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MINUTES OF THE

ADVISORY COMMITTEE ON THE MARINE ENVIRONMENT

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International Council for the Exploration of the Sea

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1 OPENING OF THE MEETING

The Chair, H.R. Skjoldal, opened the meeting at 9.30 hrs on 5 June 2000 and welcomed the participants. The ICES General Secretary, D. Griffith, then welcomed the participants to Copenhagen. The list of participants is attached as Annex 1.

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

The Chair reviewed the agenda and the items to be covered. He noted that this structure has been used for the agenda for a number of years and asked whether there was any interest in restructuring the agenda. No comments were made on this issue. The agenda was adopted as proposed and is attached as Annex 2.

The Chair stated that there will be a presentation at 14.00 hrs on Tuesday by a member of the Bureau Working Group on the Advisory Process to inform ACME on the proposals from that Working Group that will go forward to the Bureau and Council later this year.

The HELCOM request for a chapter on Baltic fish was noted. Material for this chapter has been provided by five working groups; this material needs to be reviewed, as well as the compilation of the material into a draft chapter, prepared by the Environment Adviser in advance of the meeting. This draft chapter needs to be condensed considerably, as the total number of pages should be around seven.

The Chair noted that there has been the usual problem of late submissions of Working Group reports. In addition, some reports have not been made available to the ACME as a whole, but sections have been provided for the presenters of this material. The question was raised as to whether ACME participants should have access to the entire report or only rely on the material produced by the presenter. The ACME agreed that it is important that all participants in the ACME meeting receive the entire report in advance of the meeting. It was proposed that the working groups meet earlier in the year to give the working groups time to produce their reports so that they are available in adequate time before the ACME meeting.

Some members expressed frustration that this issue has been discussed for many years and still the problem exists. It was proposed that the working groups not meet later than a certain cutoff date, e.g., 31 March. It was pointed out that most working groups have a deadline for the submission of their reports two weeks after the end of the meeting, but that many working groups do not meet these deadlines.

The ACME encouraged the Secretariat to put the draft working group reports on the ACME website as soon as they are submitted, even though there may be mis-numbering of sections, tables, etc. It was proposed that the working group be given one month to complete the report and that the date of the meeting of the working group be set with this in mind.

In summary, the Chair noted that this is a recurrent problem and must be addressed continuously. The ACME should be aware of this issue when reviewing the draft recommendations for the next meetings of the working groups. The issue of the availability of the reports of working groups reporting to Science Committees should be considered by the Consultative Committee next week. In addition, it may be useful to extend the deadline for the submission of working group reports to one month instead of two weeks, but then the entire, complete report must be submitted.

Finally, it was agreed that all material for the 2000 ACME report should be ready by the end of this meeting, so that incomplete material that needs further work after the meeting is not included in the report. The ACME members should assist in the completion of the ACME report by ensuring that all references are complete, figures are in order, and abbreviations are defined. This will save the Secretariat time in finalizing the report.

The Secretariat then described procedures to be used during the meeting in the preparation of draft sections for the ACME report.

3 REQUESTS FROM REGULATORY COMMISSIONS AND MEMBER GOVERNMENTS

3.1 OSPAR Commission

The requests from OSPAR for 2000 were reviewed and it was noted that material was available for all items on the work programme except item 3, on advice and assistance on eutrophication issues.

3.2 Helsinki Commission

The requests from the Helsinki Commission were reviewed and it was noted that material was available for all of the requests but that ACME will need to do considerable extra work on the request for the chapter on Baltic fish for the Fourth Periodic Assessment.

With regard to the triennial review of populations of seals and harbour porpoises in the Baltic Sea, the Environment Adviser reported that at a meeting of the new HABITAT Group under HELCOM that will be the recipient of this advice, the Chair of HABITAT expressed very serious criticism of the work of ICES on marine mammals in the Baltic. He even stated that ICES should disband its working group on marine mammals, as it was not able to provide adequate information for the Baltic Sea, while HELCOM will retain its Project Group on Seals, which is functioning "in an excellent manner", also covering the problems regarding the interactions of seals with salmon fisheries in the Baltic.

4 INFORMATION REGARDING OTHER FORA

4.1 North Sea Conference Process

The Environment Adviser reported that the Fifth North Sea Conference will be held in Oslo in March 2002 and activities are being initiated to develop progress reports to be considered at this conference. In this connection, a number of issue groups are being established, with participation by the North Sea States and relevant intergovernmental organizations and NGOs. ICES has agreed to participate in the issue group on fisheries (ICES Fishery Adviser) and the issue group on species and habitats (ICES Environment Adviser). The other issue groups are more related to regulatory topics, so ICES will not take part in them.

4.2 Arctic Monitoring and Assessment Programme

H. Loeng presented information on recent activities under AMAP and related programmes on the Arctic. He stated that ICES has been requested to be represented on the Assessment Steering Committee (ASC) for climate and UV radiation. H. Loeng has served as the ICES representative on this Committee initially, but he lacks confirmation as to whether he should continue to serve as the ICES representative or whether another representative should be chosen. He felt that it was very important that ICES is associated with the climate assessment work.

The ACME agreed that ICES should continue to be involved in this work and felt that H. Loeng should continue to represent ICES on the ASC.

The ACME discussed whether the draft section on AMAP should be included in the ACME report, as the material is mainly reporting on AMAP programmes. It was agreed that this section should be included in the ACME report, with some editing to shorten the text and add comments and a recommendation from ACME.

4.3 EEA and ETC/MC Inter-Regional Forum

It was reported that the last meeting of the Inter-Regional Forum, held in late September 1999, had resulted in the formation of three working groups, covering the development of environmental indicators, a marine GIS, and the improvement of data flow. ICES is represented on the working groups concerned with indicators and data flow.

4.4 Nordic Council of Ministers

The Environment Adviser stated that the Nordic Council of Ministers had accepted the report on Fisheries and Related Environment of Northern Seas, finalized by ACME at its January meeting, but that it had not yet been published. [Note: This report was published in mid-August 2000 as NMC publication Nord 2000:10.]

5 MONITORING TECHNIQUES AND GUIDELINES

5.1 Biological Effects Monitoring

5.1.1 Influence of fluctuations in salinity on biomarker and bioassay responses of marine organisms

P. Matthiessen presented a draft report section based on material from WGBEC. The ACME accepted this section for its report, and agreed that WGBEC should develop detailed guidance on validation procedures for these biomarkers at its next meeting.

5.1.2 Use of *in situ* bioassays for evaluating effects of contaminants

P. Matthiessen presented a draft report section based on material from WGBEC. The question was asked as to whether there are specific techniques that could be recommended on a broad geographical basis, e.g., over the OSPAR Convention area. Nonetheless, local problems and local organisms also need to be considered, so over-emphasis should not be given to standardization.

The ACME accepted this section for its report, with amendment to the recommendation.

5.1.3 Techniques to measure PAH metabolites

B. Pedersen presented a brief draft report section based on material from MCWG. In the discussion, it was pointed out that although internationally agreed methods have not emerged, a large amount of work has already been done and citations to the literature could be added. The ACME agreed that there should be a brief mention of the main methods along with reference to the method descriptions in the literature.

5.1.4 Sea-Going Workshop on the Effects of Contaminants in Pelagic Ecosystems

P. Matthiessen presented a draft report section, generally based on material from WGBEC with further updated material. He noted that this is a very expensive workshop and that a detailed budget for the Workshop will be prepared before the ICES ASC in September 2000. Contacts regarding sponsorship have already been made with ICES, IOC, and the Norwegian oil industry. It appears that some funding will be provided by the oil industry, particularly for chemical analysis by a central laboratory of a core group of determinands. In addition, four research vessels and the use of land-based laboratory facilities have been promised free of charge.

The ACME strongly supported this workshop. It was noted that contacts regarding sponsorship have already been made with ICES, IOC, and the Norwegian oil industry, as it is clear that external funding will be required. Subject to the availability of satisfactory funding, the ACME recommended that this workshop should proceed under ICES joint sponsorship, together with IOC and other relevant organizations.

5.2 Information on Monitoring Techniques and Guidelines relevant to OSPAR

No material was available specifically on this item, but it was noted that several points under Agenda Item 5.1 indicated techniques that were useful to the Commissions as well as sediment monitoring guidelines under Agenda Item 5.5. The ACME agreed to keep this issue in mind and perhaps have a text prepared later in the meeting. No specific text was ultimately prepared.

5.3 Information relevant to the Helsinki Commission's Monitoring Programmes

5.3.1 Assistance for HELCOM Workshop on Background/Reference Values for Concentrations of Nutrients and Chemical Contaminants in the Baltic Sea

B. Pedersen presented a draft report section based on material from MCWG.

The ACME discussed the concept of background/reference values for nutrients, noting the difficulty of dealing with natural variability and separation of anthropogenic components. It was agreed that more details should be included in this section from the reports that were mentioned in this section so that the full advice is contained here, as the present text does not provide any useful guidance to HELCOM. It was also suggested that more input could possibly be

provided in the form of a paper to the workshop, possibly concerning how to distinguish between natural and anthropogenic variability. It was noted that this HELCOM exercise aims at the development of criteria to be used in evaluating data from the monitoring programme, but the actual criteria to be used (background/reference values, ecotoxicological reference values, etc.) will depend on the intended use of these criteria.

It was agreed that further work would be done on this section to add additional material and further develop the concepts concerning the derivation and use of reference values. The revised text was reviewed later in the meeting and accepted for the report.

5.4 Substances (Nutrients, Organic Contaminants, and Trace Elements) in Marine Media that can be Monitored on a Routine Basis

J. Ólafsson presented a draft report section based on QUASIMEME material.

In the discussion, it was noted that the MCWG report contains a table showing the minimum concentrations that can be detected by most monitoring laboratories. The ACME agreed that this table should be incorporated into this section, along with some explanatory material.

The ACME recommended that MCWG seek cooperation with QUASIMEME for (1) the preparation of categorized information on laboratory performance as indicators of the ability of laboratories to perform routine monitoring, and (2) development of technical means of expressing long-term performance of laboratories from results in laboratory performance schemes.

5.5 Techniques for Sediment Monitoring

5.5.1 Normalization annex of sediment monitoring guidelines and normalization report

K. Cooreman presented a draft report section based on material from WGMS. He stated that the material contained in Annex 5 to the WGMS report contained many inaccuracies and inconsistencies and needed very major changes to be acceptable. Also most of the work of WGMS over the past years has been ignored in this annex. The model presented has an essential error, and the issue of diagenesis has not been handled thoroughly. There are also a number of other errors. Thus, none of the material in this annex is suitable for the ACME report. Specific comments from ACME will be forwarded to the Chair of WGMS. However, the material in Section 6 of the WGMS report is good and he recommended that it be included in the ACME report with some editing.

He stated that the discussion on normalization has mainly been based on chemical considerations, but he felt that normalization should be based on ecological considerations. The QUASH work has gone into great detail and is very complex and costly.

The ACME initially agreed that the material from Section 6 of the WGMS report should be the basis for the ACME report section, with the addition of some paragraphs providing conclusions or concise statements of the recommendations.

The ACME felt that a comprehensive background document on normalization would be very important to provide the basis for the ultimate development of revised guidelines for the normalization of contaminant concentrations in sediments. Thus, the ACME encouraged WGMS to finalize the guidelines on normalization and to prepare a comprehensive background document on normalization. The ACME also wished to convey to WGMS the need to consider normalization from an ecosystem perspective, and not simply from a chemical perspective. Thus, biological aspects should also be considered.

In the final consideration of this section for the report, it was felt that there is no final agreement on the recommendations for normalization and that there are some issues that have not been completely resolved. Accordingly, the ACME agreed to include a brief section on this issue in the body of its report, and attach the material from Annex 6 to its report.

5.5.2 Organotin guidelines

T. Nunes presented a draft report section based on material from WGMS. The ACME accepted this section for its report.

In the discussion, the question was raised as to whether guidelines could be prepared for the analysis of organotins in biota. B. Pedersen stated that, while methods are available for these analyses, at present it is not possible to recommend any specific method.

5.6 Statistical Aspects of Monitoring

5.6.1 Development of trend detection methods for input data

S. Uhlig presented a draft report section based on material from WGSAEM. He pointed out that there were problems with results on heavy metals, possibly owing to the effects of suspended particulate matter.

In the discussion, it was agreed that much of the material from Annex 5 and all the material from Section 4.3 of the WGSAEM report should be included as an annex to the ACME report, in order to provide complete material for OSPAR. With the addition of this material as annexes and some amendments to the draft section, the ACME accepted this for its report.

The ACME thanked S. Uhlig and WGSAEM for this extensive material.

5.6.2 Statistical methods for designing sampling allocation strategies for monitoring programmes

S. Uhlig presented a draft report section based on material from WGSAEM. The ACME felt that this material was valuable and agreed to include it in its report, with some amendment. The ACME encouraged WGSAEM to develop this material further, particularly concerning models for the relationship between the concentration of a contaminant in an organism and the ambient concentration. Work on this last-mentioned topic should preferably be conducted in association with chemists and biologists from MCWG and WGBEC, respectively.

5.6.3 Spatial issues, e.g., with regard to determination of the number of replicate samples of sediments or biota to characterize an area

S. Uhlig presented a draft report section based on material from WGSAEM. He pointed out that this item is based on a previous request from OSPAR that was considered to be very unclear, but WGSAEM has continued to work on this topic on the basis of reviews of national data. The ACME agreed to include this material in its report, with some amendment. The ACME considered that the issue of spatial sampling design (e.g., to assess the mean level in an area) should be further developed, and encouraged WGSAEM to conduct further work based on case studies.

5.6.4 Statistical aspects in relation to monitoring, integrating and interpreting biological effects

P. Matthiessen presented a draft report section based on material from an informal joint meeting between WGSAEM and WGBEC. He noted that there is clearly a need to develop additional material on biomarkers and their annual cycles, and thus monitoring programmes should not be based on only one or a few biomarkers but rather on a suite of biomarkers.

The ACME agreed to incorporate this material in its report, moving it to Agenda Item 5.1 on biological effects.

5.6.5 Implications of the outcome of the VIC programme on the monitoring of temporal trends in contaminants in biota

B. Pedersen presented a draft report section based on material from WGSAEM. She pointed out that, although it was hoped that a number of countries would submit data for this programme, only the Netherlands and Norway participated. It was pointed out that detailed biological considerations need to be taken into account along with the statistical considerations; a statement on this should be incorporated in the text.

In the discussion, it was pointed out that additional data may not assist our understanding, but rather a scientific programme to investigate the various factors that influence contaminant concentrations in fish was needed. At present, it was not clear how such a programme should be designed.

5.7 Evaluation of the Effectiveness of Monitoring Programmes in Determining Trends against a Background of Natural Fluctuations

H. Loeng presented a draft report section based on material from WGSSO. He stated that this topic has been on the agenda of WGSSO for several years and that there had been inadequate expertise on this complex topic at the meeting. He felt that if ACME would like to have further material on this topic, a workshop should be organized with participation of experts from various relevant fields.

In the discussion, it was noted that the draft text concentrated on the development of future monitoring programmes rather than an evaluation of existing programmes. The ACME decided to return to the recommendation that a workshop on this topic be held in 2002; this issue could be linked to the OSPAR request regarding assistance in evaluating nutrient data in relation to eutrophication. A joint workshop with OSPAR, HELCOM, EEA, and possibly IOC to assess monitoring programmes with regard to eutrophication could be considered. Monitoring programmes may need to be more local to adapt to local conditions, rather than regional monitoring programmes.

5.8 Use of *in situ* Chemical Oceanographic Systems for Observations of Chemical Variables

S. Carlberg reported that a review report on this topic had not been available for the MCWG. He noted that MCWG will consider this issue when this report becomes available. Accordingly, there is no material on this topic for the ACME report.

6 QUALITY ASSURANCE PROCEDURES AND INTERCOMPARISON EXERCISES

6.1 Quality Assurance of Biological Measurements in the Baltic Sea

J.-M. Leppänen presented a draft report section based on material from SGQAB. In his presentation, he reported that HELCOM has suspended funding for various expert groups working on taxonomy and other activities related to the quality assurance of monitoring data.

It was noted that SGQAB expressed deep concern over the delay in the completion of the Biological Data Reporting Format and the biological community database. The ACME agreed that this should be considered in greater detail under Agenda Item 20.

It was pointed out that there are several lists for phytoplankton taxonomy in European waters, as well as work in ICES under SGPHYT.

The ACME noted that SGQAB has requested the ICES Environmental Data Scientist, J. Nørrevang Jensen, to contact persons developing the HELCOM PhytoCount program, to agree on possible cooperation in the preparation of data entry programs. As the program for counting phytoplankton already exists, there is no need for ICES to develop such a program.

The ACME agreed to this text with several amendments. It was discussed whether a statement should be made concerning the HELCOM decision to withdraw funding for some of the QA activities that have previously been funded by HELCOM. The ACME decided that it should not express direct criticism of the decision of another organization, but that it could emphasize the importance of funding these types of activities.

6.2 Quality Assurance of Biological Measurements in the OSPAR Area

P. Gentien presented a draft report section based on material from SGQAE. In addition, he proposed that ACME consider the merging of the two groups, SGQAB and SGQAE, so that there is only one group in ICES working on QA issues for biological measurements.

The issue of publication of guidelines on chlorophyll *a* methodology was discussed. This material had originally been intended for publication in the 1999 ACME report, but at the 1999 ASC it was decided that the two texts (one from MCWG and the other from WGPE) should be merged and published in the *ICES Techniques in Marine Environmental Sciences* series. When SGQAE reviewed this document, they felt that the method described is not as widely used as previously and should not be considered an ICES standard method. S. Carlberg explained that MCWG reviewed this document at its 2000 meeting and, in addition to making a correction, changed the text to state clearly that this is only one possible method. The ACME agreed that this issue should be handled separately from the text of this section, and

will only be covered in the minutes. The ACME will communicate with the SGQAE Chair to clarify this matter and a final recommendation will be proposed at the ACME Consultations meeting in September 2000.

It was agreed that ACME will review the revised text for this section later. In addition, a new text on the Zooplankton Methodology Manual should be provided under Agenda Item 6. These two texts were ultimately accepted for inclusion in the ACME report.

6.3 Quality Assurance Procedures for Biological Effects Techniques, including Fish Diseases

P. Matthiessen presented a draft report section based on BEQUALM Project newsletters. The ACME accepted this text with some additional comments by ACME and rewording of the recommendation.

6.4 Quality Assurance of Chemical Measurements in the Baltic Sea

E. Andrulewicz presented a draft report section based on material from SGQAC.

The ACME noted the Workshop that had been held last October for QA for chemical measurements associated with environmental monitoring and the monitoring of inputs of contaminants and nutrients. This had provided a very useful forum for cooperation between these two groups of scientists.

The ACME noted that SGQAC was trying to develop technical notes for PAHs in biota and organochlorines in sediments. However, the ACME has already accepted guidelines for measuring these substances and published them in previous ACME reports. The same guidelines should be used for the Baltic Sea as for the OSPAR area to the greatest extent possible. The Environment Adviser stated that she had informed SGQAC about these guidelines at their 1999 meeting as well as about the ACME recommendation in the 1998 ACME report that these guidelines should also be applied in the Baltic Sea. Unfortunately, SGQAC has still not apparently accepted this recommendation. The ACME felt that the work of SGQAC should become more integrated into the overall ICES work as it is vital that chemical methodologies be developed for as broad a use as possible, and certainly so that methods can be used in both HELCOM and OSPAR monitoring programmes.

6.5 Certified Reference Materials for Organic Compounds for Use in Marine Monitoring

T. Nunes presented a draft report section based on material from MCWG. There was a discussion of the material in the tables. It was pointed out that the information in the tables is correct, but that there is information on other materials and other contaminants that should preferably be added before publication in the ACME report. It was suggested that the tables could be considered for publication on the ICES website.

The ACME agreed that the text should be included in the body of the report and the tables should be attached as an annex to the report. The abbreviations should be explained and possibly some information should be provided on how to order the materials. Some of the bullet points need to be included in the annex with the tables.

In light of the implications that the existence of appropriate CRMs has on the development and improvement of analytical methods and on the quality assessment of the information produced within marine environmental monitoring programmes, the ACME endorsed the MCWG view that:

a) the tables of CRMs available for routine monitoring of organic contaminants in the marine environment should be updated on a regular basis;

b) similar tables of CRMs should be prepared for other contaminants (e.g., trace metals, organometallic compounds) and other determinands routinely analysed in marine environmental monitoring (e.g., nutrients, total organic carbon).

It was proposed that these tables also be placed on the ICES website. The mechanism for the review and updating of these tables will need to be considered when the terms of reference for the next meeting of MCWG are considered. After discussion on whether ACME should have a role in deciding what material should go on the ICES website, the ACME agreed to propose that these tables be placed on the ICES website.

