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1 OPENING OF THE MEETING

The Chair, H.R. Skjoldal, opened the meeting at 9.40 hrs and welcomed the members. He commended the members who had provided the draft texts for their agenda items in advance of the meeting, as well as the working groups that had provided material for this meeting. He also commended the Secretariat for their efforts in preparing for the meeting.

The pre-draft has been on the ACE website since 15 May and the Chair noted that ACE must carefully consider this draft material with the aim of quality review and the development of advice. First priority at this meeting must be given to requested advice. Care must also be taken not to give advice that may be in conflict with that of the other Advisory Committees, particularly ACFM.

The list of participants of the meeting is contained in Annex 1.

2 ADOPTION OF THE AGENDA AND SCHEDULE OF THE MEETING; DESCRIPTION OF PROCEDURES

The draft agenda was reviewed. Many of the items relate to OSPAR requests, three relate to HELCOM requests, and most of the remainder relate to EC requests. The agenda was adopted as proposed.

The timetable was reviewed. It was agreed that the nominations for Chair would take place at 15.00 hrs on Monday, with the election on Thursday afternoon after the coffee break. The timetable was adopted, with the proposal that revised sections of the report be reviewed as they become available.

S. Jennings proposed that, based on last year's report, an executive summary be prepared for each section of the report, to be inserted after the statement of the request and the list of sources used. This could be one-half to one page long. Then the advice and recommendations could follow, with ultimately the full background material that was used to develop the basis for the recommendations.

ACE agreed that an executive summary would be included after the list of sources. Thereafter, the advice and recommendations should be provided.

ACE discussed the detail that should be included in the background material taken from the Working Group reports. It was mentioned that the environmental Commissions usually use the entire scientific background material, without going back to the Working Group report, while on the fisheries side, there is a very brief summary and the Commission needs to refer back to the Working Group report for the details. It was proposed that the client Commissions be requested to comment on how much of the background material they actually use in their work.

It was agreed that this year there should be an adequate summary of the working group report so that the client Commission does not need to go back to the working group report, but that the Commissions should be requested to inform ICES of the level of detail that they require.

3 INFORMATION RELATING TO OTHER FOR A

3.1 Conference on a European Strategy for the Marine Environment

Information was presented on this Conference, which took place in December 2002 in Denmark.

3.2 Global Ocean Ecosystem Dynamics (GLOBEC), including ICES/GLOBEC Working Group on Cod and Climate Change (WGCCC)

K. Brander provided a progress report on the work of the Working Group on Cod and Climate Change (WGCCC). This group has prepared a work plan until 2009. Under the GLOBEC work, he reported that he, as GLOBEC Project Officer, will take part in the IPCC, which will now concentrate on the effects of climate change. The GLOBEC Steering Group is presently working on developing a case for ICES to establish a position on the ICES Secretariat for a scientist working on fisheries in relation to the environment.

3.3 Global Ocean Observing System (GOOS)

In relation to GOOS, the Chair noted that ICES has a Steering Group on GOOS, co-sponsored with IOC. This group has established a North Sea Pilot Project (NORSEPP), which will work using existing resources to obtain information on operational oceanography in time for it to be used in fish stock assessments.

3.4 Global International Waters Assessment (GIWA)

ICES has been requested by the Executive Director of UNEP to prepare assessment reports using the GIWA format for the Northeast Atlantic, however, this request was not adequately detailed for ICES to be able to respond at the present time. The Chair reported that reports have been prepared for a number of regions in the world. These reports have identified the key environmental problems in relation to fresh and marine waters in the areas that have been assessed.

The Chair reported that there is now a process to establish a global system for marine assessments being developed under UNEP.

3.5 IOC/IUCN/NOAA Consultation on Large Marine Ecosystems

The Chair reported that there was a meeting at IOC in March 2003 on Large Marine Ecosystems. There are now about fifteen GEF regional projects covering shared marine areas that have been or are being established. The map of Large Marine Ecosystems has been revised, particularly in the Arctic area. The Nordic Seas are also being reviewed in this context.

4 EVALUATION OF THE POPULATON OF SEALS AND HARBOUR PORPOISES IN THE BALTIC SEA

K.-H. Kock presented a brief summary of material from WGMME, without recommendations at the present stage.

As the recommendations were not included, it was agreed that this text would be expanded to include more information from the WGMME report and draft recommendations to HELCOM. It was agreed that the extended text would be developed during the day and distributed later on Monday.

A second text was presented containing the full information on the status of marine mammals in the Baltic Sea, including an executive summary and advice. There were comments to tighten up the advice; it was agreed that the summary and advice from this section would be reviewed once again before finalizing this section.

It was noted that the advice states that upper limits should be set on intentional killing, but no limits have been proposed. This is inconsistent with other sections of the ACE report. Nonetheless, it was decided to keep this advice.

5 MONITORING PROGRAMME FOR ESTIMATING THE ABUNDANCE OF SEALS AND OTHER MARINE MAMMAL POPULATIONS IN THE BALTIC SEA

A. Krovinin had not prepared a text for this item.

It was reported that this request from HELCOM is to provide one methodology for the estimation of the population size of seals in the Baltic Sea so that there can be agreement among the countries around the Baltic Sea on actual population estimates of seals. If we are going to provide technical advice on this issue, we need to be clear and also pragmatic as to the resource demands. It was felt that ACE should come up with one methodology that reflects the science and also reflects the financial and resource realities of the Baltic region.

6 BY-CATCH OF CETACEANS IN FISHERIES

The EC representative pointed out that in the 2002 ACE report the text mentioned the use of pingers in the Baltic Sea, but this was not included in the recommendations at the end of the section.

M. Vinter presented a draft section for this item, based on the WGMME report. The material for the Baltic had been left out, as this is included under agenda item 4. However, it was pointed out that this section is for a different client than that for agenda item 4, so the brief amount of material on the Baltic Sea will be inserted in this section also.

The issue of seasonal distribution of cetaceans was raised and it was queried whether this should be added to this section, as it appears that harbour porpoises are becoming more common in the southern North Sea during certain seasons. It was discussed whether some additional material should be added that was not included in the Working Group report. It was felt that if there is a clear reference to be cited with the new material, this may be useful; however, in this case it may be best to remit the issue back to WGMME for a more detailed consideration of the issue of seasonal distributions of cetaceans in the ICES area. This could be identified as a term of reference for WGMME in 2004.

It was agreed that, although there were no new recommendations, a clear statement should be made that the recommendations from last year remain valid.

7 OVERALL CONSIDERATION OF THE APPROACH TO AND FRAMEWORK FOR THE RESPONSE TO THE OSPAR REQUESTS ON ECOLOGICAL QUALITY OBJECTIVES

C. Frid presented a brief overview of the background to the OSPAR request. He pointed out that this section will really be written based on the handling of the other agenda items on EcoQOs. He also stressed the importance of integrating all the material on EcoQOs into one section, with a single statement of the request and the sources of material.

The issue of EcoQOs on threatened and declining species was raised, as it has been questioned as to whether EcoQOs are appropriate for use with regard to threatened and declining species. There is an issue of hierarchy in approach and this should be kept in mind when reviewing the material prepared on the other items regarding EcoQOs.

The Chair noted that the history of the requests on EcoQOs is that, at the Third North Sea Conference in The Hague in 1990, the ministers requested the development of ecological objectives for the North Sea. This was first taken on by the North Sea Task Force, and thereafter by OSPAR. Ecological quality objectives were proposed as one component of an ecosystem approach to marine management, and the basis of these objectives has been developed at a series of workshops. A commitment to EcoQOs was made by North Sea ministers at the Fifth North Sea Conference in Bergen in March 2002. EcoQOs are to be considered as a set and should be applied in a consistent framework, along with other forms of regulations in relation to ecological quality.

It was pointed out that, in the OSPAR background document on EcoQOs, it states that reference levels should relate to the level of the EcoQ where the anthropogenic influence on the ecological system is minimal; this definition will need to be used in our work. We will need to state whether reference levels can be determined by a relevant method; if not, a proxy will be needed.

For some human uses of the ecosystem, there is no inherent reason why you need to move away from a reference level, e.g., it is not inherent in the use of chemicals that we contaminate the environment. For other activities, such as fishing, the human activity by its nature perturbs the level of fish stocks and, thus, the "reference level in the absence of anthropogenic activity". However, in fisheries we will never know what the reference level was, but there are objectives that can be developed for fisheries based on societal objectives and sustainable use. The reference level is not the target, but it is used to help set the target. It was proposed, however, that the direction of movement of the metric is an important issue, without specific targets. Furthermore, the choice of the target is a societal choice and not a scientific choice.

It was proposed that ACE produce a template so that next year each working group contributing to the development of EcoQOs can fill in this template with regard to the EcoQOs under their remit. Much of the material to fill in this template already exists, but in different forms. This template will help both the working groups as well as ACE next year when a final handling of this issue will occur.

It was felt, however, that given that many of the EcoQOs are failing the criteria for good EcoQOs but that they are now part of the political process, it would be best to see how we can take these EcoQOs forward in a useful way. It was pointed out that a SCOR working group is working on the development of ecosystem indicators; this group is using criteria similar to the ICES criteria for good EcoQOs and most metrics of ecosystem quality fail the application of these criteria. Nonetheless, some appropriate indicators need to be developed, more based on use.

Even though scientists may not want to advise on target levels, we can advise on upper bounds of a metric as well as on lower bounds, based on sustainability.

From the management side, the need to have different metrics is important. It could be useful to develop a matrix with the types of management objectives on one axis and the types of management measures on the other axis. This can be

evaluated on the basis of a set of criteria. For example, fisheries management needs more long-term objectives because presently management is responding only to short-terms needs.

We should indicate to OSPAR the scope and potential to correct situations that the EcoQOs are intended to correct.

In summary, it was agreed that a template should be developed to provide a structure for the further development of EcoQOs and guide the working groups that are developing the work. We should also develop further thinking about the uses of the EcoQOs and how they can be best applied. The current texts on EcoQOs will need to be reviewed for consistency and adjusted.

In the final review of the report, it was mentioned that there is no explanation of the analytical method used in the review of the EcoQOs.

8 DEVELOPMENT OF ECOQO ELEMENT (C) SEAL POPULATION TRENDS IN THE NORTH SEA

K. Gunnarson presented a draft section on this topic, based on material from the WGMME. Unfortunately, there is a lack of information on the size of the seal populations since the epizootic in 2002, and the WGMME did not recommend a method for monitoring the population size of seals. Also, WGMME did not provide information on seal populations from areas not influenced by the epizootic, even though this was available in some of the source material. Given these deficiencies in the working group report, K. Gunnarson recommended that this issue be remanded back to WGMME for further handling next year.

In the discussion, it was pointed out that the post-epizootic population should not be used as a basis for an EcoQO, but rather a previous baseline should be used. In discussion of whether no information should be presented this year, but wait for further information from the 2002 Working Group report, it was decided that a detailed request should be made for WGMME for 2004 so that all the required material can be prepared for next year. The influence of the epizootic on the EcoQO should also be considered by WGMME.

