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MANAGEMENT COMMITTEE

NAMMCO/15/MC/8

***Ad Hoc Working Group*
on
Enhancing Ecosystem-Based Management**

REPORT

Aberdeen, Scotland, UK, 20-21 September, 2005

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**Report of the *Ad Hoc* Working Group on Enhancing Ecosystem-Based Management
(EBM),
Aberdeen, Scotland, UK, 20-21 September 2005**

1. **Programme.** The meeting was convened over two days, running back-to-back with the ICES Annual Scientific Conference held at the Aberdeen Exhibition and Conference Centre. The first day comprised attendance at the opening sessions and talks of the ICES conference and the second day was a NAMMCO closed meeting. The General Secretary of NAMMCO, Christina Lockyer, welcomed participants on the evening of Monday 19 September, and clarified the arrangements.
2. **Agenda.** The agenda and schedule for the meeting is shown in Appendix 1 (Doc. 1), and was adopted.
3. **Chairmanship.** The Chairman for the meeting was Johann Sigurjonsson, Marine Research Institute, Iceland, and Rapporteurs were Daniel Pike, NAMMCO Scientific Secretary and Christina Lockyer.
4. **Goals of the meeting.** The Chairman summarised the goals of the WG with reference to the terms of reference (Doc. 5), and that the group should focus on:
 - Mapping the status of developments with respect to EBM
 - Reviewing the development of multi-species models for marine resource management which include marine mammals
 - Examining the management objectives and experiences in relation to the application of EBM across the N. Atlantic where marine mammal utilisation occurs
 - Identifying where the specific interests/role of NAMMCO in EBM lie
 - Reporting and making recommendations to the Management Committee of NAMMCO.
5. **ICES Opening day.** The first day of the meeting was the opening session of the ICES conference. The opening talk was delivered by Keith Sainsbury, Australia, on “The Ecosystem Approach to Fisheries”. This presentation summarised two recent initiatives: Ecosystem Approach to Fisheries (EAF) and Ecosystem-Based Fisheries Management (EBFM). Both were intended to bring improved ecosystem considerations and sustainability into fisheries management. EAF starts with a fishery target species perspective and adds ecosystem considerations while EBFM starts with an ecosystem perspective and adds fishery considerations. Both have similar goals and initial steps and recognise that implementation should and can commence regardless of widely differing fisheries risks and amounts of knowledge. The presentation was a management-oriented talk and based on practical examples from the Australian federal government. However, it was stressed that any management system depended also on scientific input and feedback. Regarding EBM, the focus is on managing people and their activities that have impact on the ecosystem. The presentation was a good basis for the tasks set before the NAMMCO WG.

Some of the important points relevant to ecosystem type management that Sainsbury raised included the following:

- Introduced species can often supercede native species

- Importance of climate change
- Use of the oceans is unsustainable both locally and globally
- Actions taken in the next 20 years will determine events in the next 100 years
- Planning is essential
- Clear limits and standards should be set for sustainable use
- Uncertainties should be recognised
- There should be an interplay between socio-economics, management and science.

With EBFM, one may operate with different levels of information:

- 1) Data-poor where a precautionary approach should be applied
- 2) Moderate data where one may effectively work with single species management
- 3) Future development of ecosystem-based reference points.

Both EAF and EBFM have similar initial stages where integration, prioritisation and targeting extra observations, extended reference points, increased use of spatial management, and increased precaution are involved.

In implementation, a management system and scientific support are needed.

Management systems require:

- 1) Structure and transparency particularly in decision making
- 2) Precaution in decision making – two tools were quoted: Ecological Risk Assessment (ERA) and Management Strategy Evaluation (MSE)
- 3) Regulators should have and use appropriate management tools. Here came a warning to beware the “single solution” that might mask a hidden agenda , and that Marine Protected Areas (MPA) are just one tool that should generally be regarded as a last resort in management strategy.

Scientific support can be offered in two forms:

- 1) ERA – should have a framework heirarchy and be qualitative or quantitative, depending on the risk level. ERA level 1 concerns Protected, Endangered and Threatened species (PET); ERA level 2 concerns Productivity and Susceptibility Analysis (PSA). In Australia it was noted that ERA is performed on all data-poor fisheries.
- 2) MSE – should have a scientific design of the management strategies which in turn should have a monitoring and decision feedback loop.

In the future, Sainsbury highlighted the following as being important:

- Societal goals for sustainability
- Reforming of institutions
- Scientific risk assessment
- Full use of existing data and targeting of and obtaining new data
- EAF / EBFM pathways to full EBM.

6. ICES Special Session: “Ecosystem Approach to Fisheries Management Worked Examples”.

There followed a special ICES theme session on “Ecosystem Approach to Fisheries Management: Worked Examples”, co-chaired by Paul Connolly (Ireland) and Jake Rice (Canada). The session extended all day with a total of 17 presentations worldwide. The presentations were a mix of trophic system studies, ecosystem models, government implemented management schemes, and examples of developments of EAF and EBFM. A few presentations referred to marine mammals and other top predators apart from fish, as part of the ecosystem, and the key theme throughout appeared to be that management objectives depend on one’s perspective. Clearly a management objective is essential before EBM can be implemented, regardless of other deficiencies. However, it was disappointing that relatively few presentations addressed EBM issues in the areas directly relevant to NAMMCO. It was unclear if this was because of actual lack of EBM initiatives in this region or an imbalance in the presentations offered. There were several presentations centred on the Canadian east coast area, US east coast, a presentation of an ECOSIM model for the Faroe Islands, a North Sea Fisheries Ecosystem Plan – that included marine mammals, and the EUR-OCEANS project (see below) that had some relevance. The remaining presentations were mainly from the Canadian west coast and the Southern Hemisphere.