6.6 Developments within QUASIMEME and QUASH

S. Carlberg presented a draft report section based on material from MCWG and internal reports from the QUASIMEME and QUASH projects. If some useful information on the recently completed QUASH project is available on the web, this will be added; otherwise, a short statement will be made about the completion of the project and the ultimate availability of the reports arising from this project. It was also requested that information on collaboration between QUASIMEME and BEQUALM on certain specific determinands be included in this section. With these amendments, the ACME accepted this section for its report.

6.7 Other Issues or Activities

B. Pedersen presented material on quality control of chemical monitoring data prior to their use in an environmental assessment, based on the MCWG report. A small group of members of MCWG will prepare a note on this issue for discussion at the 2001 MCWG meeting, taking into account Annex 4 of the 2000 MCWG report.

It was noted that SGQAC will also consider criteria for the QC of chemical data, so there should be some cooperation between members of SGQAC and MCWG on this topic. In addition, there is an OSPAR request relevant to this issue for 2001.

7 ENVIRONMENTAL AND ECOSYSTEM ASSESSMENT

7.1 Ecosystem Effects of Fishing in the Baltic Sea

J. Rice presented the material on this topic from the WGECO report. It was questioned as to whether information on cormorants was considered in the preparation of this material. J. Rice indicated that material on effects on cormorants was considered but not included owing to the requirement for brevity in this contribution to the chapter for the HELCOM Fourth Periodic Assessment.

The ACME agreed that the full text on this topic should be included in the ACME report, with the addition of material from SGDIB and several other amendments. The material on M74 should be moved to supplement, as necessary, other information on M74 under Agenda Item 9.3. For the Fourth Periodic Assessment, this material should be summarized into two pages.

7.2 Initial Considerations of a Scientific Framework for ICES Ecosystem Advice, including an Ecosystem Approach for the Sustainable Use and Protection of the Marine Environment

The Chair noted material from the SGEAM and WGECO reports, as well as a document initially developed last year by the MHC Chair, A. Jarre, on the Baltic Sea ecosystem.

J. Rice then reviewed the history of consideration of the topic of ecosystem management objectives within WGECO over the past few years, and summarized the work conducted at the most recent meeting on this topic.

The Chair stated that the intrasessional work on this topic should cover the definitions of relevant terms, as well as the material in the above-mentioned reports.

It was noted that this topic is very broad, and can serve as a framework for much of the work of ICES. The challenge is to get all relevant groups of people together to consider ecosystem-based management issues. The SGEAM proposal for Regional Ecosystem Groups should be considered, but the mechanisms to be used by these groups need to be developed.

It was agreed that a sub-group should be formed to review the material in the three documents mentioned above and take the item further. The sub-group will be chaired by J. Piuze, with J. Rice, E. Andrulewicz, J. Boreman, H. Loeng, E. Ojaveer, and H.R. Skjoldal as members.

On Friday morning, J. Piuze reported on progress in the work of the sub-group. Two documents are being prepared, one on the framework for ecosystem advice and another more related to reference points for fisheries from Section 7 of the WGECO report. In addition, the issue of environmental indicators was considered to be separate, so this will be returned to Agenda Item 7.6 for further discussion, although no new material on this topic has arisen from the working groups.

J. Piuze presented a discussion document prepared by the sub-group. The ACME discussed this document and decided that it should be attached to the minutes for further consideration and discussion within ICES; this document is attached as Annex 3. It was noted that this will be a first step in the development of quantitative criteria or objectives for ecosystem management.

In discussing this document, the ACME took note of the SGEAM proposal that ICES establish Regional Ecosystem Groups (REGs) to provide for the preparation of integrated assessment by experts on fisheries and environmental conditions. The work in the REGs should focus on the following tasks:

1) consider the general issue of the integration of pertinent assessment information on the changing states of large marine ecosystems (LMEs) in the region, based on regional expertise;
2) prepare periodic assessments of the status and trends in fish stocks and environmental conditions of the LMEs in the region with emphasis on: (a) climatic/physical driving forces, and (b) biological (e.g., multispecies) interactions;
3) contribute to environmental assessments and the preparation of Quality Status Reports (QSRs) in cooperation with stakeholders, academic institutions, the public, and other organizations (e.g., EEA, OSPAR, AMAP, HELCOM).

The results and products of the REGs would be reviewed and translated into advice by the JASC and, as appropriate, by ACFM and ACME.

The REGs would receive input to their work from thematic Working Groups such as the status of fish stocks from stock assessment Working Groups, climate status from Oceanic Hydrography, pollution status from MCWG and WGBEC, etc. The output from the REGs would in turn be used as input to stock assessment Working Groups and Working Groups dealing with specific environmental issues such as harmful algal blooms or fish diseases. It is likely that the number of thematic Working Groups could be reduced as some of the tasks would be taken over by the REGs.

The ACME agreed to discuss this proposal at a later meeting.

The sub-group working on this agenda item also put forward the portion of the 1999 report of WGECO containing a discussion of reference points and ecosystem considerations. The ACME decided to annex this material to its minutes, to be included in the further consideration by ICES of the issue of a scientific framework for ICES ecosystem-based advice. This material is attached as Annex 4.

7.3 Study Group on the Scientific Basis for Ecosystem Advice in the Baltic

E. Ojaveer stated that this Study Group was established at the 1999 ASC. It will meet in Gdynia on 19–21 June 2000 and report to the Consultative Committee and the Baltic Committee at the 2000 ASC.

It was asked whether there are any links between this Study Group and the GEF Baltic Sea Regional Project.

7.4 Evaluation of the Strategies of the Existing Monitoring Programmes in Terms of their Ability to Support Integrated Environmental Assessments

The Chair noted that this was on the agenda of the SGEAM, but that the small membership of the group limited its ability to carry out this evaluation in a broad way. K. Cooreman reported on the SGEAM topic, based on a review of the OSPAR QSRs for Regions I and II. This material provides a good initial basis for this evaluation.

It was noted that the tables prepared for Regions I and II are prepared on different bases, but the reason for this is not apparent in the SGEAM report. This was, however, probably due to the differences between these two regional reports.

After discussion of this item and consideration of a draft section for the report, the ACME decided that this material was still too preliminary and that further consideration needs to be given to this issue. Accordingly, the ACME agreed to annex this material to the minutes (Annex 5), for further work in the future.

7.5 Methodology and Proposals for Ecological Quality Objectives for the North Sea

H.R. Skjoldal recalled that at the 1999 ACME meeting, the ACME briefly reviewed a background document for a Workshop on Ecological Quality Objectives for the North Sea, held in Scheveningen in September 1999. The report on this Workshop has been published by the Nordic Council of Ministers; the Workshop decided on ten issues on which

EcoQOs should be developed for the North Sea. He noted that this work is being conducted jointly by OSPAR and the North Sea Conference Secretariat, with the aim of having some Ecological Quality Objectives available at the North Sea Conference in 2002. OSPAR will develop EcoQOs for declining or threatened species, and has requested ICES to develop EcoQOs for seabirds and marine mammals. He will develop a brief text on this topic for consideration later in the meeting.

This text was subsequently reviewed by ACME and accepted for inclusion in its report.

7.6 Environmental Indicators

E. Andrulewicz stated that indicators are becoming very important tools for environmental management, but they must be based on the proper parameters and the correct scale. He also pointed out that there may be a need for the participation of environmental economists in this issue.

The Chair described the table of indicators developed by the European Environment Agency Inter-Regional Forum (IRF) Working Group on Marine Indicators and the draft report of the first meeting of that group. This report was provided to ACME for its information and, particularly, for review of the table of indicators, as ICES is involved in this working group.

E. Andrulewicz stated that new indicators, such as those being developed by the Global International Water Assessment (GIWA), are incorporating environmental economic issues. He recommended that ACME take note of this development and begin to prepare its own strategy on the issue of indicators.

The ACME took note of a draft text for the ACME report, partly based on material from the SGEAM report. In discussing this draft, it was generally felt that the ICES work on this topic is at an early stage and that it would be better to wait at least one year before including text on indicators in the ACME report. Nonetheless, it was agreed that further intrasessional work on this topic should be done, on the basis of the IRF working group report and other material, and a new text containing a proposed strategy for ICES could be prepared for review later in the meeting. It was proposed that the issue of indicators also be covered in the sub-group established to consider an ecosystem approach, under Agenda Item 7.2.

Ultimately, the ACME agreed to await the outcome of the work of the IRF Working Group on Indicators, in which ICES is participating, and return to this issue next year.

7.7 Structure and Process of Environmental Assessments and Production of Environmental Quality Status Reports

The Chair recalled that about ten years ago there was a discussion in ICES concerning the structure of a Quality Status Report, containing chapters on physical conditions, chemical conditions, and biological conditions in the area being assessed. This structure was used in the 1993 North Sea QSR and also in the OSPAR QSRs. This experience has shown that this structure creates difficulties in bringing all the information together for a more integrated assessment. Alternative ways of bringing experts together could be considered to provide a more overall view of the various topics, e.g., eutrophication.

In terms of the HELCOM assessment, it was pointed out that it is difficult to bring together data on different parameters that have been collected on very different time scales, some annually down to some on a very frequent basis, and this affects our ability to conduct more integrated assessments.

Generally, a fundamental problem is that the data have not been collected in an integrated way, thus making an integrated assessment very difficult. This should point to the need to change the way that the data are generated, so that better assessments can be conducted.

Another question in this regard concerns whether all the relevant information was available for the preparation of the OSPAR QSRs.

The lack of clear conclusions in the 1993 North Sea QSR and in the OSPAR QSRs is a matter of concern. This is particularly the case with regard to the lack of conclusions on contaminants, even when levels exceed the reference values adopted by OSPAR. It was also felt that the ACME should consider the use of fisheries results in the QSRs, e.g.,

over half of the fish stocks assessed in the OSPAR area are outside safe biological limits. What does this really mean in terms of the ecosystem?

It was agreed that a sub-group should be established to address this agenda item and Agenda Items 7.8 and 7.4. The sub-group will be chaired by S. Carlberg, with J. Doyle, K. Cooreman, J.-M. Leppänen, P. Matthiessen, T. Nunes, and A. Yurkovskis as members.

On Friday morning, S. Carlberg reported the outcome of the sub-group work, as contained in a document under this agenda item. He pointed out that material prepared under Agenda Item 7.4 should immediately precede this text in the ACME report as the texts are complementary. S. Carlberg then presented in detail the text prepared by the sub-group and its recommendations.

In the discussion, it was felt that this is a very useful text for initial discussion of this topic. It was agreed that a definition of the term "environmental assessment" should be included in the section on objectives. Noting the general lack of biological data and biological effects of contaminants data, it was proposed that this lack should be stated.

The question was raised as to whether the sub-group considered the clarity of the conclusions of the OSPAR QSRs. In reply, it was stated that despite using different assessment techniques, the five regions came up with mostly the same key issues and generally in the same ranking order.

The Chair brought up the role of ICES in the preparation of QSRs. ICES provides guidance on methodologies for measurement of the various parameters and handles the data on a number of parameters; for the OSPAR QSRs it also provided specific information requested (fisheries, effects of contaminants on marine mammals), and finally conducted a peer review of the document prepared for the holistic assessment. With the reorganization of OSPAR now taking place so that the monitoring and assessment work is brought into the programmes and measures work, there is some concern that the data collected will be more subject to political control.

Doubts were expressed that ICES could play a more important role in the preparation of QSRs, as it may be seen to compromise the independence of ICES. It was felt that it could be risky for ICES to attempt to prepare such assessments. In addition, the resources required could be prohibitive. Resources would be needed in addition to those already required for work in ICES working groups, which would be too much of a strain on the system. In addition, the science needs to be kept separate from the evaluation required for the preparation of an assessment. However, there are several levels of assessment: one dealing with the scientific data and another in determining the human component of changes.

The Chair felt that there could be a parallel between the ICES work on the monitoring of fish stocks and the development of fish stock assessments and advice on fish stocks and a new way forward for the development of environmental assessments.

There could be a role for ICES in evaluating data on environmental parameters submitted to the ICES environmental databases. It could be of interest to the relevant working groups concerned with these types of data to conduct a basic evaluation and review of these data. Such an evaluated set of data could then serve as a basis for further assessment activities in the commissions and possibly even in ICES.

The ACME decided to finalize this document and attach it to the minutes (Annex 6) for further refinement based on the outcome of the work in HELCOM on the Fourth Periodic Assessment plus other considerations that may arise. In order to ensure that further work is conducted on this document, it was agreed that a sub-group comprising S. Carlberg, P. Matthiessen, and H.R. Skjoldal should work intersessionally to provide an update for the ACME Consultations Meeting in September. Contributions from all members were encouraged and especially from J.-M. Leppänen on the HELCOM Fourth Periodic Assessment.

It was felt that this material was very valuable, but that it was extremely difficult to produce a shorter version of this material for the report. However, a brief activity report could probably be prepared describing the ACME activity to produce this report. It was noted that there are many facets involved in the consideration of this subject and the document may merit from further work during the intersessional period.

The ACME decided that it would put a short section on this topic in the body of its report. If a full text can be completed by the time of the ACME Consultations Meeting in September and the 2000 report has not yet been published, then this text can be included as an annex to the 2000 ACME report.

7.8 Assessment of the Limitations in our Abililty to Conduct an Environmental Assessment

J. Doyle stated that a more pragmatic approach is needed to the preparation of QSRs on a broad geographical scale, as regional differences in conditions and data available imply that a rigid adherence to a specific structure of document creates a very uneven result.

J. Rice stated that for the evaluation of fish stocks, it is very important to have clear values to which the present state of the stocks can be compared. This is also necessary for review of the conditions in the marine environment. It is not a perfect system, but it is much easier to compare conditions with certain characteristics that are agreed to be desirable, rather than simply comparing conditions on a more general basis.

Another fundamental problem with the OSPAR QSRs is that the programme was not designed to determine cause-and-effect chains. Without the ability to attribute causes to observed effects, we cannot tell managers how to improve the situation.

The Precautionary Principle should also be taken into account when drawing conclusions in these assessments. However, it was noted that there are two potentially conflicting principles: the Precautionary Approach, and managing the risks, which may go in the other direction. The pressures come from both directions.

7.9 ICES Environmental Status Report

7.9.1 Oceanographic conditions

H. Loeng presented a summary of the ICES Annual Ocean Climate Status Summary for 1999/2000, as prepared by WGOH. He stated that the full report has been placed on the ICES website. The Oceanography Committee will recommend that the full report also be published in the *ICES Cooperative Research Report* series on an annual basis without receiving Council approval each year.

In the discussion, it was felt that it would be informative to publish the entire Status Report rather than just this very brief summary. It was also proposed that some evaluation of the implications of these conditions should be made by ACME when they review the material.

H. Loeng stated that there may be contradictory interests between the Science Committees and the ACME, thus it should be decided in the Consultative Committee how the publication should be handled.

The Chair felt that there should not be a conflict here. He would like to consider the timing of the preparation of environmental status summaries to meet the needs of other parts of ICES, such as the fisheries assessments. Their use for purposes other than basic science should be considered.

The ACME agreed that the short form of this report should be included in the ACME report with the addition of the web address and a description of the additional material that is available on the web.

The Chair expressed the appreciation of ACME to WGOH and the Oceanography Committee for this excellent work.

7.9.2 Zooplankton Monitoring Results

The Chair stated that no material was available at the present time from WGZE, but if material becomes available in the near future, it could be considered for inclusion in the ACME report. Otherwise, this material will be considered next year.

WGZE did not produce an overview of zooplankton monitoring programmes in ICES Member Countries in 1999. The ACME recommended that an annual Summary Status Report on zooplankton monitoring results in the ICES area be produced and distributed via the ICES website. The need for ongoing discussions on the use of biological indices and data produced on a routine basis for fisheries and environmental assessment groups has also been noted by the ACME.

7.9.3 Harmful algal blooms

P. Gentien stated that the production of the HAB maps is very time consuming, but they will be available by the end of June.

The ACME agreed that, rather than including these maps in the ACME report this year, they should be published on the ICES website and a short section should be included in the report describing these maps and giving the web address.

7.9.4 Fish disease prevalence

T. Lang presented draft material on fish diseases for inclusion in the ICES Environmental Status Report. This material comprised a brief text followed by several maps showing the distribution of certain diseases in fish and shellfish in the ICES area. This material is proposed for inclusion in the ACME report and on the ICES website. In the discussion, it was felt that some discussion of the maps for diseases of shellfish should be included on these maps, in a similar way as for the text on the fish disease maps. The ACME hoped that this new text could be prepared during its meeting.

The ACME accepted this material for inclusion in the ACME report and also on the ICES website. The ACME expressed its appreciation for the high quality work carried out by WGPDMO members in producing the disease maps. It was noted that the means of best presenting this material on the website should be explored with the ICES Secretariat.

7.10 HELCOM Fourth Periodic Assessment and Final Consideration of Chapter on Fish, Fish Diseases, etc.

An intrasessional sub-group was established to prepare a final draft of this chapter during the meeting. The sub-group was chaired by E. Ojaveer, with participation of E. Andrulewicz, J. Rice, T. Lang, S. Mellergaard, and A. Calabrese. It was agreed that the page restriction of seven pages total would not count the references, as they will be placed at the end of the final document. In addition, many of the diagrams can be printed in a much smaller format in the final document. The sub-group was requested to review the material and summarize it, with a view to reducing the size considerably; the sub-group was also requested to propose one page of text for overall conclusions from this chapter.

On Friday evening, E. Ojaveer presented the results of the sub-group work to revise and finalize this chapter, based on additional work with H. Sparholt. It was agreed that this text should be reviewed and comments made after review of the draft report on Saturday.

The Environment Adviser stated that she would prepare a brief section for the ACME report describing the overall chapter and indicating the sections in the report that contain more detailed information on some of the topics covered. This will be included in the draft compiled report to be distributed in mid-July.

7.11 OSPAR Requests for EcoQOs for Seabirds and Marine Mammals

The ACME reviewed the requests from OSPAR for 2001 on the development of Ecological Quality Objectives for sea mammals and seabirds in the North Sea. It was proposed that the working groups on marine mammals and seabirds should have a responsibility in responding to this request, but that other working groups, e.g., WGBEC and WGECO, should also have a role. One model is that the working groups dealing with population issues in regard to marine mammals and seabirds should collect the relevant data, quality assure that data, and then provide the material to a group considering the ecological quality aspects, e.g., WGECO, for a final treatment. Another possibility is that the request be given to one group that then convenes a workshop with participants from the various relevant disciplines.

It was agreed that it is important to have a clear consistency in the ultimate recommendations between mammals and seabirds, but the basic data must come from the specialist working groups. The specialist working groups will need to provide a synthesis of the status of populations and a health status of the populations in relation to their habitats. In addition, information from WGBEC and possibly WGPDMO should be included, and an overall group such as WGECO or SGEAM could provide guidance on the levels for the EcoQO indices.

The experience of ACFM in developing reference levels for single-species fish stock management was noted and, in particular, the need for consistency in the development of these reference levels.

In the discussion, it was felt that a clearer definition of the role of WGECO should be made, particularly in relation to SGEAM.

The Chair summed up by noting that it could be useful to hold a joint meeting of WGECO and SGEAM to deal jointly with the request for EcoQOs for marine mammals and seabirds. This could also include parallel meetings of WGMMHA/WGMMPD and WGSE to compile and evaluate the relevant data for the development of these EcoQOs.

8 MARINE CONTAMINANTS

8.1 Information on Specific Contaminants

B. Pedersen presented a draft report section based on material from MCWG. This draft section contained new information on TCPM and TCPMe, volatile organic contaminants (VOCs) in biota, monitoring and analysis of toxaphene, and dioxins.

In the discussion, the ACME agreed that the material on TCPM and TCPMe should be included in the report, but that it would be useful to include some information on the toxicity of these compounds. A reference to the 1998 ACME report, which contains a more extensive overview, should also be made. The ACME also agreed that the material on volatile organic contaminants in biota should be included in its report. However, the question was raised as to whether there really is a problem with these volatile compounds in the marine environment. The ACME requested MCWG to consider the issue of whether VOCs create a problem in the marine environment.

The ACME decided not to include the material on monitoring and analysis of toxaphene.

In reviewing the material on dioxins, the question was raised as to whether the material from WGEIM on dioxins in the Baltic Sea should be included here. The ACME agreed, in principle, with this suggestion but requested that these figures on dioxins in herring be carefully checked. The question was raised concerning the draft text in relation to human health risk; it was decided that it would be better to mention toxicity to marine life instead. It was agreed that this material would be included in the report, along with some information on dioxins in Baltic herring.

8.1.1 Evaluation of Lists of Priority Contaminants in Regional and International Organizations

J. Ólafsson presented a draft report section based on material from MCWG.

In the discussion, it was pointed out that this is a highly political subject. This section does not indicate the consequences of a substance being listed in the Water Framework Directive (WFD). In addition, the criteria used to rank the substances in terms of their relevance to the marine environment should be listed in detail, otherwise many questions can be raised on these judgements. It was also not clear whether substances on the WFD are also intended for inclusion on the OSPAR DYNAMEC list.

