NRA

National Rivers Authority
Anglian Region

INP

INTEGRATED NORTH SEA PROGRAMME

Workshop 14th/15th May 1992

Rijkswaterstaat, The Hague

D R Sayers

INTEGRATED NORTH SEA PROGRAMME

WORKSHOP 14TH/15TH MAY 1992 AT THE HAGUE

Background

1. INP is a Dutch initiative aimed at promoting co-operation between different national and international North Sea research programmes. There have been two workshops, the first at Texel on the 6th/8th June 1990 and the second at The Hague on the 14th/15th May 1992.

2. During the workshops scientists from different countries present their institute's future research plans, co-ordinating projects where possible, and reviewing the need for new research proposals. The results of the workshop are published in Workshop Reports. The Dutch intention is to seek NSTF sponsorship for INP.

3. INP is not one homogenous programme but a means of alerting scientists involved in North Sea Research to work being carried out by other Institutes. A strong theme which developed during the 1992 Workshop was the advantages to be gained from co-ordinating sea going research either by, for example, ships from different Institutes visiting the same reference monitoring point or from scientists from a different Institute joining another institute's research cruise.

4. Nine countries are participating in the INP. Within the UK the Plymouth Marine Laboratory, the Natural History Museum, the University of Bristol (Department of Botany) and the University of Wales (Bangor School of Ocean Sciences) were early contributors to the programme. Since then other UK institutions (notably MAFF) have become involved.

5. In early autumn 1991 (when the second INP Workshop was originally going to be held) the NRA was invited to participate. As a result D R Sayers (Regional Marine Officer, Anglian Region) attended the second workshop.

Programme for the May 1992 Workshop

6. A copy of the programme for the workshop together with a list of those attending is attached as Appendix A.

7. In opening the workshop the Chairman, Dr J Visser, sketched the background to INP with references to the Ministerial Conferences of the North Sea Task Force, ICES, the Oslo/Paris Commission etc as all promoting the need for research into the North Sea. He explained that the Dutch Government, and the Dutch Marine Institutes, felt very strongly that this research should be a collaborative effort and that INP was a response to this.

8. The first workshop had concentrated on the central North Sea, the German Bight, the Skagerrak and the Kattegat. This had resulted in a combined research programme starting in July 1991. The May 1992 workshop was a means of checking the willingness to maintain collaboration, an opportunity to define common themes and to plan co-operative execution. A well equipped organising committee would be needed if this were to happen preferably under international control, eg ICES or NSTF. However, even then, research would need translating into national programmes. In Holland a North Sea organising committee existed to ensure that this happened.

9. Dr Visser set the theme for the workshop as being an overview of existing INP projects; a review of national programme projects which it may be appropriate to include in INP; and the mechanics of collaboration on forthcoming activities.

10. Dr H J Lindeboom reviewed existing INP projects. A copy of this review is attached as Appendix B. Two particular comments of interests were:

    i) denitrification appears to be much higher in the Wash, and off the Danish coast, than on the Dutch coast;

    ii) that the project measuring phytoplankton distribution between Hull and Zeebrugge was reporting very low levels on the Hull side and very high levels on the Zeebrugge side.

11. Dr A Stebbing, Plymouth Marine Laboratory, spoke about ICES. He explained the history of ICES pointing out that whilst fisheries had dominated its past role it was now moving more heavily into the environmental and pollution fields. A copy of the leaflet he tabled is attached as Appendix C.

12. Dr M Bohle-Carbonell spoke about the EEC and the extent to which it would be prepared to fund research.
R & D that the EEC contributes to must reflect EEC principles: ie pre-competitive (before an open market exists); pre-norms (method development) or subsidiarity (where R & D already in place can benefit from being expanded to an EC role). The EEC expects to see added value in a research project to which it grants funds. It is not intended that EEC funding merely replaces national funding. The EEC R & D budget was about 5,700 million ecu with marine R & D taking about 104 million ecu.

13. The EEC favours funding large scale R & D projects which are too big for individual countries to run or projects which cover many EC member states (eg co-operative North Sea Projects). Most EEC marine funding is going into MAST 1, the extension to MAST 1 and now MAST2. Dr Bohle-Carbonnel stressed that to be successful in a bid for EEC R & D funding it would help to show the project had cross border collaboration, originality (ie no duplication) and a European dimension.

14. There was a presentation on the formation and function of the North Sea Task Force. This reviewed the setting up of NSTF and the role it had in producing a new Quality Status Report. Reference was made to the signing of a new Convention in September 1992 under the aegis of NSTF.

Research Themes

15. Five main project areas were identified for detailed discussion. These were:

    i) changes to eco systems;
    ii) water quality in the North Sea;
    iii) horizontal and vertical transport;
    iv) modelling;
    v) other themes.

Each institute represented at the workshop then had an opportunity to explain what research it was carrying out that fitted within these themes. Time was limited to 5-10 minutes per speaker but written contributions were also tabled. These written contributions are attached as Appendix D with the NRA contribution as Appendix E.

16. Under the first theme, changes in eco systems, there was reference to a number of organisms having disappeared from, or having decreased significantly in Dutch coastal waters. Whether this had been caused by fishing activity, pollution or climatic changes was not certain and collaboration was suggested for further investigations. This presentation was given by Dr Lindeboom of NIOZ. Dr F Colijn of Rijkswaterstaat emphasised the need to determine whether changes were natural or anthropogenic. He went on to suggest a follow up to the Bremerhaven biological workshop and the testing of new methods. Dr A Stebbing of PML spoke of the continuous plankton recording work which is now based on PML. Data from that seemed to suggest that plankton blooms were principally temperature related. Dr B Becker from the German Federal Maritime and Hydrographic Institute pointed out that during the last two years the highest salinity values since records began had been recorded in the North Sea. The main thread which developed from this first theme was the need for good international access to past data if changes were to be understood.

17. The first to speak on the water quality theme was Dr. Liebezeit from Germany. He spoke on the need for research on humic acids and the way they absorb trace metals and pesticides, pointing out that fluorescence techniques can be used to determine humic acids. Dr Stebbing from PML spoke in support of a follow up to the Bremerhaven biological workshop.
D R Sayers spoke of the monitoring work the NRA has carried out for Red List substances and the investigation into aerial surveillance as a monitoring technique. A Bale from PML spoke on the LOIS proposal, explaining that 50% of the funding had now been promised but seeking interest from other scientific institutions in the project. It appears that the LOIS project will fund the purchase of a CAS1 multispectral scanner. Integration of effort was identified as the main factor arising from these presentations.

18. The theme of horizontal and vertical transport of dissolved material was introduced by Dr Lindeboom. He spoke of the mooring that has been established just to the east of Dogger Bank and which is now visited by many research ships. He also explained that the Dutch have a monitoring cruise from the Dutch coast north up to the Shetlands and asked where other countries were working. Dr Becker from Germany spoke on sea surface fluxes and the North Sea as a transition area to the North Atlantic. He was seeking co-operation with other institutes in the use of ships and aircraft.

19. Dr Stebbing from PML spoke on the modelling theme and in particular about ERSEM (the European Regional Seas Ecosystem Model). He explained that this was just beginning and that data was needed particularly for the northern boundary of the North Sea.

20. The final session dealt with other themes with Dr Becker talking of the limitations in remote sensing techniques. Dr Schmidt-Van-Dorp spoke about the work of the World Wildlife fund in the North Sea.
In particular she said that the aims of WWF were to see the North Sea maintained in as natural a state as possible with proper conservation and coastal zone management.

21. Following the introduction of these research themes the workshop broke up into three small sub-groups the first looking at change at eco system level; the second dealing with horizontal and vertical fluxes and water quality; and the third dealing with marine science and policy.

22. In reporting back the first group pointed to a number of species that had shown change with either significant increases or decreases. The Great Weaver, Sabellaria, Rays, Sharks, Whelks and Oysters were all stated to have declined with Phytoplankton and Zooplankton having increased in some areas and decreased in others. It was felt that there was, as yet, insufficient evidence to be able to say whether the cause of these changes were man-made or natural. It was felt that the NIOZ cruise up the North Sea line and the UK LOIS work might provide some answers, but the need for more moorings data was particularly identified.

23. The second group looking at horizontal and vertical fluxes and water quality focused on concerns about the Dogger Bank area. It has been shown recently that benthos and fish from this area having surprising high levels of contaminants. Possible explanations were thought to be:

i) atmospheric deposition;
ii) the Dogger Bank being at the centre of a gyre-system within the North Sea and hence being a net accumulation zone;
iii) flare output from North Sea oil rigs;
iv) a grain size effect (ie in sediment with little fine fraction then contaminant levels in that fine fraction are inevitably high).

24. The group looking at marine science and policy identified the problem of communicating scientific data effectively to management and politicians. Some solutions were proposed but it was suggested that a future INP workshop should address this particular topic.

Conclusions

25. It was felt that the desire to know what databases exist could best be handled by means of a questionnaire and the Dutch undertook to consider formulating one for NSTF to progress. A wider membership of INP should be encouraged.

26. NSTF and ICES should be encouraged to look at further ways of disseminating information to all parties interested in the North Sea. The existing North Sea database needs to be made more user friendly.

27. NSTF is dealing with monitoring and modelling but not R & D. There is a need for an organisation which establishes good links between practising scientists in the separate countries.

28. The workshop was felt to have offered an opportunity for co-ordinating sea going research in the North Sea from 1993 onwards across national boundaries. This was seen as well worth encouraging and that national representatives on NSTF should be asked to push for further collaboration.

29. Overall, the two major areas the workshop identified as needing further research were the Dogger Bank and its problems, and the Bremerhaven biological project.

30. From the NRA's point of view the workshop was an opportunity to explain to other institutions our role within the UK and the type of research we carry out. Several NRA reports were displayed and requests were received for copies of the Blue Green Algae Report, the recent Ships and Aircraft Report and the 1990 Paris Commission Survey Report.

26th May 1992
WP-2/DSAY8/JC

APPENDIX A

List of participants INP-workshop

Dr. G. Liebezeit, Forschungszentrum Terramare, Wilhelmshaven, Germany
Dr. P. Nounou, IFREMER, France
Dr. L. Cabioch, CNRS Station Biologique de Roscoff, Roscoff, France
A. Stolk, Dep. of Physical Geography University of Utrecht, Netherlands
Dr. A.R.D. Stebbing, Plymouth Marine Laboratory, United Kingdom
Dr. A.J. Bale, Plymouth Marine Laboratory, United Kingdom
Dr. A.D. Schmidt-van Dorp, WWF, United Kingdom
Dr. B. Becker, Federal Maritime and Hydrographic AG., Germany
D.R. Sayers, National Rivers Authority, United Kingdom
Dr. S.J. Hall, Marine Laboratory Aberdeen, United Kingdom
Dr. M. Bohle-Carbonell, Commission of the European Communities
K.J.M. Kramer, Lab. Applied Marine Res. - IMW/TNO, Netherlands
J. Schoofs, Science policy office, Belgium
H.G. Fransz, Netherlands Institute for Sea Research, Netherlands

INP Organizing Committee:
drs. A. Bijlsma (Neth. Marine Research Foundation, SOZ)
dr. F. Colijn (Tidal Waters Division, DGW-Rijkswaterstaat)
dr. H.J. Lindeboom (Neth. Institute for Sea Research, NIOZ)
drs. M.B.A.M. Scheffers (Council for the Coordination of Physical Oceanographic Research of the North Sea, RvO)
drs. J. Visser (Chairman) (Policy-linked Ecological Research of the North Sea/Wadden Sea, BEON)

INTEGRATED NORTH SEA PROGRAMME, INP

INP-workshop on a Cooperative North Sea Research Programme, '93 - '95, The Hague, May 14th and 15th, 1992.
Programme:

Wednesday 13 May

Arrival	
from 20.00	Social activity for those who have already arrived, in café le Perroquet in The Hague (see map)

Thursday 14 May

PART I DEFINING COMMON THEMES

08.30	Transport from Motel Hoornwijck to Rijkswaterstaat
09.00	Opening by director of Tidal Waters Division of Rijkswaterstaat ir. P.H.A. Hoogweg
09.10	Start, introduction, adoption agenda (chairman Visser)
09.20	Overview of present INP activities by dr. Lindeboom
09.50	Presentations on international organisations: about ICES by dr. A.R.D. Stebbing
10.20	Coffee break
10.50	Presentations by international organisations, continuation:
10.50-11.25	about EC by dr. M. Bohle-Carbonell
11.25-12.30	about NSTF and OSPARCOM by B.G.M. van de Wetering
12.30	Lunch
14.00	Introduction and inventarisation of themes and projects (chairman of afternoon session dr. Stebbing)
15.00	Tea break
15.30	Discussion on choosing common themes and projects
16.30	CONCLUSION AND DEFINING COMMON THEMES
17.00	Closure part I and introduction PART II (composition sub-groups)
17.30	Dinner

PART II WORKING OUT COMMON THEMES IN SUBGROUP SESSIONS

20.00	Discussions in subgroups on themes chosen
22.00	End evening session
22.00	Transport to Motel Hoornwijck

APPENDIX B

INP - Integrated North Sea Programme 1991-1992

Progress of the 91/92 programme

H.J. Lindeboom (editor)

Introduction:

During a workshop in June, 1990 at the NIOZ (Texel) the outline of an Integrated North Sea Programma was established. Scientists from The Netherlands, United Kingdom, France, Denmark, Norway, Sweden, U.S.A., Canada and Belgium participate in this programme.
A description of the different subprogrammes was given in "Samen de zee op - Partnership in North Sea research". Following the same order, in this paper a brief overview of the status of the different programmes is given.

Programmes:

A1. Pelagic systems of the stratified North Sea.
- Coordinator : B.R. Kuipers (NIOZ).
- Participating institutes: NIOZ (NL).
- Status : One cruise in the central and northern North Sea was carried out from 18 Nov - 3 Dec 1991 (see Fig. 1).
- Plans : To carry out 3-4 three week cruises along the same transect in 1994.

A2. Flocculation in the North Sea and adjacent areas.
- Coordinator : D. Eisma (NIOZ).
- Participating institutes: NIOZ (NL).
- Status : One cruise around the entire North Sea was carried out in January 1992 (see Fig. 2).
- Plans : Three more cruises will be conducted in November 1992, April 1993 and August 1993.

A3. Sedimentation in the northern North Sea (Norwegian Channel, Skagerrak and Continental Slope).
- Coordinator : T. van Weering (NIOZ).
- Participating institutes: NIOZ, VUA, RGD (NL), Denmarks Geological Survey (DK), Univ. Gothenburg (S).
- Status : One cruise in the Skagerrak - Norwegian Channel area was carried out in June 1991 (Fig. 3).
- Plans : Detailed studies of holocene and recent environmental conditions and changes to establish sediment transport patterns. Cruises to be conducted in 1993.

A4. Interaction between short-term physical dynamics and phytoplankton dynamics in a stratified water column (Mooring-project).

Coordinator : C. Veth (NIOZ).

Participating institutes: NIOZ, RWS (DGW, DNZ) (NL), Univ. of Wales, MAFF (UK), Dept. Phys. Oc. Univ. Uppsala (S)

Status : The mooring project was executed in 1991 in the Oysterground area and is continued in 1992. In 1992 at the same site a mooring is layed out for the Seawatch (Euromar) programme.

