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Towards a North Sea Ecosystem Component of GOOS for Assessment and Management

Report from a Strategic Workshop in Bergen 5-7 September 2001

by
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1. Introduction

In the Statement issued by the Intermediate Ministerial Meeting (IMM-97) on the North Sea in Bergen, March 1997, on the Integration of Fisheries and Environmental Issues, the ministers adopted several guiding principles. One of these was that "further integration of fisheries and environmental protection, conservation and management measures, shall draw upon the development and application of an ecosystem approach". Further, the Ministers formulated the following management objectives for the North Sea:

“The Ministers AGREE that the main objectives for fisheries and environmental protection, conservation and management measures are:

to ensure sustainable, sound and healthy ecosystems in the North Sea, thereby restoring and/or maintaining their characteristic structure and functioning, productivity and biological diversity;

to achieve sustainable exploitation of the living marine resources, thereby securing a high yield of quality food; and

to ensure economically viable fisheries.”

Work is in progress to develop ecosystem objectives for the management of the North Sea. A workshop on Ecological Quality Objectives (EcoQOs) for the North Sea was held in Scheveningen, the Netherlands in September 1999. A set of 10 issues was agreed for which the EcoQOs may be developed in subsequent work. This work is now in progress in ICES, the OSPAR commission and in a special project organised by the Netherlands and Norway.

As a follow-up action from the IMM-97, a “Workshop on the Ecosystem Approach to the Management and Protection of the North Sea” was held in Oslo on 15-17 June 1998. This workshop identified monitoring as a key component of an ecosystem approach in relation to ecological objectives, to assessments, and to scientific advice to management. It also identified a lack in our ability to reveal human impacts on the ecosystem. ICES, OSPAR and the Global Ocean Observing System (GOOS) were identified as international organisations which already contributed and could contribute further to the improved monitoring of the North Sea.

In the OSPAR QSR 2000 for the North Sea the following recommendation was made:

“Future assessment of the quality status of the North Sea could benefit from improved co-operation with other fora on a European and even global scale, especially with regard to harmonised monitoring effort, data exchange and development of compatible assessment tools.”

All North Sea countries operate national monitoring and reporting systems for the marine environment, which have as end products elements of hind-casting, now-casting or forecasting. Some of this data collection is coordinated by OSPAR through the Co-ordinated Environmental Monitoring Programme (CEMP), by ICES through its fisheries related activities e.g. the International Bottom Trawl Surveys (IBTS), by the EU for various

Directives, or through initiatives such as SeaNet and EuroGOOS. Much of the ecosystem information produced, however, does not contribute to international programmes and is only available nationally. A considerable effort has been directed towards the production of assessment reports within the framework of OSPAR (QSR 2000), the North Sea Conferences and the Nordic Council of Ministers. All these reports identify the inadequacy of current systems for the collection of information on the North Sea. Although considerable progress has been made recently by a variety of national agencies and through EuroGOOS on monitoring, modelling, and forecasting physical parameters, until now no attempt has been made to establish a permanent integrated information system for the North Sea which include ecosystem parameters. Such an approach would have the synergistic effect of integrating many current national activities.

The present monitoring of the North Sea is often insufficient to reveal human impacts on the ecosystem. There is a need for improved, integrated monitoring through co-ordination and harmonisation of existing national and international monitoring activities, as well as through implementation of new methods and technology

For marine ecosystems, meteorological and climatic variability are primary driving forces for ecosystem variability. Improved knowledge of the relationship between climate and changes in ecosystems would greatly benefit the difficult task of distinguishing between anthropogenic impacts and natural variability in environmental assessments. A particular and new challenge in the future will be the use of environmental data within the annual assessment cycle for fish stocks by the fisheries research and management community. Such an approach will involve the bringing together of very large data sets and the application of new approaches to fishery assessment modelling.

The North Sea, because of the intensive work that has already been carried out in this area, is an obvious candidate for a pilot project. Developing an ecosystem approach for the management of the North Sea will need an integrated monitoring and information system and a continuous updating of information, which could be seen as a North Sea ecosystem component of the Global Ocean Observing System (GOOS).

Global Ocean Observing System (GOOS) is a permanent global system for observations, modelling and analysis of marine and ocean variables to support operational ocean services worldwide. GOOS will provide accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible; and be the basis for forecasts of climate change. Some global and regional data products are already available on routine basis.

The GOOS Coastal Ocean Observation Panel (COOP) is responsible for planning the observing system for living marine resource issues, along with coastal services and contaminants in the marine environment. Its goals are to monitor, assess, and predict effects of natural variations and human activities on the marine environment and ecosystems of the coastal ocean, delivering routine, operational data products on appropriate time scales. Principal foci are on issues of ecosystem (including human) health, living marine resources, natural hazards, and safe and efficient marine operations. GOOS is implemented through a series of global programmes and regional applications which include Regional Bodies such as EuroGOOS, Black Sea GOOS, and GOOS Africa. Many countries in the ICES area have GOOS co-ordination committees at national level.