It was noted that there is a close relationship between this issue and that in agenda item 14 on the utilization of seal breeding sites in the North Sea, and this should be kept in mind in the request to WGMME.

It was suggested that some of the material from the WGMME report on census methods for marine mammals could be incorporated into this section of the report.

The group working on this item should continue working on the text and ACE will determine later how much of this should be included in its report this year and how much should wait until next year. A final draft was subsequently approved.

9 DEVELOPMENT OF ECOQO ELEMENT (E) BY-CATCH OF HARBOUR PORPOISES

M. Vinther presented a draft section for the report on this issue, mainly following the WGMME handling of the topic. Management measures have not been stated in this text as they were provided in last year's report in response to the EC request. In addition, it is the EC that has management responsibility rather than OSPAR. The issue of population structure in relation to SCANS areas was considered. This part of the WGMME report has not been included in the draft ACE section, and this was discussed. Some mention of the geographical aspect will be considered for inclusion in this material.

10 DEVELOPMENT OF ECOQO ELEMENT (A) SPAWNING STOCK BIOMASS OF COMMERCIAL FISH SPECIES

F. Borges presented draft text based on material from WGECO.

In the discussion, P. Degnbol, Chair of ACFM, stated that the precautionary approach reference points are in the process of being reviewed and revised. He noted that the Bergen Declaration has misinterpreted the precautionary reference points for spawning stock biomass, and it would be useful for ACE to correct this misconception. The Bergen Declaration states that the biomass must be above the precautionary limit, however, it is the estimated biomass that is covered by the precautionary approach, and not the true biomass. The precautionary reference points are being used by some groups as target limits, but they have been designed so that they are a point for which the estimate may be above or below that point on average 50% of the time.

J. Rice stated that he has been involved in the meetings that have developed the reference points and he agreed that the Bergen Declaration should have stated "biomass estimate", not the biomass itself. This is owing to the Bergen Declaration being a political and not a scientific document. This can easily be corrected. On the issue of whether the PA values are targets or limit values, ACFM has repeatedly stated that PA reference points are reference points and not targets; they are intended to be lower bounds and not targets.

The Chair stated that these concepts should be written in simple language so that they can be understood by OSPAR and people associated with OSPAR.

It was felt that the terminology used here: hits, misses, and false alarms, can be very misleading. We should be very careful in the terms that we use here. It was pointed out, however, that this terminology has been used for a long time in other contexts, in signal theory. However, this language is more easily used when the result of the action can be measured immediately, rather than in the case here where a new estimate is made of the spawning stock biomass, which cannot be measured directly. It was further pointed out that the use of the word "failure" does not mean a conservation failure, but reflects whether the advice provided was correct or not within the framework under which the advice is provided. "Failure" represents a failure of ICES to give the correct advice within our own framework.

The Chair of ACFM pointed out that this is an annual management system, so that failures in one year can be corrected in the next year. Failures can be corrected later on. He did not have problems with the analysis for what it is, but would like to see further work so that a more multi-year perspective can be given to this analysis.

The Chair summarized by stating that OSPAR will not be involved in fisheries advice, so it is important to clarify the basis of the advice on fisheries in relation to the precautionary approach. He proposed that a simpler feedback be given on this EcoQO and that this analysis be further developed in association with ACFM.

EcoQOs are intended to be targets not limits, and this must be taken into account in the further development of this EcoQO. It was noted that one of the problems here is the difference in interpretation and usage of the terms "reference points" and "reference levels" between ACFM and OSPAR. However, in the OSPAR background document on EcoQOs, it specifically states that the use of the terms should be the same as that in ICES for fisheries management.

There was discussion as to whether this text should be included in the ACE report. It was pointed out that this represented the most thorough analysis of any of the EcoQOs requested by OSPAR, and it would be amiss not to include this analysis. It was proposed that two explanatory texts be included here: 1) discussion of the performance of this analysis based on the expected distribution; the actual distribution depends on the status in relation to the reference points: if the status is close to the reference point, there is a different situation from when the status is far from the reference point. 2) The element of time should be added: this is a control system relative to time, so that mistakes can be corrected later on.

It was stated that the text should be modified so that every member of ACE can understand it, so that this text can be conveyed to the outer world.

It was agreed that this text should be included in the report, after simplifying the text and including some caveats regarding the basis for this analysis. The distinction between estimate and true biomass should be clarified. The outcome of the analysis should be clarified, to show that the results show that management decisions are generally very good. The distinction should also be made between the EcoQO that spawning stock biomass remains above precautionary reference points, whereas the fisheries managers have been treating these points as target values.

An amended draft of this text was extensively reviewed. It was discussed whether the EcoQO should be based on B_{pa} or B_{lin}; it was pointed out that B_{lim} is the Biomass used as a conservation limit, below which tocks should not be allowed to fall. B_{pa} is used as a tool to keep the risk of the "true" stock from falling below B_{lim}, given the uncertainties in the annual estimates of Biomass. Hence any EcoQO on Spawning Stick Biomass should minimally keep stocks above B_{pa}.

This section was adopted after further revision.

11 DEVELOPMENT OF ECOQO ELEMENT (f) PROPORTION OF OILED COMMON GUILLEMOTS AMONG THOSE FOUND DEAD OR DYING

M. Tasker presented a draft section of the report based on material from WGSE.

Based on this material, it was noted that ICES does not have access to the data on beached or oiled birds, and it was queried whether ICES should have a role in the international coordination of these surveys. In the discussion, it was pointed out that this coordination role would be a major effort, however, ICES should have a role in the review of the results. The criterion of 10% is based on the chronic background level of oil in the North Sea, which seems to be a lower limit to the amount of oil commonly present in the North Sea.

ACE reviewed the draft advice based on this material and accepted it, with some additions to the recommendation on the analysis of pollutants on the oiled birds.

12 DEVELOPMENT OF ECOQO ELEMENT (O) DENSITY OF SENSITIVE SPECIES

The consideration of this item was merged with agenda item 13.

13 DEVELOPMENT OF ECOQO ELEMENT (P) DENSITY OF OPPORTUNISTIC SPECIES

C. Frid stated that the material that should have been produced by the Benthos Ecology Working Group was not available for the WGECO meeting, as BEWG met later than WGECO. Thus, WGECO had made a start on this topic and sent this material to BEWG to add the necessary material to provide a full response. Unfortunately, BEWG did not add to the material, but simply provided a critique of the WGECO text without completing it. The draft text was thus mainly from the WGECO report, and was accompanied by the recommendation that a workshop be held to bring this topic forward.

ACE noted that BEWG had not conducted adequate work on this topic and felt that this message should be conveyed back to the Chair of BEWG. BEWG should be made aware that ACE is depending on their work and should make greater effort to handle requests from Commissions in a thorough manner.

The recommendations in this section include a recommendation that a workshop be held to develop criteria for, and then identify, the species that should be considered as sensitive or opportunistic species. This workshop should draw upon as wide a community of expertise as possible. Noting the importance given in this material to the relationship between the benthos and their habitat, it was considered that this workshop could be expanded to cover EcoQOs in relation to habitats also. With these comments, this section was accepted.

14 COMMENCE DEVELOPMENT OF ECOQOS

14.1 EcoQO element (d) Utilization of seal breeding sites

J. Haelters presented draft text based on material from WGMME. There was little information in the WGMME report.

This text was accepted, with the request that a summary be prepared.

14.2 EcoQO element (g) Mercury concentrations in eggs and feathers of seabirds

J. Haelters presented a draft text for the report based on material from WGSE.

There were several comments concerning this draft. The issue was also raised with regard to the basis on which the reference levels are chosen. In this case, pre-1900 levels of mercury in feathers of seabirds have been used as reference levels, and it was questioned whether this should be the basis for the selection of reference levels for all EcoQOs, when possible. It was commented that working back in time might not be the best way to determine reference levels. It was proposed that ACE discuss the basis for the selection of reference levels at this meeting, so that working groups can be informed of this choice and can act on it at their 2004 meetings. It was questioned whether reference levels actually need to be established, but rather target directions, as are used in indicators. This, however, does not fit into the scheme established for EcoQOs.

This section provides information on current levels and reference levels of mercury in the feathers of several seabird species. There are also some suggested target levels for this EcoQO, and it was felt that the choice of these target levels was not adequately explained. It was proposed that a clear explanation of these target values be given in this section. ACE agreed that this is a critical issue and the criteria for the choice of reference and target levels should be decided at this meeting of ACE.

It was agreed that ACE would return to this discussion later in the week, based on preparatory work by the subgroup on agenda item 7. Members should consider this and prepare for the discussion later during this meeting.

Changes to this text were subsequently reviewed and the text was generally accepted, with the request that a summary be added at the beginning. There was discussion on the proposed objective for the metric at 1.5 times the measured reference level. Given that ICES has always stated that objective levels should be based on societal values, the statements surrounding this proposal need to be modified.

14.3 EcoQO element (h) Organochlorine concentrations in eggs of seabirds

J. Haelters presented a draft text for the report based on material from WGSE.

The need for a sampling programme in relation to this EcoQO was noted, as this is very relevant to the derivation of the reference levels. In response, it was pointed out that the EcoQOs under this agenda item are considered to be in an earlier stage of development, which does not yet request the development of methodology in relation to assessing compliance with the EcoQO. This text was generally accepted for the report, however, there was discussion on the proposed concentration values for the EcoQO. It was pointed out that this objective is related to reducing the concentrations of organochlorines in the environment, and not to potential effects on seabirds, but the correct phrasing needs to be used in association with the proposal of these values.

14.4 EcoQO element (j) Plastic particles in the stomachs of North Sea seabirds

J. Haelters presented a draft text for the report based on material from WGSE.

In the discussion, it was questioned whether if this EcoQO were met it would influence other relevant EcoQOs, such as the number of oiled guillemots. The relationship between EcoQOs should be considered.

With several amendments, this text was accepted for the report.

14.5 EcoQO element (j) Local availability of sandeels for black-legged kittiwakes

J. Haelters presented a draft text for the report based on material from WGECO and WGSE. Based on the report of these two groups, he concluded that this EcoQ did not meet three of the criteria for a good metric of an EcoQ, namely, those concerning a close relationship to a human activity.

It was pointed out that this conclusion is for the use of kittiwakes as an EcoQO and does not affect previous advice regarding the regulation of sandeel fisheries based on kittiwake breeding success.

The question of ecological relevance was brought up. It was noted that the criteria for good EcoQ metrics agreed by ACE in 2001 are a second stage set of criteria to screen metrics that have been identified as ecologically relevant to determine the possibility to use them in management. However, seabird breeding success has a strong ecological relevance, and this was strongly argued when this metric was proposed.

It was proposed that this EcoQ metric not be dropped, but that the limitations on its use should be described clearly and openly. No metric is perfect, but the performance of the metric should be described and the positive aspects as well as the negative aspects of the performance should be indicated. The point was made that the relationship between sandeel abundance and kittiwake breeding success will be weak and it can be more difficult to determine on a broader scale than on a more local scale.