In response, J. Ólafsson stated that the criteria for the ranking of these substances were not listed in the MCWG report, nor were the consequences of listing a substance in the Water Framework Directive. B. Pedersen stated that the WFD only applies to coastal water within 1 nautical mile of the coast, while the tables refer to marine waters in offshore areas.

The ACME agreed that this section should be amended to include the criteria used in the preparation of the table, and clarifications concerning WFD and DYNAMEC should be included before deciding whether to include this section in the report. It was ultimately decided that this material should not be included in the ACME report.

8.2 Relationship between Biomarkers, Physiology, and Contaminants

No material on this topic was available for the meeting.

8.3 Workshop to Evaluate the Utility of Artificial Intelligence Procedures in the Assessment of Pollution Effects in Flatfish

P. Matthiessen presented a draft report section on this topic based on material from WGBEC. This was accepted by ACME for the report with a minor amendment.

It was noted that if it proves impossible to organize a workshop in Seattle at a later date (e.g., 2002), then an alternative venue and date should be considered, utilizing one or more of the data sets listed in this report section, if they prove to

be appropriate for the purpose. If possible, a viable and costed plan will be presented to the Marine Habitat Committee at the 2000 ICES ASC in September.

8.4 Use of Chemical Data in Numerical Modelling

S. Carlberg presented some material from MCWG that was not really intended for the report.

In the discussion, it was noted that material from other agenda items was relevant to this issue. In particular, under Agenda Item 5.7 it was stated that nutrient fluxes, rather than levels, should be monitored, and a suggestion was given for a workshop. This workshop could be used to address the use of modelling tools in studying eutrophication and assessing its significance.

H. Loeng stated that in 1999 AMAP held a modelling workshop for contaminants, including inputs, that could contain some useful information. It could be valuable to establish cooperation with AMAP on this type of issue.

It was proposed that some of the material from this section concerning the use of models in working with fluxes rather than levels be incorporated into the redrafting of material for Agenda Item 5.7. A proposal for a workshop on modelling in relation to eutrophication, and which working group(s) should be involved in the planning of this workshop, should also be included.

Consideration should also be given to developing cooperation with AMAP and how this could best be carried out.

It was agreed that there would be no separate section for the report based on this agenda item.

8.5 Estuarine Transport of Trace Metals

It was noted that no material on this topic had been prepared by either MCWG or WGMS, showing the lack of experts on relevant topics in ICES. However, it was pointed out that there is quite a lot of work being conducted on estuarine transport of substances. It could be useful to include nutrients in this work also, in addition to trace metals.

9 FISH DISEASES AND RELATED ISSUES

9.1 Results of National Reports and Analyses of Data on Disease Prevalence in Wild Fish Stocks

S. Mellergaard presented a draft section summarizing new trends described in the WGPDMO report. This was accepted for the report with the addition of some new material on paramoeba-associated morality of lobsters in Long Island Sound.

9.2 Progress in Work on Fish Disease Data Assessment

T. Lang presented a draft section for the report based on material from WGPDMO. This section stressed the importance of ICES Member Countries submitting data on contaminants and on the occurrence of diseases in other fish species. T. Lang stated that WGPDMO feels that the ICES databases are potentially a very powerful tool to better understand the marine environment.

In the discussion of the progress made with regard to the statistical analysis of the ICES fish disease data in combination with other ICES environmental and fisheries data, the value of such a holistic approach in light of the need for more ecosystem-oriented assessments was stressed. It was pointed out that the various ICES data banks have an important function in this context as sources of quality-assured data, providing information on many parameters and covering large geographical areas and periods of time.

However, the ACME noted with concern that, despite the efforts of ICES over the past years to encourage Member Countries to submit relevant current and historic data, considerable data gaps (particularly contaminant data) continue to exist in the data banks, hampering more comprehensive data assessments. Possible reasons for this situation discussed by the ACME in this context were as follows:

- Member Countries have not yet fully realized the value and power of the ICES data banks for environmental ecosystem-based assessments and, therefore, have not provided the necessary funding needed for maintaining/managing the data banks and have not yet seen the need to submit their data.
- Member Countries may consider especially the ICES Environmental Data Centre only as a database serving the purposes of the Regulatory Commissions and not as a tool helping to generate advice addressing problems of direct relevance for ICES Member Countries. They may, therefore, be reluctant to provide proper funding and to submit relevant data, including data other than those requested by the Commissions.
- Funding constraints and increasing work load in the ICES Environmental Data Centre, in combination with major changes in the data bank system, have led to problems in the timely updating and completion of the Reporting Formats and the general data bank maintenance. Therefore, Member Countries may be reluctant to submit their data.

The ACME strongly emphasized the need to find ways to clarify the situation and to solve existing problems in order to enable a better utilization of the ICES data banks. This will be of particular importance for future activities related to ecosystem management advice.

The ACME supported the recommendation that data be submitted on contaminants and fish diseases in additional species. These data banks are very important to advancing our understanding of the marine environment. The ACME accepted this section for its report, with minor amendments.

The ACME requested WGPDMO to prepare a manuscript describing the statistical methodologies developed for the analysis of the ICES data in relation to fish diseases, for submission for publication in the *ICES Techniques in Marine Environmental Sciences* series. This request will be included in the terms of reference for the 2001 WGPDMO meeting.

9.3 Causes of the M-74 Syndrome in Baltic Salmon and Progress in the Understanding of Relevant Environmental Factors; Status of *Ichthyophonus* in Herring

S. Mellergaard presented a draft section for the report based on material from WGPDMO. The ACME accepted this section for its report, with minor amendment.

9.4 New Techniques in Pathology for the Detection of Endocrine Disrupting Chemicals in Marine and Estuarine Organisms, including Appropriate New Target Species Representing the Main Ecological Levels of the Marine Environment

T. Lang presented a draft section for the report based on material from WGPDMO. Several comments were made on this section. It was further noted that additional information on endocrine disruptors is contained in the WGAGFM report. It was agreed that some of this additional information should be added, but that the genetic material should be covered under Agenda Item 19.4.

9.5 Report on Diseases and Parasites in Baltic Sea Fish

T. Lang presented material from the WGPDMO report that had been prepared as a contribution to the HELCOM Fourth Periodic Assessment. However, as this material was too extensive for inclusion in the Fourth Periodic Assessment, he agreed to prepare a condensed version for that assessment. The full material from the WGPDMO report was proposed to be included as an annex to the ACME report. This was agreed by ACME.

10 ISSUES REGARDING INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

The ACME noted that WGITMO did not handle all of its terms of reference and, while its report provided national information on various subjects in annexes, it provided no evaluation of the material contained in these national reports.

10.1 Current Status of Fish, Shellfish, Algal, and Other Introductions in and between ICES Member Countries

J. Doyle presented a draft report section prepared from material contained in the WGITMO report. She noted that this report mentions introductions but does not describe possible implications of these introductions, so there is just a list of introductions without subsequent follow up.

In the discussion, it was pointed out that the WGITMO report does not provide an exhaustive list of introductions during the past year. It could be useful to ask WGITMO to provide an overview of introductions over the past ten years, along with an evaluation of the consequences and significance of these introductions.

The ACME agreed that WGITMO should be requested to follow the consequences of the various introductions and evaluate their significance.

10.2 Progress in Ballast Water Research and Management

A. Calabrese presented a draft section for the ACME report based on material from WGITMO. The ACME accepted this section for the report, with some amendment.

10.3 Directory of Dispersal Vectors of Exotic Species

A. Calabrese stated that there was a very brief mention of the development of this directory in the WGITMO report, but that the work was not yet complete. The ACME encouraged WGITMO to complete this work next year so that the report can be published.

10.4 Standardized Format for Collating Data on Non-Native Species and the Method and Fate of Introduction

A. Calabrese stated that WGITMO had not carried out the work that was anticipated under this term of reference. However, he presented a very brief draft section based on the material available in the WGITMO report.

In the discussion, it was pointed out that the OSPAR Commission has been considering requesting ICES to develop a database on non-indigenous species, but the relevant OSPAR working group has not yet provided a detailed description of what they would like this database to contain. It was further noted that there is a database for the Baltic Sea funded by HELCOM.

The ACME decided that no material on this topic should be included in its report, but agreed that there is a need to review databases on introduced species that are in development or have already been developed on a regional basis to improve communication and the dissemination of information within and between ICES Member Countries on introduced species.

The ACME agreed that the development of this standardized reporting format for the collection of data on non-indigenous species should again be put on the terms of reference for WGITMO, with high priority.

Finally, the ACME expressed its great appreciation to Prof. J. Carlton for his excellent efforts in chairing WGITMO, and wished him success in his future work.

11 BENTHOS ISSUES

The question was raised as to whether there still are plans for the North Sea Benthos Survey. It was reported that it has not yet been decided whether this proposed survey will be undertaken.

11.1 Guidelines for Sampling and Objective Community Description of Epibiota of Soft Sediments and Hard Bottom Sub-Strata, including QA Matters

J. Nørrevang Jensen presented a brief description of the outline of these guidelines that will be prepared by BEWG. The ACME agreed to include this material in its report for information to the Commissions and others.

12 NUTRIENTS, EUTROPHICATION, PLANKTON ECOLOGY

12.1 Phytoplankton Ecology Issues

J.-M. Leppänen stated that, although the Council Resolution stated that the WGPE report should be available for review by ACME, no report was available for ACME so he was not able to provide material for this agenda item.

He enquired as to the status of the workshop on eutrophication issues that had been proposed by WGPE. It was reported that the draft recommendation for this workshop had been rejected by the Consultative Committee on the basis that it was not useful to hold a workshop on this topic.

P. Gentien stated that the opinion that no workshop was needed is the opinion of WGHABD, which has requested WGPE to extrapolate the results obtained from mesocosm experiments concerning nutrient dynamics to the marine environment. Unfortunately, although this request had been made to WGPE for two consecutive years, no response was ever made by WGPE. He felt that the discussion of eutrophication was dominated by scientists from the southern North Sea, but in other areas there are many factors such as upwelling and advection that affect the nutrient processes. This points to the necessity of considering eutrophication issues in relation to the hydrodynamic conditions of the specific areas under consideration, and not on a general basis.

The ACME was unable to decide on whether to support the proposal by WGPE of a workshop on eutrophication in mesocosms. A term of reference on the biases and problems raised when extrapolating mesocosm results to coastal areas has been requested for two successive meetings. It was felt by ACME that the question has not been studied in sufficient detail. In the absence of the WGPE report at the ACME meeting, it was impossible for the ACME to decide if sufficient advancement had been made during the 2000 WGPE meeting.

The ACME, therefore, following last year's decision of the Consultative Committee, will not support this proposal for a workshop. This opinion may be revised at the ASC September meeting.

The Chair proposed that hydrodynamic aspects related to nutrient inputs and production should be included in the workshop proposed under Agenda Item 5.7. WGPE and other relevant working groups should be requested to provide detailed planning for this workshop.

12.2 Progress in Understanding the Dynamics of Harmful Algal Blooms

P. Gentien reported on the outcome of various activities under WGHABD. Although a number of these activities ultimately were not successful, they provided interesting case studies. He stated that a major outcome of WGHABD has been the initiation of a dialogue between physicists and ecologists, allowing the establishment of GEOHAB. It is proposed that a workshop be held on real-time observing systems.

The ACME generally supported this workshop, but agreed to return to this issue when a more detailed proposal is available at the 2000 ASC.

In the discussion, it was questioned whether ICES needs to maintain WGHABD now that GEOHAB has been established. In reply, it was stated that it is important that ICES maintains a group on this topic to cover relevant issues in the ICES area.

The ACME agreed to include the Executive Summary of the IOC-SCOR GEOHAB programme, prepared by P. Gentien, as an annex to the ACME report

12.3 Zooplankton Ecology Issues

W. Melle described the progress in the work of WGZE on various topics, particularly on zooplankton monitoring.

The ACME took note of the activities of WGZE, including a Theme Session on Environment-Plankton-Fish Linkages at the 2000 ASC, and a recommendation for an ICES/PICES/GLOBEC Symposium on Zooplankton Production and Ecology in 2003. The ACME supported the conduct of this Symposium.

The Chair regretted that no outcome has been made available evaluating the results of monitoring programmes on zooplankton, only descriptions of the programmes are included in the WGZE report. He stated that he had spoken to the Chair of WGZE, who has agreed to provide results of zooplankton monitoring for the ACME Consultations meeting in September. It may be possible to include this material in the 2000 ACME report, but the report should not be held up for this reason.

After discussion, the ACME agreed to include material on zooplankton taxonomic skills in its report.

13 ESTIMATION OF ANNUAL AMOUNT OF DISCARDS AND FISH OFFAL IN THE BALTIC SEA AND POTENTIAL EFFECTS

E. Andrulewicz presented a draft section for the ACME report based on material from SGDIB.

It was discussed whether these low discard figures were realistic, and the general opinion was that the figures are reliable.

The ACME reviewed the details of the draft section and requested that additional information be taken from the SGDIB report on the methods used to obtain estimates of discards. It was also decided that the information on offal should be included on an annual basis only, and not include the quarterly figures. Noting the SGDIB recommendation that the work to estimate discards in the Baltic Sea should be taken over by WGBFAS, the ACME recalled that ICES had established a study group to review discarding practices in the ICES area as a whole and thus decided not to carry this recommendation forward in its report. The ACME accepted this section with the addition of material concerning the methods used to estimate discards.

13.1 Possible Secondary Effects of Dumping Fish Remnants, including Effects on Benthos

E. Andrulewicz presented a draft section based on material from BEWG and WGECO. The ACME discussed the table in the draft section of the report concerning oxygen consumption owing to the dumping of offal. It was noted that the surface area quoted for the Baltic is for the entire Baltic Sea, whereas the dumping of discards and offal occur mainly in the southern and southwestern Baltic. This section was accepted with the addition of some qualifications concerning the scale of the presentation.

13.2 Distribution and Possible Consumption of Fish Offal and Discards by Seabirds in the Baltic Sea

E. Andrulewicz presented a draft section based on material from WGSE. This material was adopted with some small amendments; given the level of detail, most of the material was placed in an annex to the report.

14 SEABIRD ECOLOGY ISSUES

14.1 Effects of Contaminants in Seabirds

P. Matthiessen presented a draft section for the ACME report based on the WGBEC report. WGBEC feels that there is a case for the development of biological effects monitoring programmes using birds, and that these new programmes could be developed in association with existing programmes to monitor contaminants in seabirds.

In the discussion, it was felt that the list of programmes in which contaminants are monitored in seabirds is not comprehensive. It was decided that this list should be removed and reference should be made to the review on the use of seabirds as monitors of contaminants contained in the 1999 ACME report.

The ACME accepted this draft section for its report, with the amendments agreed.

14.2 Other Seabird Issues

J. Piuze stated that there were two issues in the WGSE report that could be considered under this agenda item: 1) estimates of food consumption by seabirds in the ICES area, and 2) the extent to which fisheries can alter the composition of seabird communities. He noted that ACME had included a section and an annex containing estimates of food consumption in its 1999 report, but that the 2000 WGSE report contains revised estimates of these food consumption figures. As the 1999 ACME report has not been finally printed, the annex on this topic could be removed and the text in the body of the report amended slightly to reflect that the estimates mentioned are preliminary figures. He noted that the material in the 2000 WGSE report does not contain earlier material for birds around Iceland, but has new material for the Baltic Sea. J. Piuze will contact the Chair of WGSE to determine whether further work will be done on this topic next year, to determine whether ACME should include any material on this topic in this year's ACME report.

On the second issue, the impact of fisheries on seabirds, J. Piuze presented a draft section for the ACME report based on material from WGSE. He also proposed that the full text from the WGSE report on this topic (Section 3 of the WGSE report) be included as an annex to the ACME report.

In the discussion, it was noted that estimates of uncertainty were not provided in the estimates of food consumption. Some of the figures are so large that they should be taken seriously, but levels of uncertainty are not given. The model on which these estimates are based will have a high level of uncertainty, but this is not stated clearly enough. If any of this material is used, this should be clearly stated. We need a paragraph stating that the inputs to the model are uncertain (e.g., the sampling of the diet data must have a very large uncertainty) and the model itself has a large level of uncertainty. After this has been stated, the numbers themselves can stay as they are.

The ACME agreed to await a decision on whether to include the information on seabird food consumption in its report until the Chair of WGSE has been contacted. Ultimately, the ACME decided to include some material on the impact of fisheries on seabird communities in its report, but not include the section of the WGSE report on this topic as an annex. It was noted that WGSE will compile various material from its recent reports for publication in the *ICES Cooperative Research Report* series.

15 ISSUES REGARDING MARINE MAMMALS

The Environment Adviser informed ACME that the HELCOM HABITAT Group had criticized the ICES work on marine mammals and felt that its own Project Group on Seals provided more useful information than the ICES groups. A. Bjørge stated that scientists from all countries around the Baltic Sea had been invited to attend the joint meeting of the two marine mammals working groups, but that a number of these scientists did not attend and used other communication channels into HELCOM than through ICES. Thus, the ICES working groups were not able to obtain the most recent information on marine mammals in the Baltic Sea for this triennial review.

It was pointed out that the seal situation in the Baltic Sea is very sensitive and the recently increasing population of seals has created problems with fisheries.

The ACME felt that in a situation such as this, it is important for ICES to provide independent information. It was proposed that the ICES General Secretary discuss the overlapping work on seals in the Baltic Sea with HELCOM.

A. Bjørge stated that ICES has a problem in attracting marine mammal scientists to its working groups in general. When the two current working groups were created in 1997, it was hoped that they would attract a larger group of marine mammal scientists, but this has not proved to be the case. The ACME agreed that the broader issue of attracting scientists to marine mammal work in ICES, as well as the specific case of the work in the Baltic, should be taken up within ICES.

15.1 Evaluate Populations of Marine Mammals in the Baltic Sea, including Migration, Distribution, Health Status, Effects of Contaminants, and Reproductive Capacity

A. Bjørge presented material from the joint meeting of WGMMHA and WGMMPD for the ACME report in response to the HELCOM request. This describes the population status of the three species of seals and the harbour porpoise in the Baltic Sea, as well as their health status including the effects of contaminants.

It was agreed that most of the recommendations related to research and monitoring, and that it was desirable to have some recommendations regarding management issues. The recommendations will be revised accordingly. With these changes, the ACME accepted this section for its report.

After the finalization of this section, A. Bjørge stated that the establishment of by-catch monitoring regimes recommended for marine mammals in the Baltic Sea should be expanded to other areas as this information will be needed, e.g., for the North Sea. These by-catch schemes should not be research monitoring programmes but should be conducted by the relevant regulatory authorities in the respective countries. The ACME agreed to this recommendation.

15.2 Research Programme on Cause-Effect Relationships between Contaminants and Population-Level Effects in Seals

A. Bjørge presented material from the joint meeting of WGMMHA and WGMMPD on a research programme on this topic. WGMMHA has developed a comprehensive research programme covering contaminants and their effects in

several species of marine mammals over a broad geographical area, but for funding purposes only a part of this programme has been developed into a funding proposal to the EU. The status of funding for this proposal is presently uncertain.

In the discussion of this proposal, it was felt that this is an excellent proposal, but that more details should be included in the ACME report, including the fact that non-destructive sampling will be used. Comments from ACME on this proposal should also be included. With these additions, this section was accepted for the report.

15.3 Progress in Studies of Marine Mammal Habitat Requirements, particularly in relation to Exposure to Contaminants

A. Bjørge stated that WGMMHA did not receive substantial new information on this topic for its 2000 meeting, so no text was prepared on this topic. This topic will be placed on the agenda of future meetings of WGMMHA.

16 MARICULTURE ISSUES

16.1 Environmental Interactions of Mariculture, including New Research and Monitoring Programmes

J. Doyle presented a draft section for the report based on material from WGEIM. She stated that she primarily took material related to salmon cultivation, as this is presently the most pressing given the current public pressure against the expansion of mariculture operations in many countries. The ACME accepted this section for the report, with some amendments.

The ACME, recognizing the importance of making available to Member Countries all information on the results of ongoing monitoring programmes, and directions in research and monitoring priorities, requested WGEIM to review the full proceedings of the Symposium on Environmental Effects of Mariculture that was held in St. Andrews, New Brunswick, in September 1999.

16.2 Effects of Mariculture Activities in the Baltic Sea

J. Doyle presented a draft report section based on material from WGEIM. The ACME accepted most of this material for its report, but decided that the information on dioxin levels in herring from the Baltic Sea should be moved to the text prepared for Agenda Item 8. Regarding the values of dioxin concentrations provided here, B. Pedersen stated that she had tried to find the source of these values. While the source of these values could not be located, she was able to confirm that these values do not appear to be incorrect, although values have generally decreased below these levels in the past five years. T. Lang reported that a German colleague stated that the units used here are no longer commonly used, and dioxin concentrations can vary widely in different parts of the Baltic.

It was pointed out that fish meal is used very commonly, so the levels of dioxins in fish meal are important both politically and environmentally.

It was agreed that B. Pedersen, T. Lang, and K. Cooreman would obtain information on dioxin levels in herring from studies in Denmark and Germany. This information should be compiled for Agenda Item 8.