In 1997 an ICES Steering Group on GOOS (SGGOOS) was formed in order to prepare an action plan as to how ICES should take an active and leading role in the further development and implementation of GOOS at a North Atlantic regional level, with special emphasis on operational fisheries oceanography. At a workshop convened in Bergen in 1999 a draft design and implementation plan was conceived. This had three essential components:

- To promote global / regional linkages in a GOOS context.
- To promote the ICES Annual Ocean Climate Status Summary as a contribution to GOOS.
- To design and implement a North Sea ecosystem component of GOOS in collaboration with EuroGOOS.

In order to develop these suggestions further the SGGOOS was re-nominated in 1999 as a joint ICES/IOC Steering Group on GOOS with the terms of reference to further develop an Implementation Plan. The SGGOOS initiated the above workshop co-sponsored by IOC, ICES, OSPAR, the North Sea Conferences and EuroGOOS in September 2001 to agree on a strategy for a pilot North Sea Ecosystem GOOS project.

An area of international debate is which role GOOS should play in contributing to the management of fisheries, and ICES could be a significant participant in this discussion. In the ICES area, the most important subsurface marine data originators are still predominantly fisheries research institutes. Additionally, fisheries management probably represents one of the most important global customers for GOOS. Active ICES participation in GOOS may result in putting more emphasis on fisheries and fisheries management into the GOOS concept.

There is thus a need to develop a harmonised system to monitor, assess and forecast the environment and ocean climate of European seas, taking into account existing operational collaborative mechanisms within meteorology, oceanography, modelling and remote sensing. The development of a harmonised and co-ordinated pilot ecosystem observing scheme for the North Sea, including the underlying physical parameters, could be considered as a contribution to international GOOS, and to its EuroGOOS North West Shelf Plan, and would provide a framework for an improved input to regional conventions and other international environmental agreements. The information from such a system will be of relevance not only to environmental assessment, but also for the assessment and management of living resources, coastal zone management and marine operations

More extensive and co-operative use of national monitoring results could add value and strengthen the monitoring and assessment carried out by the international institutions. In a co-operative framework the responsibility for monitoring and assessment would be with the respective international institutions. Thus OSPAR has the responsibility for its CEMP within the Joint Assessment and Monitoring program (JAMP) and ICES have the responsibility for assessment and advice on fish stocks as well as a broad range of environmental issues. The purpose of EuroGOOS is to stimulate and utilise the best available technology to permit its Member Agencies to observe, measure and model the sea with the greatest efficiency and accuracy. The European Environmental Agency (EEA) has also a responsibility to produce regular assessment reports and should be included in the co-operative framework along with any other relevant organisations.

2. Organisation of the Workshop

2.1. PLANNING AND INVITATION

At the meeting 23-25 October 2000 in Southampton the SGGOOS proposed a workshop “Towards a North Sea ecosystem component of GOOS for assessment and management” to be held in Bergen 5-7 September 2001.(Annex 5 in the report ICES CM 2001/C:01) The proposal was supported by ICES Bureau at its meeting in January 2001. As conveners of the workshop was appointed

Nicholas C. Flemming – Director of EuroGOOS
 Hein Rune Skjoldal – Chair of ICES Advisory Committee on Ecosystems
 Frans van Beek – Vice-chair of ICES Advisory Committee on Fisheries Management

Together with the ICES-Chair of SGOOS Roald Sætre these people constituted the Planning Group for the Workshop.

The first invitation was mailed 25 February 2001 and it was sent to all institutions in the North Sea countries doing regular monitoring of any compartment of the North Sea ecosystem. In early May a Second Announcement was issued and the programme was distributed. A reminder was sent 22 June to those institutions, which have not responded, and 29 June new information was sent to the registered participants.

2.2. THE MEETING

The meeting took place at the Scandic Hotel in Bergen. The list of participants appears as Annex 1 and the program is enclosed as Annex 2. The first day started with a number of presentations giving the background and setting the stage for the workshop. Later, the participants worked in three groups, each of them dealing with one of the following elements:

- Institutional and organisational framework
- Data sources and data management
- Data products and assessment products

A chair and a rapporteur were appointed for each group. Sets of questions were prepared that guided the work in the groups. These are included as Annex 4, which also contain the names of the group chairs. The reports from the groups are included as Annexes 5 to 7. The outcome of the work in the groups was presented and discussed in plenary in the afternoon of the second day.

The Planning Group of the Workshop used the group reports to prepare a draft Statement of Conclusion in consultation with the chairs of the three groups. This draft was presented and discussed in plenary the last day of the workshop. The draft was amended and a final version was agreed. This Statement of Conclusion is given as Annex 3.

2.3 FOLLOW-UP ACTIONS

The Statement of Conclusion from this workshop was reported to the meeting of the Committee of Senior North Sea Officials (CONSSO) 12-14 September 2001, to ICES

Statutory Meeting 23 September-3 October 2001, and to the EuroGOOS Annual Meeting 22 October 2001. This report will be sent to OSPAR, and to the North Sea Secretariate, ICES, GOOS and EuroGOOS. The ICES/IOC Steering Group on GOOS will consider appropriate follow-up actions and oversee the further development of the plans.