It was pointed out that if there is new evidence that has an influence on the advice provided in 1999, even though this issue has been brought up by OSPAR, this new advice should be reported for the EC to be used in the review of the regulation regarding sandeel fishing. The question is being considered in the EC as to whether to continue this type of fisheries management. Nonetheless, the issue under consideration here is related to EcoQOs and not fisheries management, and advice on EcoQOs does not cover the fisheries management question.

It was proposed that this text be modified so that it does not stop the development of this as an EcoQO. There will be a review of the performance of the EcoQOs in 2004, at which point further development may be stopped. As OSPAR is asking ICES to develop this EcoQO further, we should indicate what steps are required to further develop it. For example, there are data on local sandeel availability, but these have not yet been brought forward. These data could be

reviewed together with data on kittiwake breeding success next year. It might also be possible to compare the death of kittiwake chicks in relation to predators or storm events, so that breeding success can be corrected for other causes of mortality.

This issue will be handled again next year in the light of additional information. Possibly the EC will submit a new request concerning the management of sandeel fisheries in relation to kittiwake breeding success, to review the ICES advice of 1999.

In finalizing the discussion on this item, ACE stressed that it is important to get the right people with data on sandeel abundance together to assess the situation. The conflict of the EC question regarding sandeels and the EcoQO on this topic has created problems with handling this issue, as there is a distinction between how to handle these two situations. MCAP is requested to consider how to handle the two sides: 1) fisheries management in relation to sandeels, and 2) the EcoQO issue, presently in the OSPAR context.

14.6 EcoQO element (k) Seabird population trends in the North Sea as an index of seabird community health

J. Haelters presented a draft text for the report based on material from WGSE.

ACE discussed the issue of choosing which species should be included in this EcoQO. Clearly, a good possibility for monitoring is an important aspect of this choice. Various other factors must be considered as well, including past time series of population trends.

A second draft of this text was reviewed and further comments were provided.

15 DEVELOPMENT OF ECOQO ELEMENT (L) CHANGES IN THE PROPORTION OF LARGE FISH

S. Tjelmeland presented a draft text based on material from WGECO and WGFE. He felt that these metrics fail several of the criteria for good EcoQ metrics and, thus, that these metrics should not be implemented at the present time. It would be better to have a metric based on old fish rather than long fish, which would also provide a closer link to ACFM and its way of working.

In the discussion, the working groups were commended for their analysis and documentation of the changes in length structure of fish populations. This metric may be considered one of the more long-term metrics.

ACE discussed whether the full coverage of this topic in WGECO should be presented by ACE or whether a clear, brief summary should be presented. The firm conclusion should be provided that this metric does not fulfill the criteria for a good EcoQO. Many analyses have now been made of the relationship between fishing effort and changes in the proportion of large fish and they have not shown a clear relationship.

The question was raised as to how ACE can convey the message that this metric is not useful as an EcoQO, so that it is clear that further development of this metric should not be conducted. However, we must know what use is going to be made of this indicator. In the context of the current fisheries management, this is not a good metric. Nonetheless, the loss of large fish from the ecosystem is not something to be ignored. It is necessary for ACE to discuss the use of EcoQOs to be able to decide what advice to provide on this EcoQ metric.

It was noted that work on this metric was supposed to be based on a Dutch report that was intended to study the performance of this metric. However, the study actually reviewed a different metric, and this should be reflected in the summary for this EcoQ metric.

The Chair of ACFM noted that the use of these metrics in a management context is a key factor in the development of advice on the metrics. Advice could be geared to indicating appropriate management schemes for each EcoQO.

A revised draft of this text was reviewed. The issue of the use of this EcoQ metric in longer-term fisheries management was discussed; it was clear that it cannot be used in short-term management, but the potential for long-term use was retained. With some amendments, this text was accepted.

16 REVIEW EVIDENCE FOR THE JUSTIFICATION OF SPECIES ON THE DRAFT OSPAR LIST OF THREATENED AND DECLINING SPECIES AND CONSIDER THE DEVELOPMENT OF ECOQOS

M. Skold presented draft material from the WGFE report along with some additional material on marine mammals that was prepared during the meeting.

In the discussion, it was felt that the species that have been reviewed this year should be distinguished in some way from those that were reviewed in 2002. The heading for the fourth column, on priority for the whole OSPAR area or specific regions, should be reworded to make it clearer what is being rated. It was also pointed out that, for some of the habitats, there is a need for further evidence before they should be put on the list of threatened habitats, but no such evidence has been forthcoming during the past year. It was questioned whether the habitats without such evidence should be included on the list.

It was felt that for those habitats for which there is no information on existing threats, this should be stated along with the assurance that if a threat should arise in the future, this will be taken into account. It was pointed out that a distinction should be made between threat and decline. Where there is no evidence of decline, this should be stated. However, with regard to threat, if there is a political will to use a precautionary approach, e.g., with regard to *Lophelia* reefs, this is up to the policy makers. A differentiation should be made between hypothetical threats and real threats, because managers need to be able to justify their regulations that affect the interests of third parties. It was pointed out that it was not clear why certain of these habitats have been chosen for inclusion on this table. However, it was felt that changes should not be made to items on the table from last year's report; only new information should be included to cover the species not treated last year.

It was agreed that the newly assessed items on the table will be identified and no changes will be made in the advice from last year.

The issue of the precautionary approach in relation to habitats was considered important, as theoretically all deep-sea habitats could be threatened by bottom fishing gear or other bottom disturbance. However, this should be seen in the context of a pragmatic approach to regulation as well as self-regulation by the fishing industry, which also wishes to avoid damage, at least to its fishing gear.

ACE later reviewed the advice, including a reworked table from the 2002 ACE report on the threatened and declining species and habitats on the draft OSPAR list. The final column in the table had been split into two columns to cover the distribution of the species and where it is under threat or in decline separately. All species have now been covered in this table. The habitats that had been covered in 2002, but were not on the request, were also removed. The background evidence was not prepared according to the structure used last year, which answered the question of whether the evidence supported the nomination. WGFE instead reviewed the evidence against the Texel-Faial criteria, which had not been asked for. This supporting material will be attached to the ACE report as an annex.

Concern was expressed that changes were made to the advice provided last year, without providing evidence as to why the view has changed. The new material will be documented, but the other changes were made so that the advice was more consistent and clear. A statement to this effect will be made in the text. The new species will be highlighted in bold.

The review of cod was discussed in the light of an apparent improvement in the Northeast Arctic cod stocks, and it was pointed out that the application of criteria for threatened and declining to commercial species of fish has been questioned. However, it was pointed out that the criteria for decline concern decline on a longer-term basis, even if there may have been a recovery for a year. It was felt that this review should be on the basis of the evidence presented for threat to these species, without comment on whether these criteria are correct or not. While it is clearly important that ICES avoids conflicting advice on this very important stock, nonetheless, the Northeast Arctic cod stock meets the criteria for a decline under the Texel-Faial criteria (and IUCN criteria). In this case, it is the criteria that are the problem, and the advice is not conflicting even if ACFM may ultimately decide to increase the quota on this stock this year.

The use of the adjective "strong" and other adjectives in evaluating evidence was questioned. It was noted, however, that the adjective related to the strength of the evidence, not the strength of the decline in the species. It was decided that "strong" and "good" should be replaced by "sound".

17 PROGRESS IN MARINE HABITAT CLASSIFICATION AND MAPPING IN THE ICES AREA, INCLUDING IN THE BALTIC SEA

P. Keizer presented a draft text based on material from WGMHM. This is in response to a request from HELCOM, which does not seem to be very precisely worded. Only a small amount of work has been carried out for habitat classification in the Baltic Sea, and the development of a classification system for the Baltic will need to be the subject of a dedicated workshop, which is being planned.

It was proposed that the recommendations be expanded and that potential links with the Baltic Sea Regional Project be examined.

18 NEW INFORMATION ON THE OCCURRENCE OF COLD-WATER CORALS IN THE NORTH ATLANTIC AND THE FISHERIES OCCURRING IN THE NORTHEAST ATLANTIC

T. Noji presented a draft text based on the SGCOR report, along with some information on cold-water corals in the Northwest Atlantic. This contains updated information since last year's ACE report. The recommendations have been expanded to include all cold-water corals, not just *Lophelia* and hard corals. They also recommend expanding the work of SGCOR to include cold-water corals in the Northwest Atlantic, to better assess the impact of fishing on corals in the North Atlantic as a whole.

The recommendations also include that work on the species associated with cold-water coral reefs and their importance should be carried out, also in identifying the extent to which such species depend on the coral habitat.

The spatial scale of closures to fishing should be discussed to ensure that they are useful for the protection of the structures that we wish to protect. These statements should, however, be substantiated with clear evidence, e.g., in relation to the accuracy of the deployment of fishing gear.

It was noted that the EC would like precise coordinates on which areas should be closed to protect cold-water corals. There is also the issue of effective enforcement in relation to setting the boundaries, given current satellite systems or other means of surveillance for compliance.

The EC observer stated that they would like as extensive and detailed maps as possible so that all areas with coral reefs can be identified and a priority can be made with regard to protection against bottom fishing. The pressure is mounting to protect coral reefs, so clear identification needs to be made of the areas where such reefs occur.

It was reported that Norway has established a homepage on corals, and has enacted laws to prevent destructive practices of fishing in areas of coral reefs.

19 RELATIVE IMPORTANCE OF EXTRINSIC FACTORS ON FISH POPULATION DYNAMICS COMPARED TO FISHING

S. Lens presented a draft text based on material from WGECO. This has been summarized from much longer material from WGECO to provide a clearer response.

The EC observer stated that the request is intended to place the management of fisheries in the context of the other factors impacting on fish stocks, so that it is clear that other activities that have an influence on fish stocks are also being managed to the extent possible.

The comment was made that the impact of predation may be underestimated, particularly that by harp seals in the Barents Sea.

It was felt that the most important factors on a broad basis should be focused on because there are many special cases that can be mentioned, but these will obscure the general message, which is what should be provided here.

The assumptions underlying the conclusions of this material should be stated in the text, so that it will be clearer to readers why the specific issues have been chosen.

The question was raised as to whether temperature as a factor would fully cover the impact of climate variation. The issue of the scale on which the factors operate has not been covered, but where scale is mentioned this may need to be clarified. The issue of regime shift is also a question.

In reply, it was stated that this was as far as WGECO could go in the handling of this issue with the time they had at hand.

There was a question concerning the impact of these extrinsic factors on the recovery of collapsed fish stocks, as these factors may have a greater impact when the stock size is very low.

It was felt that the lack of evidence for, e.g., the influence of pollution on fish stocks should also be mentioned in this text.

It was proposed that four things be added to the text: 1) stocks that are collapsed are likely to have a different set of factors than stocks that are not collapsed, but fishing is still the cause of the collapse; 2) making clear at the beginning that there will be exceptions to everything stated in this text; 3) oceanographic influences are very important and the literature has been reviewed, but there may be an underestimate of these influences; and 4) there is no evidence in the literature for the influence of pollution on stocks. It was also noted that the time scale is important in these considerations and we should deal with long-term aspects, based on trends. It should also be mentioned that biogeographical changes are likely to be observed based on the climatic changes that are occurring.

