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International Council for the
Exploration of the Sea

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Quality Committee

REPORT OF THE
WORKING GROUP ON MARINE POLLUTION BASELINE
AND MONITORING STUDIES IN THE NORTH ATLANTIC

Lisbon, 28 February - 2 March 1984

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1. OPENING OF MEETING

- 1.1 The Chairman, Dr. M. Parker, opened the meeting at 10.00 hrs on 28 February 1984 and welcomed the participants.
- 1.2 Professor Remy Freire, Director of the host Institute, the Instituto Nacional de Investigaçao das Pescas, welcomed the participants to Lisbon and to his Institute. He stated that his Institute would like to have a close working relationship with similar institutes in other countries and this meeting could be instrumental in promoting this. He wished the meeting all success in its work.
- 1.3 Each member then introduced him- or herself and indicated the main areas of research interest.

2. APPROVAL OF AGENDA

- 2.1 The Working Group reviewed the draft agenda and adopted it without change. The agenda is attached as Annex 1. The list of participants is contained in Annex 2. The ICES Environment Officer served as Rapporteur.
- 2.2 The Working Group went over the papers that were to be considered during the meeting. Almost none of the papers had been available for circulation in advance of the meeting. It was considered important to try to circulate as many papers in advance of the meeting as possible; accordingly, it was suggested that reminders concerning the early preparation of papers should be sent to members along with the draft agenda prior to the Statutory Meeting.

3. ACTIONS OF COUNCIL AND ACP, AND RELATED ICES ACTIVITIES

- 3.1 The Working Group took note of a list of relevant resolutions from the 1983 Statutory Meeting, which had been circulated prior to the Working Group meeting.
- 3.2 The Environment Officer informed the Group about the main items of interest from the meeting of the Marine Chemistry Working Group (MCWG) the previous week. It was agreed that more detailed consideration of the results of that meeting should take place under the relevant items of the agenda.

4. OTHER INTERNATIONAL ACTIVITIES

- 4.1 JMG - Dr. J.E. Portmann reported on the outcome of the meeting of the Joint Monitoring Group (JMG) of the Oslo and Paris Commissions that had taken place in January 1984 (Doc. WGMFNA 1984/4). He stated that the Commissions

have taken a serious approach to assessing inputs of mercury, cadmium and PCBs to the marine environment and that a report giving estimates of land-based inputs (direct discharges, coastal runoff and riverine inputs) had been reviewed by the JMG. The JMG had reviewed the results of its monitoring programme on mercury and cadmium in biota and sea water and PCBs in biota. Dr. Portmann noted that almost all of the JMP data are of relevance to the ICES Cooperative Monitoring Studies Programme, but that many of these data are not submitted to ICES. According to the rules of the Commission, ICES cannot use JMP data unless an express statement is given that the data are submitted to ICES, also. Dr. Portmann stated that the JMG is still concerned about the analysis of PCBs in marine samples and looks to ICES for the appropriate advice. There is a growing impatience to receive this information, including on how PCB concentrations obtained using packed columns can be correlated with values obtained using individual isomers. The results of a pilot monitoring of PCBs, mercury and cadmium in sediments were reviewed. The data on trace metals showed that there were still many problems to be resolved in terms of the grain size fraction to be analyzed and the methods of extraction or digestion to use. The JMG had also discussed the computerized handling of JMP data by ICES.

- 4.2 In the discussion of the JMG meeting, the problem was highlighted that data on contaminants in fish and shellfish are often submitted to JMG without also being submitted to ICES. Accordingly, the Working Group strongly recommended that countries submitting data for the JMP should mark the data forms to indicate that the data are also submitted to ICES. This is done by inserting an "I" in field number 6 (organization code) of the Fish/Shellfish Contaminant Master form. If this is not done, ICES will not be able to utilize these data in its own work, given the present rules for data use in effect by the Commissions and accepted by ICES.
- 4.3 Dr. Arne Jensen reported that, with regard to the Oslo/Paris Commissions' request to ICES to prepare an overview report on the atmospheric deposition of contaminants to the sea, several members of the MCWG had agreed to prepare this paper but had not yet done so. In the meantime, the Paris Commission has set up a Working Group on Atmospheric Deposition. Noting that the overview paper from MCWG should be available next year, the Working Group agreed that it would also like to review and discuss this report at its next meeting.
- 4.4 GESAMP - Dr. A.D. McIntyre informed the Group on the recent activities of the IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP). The report of its 1983 meeting has recently been published in GESAMP Reports and Studies No. 18. Among the activities of GESAMP were mentioned the following:
- An oceanographic model for the dispersion of wastes dumped in the deep sea has been completed and published as GESAMP Reports and Studies No. 19.
 - A Working Group on hazardous substances in the marine environment has prepared overviews on the hazards presented by several substances, particularly in relation to human consumption. Reports have been prepared on cadmium, lead and tin and will be prepared on mercury, arsenic and organosilicons for next year.