3. Conclusions

The workshop agreed the following overall goals and actions (Annex 3):

Overall goals

To meet the challenges identified, and to increase the efficiency and effectiveness of the use of data products from current relevant national and international monitoring, the national agencies responsible for monitoring of the North Sea, should be invited to:

- establish a coordinated mechanism that could add value to existing activities by integrating data from various sources (physical, chemical, biological) to aid development of an ecosystem approach,
- collaborate by means of a pilot project sponsored by ICES and EuroGOOS to demonstrate the usefulness of this approach by integrating data on oceanography and fisheries.

Further efforts will be required in consultation with appropriate bodies to develop a strategy for establishing and implementing the coordinated mechanism. The strategy should aim among other things to:

- facilitate stronger national and international co-ordination and co-operation needed to promote and support the development of the ecosystem approach;
- promote development of an overall framework that helps to set priorities and promotes synergy, cost-efficiency and ecosystem sustainability;
- engage the fisheries science and assessment communities as enthusiastic participants in the process;
- facilitate development of the proposed North Sea ecosystem pilot project as a demonstration of the usefulness of this approach;
- stimulate co-ordination and co-operation between North Sea monitoring activities and research programmes studying relevant ecological processes and mechanisms, so as to obtain synergistic effects between them.

Actions

Institutional and organisational framework

- The co-sponsoring organisations should be invited to consider their roles in a coordinating mechanism to promote the further integration of data from various sources.
- An inventory of current national and international monitoring of the North Sea should be prepared based on existing inventories and information held by ICES, OSPAR, EuroGOOS, and EEA, and supplemented by any new information from national sources. This inventory should be GIS based and linked to inventories of data sources and data and assessment products. The Institute of Marine Research (IMR) in Norway will take the initial lead on this item with the aim to report the status of North Sea monitoring at the time of the 5th North Sea Conference.
- Based on the inventory of North Sea monitoring and guidance from the international organisations, the establishment or consolidation of a North Sea monitoring network as a concerted action between national and international agencies and organisations should be considered.
- An ICES-EuroGOOS North Sea pilot project for the integration of data on oceanography and fish stocks should be established under the guidance of the ICES-IOC Steering Group for GOOS. IMR will take the responsibility for a planning meeting in Bergen in March 2002 in connection with the 5th NSC.

Data sources and data management

- Actively stimulate the use of a meta data standard, giving insight in the quality assurance procedure used, data sampling, long term data availability and other necessary elements to enable inter-disciplinary use of data among the data providers. The co-operation between different agencies and institutes will benefit strongly from a widely accepted industrial standard for meta-data (e.g. marine-XML, IODE initiatives).
- Reach agreement between groups working on the North Sea ecosystem component on a data policy that enables open access for data. There should be clear conditions for use and appropriate recognition for the data collecting agencies and/or funding organisations (example: EuroGOOS data policy)
- Evaluate monitoring programmes for opportunities to provide increased efficiency and cost effectiveness. Possible outcomes would be a need for harmonisation, inter-calibration, and introduction of innovative methods of data gathering (e.g. new

sensors, modelled data, remote sensing and automated buoy systems or an integrated approach).

- Identify and disseminate best practice in management of the rapid increase in data volumes being generated by multi-disciplinary automated instrumentation (in-situ, models and remote sensing). Quality control and near real time distribution of large data volumes has impact on the use of -and developments in- existing infrastructure to fulfil user needs for quick access to data.

Data products and assessment products

- Promote annual web-based reporting system with a standardised format that could be updated as new national information becomes available.
- Stimulate more extensive use of physical models to provide information on state variables, which are not easily measured e.g. time series of fluxes of water by ocean currents.
- Physical models also provide a means of spatially and temporally integrating between available observations and can be used to identify gaps in the data.
- Stimulate the development of a common North Sea modelling tool, which can assist in the assessment of eutrophication status.
- Improve the flow of data to support the ongoing development of scientifically sound Ecological Quality Objectives (EcoQOs) and environmental indicators.

Annex 1**The North Sea workshop, Bergen, 5 –7 September 2001***List of participants***United Kingdom**

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Annex 2**Towards a North Sea ecosystem component of GOOS
for assessment and management**

Programme for a strategic workshop in Bergen, Norway, 5-7 September 2001, co-sponsored by IOC, ICES, OSPAR, the North Sea Conferences and EuroGOOS

5 September – Morning session

0900 - 0920	Roald Sætre: Welcome and introduction to the workshop
0920 - 0940	Hein Rune Skjoldal: The ecosystem approach to the management of the North Sea - Problems and challenges.
0940 – 0950	Martin Holt: The variability of the physical environment - Operational services
0950 – 1020	Frans van Beek: Status of the fish stocks – How is the stock assessment work carried out?
1020 – 1040	Georges Pichot: Environmental assessment
1040 – 1110	Coffee Break
1110 – 1130	Nicholas C. Flemming: The interaction between global and regional aspects of GOOS
1130 – 1150	Harry Dooley: Synthesis of the ongoing monitoring and ecological assessment work
1150 – 1210	Raymon Feron: Relevant existing network and cooperation in the North Sea (NOOS, SeaNet etc)
1210 - 1230	Kees Borst: CoastBase – A tool to integrate information from a network?

