change regularly. WKBEMIA agreed that scoping can take many forms and it must be carried out, but not necessarily directly within IEA groups. The groups should use opportunities that are offered through other activities or projects both inside and outside ICES. Examples from across the globe highlight that scoping works best when tools or results can be used as a catalyst. Discussion with stakeholders should involve tangible products rather than concepts. This suggests that starting the cycle with scoping (as suggested by Levin et al 2009) may be a little difficult, and thus while groups must clarify the objectives early on, the scoping progress should occur throughout development of the integrated ecosystem assessments with sensitivity to the resources and attention span of the stakeholders.

In some cases the policy agenda jumps ahead of scientific knowledge (Rice 2011) and a good example of this is the Marine Strategy Framework Directive (MSFD, EC 2008). MSFD can be viewed as an imposition and clarification of the higher order strategic management objectives (Good Environmental Status, GES) for the EU marine environment including fisheries (Ratza et al 2010). However in practise many suggest that the MSFD is ambiguous with unclear boundaries and conflicting objectives (Ounanian et al 2012, van Leeuwen et al 2012), a potential short coming of many examples of environmental policy. Trying to define the operational objectives and the indicators from the MSFD is difficult with the GES descriptors being applicable for ecosystem components, attributes and pressures. However, the MSFD can be viewed as the result of a politically decided scoping exercise. Thus in the EU, despite the MSFD's ambiguities, researchers have a set of strategic objectives by which to operate. The challenge however still remains to resolve the issue of trade-offs and priorities for the multitude of GES descriptors.

6.3 Structural changes needed to conduct IEAs within the ICES-context

WKBEMIA by acknowledging that IEAs will be a central element of the revised science plan sees the goal for existing regional seas groups under the SSGRSP is to develop IEAs based on the „Levin-cycle“ to provide the context for its issue-based advice (see above). The objectives for EBM and hence the IEAs will vary between different ICES regional seas and need to be developed through recursive scoping processes. Activities of the various IEA-groups towards the Levin et al. (2009) approach have been assembled in (see Annex 4).

WKBEMIA appreciated the elements in the revised science plan that should promote a better cooperation between SCICOM and ACOM groups, a prerequisite for developing and applying IEAs. However, WKBEMIA was concerned that in order to develop and use IEAs, a modified working structure needs to be developed. The group emphasized that keeping the present setup will not facilitate the development of IEAs.

WKBEMIA discussed several possibilities to re-arrange the expert group structure, but agreed that the long-term goal should be to develop the present stock assessment groups into ecosystem assessment groups. As this was considered to be unrealistic for the near future, WKBEMIA suggests the following changes/actions to be made:

- 1) *Regional IEA-groups should mandatorily meet in parallel with the respective fish stock assessment groups.*

WKBEMIA was aware that this will require some reorganization of either the fish stock or the ecosystem assessment groups to link the work for the respective ICES ecoregions?

- 2) *The benchmarking process should have a special focus on putting the issue-based fish stock advice into an ecosystem context and assure its implementation into the advice-drafting process.*

Besides the structural changes that will be necessary to facilitate the development of IEAs, WKBEMIA was worried of the necessary participation in the regional ecosystem assessment groups. Chairs have observed declining participation especially by the national (fisheries) institutes due to funding and manpower limits. However, WKBEMIA clearly states that developing IEAs will include a shift in effort towards ecosystem assessments. The suggested parallel meetings of fish stock and ecosystem assessment groups are intended to reduce the effort needed and to advance the communication between the groups.

Another point of concern was the need of outside expertise for the ecosystem assessment groups. This will e.g. include scientists from the regional conventions such as OSPAR and HELCOM on lower trophic levels dynamics and sector-specific impacts such as eutrophication. WKBEMIA suggests that the cooperation of ICES with these will be further developed.

As IEAs require the application of a range of methods/models and data, WKBEMIA was aware that regional ecosystem assessment groups will regularly need input from external experts. Hence, a better information flow of specialised expert groups (such as WGIPEM for modelling) into the regional ecosystem assessment.