Plans : To continu the programme at a low level in 1993, and to execute a large mooring programme in 1994 (to be discussed at this INP workshop).

A5. Distribution mechanisms of organic contaminants in the water, sediment and biota of the North Sea.

Coordinator : K. Booij (NIOZ).

Participating institutes: NIOZ (NL).

Status : One cruise in the Skagerrak - Norwegian Channel was carried out in June 1991 (see project 3).

Plans : No future cruises.

A6. Microcontaminants in the North Sea.

Coordinator : J.P. Boon (NIOZ).

Participating institutes: NIOZ, SOZ, DGW, VU, RUU, CATO (NL), Inst. Mar. Res. Bergen, Inst. Biochemistry Bergen (N), Oak Ridge Nat. Lab. (U.S.A.).

Status : One cruise in the southern and central North Sea was carried out in Aug-Sept. 1991. The three week cruise will be repeated in May 1992 (Fig. 4).

Plans : No more cruises are planned. Research into the background of the observed phenomena will be executed in the coming years.

A7. Benthic Links and Sinks in North Sea nutrient cycling (BELS).

Coordinator : W. van Raaphorst (NIOZ).

Participating institutes: NIOZ, SOZ, NIOO (NL), PML, MAFF (UK), Univ. Gothenburg (S), Univ. Brussels (B).

Status : Two cruises in the central and northern North Sea were carried out in August 1991 and February 1992 (Fig. 5).

Plans : No more cruises in 1992 and 1993. Depending on future programmes the field research may be continued in 1994 together with the mooring project.

A8. Coccolithophorid blooms in the northern part of the North Sea.

Coordinator	: M. Veldhuis (NIOZ).
Participating institutes:	NIOZ, RUL, VU (NL), Univ. Oslo, Univ. Bergen (N), Univ. Bristol, Nat. Hist. Mus., PML, SURC (UK), AWI (D), IAEA (Monaco).
Status	: One cruise in the Bjørnafjord (near Bergen N) with the Pelagia was carried out in April-May 1992. Another cruise is carried out by the Norwegian vessel Håkon Mosby in May 1992.
Plans	: In 1994 the programme will be repeated in the northern North Sea or north Atlantic.

B1. Phytoplankton distribution and pigment composition in the Southern Bight.

Coordinator	: F. Colijn (DGW).
Participating institutes:	DGW, RUG, DNZ (NL).
Status	: The ferry programme is being carried out, and the results of the first full year (1991) have been worked out. The programme also runs in 1992.
Plans	: To continu the project.

B2. Flow cytometry in combination with biological monitoring programme of phytoplankton.

Coordinator	: J.W. Hofstraat (DGW).
Participating institutes:	DGW, DNZ, Tripos (NL).
Status	: The results of flow cytometry and microscopic counts have been compared.
Plans	: To develop a new cellsorter.

B3. Sources of PAH concentrations in sediments of the Oystergrounds

Coordinator	: H. Klamer (DGW).
Participating institutes:	DGW, NIOZ (NL), Univ. Uppsala (S).
Status	: This project is carried out in close cooperation with project A4. Samples have been collected in 1991. The traps were lost at the end of mooring period.
Plans	: To continu the project if samples can be obtained.

The 1991-programme of the North Sea Directorate (DNZ) is described in the report "Samen de zee op - Partnership in North Sea research".

C. PML North Sea cruise and Integrated North Sea Programme.

Coordinator	: N.J.P. Owens (PML).
Participating institutes	: PML, SURC (UK), NIOZ (NL).
Status	: Research cruise 83/91 was carried out across the whole of the North Sea in August 1991 with RRS Challenger.
Plans	: To be presented at this INP workshop.

The 1991/1992-programme of the Geological Survey of the Netherlands (RGD) is described in the report "Samen de zee op - Partnership in North Sea research".

D. ASGASEX (Air-Sea Gas Exchange Experiment)

Coordinator	: W.A. Oost (KNMI).
Participating institutes	: KNMI, NIOZ, DNZ (NL), BIO, Dalhousie Univ. (Can), PML (UK), Univ. Heidelberg/ Scripps (D + USA).
Status	: KNMI will carry out a limited campaign in Sept. 1992. The actual programme will be carried out in Sept. 1993.


Za 23/11
Zo 24/11
Ma 25/11
Di 26/11
Wo 27/11
Do 28/11
Vr 29/11
Za 30/11
Zo 1/12
WB
WB
480 mijl
420 mijl
360 mijl
300 mijl
240 mijl
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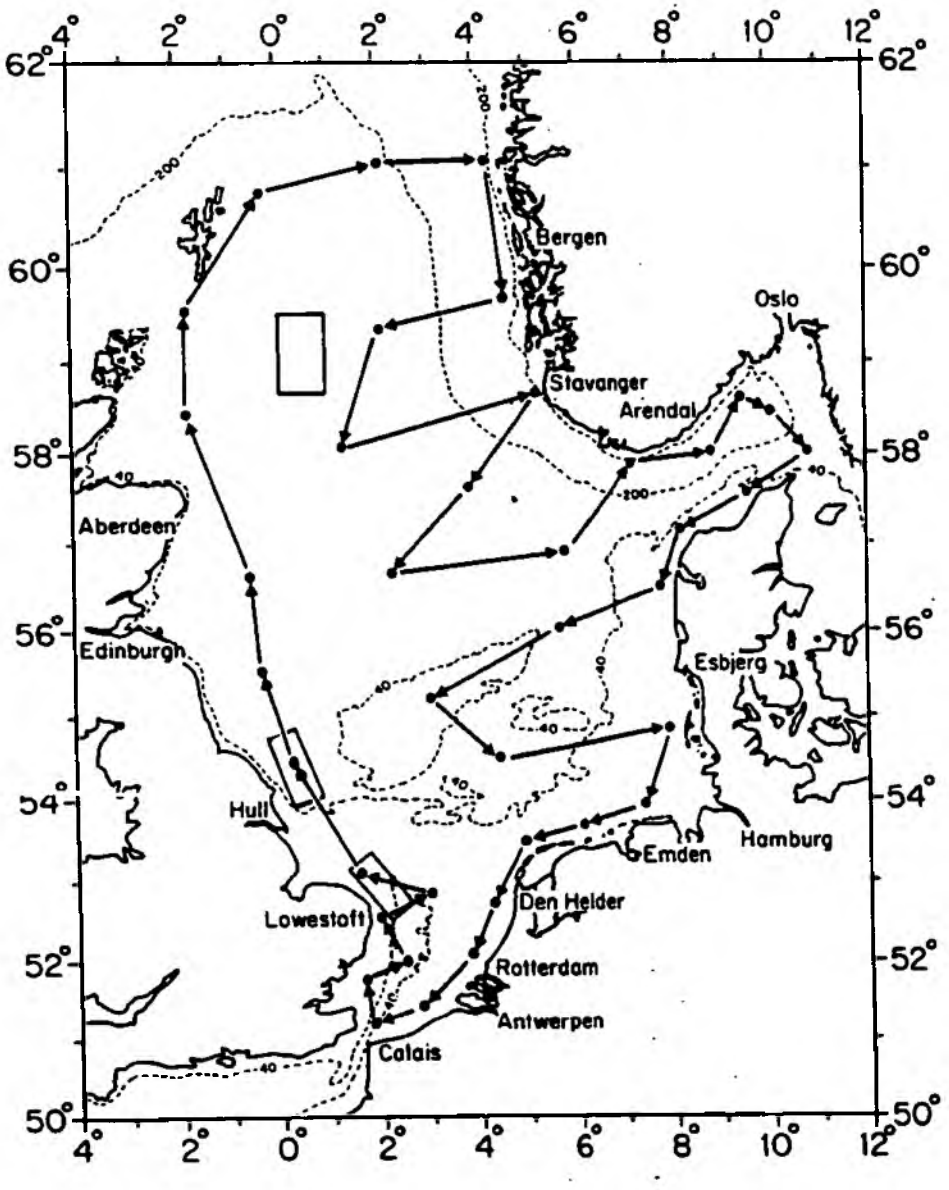
Fig. 1.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40

Fig. 2.

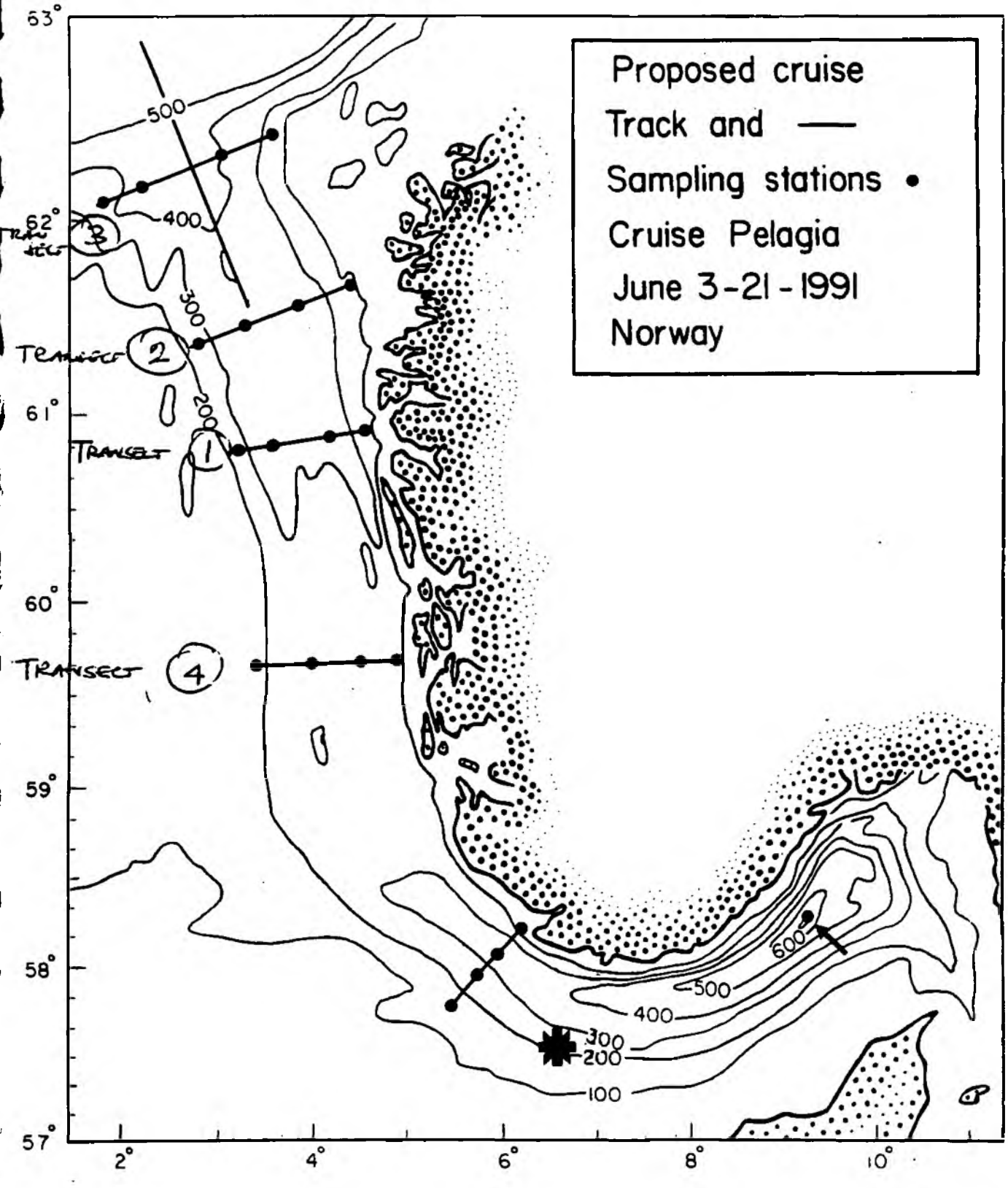
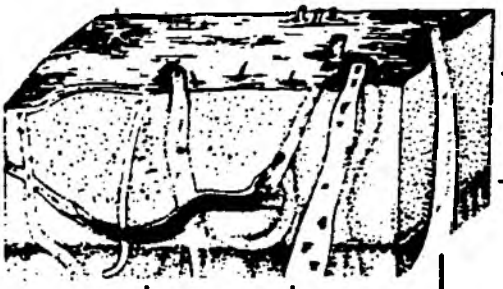

Proposed cruise
Track and
Sampling stations
Cruise Pelagia
June 3-21-1991
Norway
63°
62°
61°
60°
59°
58°
57°
2°
4°
6°
8°
10°
500
400
300
200
100
600
TRANSECT 1
TRANSECT 2
TRANSECT 3
TRANSECT 4
Proposed site for tripod test

Fig. 3



6
5
4
7
3
2
8
9
10
11
12
13
14
15
16
1
63
125
250
500
Humber
Thames
Elbe
Lake IJssel
Ems
Ijssel
Rhine
Maas
Schelde
0°
2°
4°
6°
8°
52°
54°
56°

fig. 4

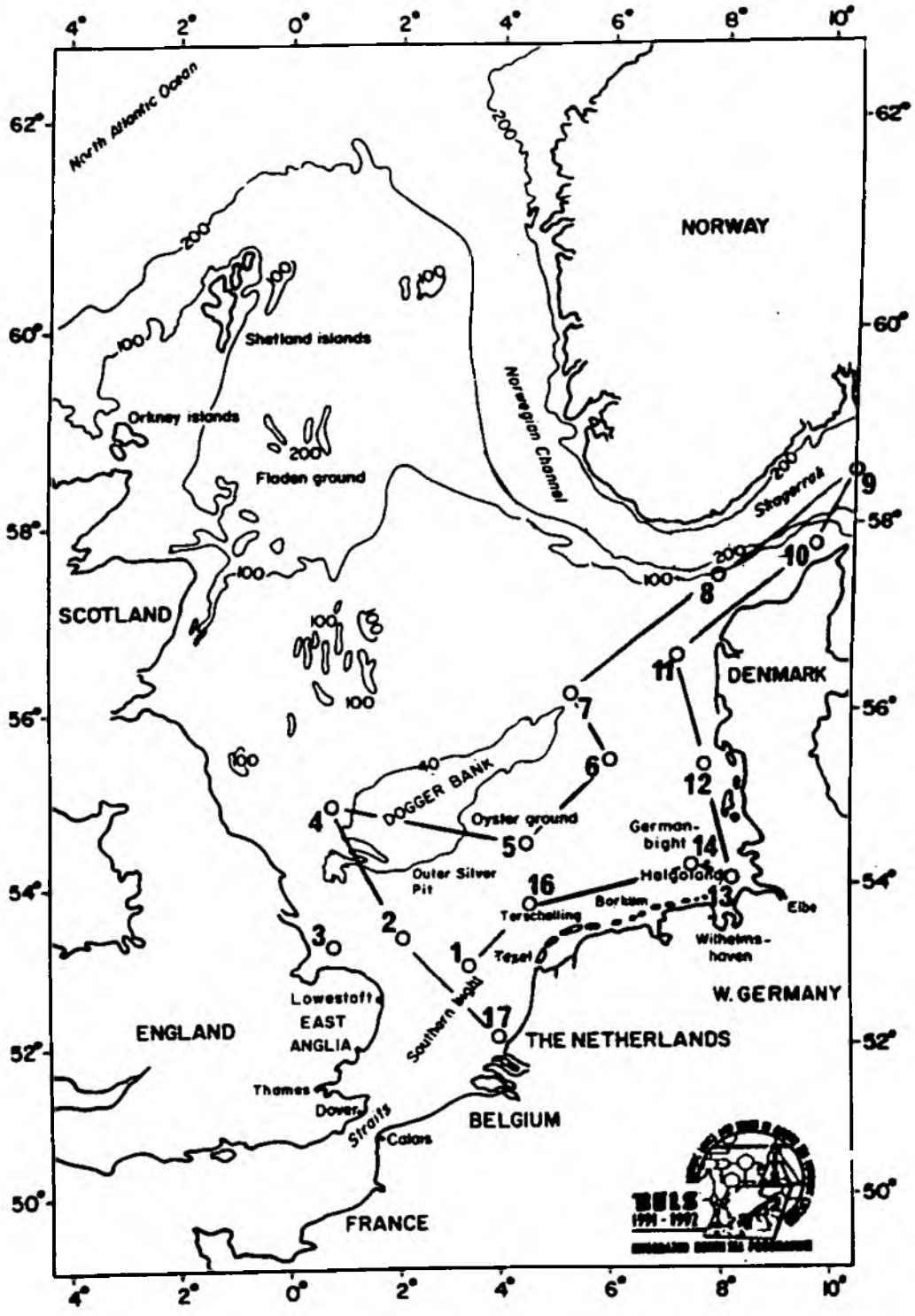


Figure 5: Cruise track of BELS leg 2 February 1992

APPENDIX C

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

FUNCTIONS

The environment of the North Atlantic and adjacent seas has been a prime concern of the International Council for the Exploration of the Sea since its inception in 1902. As the oldest intergovernmental marine science organization in the world, the Council has long recognized the mutual interdependence of the living resources and their physical and chemical environment. The Council's principal functions are to:

- promote and encourage marine research
- develop and coordinate research programmes
- publish and disseminate results of research

SCIENTIFIC STRUCTURE

The work of the Council is concentrated in the broad areas of fisheries, oceanography, and marine pollution, and is organized and carried out by scientists from the 17 ICES Member Countries. Twelve standing Subject/Area Committees, each with two appointed members from each Member Country, are responsible for keeping under review and coordinating the research of interest to the Council in their respective disciplines:

Marine Environmental Quality	Demersal Fish
Hydrography	Pelagic Fish
Biological Oceanography	Baltic Fish
Mariculture	Shellfish
Statistics	Anadromous and Catadromous Fish
Fish Capture	Marine Mammals

Two Advisory Committees provide scientific information and advice to international regulatory commissions and Member Country governments:

Advisory Committee on Marine Pollution (ACMP)
Advisory Committee on Fishery Management (ACFM)

The Council currently has 95 Working, Study, Planning, or Steering Groups and Workshops (see list beginning on p. 8) which form the main mechanism by which the bulk of the Council's work programme is planned, coordinated, conducted, appraised, and reported on for subsequent consideration by the Subject/Area and Advisory Committees on subjects such as marine chemistry; sediments; physical oceanography; environmental impact of mariculture; fish disease, behaviour, and genetics; ecology of benthos, plankton, and fish; biological effects of contaminants; trend monitoring; marine data management and statistics; single- and multispecies fish stock assessments; fishing technology; and surveys for fish eggs, larvae, juveniles, and adults.

PUBLICATIONS

Relative to its function to publish and disseminate results of research, the Council organizes scientific symposia and other meetings which are open to participants from both Member and non-Member Countries and publishes the following series of publications which are available to the scientific community and the general public:

- *ICES Journal of Marine Science*
  (*Journal du Conseil*)

- estimating fish egg and larval production from surveys;
- estimating young fish abundance (particularly in the North Sea) from surveys.

ICES coordinates research to obtain a better understanding of:

- early life stages of fish;
- recruitment to fish stocks;
- multispecies interactions and their effects on individual fish stocks.

Fisheries Data Bank

ICES maintains a computerized data bank containing:

- detailed information relevant to fish stock assessment;
- data from the annual International Bottom Trawl Surveys in the North Sea;
- catch statistics for the Northeast Atlantic.

Fisheries Advice

ICES is the officially-recognized scientific advisory body to the following regulatory commissions:

- North-East Atlantic Fisheries Commission (NEAFC);
- International Baltic Sea Fishery Commission (IBSFC);
- North Atlantic Salmon Conservation Organization (NASCO);
- Commission of the European Communities (CEC).

These commissions and governments of ICES Member Countries formulate requests to ICES for information and advice relative to the management of specific stocks of fish. The Advisory Committee on Fishery Management (ACFM) is responsible for answering these requests and providing scientific advice on behalf of the Council. In formulating its advice on the management of 90-100 stocks of fish and shellfish, ACFM utilizes information prepared by 21 stock assessment Working Groups. ACFM meets twice per year to prepare its advice, which is published annually in the *ICES Cooperative Research Report* series.

OCEANOGRAPHY

Research and Monitoring

Oceanographic investigations form integral parts of the ICES programme of multi-disciplinary work aimed at understanding the features and dynamics of water masses and their ecological processes. Special reference is on the influence of changes in the environment on the distribution, abundance, and population dynamics of exploited fish resources. These investigations are also directly relevant to marine pollution studies because physical oceanographic conditions have an influence on the distribution and transport of contaminants in the marine environment. ICES promotes the development and calibration of oceanographic equipment and the maintenance of appropriate standards of quality and intercomparability of oceanographic data. This includes the periodic conduct of intercalibration exercises, such as:

Contaminants Data Bank

ICES is the oldest international data centre on marine contaminants, including data from its Cooperative Monitoring Studies Programme and from the Oslo and Paris Commissions' Joint Monitoring Programme covering contaminants in biota, sea water, and sediments. ICES also serves as the centre for environmental and biological data used in the work of the North Sea Task Force.

Marine Pollution Advice

ICES provides scientific information and advice on marine pollution and its effects on living resources through its Advisory Committee on Marine Pollution (ACMP) to Member Country governments and the following regulatory commissions:

- Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo Commission);
- Convention for the Prevention of Marine Pollution from Land-Based Sources (Paris Commission);
- Convention for the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Commission).

As a basis for this advice, ACMP reviews the reports of approximately 20 Working Groups that coordinate work on various topics related to the marine environment and marine contamination. ACMP meets annually and publishes its report in the *ICES Cooperative Research Report* series.

COORDINATION OF COOPERATIVE RESEARCH PROGRAMMES

ICES has played a very active role in coordinating cooperative research programmes in the North Sea and elsewhere in the ICES area (North Atlantic including the Baltic). The following list of cooperative programmes is presented to illustrate the capabilities of ICES in this regard:

Oceanography

1. SKAGEX 90-91. Multidisciplinary flux study in the Skagerrak. Participating countries: Denmark, Federal Republic of Germany, German Democratic Republic, Norway, Poland, Sweden, and USSR.
2. NANSEN 87-90. Physical oceanographic study of exchange processes, primarily between Iceland and Scotland. Participating countries: Denmark, Federal Republic of Germany, Iceland, Norway, and UK.
3. PEX 86. Multidisciplinary study of scales of variability in the Central Baltic, April 1986. Participating countries: Denmark, Finland, Federal Republic of Germany, German Democratic Republic, Poland, Sweden, and USSR.
4. BOSEX 77. Multidisciplinary study of processes in the Central Baltic, September 1977. Participating countries: Denmark, Finland, Federal Republic of Germany, German Democratic Republic, Poland, Sweden, and USSR.
5. JONSDAP 76. Joint programme from March-June 1976 in the North Sea; INOUT dealing purely with physical oceanography (circulation, storm surges) and FLEX being a multidisciplinary project on plankton dynamics. Participating countries: Belgium, Federal Republic of Germany, Netherlands, Norway, Sweden, UK, and USA.

16. NORTH SEA AND EASTERN ENGLISH CHANNEL SOLE EGG SURVEY. Conducted in 1984 and 1985. Participating countries: Belgium, Federal Republic of Germany, Netherlands, and UK.

17. ACOUSTIC SURVEYS OF BLUE WHITING. Conducted continuously since 1983. Participating countries: Denmark (Faroe Islands), German Democratic Republic, Iceland, Norway, UK, and USSR.

18. HYDROACOUSTIC SURVEYS IN THE BALTIC. Conducted continuously since 1982. Participating countries: Denmark, Federal Republic of Germany, German Democratic Republic, Poland, Sweden, and USSR.

19. STOMACH SAMPLING PROJECT 1981. Conducted in 1981 in North Sea to provide input to multi-species assessment work. Participating countries: Denmark, France, Netherlands, Norway, and UK.

20. ACOUSTIC SURVEYS IN SUB-AREA IV AND DIVISION IIIA. Conducted continuously since 1979. Participating countries: Denmark, Norway, Sweden, and UK.

21. YOUNG FISH SURVEYS IN THE BALTIC. Conducted continuously since 1978. Participating countries: Denmark, Finland, Federal Republic of Germany, German Democratic Republic, Poland, Sweden, and USSR.

22. COD STOMACH DATA FOR THE BALTIC. Conducted continuously since 1977. Participating countries: Denmark, Finland, German Democratic Republic, Poland, Sweden, and USSR.

23. MACKEREL/HORSE MACKEREL EGG PRODUCTION SURVEYS. Conducted in the North Sea and the area west of the British Isles continuously since 1977. Participating countries: Federal Republic of Germany, France, Ireland, Netherlands, Norway, Spain, and UK.

24. BEAM TRAWL SURVEYS IN THE NORTH SEA AND ENGLISH CHANNEL. Conducted continuously since 1976. Participating countries: Belgium, Federal Republic of Germany, France, Netherlands, and UK.

25. INTERNATIONAL YOUNG FISH SURVEY. Survey using bottom trawl and IKMT in the North Sea conducted continuously since 1975. Since 1991, called the International Bottom Trawl Survey. Participating countries: Denmark, Federal Republic of Germany, France, Netherlands, Norway, Sweden, and UK.

26. HERRING LARVAL SURVEYS SOUTH OF 62°N. Conducted continuously since 1972. Participating countries: Denmark, Federal Republic of Germany, Ireland, Netherlands, Norway, and UK.

27. O-GROUP SURVEYS IN THE ICELAND - EAST GREENLAND AREA. Conducted from 1970-1975. Participating countries: Federal Republic of Germany, Iceland, Norway, UK, and USSR.

28. BLØDEN HERRING TAGGING EXPERIMENT. Conducted in 1969-1970. Participating countries: Denmark, Federal Republic of Germany, France, Netherlands, Norway, and Poland.

ICES WORKING, STUDY, AND OTHER GROUPS

The following Groups, for which membership and participation is open to scientists appointed by the respective Member Countries, are those in existence in 1991/1992. Working Groups are established with specific terms of reference which generally involve activities over a number of years, whereas the other Groups are usually established to undertake a specified task and exist for a much shorter period of time (e.g., 1-3 years).

Study Group on the Analysis of Feeding Data
Study Group on Baltic Sea Modelling
Study Group on Beam Trawl Surveys
Study Group on the Biological Significance of Contaminants in Marine Sediments
Study Group on Cephalopod Biology
Study Group on the Coordination of Bottom Trawl Surveys in Sub-areas VI, VII, and VIII and Division IXa
Study Group on Demersal Stocks in Division IIIa
Study Group on the Dynamics of Algal Blooms
Study Group on Ecosystem Effects of Fishing Activities
Study Group on the Fecundity of Sole and Plaice in Sub-areas IV, VII, and VIII
Study Group on FISHBASE
Study Group on Fisheries Units in Sub-areas VII and VIII
Study Group on GULF III Plankton Sampler Efficiency
Study Group on Life Histories and Assessment Methods of *Nephrops* Stocks
Study Group on Life Histories and Assessment Methods of *Pandalus* Stock in the North Atlantic
Study Group on the North American Salmon Fisheries
Study Group on the Norwegian Sea and Faroes Salmon Fishery
Study Group on Pilot Whales
Study Group on Pollution Affecting Shellfish in Aquaculture and Natural Populations
Study Group on Redfish Stocks
Study Group on Seabird/Fish Interactions
Study Group on Seals and Small Cetaceans in European Seas
Study Group on SKAGEX
Study Group on the Stock Identity of Mackerel and Horse Mackerel
Study Group on Tagging Experiments for Juvenile Plaice
Study Group on Young Fish Surveys in the Baltic
Study Group on Zooplankton Production

Planning Groups

Ad hoc Planning Group on the ICES/IOC/OSPARCOM Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media
Planning Group for Acoustic Surveys in ICES Sub-areas VII and IX
Planning Group for Acoustic Surveys in Sub-area IV and Division IIIa
Planning Group for Hydroacoustic Surveys in the Baltic
Planning Group on the Stomach Sampling Project in 1991
Programme Planning Group

Steering Groups

Steering Group on Cod and Climate Change
Steering Group for the Coordination of the Baseline Study of Contaminants in Baltic Sea Sediments
Steering Group on Fisheries/Environmental Management Objectives and Supporting Research Programmes in the Baltic Sea
Steering Group for the Production and Publication of an Atlas of North Sea Fish

Other Groups

Coordinating Working Party for Atlantic Fishery Statistics
Inter-Committee Recruitment Group

Workshops

Workshop on Age Determination of Redfish

APPENDIX D

Working document

Integrated North Sea Programme

workshop

on

May 14th and 15th, 1992

Themes for the INP workshop

A. Changes in the ecosystem/predicting the North Sea environment

From NIOZ (Lindeboom):
- Ecology of the coastal shelf with and without anthropogenic influences
- Nutrients and the planktonic community

From DGW (Colijn):
- Changes in the North Sea ecosystem

From Plymouth Marine Laboratory (Stebbing):
- The European Regional Seas Ecosystem Model (ERSEM)
- The ICES.IOC Bremerhaven Workshop and its possible successor

From Proudman Oceanographic Laboratory (Huthnance):
- Predicting the North Sea environment

From Bundesambt für Seeschiffahrt und Hydrographie (Becker):
- What does global climate change mean for sea level and water masses in the North Sea?
- Causal connections in the physical-biological system North Sea: Formulation and model simulation
- Organisms as indicators of changes in the North Sea ecosystem
- Sampling of interdisciplinary datasets to validate ecosystem models (sampling strategy like ZISCH cruises/NERC Nort Sea project)

B. Water quality of the North Sea

From Forschungszentrum TERRAMARE (Liebezeit):
- Humic acids in the North Sea - Tracers for transport of terrestial material?