5 September – Afternoon session

The participants will work in three groups, each of them dealing with one of the following elements:

- Institutional and organisational framework
- Data sources and data management
- Data products and assessment products

A chair and a rapporteur will be appointed for each of the group. The aim of the groups is to produce written text to be included in the workshop report. A set of questions will guide their work.

1400 – 1500	Plenary discussion and introduction to the work of the groups
1500 - 1600	Group discussion
1530 – 1600	Coffee Break
1600 – 1700	Group discussion continues
1730	Busses leave the hotel
1800 – 2000	Reception at the IMR

6 September – Morning session

0900 –1400 The working groups continue their work until lunch. Drafting.

6 September – Afternoon session

1400 – 1800 The working groups report to the plenary.
Discussion of the group reports.

7 September – Morning session

General plenary discussion. Preparation and finalising the workshop report and conclusion.
Closure of the workshop at 1300 H.

Annex 3**Statement of Conclusions
from****A strategic workshop in Bergen, Norway, 5-7 September 2001,
co-sponsored by IOC, ICES, OSPAR, the North Sea Conferences and EuroGOOS****TOWARDS A NORTH SEA ECOSYSTEM MONITORING COMPONENT
AS A CONTRIBUTION TO ASSESSMENT AND MANAGEMENT****Background**

In the Statement issued by the Intermediate Ministerial Meeting on the North Sea in Bergen, March 1997, on the Integration of Fisheries and Environmental Issues, the ministers adopted several guiding principles. One of these was that "further integration of fisheries and environmental protection, conservation and management measures, shall draw upon the development and application of an ecosystem approach". Developing an ecosystem approach for the management of the North Sea will need an integrated monitoring and information system and a continuous updating of information

As a follow-up action, a "Workshop on the Ecosystem Approach to the Management and Protection of the North Sea" was held in Oslo on 15-17 June 1998. This workshop identified monitoring as a key component of an ecosystem approach in relation to ecological objectives, to assessments, and to scientific advice to management. It also identified a lack in our ability to reveal human impacts on the ecosystem. ICES, OSPAR and the Global Ocean Observing System (GOOS) were identified as international organisations which already contributed and could contribute further to the improved monitoring of the North Sea.

In the OSPAR QSR 2000 for the North Sea the following recommendation was made:

"Future assessment of the quality status of the North Sea could benefit from improved co-operation with other fora on a European and even global scale, especially with regard to harmonised monitoring effort, data exchange and development of compatible assessment tools."

For marine ecosystems, meteorological and climatic variability are primary driving forces for ecosystem variability. Improved knowledge of the relationship between climate and changes in ecosystems would greatly benefit the difficult task of distinguishing between anthropogenic impacts and natural variability in environmental assessments. A particular and new challenge in the future will be the use of meteorological and oceanographic data within the annual assessment cycle for fish stocks by the fisheries research and management community. To help meet this challenge, ICES and IOC have established a joint Steering Group on GOOS (SGGOOS), which also involves the European component of GOOS (EuroGOOS).

All North Sea countries operate national monitoring and reporting systems for the marine environment, which have as end products elements of hind-casting, now-casting or forecasting physical, environmental and biological conditions. Some of this data collection is coordinated by OSPAR through the Co-ordinated Environmental Monitoring Programme (CEMP), by ICES through its fisheries and environment related activities e.g. the International Bottom Trawl Surveys (IBTS), by the EU for various Directives, or through initiatives such as SeaNet and EuroGOOS. Much of the ecosystem information produced, however, does not contribute to international programmes and is only available nationally.

More extensive and co-operative use of national monitoring results could add value and strengthen the monitoring and assessment carried out by the international institutions. In a co-operative framework the responsibility for monitoring and assessment would be with the respective international institutions. Thus OSPAR has the responsibility for its CEMP within the Joint Assessment and Monitoring program (JAMP) and ICES have the responsibility for assessment and advice on fish stocks as well as a broad range of environmental issues. The purpose of EuroGOOS is to stimulate and utilise the best available technology to permit its Member Agencies to observe, measure and model the sea with the greatest efficiency and accuracy. The European Environmental Agency (EEA) has also a responsibility to produce regular assessment reports and should be included in the co-operative framework along with any other relevant organisation.

Overall goals

To meet the challenges spelled out above, and to increase the efficiency and effectiveness of the use of data products from current relevant national and international monitoring, the national agencies responsible for monitoring of the North Sea, should be invited to:

- establish a coordinated mechanism that could add value to existing activities by integrating data from various sources (physical, chemical, biological) to aid development of an ecosystem approach,
- collaborate by means of a pilot project sponsored by ICES and EuroGOOS to demonstrate the usefulness of this approach by integrating data on oceanography and fisheries.

Further efforts will be required in consultation with appropriate bodies to develop a strategy for establishing and implementing the coordinated mechanism. The strategy should aim among other things to:

- facilitate stronger national and international co-ordination and co-operation needed to promote and support the development of the ecosystem approach;
- promote development of an overall framework that helps to set priorities and promotes synergy, cost-efficiency and ecosystem sustainability;
- engage the fisheries science and assessment communities as enthusiastic participants in the process;
- facilitate development of the proposed North Sea ecosystem pilot project as a demonstration of the usefulness of this approach;

- stimulate co-ordination and co-operation between North Sea monitoring activities and research programmes studying relevant ecological processes and mechanisms, so as to obtain synergistic effects between them.