The revised text was considered and questions were raised about the balance of the material with the new material added. After further discussion, several amendments were made and it was agreed that an executive summary should be made.

ACE considered possible ways to go forward in taking these extrinsic factors into account in fish stock assessments. Work is being conducted within ICES to bring this forward on a number of fronts. One activity could be to take information on recruitment of all the fish species in the North Sea and estimate the extent to which environmental conditions affect recruitment of these various species. There are some examples of this type of study in the literature. It was felt that an analysis of relationships between recruitment and physical and biological conditions with recruitment would be a useful exercise and a working group will need to be tasked with this term of reference for next year.

20 IMPACT OF CURRENT FISHING PRACTICES ON NON-TARGET SPECIES

N. Daan presented draft text based on material from WGECO. He pointed out that this issue was considered by ACE last year based on a request from the EC in 2001. Last year WGECO indicated what additional material is needed to provide more detailed advice, but this additional material has not been forthcoming yet. However, it appears that there is more information available from the Elasmobranch Working Group, which report is not yet available.

It was pointed out that WGECO had been give the term of reference to review the work of a Study Group that no longer exists, and it proved to be far too much work to review previous information from this group, which mainly reported on target species. It may be appropriate to create a working group to review data on non-target species, as there is a new requirement to collect these data. Unfortunately, countries continue to withhold these data, as a great deal of data exist, but the scientists cannot obtain access to them.

It was noted that the ICES study group was originally supposed to take into account both fisheries and ecological aspects of the problem of the catch of non-target species, but ultimately only the fisheries aspects were covered by this study group. The Working Group on Fish Ecology could be requested to consider aspects of this issue. The opinion was expressed that it is not worthwhile to task any working group with the review of data on by-catches and discards until the results of the very many studies on by-catches and discards are made available for use in analysis. ICES Member Countries need to make these data available and they can be aggregated in such a way that they do not create sensitivities to the countries providing the data. This applies to discard data, as the survey data are already freely available. There is a strong case that can be made for the requirement that these data be made publicly available because they relate to the ecosystem status.

It was felt that this text should be included in the report, pointing to the problem and its importance and adding a statement of the obligations that have been developed under the EC as the management authority for fisheries.

21 SENSITIVE HABITATS IN THE ICES AREA

T. McMahon presented a draft text based on material from WGECO. He noted that detailed mapping is required to show the distribution of sensitive habitats and, without this mapping, it is difficult to regulate activities in relation to sensitive habitats. This text is very similar to that in last year's ACE report, so there is a question of what is required this year. This text must also be checked with text in other draft sections of the report.

It was pointed out that WGMHM met at the same time as WGECO, so their report was not available to WGECO. Some material from WGMHM should be incorporated into this section and it should be emphasized that a habitat classification scheme is also necessary to bring this issue forward in an appropriate way.

It was agreed that this material should be compared with that in the 2002 ACE report and only new material should be brought forward. However, recommendations from the 2002 report can be repeated, without the detail contained in the 2002 report, as people tend to look at the most recent report. It was pointed out that WGECO prepared some case studies and worked examples that could be useful here.

It was queried as to whether more detailed information is required on the impact of gear on bottom habitats. The opinion was stated that we already know quite a bit about the impact of gear.

It was felt that, given that we have difficulty going further on this issue until maps have been prepared showing the distribution of the different habitat types, no further work should be done on this topic until these maps become available.

The question of the size of protected areas was brought up. It was pointed out that OSPAR will be agreeing on the designation of Marine Protected Areas at its meeting in June. There is a need to provide information on the minimum size of protected areas and the way to link areas into a coherent ecological network. A great deal of literature exists on this topic, mainly from the terrestrial field, and ICES needs to become familiar with this body of literature and how it can be adapted to the ICES marine area. One or more ICES working groups should be tasked with reviewing this literature and providing ICES recommendations on this topic. It was noted that WGMME has tasked itself with reviewing the size of area needed for the protection of marine mammals. To ensure that this work starts in the best way, a list should be prepared by a scientist in the Marine Habitat Committee of relevant literature that can be distributed to working groups that will be requested to work on this topic.

It was noted that there are regulatory issues involved in determining the size of protected areas and ACE does not have knowledge of them. It would be better to note the key issues and problems that need to be addressed in association with the closure of areas.

T. Noji stated that he was preparing material on area closures for inclusion in the text under agenda item 18.

There was a discussion on the text concerning deep-water biogenic reefs, which discussed potential fishing in areas of *Lophelia* reefs. Changes were made to this text to reflect this discussion. Several other changes were made to the summary and other parts of the text.

The recommendations from this section were considered internal to ICES and were moved to the minutes, as follows:

- ICES should progress work on the sensitivity of marine habitats to fishing impacts.
- ICES should include evaluation and definition of appropriate levels of marine habitat sensitivity in future work plans along with work on the recovery rates of different habitats after impact from fisheries activities.
- ICES should progress work on the determination of the appropriate scale of closures that should be applied for the protection of deep-sea coral reefs and the appropriate scale of separation of reef systems necessary for the development of a network of Marine Protected Areas in the Northeast Atlantic.

22 DEVELOPMENT OF ADVISORY FORMS APPROPRIATE TO THE PRESERVATION OF GENETIC DIVERSITY OF EXPLOITED STOCKS AND STOCKS SUFFERING SUBSTANTIAL MORTALITY AS BY-CATCH

J. Boucher presented draft text based on material from WGECO and WGAGFM.

It was proposed that the offer from WGAGFM that further information could be provided on specific stocks if requested by ACFM should be included in the text, as this brings the handling of this issue farther. With this and some editorial changes, this text was adopted.

23 ECOLOGICAL DEPENDENCE IN MANAGEMENT ADVICE

R. Aps presented a draft text based on material from WGECO.

In the discussion, it was felt that there are more cases where ecological dependence is included in the assessments, particularly using MSVPA; these have been described in the 2002 ACE report and a citation should be given to this in the 2003 report.

The case of the predation of harp seals on capelin in the Barents Sea was mentioned as another type of example that could be mentioned.

24 ECOSYSTEM IMPACTS OF INDUSTRIAL FISHING

S. Jennings presented a draft text based on material from WGECO.

In the discussion, it was noted that there was confusion caused by the use of the terms, particularly by-catch. It was noted that this was partly due to the use of these terms in fisheries regulations. It was agreed that an explanatory paragraph will be added to cover the use of the terms in this section.

It was noted that the entire request was not handled; the portion of the request relating to the use of fishmeal from industrial fisheries was not handled. This will require expertise from working groups under the Mariculture Committee.

A number of other comments were made regarding amendments to clarify the language in this section.

25 CONTINUE THE DEVELOPMENT OF A FRAMEWORK FOR THE PROVISION OF INTEGRATED ADVICE

25.1 General considerations from WGECO

It was noted that WGECO has been working on this issue for a number of years.

J. Rice provided an overview of the treatment of this topic in WGECO in 2003. WGECO tackled this issue in two ways: 1) analysing the conclusions on an ecosystem approach resulting from the Stakeholder Conference on a European Marine Strategy, and 2) preparing several case studies as examples of an ecosystem approach to management. Based on the outcome of these discussions, he had prepared a much briefer overview of the key issues in an ecosystem approach.

In the discussion, it was felt that this provided a useful discussion of an ecosystem approach, that should be used for further consideration within the ICES. ICES should act to develop an approach in the near future or it will be left behind.

It was felt that the material on indicator-based approaches was too optimistic in the discussion of these approaches, as they have a number of limitations. It was agreed that this should be amended to state that ICES can provide advice on the limits of the indicator approach and the means of interpreting the context of specific indicators.

An important issue with regard to ecosystem advice is that moving to a more integrated ecosystem approach would be more likely to increase inconsistencies in the development of advice and may require more time to develop, which is contrary to the requirements of the current fisheries management system.

The EC observer stated that ICES will be invited to serve in a co-lead role in the development of an EU ecosystem approach to marine management, so ICES will have a role to play in bringing this issue forward.

It was further noted that a joint statement by OSPAR and HELCOM is under preparation for adoption at the Joint Ministerial Meeting of these two Commissions in June 2003; this will emphasize the acceptance of the ecosystem approach by these two Commissions.

It was noted that the present text on a framework for the provision of integrated advice is a mixture of information and development of ideas, so it was queried as to whether this should go into the ACE report or the minutes. The view was expressed that this text should be included in the report to serve as a means of encouraging further debate on this topic both within the ICES community and between ICES and its partner Commissions.

It was agreed that this basic text would be used for the ACE report, but that some editing would be undertaken to tighten it up and remove some information that belongs to internal ICES business. A disclaimer will be placed at the beginning of this text to state that the ideas in this text have not been debated widely within ICES but are put forward by ACE to further the development of this approach in ICES. This text should be distributed to the Science Committees at the Statutory Meeting so that it can be debated, and serve as a basis for decisions on action.

In the discussion of whether this text should be included in the ACE report, it was felt that this text should be published even though the Council may choose to do something different. This shows the way ACE has recommended; if it is not followed, at least it has been stated.

There was discussion of the somewhat negative tone of the paragraphs on regional assessments, given the past experience in ICES in obtaining adequate membership and expertise on groups that have been established to develop work on regional assessments.

After the end of the ACE meeting, a lightly edited version of the section was produced for the published ACE report. The complete version is attached as Annex 2.

25.2 North Sea (REGNS report)

The Chair briefly outlined the work of the first meeting of the Regional Ecosystem Group for the North Sea.

ACE reviewed the actions recommended in the text prepared for this item. Comments were made on these actions, and they will be amended.

25.3 Baltic Sea Regional Project: Large Marine Ecosystems component

J. Thulin, Coordinator for the Baltic Sea Regional Project, provided an overview of this project, which has now been funded by the Global Environment Fund and the World Bank and will formally start on 1 July 2003. An ICES Steering Group for the Baltic Sea Regional Project was established at the last Statutory Meeting to coordinate the work in relation to the ICES scientific activities. This Steering Group met at the end of March 2003 and proposed the establishment of four groups to coordinate work in relation to specific fields of activity.

26 GUIDANCE FOR THE STUDY GROUP ON MANAGEMENT OF INTEGRATED DATA

This Study Group was established to provide guidance on the integrated use of data and promote the accessibility of data in a timely fashion. ACE members were encouraged to locate national participants for this study group.

27 ORGANIZATIONAL AND PROCEDURAL ISSUES

27.1 Issues from the Management Committee on the Advisory Process

The Chair reported that there is a perception that ACE and ACME spend too much time handling scientific issues. There are also different opinions on the nature of advice. ACFM provides technical advice on a recurrent basis, similar from year to year. In ACE, the advice requested can be quite different from year to year, and the information that is being used is partly information from ACE working groups but also from working groups under Science Committees, which is used as the basis for responses to questions from Commissions.