The problem of a lack of representation from countries around the Baltic Sea at the meeting of WGEIM and the fact that, despite the request for information, no data were supplied by these countries, was noted by ACME.

The lack of information on the use of chemicals in fish farming was noted, but it was also pointed out that not all countries collect data on the quantities of chemicals used.

The ACME agreed that, with the exception of the material on dioxins, this should be included in the ACME report and an extract provided for the HELCOM Fourth Periodic Assessment.

17 EFFECTS OF EXTRACTION OF MARINE SAND AND GRAVEL ON MARINE ECOSYSTEMS, INCLUDING EXTENT OF EXTRACTIONS AND IMPACTS ON BIOTA AND EFFECT OF TURBIDITY CAUSED BY DREDGING

C. Lima presented some brief introductory text on this item.

17.1 Current Marine Extraction Activities and Results of Assessment of their Environmental Effects

C. Lima presented a draft report section based on material from WGEXT.

In the discussion of this report section, the question was raised as to the basis on which the information on marine aggregate extraction was collected. It was noted that it appears that information on quantities extracted has mainly been reported by participants in the WGEXT meeting. The ACME decided to request WGEXT to consider the development of a more standardized format so that a full picture of the total amounts extracted can be obtained. In addition, WGEXT should consider whether a means of storing this information electronically is needed.

The ACME discussed whether to include this information in its report. At least for one country, the information contained is very fragmentary and does not show a complete picture. Thus, it was decided that rather than including the amounts extracted, WGEXT should be acknowledged for collecting this material. However, the material presented on environmental assessments of effects should be included in the ACME report

The ACME noted that there is a need to consider cooperation between WGEXT and BEWG to review the effects of marine aggregate extraction.

17.2 Progress in Updating the 1992 Code of Practice for the Commercial Extraction of Marine Sediments and the Guidelines for the Preparation of Environmental Impact Assessments

Noting that neither of these documents were available, the ACME agreed that a sentence stating that a draft of new guidelines for the preparation of EIAs should be included in the text for the section under Agenda Item 17.2.

17.3 Biological Effects of Dredged Materals Disposed of in the Marine Environment

C. Lima presented a draft report section based on material from WGEXT.

In the discussion, it appeared that the title is misleading; the section appears to be on the effects of dredging itself and not on the effects of disposal of dredged materials in the marine environment. It was noted that there is no discussion of the effects of contaminants leaching from the dredged material on eggs and larvae and how to avoid these problems. It was agreed that WGEXT should consider these types of effects also.

The ACME agreed to include this text in the report with the inclusion of some comments at the end, particularly in terms of the effects of chemical contaminants leaching from the dredged material on eggs and larvae of marine organisms.

18 MARINE HABITAT CLASSIFICATION AND MAPPING

E. Andrulewicz presented a draft report section based on material from SGMHM and prepared by the Chair of that group, E. Jagtman, who was unable to attend the ACME meeting.

It was recalled that an OSPAR/ICES/EEA Workshop on Marine Habitat Classification had been held in Oban in September 1999. A second workshop on this issue has been proposed and it was felt that any decision on a classification system should await the outcome of that workshop.

It was noted that a classification system and habitat mapping are important for a number of different purposes, including determination of fishing effects on the seabed, marine habitat protection, effects of sand and gravel extraction, etc.

The Chair reported that, at its January meeting, the ACME had supported in principle the convening of a workshop on deep-water survey technologies and the development of standards for marine habitat mapping, to be co-sponsored by OSPAR. He stated that OSPAR has subsequently decided not to co-sponsor this workshop. The Chair recommended that ACME endorse the conduct of this as an ICES workshop, organized by the Institute of Marine Research in Bergen.

The ACME requested SGMHM to prepare material for a discussion in ACME on the various classification systems and their advantages and disadvantages. The second workshop on habitat classification system should assist in this activity.

In the discussion of the recommendations, it was noted that most of them were for ICES. In this connection, the ACME recommended that the development of a marine habitat classification system be initiated for the ICES area, taking the EUNIS classification as a template, and further building on the classification at levels 4 and 5. The ACME also recommended continued participation in the evaluation of EUNIS level 3, by mapping and testing, as well as by co-sponsoring and participating in the second OSPAR/ICES/EEA Workshop on Habitat Classification.

The ACME endorsed the SGMHM recommendation that an ICES GIS database with habitat information and maps be developed. A more detailed proposal, with cost estimates, should be prepared to take this recommendation forward.

The ACME requested BEWG and WGEXT to contribute to the verification of the EUNIS classification.

Finally, noting the SGMHM recommendation that the WGEXT document on Seabed Characterization and Biotope Mapping should be annexed to the ACME report, the ACME decided to check that this is a final document as the WGEXT report indicates that this material is still in draft form.

19 ISSUES RELATED TO GENETICS

19.1 Information Rquired to Evaluate the Genetic Effects of Release of Cultured Fish in the Baltic Sea

A. Calabrese presented a draft report section based on material from WGAGFM. In the discussion, it was pointed out that this is a very important issue in the Baltic Sea; thus, it was proposed that more material from WGAGFM should be included here. In reviewing the recommendations, it was agreed that there should be some amendments. A. Calabrese, together with T. Lang, J.-M. Leppänen, and J. Boreman, should work to revise these recommendations.

It was agreed that this text should be replaced with a more extensive text for the ACME report. A summary should be provided for the HELCOM Fourth Periodic Assessment.

19.2 Protocols of Fishery and Mariculture Genetics Research in ICES Member Countries

A. Calabrese presented a very brief draft report section based on material from WGAGFM. The ACME took note of this information, but decided not to include it in its report.

19.3 Principles for the Prioritization of Marine Finfish and Shellfish Populations for Conservation

A. Calabrese presented a draft report section based on material from WGAGFM. The ACME took note of this information, but decided not to include it in its report.

19.4 Potential Genetic Implications of Endocrine Disruption

A. Calabrese presented a draft report section based on material from WGAGFM. The ACME accepted this text with minor amendment.

19.5 Potential Genetic Implications of Commercial Fisheries on Deep-Sea Fish Stocks

A. Calabrese presented a draft report section based on material from WGAGFM. The ACME accepted this text with minor amendment. J. Boreman pointed out that sea mounts are very important habitats for deep-sea species and that new species are being discovered near these sea mounts. This text was accepted for the report, with some additions and after checking the outcome of last week's ACFM discussion on deep-sea species.

20 DATA ISSUES

20.1 Activities of the ICES Environmental Data Centre

J. Nørrevang Jensen presented a draft report section on the progress in environmental data issues.

It was stated that data are not being submitted to the ICES Environmental Data Bank owing to the difficulties associated with preparing these submissions in the appropriate format. It was emphasized that ICES must develop a user-friendly

means of submitting data to ICES. There are large amounts of data on environmental parameters available in ICES Member Countries, but these data are not being submitted owing to the difficulties of preparing data submissions. It was proposed that a specific date be given in the ACME report for the development of a spreadsheet format for data submission so that a clear commitment is given to this development.

The ACME agreed that this is an extremely important issue. The ACME wished to stress to the Council that the environmental database is very important to ICES Member Countries, and not simply to the Commissions, and that ICES must provide adequate resources for this work.

It was agreed that a recommendation should be prepared concerning the development of a spreadsheet format for data exchange, including a specific date by which such a format should be available. This recommendation should include a request to the Council to make adequate resources available for this development.

The Chair noted that OSPAR is reviewing potential options for moving the data handling of input data from the OSPAR Secretariat to another data host and apparently ICES is being considered in this regard. The ACME took note of this information.

20.2 Handling of Nutrient Data for the OSPAR Commission

H. Dooley reported that there have been very few developments in relation to nutrients data during the past year, as compiled in a draft report section.

The Chair reported that OSPAR has established a small group dealing with the eutrophication issues, led by Germany and the Netherlands. They have recently started their work.

The Chair felt that the issue of nutrients and eutrophication needs to be approached on a broad basis, and the proposed workshop is part of this approach.

It was agreed that this text should cover the handling of Item 3 on the 2000 Work Programme from OSPAR; with this and other amendments, this text was accepted for the report.

20.3 Development of Biological Databases

J. Nørrevang Jensen described the status of the development of the biological community database, which has been delayed owing to a lack of programming resources in the ICES Secretariat.

It was reported that the development of the Biological Community Database has been seriously delayed owing to several circumstances. In particular, it was noted that the dependence on a part-time programmer whose work must coincide with the time schedule of the working groups involved in the approval procedure makes progress very slow.

The ACME emphasized the importance of completing work on this database as soon as possible. The potential value of this database for handling data on non-indigenous species was noted and this possibility should be considered when the database has become fully operational.

The ACME agreed that this draft section should be included in its report, after amendment.

20.4 ICES Phytoplankton Checklist

J.-M. Leppänen reported on progress in the development of an ICES phytoplankton checklist. He expressed concern that resources will need to be provided for this work, and that the persons involved have underestimated the amount of time required for this type of work. He pointed out that this work must be done to a high standard, and this requires a considerable amount of time.

The Chair of the Oceanography Committee was of the opinion that SGPHYT was aware that financial resources are needed for this work, but will not request funds from ICES.

It was noted that the checklist is intended for completion by September 2000; this will need to be reviewed by other experts. It will then need to be incorporated for use in the Biological Community Database.

H. Dooley pointed out that SGPHYT works under WGPE, but as the report of WGPE is not yet available, there might be some comments on the progress in SGPHYT work in that report.

The ACME supported the proposed terms of reference for SGPHYT. However, it was agreed that further work needs to be done on this text.

The ACME recommended that further work on the development of a checklist be conducted in two steps: 1) production of the checklist itself, and 2) provision of additional information about the species that should be compiled in a database.

20.5 Development of Reporting Format for Biological Effects Measurement Data

J. Nørrevang Jensen described the status of the development of the reporting format for biological effects data.

The ACME discussed whether the tables prepared in relation to the development of the reporting format should be included in the report. It was agreed that a draft annex with these tables should be prepared for further consideration when reviewing the overall report. In addition, some material prepared by WGPDMO on revisions to the fish disease reporting format should also be included in the report section for this item.

21 OTHER ISSUES FROM WORKING GROUPS

21.1 Marine Chemistry Working Group (MCWG)

B. Pedersen reported on the results of new work on the use of membrane systems for sampling. Further work will be done on this topic next year, so it is too early to include a section on this topic in the ACME report.

In addition, she reported on the problem that no new oxygen tables have been published by UNESCO. Equations were prepared in MCWG. The ACME agreed that these equations should be published in its report and also placed on the ICES website.

21.2 Working Group on Marine Sediments in Relation to Pollution (WGMS)

K. Cooreman presented material from the WGMS report on (1) the relationship between soft-bottom macrofauna and PAHs from smelter discharges in Norwegian fjords and coastal waters, and (2) abiotic and biotic transport and effects of dioxins in a Norwegian fjord.

The ACME decided to include this material in its report under contaminants issues related to Agenda Item 8.

21.3 Working Group on Biological Effects of Contaminants (WGBEC)

P. Matthiessen presented a draft report section based on text from WGBEC concerning biological assessment of the toxicity of marine dredged materials. The ACME agreed that this was an important topic and certainly of interest to the Commissions. The ACME agreed to include this section in its report, with minor amendment, with the items on contaminants in relation to Agenda Item 8.

21.4 Study Group on Ecosystem Assessment and Monitoring Strategies (SGEAM)

There was no additional material from SGEAM.

21.5 Working Group on Statistical Aspects of Environmental Monitoring (WGSAEM)

S. Uhlig presented a draft report section based on material from WGSAEM, covering (1) the problem of missing values in time series, and (2) software programs for calculating the power of monitoring programmes.

In the discussion, the ACME decided that the material on missing values should be incorporated into the text for Agenda Item 5.6.2, along with any necessary explanatory material from the WGPDMO report to ensure that the text is clear.

S. Uhlig further noted that the 2000 meeting of WGSAEM suffered from having only a very small number of participants. This created a very heavy workload on individual members as well as decreased the possibilities of review of the material produced. He further mentioned that it would be very helpful to have a member of the ICES Secretariat participate in the meeting, particularly with regard to handling the very complicated requests from OSPAR.

21.6 Working Group on Shelf Seas Oceanography (WGSSO)

H. Loeng presented some information from the WGSSO report on the use of chemical data in numerical modelling, particularly in relation to eutrophication. The ACME took note of this material and decided to return to the issue later in the meeting to determine whether any of the material should be included in its report.

21.7 Working Group on Introductions and Transfers of Marine Organisms (WGITMO)

It was noted that the WGITMO report was very short and that many of the terms of reference had not been addressed in an adequate manner.

21.8 Working Group on Ecosystem Effects of Fishing Activities (WGECO)

J. Rice stated that Section 3 of the 1999 WGECO report describes the work that needs to be done to review ecosystems models as a basis for choosing metrics of ecosystem status. This work needs to be done, but will require a workshop devoted to this issue. Planning for this workshop should be one item on the terms of reference for the next WGECO meeting.

He stated that ACME should consider the structure of working groups on ecosystems issues, as Member Countries cannot support more than one working group on this topic. This undoubtedly affected the participation in the first meeting of SGEAM in May.

21.9 Working Group on Pathology and Diseases of Marine Organisms (WGPDMO)

T. Lang presented material from WGPDMO concerning (1) VHS-like virus in cultured and wild fish, and (2) a proposal for incorporating parasitological studies into fish disease monitoring programmes. This text was accepted for the report without amendment.

22 ISSUES IN ENVIRONMENT AND OCEANOGRAPHY

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

K. Brander presented information on progress in the GLOBEC programme. He noted that it is now clear that the climate is changing and it is becoming clearer that this change is having an effect on fish stocks. GLOBEC is part of the IGP programme and ICES is considered to be an important partner in the GLOBEC programme. He stated that, although funds are available from several ICES Member Countries, the support of ICES as an organization is not certain, and this support is presently under review by a Bureau working group.

In the discussion, it was pointed out that climate change is clearly having an impact on fish stocks, and in preparing advice on fish stocks it is important to include this influence in their management. This climate variability is also important in considering impacts on the marine environment, as mediated through food-chain interactions. So clearly providing more insight into these relationships is very important. Thus, GLOBEC is important both for a better scientific understanding as well as for the development of management advice.

It was noted that this programme is very important to the development of long-term prognoses, both in terms of fish stocks and environmental assessments. Thus it is crucial that ICES supports this programme.

H. Loeng, Chair of the Oceanography Committee, stated that at the 1999 ASC, the Oceanography Committee made a number of recommendations in relation to the GLOBEC Programme within ICES. However, the Council did not accept these recommendations, but instead set up a Bureau working group to review the GLOBEC Office and its role within ICES. He noted that this review has been done without consultation with the Oceanography Committee, ACME, or any other of the committees within ICES that has a scientific interest in GLOBEC.

The ACME expressed concern at the way that ICES has handled the review of the GLOBEC work within ICES, and especially that the Science Committees have not been consulted.

The ACME expressed its strong support for ICES involvement in the GLOBEC programme and agreed that the information arising from this programme is very important to the work of ICES in fisheries-environmental issues.

22.2 Global Ocean Observing System (GOOS)

H. Dooley informed ACME about developments during the past year on the GOOS programme, including the establishment of a new ICES/IOC Steering Group on the Global Ocean Observing System. In addition, ICES co-sponsored with EuroGOOS a workshop on Bio-ecological Observations in Operational Oceanography. Finally, it has been agreed that the ICES International Bottom Trawl Survey is relevant to GOOS. H. Dooley compiled this material into a draft report section for ACME.

In the discussion, it was noted that there was a large bias towards the North Sea in the membership of SGGOOS; few members from the Baltic Sea have been nominated. It was commented that the interest of ICES in GOOS is rather low, with the exception of certain members of the Oceanography Committee. It was felt that there is a lack of interest in GOOS among the scientists within ICES, and it is crucial to obtain widespread support among the scientific community to ensure the success of the programme.

It was proposed that the Baltic GEF project should have a role in BOOS, the Baltic GOOS.

It was proposed that the terms of reference and justification for SGGOOS be summarized into two paragraphs. Also it was felt that the names of the nominated members of SGGOOS should be left out and the anecdotal material about the workshop should also be left out. With these revisions, the ACME accepted this section for its report.

Given the small number of nominations so far made of members in SGGOOS, ACME members were encouraged to submit nominations to SGGOOS via their National ICES Delegates.

22.3 GEF Baltic Sea Regional Project

As the Project Manager, J. Thulin, was not able to attend the meeting, this item was not handled.

23 ORGANIZATIONAL AND PROCEDURAL ISSUES

23.1 Bureau Working Group on the Advisory Process

N.A. Nielsen, the Danish Delegate to ICES and member of the Bureau Working Group on the Advisory Process, provided an overview of the new advisory system proposed by this group.

Although the ACME had intended to discuss this proposal in more detail, time did not permit this. However, it was noted that a sub-committee made up of members of both ACFM and ACME to cover the cross-disciplinary issues would be more effective than creating a separate new committee on ecosystem issues alone. Otherwise, the ACE may draw people from ACFM who have ecosystem experience, and also draw fisheries ecology expertise from ACME. In addition, a joint sub-committee would permit the work on ecosystems to be linked to both ACFM and ACME and ultimately influence the basis of the work in those committees.

In the brief discussion on this topic, it was noted that the Bureau Working Group proposal was not considered to solve the problems of integration and would probably create new problems. The proposal prepared by the Chair was considered to provide better suggestions and could form the basis for a workable system that will not cost much more than the present costs, and would provide a better integration with ACFM and ACME.

It was felt that a third committee would drain the resources of ICES, but a response to integrated advice must be developed quickly because this is needed immediately.

It was agreed that a separate ecosystem committee was considered to be counterproductive.

23.2 ICES Five-Year Strategic Plan

The Chair suggested that he prepare a discussion document indicating the way that ACME can contribute to fulfilling the Strategic Plan during the intersessional period. After agreement at the ACME Consultations Meeting, it could be useful for the Chair of ACME to present this material at the special session on the Strategic Plan to be held in association with the 2000 ASC in Bruges.

23.3 Review of ACME Shadowing System for Working Groups and Other International Fora

This item was not considered to a lack of time.

23.4 Plans for the Environmental Dialogue Meeting

The Chair described the plans for the Environmental Dialogue Meeting that will be held in Bonn on 7–8 September 2000. A Steering Group has been established to plan this meeting, comprising representatives of ICES, OSPAR, HELCOM, EC DG ENVIRONMENT, EEA, and NEAFC, with the First Vice-President of ICES, P. Mälkki in the Chair.

The meeting will begin with plenary presentations concerning the need for scientific assessment and advice on environmental/ecosystem issues and on what ICES is providing and what it can provide. In addition, three working groups will be formed on the following topics: (1) Scientific Advice: What is needed? What can ICES provide?, (2) Improving efficiency by removing restrictions on information, and (3) How to formulate integrated advice.

It is intended that three high-level representatives will attend from each Member Country, but so far only three countries have nominated their participants. Thus, ACME has been requested to ensure that participants are nominated from their countries as soon as possible. A programme with the list of speakers will be distributed within the next few weeks.

24 WORK PROGRAMMES FOR 2001

24.1 OSPAR Commission

The ACME took note of the draft OSPAR Work Programme for ICES for 2001 and agreed that terms of reference will need to be drafted for the relevant working groups. This should be done intersessionally and the ACME will return to this at the Consultations Meeting in September.

24.2 Helsinki Commission

The ACME took note of the draft requests from HELCOM for ICES for 2001 and agreed that terms of reference will need to be drafted for the relevant working groups. This should be done intersessionally and the ACME will return to this at the Consultations Meeting in September.

25 RECOMMENDATIONS FROM WORKING GROUPS

The ACME received the draft recommendations from the Working Groups but there was inadequate time to review them. The Chair requested all members who are shadows for working groups to review the terms of reference of their groups and make any amendments needed. In addition, they should check the minutes for requests made to working groups and ensure that they are formulated into terms of reference with associated justification.

26 ANY OTHER BUSINESS

26.1 Possible ACME Contributions to 2000 ASC

This was not discussed, owing to a lack of time.

26.2 Review of ACME Report Sections from January ACME Meeting

The ACME noted that three sections for its report arose from the January ACME meeting. The report section prepared for DG FISHERIES had been accepted in final at the January meeting and was sent directly to DG FISHERIES. The outcomes of the other two items, the scientific peer review of the OSPAR QSR 2000 and the preparation of the report "Status of Fisheries and Related Environment in Northern Seas" for the Nordic Council of Ministers, had been completed during the January meeting and was sent to the respective organizations shortly thereafter. However, to reflect the activities in handling these two requests, it had been agreed that the Environment Adviser would draft brief descriptions for inclusion in the 2000 ACME report.

26.2.1 OSPAR QSR 2000 review

The draft section summarizing the outcome of this review was adopted for the report.

26.2.2 Nordic Council of Ministers request

The draft section summarizing the handling of this request was adopted for the report.