Some of the main points promoted by the talks were:

- Trophic interactions and energy budgets are at the core of ecosystems, but must be coupled with environmental factors and sociological objectives for EBM
- ECOPATH and ECOSIM trophic models are widely used in ecosystem models as tools in predictions and management
- Education and outreach may increase the effectiveness of management measures
- Existing legislation may sometimes conflict with the implementation of EBM, as may the differing goals of Inter-Governmental Organisations (IGOs)
- A planned European Institute for Study of Ecosystems – EUR-OCEANS – supported by EC funding, may be useful in designing EBM in the future, but has yet to become a reality
- EBM is mostly focused on managing human activities that have an impact on ecosystems
- We have an obligation to maintain biodiversity
- There has to be a baseline or limit level for exploitation in order to balance productivity, biodiversity and habitat quality
- There is a toolbox of management measures that includes
 - 1) Effort Control
 - 2) Technical Measures
 - 3) Protected Areas
- A 5-year research plan of US NOAA highlighted the importance of lateral communication among and within government departments in order to achieve integrated / compatible action rather than conflict and ignorance about management goals
- Management Strategy Evaluation (MSE) is important for large complex fisheries where both initially qualitative and later quantitative approaches can be utilised; data-poor systems and their data needs can be decided upon after qualitative evaluation
- There is no excuse not to start EBM.

A summary made by the theme session Co-Chairman Jake Rice emphasised:

- Importance of objectives, indicators, risk assessment and socio-economic input in EBM
- Integrated involvement of science and management
- Necessity for communication at all levels

- Available data should be utilised – even if not complete
- A diverse toolbox exists for ecosystem management and evaluation
- The likelihood of short-term reductions in fisheries catches managed through EAF and EBFM that will involve transitional costs
- Implementation costs of EBM – EAF and EBFM and will occur and must be recognised at the outset, and in the light that ultimate gains from this management strategy will be in the form of ensuring ecosystem sustainability and biodiversity.

7. NAMMCO Working Group Discussion on the ICES session.

The discussion about the ICES session centred around three topics of 1) ecological energetics, trophic system models and data input, 2) the costs associated with EBM implementation (*e.g.* reductions in catches of target species and the associated socio-economic aspects) 3) the resources necessary for associated essential research and data gathering and 4) management structures required.

Discussion focused on the fact that there was frequently confusion as to the precise interpretation of EBM and its components. However, all EBM systems have the following features:

- Consideration of environmental forcing
- Consideration of species interactions
- Consideration of ecosystem effects of fishing
- Integrated management, *e.g.* fishing, oil, shipping
- Inclusive participatory decision making.

What is included in an EBM system depends on whether there is a need for wider inclusion of factors such as fishing, oil industry, gas, climate, oceanography, etc. The overriding factor is to know exactly what management objective is being addressed. A single species approach is feasible and may be adequate under many circumstances, and NAMMCO is effectively providing management advice for marine mammals using a single-species approach at present. However, NAMMCO is currently exploring trophic interactions as a prelude to an ecosystem approach.

Adi Kellerman (ICES) emphasised that in fact it is managing human activities that is important in EBM; there should be damage limitation, as ecosystems will follow their own path. It is important to examine what data are available and where one can start. Commencing with a regional approach *e.g.* N. Atlantic ecosystem would be very complex, but a local limited investigation for *e.g.* Irminger or Greenland seas had a better chance of success. One should try to integrate environmental information in fishery models.

Ulf Lindstrøm (Norway) queried whether typical multi-species modelling packages such as ECOPATH and ECOSIM would be necessary as a framework to start EBM and whether or not one could use indicators or qualitative tools. Garry Stenson (Canada) considered that instead of simple trophic models such as the the harp seal and cod/capelin trophic model, when considering EBM one should include other factors that affect MM species such as pollution and climate input: the question was where to limit the management process. The Chairman reminded the group that EBM was more holistic than hitherto used models and that

it was important to recognise that management actions would have wider implications and impact than just locally and on specific target species. Jake Rice (Canada) noted that the more complex the model became, the greater likelihood that there would have to be incorporation of “assumed” factors and data input, and a loss of predictive capability.

The best way to proceed was to begin with well-defined agreed objectives: with a small number of objectives a simple model may be adequate whereas increasing numbers of objectives would require a more complex model. Ásta Einarsdóttir (Iceland) pleaded for a start with simple objectives and a simple model. The Chairman commented that in some cases we must be satisfied with qualitative approaches. It was noted that socio-economic coupling adds a further layer of complexity and that the demand for data will increase with complexity. Daniel Pike noted that modelling is not the only available approach, with reference to the experimental approaches that have also been used in e.g. Australian reefs¹ and narwhal in Baffin Bay². Christina Lockyer noted that with reference to the current Greenlandic unsustainable exploitation of narwhal and beluga, there would have to be an assessment of the socio-economic costs of quota and hence catch reductions and adoption of clear-cut management objectives in the spirit of EBM.

8. A history of EBM development. The Chairman followed with a brief historical summary of the Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem, 1-4 October 2001, and developments since then. The purpose of this FAO-sponsored international meeting was explained. The main themes were the dynamics of the marine ecosystem, the role of man in marine ecosystems, and incorporating ecosystem considerations in fisheries management. Two issues were highlighted: incentives for rationalisation under “Rights-based” fishing, and overfishing driven by overcapacity. The conclusions were similar to those reached in Keith Sainsbury’s presentation on the previous day, with the promotion of an ecosystem approach to fisheries where multi-species trophic models as well as stakeholder input should feed in to ecosystem management. The conference was concluded by the Reykjavik Declaration where the following goals and activities were highlighted:

- Management plans with incentives
- Governance
- Prevention of adverse effects of non-fisheries
- Advancing science
- Interactions of fisheries and aquaculture
- Strengthening international cooperation
- Technology transfer
- Removal of trade distortions
- Collection of information on management regimes
- Development of guidelines.