27.2 SGAWWP

This group was established last year to review the working procedures of ACFM and also ACE. The report has not yet been finally agreed by all participants. It proposes some changes in the advisory process, including the establishment of a group or groups to integrate information from expert groups before review by the advisory committees.

27.3 Working/Study Groups under ACE

Terms of reference for working groups for 2004 need to be developed by 15 August. For the EcoQO work, members were requested to help with the development of terms of reference for work to be conducted by the relevant working groups in 2004. Members were requested to send these terms of reference to the Environment Adviser with a copy to Louise Scharff by 15 June.

The Chair thanked all members of ACE and the Chairs of all the Working Groups whose reports have been considered here for their work. It has been a challenge to bring together the work from these groups and this challenge will increase in the future.

The Chair thanked the Secretariat for its support in preparing for this meeting and providing the materials in adequate time before the meeting.

28 ELECTION OF NEW CHAIR

Elections were held according to the usual ICES procedure. Simon Jennings (CEFAS, UK) was nominated by the Committee. His nomination will have to be approved by the Council at the Statutory Meeting to be held in Tallinn in September.

The Chair closed the meeting at 13.00 hrs.

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ANNEX 2: FRAMEWORK FOR THE PROVISION OF INTEGRATED ADVICE

Request

This is an ICES issue, to continue development of a framework for the provision of integrated ecosystem advice within ICES, and consider how this could be operationalised in the near future.

Source of information

The 2001 and 2003 Reports of the Working Group on Ecosystem Effects of Fishing Activities (WGECO) (ICES CM 2001/ACME:08; ICES CM 2003/ACE:05).

The ICES Strategic Plan and Integrated Action Plan.

Report of the Stakeholders Conference "Towards a strategy to protect the marine environment" (Køge, Denmark, 4–6 December 2002).

The 2003 Report of the Study Group on ACFM, ACE, and ACME, and Working Group Protocols (SGAWWP) (ICES CM 2003/MCAP:02).

The 2003 Report of the Study Group on Precautionary Reference Points for Advice on Fishery Management (SGPRP) (ICES CM 2003/ACFM:15).

The 2003 Report of the Planning Group on the Implementation of the Baltic Sea Regional Project (PGIBSRP) (ICES CM 2003/H:05).

The 2003 Report of the Regional Ecosystem Study Group for the North Sea (REGNS), ICES CM 2003/ACE:04).

Report of a Joint Workshop (EEA-EC DG Fisheries-DG Environment) on "Tools for measuring (integrated) Fisheries Policy aiming at a sustainable ecosystem", Brussels 28–29 October 2002.

Summary

This is a discussion document, [this will just invite speculation by clients about internal divides within ICES. The caution stands strongly enough without the phrase.]and presents ideas that ICES needs to consider internally and discuss with partners, and then take actions to move forward. It is not the final word of ACE on the provision of ecosystem advice, but is intended to provoke discussions and actions that increase the ability of ICES to serve that role.

Recommendations and advice

These are recommendations to ICES. Some will require work with partners in ICES science and clients for ICES advice, but in the first instance the recommended actions are directed at ICES, not at its partners and clients.

ICES should:

1) Continue dialogue with client Commissions and other agencies and organizations interested in more integrated ecosystem-based management, and the scientific advice needed to support such management. Good dialogue will increase the likelihood that thinking and practice on this topic will progress in compatible ways within the scientific and management communities, and between ICES and its clients.
2) Continue to respond with timely and high quality scientific advice to OSPAR and other clients with regard to making the EcoQ/EcoQ element/EcoQObjective framework fully operational. The goal here is to support organizations that are trying to take a more ecosystem-based approach to their tasks, through the provision of sound, concrete, natural scientific advice on specific practices that can be implemented in the short or medium term, and that will yield concrete benefits. Such ICES activities will help organizations actually change management practices and see the positive effects of a more integrated ecosystem approach. The framework for proceeding with this has largely been developed and tested by WGECO, although much remains to be done in putting specific considerations within that framework.

3) ACFM, ACE, and the Resource Management Committee (RMC) should review the contributions of the Study Group on Incorporation of Process Information into Stock Recruitment Models (SGPRISM) and the Study Group on Growth, Maturity and Condition in Stock Projections (SGGROMAT), with regard to the effectiveness of their recommendations for placing fisheries advice into a larger ecological context. If these concrete proposals for assessment practice are found to be constructive steps ahead, ACFM, ACE, and RMC should:

   - Set out a workplan and timetable to enable the accepted products of these Study Groups to become routine practice in fish stock assessment;
   - Identify and rank in priority opportunities for other focused and topic-specific Study Groups to attack similar individual components of current practices in fisheries (or other topic) assessment and the provision of advice.

4) The Living Resources, Oceanography, Resource Management, and Marine Habitat Committees should have some time at the 2003 or 2004 Annual Science Conference (ASC) to discuss the possibilities for more integrated monitoring. Several documents, particularly those associated with EuroGOOS, already exist, and could form a basis for such a discussion. The goal would be to maximise opportunities for building on existing activities, while filling important gaps in the necessary monitoring for integrated assessments.

5) An expert group should be appointed to address the specific question of what comprises "serious or irreversible harm" on the scale of management in an integrated ecosystem context. The Precautionary Approach (PA) framework within ICES fisheries advice has been challenging to develop. Consistency and acceptance among clients has required that ICES (and fisheries organizations more generally) pay close attention to the nearly universal reference in documents citing the PA or Precautionary Principle (PP) that the application of precaution is only warranted in cases where what is at risk is "serious or irreversible harm", not just to avoid doing something that a group of specialists does not like. The goal of this activity would be for ICES and its clients to commence development of an operational interpretation of "precaution" (as distinct from simply good risk management), to allow progress on this topic as well.

6) ACE, ACFM, the Management Committee on the Advisory Process (MCAP), and RMC should create Terms of Reference and identify appropriate membership for a Workshop or Study Group to consider and, to the extent possible, to investigate with practical examples, the implications of moving to a more integrated ecosystem approach on the consistency and timeliness of ICES advice on fisheries and other issues. Many ICES reports assume that moving to more integrated regional assessments will improve the basis for ICES advice. However to this point, no one has analysed whether these two initiatives (improved timeliness and consistency of advice and advice based on regional integrated assessments) would naturally move ICES in the same direction and hence be relatively easy to achieve simultaneously, or if they might necessarily be incompatible, and hence require even more effort to achieve together. The goal here is to build a better understanding within ICES, and with ICES clients, with regard to what changes are to be expected in ICES advice as ICES moves in this direction. The template for ICES advice on fisheries management (and other topics) could also be reviewed to ensure that the advisory templates can accommodate the types of information that ICES might be providing in a more integrated ecosystem context.

7) The Consultative Committee and MCAP should develop Terms of Reference for a subsidiary group to consider the minimum participation in numbers, geographical distribution, and disciplines, in order for a Regional Assessment group to proceed effectively. Proposals for integrated assessments which are "designed to integrate existing effort, not duplicate it or create unnecessary new effort" are welcome, but even the necessary new effort may be substantial, and should be estimated to ensure that the work will be able to be conducted thoroughly and effectively.

8) In situations where ICES enters into a dialogue with clients about specific non-standard advisory requests, ICES should be alert for well-chosen opportunities to include in the Memorandum of Understanding or formal request negotiated with the client, an acknowledgement that the advice to be provided will give appropriate attention to the broader ecosystem context. The goal is to provide some of the "living examples" of how scientific advice in a more integrated ecosystem context is the product managers and other clients should always be seeking. Recovery planning of collapsed fish stocks and evaluating the ecosystem impacts of aquaculture are two examples of good candidates for such dialogue.

9) Notwithstanding 7) above, ICES should be vigilant not to undertake to provide "expert advice" on issues of governance and social sciences, where ICES does not have such expertise. The goal is not to deny that governance and social sciences are central to a more integrated ecosystem approach, but rather to ensure that clients know that, with current expertise and operational characteristics, ICES is not able to draw on any special expertise in these fields.

10) ACE recommends that:

    A Theme Session covering "Integrated Assessments" should be held at the 2005 Annual Science Conference. This would be timely in respect of the OSPAR intermediate quality status assessment in 2005 and other specific OSPAR thematic assessment needs.

Scientific background

This is a discussion document that presents ideas that ICES needs to consider internally and discuss with partners, and then take actions to move forward. It is not the final word of ACE on the provision of ecosystem advice, but is intended to provoke actions that increase the ability of ICES to serve that role.

This is a self-generated Term of Reference, and has been addressed by ACE during each of its meetings. Many national and international jurisdictions with management responsibilities for aspects of marine environments or their uses also have sponsored meetings or initiatives to advance the ability to provide integrated management advice. A number of these initiatives were reviewed in ICES (2002). Since that review, meetings have continued to address the issue; within the ICES area, most notably the Stakeholders Conference "Towards a strategy to protect the marine environment" at Køge, and initial meetings of ICES regional ecosystem study groups for the North Sea (REGNS) and the Baltic Sea (PGIBSRP).

Each of these initiatives builds on the text of preceding reports, but, the outputs of these initiatives are still generally characterised by generalities and conceptual terms. As recently as December 2002, the [Køge] meeting, concluded that there is STILL a "need to complete the task of interpreting, in clear and unambiguous terms, what the 'the concept of an integrated ecosystem approach' means, and how it is applied in practice" [Køge ref]. It is time to move from conceptual language to very specific points. To move ICES forward, this section undertakes four tasks:

1) From the WGECO report, it identifies commonalities among the many discussions in the literature and meeting reports, with regard to key features of "integrated ecosystem advice".
2) It considers which of those common features in (1) lie within the expertise and purview of ICES and its science and advisory competences. Where components commonly held to be part of an integrated ecosystem are or could be within ICES competence, they are reviewed critically to identify specific enabling activities. Where they are not within ICES competence, suggestions are offered for where actions to address the needed components would be most appropriate.
3) It consolidates and reviews the conclusions of two new groups created in 2002 to initiate coordinated ecosystem studies and, eventually, assessments in the North Sea (REGNS) and Baltic Sea (PGIBSRP).
4) It offers specific activities that ICES could undertake in the short term, to promote progress towards providing the scientific and advisory basis for more integrated ecosystem approaches to management of the uses of marine ecosystems.

15.1 Working Group on Ecosystem Effects of Fishing Activities (and its supporting documents)

15.1.1 Common features of discussions of integrated ecosystem advice and management

The reports and initiatives nationally, regionally, and globally that were reviewed by WGECO in 2003 and earlier years, and by ACE in 2002, bring out a number of features of an integrated ecosystem approach that are common across these initiatives. These include:

Inclusive, participatory governance and decision-making, with an informed citizenry is featured in nearly every discussion of Integrated Ecosystem Approaches. Past treatments of the advisory framework by ICES also acknowledge this as an important feature of ecosystem approaches.