7 Continuation of the WKBEMIA process

The SCICOM Steering Group on Regional Seas Programmes is planning a series of benchmarking meetings for IEAs. This first benchmark workshop will be followed by a second benchmark workshop in 2014, with greater input from ACOM (e.g. co-chaired by ACOM and SCICOM representatives). A third benchmark meeting is planned for 2016 that will invite stakeholders. Throughout the benchmarking process, integrated ecosystem assessments will transition from SCICOM to an intermediate position in the ICES organization between SCICOM and ACOM.

For the next workshop WKBEMIA will find a venue in the USA, since IEAs are best developed within NOAA. A candidate venue would be UMASS, Woods Hole. Besides co-chairs by ACOM and SCICOM, it was suggested that a leading US-scientist would be asked for co-chairing. Candidates would be Phil Levin (NOAA), Jason Link (NOAA) or Benjamin Halpern (NCEAS). **ToRs and workshop chairs should be discussed during the next ICES ASC in Iceland.**

Since the suggested Science plan is not planning any supporting activities which will not increase the achievements from a status quo level of IEAs in a foreseeable future, SSGRSP and WKBEMIA advocate that Integrated Ecosystem Assessments form a strategic initiative between ACOM/SCICOM to support the WKBEMIA-process.

Annex 1: List of participants

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Annex 2: Agenda

ICES Workshop on Benchmarking Integrated Ecosystem Assessments [WKBEMIA]; Copenhagen, DK, ICES Headquarters, 27-29 November 2012

Tuesday 27/011/12

Session on “Integrated Ecosystem Assessments – definitions and aims”

1230 – 1300	Arrival of participants
1300 – 1315	Welcome and practical information (Steve Cadrin, Christian Möllmann, Jannica Haldin) and discussion of the agenda
1315 – 1345	Introduction and background of the workshop – SSGRSP and the development of Integrated Assessments (Yvonne Walther)
1345 – 1415	Development of Integrated Assessments within ICES based on experience with WGIAB (Christian Möllmann)
1415 – 1445	The NOAA Integrated Ecosystem Assessments (Steve Cadrin)
1445 – 1515	Coffee and Tea
1515 – 1545	Other approaches to Integrated Assessments (Dave Reid)
1545 – 1615	Reflections on the current direction of IEA, goals for ICES and WKECOVER (Mark Dickey-Collas)
1615 – 1800	Discussion on Integrated Ecosystem Assessments (IEA) ◆ What do we mean by IEA? ◆ What do we want to achieve by IEA? ◆ What can we achieve in the ICES framework? ◆ What do we want the IEA-groups to do? ◆ How do we bring IEAs from the SCICOM to the ACOM side – do we really want this? ◆ ...?

Wednesday 28/11/12

Session on “Integrated Assessments – what does ICES want and need?”

0900 – 0945	Renewal of ICES strategic plan, including ACOM and SCICOM plans (<i>Adi Kellermann</i>)
0945 – 1030	Road map for ICES advice and the knowledge base required for advice (<i>Poul Degnbol</i>)
1030 – 1100	Coffee and Tea
1100 – 1300	Discussion on the role of IEAs for ICES Science and Advice
1300 – 1400	Lunch

Session on “Developing OPERATIONAL IEAs for ICES advice

1400 – 1445 Integrated ecological–economic modelling – status, progress and wider future perspectives views of SGIMM on integrated assessments (*Jörn Schmidt*)

1445 – 1530 New ideas of WGIAB towards IEA (*Lena Bergström*)

1530 – 1600 *Coffee and Tea*

1600 – 1730 Room for additional presentations/views/comments of participants; or/and split into groups developing visions/ideas of Operational IEA, addressing e.g. questions like:

- what are goals for IEAs in the different ICES regional seas?
- what tools should be applied to conduct IEAs within ICES?
- what is the relationship between present ICES stock assessment and IEAs?
- do we need a revision of the assessment group structure to derive IEAs?
- do we need changes in the ICES Expert Group structure for operationally conducting IEAs?
- How do we get the data and how are can these efficiently be used?
- ... more to be developed during the workshop!