Actions

Institutional and organisational framework

- The co-sponsoring organisations should be invited to consider their roles in a coordinating mechanism to promote the further integration of data from various sources.
- An inventory of current national and international monitoring of the North Sea should be prepared based on existing inventories and information held by ICES, OSPAR, EuroGOOS, and EEA, and supplemented by any new information from national sources. This inventory should be GIS based and linked to inventories of data sources and data and assessment products. The Institute of Marine Research (IMR) in Norway will take the initial lead on this item with the aim to report the status of North Sea monitoring at the time of the 5th North Sea Conference.
- Based on the inventory of North Sea monitoring and guidance from the international organisations, the establishment or consolidation of a North Sea monitoring network as a concerted action between national and international agencies and organisations should be considered.
- An ICES-EuroGOOS North Sea pilot project for the integration of data on oceanography and fish stocks should be established under the guidance of the ICES-IOC Steering Group for GOOS. IMR will take the responsibility for a planning meeting in Bergen in March 2002 in connection with the 5th NSC.

Data sources and data management

- Actively stimulate the use of a meta data standard, giving insight in the quality assurance procedure used, data sampling, long term data availability and other necessary elements to enable inter-disciplinary use of data among the data providers. The co-operation between different agencies and institutes will benefit strongly from a widely accepted industrial standard for meta-data (e.g. marine-XML, IODE initiatives).
- Reach agreement between groups working on the North Sea ecosystem component on a data policy that enables open access for data. There should be clear conditions for use and appropriate recognition for the data collecting agencies and/or funding organisations (example: EuroGOOS data policy)

- Evaluate monitoring programmes for opportunities to provide increased efficiency and cost effectiveness. Possible outcomes would be a need for harmonisation, inter-calibration, and introduction of innovative methods of data gathering (e.g. new sensors, modelled data, remote sensing and automated buoy systems or an integrated approach).
- Identify and disseminate best practice in management of the rapid increase in data volumes being generated by multi-disciplinary automated instrumentation (in-situ, models and remote sensing). Quality control and near real time distribution of large data volumes has impact on the use of -and developments in- existing infrastructure to fulfil user needs for quick access to data.

Data products and assessment products

- Promote annual web-based reporting system with a standardised format that could be updated as new national information becomes available.
- Stimulate more extensive use of physical models to provide information on state variables, which are not easily measured e.g. time series of fluxes of water by ocean currents.
- Physical models also provide a means of spatially and temporally integrating between available observations and can be used to identify gaps in the data.
- Stimulate the development of a common North Sea modelling tool, which can assist in the assessment of eutrophication status.
- Improve the flow of data to support the ongoing development of scientifically sound Ecological Quality Objectives (EcoQOs) and environmental indicators.

Annex 4

Questions guiding the work of the three working groups

Group 1: Institutional and organisational framework (Chair: Colin Summerhayes)

- Should an operational network of participating institutions responsible for the ecological monitoring and assessment of the North Sea be established?
- How could this be done; the principle of “Lead institutions”, shared tasks or EC application for Concerted action or Thematic network?
- What will be the role of ICES, EuroGOOS and OSPAR?
- What kind of proposals for actions to facilitate the implementation of the North Sea ecosystem component of GOOS could be put forward, such as a program of workshops or special meetings under the auspices of ICES, EuroGOOS or other?
- What will be the interrelationship between the operational activity and research?

Group 2: Data sources and data management (Chair: Raymond Feron)

- What kind of long-term routine data sources is available from the North Sea?
- What will be the data management policy for transmission, exchange, distribution and archiving of data?
- How can we exploit existing activities, such as SeaNet and the European Directory of the Initial Ocean Observing System (EDIOS)?

Group 3: Data products and assessment products (Chair: Chris Reid)

- What standard data and assessment products as well as services are needed?
- What will be the role of models?
- How to stimulate further development of environmental quality indicators and ecological quality objectives?
- How to integrate information from a network; could existing activities, such as CoastBase be exploited?
- How should data and assessment products be distributed?

Annex 5

Report from group 1: Institutional and Organisational Framework

For marine ecosystems, meteorological and climatic variability are primary driving forces for ecosystem variability. Improved knowledge of the relationship between climate and changes in ecosystems would greatly benefit the difficult task of distinguishing between anthropogenic impacts and natural variability in fisheries and environmental assessments.

National agencies have for many years collected marine data for specific agency objectives, and there are already European networks and agencies to assemble data sets for specific purposes such as navigational safety, or flood prevention, or monitoring algal blooms. No system exists at present to link the data sets between different European-scale agencies. Such connections are also usually lacking at the national level, where it is difficult to combine data obtained for different purposes, or from research sources and operational agencies. Study of real examples shows that pooling the data sets and assimilating and integrating the data by using models results in better products for all parties.