It is **human activities that are managed, and the not the ecosystem**. Many decisions are perceived as risk-risk choices among competing uses, not just balancing the intensity of use with protection of the environment. Not only are human activities the ecosystem properties that are managed, but of the impediments and components of the way forward listed in the Køge Report, eight of thirteen cannot be addressed without society making value-based choices among competing potential human activities.

Almost every initiative and document gives a **prominent role for the social sciences** in identifying goals, developing management approaches, and evaluating the consequences of management actions. Over half the points in the Køge Report that were analysed by WGECO required a moderate or high degree of social science input in order for any meaningful progress to be made.

Specification of higher-order management objectives is required, although these are usually highly conceptual and additional work is needed to make them operational. These characterize nearly every initiative reviewed in ICES (2002), and form the core of the approach endorsed at the Køge Stakeholders Conference.

Indicator-based approaches, often with explicit operational objectives and reference points, are the basis for operationalising the conceptual objectives. This is particularly prominent in the Bergen Declaration from the Fifth North Sea Conference and associated documents, the approach adopted by the Monitoring and Assessment Group (MONAS) for HELCOM, and Køge Stakeholders Conference Report.

Most proposals stress a **reliance on the Precautionary Approach (PA)** in advice and decision-making.

Advice on single resource uses needs to include consideration of the status of not just the resource being used, but other **ecosystem components interacting with or influencing the resource, and other human activities that affect the resource or interact with the resource use.**

This is most often specified for fisheries, where it is argued that assessments should consider more environmental influences on stock status and dynamics, and advice should be more fleet-based and consider the ecosystem effects of the entire fishery.

Monitoring covers many ecosystem components and is conducted in integrated programmes. Many of the international organizations around the North Sea and Baltic Sea (OSPAR, IBFSC, HELCOM) or more regionally and globally (IOC, SCOR, and other sponsors of GOOS, GLOBEC, etc.) feature this point.

Regional assessments that integrate all major ecosystem components and human activities in the regional seas are conducted and reported periodically. This is given prominence in the Bergen Declaration, many of the Baltic initiatives, and in past treatments of the topic by ICES.

Management that is integrated and adaptive, rather than piecemeal and rigid, is required. This need is acknowledged in the Bergen Declaration and the Køge Report. Various organizations and jurisdictions are undertaking discussions both officially and informally with regard to coordinating their management approaches more effectively.

Analysis of common themes from an ICES perspective

Inclusive, participatory governance and decision-making. ICES is not a body with expertise in governance structures and processes. As a scientific advisory body, ICES is positioned to inform governance and decision-making bodies, whatever their nature. However, its disciplines of strength give ICES no particular legitimacy in advising on one form of governance over another. Rather, through maintaining credibility, relevance, and timeliness of scientific information and advice, ICES should be the primary source that all groups come to for their scientific advice. Therefore, the ICES role in discussions of governance structures is simply to keep the lines of communication open, and ensure that the evolving governance systems appreciate the need for scientific support, and look to ICES as the best source for that support.

It is human activities that are managed, and not the ecosystem. The ICES strength has traditionally been in understanding the structure and function of marine ecosystems, and in the impacts of human activities on those ecosystems and their components. Science to understand the management of human activities has played a much smaller role in ICES science programmes. Examples of such initiatives exist, largely in subsidiary groups reporting to the Resource Management Committee. ICES has not developed strong expertise in the area of actually advising on how human activities should be managed, despite ICES expertise in advising on ecological and environmental aspects of management.

Prominent role for the social sciences. Despite several theme sessions at Annual Science Conferences in the 1990s on the opportunities for and values of linkages with the social sciences, aside from the Study Group on Fisheries Systems ICES has made almost no such linkages. ICES lacks expertise in this area, and the ICES Strategic Plan and Action Plan do not include provisions to develop such expertise in the medium term. The Social and Economic Module of the Baltic Sea Regional Project is structured around these considerations, but the linkage of this module to ICES is less clear than the linkage of the modules on Productivity, Pollution and Ecosystem Health, and Fish and Fisheries.

The current limited capacity in social sciences puts important boundaries on the ICES role in the provision of advice to support integrated ecosystem approaches to management. Of the fourteen impediments and challenges to progress on implementing an ecosystem approach that were identified at the Køge Conference, half of them required high or moderate involvement of social scientists in order to address the impediment or challenge. The ICES role in the provision of information and advice on progressing towards a more integrated ecosystem approach to the management of human activities in marine ecosystems will be primarily in diagnosing what needs to be done to improve ecosystem

status and sustainability of uses, and developing and evaluating tools to do that task better. ICES will have little expert role in advising on how to manage human activities to deliver the needed improvements.

Specification of higher-order management objectives. ICES has significant technical expertise in advising on conceptual, higher-order management objectives, and has served this function many times in the past, whether in response to external requests for advice or self-motivated. Where needed, ICES can continue to provide support for this activity with existing expertise and structures, although requests for such support are unlikely to be common. Most organizations seem to have little difficulty in setting higher-level ecological, social, and economic objectives.

Indicator-based approaches. The commitments to indicator-based approaches in the Bergen Declaration and the Køge Conference Report are very important. The approach buys wholly into the framework proposed in past by ICES (2002) for an objective/indicator / reference point approach to more integrated ecosystem management of human activities. The adoption of this approach means that progress can be incremental, building on current practice and experience in each scientific discipline. It also means that the progress towards a more integrated ecosystem approach in all cases will be science based, using as much or as little scientific capacity as exists. Key science roles will include testing the information content and reliability of indicators for conceptual objectives, refining conceptual objectives into operational objectives, and identifying suitable positions for limits on the indicators. Section 6 of this report provides concrete examples of exactly how science will contribute continued progress towards a more integrated ecosystem approach to management.

ICES has important strengths in providing the scientific support for setting operational ecosystem objectives, selecting appropriate indicators, and estimating appropriate conservation reference points. The explicit mention in the Bergen Declaration of ICES as the source of such support, and the OSPAR request for advice addressed in Section 6 of this report illustrate both our stature and our ability to serve this function professionally. The reports of WGECO in 1999 through the present all address directly the issue of what should comprise operational objectives for integrated ecosystem approaches to fisheries, and the reports of the Working Group on Seabird Ecology (WGSE), the Working Group on Marine Mammal Ecology (WGMME), and other groups do similar but more case-specific jobs for other activities. ICES is also serving a very important function by identifying the limitations on uses that can be made of individual indicators, and on indicator-based approaches in general.

ICES is doing the right things here, and generally doing them in the right way. The ICES future is likely to include:

1) assessing and reporting the status against indicators for many ecosystem components on a regular basis (as ACFM does now for the spawning stock biomass (SSB) and fishing mortality (F) of many harvested fish stocks),
2) identifying new indicators and reference points where they are needed, and
3) advising on the cautions and limitations that are appropriate when interpreting or making decisions based on indicators.

Nonetheless, although the framework for selecting and evaluating indicators is developed moderately well, ICES is still in the testing phase for the framework. ICES is learning a lot from the testing, and finding many ways that the framework needs to be adapted and refined. It is far from mature.

ICES should not be complacent here, however. There have been some challenges in reaching this position, including difficulties with clients in framing scientifically clear and tractable requests for advice on appropriate indicators and objectives. Also, ICES has no monopoly on scientific expertise in this area. ICES clearly has the expertise and competence to provide leadership and the necessary support to managers in the tasks of identifying appropriate indicators and reference points, evaluating status on them, and reporting status relative to management reference points. However, ICES must continually ensure that it keeps the necessary scientific rigour and diversity of expertise in its contributions to demonstrate that it is, in fact, the most authoritative science voice on these issues.

Reliance on the Precautionary Approach. ICES has provided leadership in the application of the precautionary approach in advice on fisheries, using limit and precautionary reference points for biomass and fishing mortality as the basis for quantitative harvest advice for most fish stocks. However, even in these single-stock, two-indicator applications, it has proved challenging to keep the application consistent across stocks and current with changing assessments (ICES, 2003). Ways to set comparable reference points for indicators of ecosystem status have been discussed in several working groups. However, the challenge of developing a consistent framework for the application of precaution in more integrated ecosystem advice has not yet been tackled, by ICES or by other groups. It will not be simple to define objectively what comprises "serious or irreversible harm" for many of the more integrative ecosystem properties, and even more difficult to apply a consistent standard for such harm across many different attributes. There

is an opportunity for ICES to display global leadership on this topic, but based on the experience with fisheries advice, the task will require a significant amount of time and effort.

Advice on single resource uses needs to include additional ecosystem components, and other human activities. The goal features prominently in the ICES Strategic Plan and supporting Action Plan, and in the Report of the Study Group on ACFM, ACE, and ACME and Working Group Protocols (SGAWWP). ICES already has demonstrated strengths in assessing the impacts of fishing on marine ecosystems (the work of WGECO), and a number of Study Groups as well as the GLOBEC Office are doing important work on assessing the impact of the environment on fish populations. ACE is building capacity and acquiring experience at providing somewhat more integrated advice.

What is absent is a clear roadmap for how to move forward in a concerted manner, rather than simply having study groups proliferate and WGECO's Terms of Reference become longer every year. The SGAWWP report includes a prominent role for "Integrating Assessment Groups" and acknowledges explicitly the desire to place fisheries advice in an ecosystem context, as well as taking an ecosystem approach in ICES advice generally. However, the report is vague about how this will be done. It notes that even among the Study Group participants "there was a range of views" on the best organization and activities of the ICES groups inputting to the final advisory step and a discussion of approaches under consideration concludes that "this may not work well for some stocks or for some areas."

There are some specific steps available to ICES in the short term that would make at least fisheries advice more inclusive of additional influences on stock dynamics. For example tools developed in SGPRISM andSGGROMAT]. could be made part of standard assessment practice. However suchsteps are small compared to the expectations arising from the language in the commitments to integrated ecosystem advice.

Put simply, it is clear that ICES is far from having consolidated its own thinking on how to make advice more integrated at the level of either Working Group activities or Advisory Committees. Without specific guidance on what a single advisory committee structure and regional assessment groups would do differently from at present, it would be premature to conclude that such structural changes would necessarily make advice more ecosystem-based. After all, regional assessment groups have been proposed as an alternative to the current ACFM structure, simply to address some fisheries issues better.

There is another issue that ICES must address with regard to the provision of more integrated advice. Although clients of ICES advice have all subscribed to the concept of more integrated, ecosystem advice, they are also calling for advice of ever greater consistency and on faster schedules. Although a formal analysis has not been undertaken by ICES, it seems likely that moving to a more integrated ecosystem approach would be more likely to increase inconsistencies and require more time for generating advice. The parameterised functional models and supporting data that are necessary for assessments to include the effects of environmental covariates and other human activities on stock dynamics will be even less consistently available than are catch and research survey data. Moreover, stocks are likely to react in more diverse ways to these factors than they do to directed harvesting, and methods to include such factors in analyses or interpretations are less consistently codified. All these factors are likely to make integrated ecosystem advice on fisheries less consistent rather than more consistent, even if ICES considers such advice to have a more complete scientific basis. Expertise from more groups will also be needed for input on the path to the provision of the final advice, so more time (and more careful scheduling), rather than less time, will be needed to provide the advice as well.