27 ADOPTION OF THE 2000 ACME REPORT AND REVIEW OF DRAFT MINUTES

In reviewing the material under Agenda Item 13, it was agreed that the Environment Adviser would edit the various sub-sections into one compiled text. To provide more balance in the text, much of the material on seabird consumption of offal should be moved to an annex. She proposed that this editing be done as soon as possible, in association with E. Andrulewicz and J. Boreman, and the final draft text will be posted on the ACME website for final review by ACME participants.

It was reported that attempts had been made during the ACME meeting to cover the issue of dioxin concentrations in Baltic herring, but it had not been possible to obtain appropriate material during the meeting. Accordingly, the ACME requested MCWG to review data on dioxin concentrations in fish at its 2001 meeting.

In discussing the draft report section for Agenda Item 8.1, concern was expressed that the table in this section was not based on clear criteria and doubts were expressed as to some of the judgements made on specific substances. P. Matthiessen stated that further work could be done to develop this material also using ecotoxicological values, as the present table does not appear to take effects into consideration. The ACME proposed that further work be done on this topic, using clear, stated criteria. This work should be done by MCWG in cooperation with WGBEC to bring in ecotoxicological criteria, for review next year.

The ACME reviewed the draft chapter for the HELCOM Fourth Periodic Assessment and accepted it, noting that the text was still too long and will need to be condensed somewhat.

With the above comments and many others, the ACME approved the 2000 ACME report.

The Environment Adviser stated that the compiled ACME report will be prepared by mid-July and both sent in hard copy and placed on the ACME website. A review time of four weeks will be given. Comments on the ACME report, the ACME minutes and the recommendations will all be due at that time, in the second week of August.

As all business was complete, the Chair thanked the participants for their hard work and thanked the Secretariat for their unflagging efforts. He then closed the meeting at 15.50 hrs on 10 June 2000.

ANNEX 1

LIST OF PARTICIPANTS

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ANNEX 2

FINAL AGENDA

Report Section

	1		Opening of the meeting
	2		Adoption of the agenda and schedule of the meeting; description of procedures
	3		Requests from regulatory commissions and member governments
2.1		3.1	OSPAR Commission **PAWLAK**
3.1		3.2	Helsinki Commission **PAWLAK**
	4		Information regarding other fora
		4.1	North Sea Conference process **PAWLAK**
6.3		4.2	Arctic Monitoring and Assessment Programme **LOENG**
		4.3	EEA and ETC/MC Inter-Regional Forum **PAWLAK / SKJOLDAL**
		4.4	Nordic Council of Ministers **PAWLAK**
6	5		Monitoring techniques and guidelines
		5.1	Biological effects monitoring
6.1.1		5.1.1	Influence of fluctuations in salinity on biomarker and bioassay responses of marine organisms **MATTHIESSEN / COOREMAN**
6.1.2		5.1.2	Use of *in situ* bioassays for evaluating effects of contaminants **MATTHIESSEN / COOREMAN**
6.1.3		5.1.3	Techniques to measure PAH metabolites **PEDERSEN / MATTHIESSEN**
6.1.4		5.1.4	Sea-Going Workshop on the Effects of Contaminants in Pelagic Ecosystems **MATTHIESSEN / COOREMAN**
		5.2	Information on monitoring techniques and guidelines relevant to OSPAR **COOREMAN / PEDERSEN**
		5.3	Information relevant to the Helsinki Commission's monitoring programmes
6.2		5.3.1	Assistance for HELCOM workshop on background/reference values for concentrations of nutrients and chemical contaminants in the Baltic Sea [HELCOM 2000/4] **PEDERSEN / CARLBERG**
6.4		5.4	Substances (Nutrients, Organic Contaminants and Trace Elements) in marine media that can be monitored on a routine basis [*ospar, helcom*] **ÓLAFSSON / PATIN**
6.5		5.5	Techniques for sediment monitoring
6.5.1, Annex 1		5.5.1	Normalization annex of sediment monitoring guidelines and normalization report [*ospar*] **COOREMAN / NUNES**
6.5.2		5.5.2	Organotin guidelines **NUNES / COOREMAN**
6.6		5.6	Statistical aspects of monitoring
6.6.1, Annex 2		5.6.1	Development of trend detection methods for input data [OSPAR 2000/2] **UHLIG / GENTIEN**
6.6.2		5.6.2	Statistical methods for designing sampling allocation strategies for monitoring programmes **UHLIG / GENTIEN**
6.6.3		5.6.3	Spatial issues, e.g., with regard to determination of the number of replicate samples of sediments or biota to characterize an area [*ospar, helcom*] **UHLIG / NUNES**
6.6.4		5.6.4	Statistical aspects in relation to monitoring, integrating and interpreting biological effects **UHLIG / MATTHIESSEN**
6.6.5		5.6.5	Implications of the outcome of the VIC programme on the monitoring of temporal trends in contaminants in biota **PEDERSEN / UHLIG**
6.7		5.7	Evaluation of the effectiveness of monitoring programmes in determining trends against a background of natural fluctuations **LOENG / GENTIEN**
		5.8	Use of *in situ* chemical oceanographic systems for observations of chemical variables **CARLBERG / PEDERSEN**
7	6		Quality assurance procedures and intercomparison exercises
7.1		6.1	Quality assurance of biological measurements in the Baltic Sea [HELCOM 2000/2] **LEPPÄNEN / YURKOVSKIS**
7.2		6.2	Quality assurance of biological measurements in the OSPAR area [OSPAR 2000/1.1] **GENTIEN / MELLE**
7.3		6.3	Quality assurance procedures for biological effects techniques, including fish diseases [*ospar, helcom*] **MATTHIESSEN / LANG**

7.4		6.4	Quality assurance of chemical measurements in the Baltic Sea [HELCOM 2000/2] **ANDRULEWICZ / PATIN**
7.5, Annex 3		6.5	Certified reference materials for organic compounds for use in marine monitoring [*ospar, helcom*] **NUNES / PEDERSEN**
7.7		6.6	Developments within QUASIMEME and QUASH **CARLBERG / PEDERSEN**
		6.7	Other issues or activities **PEDERSEN /CARLBERG**
7.8		6.8	ICES Zooplankton Methodology Manual **GENTIEN**
19	7	Environmental and ecosystem assessment	
19.1		7.1	Ecosystem effects of fishing in the Baltic Sea [HELCOM 2000/3] **RICE / OJAVEER**
		7.2	Initial considerations of a scientific framework for ICES ecosystem advice, including an ecosystem approach for the sustainable use and protection of the marine environment **RICE / PIUZE**
		7.2.1	Reference points **PIUZE**
		7.3	Study Group on the Scientific Basis for Ecosystem Advice in the Baltic **OJAVEER /**
		7.4	Evaluation of the strategies of the existing monitoring programmes in terms of their ability to support integrated environmental assessments [*ospar, helcom*] **COOREMAN / PIUZE**
19.6		7.5	Methodology and proposals for ecological quality objectives for the North Sea **SKJOLDAL / MELLE**
		7.6	Environmental indicators **ANDRULEWICZ / SKJOLDAL**
19.4, Annex 9		7.7	Structure and process of environmental assessments and production of environmental quality status reports **MATTHIESSEN**
19.4		7.8	Assessment of the limitations in our abililty to conduct an environmental assessment **DOYLE / CARLBERG**
19.3		7.9	ICES Environmental Status Report
19.3.1		7.9.1	Oceanographic conditions **LOENG**
		7.9.2	Zooplankton monitoring results **MELLE**
19.3.2		7.9.3	Harmful algal blooms **GENTIEN**
19.3.3, Annex 8		7.9.4	Fish disease prevalence **MELLERGAARD / LANG**
19.2		7.10	HELCOM Fourth Periodic Assessment and final consideration of chapter on fish, fish disease, etc. **OJAVEER / ANDRULEWICZ**
		7.11	OSPAR requests for EcoQOs for seabirds and marine mammals **SKJOLDAL / PAWLAK**
8	8	Marine contaminants	
8.1		8.1	Information on specific contaminants [*ospar, helcom*] **PEDERSEN / MATTHIESSEN**
		8.1.1	Evaluation of lists of priority contaminants in regional and international organizations **ÓLAFSSON / YURKOVSKIS**
		8.2	Relationship between biomarkers, physiology, and contaminants **ÓLAFSSON / YURKOVSKIS**
		8.3	Workshop to Evaluate the Utility of Artifical Intelligence Procedures in the Assessment of Pollution Effects in Flatfish **MATTHIESSEN / UHLIG**
		8.4	Use of chemical data in numerical modelling **CARLBERG / LOENG**
		8.5	Estuarine transport of trace metals **PEDERSEN / NUNES**
		8.6	Relationship between soft-bottom macrofauna and PAHs **COOREMAN**
		8.7	Abiotic and biotic transport and effects of dioxins **COOREMAN**
9	9	Fish diseases and related issues	
9.1		9.1	Results of national reports and analyses of data on disease prevalence in wild fish stocks **MELLERGAARD / LANG**
9.2		9.2	Progress in work on fish disease data assessment **LANG / MELLERGAARD**
9.3		9.3	Causes of the M-74 syndrome in Baltic salmon and progress in the understanding of relevant environmental factors; status of Ichthyophonus in herring **MELLERGAARD / LANG**
9.6		9.4	New techniques in pathology for the detection of endocrine disrupting chemicals in marine and estuarine organisms, including appropriate new target species representing the main ecological levels of the marine environment **LANG / MELLERGAARD**
9.4		9.5	Report on diseases and parasites in Baltic Sea fish [HELCOM 2000/3] **MELLERGAARD / LANG**
Annex 5	Annex for 9.5		
10	10	Issues regarding introductions and transfers of marine organisms	
10.1		10.1	Current status of fish, shellfish, algal, and other introductions in and between ICES Member Countries **DOYLE / CALABRESE**
10.2		10.2	Progress in ballast water research and management **DOYLE / CALABRESE**

10.2		10.3 Directory of dispersal vectors of exotic species **DOYLE / CALABRESE**
10.2		10.4 Standardized format for collating data on non-native species and the method and fate of introduction **DOYLE / CALABRESE**
	11	Benthos issues **NORREVANG JENSEN / LEPPÄNEN**
11.1		11.1 Guidelines for sampling and objective community description of epibiota of soft sediments and hard bottom sub-strata, including QA matters **NORREVANG JENSEN / LEPPÄNEN**
	12	Nutrients, eutrophication, plankton ecology
		12.1 Phytoplankton ecology issues **LEPPÄNEN / GENTIEN**
11.2, Annex 6		12.2 Progress in understanding the dynamics of harmful algal blooms **GENTIEN / LEPPÄNEN**
11.3		12.3 Zooplankton ecology issues **MELLE / GENTIEN**
12	13	Estimation of annual amount of discards and fish offal in the Baltic Sea and potential effects [HELCOM 2000/5] **ANDRULEWICZ / OJAVEER**
12		13.1 Possible secondary effects of dumping fish remnants, including on benthos **ANDRULEWICZ / OJAVEER**
12, Annex 7		13.2 Distribution and possible consumption of fish offal and discards by seabirds in the Baltic Sea **ANDRULEWICZ / OJAVEER**
13	14	Seabird ecology issues **PIUZE / BJØRGE**
13.1		14.1 Effects of contaminants in seabirds **PIUZE / MATTHIESSEN**
13.2		14.2 Other seabird issues **PIUZE / BJØRGE**
14	15	Issues regarding marine mammals
14.1		15.1 Evaluate popuations of marine mammals in the Baltic Sea, including migration, distribution, health status, effects of contaminants, and reproductive capacity [HELCOM 2000/1] **BJØRGE / BOREMAN**
14.2		15.2 Research programme on cause-effect relationships between contaminants and population-level effects in seals **BJØRGE / MATTHIESSEN**
		15.3 Progress in studies of marine mammal habitat requirements, particularly in relation to exposure to contaminants **BJØRGE / BOREMAN**
15	16	Mariculture Issues
15.1		16.1 Environmental interactions of mariculture, including new research and monitoring programmes **DOYLE / CALABRESE**
15.2		16.2 Effects of mariculture activities in the Baltic Sea [HELCOM 2000/3] **DOYLE / CALABRESE**
17	17	Effects of extraction of marine sand and gravel on marine ecosystems, including extent of extractions and impacts on biota and effect of turbidity caused by dredging **LIMA / ANDRULEWICZ**
17.1		17.1 Current marine extraction activities and results of assessment of their environmental effects **LIMA / ANDRULEWICZ**
		17.2 Progress in updating the 1992 Code of Practice for the Commercial Extraction of Marine Sediments and the Guidelines for the preparation of Environmental Impact Assessments **LIMA / ANDRULEWICZ**
17.2		17.3 Biological effects of dredged materals disposed in the marine environment **LIMA / ANDRULEWICZ**
18	18	Marine habitat classification and mapping **JAGTMAN / ANDRULEWICZ**
16	19	Issues related to genetics **CALABRESE / MELLERGAARD**
16.1		19.1 Information required to evaluate the genetic effects of release of cultured fish in the Baltic Sea [HELCOM 2000/3] **CALABRESE / MELLERGAARD**
		19.2 Protocols of fishery and mariculture genetics research in ICES Member Countries **CALABRESE / MELLERGAARD**
		19.3 Principles for the prioritization of marine finfish and shellfish populations for conservation **CALABRESE / MELLERGAARD**
16.2		19.4 Potential genetic implications of endocrine disruption **CALABRESE / MELLERGAARD**
16.3		19.5 Potential genetic implications of commercial fisheries on deep-sea fish stocks **CALABRESE / MELLERGAARD**
21	20	Data issues
21.1		20.1 Activities of the ICES Environmental Data Centre [OSPAR 2000/5.1, 5.2, AMAP, HELCOM] **NØRREVANG JENSEN**
21.2		20.2 Handling of nutrient data for the OSPAR Commission [OSPAR 2000/5.3] **DOOLEY**

21.3		20.3 Development of biological databases [OSPAR 2000/6, HELCOM] **NØRREVANG JENSEN**
21.4		20.4 ICES phytoplankton checklist **LEPPÄNEN**
21.5, Annex 10		20.5 Development of reporting format for biological effects measurement data [OSPAR 2000/7] **NØRREVANG JENSEN**
	21	Other issues from Working Groups
7.6, Annex 4		21.1 Marine Chemistry Working Group (MCWG) **PEDERSEN**
		21.2 Working Group on Marine Sediments in Relation to Pollution (WGMS) **COOREMAN**
8.2, 8.3, 8.4		21.3 Working Group on Biological Effects of Contaminants (WGBEC) **MATTHIESSEN**
		21.4 Study Group on Ecosystem Assessment and Monitoring Strategies (SGEAM) **PIUZE**
		21.5 Working Group on Statistical Aspects of Environmental Monitoring (WGSAEM) **UHLIG**
		21.6 Working Group on Shelf Seas Oceanography (WGSSO) **LOENG**
		21.7 Working Group on Introductions and Transfers of Marine Organisms (WGITMO) **DOYLE**
19.5		21.8 Working Group on Ecosystem Effects of Fishing Activities (WGECO) **RICE**
9.5		21.9 Working Group on Pathology and Diseases of Marine Organisms (WGPDMO) **LANG**
20	22	Issues in environment and oceanography
20.1		22.1 Global Ocean Ecosystem Dynamics (GLOBEC), including ICES/GLOBEC Working Group on Cod and Climate Change (WGCCC) **BRANDER**
20.2		22.2 Global Ocean Observing System (GOOS) **DOOLEY**
		22.3 GEF Baltic Sea Regional Project **THULIN**
	23	Organizational and procedural issues
		23.1 Bureau Working Group on the Advisory Process **SIGURJÓNSSON**
		23.2 ICES Five-Year Strategic Plan **SKJOLDAL**
		23.3 Review of ACME shadowing system for working groups and other international fora
		23.4 Plans for the Environmental Dialogue Meeting **PAWLAK**
	24	Work programmes for 2001
		24.1 OSPAR Commission **PAWLAK**
		24.2 Helsinki Commission **PAWLAK**
****	25	Recommendations from Working Groups
	26	Any other business
		26.1 Possible ACME contributions to 2000 ASC
		26.2 Review of ACME report sections from January meeting **PAWLAK**
2.2		26.2.1 OSPAR QSR 2000 review **PAWLAK**
4		26.2.2 Nordic Council of Ministers request **PAWLAK**
5		26.2.3 DG Fish **PAWLAK**
	27	Adoption of the 2000 ACME Report and review of Draft Minutes **PAWLAK**

ANNEX 3

INITIAL CONSIDERATIONS OF A SCIENTIFIC FRAMEWORK FOR ICES ECOSYSTEM ADVICE, INCLUDING AN ECOSYSTEM APPROACH FOR THE SUSTAINABLE USE AND PROTECTION OF THE MARINE ENVIRONMENT

Request

ICES has requested an examination of how to provide advice to its customers on fisheries and environmental issues in an integrated fashion, using an ecosystem approach as a basis. This topic is also of interest to many ICES customers such as the Nordic Council of Ministers and the North Sea Secretariat as well as to Commissions like OSPAR in relation to the development of Ecological Quality Objectives.

Source of the information presented

The 2000 report of the Study Group on Ecosystem Assessment and Monitoring (SGEAM), the 1999 report of the Working Group on Ecosystem Effects of Fishing Activities (WGECO), and ACME deliberations.

Status/background information

The ACME considered four aspects related to an ecosystem approach to ocean management: (A) terminology and definitions; (B) a framework for an ecosystem approach; (C) desirable general properties of ICES ecosystem advice; and (D) the scientific elements of an ecosystem approach.

(A) TERMINOLOGY AND DEFINITIONS

Ocean management is a complex field encompassing multidisciplinary interests and expertise including the management and protection of marine resources and habitats, contaminants assessment and control, fisheries, oceanographic and environmental research, and the development of new technologies. Ocean management is also evolving within the context of international conventions and laws, emerging national legislation and initiatives, and with the increased participation of all levels of government, non-governmental organizations, and all major stakeholders. A common understanding of the definitions and terminology related to an ecosystem approach to ocean management is a prerequisite to the discussion of such an approach within ICES and with ICES customers.

The following is a list of terms that ACME considers important to define in order to set a solid foundation on which to build a scientific framework for an ecosystem approach to ocean management.

(1) Ecosystem

The ACME proposes that the definition of ecosystem from Article 2 of the *Convention on Biological Diversity* should be adopted for the purposes of an ecosystem approach to ocean management:

"*An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.*"

This definition does not specify any particular spatial unit or scale, which allows the flexibility to refer to any functioning unit at any scale. Indeed, the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a grain of soil, a pond, a forest, a biome or the entire biosphere, and it should be recognized that ecosystems exist at all scales and within any chosen boundaries. The choice of ecosystem boundaries has important implications on management because many important species have distributions which cross ecosystem boundaries, thus making management difficult.

(2) Ocean Management Using an Ecosystem Approach

Ecosystem management, ecosystem-based management and ecosystem approach are all expressions that have been used synonymously to designate an integrated or holistic approach to ocean management, which recognizes the complexity of ecosystems and the interconnections among component parts. Adopting an ecosystem approach to ocean management does not imply an attempt by humans to manage ecosystems, but rather to manage human impacts on

ecosystems. It recognizes that human activities have impacts on ecosystems, and that human social and economic systems constantly interact with the physical and biological parts of ecosystems.

The following definition for Ocean Management using an Ecosystem Approach is proposed by ACME:

"Integrated management of human activities based on knowledge of ecosystem dynamics to achieve sustainable use of ecosystem goods and services, and maintenance of ecosystem integrity."

This definition points to the need for a comprehensive and holistic approach to understanding and anticipating ecological change, assessing the full range of consequences, and developing appropriate responses. Healthy ecosystems perform a diverse array of functions that provide both goods and services to humanity. The term "goods" refers to items given monetary value in the market place, whereas "services" from ecosystems are valued, but rarely bought or sold.

(3) Ecological Quality

The general expression "Ecological Quality" should be defined along with a number of related terms pertaining to objectives and reference levels. The definitions proposed come from the Scheveningen Workshop on Ecological Quality Objectives for the North Sea held in September 1999 (TemaNord, 1999:591).

a) Ecological Quality (EcoQ)

"An overall expression of the structure and function of the marine ecosystem taking into account the biological community and natural physiographic, geographic and climatic factors as well as physical and chemical conditions including those resulting from human activities."

b) Ecological Quality Objective (EcoQO)

An ecological quality objective should reflect an ecosystem approach and integrate objectives for various ecosystem components, for example, within a multidimensional framework. It should result from a management decision based on scientific advice. The proposed definition is:

"The desired level of ecological quality relative to a reference level."

Within the OSPAR framework for Ecological Quality Objectives (EcoQOs) for the North Sea (TemaNord, 1999:591), a set of ten issues were identified. These issues divide the ecosystem into manageable units, under which EcoQOs can be developed. The ACME is of the opinion that, in order to implement an ecosystem approach to ocean management, all ten issues should be considered together in an integrated manner. Measuring individual EcoQOs would not necessarily comply with an ecosystem approach. It is also felt that further work is required to review the ten issues proposed to ensure that all aspects of the ecosystem are accounted for. This would improve the framework through which EcoQOs could be proposed.

c) Ecological Quality Reference Level

"An ecological quality reference level is defined as the level of ecological quality, based on scientific evidence, where the anthropogenic influence on the ecological system is minimal."