¹ <http://www.marine.csiro.au/LeafletsFolder/26trawl/26.html>

² Laidre K.L., Heide-Jørgensen M.P., Jørgensen O.A., Treble M.A. 2004 Deep ocean predation by a high Arctic cetacean. *ICES J. Mar. Sci.* 61:430–440.

In Reykjavik in 2002 the FAO Expert Consultations produced an important document: “*FAO Guidelines on the Ecosystem Approach to Fisheries*”, along with several other useful papers. These guidelines were adopted by FAO/COFI in early 2003. The World Summit on Sustainable Development, held in Johannesburg in 2002, encouraged the application of the ecosystem approach by 2010 - noting the 2001 Reykjavik Declaration, and maintaining productivity and biodiversity. More recently, ICES have made progress hosting a dialogue meeting with different stakeholders in 2004, and in 2005, publishing “*Guidance on the Application of the Ecosystem Approach to Management of Human Activities in European Marine Environment*”. Presently a European Marine Strategy is under development, although it has not been implemented yet. It is anticipated that approval may come from the EC by February 2006. There is currently also a great deal of activity at the national level.

Following this summary, Fernando Ugarte (Greenland) raised the question as to why single species management was being rejected in favour of ecosystem management. The response (Jake Rice) was that single species management was not inappropriate but that it had a history of poor results with dire consequences. It could still be used so long as more environmental conditions were considered within the ecosystem context as these had great bearing on cycles of marine productivity and subsequently of recruitment of higher predators. The Chairman also pointed out that marine productivity can quite strongly affect large baleen whale reproduction.

Christina Lockyer pointed out that many species of whales and seals are highly migratory and may move between ecosystems. It was important to recognise that management strategies – especially for single species, adopted locally may have effects elsewhere, e.g. sei whales taken according to IWC-based quotas in Antarctic Area III and off South Africa during the 1960s and early 1970s were extirpated from S.Africa because of effective double-harvesting of the same population at both ends of the migration routes (Best, 1976)³.

9. Implementation of EBM. Christina Lockyer proceeded with a presentation on applying EBM entitled: “Essentials for Implementation of Ecosystem-Based Management to Living Marine Resources”. There followed the FAO definition of EBM:

“Ecosystem-Based Management strives to balance diverse societal objectives by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions, and applying an integrated approach to ecosystem management within ecologically meaningful boundaries.”

The presentation (see the full version in Annex 1) summarised some items that would require common ground among stakeholders such as interpretation of what constitutes a marine ecosystem; goal(s) for achieving benefits and opportunities from ecosystem-based management of the marine system; understanding of how living marine resources contribute to food security; understanding of the main elements of ecosystem-based management; recognition of the main obstacles to applying ecosystem-based management of living marine resources; agreement on the steps to be taken at national, regional and international levels to implement ecosystem-based management of living marine resources; and understanding of the role of the scientific community, national governments and FAO in developing the

³ Best, P.B. 1976. Status of whale stocks off South Africa, 1974. *Rep.int. Whal. Commn* 26: 264-286. (see Table 5, pp.279-280.)

knowledge and the legal and institutional framework for applying ecosystem-based management.

- 10. In discussion** of this presentation, Jake Rice noted that the core issue is getting management objectives straight. There is also a big difference between sustainable harvest and managing predation by marine mammals - the latter has a much higher data demand. The situation will therefore arise that different countries may adopt different management objectives, depending on their perspective on marine mammals.

Tore Haug (Norway) reiterated the fact that ecosystems are dynamic, but that trophic models may not necessarily be predictive. Careful monitoring is very important for feedback on performance of management objectives implemented.

The Chairman explained that EBM can be viewed as a tool to measure values of different ecosystem components by giving them “value tags”. As an example, he mentioned the Icelandic management decision to “sacrifice” the shrimp stock for the sake of cod and capelin, as it was of less economic value. Another example given was the North Sea objective to protect harbour porpoises. One might also choose to have an objective to reduce some marine mammal populations if that was desirable. In the Barents Sea, management objectives focusing on cod and capelin would have knock-on effects for marine mammals there. Mike Hammill (Canada) pointed out that there was a clear management objective set with regard to harp seals in ICES-NAFO, so the main question for NAMMCO was what objectives were set for marine mammals by member states: conserve marine mammals or satisfy fishery needs as these were different perspectives. With given objectives we can come forward with proposals to incorporate marine mammals in an ecosystem approach. If the focus is on maintaining high marine mammal populations, we should establish objectives for marine mammals.

The Chairman pointed out that NAMMCO is a creation of member states that are also interested in fish, although we should ensure that NAMMCO is contributing to development of EBM. Halvard Johansen (Norway) agreed that members of NAMMCO are fishing nations and are concerned with sustaining fisheries, and thus may want to have the option of a higher rate of use of marine mammals if it benefits fisheries. He also mentioned that it was impossible to stabilise some stocks as there is no market for the products. What can be done with the marine mammal meat if there is no consumer? The conclusion was that it is not a simple choice in setting management objectives; there is social complexity, interests of other states, etc. and that also world opinion matters. One must operate within the limits of current knowledge and also know how low a level one can reduce a population to yet retain it as part of the ecosystem.

The Chairman explained that in Iceland, the exact ramifications of whale population reductions cannot be predicted at present, but the scientific advice is to not let populations grow indefinitely because of concerns for the fishery.