1730 – 1800 Short summary of the day and the group work

1930 – *Common Dinner*

Thursday 29/11/12

0900 – 1030 Group work to be continued

1030 – 1100 *Coffee and Tea*

1100 – 1300 Summary of workshop and reporting assignments; report writing

1300 **End of the workshop**

Annex 3: Roadmap for Provision of Integrated Advice in ICES

Roadmap for Provision of Integrated Advice in ICES

The purpose of this document is to provide a roadmap for the provision of integrated advice. This was asked for by the European Commission. A timeline is provided in tabular format and a list of research needs to underpin the process is given.

- 1) MSY Framework for individual stocks
- 2) Stocks without forecasts
- 3) Frequency of assessments and of advice
- 4) Mixed fishery advice (technical interactions)
- 5) Biological interactions (multispecies) advice
- 6) Wider ecosystem advice and its drivers
- 7) Multispecies management plans development
- 8) Research Needs

EC would like ICES “to prepare an implementation plan for the development of the advice necessary to implement mixed-fisheries management. Specifically, we would like ICES to indicate when each of the following milestones could be achieved for each of the main ecoregions (or other relevant management areas)”. The table below shows where in this document, these requests are dealt with.

Table 1. Overview of timelines for provision of integrated advice by ecoregion. See text in individual sections for further details.

Advice Type	Norwegian Sea	Barents Sea	North Sea	Baltic Sea	Wide: Pelagic	Wide: Deep sea	Biscay Iberia	Celtic Eco Region	Iceland Faroe
Single Species MSY Section 1	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	n.a.	Ongoing	Ongoing	Ongoing
Data poor MSY proxy Section 2	*2012+	*2012+	2012-2015	2011-2015	Ongoing (sharks)*	*2014+	2013-2015	2011-2015	2011-2016
Mixed fishery Section 4	n.a.	n.a.	*2012	n.a.	n.a.	n.p.	2012-2015	2013-2015	ongoing (Faroe) n.p. (Iceland)
Multi species Section 5	*2013-2016+	ongoing (cod/capelin) 2013+ (others)	*2012-2014	*2012	*2011-2016+	n.p.	*2013-2016+	*2012-2017+	Ongoing
Wider ecosystem Section 6	2013-2016+	2013-2016	2013-2016+	2012+	2011-2016+	2012+	2013-2016+	2013+	2011+
MSFD Section 6*	n.a.	n.a.	2012-2018	2012-2018	2012-2018	2012-2018	2012-2018	2012-2018	n.a.
MSP Section 6*	2013-2016+	2013-2016+	2013-2016+	2013-2016+	2013-2016+	Ongoing*	2013-2016	2012+	n.a.

n.p. not planned

n.a. not applicable

+ advice on ongoing basis from that year

* annotation in *italics* below

1) MSY Framework for individual stocks

Provision of advice towards achieving MSY by 2015 is well underway in ICES. A framework has been developed over the past two years, and many of the key stocks have assessments and forecasts providing such advice. In addition there are many species where management plans have been developed and agreed, for which ICES provides advice. In some cases forecasts are provided that are based on information other than catch-at-age data, and this has been an area of considerable development by ICES in recent years (examples include western horse mackerel and *Nephrops* stocks).

The current system delivers forecasts for stocks accounting for a large proportion of landings. Progress is ongoing to increase the number of stocks in this category. The benchmark process (Doc. 7.c.) is progressively delivering assessments for species that recently did not have forecasts.

2) Stocks without forecasts

ICES is keen to reduce the number of stocks for which forecasts are not provided. The existing process (MSY Framework) is expected to reduce the number of stocks without forecasts. However, it should be recognized that due to resource constraints, full analytical assessments and forecasts cannot be provided for all species or stocks. This may be a matter of unavailability of data, or it may be methodological. A process is underway to produce an advisory framework for such stocks. To that end, two groups will meet in 2012: WKFRAME3 and WKLIFE. The first of these will develop the form of advice for these stocks in 2012. The second, is an initiative that happens over several years. Further research funding would be very welcome to support these initiatives.