The reference level has to take into consideration natural variability and trends. For example, the historic level for certain environmental conditions (e.g., pristine conditions) may not be an appropriate reference level for the contemporary ecosystem if this ecosystem has evolved, through natural trends, towards different characteristics. It should furthermore be noted that "reference level" in this context is different from the expression "reference point" used in the context of fisheries.

(4) Indicator

"An indicator is a variable, or an index combining different variables, which provides information on the state of the ecosystem".

Indicators are usually used to reflect trends in the state of ecosystems and are used to monitor the success towards achieving management objectives. Indicators can provide information on the biological, physical, social or economic conditions. A simple classification for indicators includes pressure indicators, which reflect human influence on the natural environment (e.g., nutrient discharges), and condition indicators, which address environmental conditions (e.g., nutrient concentrations in a certain area).

(5) Sustainability

Sustainability is often used in the context of *sustainable development*, which was defined by the Brundtland Commission as

"*development that meets the need of the present without compromising the ability of future generations to meet their own needs."*

In the context of an ecosystem approach to ocean management, the sustainability concept carries two different aspects: sustainability of use (sustainable use) and sustainability of ecosystems. The two are tightly linked since sustainable use of ecosystems can only be achieved if the ecosystems are themselves sustainable.

(B) A Framework to an Ecosystem Approach

ECOSYSTEM APPROACH AND NORTH SEA MANAGEMENT

In 1997, at the Intermediate Ministerial Meeting (IMM) on the Integration of Fisheries and Environmental Issues in the North Sea, in the Statement of Conclusions, conclusion 2.6 referred to the ecosystem approach as follows:

"Further integration of fisheries and environmental protection, conservation and management measures, drawing upon the development and application of an ecosystem approach which, as far as the best available scientific understanding and information permit, is based on, in particular:

- *the identification of processes in, and influences on, the ecosystems which are critical for maintaining their characteristic structure and functioning, productivity and biological diversity;*
- *taking into account the interaction among the different components in the food-webs of the ecosystems (multi-species approach) and other important ecosystem interactions; and*
- *providing a chemical, physical and biological environment in these ecosystems consistent with a high level of protection of those critical ecosystem processes."*

The objective of the North Sea States is to develop a management regime of the North Sea that is based on an ecosystem approach. This approach is considered to be fundamental to achieve sustainable use and protection of the marine environment. It is intended that management decisions consider all consequences of human activities for the marine environment in an integrated way.

The Oslo Workshop

A Workshop on the Ecosystem Approach to the Management and Protection of the North Sea was held in Oslo, Norway, in 1998. The Oslo Workshop was the follow up to conclusion 2.6 of the IMM in 1997. A mixture of scientists, policy makers, user groups and NGOs attended. The Oslo Workshop can be considered as the first European attempt to define a general framework for an ecosystem approach to ocean management. The Oslo Workshop on the Ecosystem Approach resulted in eight conclusions (TemaNord, 1998):

1) There is a need for integrated management of human activities in accordance with the principles of sustainable use and protection of the North Sea ecosystem;
2) There is a need for agreed-upon definitions of terms such as "ecosystem" and "ecosystem approach";
3) Clear objectives to the management and protection of the North Sea must be formulated. There is a need for both general objectives and specific operational objectives;
4) Management of the North Sea should be based on the best use of scientific knowledge;
5) There is a need for focused research on climatic, biological and human driving forces of ecosystem variability;

6) There is a need for improved integrated monitoring to reveal the human impacts on the ecosystem;

7) There is a need for integrated assessments on fish stocks, the environment, and socioeconomics issues;

8) Stakeholders, along with scientists, managers and politicians, should be involved at different stages of the decision process.

Comparison of basic elements for an ecosystem approach from various models

The ACME considers the conclusions of the Oslo Workshop to be valuable and useful as a basis for the construction of a framework for the development of an ecosystem approach to ocean management. In other fora, similar progress has been made on the development and implementation of an ecosystem approach (Lubchenko, 1994). In the US, several reports address the development of an ecosystem approach to ocean management based on strengthening the linkage between science-based assessments of the changing state of marine ecosystems and the economic valuation of ecosystems goods and services. Interesting material is found in the findings of an expert panel of the Ecological Society of America (ESA) (Christensen *et al.*, 1996), reports by Zinn and Corn (1994) and NOAA publications (Baker, 1996; Griffis and Kimball, 1996).

Lanters (1999) compared the results of the Oslo Workshop (TemaNord, 1998) with the report of the Ecological Society of America (Christensen *et al*., 1996) and of the U.S. Interagency Ecosystem Management Task Force (Anon., 1995) to identify some general "rules" to an ecosystem approach to ocean management. The U.S. Interagency Ecosystem Management Task Force is responsible for the implementation of the ecosystem approach in day-to-day management. Their major cases are land-based but some management regimes concern coastal areas or inland waters. ESA is a professional society of ecologists which promotes the responsible application of ecological principles to the solution of environmental problems through reports, journals, research, and expert testimony to Congress. The results of the comparison are presented in Table A3.1.

Table A.3.1. A comparison of the basic elements for an ecosystem approach to ocean management mentioned by the Oslo Workshop (TemaNord, 1998), ESA (Christensen *et al*., 1996), and the U.S. Interagency Ecosystem Management Task Force (Anon., 1995) (modified from Lanters, 1999).

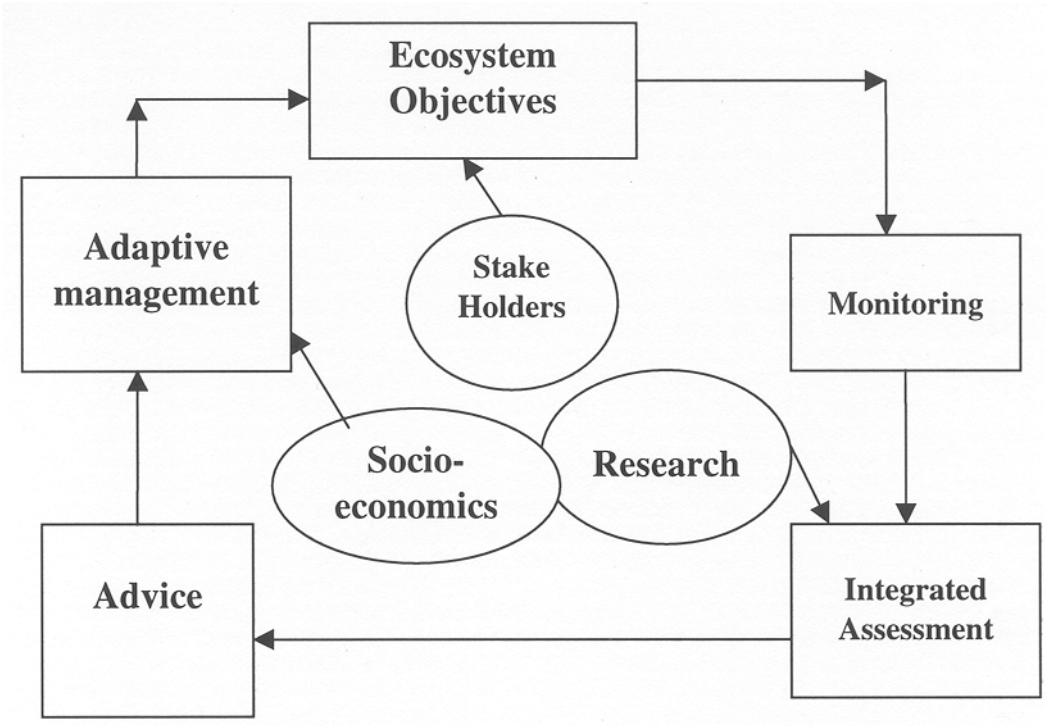
Oslo Workshop	ESA	U.S. Task Force	Common element
Sustainable use and protection of the ecosystem	Sustainability as a precondition before "deliverables"	Sustaining or restoring natural systems and their functions and values (objective)	*Objectives cover sustainability*
Clear objectives, general and operational	Measurable goals	Long- and short-term consequences	*Clear, measurable objectives*
Best use of scientific knowledge	Sound ecological models and understanding	Using the best science	*Optimal scientific input*
Research on climatic, biological and human driving forces on ecosystem variability	The dynamic character of ecosystems. An ecosystem approach to management avoids attempts to "freeze" ecosystems in a particular state or configuration		*Taking into account natural dynamics*
Integrated monitoring to reveal human impact	Management approaches must be viewed as hypotheses to be tested by research and monitoring programmes	Improving information and data management	*Evaluation of measures through monitoring*
Integrated assessments on environment, socioeconomics and ecology	Humans as ecosystem components. An ecosystem approach to management values the active role of humans in achieving sustainable management goals		*Integrated assessment on environment, socioeconomics and ecology*
Stakeholders, along with scientists, managers and politicians are involved in the decision process		Forming partnerships between federal, state, and local governments, aboriginal peoples, landowners, and other stakeholders	*Involvement of stakeholders, scientists and politicians*
	Context and scale. There is no single appropriate scale or time frame for management	Adjusting management direction as new information becomes available	*Adaptive management*
		Communication with general public	
		Coordination among federal agencies	

These common elements can be considered as the basic elements for an ecosystem approach to ocean management and can be used to construct a framework for the implementation of such an approach. The similarity in the issues addressed by the different documents is striking. This shows that there is fairly wide consensus on the basic elements of an ecosystem approach. More recently, ecosystem-based management of marine fisheries has been endorsed in an evaluation report of the U.S. National Research Council (NRC, 1999).

A framework for an ecosystem approach

The framework presented in Figure A3.1 is based on the above-mentioned references as well as on discussions held by SGEAM and ACME, and it is constructed on the assumption that specific and operational objectives for the marine environment are already available.

Figure A3.1. A framework for an ecosystem approach of marine ecosystems to achieve sustainable use of ecosystem goods and services and conservation of ecosystem integrity.



In essence, the framework presented here is not new. Monitoring generates information on the ecosystem and interacting human activities in order to assess the state of the system, while research provides insight into relationships, interactions, and processes guiding the ecosystem. This information feeds the integrated assessment which is subject to the objectives that are stated for the marine ecosystem at stake. Comparison of the results of the integrated assessment with the objectives will result in scientific advice to management on what measures should be considered to achieve the objectives set. This advice is used by managers and policy makers to set up a management regime for a given period. Various stakeholders can be involved at any stage in the process. The effect of this new management regime is measured through monitoring. And the process starts over again. In the real world, there are many interactions between the parties involved and this communication forms an important aspect of the ecosystem approach.

The integrated assessment is a major issue which forces other steps of the framework to deal with integrated issues. For monitoring and research, this can be interpreted as multidisciplinary research and integrated monitoring where, at least, data exchange between different fields of work is common practice. The ACME recognizes that the process to define operationally specific objectives for the management of marine ecosystems is a major challenge before an ecosystem approach can come into action. This process involves the interaction between scientific knowledge, socioeconomic forces, and national and international agreements, ending up in a political and managerial decision-making process.

(C) DESIRABLE GENERAL PROPERTIES OF ICES ECOSYSTEM ADVICE IN THE FUTURE

ICES provides advice on a wide range of topics. Increasingly, ICES is being asked to provide advice of a multidisciplinary nature, involving ecosystem considerations, and on the state of ecosystems. This is consistent with increasing attention to management of the marine environment within a precautionary approach.

There are a number of desirable properties of ICES advice generally which should also be used in developing "ecosystem advice":

1) ICES ecosystem advice should accommodate client (e.g., Member Countries, fisheries management agencies, environmental management agencies) needs for advice, e.g., for management strategies under an ecosystem perspective.
2) Much ICES ecosystem advice would be directed towards client commissions and, therefore, relate to those marine areas that are subject to international management—i.e., the open sea rather than the coastal zone.
3) ICES ecosystem advice should also incorporate issues of the coastal zone that are of potential importance to offshore areas, i.e., the wider ecosystem.
4) ICES ecosystem advice should also address topics which are indirectly useful to an ecosystem approach to ocean management, such as advice on changes in carrying capacity, and the resistance and/or resilience of ecosystems.
5) ICES ecosystem advice should carefully avoid giving the impression that marine ecosystems can be engineered (i.e., subjected to varying short-term management objectives without accounting for the natural variability and/or change of the system and its living resources).
6) Fish stock assessments, and a high proportion of ICES activities, have focused on annual, tactical fisheries decision making. This is somewhat different from environmental advice, where case studies are more typical, and the decision-making process is usually on a multi-annual basis. It is likely that this difference would be reflected in applications where (traditional) environmental and (traditional) fisheries aspects are to be joined.
7) ICES ecosystem advice should continue to emphasize the needs for high quality data and assessments as the basis for such advice.
8) ICES ecosystem advice should be based on the best available science. In cases where full analytical solutions are not available, other methods should be applied that summarize the best available knowledge in order to be able to address acute problems.

(D) THE SCIENTIFIC ELEMENTS OF AN ECOSYSTEM APPROACH

Marine ecosystem dynamics

Marine ecosystems are characterized by a high degree of natural variability, which is a primary driving force of ecosystem dynamics. In addition, there are also strong biological interactions between organisms at various trophic levels in ecosystems. The climatic driving forces can act either directly on species and populations or indirectly by providing conditions for different biological interactions. The climatic forcing and the biological interactions add up to more or less complex patterns of ecosystem dynamics.

Fish stocks are particularly prone to show large variability due to their mode of reproduction and large recruitment variability. Since many commercial fish stocks are large and constitute major components of marine ecosystems, their variability is reflected in the variability characteristics of the ecosystems. Also, plankton and benthos may show variation in relation to climatic forcing.

The natural variability in fish stocks, plankton, and benthos is a shifting baseline for the state of the ecosystem which must be taken into account both when conducting environmental assessments and when setting EcoQOs. This means that one must acknowledge the variability and not set fixed objectives. The lack of specific knowledge may, however, make this difficult in many cases.

Integrated assessments

Production of integrated assessments is an important scientific element of an ecosystem approach. There is a need to move from the present assessments of fish stocks and environmental conditions to more holistic and integrated ecosystem assessments. Integration is required at least at three levels:

1) Integration of environmental information into the assessment of fish stocks

Integration of environmental information into assessments of fish stocks offers the promise of better assessments of current status and trends. This is because of the strong influence of climatic variability for the dynamics of many fish stocks. Such use of environmental information is a major focus for operational fisheries oceanography as described by ACME (ICES, 1998). The implication for ICES is a need to speed up the reporting, compilation, and assessment of environmental data from contributing national laboratories to match the time frame for assessing data on the fish stocks.

2) Integration of information on fish stocks and fisheries into environmental assessments

Integration of information on fish stocks and fisheries into environmental assessments is currently done in the preparation of Environmental Quality Status Reports (QSRs). There is considerable scope for improving the involvement and information of fisheries experts and expertise in collaboration with environmental experts. The scientific challenges are to better assess the indirect effects of fisheries through trophic interactions and habitat deterioration, and to assess and separate the impact of fisheries from the impacts of other human influences such as eutrophication and pollution.

3) Integration of socioeconomic considerations into environmental or ecosystem assessments

The third level of integration involves the consideration of socioeconomics in ecosystem assessments. Fisheries management is, on the one hand, confronted with the multidimensional problem of effects on individual species, communities, and ecosystems and, on the other hand, with sustaining an economically viable fishery. Socioeconomic considerations are the main driving force for fishing and are of major importance in designing and developing sustainable fisheries. An integrated ecological and economic approach is expected to facilitate the communication between the fisheries sector, and research and management, and to give insight into the strategies performed by the fishing industry to achieve maximal economic profit. In the Northwest Atlantic, NOAA's National Marine Fisheries Service has introduced the use of the five module framework in fishery assessments that includes consideration of ecosystem (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socioeconomics, and (5) governance (Sherman, 1994).

Monitoring

To support integrated assessments, monitoring programmes provide updated information on status and trends. There is a need to move towards integrated monitoring in an ecosystem context. Thus, all elements in existing national and international monitoring programmes in a given ecosystem should be reviewed with the aim of incorporating them into an integrated ecosystem monitoring programme following appropriate adjustments. There is considerable potential for a more comprehensive and efficient utilization of monitoring results in integrated assessments.

Many commercial fish stocks are regularly monitored through research vessel surveys. In many instances, environmental data are collected during fish stock surveys. An example is provided by the ICES-coordinated IBTS (International Bottom Trawl Survey) in the North Sea. During this cruise, hydrographical data are collected which provide semi-synoptic descriptions of the distribution of water masses and density fields. This has been accepted as a component in the international GOOS programme. Many laboratories also monitor nutrients during the winter IBTS. This has provided some of the most comprehensive data on winter nutrient distributions in the North Sea and was used in the 1993 North Sea QSR. With low additional costs, it would be possible to extend this nutrient monitoring as a component of a systemic nutrient budget, productivity, and eutrophication monitoring programme (see ICES ACME 1997 ??). However, other components also need to be incorporated, such as climate, plankton and benthos.

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ANNEX 4

REFERENCE POINTS AND ECOSYSTEM CONSIDERATIONS

1 INTRODUCTION

WGECO began a consideration of the issue of "reference points which include ecosystem considerations" in 1997. To begin, it is necessary to reiterate the assertion that management of fishing effort at levels which deliver a high probability that conservation objectives are achieved for the target stocks (i.e., SSB > B_{pa}) is likely to be the single biggest change that would ensure conservation of the ecosystem. This is especially so if combined with targeted protection of key habitats/features.

OSPAR and the North Sea Conference of Ministers consider the implementation of an ecosystem approach in fisheries management as an important step for the integration of fisheries and environmental issues. Since there is not yet a clear and agreed upon definition of an ecoystem approach (NRC, 1999), the approach taken in this chapter will be along several lines. There are a growing number of documents which describe the features of ecosystem management approaches (e.g., Anon. 1995; Christensen *et al*., 1996; Lanters, 1999).

In reviewing this issue in 1997, WGECO identified the following areas where additional reference points might be appropriate:

- reference points for non-target species;
- reference points for ecologically dependent species (species that are so tightly linked ecologically to the target species that changes in the abundance/distribution of the target, which do not approach B_{pa}, may still compromise the status of the ecologically dependent species (ICES, 1998a, Section 8.2.2.2));
- reference points for the genetic health of populations;
- reference points regarding the consequences of increased populations of scavengers.

These considerations are revisited in the light of advances in our understanding which have emerged since 1997 and add a consideration of other areas of the ecosystem where management may be required to achieve sustainability and where reference points may be defined. Specifically, we will consider the need and possibilities for reference points for single species including, but not restricted to, scavengers, marine habitats, genetic health of populations, and ecosystem properties.

Such considerations implicitly recognize the need for integrated management of the marine environment and that managers will have to operate with multiple management criteria. Such multiple management criteria are now an accepted part of fisheries management in multispecies fisheries such as in the North Sea, even if methods for simultaneously meeting them all are not perfected.

In developing an ecosystem-scale management perspective, it must be recognized that the objectives set will include much wider considerations than those traditionally addressed for fisheries management. The overall ecosystem objective should involve sustainability. Sustainability means different things to different people. We take it to mean that current activities do not compromise the ability of the environment to provide resources and services in the future, nor reduce the choices available to future generations. Further, we should recognize that with regard to fisheries there are three aspects to sustainability:

1) Sustainable fisheries. The level, and composition, of landings are sustainable.
2) Sustainable fishing industry. This is the socioeconomic sustainability of fishing and includes considerations of the viability of communities dependent on fisheries, the size and nature of the fishing industry and all linked economic and social activities—including merchants and fish processing sectors, chandlers, vessel building and repair, etc.
3) Sustainable ecosystems. The nature, species composition, and functioning of the environment are not placed at risk of changes that seem long lasting and difficult to reverse.

It is not for scientists to advise on the balance between these three, but such a consideration must form an explicit part of any ecosystem management scheme. It should however be recognized that a number of existing international agreements (Table A4.1.1) already place a priority on sustaining the ecosystem, arguing that pursuit of social and economic sustainability cannot be allowed to result in an unacceptable risk to conservation of the ecosystem.

Any ecosystem approach to management must also have mechanisms for dealing with the inherent uncertainty in predictions of marine system dynamics. The application of a precautionary approach to fisheries management has seen advances in recent years, but these will need to be developed and extended if any management scheme based on an ecosystem approach is to be effective. In particular, admonitions that uncertainty about the status of single species cannot be used as a reason to defer cost-effective measures to reduce risk, must be expanded to acknowledge the greater uncertainty about ecosystem status and trajectory.

Science has to deal with the complexity of the marine system that includes thousands of species and many different types of habitats. The degree of mutual coherence is poorly known and predictive scientific models are not, and may never be, available. In addition, human use may already have changed the most sensitive components of the marine system, hampering identification of reference levels. If any changes are observed in ecosystems, it is important to differentiate between changes that form part of natural variability and those that represent the effect of one or more human activities. In is in this context that operational reference points are considered for species, habitats, genetics, and emergent properties of ecosystems.