Garry Stenson (Canada) noted that in data-poor situations, one can go forward with EBM but with a precautionary approach.

In concluding the discussion, clearly EBM approach forces the setting of objectives. NAMMCO can make objectives, but these should be stock-based rather than generalised. Depending on the level of the objectives, a general outline of objectives that apply to all populations can be set. There can be individual considerations as to how they are applied and detailed target objectives can be stock specific.

In moving forward towards an ecosystem approach, it must be recognised that larger ecosystem models are under development and that NAMMCO can participate in this development. NAMMCO will also have to deal with non-hunted species as well as exploited ones. An important role for NAMMCO could be in ensuring connectivity between management organisations. Goals for NAMMCO could include:

- 1) A more holistic view of marine mammal management - incorporating ecosystem concepts, climate change, socio-economics, etc.
- 2) Provide marine mammal input to models under development by other jurisdictions and organisations, and member states
- 3) Investigating and monitoring species that are not harvested, and those not “important” economically; however, NAMMCO currently review non-harvested species periodically
- 4) Coordination between areas to ensure that activities are consistent and non-conflicting.

A draft set of objectives and options to discuss and shoot down - “straw dogs”, could be provided to the Management Committee to get the EBM process rolling, and the Chairman stressed the need for establishing clear management objectives in EBM.

An additional point is the question of limited resources and manpower in implementing an ecosystem approach, and what NAMMCO can do to facilitate improvement in funding.

An ecosystem case study – Barents Sea. A presentation on the Barents Sea ecosystem with emphasis on marine mammal fishery interactions was presented by Ulf Lindstrøm, Institute for Marine Research, Tromsø, Norway. This elaborated in more detail than earlier on the Barents Sea trophic system with the interplay of minke whales, harp seals, capelin, herring, cod, and other prey. Ulf Lindstrom summarised the development of multi-species models for this region and the current ongoing work. Much of the data between 1992 and 1999 was collected from both scientific and commercial whaling, with an emphasis on trophic interactions and dietary analysis. His main comment was that over a 15-year period to the present, minke whale predation had tracked prey abundance and been reflected in body condition. There had been large-scale changes in habitat use, which corresponded with prey abundance and availability. He also mentioned the importance of the capelin to fisheries, whales and harp seals, wherein lay potential dilemmas and conflicts in determining management objectives. The summary of his presentation is found in Annex 2.

In discussion, it was noted that this study will feed into large scale ecosystem modelling projects. Modelling will include capelin, herring, cod, minke whales and maybe harp seals, although better dietary data are required for the seals. Tore Haug noted that harp seals were

prime predators in the Barents Sea ecosystem and within a few years better information on harp seal foraging will be available.

The question was raised whether there should be a case study addressing harp seals, and if this would be a way forward. Daniel Pike reminded the WG that this had been put forward before, but had been put in abeyance at the last meeting of the Council (March, 2005). Ulf commented that it was better to work holistically with several species simultaneously. The Chairman stated that models are of basic importance if different values are going to be weighed, and he reported that Iceland is now recently employing a person to implement marine mammals in GADGET. Tore Haug noted that the SC has provided recommendations to improve information for harp seals, and there is now increased activity in this study area. It was concluded that a pilot study would require a trophic model, as well as information on socio-economic implications of management measures.

The Chairman proposed that the WG should be developing a shopping list for EBM, highlighting the main needs, and establishing a separate *ad hoc* group including scientists and managers to proceed with this. This in its own way is a form of management model, but the outcome might indicate whether or not modelling is critical in the EBM process. Christina Lockyer commented that a lot of work had already been invested in models in the SC, so that building upon this was a sensible move.

In concluding this discussion, it was emphasised that models are still required as originally requested by the Council for the past 8 years, and that a framework or shopping list for all or a particular stock should be developed.

12. Objectives and Experiences in Various Countries.

Norway

Halvard Johansen described the aims and objectives of the recent government White Paper in Norway. The overall objective is to maintain viable stocks in all areas, with the controlled use of any surplus. As a general policy Norway does not allow exploitation of any species unless there is sufficient information on stock status and sustainable catch levels. He presented the main points for seals, whales and coastal seals.

1) Seals:

Norway would like to know the sizes of seal stocks and have recommendations for harvest levels, particularly exact sizes for harp and hooded seals in the Greenland Sea. Although there have been no specific objectives for seals to date, increased quotas for harp seals are planned for next year, but it might not be realistic to take considerably higher quotas in the immediate future even though there is growing demand for seal products in the market. For hooded seals which are more important commercially, a different strategy is necessary and quotas may have to be reduced in order to rebuild the stock which is not as large as anticipated. Final decisions await the ICES-NAFO report on harp and hooded seals.

2) Whales:

Norway plans to increase the quota for minke whales, which has been set using the IWC Revised Management Procedure (RMP). Norway has been looking at modifications to the

RMP to make it specific for Northeast Atlantic minke whales. The version of RMP used is generic for all baleen whales. However this will be taken up by the IWC Scientific Committee in 2006. Norway wants to set quotas for 5 year periods and is currently in the third year of a 5-year quota period. The increases next year will be based on a retrospective calculation, but ultimately quotas will reflect market needs.

In addition to exploitation objectives, Norway will examine the role of fin and humpback whales, and white-beaked and white-sided dolphins in the ecosystem. The first priority will be feeding studies on dolphins.

3) Coastal seals:

In consideration of common (harbour) seals and grey seals, Norway had a clear objective - stocks must be decreased. It is important to allow recovery of the cod stock. Quotas for seals set are an unsustainable 25% of the most recent population estimates. However, the catches have not filled these quotas, and the actual catches are thus probably sustainable. There are other fishery considerations such as competition and gear interactions, as well as seal/cod worm problems.