A particular and new challenge in the future will be the use of environmental data within the annual assessment cycle for fish stocks by the fisheries research and management community. Such an approach will involve the bringing together of very large data sets and the application of new approaches to fishery assessment modelling.

There is thus a need to develop a harmonised system to monitor, assess and forecast the environment and ocean climate of European seas, taking into account existing operational collaborative mechanisms within meteorology, oceanography, fisheries, modelling and remote sensing.

The information from such a system will be relevant to a variety of users and organisations, including national governments, the EU, ICES, OSPAR, and the North Sea Conferences, not only for the assessment and management of living resources, but also for coastal zone management, marine operations and environmental assessment. It could also help to improve input to regional conventions and other international environmental agreements.

Building such a system will require capitalising on the existing resources offered by OSPAR, ICES, by EuroGOOS, and by relevant national and international agencies and organisations.

Bearing in mind the need to increase the efficiency and effectiveness of the use of data products from current relevant national and international monitoring, the national agencies responsible for monitoring of the North Sea, should be invited to:

- (i) establish a coordinated mechanism that could add value to existing activities by integrating data from various sources (physical, chemical, biological) to aid development of an ecosystem approach,
- (ii) collaborate by means of a pilot project to demonstrate the usefulness of this approach.

Further efforts will be required in consultation with appropriate bodies to develop a strategy for establishing and implementing the coordinated mechanism. A strategy for developing the proposed pilot project is suggested in Annex 1.

Establishment of both the mechanism and the project will have financial implications for individual agencies and within departments, but there should be no net requirement for increased expenditure at the national or international level. The adoption of an ecosystem approach to monitoring the North Sea should lead initially to maximising the information value of present observations by integrating existing systems. Much of this added value can be obtained by reallocating resources, and exploiting ongoing improvements in observing technology, data communication, and computing to achieve faster processing of data, more rapid assembly of large data sets, and the distribution of new data products. It may prove necessary to reallocate resources to provide design, coordinate and manage the integration process.

The Pilot Project

We recommend that the pilot project should be sponsored by ICES and the EuroGOOS Association, and should be named the ICES-EuroGOOS North Sea Ecosystem Pilot Project.

The objectives of the pilot project (which form the basis for definition of its terms of reference) should be to further contribute to increasing the efficiency and effectiveness of current relevant national and international monitoring systems, so as to facilitate application of an ecosystem approach to fisheries management. The focus on living resources is intended to limit the scope of the project to something achievable within a specified time frame. If the project succeeds its remit could be expanded to determine the usefulness of this approach as a tool for comprehensive environmental analysis in support of improved environmental assessments.

A key next step is to seek formal agreement to sponsorship of the project by both ICES, through its Annual Scientific Meeting in September 2001, and EuroGOOS, through its Annual Meeting in November 2001, to enable an appropriate statement about the project to be taken forward to the Fifth North Sea Conference, in Bergen in March 2002.

We envisage that responsibility for facilitating the development of the project will lie within the ICES-IOC Steering Group for GOOS (SGG), and that ICES may need to formulate a Resolution to that effect. In order for the SGG to carry out this task effectively, the SGG needs more representation by fisheries experts from fisheries agencies.

The project participants will decide leadership of the project and the project management structure.

Among other things, the project team should work to facilitate coordination and cooperation with research programmes studying relevant ecological processes and mechanisms to obtain synergistic effects both between research programmes and between monitoring and research activities.

It is recommended that the SSG should consider how stakeholders should be involved to guide the design of the pilot project.

Project participants will be expected to follow the ICES and EuroGOOS data policies. Ultimately, the success of the project will depend to a large degree on the willingness of participants to make data available.

Annex 6

Report from Group 2: Data sources and data management

Action 1

Actively stimulate the use of a meta data standard, describing the quality assurance procedure, data sampling, long term data availability and other necessary elements to enable inter-disciplinary use of data among the data providers. The co-operation between different agencies and institutes will benefit strongly from a widely accepted industrial standard for meta-data (e.g. marine-XML, IODE initiatives).

Action 2

Reach agreement between groups working on the North Sea ecosystem component on a data policy that enables open access for data. There should be clear conditions for use and appropriate recognition for the data collecting agencies and/or funding organisations (example: EuroGoos data policy)

Action 3

Evaluate monitoring programmes for opportunities to provide increased efficiency and cost effectiveness. Possible outcomes would be a need for (inter-)national harmonisation, inter-calibration, and introduction of innovative methods of data gathering (e.g. new sensors, modelled data, remote sensing and automated buoy systems or an integrated approach).

Action 4

Identify and disseminate best practice in management of large data sets generated by increasing use of multi-disciplinary automated instrumentation.

Q1 what kind of long term data sources are available from the North Sea?

Use existing national and international inventories and catalogues to quickly access the available data sources (e.g. ICES, EDMED, OSPAR, NODC, Réseau National de Données Oceanographique, IACMST Marine climate data, IAMCMST Operational data sources, GLOSS, EuroGloSS, ESEAS, National Met Offices, Metocean Buoys, ShellNet, Hydrographic Survey Offices, ECMWF windfields etc. etc.)

System architecture is critical in defining need which guides the process of identifying the relevant data source.