From Plymouth Marine Laboratory (Dr. A.R.D. Stebbing):
- Water quality in the North Sea

From National Rivers Authorities (D. Sayers):
- Controlling hazardous substances on the North Sea action list

From Institute of Aerosol Science University of Essex (Dr. I. Colbert):
- Atmosperic chemistry

C. Horizontal and vertical transport in the North Sea

From NIOZ (Lindeboom):
- Horizontal and vertical transport of dissolved materiel in the North Sea and along the shelf edge and the effect of transport phenomena on the ecology
- Mooring systems and synoptic surveys to study the realtions between short-term changes in the physical structure of a stratified water column and phytoplankton biomass, activity and sedimentation

From Plymouth Marine Laboratory (Stebbing):
- The Land Ocean Interaction Study (LOIS)
- The ICES.IOC Bremerhaven Workshop and its possible successor

From Bundesambt für Seeschiffahrt und Hydrographie (Becker):
- The North Sea as a transitional zone between northwest Europe and the
- Vertical fluxes of momentum, energy and matter through the sea surface
- The quantitative role of organisms in the turnover of energy and matter in the North Sea

D. Other themes

From Bundesambt für Seeschiffahrt und Hydrographie (Becker):

- Verification of satellite oceanography in the North Sea
- How reliable are out assessments on the state of the North Sea

Changes in the ecosystem

and

Predicting the North Sea environment

INTEGRATED NORTH SEA PROGRAMME

INP-workshop on a Cooperative North Sea Research Programme '93 - '95.

Title theme: CHANGES IN THE NORTH SEA ECOSYSTEM

Proposed by: Dr. F. Colijn, Tidal Waters Division of Rijkswaterstaat

As yet there are several indications that the North Sea ecosystem shows cyclic or periodic changes in plankton communities. This type of information can be derived from long term observations at specific stations (Plymouth, Marsdiep and Helgoland) or from analyses based on the Continuous Plankton Recorder.
Another type of disturbance of the system could be the changes in species composition of the main commercial and non-commercial fish species. Part of the explanation for these changes is the fishery itself, both as an harvesting industry and as an activity giving rise to bycatches on the non-commercial species. There is also growing concern about the physical disturbance of the seabottom and its negative effects on the bottom fauna. To date there is no indication of the possible recovery after disturbance of the system, being the benthos or the pelagial.
Besides anthropogenic effects on the system the influence of climatic changes might be important as well, because the physical environment is of overwhelming importance for the dynamics in the system. Intrusion of Channel Water or North Atlantic water into the North Sea has long term effects on the water composition in the system and exerts its influence for a long time (months to years) especially when these quantities are much larger than the average amounts.
The influence of low level concentrations of contaminants still poses a threat to the system, which is alleviated by using the precautionary principle for a series of compounds.
Still it is very difficult due to large natural variations in densities to distinguish pollution effects from natural variation.
Studies in the North Sea could be directed towards solving the problem of natural versus anthropogenic changes in the system.

Ecological aspects of different parts of the North Sea, with different levels of anthropogenic influences, should be compared. If an area where the influence of fisheries is negligible could be located or created the effects of fisheries on the North Sea ecosystem may be studied. Sublethal effects of micropollutants may be best studied in areas where the fishing pressure and the occurrence of eutrophication phenomena are relatively small. Such a study could partly focus on long living organisms like small shellfish and different non-commercially interesting fish species.
Long-term data sets should be created and special effort might be put in collecting and combining different data sets including unpublished data collected in the past.
A combined effort to locate areas for this research and to conduct this research in different areas with comparable techniques should be part of an Integrated North Sea Programme.

Draft Skeleton Proposal ERSEM II

Job Beretta; coordinator

NSTF Workshop on a Co-operative North Sea Programme 93-95

Research Theme: ERSEM-II (Draft Skeleton Proposal).

Introduction

The principal objective of the first ERSEM project, partially funded under MAST-I was to develop a generic ecosystem model describing the carbon-cycle and the associated cycling of the nutrients N, P and Si. This model was spatially differentiated into the ICES boxes, using 2 vertical layers for the ICES boxes deeper than 30 m. The advective exchanges between the boxes were forced as daily net flows across the box boundaries, as calculated from a 3D circulation model (the Backhaus model) for the period 1988-1989.

The model developed in ERSEM-I will only be applied to simulate the seasonal cycle of biological production and mineralization in the North Sea. Within the constraints of the present project it is not possible to test the generic nature of the model by applying it to other areas.

The ERSEM-I model is able to reproduce the main features of the seasonal cycle in terms of carbon production/dissolution and nutrient cycling, since these processes are dominated by the smaller, short-lived organisms that lend themselves well to be modelled as bulk biomass and that are usually treated the same way experimentally. However, modelling the longer-lived, larger organisms as bulk biomass is not so easy to reconcile with the usual experimental approach which tends to study individual representatives in order to determine the relevant rate constants. The rate constants derived from individuals then need to be scaled such that they are representative for a whole functional group such as 'demersal fish', with the additional problem that the rate constants change (decrease) strongly over the life-time of these organisms. To adequately represent the properties of the larger, long-lived organisms (usually the higher trophic levels) it will be necessary to include size-structured functional groups into the model.

In order to use the ERSEM-I model for studies of interannual variability and even long-term trends, it will be necessary to include the sinks of both carbon and nutrients, which are located in the benthic system.

The presence in the model of a benthic submodel describing both carbon- and nutrient dynamics offers the possibility to define these sinks of both carbon and nutrients (such as burial, denitification, immobilisation of P) which is an absolute prerequisite for studying long-term trends.

On the biological side, a prerequisite for studying the underlying causes for long-term trends, is an adequate representation of overwintering strategies of the various functional groups, especially in the zooplankton. The overwintering strategies are also closely related to the ability of grazers to have a strong numerical and functional response to the spring bloom (appearing at the right place at the right time).

It will be clear from this introduction that in order to come closer to understanding long-term trends, continuing model development in ERSEM-II will be necessary.

If we characterise ERSEM-I as the development phase of the seasonal-cycle model with a first application to the North Sea, we can see ERSEM-II building on this basis by:

I Applying and testing ERSEM in different ways:

- increase the spatial resolution of the model and apply it to the North Sea coastal areas (NIOZ, IfM, MLA)
- Test the generality of the model by applying it to different physical models. These systems might be:
- The Baltic (Un. of Stockholm)
- The Adria (ERSEM, MERMAIDS)

For the North Sea applications, the emphasis will be on increased spatial resolution in the continental coastal strip (NIOZ), long-term nutrient cycling (IfM), testing the model against mesocosm experiments (MLA, VKI).

For an application of ERSEM to the Baltic we reply on our Swedish partner (Fredrik Wulff) to provide a specification of what and how.

The application of ERSEM to the Adria is dependent on the MERMAIDS group taking the leading role, with the ERSEM-partners through VKI, participating in a consultative role; the results of this application, however are very relevant to the question of the generality of our formulations and may lead to extensive revision of the model!

II Further development of the ERSEM model:

- improvement of modules as required by testing of the model (partner responsible);
- collecting data to define the boundary-conditions and for improved parameterisation and more rigorous validation (PML);
- improvement of the allometry of the state-variable definitions (UO, VKI, NIOZ);
- extension of the higher trophic level modules (MLA);
- begin modelling the interdependence between community structure and -function in the benthic (UO, PML).

III Modelling tool development (NIOZ, UO, U STRATHCL)

- research and define alternatives for modelling tools such as SESAME (NIOZ etc);
- inclusion of scientific visualisation tools in our modelling tools (VKI, NIOZ, UA?);
- inclusion of record structures in SESAME (UO);
- partial evaluation (ERSEM, DIKU).

This last item links to research going on in ESPRIT on methods to automatically optimise executables in order to minimise execution time; something we will sorely need when we increase our spatial resolution.

Co-ordinator Bob Baretta

Predicting the North Sea Environment

J.Huthnance; Proudman Oceanographic Laboratory

Predictions are wanted for several purposes including the following.

a) Rational policy decisions. Any actions altering anthropogenic influences on the North Sea will have consequences which should be predicted in advance, to enable informed judgements. Predictions for this purpose typically entail sophisticated models (because quality of prediction is important, but there should be no need for urgency) and various scenarios (of context, inputs, parameter values or forcing as appropriate).

b) Diagnosis of change. There is public interest in whether perceived trends or variability are anthropogenic, climate-induced, 'natural' or indeed only perceived through increased observation and communication. The cause may have policy implications. Again, the diagnosis involves sophisticated predictive models (for quality without urgency) to test alternative hypotheses through comparison of the consequent predictions with observation.

c) Design. Sea-level and wave statistics, including extremes, are present examples of predictions used to design offshore structures. Corrosion by sea-water constituents, effects on sedimentation patterns, the level of continued preparedness against accidental spills are other questions. The need is for probability distributions, which may be derived by model predictions from a probability distribution of other input variables (e.g. storm-surge statistics from a model with meteorological forcing with known probabilities) or in a few instances more directly from the statistics of long series of measurements.

d) Operations. Navigation, offshore construction, mariculture, fishing and various recreational activities are examples requiring forecasts of actual (not just probabilistic) conditions on an hourly to daily basis. Evidently, the forecast must be available to the operator before the forecast period. Continuing needs may justify the establishment of a permanent 'operational' forecast system which may then use quite sophisticated models, according to the availability of their required input data.

e) Warnings and clear-up operations. Storm-surges, oil and chemical spills are present examples, and the progress of toxic blooms, anoxic conditions or sudden changes of temperature are others where forecast warnings may be envisaged. Speed is an important factor; the forecast must run from input data assembly to output data destination before the forecast period. An operational system may be quite sophisticated if permanent (as for storm-surge forecasts based on meteorological model input) but otherwise 'portability' for rapid implementation in context may be a large factor, with some empiricism and simplifed requirements for input reflecting the expected availability of data.

Scope

The North Sea Task Force has identified the following as coming within its area of concern: nutrients, and their relationship with plankton blooms; ecology; contaminants; toxins (metals, organic substances); disease. Another use of predictions is for the testing of hypotheses, as part of the scientific process of developing understanding about these aspects of the North Sea system.

Our present knowledge indicates that the following aspects are also involved in such understanding; hydrodynamics and waves (meteorological, tidal and density forcing); transport, dispersion and mixing processes; sediment erosion, flocculation, deposition, cohesion, bioturbation and fluxes therein; particle-water interactions and adsorption onto particles according to temperature, salinity, pH, Eh and surface properties; sources and sinks of the various constituents (including non-conservative processes within the sea and exchange across air, land- and sediment boundaries).

As well as topic, there are questions of extent: concentration on particular areas (e.g. estuaries and nearshore emphasising the influence of freshwater, inputs, mixing and sediments; coastal jets, plumes, fronts and eddies); required spatial resolution (perhaps finer nearshore) and dimension (vertical average?); temporal resolution (hourly to interannual).

Outline action

1) It is necessary to identify (more specifically than above) the purposes for which predictions are required.

2) Then model characteristics appropriate to these purposes should be identified. Such characteristics are in terms of topic coverage (primary and consequential), extent, spatial and temporal resolution, model type (statistical, empirical, numerical; hindcast or forecast; operational).

3) To avoid a plethora of incompatible models, groupings should be identified which may be brought within a modular framework. It is 'traditional' to classify according to topic coverage, but other characteristics affect compatibility, especially model type and resolution. For example, it might be decided for diagnosis and policy purposes that predictions were required with daily and 10km resolution over the whole North Sea covering hydrodynamics and sediment transport (necessarily), nutrients, primary production and contaminants/toxins, but that only hindcasts were needed for various scenarios. A framework would be necessary to bring together the expertise in different topic areas as modules interfaced through the framework. A separate framework might be necessary for a 'portable' local forecast model of finer resolution but narrow topic coverage.

4) Establishment of any framework within which individual scientists are to be persuaded to work entails a long-term commitment and support, to make worthwhile their investment in compatibility, and some effort in making the framework 'user-friendly'.

5) Prediction systems have input data requirements according to their extent and scope. The establishment of any system must include the provision of the appropriate input data: for hindcasts and forecasts of actual events, this will require measurements of real initial and boundary conditions (including source/sink terms).

John Huthnance

Dr. B. Becker
Federal Maritime and Hydrographic Agency

1

What does global climate change mean for sea level and water masses in the North Sea?

Global climate models predict a general atmospheric warming for the next century due to the greenhouse effect. This will lead to a rise in sea level, modifications in atmospheric and oceanic circulation and to changes in hydrological cycles. These worldwide changes are of vital importance for the North Sea Coast as a sphere of existence and economic activity as well as for the North Sea ecosystem.

Research needs

The coarse resolution of global models and their high internal variability have precluded reliable predictions of regional consequences for the North Sea up to now. These are, however, highly desirable, considering the potential environmental, social and economical impact. Of particular interest:

- the evolution of sea level along the North Sea Coasts
- the development of mean temperatures and salinities in the North Sea
- the development of the wind statistics over the North Sea

Comments

Long term observations of sea level around the North Sea reveal differing trends. Generally, however, an increase in mean sea level has been found. The significance of this trend, its magnitude and future development are aspects of great economic relevance. Considerable regional differences could exist.

Temperature and salinity characterize the water masses of the North Sea and thus the state of the ecosystem, fish stocks etc.

There are indications that unusual weather conditions have occurred more frequently over the North Sea during the past decade. It is still unknown whether this lies within the natural range of variability or is already a systematic consequence of climate change. It is necessary to determine the regional consequences of a global climate change for the weather in the North Sea.

This project would complement existing national activities (Netherlands, Germany) and serve as an exemplary exercise for investigating the links between global trends and local effects.

Research Strategy

As a first step, trend analyses should be carried out - if not already the case - for long term data sets (tide gauges, wind statistics, temperature, salinity, nutrients).

Since it doesn't appear probable that global models can be supplied with sufficiently resolved regional models in the near future, the relationship between (large scale) climatology and hydrography of the North Atlantic with those (small scale) of the North Sea must be established by means of statistical analysis of existing data sets.

The resulting transfer functions could be used to calculate the development in the North Sea during the 21st century from global scenarios.

Dr. B. Becker
Federal Maritime and Hydrographic Agency

Causal connections in the physical-biological System North Sea: Formulation and Model Simulation

The North Sea ecosystem encompasses atmosphere, hydrosphere, biosphere and lithosphere and is regulated by their interrelationships. A complex model, in which causal connections are formulated and quantified, would be a valuable tool for understanding how this system functions, how it is affected by natural (weather) and artificial (e.g. eutrophication) influences. After sufficient verification, such a model would be suitable for making predictions.

Research needs

Modeling of transient three-dimensional, barocline hydrodynamics and its wave field as a function of wind, tides and lateral boundary conditions has been largely successful. Research deficits exist in the following:

- analysis and formulation of small scale biological, chemical and physical processes
- quantification of internal sources and sinks of the system
- formulation, implementation and validation of a complex ecosystem model for the North Sea, on the whole or in part
- calculation of specific scenarios

Comments

Processes such as stratification, convection, mixing, flocculation, chemical and biological transformations, exchange between dissolved and particulate phases, grazing etc. have not been adequately investigated, formulated and quantified. They are decisive for regulation of the ecosystem and, thus, for corresponding models.

There are hardly any substances which behave conservatively in water. Internal sources such as resuspension and remineralization or sinks such as decomposition and chemical transformation constantly change the "pool" of any particular substance. Significance and magnitude of these sources and sinks must be investigated and quantified.

There exist numerous models for ecosystems. They suffer from poorly formulated processes, uncertain empirical parameters, insufficient validation.

It will not be possible to simulate the causal connections between atmospheric forcing, anthropogenic emissions and production - for example in the case of exceptional algae blooms - until a sufficiently complex and verified model of an ecosystem has been developed. It would then be possible to

calculate different scenarios for various protective measures.

Research strategy —

For process studies it is necessary to analyze existing data sets (e.g. MAST, PRISMA) and to collect new data in small scale field experiments. Use of mesocosms is to be recommended here.