General information on EBM:

In Norway there is as yet no institutionalized framework for EBM, although in the Barents Sea there is some consideration in the capelin fishery.

Greenland

Fernando Ugarte reported that Greenland defers to the IWC through Denmark, for the determination of catch levels of large whales. Sustainability is thus determined by the IWC. For catches of all marine mammals, the objective is sustainability. Narwhal, beluga, walrus and polar bear, are of special concern because catch levels at the moment may be unsustainable. Currently, the immediate objective with respect to narwhal and beluga is to stop the present declines in these stocks, and therefore quotas have recently been introduced. These quotas are still higher than recommended for halting the population declines. The Scientific Committee have recommended a time limit for halting the population declines and in 2006, the quotas may be at Scientific Committee recommended levels. In the future, they also hope to introduce quotas on polar bears and walrus. Presently there is no regulation on harp and hooded seals. The lack of good population estimates for most species of marine mammals in Greenland makes it difficult to achieve adequate management plans. Greenland claims that implementation of regulations is difficult because of political and bureaucratic delays. There is a need for a better definition of what is meant by sustainability and for improved communication and consensus-building among stakeholders (i.e.: hunters, managers and scientists).

General information on EBM:

As of yet, there is no formal framework for EBM.

Canada

Mike Hammill and Garry Stenson summarised the position of Canada with regard to management of marine mammals.

1) Whales:

Here there are only native hunts for beluga, narwhal and bowhead whale. The narwhal and beluga stocks, that are shared by Canada and Greenland are regulated according to the advice of the JCNB. Here it is important to note that there are several different stocks of beluga – some of which are listed under Canada’s Species At Risk Act. Other stocks are managed by under a co-management agreement with the land-claims signatories or directly by the dept of Fisheries and Oceans, each with different management objectives.

2) Seals:

There are three species that are currently exploited commercially (harp seals and hooded seals) or have the potential for commercial exploitation (grey seals) . An objective-based fishery management (OBFM) approach with reference levels exists. Under this management approach, species are characterized as data rich or data poor depending on the number of abundance estimates available, the time since the last estimate and availability of information on reproductive or mortality rates. Harp seals are considered data-rich, while hooded and grey seals are considered data-poor . For data-poor species if their numbers are thought to exceed a level of 30% of their estimated maximum abundance then harvest levels are set using the Potential Biological Removals (PBR) approach. In the case of hooded seals an additional restriction forbids the taking of “blue-backs”(i.e. young). There is no market for adult hooded seals and thus very limited catch presently for this species. Harp seals are data-rich and abundant. The objective here is to maximize economic return, but maintain the population above reference level 1, which is 70% of the largest estimated population size. A 3-year management plan ended this year and a new management plan is being developed. This plan may be extended to 5 years. For a population to be considered data-rich, there have to be three population estimates, the most recent within 5 years, and recent biological parameters (reproductive and./or survival). There has been little interest in grey seals until now, primarily because of lack of markets. Since they are considered data-poor under the OBFM scheme, harvest levels are set using PBR, which is a very “risk adverse” approach.

General information:

EBM is being implemented, primarily in fisheries, but without any formal process. Presently, all seal management objectives are single species based without reference to fish dynamics. *Ad hoc* measures can be taken, e.g. no fishing for krill, and low capelin quotas to reserve food for fish.

Faroes

Bjarne Mikkelsen reported that no management objectives are established for pilot whales or white-sided dolphins, although catch levels are thought to be sustainable. Historically, all catches for these species are within the immediate coastal vicinity (ca 5 miles) of the Faroës and limitation on catching is determined and applied locally by the authority depending on the catch performance for that year and whether or not the need for meat is saturated. It was noted that the abundance estimates for pilot whales are difficult to determine because the distribution area is very large and not fully covered in sightings surveys. However, catches have been stable for 300 years.

The Faroes have also requested advice on sustainable harvest levels for fin whales from NAMMCO, but no takes are planned at present.

Grey seals and harbour porpoises, two resident populations, are also taken locally at very low levels. An initial future management objective for marine mammals could be to regulate the small defensive take of grey seals around fish farms.

General information:

There is no formal process at present for EBM. However, the Faroes are now looking at cod, haddock and saithe modelling in relation to ecological production on the Faroe Plateau.

Iceland

Ásta Einarsdóttir reported the management situation in Iceland.

1) Seals:

Iceland has a general objective of sustainable use. There is a specific objective for grey seals: to maintain the stock at current level and take protective measures if there is evidence of further decline in population.

2) Whales:

Iceland maintains an objective of sustainable use with respect to whales. Recommendations for allowable catch of fin, sei and minke whales are issued every year by the Marine Research Institute, although no fin and sei whales have been taken since 1989. The sustainable catch guidelines are conservative and based on assessments by the Scientific Committee of NAMMCO. Quotas will not be issued until commercial whaling recommences. There are no recommendations for blue and humpback whales.

Currently, a scientific programme for minke whales is underway. The main objective of the programme is to elucidate the ecological role of minke whales in the marine ecosystem off Iceland. So far, 100 minke whales have been caught and it is planned to take a further 100 in accordance with the original programme.. This level of catch is sustainable based on NAMMCO advice for a population estimate of 44,000 minke whales in the Icelandic area.

General information:

With respect to EBM, there is no formal system. Presently there is a management system for cod, capelin and shrimp, and modelling systems of BORMICON and GADGET including marine mammals are being developed, but are only in the initial stages.

In concluding the objectives and progress on EBM, Halvard Johansen reported that there was no Norwegian ecosystem-based framework although there were models being worked on with the precautions on the capelin harvest to reflect cod and whale consumption in the Barents Sea. Tore Haug noted that biological reference points were being developed for harp and hooded seals.