ICES clearly has in-house work to do to consolidate its own views of the detailed process by which integrated ecosystem advice can be provided, and to sell those views to its own Council. ICES also must undertake serious discussions with clients on nuts-and-bolts implications of providing integrated ecosystem advice, not just higher-level conceptual discussions of whether or not the idea of more integrated ecosystem advice is a good one. Both ICES and its clients need to understand the costs as well as the benefits of moving in this direction, and engage in focused dialogue on specifics.

Monitoring covers many ecosystem components and is conducted in integrated programmes. ICES has a long history of coordinating monitoring in the ICES area. Several subsidiary groups of the Living Resource Committee coordinate fish surveys throughout the Northeast Atlantic, and subsidiary groups of the Marine Habitat and Oceanography Committees identify appropriate monitoring standards and in some cases establish survey protocols for monitoring lower trophic levels, and physical and chemical ecosystem properties. ICES has had a central role in recent initiatives to expand and coordinate monitoring programmes, particularly EuoGOOS and the Baltic Sea Regional Project. Other organizations, such as OSPAR and HELCOM, routinely consult ICES for advice on monitoring needs and standards. Monitoring features clearly in the ICES Action Plan for the near future. It seems that ICES is doing the right things the right way in this area, and such activities should remain a priority. There are many needs and opportunities for more monitoring programmes on more ecosystem components and in new places. ICES can expect to continue to play a major role in diagnosing the needs for scientific monitoring programmes, planning the activities that

would comprise the additional programmes, and coordinating and reviewing progress on biological, physical, and chemical monitoring programmes once in place

Regional assessments that integrate all major ecosystem components and human activities. Regional assessments have been undertaken by other organizations, and these groups have come to ICES for the primary scientific input on the physical and biological ecosystems. However, in all policy-scale documents the expectation is that "integrated" means that the social and economic aspects of uses of regional marine ecosystems will be part of the assessment.

As noted earlier, ICES does not have expertise in social and economic sciences, so by itself, ICES can never undertake fully integrated assessments of the scope expected by our main clients. As ICES considers creating regional ecosystem assessment groups internally, it needs to consider seriously how the full integration will be achieved. To this point, external clients have been willing to coordinate production of the overall regional ecosystem assessments, with ICES receiving cost reimbursement for the work that if contributes to these initiatives. Even if ICES continues to serve only this role, it faces major challenges.

First of all, if ICES attempts to undertake regional assessments using only its existing strengths, we would produce a product that would not be fully useful to managers. Even if ICES did its job well, clients might perceive such "natural science" assessments as only making their jobs more difficult. Such limited regional assessments could report poor biological conditions, but would not help make managers more effective at doing something about the degrading ecosystems. Effective management actions for healthier environments depend on good knowledge of and planning for the social and economic consequences of management measures, and not just sound scientific evidence that actions are needed. To produce regional assessments of full value to clients, ICES needs to have strong linkages to experts who can review the human practices that are associated with the declines, identify the key social and economic drivers, and evaluate the sustainability of options. This is much more ambitious than just summarising where and how large the fish harvests were.

Second, even if there were reasons to prepare regional assessments addressing only the biology, physics, and chemistry, they would be very demanding on ICES resources. Attempts to set up regional groups for integrated regional assessments have had trouble attracting an adequate number of participants and/or the right diversity of experts. If ICES attempts integrated regional assessments, and cannot summon enough expertise to do a first-rate job, ICES may be hurting its own credibility. These are issues that all of ICES needs to consider carefully.

Management that is integrated and adaptive. Adaptive management generally means monitoring the consequences of a management alternative that is selected for implementation, evaluating monitoring results against performance standards, and modifying the management approach based on the feedback of its performance. Many current ICES programmes and strengths position it to play an important advisory role in adaptive management. Clients already commonly ask to be advised on the risks and consequences of management alternatives, and not just a single "preferred choice". ICES is also well prepared to identify scientifically sound performance properties to monitor, and performance standards that would indicate whether the management strategy was succeeding or failing to make progress towards its ecological and environmental goals. Where failures occur, ICES could also advise on the nature of the adaptations to management that would be necessary to correct the failures.

Moving to integrated management would pose more challenges to ICES. Integrated management needs more integrated assessments and a different type of scientific advice. Although ACE and MCAP both exist in large part to make sure that ICES advice is consistent and well integratedthe integration, to the extent that occurs, is at a very late stage in the process. All the scientific basis for the advice has already been prepared by the Subsidiary Groups. Moreover, both the time available for ACE work, and the nature of the work of all the advisory committees, means that very little true integration can be done; material from different sources can be put next to each other, but that is not the integrated advice required for truly integrated management. If ICES is to provide scientific advisory support for integrated management, more fundamental changes in approach would be needed at the level of the working and study groups. In more limited tasks, an approach of sequential working or study group meetings to each add value and integration to the products of the preceding ones is proving taxing on ICES science capacity, and the consequences of a group early in the sequence failing to fully discharge its terms of reference amplify through the succeeding groups. This gives cause for caution about the ease with which the existing ICES approach to providing the scientific support for management can move through small evolutionary steps to providing support for integrated management.

If there is a silver lining for ICES in the prospect of moving to integrated management, it is that moving from the current management approaches to integrated management will require the management agencies to undergo some major changes themselves. If there is a true move to integrated management, managers will need a different kind of scientific support, and not everything they are currently obtaining for single-species: single input management, plus something more integrated added on top. If ICES were freed from having to support all the advisory needs of the

current "un-integrated" management systems, it would have more scope to rearrange its entire approach to supporting the advisory processes. That might make it somewhat more feasible to restructure in ways that could provide the scientific products needed by integrated management more effectively.

15.2 Regional Ecosystem Study Group for the North Sea

15.2.1 General considerations

At its first meeting in 2003, the Regional Ecosystem Study Group for the North Sea (REGNS) considered a variety of national initiatives around the North Sea that were intended to advance a more integrated ecosystem approach to management, and noted that

i) There is wide acceptance that the science of ecosystems is under development and in many cases questions relating to ecosystem function and response are unlikely to be answered completely for many years. The challenge facing Member Countries is therefore to make better use of present scientific knowledge to establish the operational scientific tools (models) to support the thematic assessment and management needs.
ii) For most Member Countries, existing monitoring programmes demonstrate little integration between the scientific output from R&D programmes and the types of monitoring being undertaken. This is because the present programmes largely reflect compliance against traditional sectoral policy drivers dealing with fisheries, chemical contamination, ocean climate, and nature conservation. However, the ecosystem approach cuts across all these sectors. Without coordination of the respective national and international sectoral monitoring programmes, excessive duplication of effort may result. When one set of monitoring results provides inputs to evaluating progress of many sectors towards their objectives, some measure of control and coordination is required to ensure equitability of activities between sectors.
iii) Currently the present system of assessment and control of monitoring is very much sectoral based. The need for adaptive management requires not only the monitoring to be integrated, for example, nutrients monitoring should be integrated with operational modelling of ocean processes and the measurement of eutrophication effects, but it also requires the regulatory advice to respond (pro-actively) to any changing pressures and environmental conditions which may give rise to adverse effects.
iv) The feedback from the assessments to regulate the inputs and pressures on a time-scale commensurate with mitigating for any effects is essential. The mechanisms by which such feedback can be applied are subject to discussion and agreement, but they will ultimately depend on the type of activity, the location, and resources available to the relevant competent authority.

The ministers at the Fifth North Sea Conference agreed to implement an ecosystem approach to the management of the North Sea. The ministers invited ICES and GLOBEC to consider the priority science issues and contribute to their development.

In brief, the scientific issues are:

Short-term (3–5 years) Priority Issues:

- Operational fisheries oceanography;
- Habitat mapping (first generation);
- Spawning areas of fish populations;
- Experimental studies of trawling closure areas;
- Threatened and declining species and habitats;
- EcoQOs and indicators.

Longer-term (> 5 years) Priority Issues:

- Role of benthic species richness:
- Ecological transfer efficiencies:
- Population dynamics of key species:
- Food web and life history interactions;
- Transport and effects of contaminants.

The North Sea Ecosystem Science Programme, recommended by the expert conference in Bergen in 2002, could serve as the framework for the implementation and coordination of regional ecosystem R&D. A Regional Programme for the North Sea could be co-sponsored by GLOBEC, whose North Atlantic office is housed in ICES. This research initiative should be open and inclusive, and care should be taken to avoid unnecessary duplication of research activities. ICES could use its machinery with Working Groups and Science Committees in assisting the planning and implementation of the research to address the priority science issues.

15.2.2 Integrated Ecosystem Assessments

ACE recognises two types of assessment which underpin the ecosystem approach; these are i) general assessments; and ii) thematic- (or activity-) based assessments. Although thematic and general assessments are closely related, they have different purposes. Thematic assessments embody the adaptive management principle, which requires that activities are managed in a way that is responsive to the dynamics of the ecosystem. In considering general assessments, a combination of activities and their effects on the ecosystem need to be assessed. This requires a greater degree of understanding of ecosystem function and the cause-effect pathways which determine state and impact.

In both types of assessment, the ecosystem is considered as a set of biological compartments that are trophically linked and which interact with their environment, including human pressures. ICES Working Groups map onto the compartments (boxes) of the ecosystem reasonably well. However, the links between ecosystem compartments are not so well reflected in the ICES Working Group structure and this represents a gap in capability that must be addressed, if ICES is to be positioned to conduct integrated ecosystem assessments when these are requested by clients.

In order to move towards supporting both general and thematic assessments required by clients (OSPAR, HELCOM, EC, etc.), ACE recommends that the following three proposals be considered by ICES. These should not be seen in isolation of each other, but should be considered as complementary elements towards delivering a permanent mechanism to address integrated assessments by ICES Working Groups. The elements could be implemented in a step-wise manner. However, the outcome of the first step will determine the remaining steps; subsequent steps (if any) will be shaped entirely by the outcome of the Theme Session on Integrated Assessment at the ASC in 2005 and therefore subsequent steps should be viewed as conditional.

Step 1: 2005 ASC Integrated Assessment Thematic Session

Because the ICES Working Group structure does not lend itself to integrated assessments across the different components of the marine ecosystem or external drivers, or within individual regional ecosystems, a new process is required to facilitate holistic integration of advisory products within ICES. ACE is acutely aware of the heavy operational burden on some ICES Working Groups, especially the fish stock assessment Working Groups. Although the proposal outlined below will involve additional work for specific Working Group members, ACE wishes to stress that:

a) The proposal is designed to integrate existing effort, not duplicate it, or create unnecessary new effort;
b) ICES and its Member Countries will be required to undertake integrated assessments. Therefore, ICES needs to establish a process where value can be added to the exiting assessment work of Member Countries;
c) The proposal should take place over a two-year period in order to allow work planning.

ACE recommends that:

A Theme Session on Integrated Assessments should be included in the 2005 Annual Science Conference. This would be timely in respect of the OSPAR intermediate quality status assessment in 2005 and other specific OSPAR thematic assessment needs, as well as the needs of HELCOM.