ICES will provide advice for these stocks, using a precautionary framework which delivers directional advice on sustainability over the period 2012-2015. In a few cases this may extend a little longer, particularly for deepwater species. The timelines indicated reflect the differing amounts of time required to roll out such advice between eco regions.

In the Norwegian and Barents Sea the only species of relevance here are the deep-water species and/or elasmobranchs, and these will be dealt with on an ongoing basis in the coming years. Most deep-sea species are particularly problematic from an assessment perspective. A better advice basis is expected after a benchmark workshop in 2014. Pelagic shark advice is an ongoing work and is conducted in conjunction with ICCAT in some cases.

3) Frequency of assessments and of advice

To streamline the process, it will be necessary to consider the frequency of assessments and advice provision. This approach is being taken for some non-forecast stocks in the Celtic Seas area, where there are many stocks that are either new MOU species, or assessment-challenged stocks. For these stocks, ICES will reduce the frequency of advice provision from annual to biannually or more. In 2012 the initial approach will be a pragmatic one, reducing the number of stocks for which advice shall be provided. The criteria will include biology, difficulty in achieving adequate methods, and management needs. Over the period 2012-2015 it is planned that advice shall be provided for all these species.

In 2012 ICES will conduct a statistical study to inform an examination of the frequency of assessments. This will inform future prioritization and rationalization of advice

provision from 2013 onwards. Over a longer period it may be possible to examine changes to frequency of advice for stocks currently with annual forecasts. This could include analyses of changing the frequency of input data in survey-based rules, and also of the frequency of age-based analytical assessments.

4) Mixed fishery advice (technical interactions)

There are two approaches to this issue. One approach is where advice for one stock (usually cod) drives the management. In this case advice is simply a presentation of the consequences for all the other stocks, predicated on the cod advice. A more involved approach is where a range of options are provided, allowing managers and stakeholders to explore trade-offs between different choices. Whatever approach is taken it should take account of plausible ranges in the choice of MSY targets, for the main species, and a looser precautionary approach to the remainder. It is obvious that all MSY targets cannot be achieved simultaneously and that the MSY itself will depend on multispecies and mixed fishery interactions. Consequently the approach must be adaptive in nature. Whatever approach is taken it will need to be consistent with the requirements of the MSFD and it should take account of plausible ranges in the choice of MSY targets, for the main species, and an indicator-based directional sustainability advice for the remainder.

The timelines for introducing mixed fisheries advice will vary from region to region. In the North Sea, ICES will provide quantitative advice in 2012. For the Celtic Seas, Biscay and Iberia the process to provide such advice is not yet mature. However work is underway in all regions, and is expected that quantitative advice can be provided by 2015. In the meantime, ICES can provide qualitative or semi-quantitative advice for these areas.

ICES can develop advice in these areas by:

- 1) Carry out a detailed review of mixed fisheries interactions within the CS including spatial analyses (e.g. VMS) and métier interactions.
- 2) Transparently provided integrated information on landings, discards and effort at an appropriate scale (i.e. spatially resolved métiers). Where data gaps exist e.g. in discards modelling approaches should be developed and explored.
- 3) Develop a decision support modelling framework to support discussions with stakeholders and managers about options and trade-offs in mixed species fisheries.
- 4) Provide advice to managers and stakeholders about key data deficiencies where possibly suggesting remedial solutions.

Current sampling levels for discard estimation are not adequate. Yet it is recognized that substantial increases are unlikely to be financially feasible. Modelling approaches must be explored to estimate discarded quantities and changing patterns of fleet behaviour on discarding. Also, it could be useful to examine means to achieve discard estimates from industry.

5) Biological interactions (multispecies) advice

Some ICES advice already has such interactions built-in. Examples are cod and capelin in the Barents Sea.