Existing ecosystem models must be extended step by step and verified, new process formulations incorporated in them and tested using the above-mentioned data sets.

A particular challenge will be the prognostic simulation of exceptional algae blooms as a function of weather and emissions.

Dr. B. Becker
Federal Maritime and Hydrographic Agency

Organisms as indicators of changes in the North Sea ecosystem

The high degree of natural variability in the atmospheric forcing over the North Sea and the corresponding short-period fluctuations in the water (natural "noise") make it extremely difficult to detect increases in substances, e.g. PCB-concentrations in water. The accumulation of contaminants in organisms, their effects and the reactions of the organisms to them are integrative and longterm and therefore good indicators for changes in the ecosystem.

Research needs

Well-known in this respect is the mussel watch concept. There are a number of further suggestions for bioindicators:

- degradation of rocky shore benthos
- bacterial disease in flatfish
- increase of seabird populations

Comments

In the North Sea there are extensive rocky shore communities with a remarkably productive vegetation. There is evidence that North Sea rocky shore communities are under degradative pressures, and it is not known to what degree discharges of nutrients, contaminants and suspended matter are responsible.

There is evidence that bacterial diseases are increasing in flatfish of the North Sea and that there is a connection between eutrophication/pollution and the concomitant triggering of bacterial infections, but the specific mechanisms are still unknown.

Populations of most seabird and fish eating coastal bird species have reached highest numbers since the start of countings at the end of the last century. The most important causes for this development appear to be the changes in fisheries' practices and increasing food resources as a result of eutrophication.

Research strategy

It is of primary importance to carry out local field experiments to gain qualitative and in particular quantitative knowledge about the above-mentioned changes. These should be carried out in rocky shore regions (benthos), in regions of varying degrees of pollution (flatfish) and for sea birds, specifically in areas which have not been sufficiently covered by national activities.

Water quality of the North Sea

Water Quality in the North Sea

Dr. A.R.D. Stebbing; Plymouth Marine Laboratory Programme 93-95

Research Theme - Water Quality in the North Sea - integration of biological with physico-chemical data.

Introduction In March 1990 an ICES/IOC Seagoing Workshop on Biological Effects Techniques was mounted from the Alfred Wegener Institute Bremerhaven. It was organised by the ICES Working Group on the Biological Effects of Contaminants and the IOC Group of Experts on the Effects of Pollution. Interpretation results of the Workshop data is now being made, following the Concluding Meeting of the Workshop in Copenhagen (11-13 September), and the integration of the chemical and hydrographic data with the biological results, as the work is being prepared for publication as a Special Volume of Marine Ecology Progress Series.

The results of the Workshop are of importance to the NSTF because it was based in the North Sea, involving the deployment of over 50 biological effects techniques, by 80+ scientists from 7 research vessels on two contamination gradients. One from the Elbe/Weser Plumes ran NW 200 km out the Dogger Bank, and the other was related to a drilling site off the Dutch Coast.

While the Workshop was intended primarily to compare biological techniques on these gradients it highlighted a number of important ecotoxicological research problems that require further work. However, the ICES/IOC group involved have not yet developed a specific proposal or sought further financial support. Nevertheless it was felt useful to prepare a discussion document for the NSTF workshop.

Results The results of the Workshop showed that:

1. Many biological techniques are now capable of detecting and responding to contamination gradients offshore in the North Sea.

2. These responses primarily occur at the sea surface and sea bottom, where contaminants accumulate to higher concentrations than in the water column.

3. The diagnostic capacity of biomarkers is going some way to identifying the groups of contaminants responsible.

4. While chemical data clearly indicate the gradients studied, in some respects they need to be appropriate for the interpretation of biological effects. They:

-are not specific to the bioavailable fraction (eg metals)
-may exclude biological active microcontaminants
-do not consider matrices that are vehicles for contaminants (eg POC - suspended and deposited tripton)
- are sometimes expressed in the wrong way..

5. The sensitivity and precision of biological data is now more than adequate for the routine use of some techniques in monitoring programmes.

Research areas requiring additional work

1. **Routes and mechanisms of exogenous contaminant flux.** The routes of contaminant input to the North Sea (riverine, atmospheric etc) determine their dispersal, but also influence the points where accumulation (interfaces, gyres, fronts), and therefore biological effects are more likely to occur. The role of particulate matter as a vehicle for contaminants is crucial in determining transport and sites of secondary reconcentration.

2. **Routes of endogenous contaminant flux, metabolism and effects.** To interpret indices of biological effects, it is important to know their pathways, sites of accumulation and metabolism in organisms. In particular to understand xenobiotic metabolism in flatfish liver at the biochemical and cellular levels, the metabolic cost of fuelling detoxication mechanisms (MFO) in relation to effects upon the organism (immunosuppression, tumour induction and gross pathology) and thus the population.

3. **Integration of chemical and biological data to identify the causes of deleterious effects.** The relation between contaminant chemistry and indices at lower levels of biological organisation remain unclear, yet it is only at these levels that a mechanistic understanding of effects is possible. There is scope for evolving chemical analyses the bioavailable fractions of toxic contaminants, and for considering additional matrices than tissue, water and benthic sediments. Diagnostic techniques called "biomarkers", which are typically lower order responses (eg EROD), offer great potential in identifying biologically active classes of contaminants. It would seem that correlational analysis, perhaps using multivariate techniques, will continue to offer the best means of indicating causality.

Discussion

We are required to establish links between contaminant inputs, concentrations and effects. The weakest is the interdisciplinary link between the chemistry of contaminants and their biological effects. The ICES/IOC Workshop addressed that link directly, yet the major conclusion from those involved was that greater integration is required between the different specialist areas that together determine environmental quality.

The Workshop attempted not only to bring together contaminant chemistry and biological indices, but to go further in particular areas by closely relating specialist interests on the same organisms and gradients (eg dab liver biochemistry, molecular, cellular and gross pathology; sediment chemistry and bioassays with benthic community structure).

The traditional sequence of reasoning is that environmental contaminant chemistry should be used to interpret the biological effects data. However, the quality and specificity of the biological data is such now that this sequence should be reversed. Biological indices can provide the primary measure of environmental quality, and chemical effort reserved for times and places where there is a demonstrable biological problem.

A.R.D. Stebbing, 10 October 1991

ATMOSPERIC CHEMISTRY

The potentially degrading effects of pollution inputs to the North sea have been recognised for several decades. However, due to the difficult experimental measurements needed in assessing atmospheric inputs a great deal of uncertainty exists in quantification of the actual fluxes involved. A detailed knowledge is required of the atmospheric concentration, size distribution and phase of the species under investigation, which when combined with dry deposition velocity, precipitation depth and scavenging ratios will yield total flux. Unfortunately these factors vary both spatially and temporally subjecting the estimated flux to considerable uncertainty.

Due to the complex problems associated with measuring atmospheric species over the North Sea considerable emphasis has been placed on the development of atmospheric models. The controlling parameters in these models are usually source strength, meteorological variables and wet and dry deposition processes. Problems can arise in defining the source strength as emission inventories are often incomplete and subject to considerable uncertainty. The publication of emission inventories typically takes several years before all statistical compilations are completed, making them rapidly outdated as emission controls and regulations are imposed. The development of models accounting for atmospheric chemical and physical transformations will be a major advance in understanding the flux to the North Sea.

Research in the following areas is required :

a) Measurements of atmospheric concentrations derived from shipborne studies for each element of concern, under different meteorological conditions.

b) Experimental studies of aerosol deposition over water surfaces.

c) Measurements of the size spectrum of aerosol (especially large particles) over the North Sea.

d) Measurements of the scavenging efficiency in relation to particle size and speciation.

e) Appropriate emission inventories for natural and anthropogenic sources and gaseous species to be readily available.

Dr I Colbeck
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Humic acids in the North Sea - Tracers for transport of terrestrial material?

Gerd Liebezeit
Forschungszentrum TERRAMARE
Schleusenstraße
W-2940 Wilhelmshaven

Humic acids in marine waters have received attention since the work of Kalle on "Gelbstoff" easily measurable by its characteristic fluorescence behaviour. These spectral features have made this compound class a preferential target in remote sensing. It is generally assumed that this so far uncharacterised fraction of the dissolved organic carbon pool is of terrestrial origin. This is corroborated by marked concentration gradients from estuaries into the open sea indicating conservative mixing.

As humic acids are polyelectrolytes carrying a number of functional groups (carboxylic, phenolic, amidic etc.) they strongly complex trace metals and are also associated with organopollutants. Due to their reactivity they may be adsorbed onto clay minerals or transferred into particulate form in the process of biological macroaggregate formation. By this mechanism highly polluted organic material will be transferred to the sea bottom and into the suspension and sediment feeding food web. This is of particular importance in areas such as the southern North sea where the fine fraction i.e. the one preferentially ingested by macrobenthic organisms constitutes only a minor fraction of the total sediment.

From the analysis of an extended number of seston samples taken in the North Sea in 1985 and 1986 it could be demonstrated that particulate humic acids also exhibit conservative behaviour upon mixing. On the other hand, significant relations with total chlorophyll and biogenic opal were also found at times of high phytoplankton activity. This suggests that marine primary producers may be sources of humic acid precursors with similar fluorescence characteristics as "true" humic acids. In this case organic material of marine origin may be another sink for dissolved pollutants acting as a transfer agent from the water column into the sediment.

The above data will be presented in detail together with a research proposal which aims at identifying the molecular signatures of the two endmembers, i.e. humic acids of marine and terrestrial sources, by applying advanced geochemical techniques.

Horizontal and vertical transport in the North Sea

Dr. B. Becker
Federal Maritime and Hydrographic Agency

The North Sea as a transitional zone between northwest Europe and the North Atlantic: Matter, energy and momentum fluxes

Interrelationships between ocean and land form the basis for life on earth. The marginal seas are an important transitional zone in this respect for major transfer processes in both directions. In this sense, the North Sea is the most important transitional zone for fluxes of matter, energy and momentum between the North Atlantic and northwest Europe.

Research needs

Circulation and transport processes in the water of the North Sea and the air over it have been investigated thoroughly. Far less is known about the lateral fluxes between

- the North Atlantic and the North Sea
- the Baltic and the North Sea
- the Waddensea and the North Sea

Comments

The intensive exchange of water masses between the Atlantic Ocean and the North Sea involves a massive exchange of matter, energy and momentum. These determine our climate, the dynamics of the North Sea and the state of the ecosystem. In many cases not even the sign - let alone the magnitude - of the fluxes is known.

It is well known, however, that the North Sea ecosystem as we know it is endangered by the introduction of nutrients and contaminants from land. Global influences are regulated by fluxes over the shelf edge.

North Sea and Baltic interact intensively - both hydrodynamically and ecologically - over the Belt Sea, Kattegat and Skagerrak. They must be viewed together as a system.

The greatest inputs of nutrients and contaminants into the North Sea are from rivers, in many regions via the Waddensea. The Waddensea functions as accumulator, reactor and internal source and sink for the system. Without knowledge of the fluxes between the Waddensea and the North Sea, no formulation of landward boundary conditions is possible. On the other hand, investigations of the ecologically highly important Waddensea require knowledge of the fluxes on the seaward side.

The project would complement existing and planned national (NERC North Sea, PRISMA) and EC-programs (MAST). A corresponding initiative for an "Integrated Project" in MAST II (NOWESP) was not realized.

Research strategy

In order to quantify the fluxes (through water and air), a comprehensive data basis is necessary. In part, existing data sets can be used, however it will be necessary to carry out specific measurements along transects at the North Sea entrances and in the Waddensea.

The coupling of coastal waters, open North Sea and North Atlantic will be carried out with a hierarchy of 3-dimensional circulation and transport models.

Due to local variability of the system, the investigations must be carried out with a high resolution in time and in space (no annual means).

Dr. B. Becker
Federal Maritime and Hydrographic Agency

Vertical fluxes of momentum, energy and matter through the sea surface

The dynamics and element cycles in the North Sea are strongly affected by interactions with the atmosphere. The wind generates currents and waves, and this process is influenced by artificial and natural surface films. Heat exchange at the surface causes and destroys stratification in the water, which then again interacts with the circulation and, in turn, modifies the surface fluxes. Fluxes of matter from the atmosphere into the ocean are significant input pathways for nutrients and contaminants from the land into the ocean.

Research needs

Of primary importance for the pollution of the North Sea is the mass exchange, for the forcing of currents and waves the input of momentum from the wind is the key factor, for the heat budget and stratification the flux of thermal energy is most important. Specific subjects of investigation:

- dry and wet deposition from the atmosphere
- formation, stablility and destruction of mixed laxers
- vertical migration of organisms, accumulation of plankton
- structure and effects of surface films

Comments

In recent years, the importance of atmospheric contaminant inputs into the sea coming from distant land-based emissions has been increasingly recognized. Relatively high concentrations of contaminants in the open North Sea water can be partly explained by this.

The interactions between the ocean and the atmosphere occur in the mixed layer. Proper modeling of these requires an understanding of the processes involved (absorption, turbulence, convection). These cannot be resolved explicitly for all scales, although they must go into the large scale models. Research on appropriate parameterizations has not yet been sufficient.

The most productive plankton organisms are associated with the mixed layer. Their role in the physical system (via surface films, changes in albedo, vertical transports) has not yet been clarified.

Remote sensing shows that surface films are quite common in the North Sea. In spite of their minuscule thickness, they influence significantly (via microstructures) fluxes of momentum, energy and matter at the sea surface. This field has not been studied sufficiently.

Research strategy

At coastal islands, research platforms and from ships it is necessary to increase measurements of atmospheric deposition for nutrients and contaminants.

There is not enough data available concerning the evolution of mixed layers. The few data sets are local (FLEX, PROFILE) and usually do not consider advection. A blanket data set for the formation and destruction of the summer mixed layer in the North Sea does not exist. Specific measurements must be carried out with ships and satellites. At the same time, surface films should be investigated.

For numerical models, the coupling of mixed layer models with three dimensional circulation models is of highest priority. In this connection, a transient thermodynamic forcing by real, remotely sensed temperature data should be considered.

Dr. B. Becker
Federal Maritime and Hydrographic Agency

The quantitative role of organisms in the turnover of energy and matter in the North Sea

Most investigations, particularly model studies, of transport and dispersion processes in the North Sea do not take the role of organisms sufficiently into consideration (exception: nutrients). It is, however, indubitable that microorganisms, phyto- and zooplankton, in particular, are decisive in the turnover of contaminants, in flocculation, in vertical migration of suspended matter.

Research needs

The role of organisms must be qualitatively understood and quantitatively formulated for particular substances. Of particular importance:

- analyses and correlations of distribution patterns of organisms, dissolved and suspended matter
- establishment of causal connections by means of process studies
- formulation and parameterization of these processes (e.g. bioaccumulation) and their incorporation into transport models

Comments

There exist extensive comprehensive quasi-synoptic data sets on the spatial and temporal distribution of relevant ecosystem parameters in the North Sea (e.g. NERC, ZISCH). These show characteristic patterns which can be brought into a congruent picture with the help of causal arguments and statistical analyses.