What are North Sea limits say ICES definition which will include the Skagerak Observations from ships are carried out in the North Sea by a variety of user for various purposes. There may be a good case for co-ordinating effort to make more efficient use. For example it may be possible to link cruises between different countries to provide better coverage, it may be possible make cruises multi-functional eg fisheries cruises collecting additional environmental data. Here there may a role of automated 'ferry box' type system to reduce staff-time requirements. These arguments are especially important for large and

increasingly expensive ships. The UK experience is of a reduction in larger (>30m) research vessel capacity.

There 4 long term time series of plankton: Sylt, Marsdiep, Helgoland, CPR

Recognising the increasing pressure on budgets and especially research then combining monitoring and research programme it may be cost effective way forward although there is a need distinguish between routine and non-routine programmes.

Driver may be same but implementation different between nations - potentially fuels conflict
Original questions for some long term monitoring not the only ones that may be addressed with
this data. eg CPR for herring fishery but now data much more widely used.

Remote sensing data now routinely available but needs archiving outside of space agencies otherwise lost. Products include altimetry, SST and calibrated ocean colour via Nansen Inst. RS can enable more focused use of research vessels

Relevant EU Projects

Sea search, Coastbase, Seanet, NORWESP

Q2 what will be the data management policy for transmission, exchange, distribution and archiving of data

Distinguish between data management policy and data policy

Real time data needs

- fixed point platforms eg tide gauges - surge models
- infrastructure exists for some of these system
- early warning - eg HAB
- operational model requirements - assimilation and validation
- problems are single point observations less use for models than wide area data?

Consider need to co-ordinate monitoring programmes on national scale critical if to co-ordinate on a European and or global scale.! UK recent review - document available from IACMST

Policy

- Monitoring data should be available for everyone - but some institutes need time to publish or others to sell
- USA and CPR an example - different approaches
- Problems of free access in exploitation by commercial organisations
- We would like an open data policy but could accept time delays required by some institutes could be accommodated. May lend the data - cant pass on to other organisations and allow only use for one purpose.
- Adding value to data and then re-selling
- Short funding of framework V not helpful - other directorates may have longer term approach eg with agriculture, forestry
- Linking disciplines may be helpful

Q3 How can we exploit existing activities such as SeaNet and the European Directory of the Initial Ocean Observing System (EDIOS)?

- Can augment existing observational networks with new sensors/samplers to meet other user needs
- Ferry boxes on research vessel
- Need to ensure timely availability of data - especially for operational purposes
- Every existing network working towards a more open distribution policy should be encouraged EDIOS can stimulate national partners to contribute
- Good way for wider community to access good practice
- Infrastructure and knowledge available through such network

Q4 data quality

- Focus on measurements
- Clear audit trail, transparent QA procedures
- Acceptable quality
 - Is the data and sampling fit for purpose ?
 - Error limits, meta data
 - **Good** quality data can be **no good** for answering certain questions
- Intercalibration, both national and international

New data acquisition systems (and models)

- automated in-situ instrumentation
- remote sensing = modelled data
- model output = modelled data
- Explore extremely large 4D-data-sets
- The need for new expertise fields

Annex 7

Report from group no. 3: Data and Assessment Products

The policy drivers for data and assessment products are:

North Sea Ministerial Conferences
OSPAR Convention and
EC Directives

As an introduction to the discussions on data and assessment products, the priorities identified at the Intermediate Ministerial Meeting, 1997, document some of the priorities for data and assessment products in the North Sea. The Ministers agreed that the main objectives for fisheries and environmental protection, conservation and management measures are:

- to ensure **sustainable, sound and healthy ecosystems** in the North Sea, thereby restoring and/or maintaining their characteristic structure and functioning, productivity and biological diversity;
- to achieve **sustainable exploitation** of the living marine resources, thereby securing a high yield of quality food; and
- to ensure **economically viable fisheries**.

Another useful starting point for a discussion on data and assessment products are some of the recommendations contained in the OSPAR QSR 2000 for the North Sea:

Recommendation 2: Future assessments of the quality status of the North Sea could benefit from **improved co-operation** with other for a on a European and even global scale, especially with regard to **harmonised monitoring effort, data exchange and development of compatible assessment tools**.

Recommendation 3: An **overview of existing information** and literature should be established in particular regarding the occurrence and effects of hazardous substance in the marine environment. Steps should be taken **to close gaps in knowledge** and there is a need **to concentrate effort on particular issues of concern**. In respect of temporal trends and spatial surveys, monitoring efforts should be optimised within the JAMP.

Recommendation 4: Effort should be invested in **developing tools for the assessment** of substances and effects of concern, taking into account the merits of **integrating biological effects and chemical monitoring** approaches. Further developments of biomarker techniques and more efficient data gathering is crucial e.g. by one-off pilot laboratory.

Recommendation 6: On the basis that the **possible changes associated with global warming** will increasingly assume greater importance in the medium to long-term, the implications on the North Sea environment of those changes should be evaluated.

