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INTERNATIONAL COUNCIL FOR  
THE EXPLORATION OF THE SEA

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Hydrography Committee  
Ref Plankton Committee

REPORT OF 1ST MEETING OF ICES WORKING GROUP ON COORDINATION OF HYDROGRAPHIC  
INVESTIGATIONS IN THE NORTH SEA, 12-13 MARCH 1974 IN LOWESTOFT

Participants

H W Hill (Chairman)  
J W Ramster  
H Weidemann  
K P Koltermann  
A Svansson  
L Otto  
R Ljoen  
G Pichot  
J H Steele  
R R Dickson (Secy)  
W Lenz (Observer)  
G Radach (Observer)  
J W Talbot (Observer) part time for Items 5(a) and 5(b)  
D Jeffries (Observer) " " " " " "  
J Dutton (Observer) " " " " " "  
P G W Jones (Observer) " " " " " "  
D H Cushing (Observer) part time for Item 5(c)

Item 1. Adoption of Agenda

The agenda was adopted after the addition of Item 5(c) "Possible wider collaboration during JONSDAP NORTH" which Dr Cushing, Chairman of Plankton Committee, was invited to attend.

Item 2. Discussion on draft report of Working Group on Permanent Moored  
Current Meter Stations in the North Sea

After a short discussion of the major items, a small ad hoc group was detached to prepare the final draft of the report for approval under Item 8.

Item 3. Cooperative North Sea investigations in progress

(a) Report on JONSDAP SOUTH

The Group felt that while the informal nature of JONSIS was initially its most advantageous feature, this informality may be a disadvantage under certain circumstances. It was thought that in the competition for funds with other more formal agencies, in the coordination of biological and physical problems, and in the regulation of data exchange, some of the research activities of JONSIS now required the authority of firmer government control.

The Group recommends that future cooperative experiments of this type

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should be conducted as far as possible as ICES ventures. It is further suggested that the present JONSDAP-NORTH experiment might also gain by seeking the endorsement of ICES at this stage.

As regards the JONSDAP-SOUTH experiment (now completed) the group felt that it would be impracticable to attempt a complete publication of results. Instead the group recommends that charts of certain basic parameters ( $T^{\circ}$ ,  $S^{\circ}/\text{oo}$ ) should be published in some suitable publication (Ann. Biol.) but that the remaining data should be issued in the form of data inventories only.

(b) Report on JONSDAP NORTH

Dr Svansson reported on the progress to date in planning the JONSDAP-NORTH experiment. The group noted the need for preliminary studies to optimise the planning of this experiment. Specifically these are:

- (i) the use of North Sea models to plan the best station positions on the northern boundary;
- (ii) estimates of the spatial variability of currents;
- (iii) estimates of Stokes drift;
- (iv) further development of acoustic release and deep mooring techniques.

The group then discussed the three main facets of the JONSDAP-NORTH experiment:

- (1) the Fladen physical-biological-chemical experiment;
- (2) barotropic modelling for storm surge prediction;
- (3) the study of the inflow and outflow in the North Sea as a baroclinic problem.

A need was evident for further detailed studies in order that the time and space scales covered by the JONSDAP-NORTH experiment might be tailored to the solution of these three distinct but connected problems. This becomes important in view of the limited resources of ship-time and equipment available.

It was suggested in addition that since the JONSDAP-NORTH experiment does, in fact, now concern the whole North Sea, it might aid the participation

of certain nations (France, Belgium, Holland) if the name were changed to JONSDAP 76.

Item 4. National cruise plans for 1974.

These are described on the following timetable and footnotes:

	J	F	M	A	M	J	J	A	S	O	N	D
FRG						X		X	X			
Belgium				X	X				X			
Holland												
DAFS				X								
Norway	X	X				X	X				X	
Sweden					X				X			X
MAFF	X		X	X	X				X			

FRG. Apart from GAUSS cruises in the southern North Sea (5-20 June and 26 August-12 September) a current meter station will be maintained in the German Bight from March to early winter.

Belgium. Plan 2 big surveys of a 50 station grid.

Holland. Busy with data reduction from JONSDAP-SOUTH in 1974 but NLOZ will conduct 3 two-week cruises on chemical/pollution problems in the Southern and German Bights.

In 1975 seetime has been reserved to clear up any outstanding problems connected with JONSDAP-SOUTH but may be of assistance to JONSDAP-NORTH experiment at the same time.

DAFS Plan hydrobiological work on plankton patchiness along  $0^{\circ}30'E$  between  $58^{\circ}$  and  $61^{\circ}N$ . This cruise will provide data required for the planning of the Fladen experiment.