The analysis of field data, together with results from mesocosm and laboratory experiments yields information about the capacity of microorganisms and plankton to bind, transform and release dissolved substances and to control the transition between dissolved and particulate phases. These investigations will yield numerical values for the role of organisms in the turnover of energy and matter in the North Sea (as compared, for example, to advection by the currents).

According to their relative significance, and some biological processes are of central importance in this respect (e.g. for oil dispersion), these processes must then be built into transport and dispersion models.

Research strategy

First of all it is necessary to analyze the available quasi-synoptic data. The clearest results are to be expected from

small scale, process-oriented studies (drifting ship, mesocosms). There is a need for such experiments in the future.

Laboratory experiments would be useful in cases where marine conditions can be adequately simulated.

In existing transport models for dissolved and suspended matter, the role of organisms must be expressed in equations. These equations must be tested by comparison with field data.

Title theme: Mooring systems and synoptic surveys to study the relations between short-term changes in the physical structure of a stratified water column and phytoplankton biomass, activity and sedimentation

Proposed by: Netherlands Institute for Sea Research (NIOZ)
P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands.

In the carbon cycle and carbon budget of the North Sea short lasting mixing events in the stratified water column play a significant role, but such events are difficult to quantify with normal ship borne observations. Simultaneous measurements of physical and biological parameters with moored instruments, combined with regular synoptic surveys around the mooring area during all seasons will give the possibility to quantify the influence of atmospheric forcing on exchange of phytoplankton and nutrients between the layers and the influence of turbulence structure on sedimentation rate of the primary produced organic matter.
The aim is to find a parametrization of these processes and to develop a vertically resolved coupled physical-biological model for the lower trophic levels in the stratified regions of the North Sea.

Comparison the ship borne measurements of phytoplankton blooms with measurements done by moored instruments (Mills & Tett, 1990) have shown that, in particular in periods of the year when the water column is stratified, large differences were obtained in the calculation of vertical fluxes of organic matter. The differences are mainly caused by short lasting phytoplankton bloom events coinciding with strong atmospheric forcing, during which exchange of water between ipper and lower layer occurs. Apparently disturbances of the physical structure of the water column cause a redistribution of either (certain species of) phytoplankton or nutrients over the water column, which enables such a short lasting bloom to develop. Under conditions of strong atmospheric forcing ship borne measurements are generally difficult to perform. Moreover, the timescales of these blooms are so short, probably due to the high sinking rates of the cells, that a ship is generally not at the spot in time to monitor the evolution of such a bloom, if it is available at all at the unpredictable moment of strong wind force.
Thus only with moored instruments such simultaneous measurements can be obtained during all circumstances.

It is important to know the relation between the variability in hydrodynamical and in biological processes, in particular in the primary production, species composition and sedimentation rate, in order to distinguish between natural fluctuations and possible trends generated by a variety of causes. Changes in nutrient availability fue to human activity and/or climate change and changes in meteorological forcing due to climate change are supposed to have measurable influence on essential parts of the carbon cycle, as the primary production and the sedimentation of organic matter.
The integrated effect of these events on the total carbon budget and on the carbon cycle of the North Sea is assumed large. For an adequate modelling of the concentration and species composition of the lower trophic levels in the stratified parts of the North Sea, in particular during the summer months, a good quantification and parametrization of these short lasting phenomena is essential. The strong correlation with atmospheric forcing demonstrates that simultaneous measurements

of biological parameters with physical oceanographical and meteorological parameters are needed to get the necessary information for developing parametrizations of the governing processes.

An important part of the project would be the integration of the short lasting events in vertically resolved coupled physical-biological models.

For the INP we suggest a cooperation between institutes interested in the use of moored stations in the North Sea. Possibly different countries will or can conduct this type of research in their region of the North Sea. During the workshop an integrated programme, concerning different moorings in different sea areas and synoptic shipbased surveys also visiting the different mooring sites can be discussed.

INTEGRATED NORTH SEA PROGRAMME

Dr. P.M. Holligan
Plymouth Marine Laboratory

NSTF WORKSHOP ON A CO-OPERATIVE NORTH SEA PROGRAMME 93-95

RESEARCH THEME: LAND-OCEAN INTERACTION STUDY (LOIS): A UK COMMUNITY RESEARCH PROJECT

This programme will elucidate the basic processes that determine the quantities, transformation and fate of materials transported between land, ocean and atmosphere at the land-ocean boundary, and their effects on the properties and health of coastal ecosystems. It will accurately measure and define boundary exchange processes and lead to the development of prognostic models of the regional impacts of continuing development of coastal regions, rising sea level and climate change. The results will be needed for the effective solution of a wide range of environmental problems in the coastal zone, and the management of sustainable exploitation of the coastal ocean's natural resources.

PROPOSED RESEARCH

The overall aim of LOIS is to develop predictive models of the responses of the coastal zone to changes in human activities, climate and sea level. In order to achieve this aim, we need a better quantitative understanding of the transports, transformations and fates of biogeochemically important elements (in particular carbon, but also nitrogen, phosphorus and sulphur) from river catchment basins to the coastal zone. This major interdisciplinary research programme requires contributions from marine, atmospheric, terrestrial, freshwater and earth sciences, and includes combined catchment basin/coastal zone experiments, shelf-edge experiments, and modelling. The major components are:

- development of simulation models of the transfer of materials and energy at the land and ocean boundaries of the coastal seas, with particular emphasis on the mechanisms of physical forcing and non-linear interactions between different processes;

- combined experimental and modelling study of the fluxes into, and out of, the coastal zone, including the processes that determine the particulate and dissolved loads of rivers, movement of groundwater, atmospheric transfers, coastal erosion and accretion, and exchanges across the shelf-break, with emphasis on intermittent events;

- process studies to quantify sources and sinks of matter within the coastal zone, with emphasis on particle-water interactions, the production and fate of organic mater, trace gas fluxes, the effects of contaminants on biogeochemical transformations, and the cohesive properties of sediments;

- reconstruction of changes in the coastal zone during the late Holocene period to identify critical geomorphological and ecological processes that determine the nature of the land-ocean boundary.

Each component will include basic research on hydrological and geomorphological processes and include key process studies, for example:

- effects of catchment processes, biological transformations and freshwater management on the delivery of riverine materials to the coastal zone;

- effects of eutrophication on biological productivity, recruitment processes, ecosystem diversity and stability in the coastal zone;

- atmospheric delivery of nutrients and contaminants to the coastal zone;

- effects of benthic organisms on estuarine biogeochemical regulation;

- sediment transport in the coastal boundary zone and at the outer shelf;

- influence of seasonal stratification on fluxes of oceanic nutrients and shelf sediments across the shelf break.

LOIS will attract the substantial UK expertise in HEIs and Institutes to address these key problems, building on previous NERC investment which has led to instrument and technique development which now enables the rates of key processes to be measured. LOIS will involve the first application of a wide range of new technologies and methods within an interdisciplinary programme on coastal research. These will include the use of advanced acoustic techniques, airborne remote sensing, tracer methods using stable isotopes and biological markers, 'event-triggered' sampling devices, and new methods for pollution analyses and stratigraphic interpretations to test specific hypotheses. New sensitive methods will be used to examine the impact of sublethal levels of contaminants on the cycling of nutrients and other biogeochemically important processes in the sediments. A Geographic Information system (GIS) will be developed for the coastal zone as a means of interfacing models with heterogeneous geographic databases (including remote sensing imagery), and as a basis for developing expert systems for coastal zone management. Modelling will play a central role in testing hypotheses, in defining processes for which better measurements are required, and in creating a broad temporal and spatial framework for site-specific studies.

This Community Research Project will draw on existing NERC research, experience and skills (Figure 1). The shelf edge work will link with the WOCE (World Ocean Circulation Experiment) and BOFS (Biogeochemical Ocean Flux Study) Community Research Projects. Skills used in the North Sea Community Research Project, which terminates in 1992, will be redeployed into LOIS. The development of a land-ocean GIS will build on the terrestrial GIS being developed within the NERC community. Selection of the main study sites will take account of previous and existing studies by NERC and other agencies; collaborative links will be developed with relevant agencies in the UK and overseas. LOIS will enable the UK to make a substantial contribution to the international planning of the International Geosphere-Biosphere Programme (IGBP) core project on Land-Ocean Interactions in the Coastal Zone (LOICZ), thus ensuring that UK priorities are strongly represented. Additional funding for LOIS-related work in a wider European context will be sought through the EC Environment and Marine Science and Technology Programmes (MAST).

IMPORTANCE OF RESEARCH

The research encompassed by LOIS will enable major scientific advances to be made and will deliver the following:

i) the first integrated environmental databases for selected coastal sites;

ii) the first tested simulation models of boundary fluxes and sinks for important properties (eg suspended matter, organic matter, nutrients, contaminants) of the coastal ocean;

iii) a new capability for developing fully coupled land-ocean prognostic models of the impacts of environmental change in the coastal zone.

The research on the carbon cycle will contribute, in conjunction with major studies already underway on the ocean and land carbon cycles (BOFS and the new Terrestrial Initiative in Global Environmental Research, TIGER) to a balanced view of the global carbon cycle, and its significance in terms of atmospheric CO_2 and emissions of other biogenic trace gases from marine and coastal ecosystems. Hydrological studies in TIGER and elsewhere define the relationship between climate and water flows from land to ocean.

Research on boundary exchanges and biogeochemical recycling of materials, and a focus on intermittent events (eg floods and storms) will enable significant advances to be made in understanding the effects of interactions between the land, ocean, atmosphere and sea bed on the properties of the coastal zone. Investigation of the sedimentary record will give the necessary historical perspective of how the land-ocean boundary has changed through the current interglacial period. The continuing development of the UK coastal zone, both in terms of population size and economic value, and the complexity of the environmental systems make it particularly important that these systems are fully understood. This will allow rational and effective action to be taken to meet serious perturbations in the future whether these stem from climate and sea level change, or pollution episodes. It will also produce a clearer understanding of the implications of development and novel uses, both on the coast and upriver.

Co-ordinator P M Holligan
Plymouth Marine Laboratory

Other themes

Dr. B. Becker
Federal Maritime and Hydrographic Agency

Verification of satellite oceanography in the North Sea

Field work and numerical modeling as well as theoretical oceanographic studies will be strongly influenced in the coming decades by the new generation of radar satellites (e.g. ERS-1, JERS (Japan), Almaz (Soviet Union).

They enable oceanographers a routine monitoring of the ocean surface also in night time and during cloud coverage. Potentially these satellite sensors can be used for large area covering field campaigns for which data in regular intervals become available. They can also be sued to calibrate and verify numerical model results. From a practical view they will help to economize the commerical activities connected with the ocean.

Research needs

The data are already available or will be available in a short time. Satellite derived parameters like wind vector fields, sea surface height, surface temperature, current edges etc. will be distributed but a lot of questions are still open and answers will become urgently needed, e.g.:

- How useful and necessary is the sea surface height for prediction of extreme storm surges, how has it to be implemented into appropriate models?
- Are the wind measurements dependent on oceanographic parameters like sea state, air sea temperature difference, slicks, algae mats etc.?
- Are the wind fields representing surface stress, 10 m level winds? What is their importance for layered air-sea boundary layer?
- How can we exploit subsurface information clearly visible in the radar images?
- What are the connections between features in radar imaging and optical satellite sensors?
- Is current information deducable from radar images?

Comments

Such research is timely and necessary since it will turn over the already developed remote sensing techniques into valuable tools for oceanographic research. The North Sea is worldwide a most useful area to start this project because of the variable weather conditions, the high performance of the adjacent research groups and the large economic activities going on in this area.

Research strategy

It is proposed to set up a coordination committee that develop

- a technical plan to incorporate satellite oceanography into the oceanographic activities of the institutions that are doing research in the North Sea
- a plan to acquire funding for a planning period over 10 years

Dr. B. Becker
Federal Maritime and Hydrographic Agency

How reliable are our assessments on the state of the North Sea?

Our assessments on the state of the North Sea and trends in the North Sea ecosystem are based primarily on observational data. These reflect a whole spectrum of processes, and among these one of the strongest signals comes from short-term stochastic weather fluctuations. This masks every longer term development. This effect is amplified by additional sources of spatial inhomogeneity (patchiness). The question of representativity is relevant for all point measurements (practically all in-situ measurements)

This question also applies to model results, since they are dependent on observational data for forcing and for verification. Moreover, models contain various empirical parameters and numerical inadequacies.

Research needs

The most important problems in this respect are:

- application of statistical tests to observational data
- development of appropriate measurement strategies and observational grids for the questions investigated
- formulation of comparative criteria for numerical models

Comments

The use of statistical methods to determine coherence scales, to calculate spectra and to compute signal-to-noise ratios must become routine. The fact whether data are "believed" or not must be reflected in reproducible statistics.

"Aliasing" can rob carefully performed measurements of their meaning. Experimental design, in their conception as well as in measurement frequency, must be oriented on the inherent scales of the problem investigated.

It would be unrealistic - and not even desirable - to expect one North Sea model to satisfy the needs of all researchers. Models will continue to differ with respect to their algorithms, process parameterizations and discretization. It is thus necessary to come to international agreement on test examples and quality criteria.

Research strategy

International expert groups should be formed to compile a catalogue of statistical tests for observational data, from guidelines for experimental design and observational grids to comparative and quality criteria for numerical models.

Ref: AS/INP.2

Research theme proposed for the
Second Integrated North Sea Programme Workshop,

Dr A D Schmidt-van Dorp, WWF International

12 May 1992

INTERACTION BETWEEN SCIENCE, POLICY AND MANAGEMENT FOR THE PROTECTION OF THE NORTH SEA

The health and productivity of the North Sea ecosystem has been of serious concern for a long time. The Common Fisheries Policy of the European Community of 1983, aiming at maintaining stocks of commercially important fish species at a sustainable level, and the Conferences of Ministers responsible for the North Sea in 1984, 1987 and 1990, debating the threat from pollution, reflected this concern. However the approach of modelling the distribution of contaminants and a joint Master Programme for monitoring the concentration of certain substances is unlikely to assess in the short term the state of health of the sea or detect long term effects on the ecosystem.

The third Ministers Conference agreed to adopt a common approach for developing species and habitat protection and appropriate conservation measures. Whereas now several national inventories of marine and coastal biotopes are under development, a common set of principles guiding coordination of scientific information and parameters for management and conservation of the ecosystem still need to be developed for this area (and other marine areas with similar problems).

This workshop needs to consider the methodology to transform scientific knowledge and understanding into concepts useful for policy makers and for the development of practical measures to assist the management in monitoring of the marine and coastal ecosystem, including its living components (such as guidelines, compilation and reproduction of information in maps, information systems etc.).

"CONSERVATION OF THE NORTH SEA ECOSYSTEM"

A Summary of WWF's North Sea Project for the Second Integrated North Sea Programme Workshop,

14 - 15 May 1992, Rijswijk, The Netherlands

By Dr A D Schmidt-van Dorp, WWF International
Panda House, Weyside Park, Godalming, Surrey GU7 1XR, U.K.

WWF'S MISSION FOR THE NORTH SEA

WWF aims:
- to conserve, and where necessary restore, the natural[1] state of the North Sea;
- to achieve integrated management of coastal areas through sustainable use[2], whilst maintaining the maximum area in a natural state;
- to protect the natural flora, fauna, habitats and characteristic ecological equilibrium of the Sea, and therefore its function in the marine ecosystem of the North-East Atlantic Ocean.