Step 2: Regional Integrated Assessment Programmes

Taking advantage of the existing Working Group and Science Committee structure of ICES, Integrated Assessment Programmes could be established to meet specific customer needs. The programmes could be established either on a regional or a thematic basis depending on need, but in all cases would be led by a senior scientist from the ICES community. It is anticipated that programme meetings would be required and that they would be supported by appropriate levels of intersessional correspondence. The programme meetings should be chaired by the programme leaders and attended by the relevant Working Group Chairs. The meetings could be held when the relevant Working Groups have delivered products according to the specific terms of reference requested by the Integrated Assessment Programme objectives.

The advantage of this approach is that one individual is tasked with the responsibility of coordinating the inputs required from existing Working Groups. It represents no structural change to the existing working arrangements but rather adds an additional level of assessment which cuts across Working Group activities. It does increase the workload of Working Group Chairs, and almost certainly will require Working Groups to address additional terms of reference as part of their tasks.

Step 3: Regional Integrated Assessment Groups

This step recognises the need to formally acknowledge Step 2 by establishing permanent ICES integrated assessment groups. The groups should recognise the activities already in hand by Member Countries to coordinate national monitoring programmes to deliver both thematic and general assessments required by OSPAR (Joint Assessment and Monitoring Programme, JAMP), the EU (Water Framework Directive, WFD) and the Helsinki Commission. This effort in some cases is considerable, but is in general a common activity across Member Countries. ICES could play a value-added role in integrating the national assessments.

This could be undertaken at two levels:

i) for general assessments such as the periodic OSPAR Quality Status Report (QSR), Regional Ecosystem Groups (REGs) would be tasked with undertaking integrated assessments on a regional basis by drawing together the relevant national assessment products and, where available, thematic assessments. This would be on a time-scale commensurate with customer (QSR) reporting needs and the groups should be considered as permanent within ICES;
ii) for thematic assessments, which would address specific needs such as eutrophication and contamination, Thematic Ecosystem Groups (TEGs) would be established on an *ad hoc* basis and would consist of members drawn from existing ICES Working Groups that would enable the integration of the science needed to support the assessment needs. Common terms of reference for Working Groups which identify forthcoming thematic assessments would ensure that value is added to the work of TEGs when they are convened. These groups would in general be temporary.

15.2.3 Integrated monitoring

Most, if not all, the mandatory monitoring programmes undertaken at the national level by Member Countries can be placed into one of four sectors: i) fisheries; ii) contamination/pollution (including physical disturbance); iii) species and habitats; and iv) ocean climate and processes. Each Member Country has different mechanisms for managing the programmes within each sector, but in general the sectors and programmes have evolved in response to specific policy and legislative drivers laid down by international conventions and the European Commission, and require specific assessment products. Adopting an ecosystem approach will inevitably require the integration of sectoral-based monitoring programmes in order to avoid unnecessary duplication of effort.

ACE recognises that the integration of monitoring programmes will need to occur at a number of institutional, national, and international levels, namely: i) harmonising the monitoring effort between sectors to obtain the best use of resources; ii) recognizing the need to integrate within each sector; and iii) whilst i) and ii) enhance the thematic assessment needs, there is also the need to integrate the monitoring programmes with the R&D and current scientific understanding of ecosystems to deliver general integrated assessments.

An integrated monitoring programme should therefore have the following characteristics to allow it to be readily used for integrated assessment purposes:

1) complementary spatio-temporal scales;
2) metrics informed by R&D;
3) a consistent suite of base metrics to which a suite of additional, adaptable metrics can be added;
4) changes to methodology should not disrupt time series;
5) the time frame of resulting data availability should be similar for all metrics;
6) a framework for data quality assurance.

In addition to intersessional work to contrast existing national initiatives, within each Member Country considerable progress could be made towards identifying the potential for their integrated monitoring programmes. Such coordination and integration at the national level would serve as a template for integration at the international level. In this respect, the ICES-EuroGOOS Planning Group on the North Sea Pilot Project (NORSEPP) provides an opportunity for Member Countries to coordinate their respective monitoring programmes within a regional context and offers this for international coordination and integration by NORSEPP. This might be most efficient if multiple assessment needs are met, such as oceanographic influences on fish stock assessments and their influences on nutrients, primary production, and regional eutrophication.

15.3 Planning Group for Implementation of the Baltic Sea Regional Project

ICES must develop a strategy for implementing the GEF-funded Baltic Sea Regional Project (BSRP) and ensuring effective ways for ICES to contribute to and to benefit from the Project. The Baltic Sea Regional Project is intended to address priority issues relate to three of the five project modules: the Productivity Module, Pollution and Ecosystem Health Module, and Fish and Fisheries Modules. Details of these priorities are:

<u>Productivity Module</u>

- Assessment of productivity levels in the adversely affected coastal and offshore ecosystems of the Baltic Sea;
- Application of innovative technologies and buoy systems in environmental assessments;
- Identification of links between land-based nutrient inputs and long-term changes of both productivity and biodiversity in selected areas.

<u>Pollution and Ecosystem Health Module</u>

- Application of ecological quality criteria for the Baltic Sea;
- Implementation of the HELCOM Cooperative Monitoring in the Baltic Programme (COMBINE);
- Eutrophication and biological effects;
- Chemical pollution and biological effects;
- Invasive species and biodiversity;
- Multiple marine ecological disturbances (MMED).

Fish and Fisheries Module

- Improvement of assessment and management scheme for main commercial fish stocks in the Baltic Sea;
- Improvement and implementation of assessment and management measures for sustainable exploitation of coastal fish resources;
- Implementation of IBSFC Salmon Action Plan;
- Evaluation of the impact of fisheries upon ecosystems of the Baltic Sea.

It will be very difficult to integrate these activities into existing ICES groups, because most appropriate groups already have overloaded agendas. Therefore, a key component of the strategy will be the establishment of new Expert Groups under the Baltic Committee whose activities will lead to the development of ecosystem-level assessments, advice and management. These Groups will have to have integrated and overlapping terms of reference. There will also need to be an integrating Study Group on modelling issues, including the identification of the data requirements for ecosystem modelling work in the Baltic area.

A number of issues have been identified as relevant to enhance the Baltic Sea multispecies/ecosystem management process. In particular, the following issues were identified as basic objectives of the new groups:

a) Improvement of temporal and spatial coverage of physical oceanographic factors (coarse and fine scale) and assessment of plankton community (pelagic fish growth and feeding);
b) Improved acoustic estimates of pelagic species abundance and spatial distribution;
c) Establishment of a GIS Data Centre and GIS Database;
d) Development of environmental-fisheries integrated models for management;
e) Development of ecosystem health indicators versus indices;
f) Coordination of joint abundance surveys including stomach sampling (e.g., from market sampling and survey sampling);
g) Objective to move from single species assessment/management to multispecies assessment/management.
h) Workshops to develop management models and indicators for sustainable fisheries (both open sea and coastal);
i) Coordination of Baltic Sea multispecies issues;
j) Promoting the use of Baltic herring and sprat for human consumption (e.g., dioxin issues).

Particular activities to advance work on these issues include:

Fish and Fisheries Module: The Study Group on Multispecies Assessment in the Baltic needs additional information related to the incorporation of environmental variability and spatial heterogeneity in fish stock modelling in the Baltic, which should be the central remit of the proposed BSRP Group for the Fisheries Module.

Pollution and Ecosystem Health Module: The traditional approach in the assessment and management of the Baltic Sea is based mainly on the assessment of water and sediment quality. Thus, the structure and function of the whole Baltic ecosystem as well as ecosystem health is not covered sufficiently. At present, there are not even any appropriate scientific tools available to use in ecosystem health assessment. Consequently, when developing the concept of ecosystem health, the following issues should be included in the remit for the supporting Working and Study Groups:

- Identification of natural sub-systems in coastal areas;
- Monitoring the biological effects of eutrophication, contamination, and fisheries;
- Development of Ecological Quality Criteria (EcoQCs) for assessing ecosystem health;
- Establishment of Environmental Reference Systems (including reference values, historical reference points, and reference areas);
- Development of classification lists of endangered species for different Baltic sub-regions;
- Updating and continuing development of existing biotope/habitat classification;
- Evaluating biological diversity (including xenodiversity/invasive species);
- Implementing nature conservation areas (including management/protection plans);
- Studying the effects of pollution on the functioning and structure of the ecosystem;
- Multiple Marine Ecological Disturbances (MMED).

These may require new Terms of Reference for existing groups as well as new groups to work in support of this module.

The implementation of this concept will require the development of decision-maker-friendly tools including decision-maker-friendly assessments and advice to management, using the standard tools of objectives, indicators, and reference points that ICES already uses in its advice.

Productivity Module: An ecosystem-based approach to marine assessment and management requires quantification of productivity, which in turn requires the BSRP to assess existing data, data needs, and data collection strategies for Baltic Sea productivity. Currently, Baltic Sea productivity-related data are collected at several separate trophic levels (primary production, phytoplankton, mesozooplankton, macrozoobenthos, phytobenthos, and fish biomass), but the data are rarely interpreted in the context of trophic interactions. Indicators have to be developed that allow material and energy flows to be followed from producers to consumers, including also the abiotic resources necessary to primary producers. The stability of these flows with respect to external disturbances should also be assessable from the indicator system. It will be important that the group is aware of indicator developments in other parts of ICES and takes heed of the guidelines prepared by ACE.

So far, productivity data have been collected mainly based on organism size, habitat type, or taxonomic entity. These data should be analysed with respect to functional groups of organisms, fulfilling specific functions within trophic flows in the Baltic Sea. Gaps where the current data do not cover relevant pathways should be identified and adaptations to the data collection and analysis strategy should be recommended for implementation by the BSRP. The use of the modern instrumentation and techniques in collecting marine productivity data should be evaluated and the need for unified standards within the Baltic Sea region should be addressed, in particular in partnership with the Baltic Ocean Observing System (BOOS) whose main concern is in the field of operational monitoring systems.

Ecosystem Modelling Module: There is need for complete ecosystem models of the Baltic covering the food web from nutrients to zooplankton. In current models used to address eutrophication and HAB issues, top-down control is truncated and parameterised in terms of mortality, whereas fishery models ignore the bottom-up effects. A first step to link ecosystem models and fish aspects is addressed in larvae drift models, but much more work has to be done to develop models that link bottom-up and top-down controls. Any new modeling group should interact closely with the Study Group on Modelling of Physical-Biological Interactions (SGPBI) in order to benefit from the best available expertise, and to ensure complementary activities. It was also clear that the work of this Group complements the modelling work of SGMAB, and close association with that Group was also necessary.

References

ICES. 2002. Report of the ICES Advisory Committee on Ecosystem, 2002. ICES Cooperative Research Report, 254. 129 pp.

ICES. 2003. Report of the Study Group on Precautionary Reference Points for Advice on Fishery Management. ICES CM 2003/ACFM:15.