Norway As an extension of past surveys (at least 1 cruise per year since 1967), three surveys will be made at 200 stations between  $56^{\circ}$  and  $61^{\circ}N$  (14 January-10 February, June - early July and 1-27 November) plus more frequent sections from Bergen to Shetland and Arendal to ?

Sweden Three routine east Skagerrak cruises supplemented by a more frequent Kattegat section.

MAFF Two Stokes experiments in March, with the possibility of further work during equipment tests in April/May. Trace metal surveys in January, March and September.

Most members felt that little could yet be said about plans for 1975.

Item 5a. Input of pollutants to the North Sea

The group addressed itself to a question posed by the ICES Advisory Committee on Marine Pollution concerning the input of pollutants to the North Sea. After a wide ranging discussion the group felt that this problem would best be approached by preparing material for two future meetings and recommends the following:

- i. a joint session with the ICES Working Group on International Study of the Pollution of the North Sea at its next scheduled meeting; for this meeting members of the Working Group are asked to prepare detailed assessments of pollutant inputs in specific key areas eg Humber (UK MAFF), Clyde (UK DAES), a typical fjord (Norway), etc and to present them for informal discussion;
- ii. the preparation of two papers for presentation to the Hydrographic Committee at the Statutory ICES Meeting in 1974. Firstly a presentation by Professor Wollast of the current Belgian attempt to model the dispersion of pollutants by sediment transport, solid suspension, solution and biological uptake in the Schelde estuary. Secondly (if possible) a report by De Groot on the Dutch study of dispersion pathways in the Rhine estuary, Dutch coast and Wadden Sea.

The group noted the difficulty (also experienced by other groups such as SCOR) of providing quantitative assessments of total pollutant input but felt that the above approach may identify some of the grosser generalities of the problem.

Item 5b. Consideration of flushing time and water budget of the North Sea

The group also addressed itself to a question posed by the ICES Working Group on the International Study of the Pollution of the North Sea and its

Effects on Living Resources and their Exploitation. Specifically this question concerned the availability of data on the water budget and flushing time of the North Sea. In discussing this problem the group noted that although various estimates of water budget have been published, the observational bases for these estimates are extremely poor. Thus current estimates of oceanic inflow in the northern North Sea vary from 23 000 km<sup>3</sup>/yr to 44 000 km<sup>3</sup>/yr, while those of inflow from the Channel range from 1 800 km<sup>3</sup>/yr to 7 400 km<sup>3</sup>/yr. More generally the group questioned the usefulness of any single "North Sea" estimate of flushing time since it was felt that the residence time of a watermass is likely to vary greatly in different hydrographic regions of the North Sea.

The group elected to investigate the reliability of our present figures for each major component of the water budget and to investigate whether radioactive tracer studies or the use of mathematical models are capable of improving the reliability of our present estimates.

Related to this the Group noted that the volume transport data derived from the Dover Straits telephone cable now appear to be giving reliable estimates of the drift to the Southern Bight. Since these data are of wide general interest, the group recommends that JONSIS should approach IOS with a view to making these data more widely available on a continuing basis.

Item 5c. The possibility of wider participation in the Fladen Ground project of JONSDAP. NORTH

Svansson, Radach and Steele reported on the current detailed plans for this experiment. Basically this is envisaged to be a multi-disciplinary study of some 3 months' duration aimed at a full description of the development of the thermocline and of phytoplankton and zooplankton production cycles especially the interactions of these physical and biological processes. The experiment is sited in a zone of weak currents in the hope that this will permit a meaningful characterisation of events within a

restricted area of the North Sea. However advective processes will be monitored (by drogues, dye and current meters) so that their influence may also be considered. Models will be developed and verified by measurements for both physical and biological-chemical processes.

Further biological and hydrographic support for this experiment were offered by MAFF (Cushing) and Belgium (Pichot). However, in order to encourage the fullest participation by other agencies the group recommends that the plans for this experiment should be described at a joint meeting with the ICES Plankton Committee and it was suggested that Dr. Gillbright, as a member of the Plankton Committee associated with the project should make such a presentation.

The group noted that although, from preliminary estimates, there appeared to be sufficient equipment resources to cover all three main aims of JONSDAP NORTH, this was most likely to be achieved in practice if firm planning was begun now. It was also noted that subsequent data processing would be made easier if procedures were firmly standardised at this stage. For these reasons the group recommends that planning for JONSDAP NORTH should be coordinated under two Project Managers working in close liaison [one from SFB 94 Meeresforschung Hamburg concerned with the Fladen project; one concerned with the inflow/outflow and storm surge modelling projects].

Item 6. Possible cooperative exercises during 1974 and 1975

The group felt that the main pre-JONSDAP-76 exercises should aim to provide the following information:

1. Estimates of Stokes drift from as many different areas of the North Sea as possible;
2. Estimates of spatial variability, especially, on the Fladen Ground.