ACTIVITIES

The activities undertaken include:

1) Seven reviews of the various parts of the ecosystem

Seven reviews, each on major components of flora, fauna and habitats of the North Sea ecosystem, and on diffuse pollution from land based sources, will compile existing data into ecological parameters and establish ecological objectives for each part. Each review will be made through cooperation of scientists in a number of North Sea countries. The preliminary results will be circulated amongst the scientific and conservation community of the North Sea, who are experts in individual and often separately running disciplines, to incorporate their views and opinions into the final document.

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[1] "Natural" in this context means with antropogenic impact as minimal as not to interfere with the physical, chemical and biological processes the way they would proceed without human presence; the experimental way of testing this is to reduce a particular impact or set of impacts to a level, where any further decrease of the same factor(s) - all other factors remaining the same - does not produce any changes to the system.

[2] "Sustainable use" in this context means: use of an organism, ecosystem or other renewable resource at a rate within its capacity for renewal.

The selection of ecological parameters and objectives will facilitate the development of integrated management of the marine and coastal biotopes in the North Sea. It will also provide an ecological foundation for the establishment of policies and action programmes and facilitate the creation of regulatory structures in the marine and coastal environment.

2) Design and development of a geographical information system

The design and development of a geographical information system which will take specific marine characteristics into account and the implementation of the compiled ecological information into this system. This system will provide the facility to combine data of a varying nature into digital maps and to manipulate this data in mathematical computations. This is particularly important in view of the changeable nature of the marine and coastal environment. It will also provide the facility to print conventional maps, a number of which will be included in the reviews.

3) Pilot study on diffuse sources

A pilot study undertaken on the implementation of the precautionary principle for a number of persistent, bio-accumulating or toxic substances entering the marine environment through rivers, estuaries and other diffuse sources along the Lower Saxonian coast.

4) Dissemination of the results

The seven reviews will form the basis for an awareness-raising programme, involving:
- the publication and distribution of working documents among the conservation and scientific community and authorities involved in management of the North Sea and its coastal areas;
- the publication of booklets in English and French, as individual reports on the various major groups of the ecosystem for the scientific, conservation, coastal and maritime community and for a broad range of the interested public in all North Sea states;
- workshops and lectures.

FOLLOW UP

- For the dissemination of the mapping system a "users friendly" copy is to be produced through a follow up project.
- A long term increase of awareness is to be expected from the preparation of a teachers education package with the cooperation of various international institutes for professional education.

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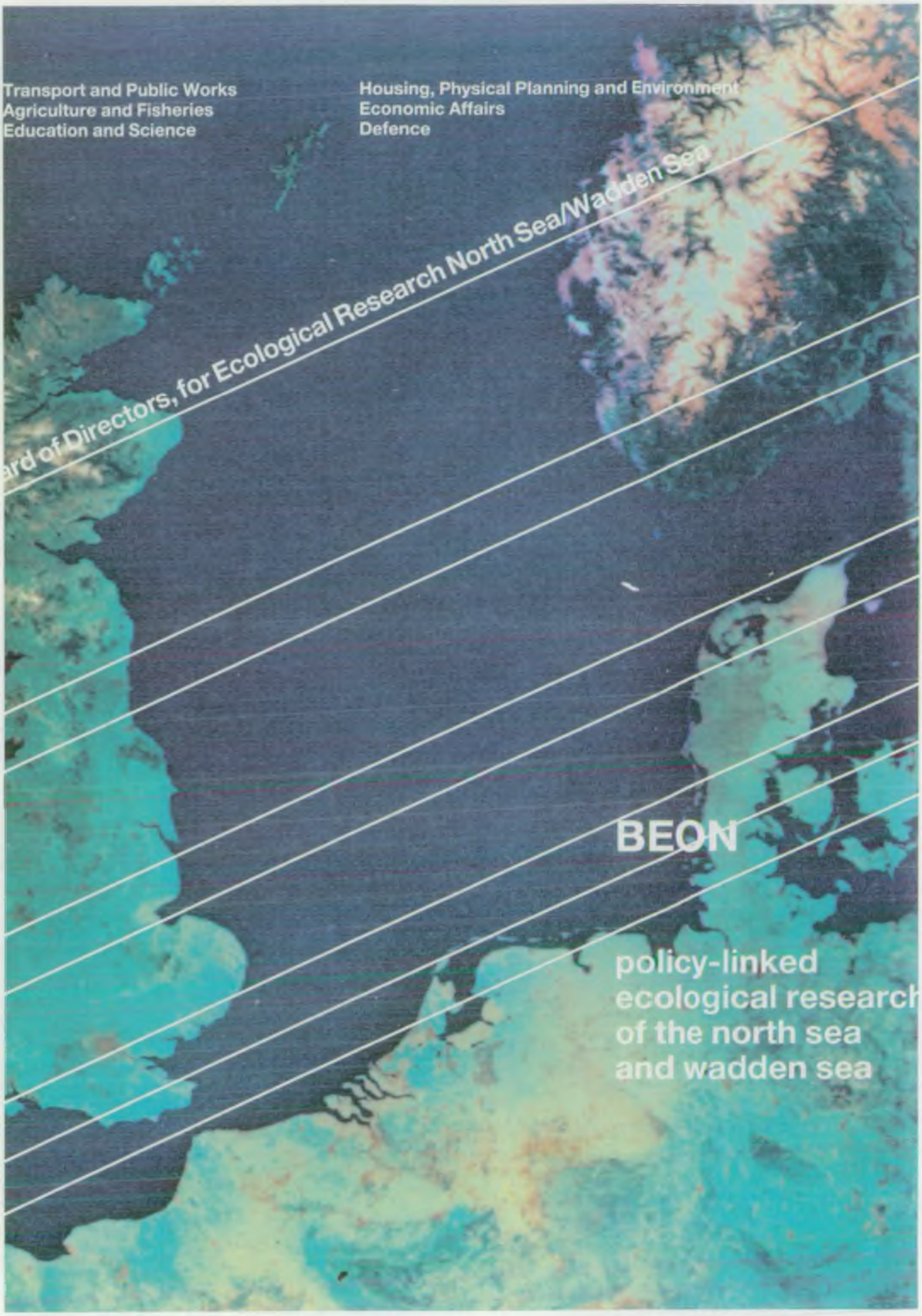
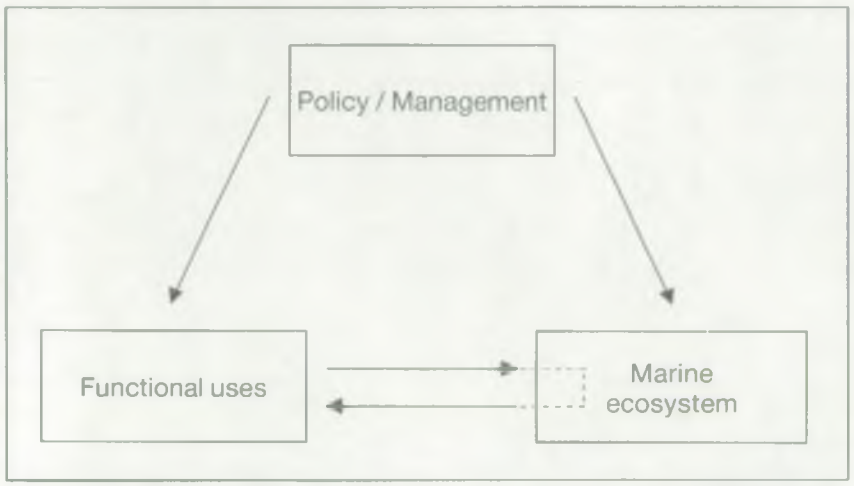

Transport and Public Works
Agriculture and Fisheries
Education and Science
Housing, Physical Planning and Environment
Economic Affairs
Defence
ard of Directors, for Ecological Research North Sea/Wadden Sea
BEON
policy-linked
ecological research
of the north sea
and wadden sea

What is BEON

BEON is the Dutch acronym for 'Policy-linked Ecological Research on the North Sea and Wadden Sea'. It is an ongoing research programme with the following aims:

- involve Dutch marine and environmental research organizations in joint research to produce an integrated picture of the North Sea ecosystem which can be used to assess the temporal and spatial aspects of human impact;
- ensure research strategy is guided by and focused on the problems fundamental to North Sea policy;
- stimulate international co-operation.



The interaction between the marine ecosystem, it's functional uses and policy/management plays an important role in the design of the research programme.

Why BEON

The North Sea basin accumulates large amounts of river water discharged from industrialized Western Europe. It is interconnected to the Atlantic Ocean and the Baltic Sea. Large parts of Europe influence this marine environment via the atmosphere. The North Sea (and the Wadden Sea) are put to varied and intensive use. Many governmental departments from various European countries are involved in aspects of the North Sea.
Because of this human activities and interests readily interact in the North Sea environment. Damage to the marine environment can occur in many different ways.

The Dutch Government pursues a harmonized interministerial policy on the sea areas concerned. The policy is prepared by the Interdepartmental Co-ordinating Committee for North Sea Affairs (ICONA) and the Interdepartmental Wadden Committee (IWC).

In the report entitled 'Harmonization of North-Sea Policy' it was stated that the Dutch Government's policy for the North Sea is directed towards a sustainable development of the ecological values of the North Sea.

This means:

- aiming to preserve and restore the most natural diversity of species and aquatic ecosystems in the North Sea;
- preventing human activities from inducing irreversible damage to the North Sea ecosystem and imparing the important practical functions of the sea;
- preventing further deterioration of environmental quality;
- reducing the extent of environmental pollution.

Contaminants can damage flora and fauna.

Many different contaminants are transported to sea by rivers.

Shipwrecks form a good substrate for a rich biotic community.

The location of the 9 institutes represented on the Board of Directors for Ecological Research on the North Sea and Wadden Sea.

It is essential that this policy be underpinned by an adequate understanding of various aspects of the North Sea environment, such as:

- the ecological functioning of the North Sea system as an entity and its interaction with neighbouring systems;
- the nature and extent of damage done to the marine environment;
- the ecological and social consequences of this impact.

Policymakers were becoming increasingly frustrated by the lack of an integrated picture of these aspects and by the diversity and fragmentation of the information on the North Sea environment. So in 1986 the six Dutch ministers involved in North Sea affairs signed an Interdepartmental Framework Agreement which provides for more intensive co-operation and a more policy-linked approach to ecological research on the North Sea. This agreement laid the foundation for the BEON programme.

Projects for implementation within the BEON programme must be formally approved by the ministries concerned. The ministries are:

- Transport and Public Works (which co-ordinates matters concerning the North Sea);
- Housing, Physical Planning and Environment;
- Agriculture and Fisheries;
- Economic Affairs;
- Education and Science;
- Defence;

The sea has many practical functions e.g. for fishery.

Responsibility for the BEON programme

A Board of Directors for Ecological Research on the North Sea and Wadden Sea (DO) is responsible fo the implementation of the BEON programme. The board of directors of the following (research) institutes is composed of:

- The Delta Institute for Hydrobiological Research, Yerseke (DIHO);
- The Netherlands Institute Oceanic Sciences, Texel (NIOZ);
- The State Research Institute for Nature Management, Arnhem (RIN);
- The State Institute for Fishery Research, IJmuiden (RIVO);
- The National Institute of Public Health and Environmental Protection, Bilthoven (RIVM).
- Rijkswaterstaat (RWS):
  - Tidel Water Division, The Hague, Middelburg, Haren (DGW);
  - North Sea Directorate, Rijswijk (NZ)
- The Netherlands Organization for Applied Scientific Research, Delft (TNO) (Division of Technology for Society);
- The Delft Hydraulics Laboratory, Delft (WL);

Studies at sea and in the laboratory are an important part of marine research.

The Tidal Waters Division not only provides the chairman of the DO, but also houses the secretariat (the BEON Planning Section), which co-ordinates the BEON programme.

BEON's field of research

The Dutch Government's policy is primarily focused on the Dutch sector of the North Sea. From the point of view of research, of course, territorial boundaries of this nature are irrelevant: material flows and marine organisms do not adhere to lines drawn on a map. The North Sea is thus viewed as a single entity within which ecological subsystems (some of them corresponding to geographical areas) can be distinguished. This requires international research co-operation.

The research area does not only include the Dutch sector of the continental shelf, but also Dutch coastal waters such as the Wadden Sea, the Delta region ond other estuaries and bays, plus, adjacent sectors of the continental shelf of other North Sea states.

The research on the ecosystem takes all biological, physical and chemical factors into account.

The North Sea. As ecosystem an entity. Politically the areas has been apportioned between the North Sea states.

The first BEON medium-term plan

The first BEON medium-term plan covering the period 1988-1993 was published in 1987. The plan outlines the aims of the joint research effort and the strategy. The problem areas on which the BEON programme will concentrate are:

- eutrophication
- pollutants, with special reference to micro-pollutants, but also oil and radioactive substances.

The reasons for concentrating primarily on these problem areas are:

- the importance attached to them in government policy;
- the extent and long duration of their effects on the ecosystem;
- the wide range of uses to which the North Sea is put by man.

The programme will also look at the problem of the disturbance caused to the bottom ecosystem by fishery.

A healthy sea provides a home for seals too.

The structure of the research programme was derived from the following relation chain:
Human impact-System-Effect.

The following items will be dealt with:

1. *trends*, both retrospective and prospective;
2. *sources*, with special reference to input via the atmosphere;
3. *transport, sedimentation and erosion*, within the system;
4. *availability of microcontaminants, their uptake and concentrations in organisms;*
5. *biological and ecological effects;*
6. *effects on man*, consequences for human health;
7. *social effects*, consequences for practical functions;
8. *risks analyses;*
9. *problem-solving research.*

As much use as possible will be made of ecological modelling to integrate these various aspects.

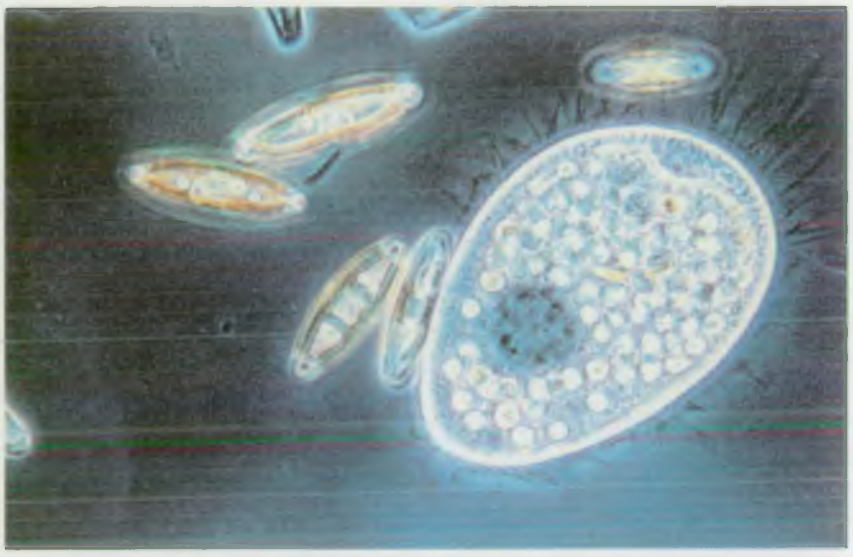
The coastal zone area is a clearly recognizable part of the marine environment.