Fernando Ugarte commented that although Greenland currently had no policy on EBM, they were keen to learn how to implement it. He mentioned the recent establishment of a department of marine ecology in the Greenland Institute for Natural Resources, which would

be focusing on ecological studies in the Nuuk area. This would not include marine mammals initially but might do so in the future.

In Canada, Mike Hammill stated that although there was no EBM process at present, commercial fishing of krill was not allowed and Garry Stenson indicated that capelin quotas have been set low to allow food for cod for many years.

In the Faroes, Bjarni Mikkelsen stated that with respect to the GADGET modelling, they were waiting for the outcome of the Barents Sea case study before implementing the model in Faroese waters.

In Iceland, the Chairman reported that a multi-species model had been studied for several years on the capelin – cod – shrimp (earlier whale) interactions. Thus there has been some development towards ecosystem-based management.

13. Recommendations.

The *Ad Hoc* WG decided on **two main recommendations** as a way of advancing EBM within the NAMMCO system. The recommendations are listed below as two over-arching objectives:

Objective 1:

Promote the development of an ecosystem-based approach to the management of marine mammals currently under consideration by NAMMCO

- This would require a ‘holistic’ approach to the management of marine mammals that includes biological, environmental and socio-economic considerations. In order to advance this approach it is recommended to produce a framework or “shopping list” of what will have to be included in such an approach. The items could include, for example, issues such as climate change, pollution, competition for food, user knowledge (Traditional Ecological Knowledge), cultural needs, impact of fisheries on marine mammals, etc.
- It will be essential that specific management objectives relevant to EBM be developed and biological reference points be identified for marine mammal stocks of interest to NAMMCO (e.g. ICES/NAFO WG on Harp and Hooded Seals⁴). Currently, NAMMCO sets objectives on a single species basis without reference points.
- Recommend a specialist *ad hoc* group meet to develop a framework approach with an input from a variety of sources, as appropriate, possibly exploring some relevant case studies.

Objective 2:

Encourage member states to develop EBM approaches for their respective areas.

- These EBM approaches would include more than multi-species trophic models although such models could be included as a sub-component. It is noted that currently there are at

⁴ Report of the ICES/NAFO Working Group on harp and hooded seals (WGHARP). ICES WGHARP Report 2005. ICES Advisory Committee on Fishery Management ICES C.M.2006/ACFM:06, Ref. D, G.

least two multi-species trophic models under investigation in NAMMCO countries – Scenario C Barents Sea model for harp seal, minke whale, cod, herring and capelin, in Norway, and a GADGET based model for grey seals in Iceland (see NAMMCO Annual Report 2004, SC report, section 8, pp.227-229).

- These EBM approaches could build upon those developed in various parts of the world and identified during the ICES annual scientific conference special session in Aberdeen, 2005.
- Marine Mammals will be an important component of approaches in the NAMMCO area and therefore NAMMCO can play a significant role by:
 - 1) ensuring that the appropriate data on marine mammals are available as input;
 - 2) continuing to improve our understanding of all marine mammals that occur in these areas (i.e. not just the ones currently hunted, but those that may be important components of the ecosystem such as tourism, by-catch and fish consumers);
 - 3) promoting an awareness of ecosystem-based management with managers and the general public;
 - 4) coordinating inputs among regional approaches to ensure consistency in the way in which marine mammal data are incorporated.

These two objectives are not mutually exclusive and can be carried out in an incremental approach as recommended by FAO. Significant progress on Objective 1 can be made in the immediate future. Progress on Objective 2 may be slower and dependent upon priorities that are not under the control of NAMMCO. However, NAMMCO can address the issues under its mandate in order to have the important data available when required.

In addition to the above, it is suggested that when NAMMCO Council, through the MC, requests advice on harvest levels or a general stock assessment from the SC, they should also request that the SC comment on the ecosystem level effects of the options they advise. This could include comments on the effects on predators, on prey, by-catch, noise, disturbance, pollutants and other relevant issues. This advice could be given in a qualitative and/or a quantitative way, depending on the information and expertise available to the Committee.

Additional suggestions

In addition to the above recommendations there were some suggestions for consideration.

Funding

An important matter raised during the meeting was that of ensuring adequate funding is available for continued progress in EBM. It has already been noted that progress on ecosystem models within member states has not proceeded as fast as desirable because of inadequate resources (NAMMCO annual Report 2004, SC report, section on Workplan, p.231). NAMMCO may wish to actively explore ways to seek funding both internally and externally for advancing specific projects.

Socio-economic concerns

In proceeding with ecosystem-based management, socio-economic concerns should be identified specifically by area, and incorporated into the objective setting and management strategy decision process.

14. Closure

The Chairman thanked all participants for their helpful input, and the rapporteurs. The report would be drafted and circulated within a short time period after the meeting. Christina Lockyer in turn thanked the Chairman for his competent guidance and leadership in the meeting and for keeping to the schedule.