In the case of the Baltic, multispecies advice shall be provided in 2012 for the first time.

In the Norwegian Sea there is a very good understanding of the foodweb and predator–prey interactions. However there is no multispecies advice at present. Two issues arise here related to the relationship between zooplankton and pelagic fish.

- 1) It has been observed that zooplankton abundance has decreased significantly since 2008 in this area. It is believed that this is related to the high abundance of pelagic stocks (herring, mackerel and blue whiting) which are grazing on zooplankton.*
- 2) In addition there is a wish by industry to increase harvesting of zooplankton in the area.*

*Consequently, ICES should therefore assess the status of zooplankton and provide information on the relationship between plankton and the growth and recruitment of pelagic fish, and provide advice for the management of the exploitation of zooplankton. The preliminary steps for assessment should address the following issues: how data on zooplankton in this area can be improved, assessment methodology, what are the main interest and conduct an exploratory assessment of *Calanus finmarchicus*.*

For the North Sea, the underlying science is well developed and sufficient for the provision of advice, although up-to-date stomach analyses are required. It is expected that ICES can provide such advice over the period 2012-2015. A format for provision of advice can be decided quickly. However it is expected that some special requests will have to be dealt with in the North Sea, in the near future.

In the Celtic, Biscay and Iberian regions, the timelines will be somewhat longer. In Biscay and Iberia there is a better availability of data (e.g. stomachs) than in the Celtic Seas, where stomach data do not exist. In these regions additional research is required, in order to compliment work already underway. While the science matures over the next four years, some advice can already be given, based on published studies. Thus, advice development will take place in parallel with developments in the science, rather than waiting until the science is mature.

6) Wider ecosystem advice and its drivers

The Marine Strategy Framework Directive (MSFD) and the Marine Spatial Planning (MSP) initiatives are strong drivers for ecosystem advice. The exact mechanism of how the MSFD requirements will influence advice and management will become clear when the reform of the CFP is completed. The obligation is on individual MS to put in place measures to achieve Good Environmental Status by 2020. Recital 39 of the MSFD refers to such fisheries measures and Article 14 of the Directive makes provision for a Member State to identify to the Commission instances where GES cannot be achieved due to “action or inaction for which the MS concerned is not responsible”. MS are required to define and report on GES by 2012 and to initiate a programme of measures to achieve or maintain GES by 2016. There is a 6 year reporting cycle and the next report on GES will be in 2018. It is the second iteration of the MSFD that will be influenced by these proposals. In 2013, good environmental status (GES) must be defined.

Some spatial advice is already being provided, it has been a special feature of deep sea advice to NEAFC in recent years.

Various types of advice can be provided under this heading. The first phase can use “lowest-hanging-fruits” The most likely advice types here are the impacts of fishing on non-target species (e.g. seabirds, mammals, corals), and also habitat impacts. Such advice is provided on an ongoing basis and this will continue and be further developed. Advice could also be provided on recruitment regimes, and to some extent this is already being incorporated into advice for North Sea herring, blue whiting and Faroese stocks.

A second phase would be the provision of fully integrated advice. The advice should provide information on the impacts on the ecosystem and also the interactions between these (additive vs. multiplicative etc.). Much of this will come from the Regional Seas programme in bottom-up type initiatives from the scientific community. This development may be of a longer term nature (after 2016). It is expected that this process will mature in the Baltic Sea first.

7) Multispecies management plans development

Development of such plans must take place with stakeholder interaction, through the RACs etc. It is expected that the initiative for such plans will come from stakeholders in many cases. ICES is prepared to be fully engaged in the process of developing such plans.

There are initiatives underway in various places to develop management plans incorporating multispecies considerations. The SWWRAC is working on such a plan for the Biscay/Iberia region. Another initiative in this area is being supported by the EC-funded project *GEPEO*. A similar initiative is being developed in the NWWRAC for VIIIf, g. This plan aims to follow scientific advice for MSY by 2015, for the main species caught in the mixed fishery. As the MP is based on mixed demersal stocks choices on the appropriate MSY targets will have be decided. For the remaining species, (taken as bycatch) in the mixed fisheries the plan will incorporate a suite of indicators and a risk assessment framework.