Table A4.1.1. An overview of the main global conventions, laws and treaties applying to the conservation and management of marine living resources. These are often given regional specificity in "local" conventions such as Annex V of the OSPAR Convention which covers protection of species and habitats.

Convention or treaty	Year	Main objective
UN Law of the Sea	1982	Regulation of the management and authority of all living marine resources. Establishment of an Exclusive Economic Zone
Bonn Convention	1983	Protection of migratory stocks of wild species (species moving across national borders)
CITES and GATT		General Treaties governing prevention of trade in endangered species (CITES) or reduction of environmental impact (GATT)
Convention on Biological Diversity (CBD)	1992	Result of UNCED Conference. Protection of biodiversity at level of genetics, species and ecosystems
Agenda 21 - Chapter 17	1992	Result of UNCED Conference. Protection of all marine and coastal areas by rational use and development of living resources
FAO Code of Conduct	1995	Code of Conduct for Responsible Fisheries by considering ecosystem and socio-economic aspects of fisheries and the precautionary approach
Jakarta Mandate	1997	Elaboration of CBD for marine systems in which Marine Protected Areas form a major issue
UN Convention on Migratory and Straddling Fish Stocks	not in force	Conservation and protection of border-crossing and high seas fish stocks

2 POPULATION AND SPECIES REFERENCE POINTS/OBJECTIVES

What is at risk and how do fisheries place them at risk?

2.1 Populations of Target and Non-Target Species

If improperly managed, fisheries can place **populations of both target and non-target species** at risk, through inflicting unsustainable mortality over periods of time long enough to impact abundance. The mortality can be severe enough to cause a population decline directly, to spawning biomasses at which either the probability of good recruitment is reduced or the probability of poor recruitment is increased. These are the criteria presently used by ICES to decide if a stock is inside or outside safe biological limits.

Where fisheries inflict less severe mortality, the fishery will change **the age composition of the stock** relative to the unexploited condition. The changes may be great enough that spawning biomass comprises disproportionately more first-time spawners or total biomass may depend excessively on new recruits. Neither of these changes is desirable, as

there is evidence that, for at least some species, first-time spawners have lower reproductive value on a per kilogram basis (Trippel, 1998), and dependence of biomass in incoming recruitment makes the stock more vulnerable to short-term periods of poor recruitment or environmental stress. Hence, reference points even for target species should ensure a suitable age composition as well as an adequate total spawning biomass and sustainable fishing mortality.

Without being killed, target or non-target species may suffer **injury or exposure which results in increased vulnerability to predation**. This can result from physical damage as gear passes over individuals or as individuals pass through gear, or from rough handling and release. Once injured or exposed, if predators are present, the biological effect is much the same as for direct mortality. Hence, the seriousness of this effect would be evaluated in the same way as for direct fishing mortality: is the total death rate sustainable and is biomass being conserved?

NOTE: For all the direct effects above, from a biological perspective, and according to the international agreements reviewed in Table A4.1.1, ICES is concerned about the conservation of all species. Hence the same questions are asked about the sustainability of all populations in the face of total mortality and the contribution of fishing mortality to total mortality. **There is no justification to apply different standards to species of commercial and non-commercial importance.**

The direct mortality due to being killed by fishing gear can become excessive if effort is too high, either overall, or in the area where the species suffering unsustainable mortality is concentrated. Injury or exposure by gear that results in increased vulnerability to predators can jeopardize conservation of a species if a biologically important fraction of a population encounters the gear and is not retained.

2.2 Spatial Properties

Fishing can successively deplete meta-populations so that even if local sub-populations are not demonstrated to be genetically distinct, the species or stock ceases to be present in progressively larger parts of its historic range. Although special circumstances would be required, it is theoretically possible that a population as a whole could be above its biomass reference point and experiencing total mortality still below the mortality reference point, yet the fishery could be causing a reduction in range. The key circumstances include intense localized exploitation and low mobility of the species being killed. There are several reasons that managers should take safeguards that fisheries do not cause major reductions in range. It has been theorized that a species (or stock) becomes less resilient to environmental challenges as distribution contracts, if only by becoming more vulnerable to catastrophies (Tuljapurkar, 1990). Some studies have conjectured that a reduction in spawning area reduces reproductive potential by not allowing full seeding of larval/juvenile habitats (Burgman *et al*., 1992; Groom and Pascual, 1998). Also, as a population becomes spatially concentrated, q (catchability to fishing gear) goes up and the stock becomes more vulnerable to further overfishing, even when fleet behaviour has not changed.

Reduction in range or in meta-population structure can occur if a fishery is not distributed representatively across the full range of the species of concern, and redistribution of the species is slow relative to its population dynamics responses to fishing mortality.

2.3 Dependent Species

Fishing can deplete a population locally so dependent predators cannot find sufficient food to survive or reproduce at sustainable rates, even though the stock as a whole is within safe biological limits, and the population genetic diversity may not be compromised. Evidence for this effect, and reasons to be concerned about it, are reviewed in ICES (1999b).

Conservation of ecologically dependent species can be jeopardized if the fishing fleet is more mobile than the dependent species and the prey is widely distributed but slowly mobile. Given those two factors, a fishery may cause local depletions of prey for periods of time that are long relative to the needs of the dependent species, if the fishery concentrates harvests disproportionately in areas important to the dependent predator.

2.4 Scavenger-Caused Effects

Fishing can produce so much waste that species which feed on offal and discards can increase greatly in abundance. The incidental mortality that the scavenging species inflict on alternate prey may become unsustainable, or through competition for limited space the scavenging species may cause reproduction below replacement rates for the species displaced from breeding (or other) sites. Evidence for this effect is reviewed in Section 5.2 of the 2000 ACME report.

Fishing produces wastes (discards and offal) which can be concentrated and readily available as food for scavengers who can exploit this food source. If the scavengers also prey on species that cannot use this food supply, or compete with them for breeding space, then a fishery that increases food to scavengers may cause mortality or poor recruitment of species who are eaten or out-competed by scavengers.

3 HABITAT FEATURES

What is at risk and how do fisheries place them at risk?

Marine habitats are generally distinguished by the physical nature of the environment; e.g., silty-mud is distinct from muddy-sand, frontal regions separate mixed and stratified waters. These can include biologically produced features such as reefs and turf.

Changes in the nature, extent and spatial distribution (degree of patchiness) of habitat features can compromise the ability of the ecosystem to support a natural species assemblage and hence normal ecosystem function (Dayton *et al.*, 1995; NRC, 1999).

There are limited data on the impact of fishing on habitats within EU waters (see Section 5.2 of the 2000 ACME report). In addition to the impacts recognized from bottom trawls (Section 5.3 of the 2000 ACME report), there are data which suggest that deep-water fisheries to the west of Scotland, around the Faroe Islands, and in northern Norway have caused substantial damage to beds of the cold-water coral *Lophelia*, and data also indicate damage to *Sabellaria* reefs in coastal waters of the North Sea and Irish Sea (STECF, 1999).

In the northwest Mediterranean, changes in the size and species composition of fish populations caused by fisheries may have led to large changes in benthic communities as a result of increased abundance of sea urchins (Sala *et al.*, 1998). This is an example of a habitat modification mediated through changes in the food web.

Section 5.3.1 of the 2000 ACME report presents the conclusions about aspects of marine habitats which may be put at risk by fishing. They are repeated briefly here.

Bottom towed gears can remove some physical features

Bottom towed gears may cause the loss of physical features in the environment such as peat banks, boulder reefs, or gravel banks. These changes are always permanent, and lead to an overall reduction in habitat diversity. This in turn can lead to the local loss of species and species assemblages dependent upon such features. Examples might include attached bryozoan/hydroid turf and essential fish habitat such as herring spawning grounds. Even when substantial quantities of the habitat feature remain, if the habitat has become highly fragmented, this may compromise the viability of populations dependent upon it.

Bottom towing of gears can cause a reduction in structural biota (biogenic features)

Loss of structure-forming organisms such as colonial bryozoans, *Sabellaria*, hydroids, sea-pens, sponges, mussel beds, and oyster beds can result from the impact of bottom towed gears. These changes may be permanent, and lead to an overall loss of habitat diversity. This in turn can lead to the local loss of species and species assemblages dependent upon such biogenic structures. Essential fish habitat such as juvenile gadoid nursery habitat would be an example. Even when substantial quantities of the biogenic feature remain, if the feature has become highly fragmented, this may compromise the viability of populations or species dependent upon it.

Bottom towed gears can cause a reduction in complexity

Towing of bottom fished gears can cause the redistribution and mixing of surface sediments as well as degradation of habitat and biogenic features. This can lead to a decrease in the physical patchiness of the sea floor (i.e, decreased heterogeneity) within fishing grounds. These changes are not likely to be permanent.

Bottom towed gears alter the physical structure of the sea floor

Towing of gears on the sea floor can cause a reshaping of seabed features such as sand ripples and damage to burrows and associated structures (e.g., mounds and casts, microhabitats). These features provide important habitats for smaller animals such as meiofauna.

4 GENETIC PROPERTIES OF POPULATIONS

What is at risk and how do fisheries place them at risk?

Total genetic variation within a species can be partitioned into variation within and among populations. Fisheries may have consequences for both types. Within populations, phenotypic changes associated with fisheries are well documented for a number of species and include changes in morphological and life history traits such as weight- and length-at-age, and age- and length-at-maturity, spawning time, etc. (e.g., Rijnsdorp, 1993; Rowell, 1993; Millner and Whiting, 1996; Trippel *et al*., 1997), many of which may be correlated (ICES, 1997). Such changes may arise through relaxation of intra-specific competition, response to shifts in environmental conditions (phenotypic plasticity) and to change in genetic composition; it is often difficult to establish which of these effects is responsible for the observed response. To the extent that the changes are genetically based, intensive selective fishing will result in changes in gene frequencies, and possibly in loss of alleles within the exploited populations.

Populations that are reproductively isolated, with little or no gene flow between them, will tend to diverge genetically either through different selective forces or through genetic drift. Salmonids have high among-population variance resulting from their homing behaviour at spawning time (e.g., Gharrett and Smoker, 1993). However, even in species that have free-drifting larvae, gametes or spores (approximately 70 % of marine invertebrate species have pelagic larvae; Mileikovsky, 1971) and are ultimately distributed over a wide area, local populations can often be discerned (e.g., cod: Ruzzante *et al*., 1997; squid: Shaw *et al*., 1999; marine algae: van Oppen *et al*., 1996). In such species, loss of sub-populations results in loss of the unique characteristics of the genome of the sub-population.

Natural selection acts within populations, while the genetic potential of the species to adapt to environmental changes depends on the total genetic diversity represented among populations. It is necessary to maximize both types of variation to maintain full potential for evolutionary change within a species.

In general, modelling studies have shown that size selection favours slow-growing and late-maturing fish, although there are exceptions to this (ICES, 1997).

Fishing mortality is a highly selective process, both with respect to the size of the organism captured and location (ICES CM1997/F:4). The fishery may also directly or indirectly favour capture of one sex over another (e.g., American lobster, shrimp), altering the sex ratio and/or sex-specific size frequency of the breeding population. In addition, migratory stocks may be under different selection pressures in different parts of their range due to different fishing methods. Fishing therefore has the potential to affect the genetic diversity and genetic structure of a species.

Selective breeding programmes for cultured fish (e.g., salmon) and invertebrates (e.g., abalone) have shown that significant amounts of genetic heritability (the proportion of phenotypic variation that is inherited from one generation to the next) exist for yield-related traits. Life-history traits, being closely linked to fitness, have relatively lower heritabilities, however even these are capable of showing a substantial selection response in only a few generations (ICES, 1997). Although extrapolation of heritability estimates determined from breeding programmes to those in wild fish stocks should not be made, this research has demonstrated clearly that there is genetic variation in those traits selected for by fishing. The stronger the selectivity (in the fishery sense “selective”) of the fishery for certain traits, and the greater the proportion of total mortality made up of fishing mortality, the greater will be the effect of fishing on the genetics of the exploited population. The persistence of fishing-induced genetic changes will depend upon the other selective forces operating on the species, the proportion of genetic diversity affected and the reproductive biology of the species. In some cases, genetic change may not be readily reversed by altering fishing practices (Law and Grey, 1989). Consequently, fishing can cause evolution of phenotypic traits of the exploited species (Law and Rowell, 1993), although the time scale over which it operates is unknown.

Fishing can also selectively harvest some sub-populations intensively, while harvesting other sub-populations lightly. In these cases, a rate of fishing mortality which is sustainable at the scale of the whole species may successively eliminate isolated sub-populations, and reduce the total genetic variability of the stock or species.

5 EMERGENT PROPERTIES OF ECOSYSTEMS

5.1 Emergent Properties: What are they?

In the past, WGECO has considered ecosystem level reference points (ICES, 1996, 1998a). Discussions highlighted issues such as:

- food web dynamics;
- species richness and evenness (diversity);
- distribution of life histories;
- production:biomass ratios.

These are not direct biological properties but are functions of the entire ecosystem and are referred to as emergent properties. They are important not only because they may tell us something about the functioning/status of the ecosystem, but also as they have been widely perceived as indicators of environmental status.

5.1.1 Does fishing put emergent properties at risk?

There has been considerable speculation as to the extent to which fishing may alter these emergent ecosystem properties (see ICES (1998a) and earlier sections of the 1999 WGECO report). It is also true that many press and popular articles have been highly emotive in their commentary on this issue. We have reviewed the **evidence** that has emerged since the last WGECO consideration and can find none which would cause us to revise our conclusions.

The need for some ecosystem reference points is real. At this time, it is believed that ICES is not in a position to recommend that ecosystem emergent property reference points are necessary, beyond the reference points which would assure sustainability and conservation of all species and habitats impacted by fishing. Neither is ICES prepared to confirm that single species, habitat and genetic reference points alone are enough to ensure a precautionary approach to ecosystem management. Some study may yet provide compelling evidence that reference points for emergent properties of ecosystems are also required to ensure conservation of the ecosystem, but to this time none have.

6 REFERENCE POINTS FOR MANAGEMENT

Ecosystem approaches to marine management will require many reference points. Exceeding any reference point whether for target species, non-target species, habitat change or genetic health, should invoke mitigation measures.

6.1 Populations and Species

6.1.1 Direct mortality

For target species, conservation can be achieved by following the precautionary approach. Special importance should be given to two activities. One is setting B_{pa} and F_{pa} sufficently far from the biological limits to allow for uncertainty in estimates of present biomasses and fishing mortalities, and uncertainty about the future states of nature (especially, but not exclusively, future recruitment) for the time scale of management and the degree of risk aversion managers (and society) demand. The other is implementing harvest control rules, to ensure that necessary conservation measures are implemented in a timely way when a reference point is violated. Together, these measures should keep target species inside safe biological limits with high probability (ICES, 1998b). Occasionally the biology of a species makes an escapement goal or a total mortality a more appropriate reference point than an exploitation rate, but those circumstances are well understood (ICES, 1999b).

For non-target species, there is no reason to take a different approach to assuring conservation. The implementation problem is the practical impossibility of setting biomass and fishing mortality reference points for every non-target species in the ecosystem, and then assessing compliance. As a practical solution, we propose setting biomass and fishing (or total) mortality reference points for non-target species of high vulnerability, and monitoring their compliance. This proposal assumes that the documented conservation of a set of non-target species of high vulnerability gives high probability of also ensuring conservation of other non-target species of lower vulnerability. We suggest that vulnerability should be evaluated with regard to:

- the ability of the species to tolerate an increase in mortality (see Section 5.3 of the 2000 ACME report—long-lived species of low fecundity are likely to be more vulnerable than short-lived species of high fecundity, controlling for factors such as likelihood of exposure to specific gears);
- the likelihood that the gear will encounter the species (there should be a relatively high probability of exposure to the gear);
- the likelihood that an encounter with the gear will kill or injure the species (species which are soft or brittle may be more vulnerable than species with hard shells or leathery epidermis);

- the proportion of the population which is in the area where the fishery operates (a large part of the species' range should lie within the area of activity of the fishery on macro [geographic] and micro [habitat] scales);
- it must be possible to quantify at least the sign of the trend of the population, and ideally more;
- moreover, because most population trends are likely to be affected by several factors as well as fishing (Daan *et al*., 1996), it will often be important to monitor several areas with substantial contrast in fishing intensity.

6.1.2 Range

For reference points addressing reduction of range and loss of population structure, the same reasoning applies with regard to the impossibility of assessing all species and the need to select species whose conservation is likely to ensure conservation of less vulnerable species. Within the field of ecology there is significant debate and conflicting data about the relationship between population size and range occupied (see MacCall, 1990; Fretwell, 1972). The current weight of evidence suggests that it is not appropriate to generalize that a reduction in range necessarily corresponds to a decline in abundance. Nonetheless, it is a symptom which warrants investigation when observed (e.g., Baltic cod). The assumption that a reduction in range corresponds to a reduction in abundance may be safer for moderately sedentary species than for highly mobile ones, particularly if the mobile species routinely migrate extensively and opportunistically. Therefore, the assumption may be appropriate for many benthic species.

For the sedentary species, information is usually lacking regarding the dependence of local recruitment on local spawning. Hence, there is likely to be controversy about the scale at which a documented effect should trigger a management action, that is, about the value of the precautionary reference point for range reduction. The properties characteristic of a good candidate species for setting reference points regarding range reduction vary with the mobility of the species.

For species which are moderately sedentary, appropriate properties include:

- presence and abundance can be quantified well with properly designed monitoring programmes, including the use of proper statistical approaches to analysing change in infrequent observations, if the species is uncommon;
- information linking fishing to the loss or depletion of local populations is sound—this often requires evidence of direct mortality, physical injury from gear combined with increased risk of predation, or loss of essential habitat features for the species caused by fishing gear (use of the latter type of evidence also presupposes knowledge of essential habitat for the species);
- it possesses at least some of the characteristics of vulnerability discussed under direct mortality;
- it is desirable, but not essential, that there be some knowledge of the degree to which local recruitment depends on local population status.

Even for species with these characteristics, it usually will NOT be clear what decline in range should be used as a reference point to trigger management action. Baillie and Groomsbridge (1996) and CITES (1994) have adopted range criteria, but these were developed for species with population dynamics of birds and mammals. Many sedentary benthos may be viewed more like plants, and there is substantial debate about the shape of the functional relationship linking change in range to change in abundance and threat to conservation.

If a species is quite mobile, appropriate properties include:

- factors affecting changes in distribution are known. Ideally, this includes not just knowledge of typical migration patterns, but also some understanding of how migration routes and timings, and areas occupied during a season, change with environmental conditions such as temperature, salinity, oxygen, etc.
- change in range can be documented with appropriate quantitative methods. These must reflect the uncertainty in spatial distribution appropriately, if the reference points are to have a sound relationship to degree of risk aversion.
- there should be plausible links (with some documentation) between fishing depleting local populations (the proximate mechanism could be either direct mortality or loss of essential habitat) or fishing reducing population numbers and the decline in abundance resulting in contraction of range.

Even with the above information available for a candidate species, it often will not be clear what decline in range should be used as a reference point to trigger management action. Because of at least differences in dispersal properties of reproductive propagules, criteria developed for birds and mammals may not be appropriate for mobile marine species.

Present knowledge of the spatial dynamics of most mobile marine species is inadequate to state how large a decrease in range corresponds to a marked increase in likelihood that the population is suffering unsustainable mortality. Moreover, the functional relationship of abundance to range is likely to be non-linear, have species-specific parameters which could vary with migration habits, diets, and life history parameters, and be difficult to parameterize.

6.1.3 Ecologically dependent species

For **ecologically dependent species,** the same reasoning applies with regard to the need to select species whose conservation is likely to also ensure that less dependent species are not at risk from the fishery depleting the common food supply. Some ecologically dependent species (particularly seabirds and marine mammals) show parental care, so food depletion may be detected with reproductive failure rather than waiting for population-scale responses to be quantified.

Characteristics for good species for which to set reference points include:

- diet is reasonably well known, including information on inter-annual variability;
- evidence is available that the species of prey being harvested by the fishery is well represented in the diet;
- evidence is available that prey-switching from the species being harvested is rare, or at least does not result in complete compensation when the prey has become rare;
- evidence is available that the foraging range of the species of interest does not extend well beyond the region of operation of the fishery on a time scale relevant to the rate of renewal of the prey;
- there is a population parameter (such as breeding success, growth rate) related to feeding whose trend can be quantified. The population parameter is best if it is not strongly influenced by non-feeding conditions.

Because many population parameters are influenced by diverse environmental factors, the reference point suitable to trigger management action may have to be a sustained change in the population parameter, corresponding to activity of the fishery over a comparable period.

As an example, the ICES Study Group on Effects of Sandeel Fishing (ICES, 1999b) presents a rationale for using a three-year depression in breeding success of kittiwakes (*Rissa tridactyla*) as a reference point corresponding to local depletion of sandeels.