APPENDIX 1 – AGENDA

1. Programme Arrangements and Welcome
2. Adoption of Agenda and programme schedule (for ICES Sessions)
3. Appointment of Chairman and Rapporteurs
4. Goals of the meeting
5. ICES Opening day: Review of the Opening Session, General Assembly and Talk by Keith Sainsbury “The Ecosystem Approach to Fisheries”.
6. Review of the ICES Special Session – “Ecosystem Approach to Fisheries Management Worked Examples”; programme and presentation list on the ICES website: <http://www.ices.dk/iceswork/asc/2005/Programmespreadsheet.pdf>
7. NAMMCO Working Group discussion on the ICES sessions – relevance to NAMMCO
8. A history of EBM development – Jóhann Sigurjónsson, MRI, Reykjavik
9. Implementation of EBM – “Essentials for implementation of ecosystem-based management, and reference to work of FAO” – Christina Lockyer, NAMMCO, Tromsø
10. Discussion on Implementation of EBM
11. An ecosystem case study – Barents Sea. A presentation on Barents Sea ecosystem with emphasis on marine mammal fishery interactions – Ulf Lindstrøm, IMR, Tromsø
12. Objectives and experiences in Various Countries – with reference to management strategies and EBM
13. Recommendations – specific recommendations and suggestions to NAMMCO for the way forward on enhancing ecosystem-based management
14. Closure of the meeting.

APPENDIX 2 – LIST OF DOCUMENTS

- NAMMCO/MC/ECOWG/2 Doc.1 Enhancing Ecosystem Based Management: NAMMCO *Ad Hoc* Working Group Meeting, Aberdeen, 20-21 September 2005 – Schedule and Agenda.
- NAMMCO/MC/ECOWG/2 Doc.2 Enhancing Ecosystem Based Management: NAMMCO *Ad Hoc* Working Group Meeting, Aberdeen, 20-21 September 2005 – List of Documents.
- NAMMCO/MC/ECOWG/2 Doc.3 Enhancing Ecosystem Based Management: NAMMCO *Ad Hoc* Working Group Meeting, Aberdeen, 20-21 September 2005 – *Ad Hoc* Working Group meeting Participants.
- NAMMCO/MC/ECOWG/2 Doc.4 Report – revised 15 March 2003 - NAMMCO/13/MC/9rev: NAMMCO *Ad Hoc* Working Group on Enhancing Ecosystem-based Management, Copenhagen, 3-4 December 2003.
- NAMMCO/MC/ECOWG/2 Doc.5 Excerpt from NAMMCO Annual Report 2004: Report of the Management Committee, pp.142-143. Mandate for the *Ad Hoc* Working Group on Enhancing Ecosystem Based Management.
- NAMMCO/MC/ECOWG/2 Doc.6 Essentials in applying ecosystem based management to living marine resources – presentation summary (as handout).

APPENDIX 3 – PARTICIPANTS

| | |
|------------------------------------|--|
| Chairman | Jóhann Sigurjónsson, MRI, Reykjavik, Iceland |
| Secretariat | Christina Lockyer, General Secretary, NAMMCO, Tromsø, Norway Daniel Pike, Scientific Secretary, NAMMCO, Tromsø, Norway Charlotte Winsnes, Administrative Coordinator, NAMMCO, Tromsø, Norway |
| Council representatives | Halvard Johansen, Ministry of Fisheries, Oslo, Norway Fernando Ugarte, Greenland Home Rule, Nuuk, Greenland Bjarni Mikkelsen, Museum of Natural History, Tórshavn, Faroes Ásta Einarsdóttir, Ministry of Fisheries, Iceland |
| Inter-governmental representatives | Adi Kellerman, ICES, Copenhagen, Denmark |
| Invited Participants | Mike Hammill, DFO, Mont-Joli, Canada Garry Stenson, DFO, Canada Jake Rice, Canadian Stock Assessment, Secretariat, Ottawa, Canada Tore Haug, IMR, Tromsø, Norway Ulf Lindstrøm, IMR, Tromsø, Norway |

ANNEX 1

Implementation of EBM – a presentation by Christina Lockyer

The presentation illustrated the possible different perspectives of managers depending on whether fisheries or marine mammals are a priority. Two examples were presented:

- 1) Fisheries interaction in the Canadian N.W. Atlantic between harp seals and commercial fisheries for cod, where the cod fishery is unsustainable. The fishery subsequently collapsed although the seal population remains healthy, perhaps because of other prey options..
- 2) Fisheries interaction between Stellar’s Sealion in the N.E. Pacific and the local groundfish fishery, where the fishery depleted the groundfish stocks in the area and lead to diminished prey for the Sealion population with resulting mortality and lowered recruitment. The fishery can move elsewhere to other groundfish stocks but the sealions’ survival becomes threatened.

These cases illustrated the importance of management priorities and objectives and that there is always a cost in terms of biodiversity with exploitation.

The presentation continued with examples from Bax (1991)⁵ that showed the relative impacts of different predators in a variety of ecosystems through estimated yearly loss of fish (tonnes pr. km²) from predation / exploitation in six different ecosystems.

| Ecosystem | Birds | Mammals | Fish | Fisheries |
|------------------------------|--------------|----------------|-------------|------------------|
| <i>Benguela Current</i> | 0.3 | 2.6 | 56.5 | 1.6 |
| <i>Georges Bank</i> | 2.0 | 5.4 | 42.5 | 6.1 |
| <i>Bals fjord</i> | 0.0 | 0.0 | 14.1 | 1.5 |
| <i>Eastern Bering Strait</i> | 0.2 | 1.5 | 11.0 | 1.4 |
| <i>North Sea</i> | 0.6 | 0.1 | 7.0 | 4.4 |
| <i>Barents Sea</i> | 0.0 | 3.0 | 5.1 | 1.8 |

⁵ Bax, N.J. 1991. A comparison of fish biomass flow to fish, fisheries, and mammals in six marine ecosystems. *ICES Mar. Sci. Symp.* 193:217-224.

The two examples most relevant to NAMMCO were the North Sea and the Barents Sea, where in the latter, marine mammals comprise a significant consumer of fish, taking more than the fishery but less than predatory fish. In the North Sea, predatory fish and fisheries are more important than other predators. Such information on standing stocks and biomass with knowledge on predator-prey links is essential for an ecosystem approach to management.