8) Research Needs

- Study of indicator-based metrics for data poor species (without forecasts).
- Modelling approach to discard estimation.
- Mixed fisheries interactions in Celtic/Biscay/Iberia to complement work already underway:
 - International review of mixed fisheries interactions.
 - Develop a decision support modelling framework
 - A series of case studies of possible approaches, involving iterative management plan development with stakeholder interactions.
- Updated stomach sampling in the North Sea
- Better understanding of the foodweb (western and southwestern waters especially).
- Development of indicators of foodweb structure and function and size-based models of ecosystem function, e.g. size-based metrics, stable isotope work etc.
- Examination of industry-led discard estimation programmes.

Annex 4: Progress of Integrated Assessment Groups towards the components of the Levin et al. (2009) approach.

1). WORKING GROUP ON THE NORTHWEST ATLANTIC REGIONAL SEA (WGNARS)

Component	Methods/Models	Results	Gaps/Needs
Scoping	Message box (internal tool to define message)	First iteration of identified objectives and scoping process	Implementation of ongoing scoping process
	Communication products (brochures, web pages, fact sheets, video, social media) Outreach to existing organizations Workshops, Symposia Establishment of stakeholder advisory group		
Ecosystem indicators and targets	Development of conceptual framework for including social science in EAM Indicators: Expert opinion, theoretical and empirical analysis, multivariate analysis to reduce dimensionality, guidelines from IndiSeas; Frank and Choi ecosystem assessment; including social and economic indicators Thresholds/targets: empirical identification based on statistical models; identification based on theoretical considerations	Compilation of indicators from multiple sources; compilation of stressors; statement of principles for indicators	Stronger linkage between indicators and objectives, pressures, drivers, impacts; Strategy for integrating indicators approach with spatially explicit place-based approach
Risk Analysis	Pathway of Effects models	None yet	Consensus on approach to identifying thresholds
Assessment of status relative to goals	Ecological Risk Assessment Framework	None yet	Review of risk analysis methodology including consideration of cumulative effects
Management strategy evaluation	None yet	None yet (except IndiSeas)	Consensus on goals within each ecoregion
	MSE in models such as Multispecies Biomass Production Model (MS-PROD), Swept-Area Seabed Model (SASII)	Assessment of tradeoffs among indicator values given different exploitation strategies; model strategy to minimize seabed impacts at a given fishing level	review of MSE methodology; consensus on key issues to address
Monitoring ecosystem indicators and performance evaluation	Empirical analysis of ecosystem monitoring data	Ongoing, not yet targeted on goals	Consensus on goals, indicators, thresholds within each ecoregion
	Other themes to include dynamics of pelagic and benthic habitat and interactions of processes across scales		

2) ICES/HELCOM WORKING GROUP ON INTEGRATED ASSESSMENTS OF THE BALTIC SEA (WGIAB)