The research will also pay due attention to:
- development of methodology, including remote sensing, mesocosms and mathematical models;
- the transfer of information.

Co-operation

Co-operation and co-ordination with other programmes and bodies, both domestic and foreign, will feature prominently in the implementation of the BEON programme.
At national level this will involve bodies such as the Consulting Council for Physical Oceanographic Research of the North Sea, the Netherlands Marine Research Foundation and the universities.
At international level, it will involve the North Sea Task Force, and other North Sea states. This will create a basis for international co-ordination.

A very dynamic environment is created where sea meets land.



Microscopic plants and animals form the basis of the foodweb.

The text of the BEON medium - term plan and other information about BEON activities can be obtained from the Planning Section, Policy-linked Ecological Research on the North Sea/Wadden Sea, at the following address:

(PB-BEON)
Rijkswaterstaat
Tidal Waters Division
Koningskade 4
P.O. Box 20907
2500 EX The Hague
The Netherlands

Phone: 31-(0)-70-3745142 or 31-(0)-70-3745144
Telex: 33566 DGWHK NL
Telefax: 31-(0)-70-3282059

MARIS

A CLEAR PICTURE OF THE SEA

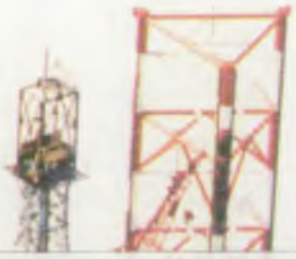
Nowadays reliable information and data are of vital importance when undertaking new projects and carrying out activities. The North Sea is no exception in this case. The construction of a new pipeline, the biological research in the behaviour and presence of certain fish populations, the deepening of the approach channel to a harbour and the defense of coast against the onslaught of the sea are examples, wich illustrate the need for detailed and reliable information and data. Information dealing with the environment, such as composition of the seabed, wave climate, currents, depths, waterquality, fauna and flora, as well as information dealing with the use of the sea by e.g. oil & gas industry, shipping and fisheries. More and more information systems are used to support design and analysis of problems.

Marine Information Service for knowledge, information and data of the North Sea

As an initiative of the Dutch Government the MARIS foundation was established in 1989, aiming at the promotion on a wide scale of the overview and accessibility of knowledge, information and data concerning the sea, in particular the North Sea.

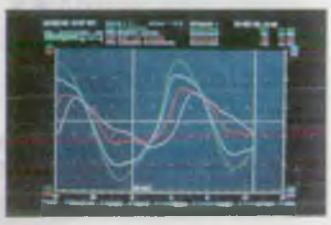
Information service

MARIS acts as an information service and as a data brokerage service. MARIS is in a position to mediate in localizing, and if required obtaining and processing in more detail, all sorts of data and information on the sea and its usage. This is feasible thanks to the extensive network of national and international controllers of marine knowledge, information and data from the governmental-, research-, and trade and industry sector, which are at the disposal of MARIS.



Databases

MARIS supplies a broad selection of databases on diskettes containing a.o. a survey of oil- and gas industrial activities, available measurements data and publications on disciplines like geology & geotechnics, physical oceanography, water quality, marine biology, bathymetry, research projects in the area of marine environment. Databases on the extraction of sand and gravel from the sea, on buoys and peripheral data of importance to the lay-out of electronic chart systems, such as the position and boundaries of military exercise areas, vessel traffic systems, etc.



Oil Patch Directory Europe

MARIS is a partner in the Oil Patch Directory Europe. The OPD is a computerized listing on diskettes of thousands of European companies and institutions supplying goods and services to the oil & gas, marine and maritime industry. The directory with a simple selection programme is distributed amongst decision makers. The programme is updated once every four months. Vendors to mentioned industries are welcome to advertise.

Marine Geographical Information Manager

The MGIM is a dynamic geographic information programme to be used on a PC. By employing simply a mouse the system offers an abundance of opportunities to produce electronic coloured charts with surveys of pipelines, measuring locations, boundaries, water depths (depth contours), etc. The package contains options for various projections, plots (A0-A4), route planning, selection from a chart via a prescribed area, analysis of overlays and to zoom in on a large range of chart scales (between 1:5,000 and 1:10,000,000). MARIS data and own information can be easily added to the chart and basic charts of various sea areas are available. The MGIM can also be used to prepare and guide operations at sea and moreover the MGIM can be employed as a visual entrance to broad databases.

Systeem Analysis and Software Development

MARIS is increasingly active in the development of software as a follow-up to advising on system configuration. A recent example is the ASAP system which was developed for UNEP in cooperation with Delft-Hydraulics and BSO/Origin. The system is used to chart the environmental consequence of the Gulf War for the Arabian Gulf, to analyze the measures taken and to evaluate the effectivity of these measures.

Real Time Hydro Meteo information

MARIS is also agent for marine environmental data which are collected by Rijkswaterstaat (Public Works Department). The Multipurpose Presentation Unit is one of these recently developed products. The availability of a PC and modem enables anyone to receive real time data from various hydrological and meteorological monitoring networks which are managed by Rijkswaterstaat. These measuring networks concern the Dutch coastal waters and the entire North Sea, and comprise data such as water levels, wave heights, wind force, temperature, etc. Historic, actual and forecasted hydro meteo data can be consulted with this MPPU-package.

For further information:

MARIS

P.O. Box 5807, 2280 HV Rijswijk, The Netherlands,
Telephone: +31 (0)70 3949500, ext. 253/252, Facsimile: +31 (0)70 3900691.

APPENDIX E

NRA

Integrated North Sea Programme

INP Workshop 14th/15th May 1992 at The Hague

Chemical Analysis Methods - Methodology for Organic Analysis

The UK National Rivers Authority (NRA) has a research project with the objective of improving Annex 1A analytical methodology. The aim of the project will be to increase sample throughput and reduce cost through time and manpower savings produced by the use of new technologies. The project will also look at producing methods for the unambiguous identification of Annex 1A organics.

The specific objectives of the project will be:

i) to develop solid phase abstraction (SPE) methods for Annex 1A organics in treated sewage, river water and saline samples;

ii) to develop robot compatible abstraction methods for fish tissues, sediments and sewage sludge for Annex 1A components;

iii) to investigate mass spectrometry for unambiguous identification of Annex 1A organics;

iv) to determine the cost benefit of any new analytical methodology as a result of the research.

At present the NRA's research in this topic area is introspective. It may be an area where international collaboration would be possible. It would be useful to know the extent of similar work in other countries.

Integrated North Sea Programme

INP Workshop on 14th/15th May 1992 at The Hague

NRA

Coastal Water Monitoring and Surveillance using Ships and Aircraft

The UK National Rivers Authority has a duty to assess the quality of all fresh and marine waters including coastal waters as far as the three mile territorial limit. For England and Wales this three mile wide strip amounts to some 8000 square miles and is by far the biggest amount of water for which the NRA has water quality responsibility. It is not feasible to monitor the quality of the water in this area in a similar manner to that of inland surface waters; nor is this desirable. Different techniques are needed.

The NRA has commissioned two research projects to examine the feasibility of monitoring coastal waters by remote sensing by satellite and a combination of aerial/shipboard surveillance. The results of the project on satellite remote sensing show that space born sensors lack resolution and there are limitations on image availability due to cloud cover. The results of the second project using ships and aircraft were more favourable. Spatial resolution was typically between 1m and 10m and, although cloud cover did affect results it was often possible to fly beneath a high cloud base thus reducing weather dependency.

This second research project was carried out during the summer of 1991 and had the following specific objectives:

i) to carry out a combined aerial and marine survey around the UK south coast from the River Thames to the River Severn to provide near-synoptic multi-spectoral data, aerial photographs, water samples and water quality data;

ii) to arrange for the processing of the data from the aerial survey to provide information with respect to chlorophyll, suspended solids and other water quality parameters;

iii) to calibrate the aerial spectral data using information gained from the water samples;

iv) to review the data obtained and make recommendations on the viability of using these techniques as a monitoring tool;

v) to produce a rationale for monitoring coastal waters using remote sensing techniques.

The project dealt not only with the scientific validity of the monitoring approach, but also tested the logistics of carrying out such an operation. It was undertaken by the Department of Oceanography at the University of Southampton and involved the use of the twelve channel Daedalus Airborne Thermatic Mapper (ATM) and the more advanced 288 channel Itres research Compact Airborne Spectrographic Imager (CASI) flow in a navajo chieftan aircraft belonging to the Natural Environment Research Council plus the NRA's research vessel Vigilance.

Following the conclusion of this research project, consideration is being given to extending the approach on an operational basis to all the coastal waters for which the NRA has water quality responsibilities. The proposal is for four surveys per year around the coast of England and Wales with each survey combining data obtained from the NRA's survey vessels with remote sensing data obtained from a multi-spectral imager. The information obtained would be as follows:

NRA

a) Continuous trace readings around the coast from the vessels for:

i) dissolved oxygen;
ii) salinity;
iii) temperature;
iv) pH
v) optical density (transmission)
vi) chlorophyll

b) From a network of survey sites every 15km around the coast water samples would be taken and analysed ashore for, in the first instance, the following determinands;

i) nutrients (phosphate, total oxydised nitrogen, nitrite and silicon)

ii) metals (zinc, copper, cadmium, mercury, nickel and chromium)

iii) suspended solids.

Each complete annual coastal survey would take 26 days of boat survey time.

At the same time as (or within a few hours of) the boat surveys, the coast would be overflown by plane with a multi-spectral imager and a survey camera, integrated to a navigation system enabling the data to be inter-related to the boat data.

The intention is that the monitoring strategy would provide the following information:

i) levels of winter (February) nutrients, particularly nitrate, which are essential for assessing the level of eutrophication and determining any designated sensitive areas in relation to the EC Nitrate and Urban Waste Water Treatment Directives;

ii) the location, occurrence and intensitive of algal blooms by reference to the chlorophyl concentrations;

iii) baseline data from a standardised network of sites to fulfil monitoring obligations arising from other EC directives and from the Joint Monitoring Programme of the Oslo and Paris Commissions and the North Sea Task Force;

iv) information on the plumes and mixing zones of the major discharges which could be sources of nutrients or other chemical inputs of interest and which would enable precise delinearation of sampling points in relation to them.

There is considerable scope for the use of these facilities in Europe. Opportunities exist through the Flux Manche Programme for collaboration with France, Holland and Belgium. The main link with Holland exists between Southampton University and NIOZ, Texel looking into spectral analysis.

Integrated North Sea Programme

INP Workshop on 14th/15th May 1992 at The Hague

NRA

National Rivers Authority
Anglian Region

Controlling hazardous substances on the North Sea action list

The UK National Rivers Authority (NRA) has been monitoring for Red List and Annex 1A substances for two years. All significant freshwater rivers are monitored at the tidal limit. Discharges of trade or sewage effluent made direct to estuaries and coastal waters are analysed at the point of discharge. Samples are collected monthly at approx 250 locations (100 rivers, 100 sewage works and 50 industrial sites).

The first six months data (July 1990 - December 1990) have been worked up to give discharge loads using the Paris Commission procedure. Here less than values are first treated as real values and a high load calculated: they are then treated as being zeros and a low load calculated.

The 1990 low loads have been ranked across all ten NRA regions (ie England and Wales) to give an indication of where the major loads occur. Until results are available for a calendar year only limited conclusions can be drawn. Seasonal factors (particularly relevant for some pesticides) will be missing from the 1990 data. The 1991 data are currently being worked up but will not be available for some months. The 1990 data are for the UK Red List substances: subsequent data are for the full Annex 1A list (except dioxins).

For control purposes an initial division has been made into substances that appear to be diffuse in origin (ie principally river borne), those that appear to be of point source origin (ie principally from effluents) and those that appear to be of mixed origin. Point sources can be controlled by the NRA using existing legislation to vary the discharge consent and decrease the amount of the particular substance that can legally be discharged. Diffuse sources will be more difficult to control and may require restrictions on marketing and use.

On first appearance the following substances are point sources: mercury, cadmium, dichlorvos, 1,2-dichloroethane, azinphos-methyl (but detected in few samples) and malathion. The rest are either diffuse or mixed.

Currently the NRA is extending its analysis of trade and sewage effluents to some of those discharging to fresh water rivers above the tidal limit in an attempt to reduce the apparent number of diffuse sources. It is also discussing with dischargers already identified as having significant loads of Annex 1A substances how they might reduce those loads.

NRA

Integrated North Sea Programme

INP Workshop 14th/15th May 1992 at The Hague

Chemical Monitoring - Quality Control and Sampling Procedures

The UK National Rivers Authority has a research project, the objective of which is to define suitable protocols for a quality control programme for the sampling, storage and transportation of samples. It will also seek to determine the cost and practicality of such a programme.

The specific objectives of the project will be:

i) to produce a draft protocol for the inclusion of a quality assurance programme into routine sampling programmes;

ii) to design and carry out an intensive sampling and analysis exercise to provide sufficient data over a relatively short time period to determine the magnitude of sampling errors;

iii) to carry out a pilot exercise to test the practicality and acceptability of (i) above.

The background to this project is that whilst much quality control activity has been directed towards the assessment of errors arising during analysis and on the suitability of sample bottles and preservatives, little is known about the magnitude of errors occurring during sampling collection and transportation. It is recognised that the introduction of quality control into sampling activities is not likely to be easy. The aim of the project is to provide sufficient information to enable sound decisions to be made on this issue.

It is anticipated that the final report on the project will include a code of practice for the routine quality control of sampling activities. It will also include information on the costs and practicalities of implementing such a code of practice as well as data indicating possible areas in which errors may occur and the magnitude of such errors.

Errors arising during the collection of samples affect all monitoring programmes. It will be useful to know to what extent this research area has been investigated by other countries involved in North Sea monitoring work.

NRA

Integrated North Sea Programme

INP Workshop on 14th/15th May 1992 at The Hague

Bio-accumulation of Annex 1A Organic Compounds

The UK National Rivers Authority (NRA) has a research project, the objective of which is to develop code of practice on the use of bio-accumulation techniques for monitoring Annex 1A trace organics substances in freshwaters and estuaries. The specific objectives of the project are as follows:

i) to review the literature on and current practices with bio-accumulation techniques for assessing the distribution of persistent pollutants;

ii) to determine suitable organisms to use as the accumulators of specific substances;

iii) to identify research needs and formulate a programme of work;

iv) to undertake a practical evaluation of relevant organisms for monitoring particular substances;

v) to formulate a code of practice for the use of bio-accumulation as a monitoring technique.

The background to the project is that there is a need for a method which would enable the NRA to monitor effectively, and with confidence, situations where intermittent pollution exists involving pesticides and similar compounds. There is increasing concern about contamination of surface and underground waters by organic pollutants. The sources are often diffuse or intermittent and the levels present are often at, or below, the limits of detection. Living tissues are able to accumulate many substances to levels which are easier to detect and also act as integrators of episodic discharges. Bio-accummulation techniques are already in use within the NRA but variations in methodology can hinder the comparison of data. Standardised techniques may therefore be an advantage. Research into the significance and interpretation of the data obtained is also required.

The use of bio-accummulation techniques will be common in other countries and it will be interesting to hear to what extent similar research is being carried out.