Further examples were given: Barents Sea minke whale, harp seal, cod, krill, capelin and herring interaction, where it is clear that the ecosystem is dynamic with constant shifts in prey availability and preference by predators and that capelin plays a major role in determining ecosystem balance.

A list of types of institutions that might be consulted or collaborated with in implementing EBM was presented, along with the topics that might be embraced. These included:

- 1) Research institutions
 - Climatology – seasonal and longer term weather cycles
 - Oceanography – ocean temperature patterns and primary production
 - Environment – pollution issues etc.
 - Marine Biology – all levels and ecosystem
 - Fisheries – all aspects including by-catches and discards, advice on catch levels
 - Dynamic modelling – predictive, impact assessment
- 2) Commercial Fisheries
 - Marine mammals – whales in the open sea
 - Fish – trawls, set-nets, etc.
 - Invertebrates (shrimp, etc.) – dredge, trawls, etc.
 - Algae harvesting
- 3) Farming
 - Fish – especially those releasing fish to the marine environment
 - Algae
- 4) Hunters – both private individuals and commercial cooperatives
 - Marine mammals – whales, seals, walrus, polar bear, otters, etc.
 - Seabirds including egg-gathering
- 5) Socio-economic bodies
 - Economic trade-offs and subsidies – the human aspect
- 6) Governmental organisations
 - Control and regulation at national and local level – policy making
- 7) Inter-Governmental organisations
 - Control and regulation at international and regional level; even global level
 - Legislative possibilities
- 8) Non-governmental organisations
 - Watch-dog activities
 - Independent advice.

Presently NAMMCO has limited contact with several of these types of organisations, and stronger contact with others, and future contacts may depend largely on what level NAMMCO

wishes or is able to become involved in EBM. However, a broadening of perspective will be necessary when appropriate.

A specific but not exhaustive list of international organisations that might be most directly relevant for NAMMCO in collaborative management included ICES, ASCOBANS, ACCOBAMS, IWC, JCNB, NAFO, NEAFC, NASCO, OSPAR, AC, FAO, UNEP, UNESCO and IUCN, with most of whom NAMMCO already has observer relations. It may be mostly a matter of enhancing communication and exchange with these organisations. Currently, NAMMCO is preparing a Memorandum of Understanding with ICES, which will be a good vehicle for increased cooperation on EBM. With some organisations, there may be conflicting objectives e.g. between sustainable use and total protection such as in NAMMCO and ASCOBANS / ACCOBAMS. However, there may be more common ground than apparent when taking a broader ecosystem view of pressing issues threatening marine mammal species, that will enable cooperative action.

The key principles for an Ecosystem Approach to management based on the Convention on Bio-Diversity (CBD) decision V/6 are

- 1) The objectives of management of natural resources are a matter of societal choice
- 2) Management should be de-centralized to the lowest appropriate level
- 3) The effects of other activities on other ecosystems must be considered
- 4) There is a need to manage the ecosystem in an economic context
- 5) Ecosystem structure and functioning must be conserved, in order to maintain ecosystem services
- 6) Ecosystems must be managed within the limits of their functioning
- 7) Appropriate spatial and temporal scales must be set in place
- 8) Objectives should be set for the long term
- 9) There must be recognition that change is inevitable
- 10) The appropriate balance between conservation and use of biological diversity must be sought
- 11) All forms of relevant information must be considered
- 12) All relevant sectors of society and scientific disciplines must be involved.

In conclusion, in order to implement an ecosystem approach in management, one should start on the basis of existing knowledge and information and one should be incremental in approach. A chain of command with feedback is illustrated below and is based on information from Kevern L. Cochrane of Fishery Resources Division, FAO, Rome.



Finally, there were a number of potential obstacles noted that could impede the implementation of EBM. These were

- Mismatch between expectations and resources
- Reconciling a much expanded set of conflicting objectives
- Insufficient or inadequate participation by stakeholders
- Insufficient knowledge
- Equity issues.

ANNEX 2

An ecosystem case study – Barents Sea – a presentation by Ulf Lindstrøm

The presentation suggested that northeast Atlantic minke whales' use of prey varies considerably both in space and time, mainly due to geographic differences in the distribution and availability of favourable prey. Capelin and krill dominate the whale diets in the northernmost Arctic areas while herring is the major prey in the southernmost coastal areas. Small and medium scale prey preference studies, however, suggest that capelin is the most preferred prey species.

Changes in minke whales' use of prey and habitat during the past decade appear to correlate well with changes in the abundance of their favourable prey (capelin and juvenile herring). By adopting a flexible foraging behaviour, minke whales may to some extent compensate for changes in food availability without compromising their energy status.

Minke whale consumption of prey in the northeast Atlantic has been assessed but no practical use of this knowledge has been made for the management of the resources in this ecosystem until more recently. Minke whale predation on herring was implemented in the assessment model of herring. The result suggest that minke whale predation of herring affects the assessment of herring; the estimated stock sizes of juvenile and adult herring decrease 20% and 35%, respectively, compared with the baseline assessments. The predation mortality constituted almost half the total natural mortality of adult herring but only 10% of the total juvenile mortality.

More recently, the functional response has been assessed at various spatial scales. Minke whales exhibit a hyperbolic (type 3) functional response to their favourable prey implying that minke whales have the potential of stabilising predator-prey dynamics in the Barents Sea. Russian / Norwegian aerial surveys in the northern Barents sea in 2001-2004 indicated that several sea mammal predators use the same habitats, and perhaps food, both in time and space. The distribution of Barents Sea harp seals did not overlap with the distribution of capelin and polar cod, suggesting that they are exploiting other prey in that time period.