6.1.4 Scavengers

For **scavengers,** one is considering management action to address a higher order relationship, in that the increase in scavenging species is only a concern because they may reach abundances where they are detrimental to other populations. Correspondingly, an appropriate reference point must be for a species whose populations are likely to be negatively impacted by abundant scavengers. Moreover, one must be confident that the scavengers presenting the threat to the species of concern are those whose populations are benefiting from fish remnants produced by the fishery. If both the scavengers and the populations that the scavengers are affecting are birds, it might be appropriate to use declining access to breeding sites, increased disturbance of breeding activities (from courtship to fledgling success), or direct mortality as indicators of impact.

Characteristics of good species for which to set reference points for impacts of scavengers have many similarities with criteria for choosing ecologically dependent species (Section 6.1.3 above), and include:

- The link between the scavenger population and the population of concern is tight, and well documented.
- The feature(s) of the population of concern which are being monitored can be quantified well.
- The trend in the feature being monitored can be shown to be causally linked to the impact of scavengers, and is not often likely to experience large perturbations due to the other factors.
- The increase in the scavenger population can be shown to be causally linked to the provision of fish remnants.

6.2 Habitats

Protection of habitats is a prerequisite for protecting the species dependent upon the habitats. Given the recognized loss of habitat features in some areas, development and implementation of ecosystem management objectives ensuring the protection of the remaining areas must be seen as a priority, particularly if habitat features which are vulnerable to disturbance are uncommon.

The most straightforward approach to habitat protection is the complete exclusion of damaging activities from all habitats at risk. It may, however, be that a certain level of habitat degradation may be acceptable, for example because the effects are reversible.

Ultimately, management for habitat considerations may extend to all habitats, but at least initially such considerations are likely to be restricted to a sub-set of habitats. We set out below factors which may influence the choice of such a sub-set, and the reference points that might be appropriate.

6.2.1 Criteria for selection

Criteria that might be used to select habitats for conservation include:

- High degree of 'endemic' biota, for example, sea lochs and coastal lagoons.
- Restricted distribution, inherently rare habitats such as Lophelia reefs.
- High biological diversity. The Jakarta Mandate requires protection of habitats with high biological diversity—candidate areas might include sub-littoral reefs and boulder beds.
- EC Habitats and Species Directive Annex 1 list—the EC Directive provides a list of habitats within Europe which it believes should be protected.
- Identified in Biodiversity Action Plans—in the UK this includies Sabellaria reefs, Modiolus beds, Lophelia reefs, deep mud.
- Essential fish habitat—such as gravel banks for herring spawning.

6.2.2 Possible reference points

The stage of development of reference points for populations is well in advance of that for habitats. Current knowledge therefore does not allow a full discussion (cf. Section 5.1 above), rather we point to features which warrant further investigation:

- Proportion of initial area maintained in un-impacted condition.
- Some property of the spatial distribution—e.g., minimum of n % in un-impacted condition in any ICES rectangle. This, at least partially, addresses the issue of patchiness.
- Some measure of habitat quality (e.g., epibiota: biomass per unit area) across the whole habitat unit. Such reference points would allow some use of, and hence effect on, an area. This requires knowledge of the form of the relationship between the degree of change in range and the risk that the change is irreversible.
- As current management of target species is done within a precautionary framework, including multiple reference points (biomass and fishing mortality), management of habitats may also require combinations of criteria. Such a criterion might be "no more than *x* % change in a metric in the entire habitat unit and a minimum of *y* % in un-impacted condition in an ICES rectangle".

6.3 Genetic Properties

A number of management measures are available to conserve genetic diversity of exploited species (ICES, 1999a) and some of these could require reference points specific to genetic properties of the stock or species. Genetic diversity is directly related to N_e, the effective number of spawning individuals in a population, and the most appropriate variable for assessing population viability (Barton and Whitlock, 1997). Complex social systems, skewed sex ratios, and other complicating factors of breeding systems may result in N_e being smaller than the number of mature individuals in a population (Burgman *et al.*, 1993). Maintaining large N_e increases the likelihood that favourable mutations will become widespread and deleterious ones will be unduly expressed.

Population size is the single most important factor in sustaining a high level of genetic variation within a population of a species, and for essentially all fished species maintaining a population above B_{pa} has a high likelihood of ensuring that the number of potential breeding individuals also exceeds N_e.

Given a mean population size, N_e is negatively influenced by extreme fluctuation in population size, variation in the number of offspring per family, and unbalanced sex ratios. Keeping a population above B_{pa} will prevent fluctuations serious enough to result in unacceptable risk to N_e. Variation in offspring per family is not amenable to measurement or control in the wild, so reference points addressing that factor usually are not appropriate. This could be a concern for harvesting of moderately sedentary intertidal species, such as abalone (*Haliotis*) and sea urchins (*Strongylocentrotus*), where "mating" opportunities are restricted by the linear nature of the habitat. However, setting B_{pa} can accommodate the need for a reasonable density as well as abundance of mature individuals.

The sex ratio of a population is rarely considered as a management objective, although if the sex ratio of breeders departs from 1:1, N_e and genetic variation will be reduced. An effective population of 50 males and 50 females is nearly 2.8 times larger, genetically, than one of 10 males and 90 females. Some jurisdictions manage species such as snow crabs (*Chionocetes*) and shrimp (*Pandalus*) with size limits which allow only males to be harvested. In such cases, target exploitation rates are set to ensure that enough males survive to mate with all females. Under such approaches, it is unlikely that the skew in sex ratio will be so bad that N_e reaches values which reflect significant risk to the population.

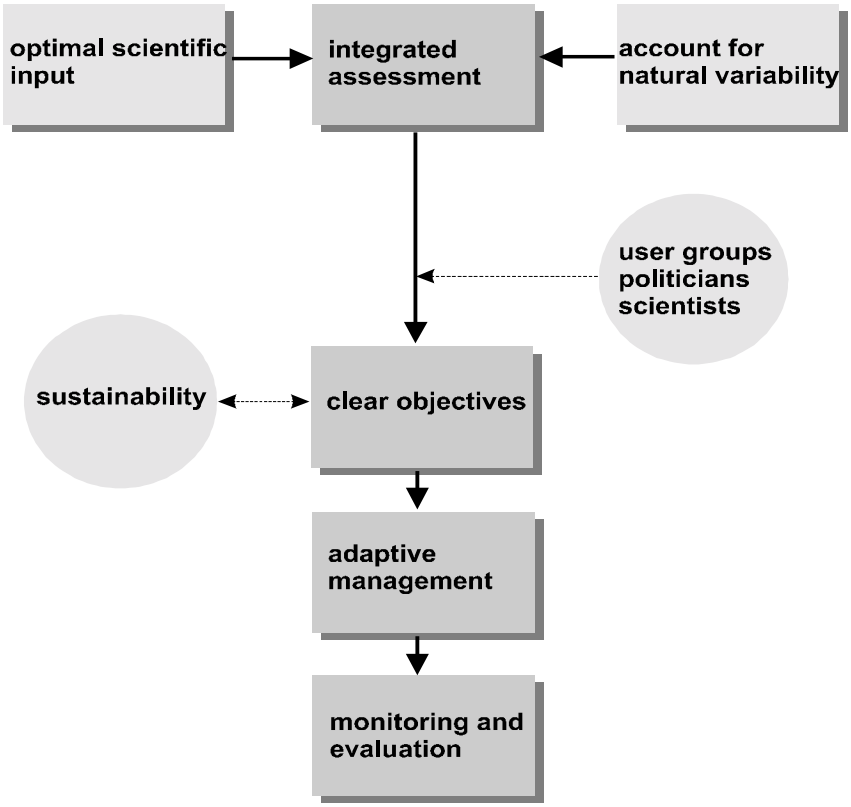
For species where there is a high degree of population sub-division, that is high among-population genetic variation, reference points may be needed for the individual populations. Tools for population risk assessment, such as population viability analysis, may be appropriate for developing reference points for subpopulations (Burgman *et al*., 1993; Beissinger and Westphal, 1998; Dunham *et al*., 1999). The reference points themselves, however, are still likely to be numbers or biomasses, and function like B_{pa}. When the extinction risk of many local populations must be considered, the same problems of practicality are encountered as with reference points for all possible species of by-catch. Suggestions in Section 5.1 above, are relevant here. In addition, Allendorf *et al*. (1997) have provided a set of qualitative criteria for ranking conservation value of salmonid stocks, and these warrant review for wider application.

Reference points for selection differentials may be important, but further work within that field is required before it will be possible to identify reference points which can be applied within existing precautionary frameworks. More must be known about the relationship between selection differential and conservation risk, and how to measure selection differentials in operational settings, before reference points can be proposed for this important property.

6.4 Emergent Properties

While not ruling out the need to continue to monitor developments in this area, WGECO finds no evidence that such ecosystem properties need, or even can be, subject to direct management objectives. However, WGECO acknowledges that, even if reference points for emergent properties are not warranted by present knowledge, many metrics of ecosystem properties, such as measures of diversity, can serve a valuable role in communicating with many clients of marine science, for example, as part of the approach proposed in Lanters (1999) and illustrated in Figure A4.6.4.1.

Figure A4.6.4.1. A framework for ecosystem management. The central line shows how to make it operational. Other elements are preconditions for ecosystem management (from Lanters, 1999).



7 CONCLUSIONS

A number of international agreements require protection of the marine ecosystem. The ACME believes that in some areas there is now urgent need for key habitats to be afforded protection. A difficulty at present is that our knowledge about benthic habitats is limited. We have some knowledge about soft-bottom habitats and communities, but the diversity of habitats associated with hard bottoms and their special topographical features, including habitat-forming species such as deep-sea corals and *Sabellaria* reefs, are not well known. There is therefore a need for classifying and mapping the distribution of benthic habitats. Development and implementation of population reference points for non-target species is hampered by our lack of knowledge of the biology and ecology of many species and the often rather subjective allocation of taxa to groupings such as "sensitive to fishing". There is a need to increase our knowledge of the ecology of the benthos and the development of robust and objective criteria, and scales/metrics, for the independent assessment of vulnerability/fragility of habitats and species.

It is generally accepted that discards have a negative effect on the ecosystem in most instances. They provide no economic return and the extra time spent sorting the catch places an economic burden on the industry. Minimizing unwanted catch must therefore remain an important management objective. This must be achieved by better selectivity of the gear and the release back into the water of the unwanted catch alive and in good condition.

7.1 Recommendations

At this time, ICES is not in a position to recommend that reference points for emergent properties of ecosystems are necessary, beyond the reference points which would assure sustainability and conservation of all species and habitats impacted by fishing. Neither are we prepared to confirm that single species, habitat, and genetic reference points alone are enough to ensure a precautionary approach to ecosystem management, only that no properties have been shown to be placed at risk if the constituent components are conserved.

Failure to address socioeconomic issues limits our ability to make progress with implementing existing biologically based management. Further development of integrated management objectives as a basis for an ecosystem approach to management requires development of socioeconomic models that allow integration of ecological and social issues.

The way ahead involves:

- rapid implementation of habitat reference points for key habitats;
- rapid movement to fishing efforts that are sustainable for the target species reference points;
- further development of genetic reference points and reference points for non-target species;
- reduction in unwanted catch without increasing the quantity of damaged material left on the sea floor;
- development of mechanisms linking ecosystem management tools to appropriate reference points;
- development of strategies and tools for addressing the social costs of reduction in harvest required to meet ecosystem (and single species) reference points.

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ANNEX 5

EVALUATION OF STRATEGIES OF EXISTING MONITORING PROGRAMMES IN TERMS OF THEIR ABILITY TO SUPPORT INTEGRATED ENVIRONMENTAL ASSESSMENTS

Request

There is no specific request; however, the material may be of use to the OSPAR Commission and the Helsinki Commission in the further development of monitoring programmes.

Source of the information presented

The 2000 report of the Study Group on Ecosystem Assessment and Monitoring (SGEAM) and ACME deliberations.

Status/background information

In view of the developments on ecosystem assessment and monitoring in the ICES area, the ACME felt that the monitoring strategies and the outcome of the monitoring programmes should be evaluated in order to assess their effectiveness to support ecosystem assessments.

An initial discussion, held at the SGEAM meeting in 2000, was primarily based on the OSPAR regional reports and the 2000 Quality Status Report for the OSPAR Convention Area and the HELCOM Third Periodic Assessment of the Baltic Sea.

Monitoring of the various components of the marine environment and its living marine resources forms the necessary basis for carrying out assessments of the status of ecological quality and resultant progress towards achieving ecological quality objectives (e.g., reduced levels of pollutants, more viable fisheries within sustainable ecosystems).

In order to monitor the status of the environment and its living marine resources, a programme of measurements and information gathering must be conducted in time and space. As national networks of collaborating laboratories and other institutions in many countries collect the data, it is necessary that data be collected according to agreed protocols involving their intercomparison and quality assurance. On the basis of quality assured data, periodic assessments are then carried out—often involving peer-review and necessary consensus—in order to provide the best available scientific information and advice for the political decision-making process for management (e.g., regulatory) purposes. Thus, it is vital that the underpinning process starting with monitoring provides both the appropriate quantity and quality of data so that those involved in the scientific and political processes can agree on the status and trends concerning the ecosystem and its components.

Due to the limited time, only two OSPAR regional reports were reviewed. The impressions of the reports are summarized below.

As Table A5.1 shows, the sources of information are a mixture of time series data, monitoring data, fisheries statistics, case studies, and general opinion. This is also the case for OSPAR Region II (Table A5.2). The sources of high impact are in general better documented through regional monitoring or time series data compared with sources of lower impact, but to be able to secure the scientific basis which was demanded from the OSPAR Convention, there is a need for a coordination of data input from the different countries that are responsible for data collection in the OSPAR regions.

Table A5.1. OSPAR Region I.

Impact source	Observed effects	Source of concern	Source of information
Fisheries	Large	Stock size reference points	Monitoring. Fisheries statistics.
	Large	Population composition	Monitoring. Scientific data. Time series.
	Large	Tropic interactions	Monitoring. Scientific data.
	Large	Discards and non-target species	General opinions.
	Large	Habitat destruction	Scientific data. General opinions.
	Large	Fisheries vs. Seabirds	Monitoring. Time series. Scientific data.
Sea mammals	Large	Population size reference points	Monitoring. Scientific data. Time series.
PCBs	Medium	Level of PCBs in the system	Studies? General opinions
	Medium	Biological effects of PCBs	Scientific data.
Other persistent organic compounds	Medium	Level and biological effects	Scientific data. Time series.
Mariculture	Medium	Genetic 'pollution' of wild stocks	Studies. General opinions.
	Medium	Increased infections of parasites and diseases on wild stocks	Studies. General opinions.
Oil and gas	Medium	General environmental risk	Scientific data. General opinions.
PAHs	Small	Level and biological effects	General opinions.
Metals	Small	Level and biological effects	Scientific data. Time series. General opinions.
Radionuclides	Small	Levels	Time series.
Introduced species	Small	Biological effects	General opinions.

Table A5.2. OSPAR Region II.

Classification	Source of concern	Area covered	Type of data
High impact	Removal of target species by fisheries	Regional	Monitoring
	Inputs of trace organic contamination	Regional	Monitoring
	Seabed disturbance by fisheries	Local	Studies
	Inputs from nutrients from land	Regional	Monitoring
	Effects of discards and mortality of non-target species	Local	Studies
	Input of TBT and other antifouling substances by shipping	Regional	Monitoring
Upper intermediate impact	Input of oil and PAH from oil industry	Regional	Monitoring
	Input from oil and PAH from Shipping	Local	Monitoring
	Input from other hazardous substances from oil and gas industry	Regional	Monitoring
	Input from other hazardous substances from shipping	Local	Studies
	Input of heavy metals from land	Regional	Monitoring
	Input of oil and PAH from land	Regional	Monitoring
	Introduction of non-indigenous species from shipping	Regional	Studies
	Introduction of cultured specimens, non-indigenous species and diseases from mariculture	Local	Studies
	Inputs of microbiological pollution and organic material from land	Regional	Monitoring
Lower intermediate impact	Physical disturbance by offshore industry	Local	Studies
	Input of litter from shipping	Local	Studies
	Dispersion of substances by dredging & dumping of dredged material.	Local	Monitoring
	Dumping of ammunition by military activities.	Local	Studies
	Constructions in the costal zone by engineering	Local	Studies
	Input of chemicals by mariculture	Local	Studies
	Mineral extraction	Local	Studies
	Input of nutrients and organic material from mariculture	Local	Studies
	Physical disturbance by dredging and dumping of material	Local	Monitoring
	Inputs from radionuclides from land	Local	
Lowest impact	Physical disturbance by shipping		
	Input of litter by recreation		
	Physical disturbance by military activities		
	Physical disturbance by recreation		
	Power cables by engineering operations		
	Dumping of inert material		

ANNEX 6

EVALUATION OF LISTS OF PRIORITY CONTAMINANTS IN REGIONAL AND INTERNATIONAL ORGANIZATIONS

Request

There is no specific request; this is part of the continuing ICES work to keep under review contaminants of interest in a marine environmental context.

Source of the information presented

The 2000 report of the Marine Chemistry Working Group (MCWG) and ACME deliberations.

Status/background information

The MCWG discussed work going on to identify contaminants of special concern within the EU and OSPAR. The European Commission has made a proposal to the European Parliament containing a list of compounds to be included in the proposed Water Framework Directive (WFD). The WFD covers groundwater, surface water, fresh water and coastal water within 1 nautical mile (approximately 1.8 km) of the coast. The selection of compounds is based on a procedure called Combined Monitoring-based and Modelling-based Priority Setting (COMMPS). A Nordic and a Danish database have been used for modelling concentrations of candidate compounds in the environment. Compounds are not ranked within the single lists, and no proposals for analysis in matrices other than water are included within the proposed WFD. The proposal is likely to be accepted by the European Parliament in its present form. OSPAR also has a working group called DYNAMEC which is trying to identify hazardous substances as defined in the Esbjerg Declaration. DYNAMEC is currently discussing a preliminary list of about 400 compounds in order to prepare a list on substances of special concern, which could perhaps comprise 50–60 compounds. The selection will be based on monitoring data indicating environmental concentrations, effect data, and the inherent properties of the compounds. The list should include the compounds on the WFD list, and be completed by the summer of 2000. The OSPAR list will form the basis for further discussions of the matrices in which the monitoring should be conducted and the methods to be used and ICES is likely to be asked to advise on these aspects and associated quality control issues.

The Marine Chemistry Working Group (MCWG) discussed the chemicals proposed in the Water Framework Directive and on the basis of individual expert experiences made comments on the relevance of their occurrence for offshore areas.

Table A6.1. The WFD list of compounds of possible concern for coastal waters and notes on their relevance for study in the offshore marine environment.

Compound(s)	**Relevance of occurence for offshore marine environment**
PAHs	High
Naphthalene	High (include in PAH group)
Anthracene	High (include in PAH group)
Pentachlorophenol	Probably low (survey)
Chlorpyrifos	Probably low (not found in estuaries)
Hexachlorobenzene	High
Trichlorobenzenes	Probably low
Chlorfenvinphos	Unknown (found in estuaries, antifouling agent, survey)
Diuron	Unknown (found in estuaries, antifouling agent, survey)
Trifluralin	Probably low (not found in coastal waters)
Trichloromethane	Low (low levels in coastal waters)
Dichloromethane	Low (low levels in coastal waters)
1,2-Dichloroethane	Low (low levels in coastal waters)
Isoproturon	Unknown (limited data base, survey)
Endosulfan	Low (limited use)
Alachlor	Unknown (low levels found in coastal waters, survey)
Hexachlorobutadiene	Low (not found in coastal waters)
Hexachlorocyclohexane	High
Atrazine	High
Simazine	High
Benzene	Low
$C_{10–13}$Chloroalkanes	Unknown (limited data base, difficult to analyse, survey)
Di(2-ethylhexyl)phthalate	High
Octylphenols	High
Nonylphenols	High
Tributyltin compounds	High (including triphenyltin compounds)
Pentachlorobenzene	Probably low (survey)
Brominated diphenyl ethers	High
Nickel	Low
Lead	High
Cadmium	High
Mercury	High (speciation necessary)

It is furthermore evident that the WFD list was based on water and sediment levels (measured and predicted) and that it did not take bioaccumulation into account or the distribution between dissolved phase and adsorption to suspended particles. The compounds studied in the marine environment should also include some of the “classical” pollutants and compounds used as substitutes for tin organics as antifouling agents, such as Irgarol and copper based agents (Table A6.2).

Table A6.2. Additional compounds of relevance for study in the marine environment.

Compound(s)	**Relevance for the marine environment**
PCBs	High
DDTs	High
Polychlorinated dioxins/furans	High
Toxaphene	High
Irgarol	High (antifouling agent)
Copper	Probably high (antfouling agent)

Need for further work or additional data

The study of new contaminants in the marine environment and considerations of their inclusion in monitoring programmes, involves much research on their chemical and ecotoxicological behaviour. The MCWG and the WGBEC generally follow what advances are made in this field.