The following Stokes drift experiments were thought to be possible during 1974 and 1975:

- a. MAFF Two experiments, March 1974 off Lincolnshire coast; with the possibility of further work in 1975;
- b. FRG One experiment, German Bight, June 1974, GAUSS; with the possibility of further work in 1975;
- c. Norway Possible, 1974; with the possibility of an experiment in the Norwegian Rinne in 1975.
- d. Belgium Probable 1974 (1975, unknown);
- e. Holland One or more experiments in 1975, probably in the following contrasting locations - (i) Southern Bight  
(ii) NW of Texel (amphidromic point);
- f. Sweden Possible in 1975 (new ship).

It was noted that if possible Stokes drift experiments should also be conducted in the northern North Sea, to the north and to the south of the latitude of Aberdeen since this appeared to cover a zone of contrasting current regimes and was necessary for the interpretation of results from the Fladen experiment.

As regards spatial variability estimates the group noted that these were chiefly required from the Fladen Ground and the northern boundary line of JONSDAP NORTH. DAFS and Belgium hope to conduct such exercises in 1975; other national efforts were unclear until the research cruise schedules for 1975 become firmer, though Holland will probably be able to conduct similar studies off the Dutch coast in 1975.

The group recognized, however, that the standard Norwegian section worked along  $59^{\circ}17'N$  since 1967 provided a valuable data base from the point of view of spatial variability and recommends:

1. that vessels crossing this area are asked to work this section whenever possible;
2. that these vessels should make observations of temperature, salinity, plus (if possible) phosphate, nitrate and chlorophyll at standard depths, and at standard stations;

3. that surface and bottom temperatures from this section should be transmitted direct to DHI Hamburg (who will bear the cost).

During further discussion of this general problem the group raised the question of experiments to compare residual drift estimates from current meters with the drift of dye patches. Dr Weidemann confirmed that this would be one aim of the Fladen project.

Item 7. Data coordination and exchange

The group considered its terms of reference under this heading. It was noted that since organised channels (Service Hydrographique, National Data Banks, etc) do exist to handle routine data exchange this group should address itself specifically to those problems of data exchange arising from cooperative experiments such as JONSDAP. The group notes:

(1) The importance of firm planning before each such exercise to ensure uniformity of data and so facilitate data reduction;

(2) that the general problems of data exchange in cooperative experiments are well set out in the Report of the Working Group on Permanent Moored Current Meter Stations in the North Sea.

Item 8. Acceptance of final Report of the Working Group on Permanent Moored Current Meter Stations in the North Sea

The group examined the latest draft in detail and made a number of amendments. It was then agreed subject to some minor additional changes which were to be incorporated in the final draft which is attached as Annexure 1.

Item 9. Advice to JONISIS on suitable locations for a long term network of stations

There was some discussion of suitable locations for long term buoys but it was felt that in view of the impending North Sea/Baltic and Faroe/Shetland sub-regional group meetings of COST the following week,



advice at this stage to JONSIS would be premature. It was also felt that some study should be made of the results of the JONSDAP SOUTH experiment before offering such advice.

Item 10. Any Other Business.

No other business was raised.

H W Hill  
Chairman

Agenda

Tuesday 12 March

- 1 Adoption of agenda.
- 2 Discussion on draft report of W G on Permanent Moored Current Meter Stations in the North Sea. (Small ad hoc group to meet separately to prepare final draft).
- 3 Co-operative investigations in the North Sea already in progress:
  - (a) Report on JONSDAP SOUTH;
  - (b) Report on JONSDAP NORTH (Dr Svansson).
- 4 National cruise plans for 1974 and 1975.
- 5 (a) Input of pollutants to the North Sea (Dr Svansson);
  - (b) Consideration of water budget and flushing time of North Sea.

Wednesday 13 March

- 5 (c) Possible wider collaboration during JONSDAP NORTH.
- 6 Possible co-operative exercises during 1974 and 1975:
  - (a) Stokes drift experiments;
  - (b) Others.
- 7 Data co-ordination and exchange.
- 8 Acceptance of final Report of W G on Permanent Moored Current Meter Stations in the North Sea.
- 9 Advice to JONSIS on suitable locations for long term network of stations.
- 10 Any other business.