Components	methods & models	results	gaps & needs (3)
Scoping	Scoping was discussed in WGIAB 2012 in relation to prevailing higher level objectives in order to identify areas where WGIAB could contribute. WGIAB has not undertaken any formal scoping process involving stakeholders, so therefore the group has used the goals of the Baltic Sea Action Plan (BSAP) and the Marine Strategy Framework Directive (MSFD).	CFP, BSAP and MSFD were identified as giving objectives and goals for the Baltic Region.	WGIAB identified the need for a scoping exercise in order to harmonise existing goals, identify roles and expectations. This should be run by relevant regional bodies. (1)
Develop indicators & Targets	Potential contributions from WGIAB to indicator development and harmonisation were identified in relation to existing information on MSFD, CFP and BSAP. *Theoretical aspects of a formal risk analysis discussed and considered. However, the group has not explicitly worked on this aspect. *Partly incorporated in MSE (see below). Development of early warning indicators for the Central Baltic Sea food web (Lindgren et al 2012). * Biological Ensemble Modeling Approach (BEMA) of the Eastern Baltic cod and the food web (Gårdmark et al, in press).	*Potential contributions were identified within the MSFD descriptors on biodiversity (D1), commercial fish (D3) and food webs (D4). *Targets from the BSAP related to nutrient loads and CFP management plan for eastern Baltic cod were used in a modelling exercise. *Contribution of indicators of cod recruitment environment as input to WGIABAS (2010-2012).	*No specific targets of MSFD indicators had been identified at the time of the meeting. When these are defined (this is up to member states), they should be harmonised at regional level. *Indicators in relation to CFP should be addressed more explicitly, together with relevant stock assessment groups.
Risk analysis		See MSE below, Lindgren et al (2012) and Gårdmark et al (in press). * Biological and abiotic data available for main part of the Baltic basins. Information on long term trends in different foodweb components in relation to abiotic conditions. Data correlated match MSFD D1, 3, 4. * Published in for example Möllman et al (2009), Dieckmann & Möllman (2010) and Lindgren et al (2012).	More directed work within the "Living EA approach" is identified as important for future work.
Assess Status	WGIAB has over years, as a core activity, assessed trend in food web components using the REGIONS approach and BEMA (Biological Ensemble Modeling Approach, Gårdmark et al in press).		Socio-economic and spatial information should be incorporated. Datagaps identified also in certain foodweb components and pressures.
Management Strategy Evaluation	As an example of MSE, WGIAB 2012 simulated the effect of fishing and nutrient load reductions, in the presence of further climate change, on the Central Baltic Sea food web using four models, ranging from single species to food web models, and evaluated the effects of the different management scenarios on the indicators identified in Step 2.	Example on potential cumulative effects of pressures. Management scenarios presented on a few ecosystem indicators (see WGIAB 2012 report).	*This exercise does not provide a full MSE within an EA context, but is rather intended as an example to be developed further (2). *See also ToRs for 2013-2015 (within the WGIAB 2012 report).
Monitoring	WGIAB has used a lot of monitoring data but has not explicitly worked on this aspect.	-	see cell D6. Monitoring needs should be evaluated further and ways to fill datagaps identified. (1) One important scientific challenge for the successful implementation of the MSFD and the CFP was identified as the evaluation of how different management goals are interdependent on each other, for example the recognition of potential trade offs between and among indicators within Descriptor 1, 3 and 4 of the MSFD. A structural challenge was identified by a poor level of interaction among sectorial pillars, for example among the environment pillar and the fisheries pillar. (2) This exercise is not to be viewed as an actual MSE for the Central Baltic Sea, but as an example of its application within an EA loop. In contrast to many models used for MSE for fisheries, the models used here do not include any models on actual actions in response to decided management strategies (such as fleet dynamics), nor any management models including e.g. models of the assessment process itself. As such, this example can only give suggestions on the response of ecosystem indicators to fishing and nutrient reduction strategies should they be perfectly implemented (in a world without stochasticity). (3) See also ToRs 2013-2015 in the WGIAB 2012 report.

3) Working Group on Ecosystem Assessment of Western European Shelf Seas (WGEAWESS)

Component	methods & models	results	gaps & needs
Scoping	Partially addressed in Ecosystem	Descriptions include pressures	Inclusion of stakeholders in
Develop Indicators & Targets	Focussed on MSFD None adopted, but exploring PSA	Pending National MSFD discussions NA	
Risk analysis	Full ecosystem descriptions	Ecosystem descriptions	Move from description to
Assess Status	None, no management	NA	Common platform/method
Management Strategy	yes, but not specifically in an	???	Development of integrated
Evaluation			
Monitoring			

wrt status we are putting together a database with all the available information including the Guadalquivir Estuary and fishing activity in the Gulf (Kenny et al approach)
wrt the monitoring there are surveys on fish and plankton and the information on plankton is being analysed at the moment (but not available yet)