Recommendation 7: The ecosystem approach, which has been a major recommendation of the 1997 IMM, needs further development and application according to OSPAR's Annex V. An important aspect of this approach is improved **integration** between the different sectors operating on the sea, but also between scientists, policy makers and other stakeholders.

Through concerted action these parties should progress towards effective protection and conservation of ecosystems and biological diversity in the marine area.

Recommendation 8: In order to increase understanding by all the stakeholders and by the general public of the human influence on the marine environment and the related policies, **dissemination of information** should be actively pursued by a variety of means (e.g. **publication of reports, information to the press and web-sites**).

1. What standard data products and assessment products are needed?

It is important to link data and assessment products with the questions being asked by the North Sea Ministers. Many countries were able to show examples of good data and assessment products used in national/OSPAR reports. In the first instance, the information products which best answer the Ministerial questions should be selected. North Sea states should then ensure that monitoring programmes can supply the necessary information for use in these products.

Building on the recommendations in the QSR 2000, it is suggested that an inventory should be produced of all routine monitoring activities undertaken in the North Sea. This should include information from the EuroGOOS inventories and ICES Inventories. The products of the inventory should be incorporated onto a GIS so that gaps in coverage may be identified. The GIS should include the catchments inflowing to the North Sea and reference to inputs surveys and river run-off. Some indication of the policy drivers for specific measurements/determinands should be made.

There was much support of an annual web-based reporting system with a standardised format that could be updated as new national information becomes available.

Some assessment of the costs involved in the production of data products and assessment products for the North Sea needs to be made.

Potential Data Products

Chemistry / Biology / Biological Effects / Inputs / Habitats

To be completed by OSPAR

Fishery Products

To be completed by ICES

Indicators / River Inflow / Catchment Information / Socio-economic

To be completed by the EEA

Oceanographic Products – To be completed by EuroGOOS

Maps or time series at specific locations of daily – weekly – monthly or seasonal averages of:

- sea surface temperature
- near bed temperature
- thermocline depth
- surface or near surface currents
- mid level currents

- near bed currents
- transport through specific sections and
- temperature or current profiles
- outflow from the Baltic
- oceanic inflow to the North Sea
- forecasts of the position of fronts

Potential Assessment Products

- GIS based inventory of ongoing monitoring activities in the North Sea.
- EcoQOs
- commercial fish species
- threatened species
- some
- some
- plankton
- benthos
- habitats
- nutrients
- oxygen
- some

2. What will be the role of models?

The consensus is that both monitoring and modelling have roles to play in the description of the status of the marine environment. In particular it was noted that physical models provide a means of spatially and temporally integrating between the available observations and can be used to identify gaps in the data. They can also provide information on state variables which are not easily measured e.g. water transport.

Distinctions were made between the physical models which are well developed for the marine environment and for biological or ecological models. It was agreed that much more work is necessary before the latter can be used with confidence. The on-going approach to develop a common North Sea wide eutrophication modelling system should be supported. As a link to such models, a link to hydrological data is needed.

Model diagnostics and post-modelling analysis of products??

3. How should the development of environmental quality indicators and ecological quality objectives be stimulated?

The consensus was that there is no need to stimulate further development of indicators or EcoQOs as this is already taking place both at national level for the purposes of the WFD and through both OSPAR and the EEA. There is a need to consolidate the ongoing work in this area to ensure that

- There is international agreement on the indicators that should be used so that they can be implemented on a North Sea scale
- Selected indicators / EcoQOs are scientifically robust
- There is consistency in the data gathering process feeding into the indicators reports.

4. How can the information gathered from a network be integrated; could existing activities such as CoastBase be exploited.

It was agreed that data need to be accessible for assessment purposes. In the future, it is envisaged that there will be a move from central databases like ICES to interlinked datasources for compiled data products. Standard internet procedures for data exchange need to be developed. Many issues were raised on quality control which is currently managed by the ICES database manager. This was agreed to be of vital importance but should be possible to address under the web-based applications.

CoastBase is a funded pilot project. At the end of the funded period, countries will be asked to support this financially. A product like CoastBase could potentially be used in the future. The product would need to be evaluated on completion of the trial project before this could be adopted as a common tool.

5. How should data and assessment products be distributed?

The products must be of benefit to everyone contributing. These must be attractive and must be relevant to both the public and the policy makers. Products must be timely, understandable, of relevance to a wide audience as well as addressing policy issues. The latest technologies should be used in the distribution of information e.g. web based. To contribute to the dissemination of monitoring data products and assessment products, the services of a scientific journalist should be employed to disseminate and publicise new developments to policy makers, environmental managers and the public.

Recommendations

- A GIS based inventory of ongoing monitoring activities in the North Sea.
- Consideration should be given to the production of an annual web-based reporting system.
- An assessment of the costs involved in the production of data products and assessment products for the North Sea need to be made.
- Ensure that there is international agreement on the indicators that should be used so that they can be implemented on a North Sea scale
- Ensure that selected indicators / EcoQOs are scientifically robust
- Ensure that there is consistency in the data gathering process feeding into the indicators reports.
- To develop standard Internet procedures for data exchange with appropriate quality control measures.
- The services of a scientific journalist should be employed to disseminate and publicise new developments to policy makers, environmental managers and the public.