ANNEXURE 1

The Conclusions and Recommendations of the Working Group on  
Permanent Moored Current Meter Stations in the North Sea

From its consideration of the results of setting up a pilot North Sea network of moored current meter stations in the North Sea during the period October 1970-October 1971 the Working Group concludes that:

- (i) The moored station technique is viable even in a heavily-fished area like the North Sea and even when relatively small marker buoys and associated light anchors and wires are used. Care must be taken in choosing station positions, however, and where possible reference should be made to recent charts by calendar month or season of fishing intensity by statistical rectangle. It would seem possible too that losses might be reduced if rather bigger surface buoys than those used in 1970-71 were brought into operation.
- (ii) From the generation of moored self-recording current meters as personified by the Plessey MO 21, the Aanderaa Mark 4 and the various Hydrowerkstätten models, 60-80 per cent of the expected data will be obtained, provided that the station is not disturbed or broken up by fishing activities. The data loss due to instrument mal-function of one kind or another is of the same order as that from instrumental loss.
- (iii) (a) In all moored current meter studies, the careful preparation of instruments and the most detailed pre- and post-cruise calibration checks of all sensors are of crucial importance. In particular, as far as studies of residual current systems are concerned, it is essential that the most systematic and detailed checks of the direction sensor should be carried out.  
(b) In any exercise involving the use of more than one type of current meter, an intercalibration station, made up of at least one example of each type of meter being used, with the instruments placed as close to each other as possible on the common meter wire, is an absolute necessity.
- (iv) The residual trends from the stations maintained by the Group support the view that in the Southern and German Bights of the North Sea the wind regime is the main factor deciding the nature of the residual drift over a period of 1-7 days. The suggestion, provided by many earlier studies, that there is steady drift

north-eastwards from the Straits of Dover to the German Bight for most of the time is not supported by these data. On the other hand, in the western half of the central North Sea, an area that is here taken to include all the Dogger Bank, factors other than the 7-day wind regime appear to be of greatest significance.

- (v) Whenever a future group is formed to manage a similar moored current meter network it would be an advantage:
  - (a) to designate, from among the members, a project manager, who would be able to give first priority to work connected with the Group's activities in his day-to-day schedule;
  - (b) to develop common data-processing systems on the lines of Table 4 of this report, and for all members to have tested their system on a master-set of data before any new field data are processed.
- (vi) Existing National Data Centres and those in the process of being formed should be urged to agree among themselves on a common format for the storage of original recording current meter data, as corrected and approved for general circulation by the collectors of each set of data.
- (vii) It is vitally important that all European fishermen are informed of any moored stations that are established for any reason, and that they are frequently reminded of their existence. Ideally a daily broadcast from all coastal radio stations is required throughout the period of any exercise.
- (viii) These results confirm the need for at least near-top and near-bottom records to be obtained from any moored current meter station, so that at least the outline of the character of the water movements at that observation point can be provided on an objective basis.
- (ix) In the immediate future, particular attention should be paid to the need for investigating in the North Sea area:
  - (a) the nature of the Stokes' Drift Correction Factor;
  - (b) spatial variability in general;
  - (c) the residual circulation of the area north of  $55^{\circ}\text{N}$ .
- (x) Mathematical modelling work that assumes the existence of a single wind regime for the whole of the North Sea basin during a particular run is more closely applicable to the field situation than is generally supposed. When such work makes use of field data it would seem that mean values of gradient winds are likely to be

at least as useful as those calculated from wind observations at coastal stations.

### RECOMMENDATIONS

1 Having regard to these conclusions in general, the Working Group thinks that it is clear that moored buoy network studies are of very great value in furthering the understanding of the nature and variability of large-scale circulation patterns at all scales but particularly at the large (sea-area) scale. It accepts, however, that such studies pose equally large-scale financial and logistical problems. It recommends, therefore, that before another ICES-sponsored network similar to the pilot venture of 1970-71 is set up, the Hydrographic Committee should assess carefully beforehand the uses to which the data will be put, see how far existing networks or sets of data meet these uses, pay particular attention to the time-scales involved in getting stations established and reports written, and then, and only then, decide the most cost-effective way of using the limited resources of its members.

2 Because of the complications and possible misinterpretations brought about by the differences in theory between Eulerian and Lagrangian drift the Working Group recommends that anyone wishing to use the results of this exercise should consult a Working Group member before beginning their analysis.

3 In view of the critical importance of estimates of residual drift in many aspects of fisheries investigations, the Working Group recommends that the calibration of self-recording current meters should be placed on a systematic international footing, at least as far as ICES members are concerned. In particular it recommends that a European intercalibration centre should be established which, ideally, would not only provide standardized calibration facilities on a routine basis, but would also study the interactions of current meters and their moorings in continental-shelf locations.

4 The Working Group recommends that the new Working Group on Coordination of Hydrographic Investigations in the North Sea should lay particular stress on investigating:

- (a) the nature of the Stokes' Drift Correction Factor;
- (b) spatial variability in general;
- (c) the residual circulation of the area north of 55°N;
- (d) the influence of the wind as a forcing function on residual water movements; in this context reference should be made first to Section 6 (iii) of this report.