- A Working Group on the exchange of pollutants between the atmosphere and the oceans is presently looking at the Mediterranean Sea to apply its models for the deposition of substances into the sea and their transport back into the atmosphere.
 - A new working group has been established on the flux of pollutants at the land-sea boundary.
- 4.5 The Working Group agreed that GESAMP was doing a lot of work relevant to its concerns and, thus, the Working Group should keep contact with GESAMP and stay informed of its activities.
- 4.6 LDC - The Chairman provided information on the last Consultative Meeting of the London Dumping Convention (LDC). The LDC has adopted guidelines for the application of Annex 3 of the London Dumping Convention; these guidelines rely heavily on work carried out by GESAMP and ICES. The LDC has set up an intersessional working group to attempt to define more clearly the purposes and criteria for placing substances on the "black list" or the "grey list"; much work in ICES is relevant to this work.
- 4.7 The Environment Officer gave an overview of the work carried out by the ICES/SCOR Working Group on the Study of the Pollution of the Baltic.
- 4.8 Dr. G. Weichart informed the Group that a Conference for the Protection of the North Sea against Pollution will take place in the Federal Republic of Germany in November 1984. In preparation for this Conference, an assessment of the pollution situation in the North Sea is being prepared.
- 4.9 Dr. P. Nounou reported that a memorandum of understanding had recently been agreed between IOC and UNEP covering overlapping programmes. Under this agreement, joint groups will be formed, so that the Working Committee for GIPME (Global Investigation of Pollution in the Marine Environment), GEMSI (Group of Experts on Methods, Standards and Intercalibration) and probably also GEMS (Global Environmental Monitoring System) will be sponsored jointly by IOC and UNEP. Dr. Nounou reminded the Group that a memorandum of understanding between ICES and IOC had also been agreed in late 1983. He noted that representatives of developed countries have strongly wished that this agreement could specify the activities in more concrete terms so as to avoid duplication in the work carried out by the two organizations. He felt that generally the activities of IOC, UNEP and ICES on the same types of programmes, e.g., monitoring of marine pollution, should be harmonized.
- 4.10 The Working Group noted that, in the light of the IOC-UNEP agreement, IOC will obviously become more involved in monitoring programmes. The Working Group therefore felt that, given the possible overlap with regard to monitoring and the other areas of common interest between ICES and IOC, concrete steps should be taken to improve the communication between ICES and IOC, in implementation of the memorandum of understanding. The Working Group requested the Marine Environmental Quality Committee to consider this issue and make proposals.
- 4.11 Dr. B.I. Dybern reported that the 14th Conference of Baltic Oceanographers (CBO) will be held in Gdańsk, Poland, on 27 September - 2 October 1984. The theme of the Conference is "Physical and Chemical Processes and their Ecological Significance." During two days of the Conference, problems of eutrophication and of patchiness (inhomogeneity) will be discussed together with scientists representing the Baltic Marine Biologists (BMB), the other independent marine organization in the Baltic area. Dr. Dybern stated that

many of the items to be covered would be of interest to ICES.

- 4.12 In closing the discussion under this agenda item, the Chairman requested Dr. Dybern to provide a written report on the activities of relevant organizations in the Baltic Sea and Dr. Nounou to provide a written report on relevant IOC activities for the next meeting of the Working Group.
5. BIOLOGICAL EFFECTS STUDIES
- 5.1 Fish Pathology
- 5.1.1 Dr. V. Dethlefsen reported on the results of the Workshop on Methods in Fish Disease Surveys, which had been held on 3-12 January 1984 on the research vessel "Anton Dohrn" (Federal Republic of Germany). The aim of the Workshop was to consider the methods for conducting fish disease surveys, to identify problems and to come to an agreement on the best ways to carry out such surveys. The Workshop also provided the opportunity to intercompare and coordinate the identification of certain fish diseases. Dr. Dethlefsen stated that twelve scientists from eleven ICES member countries had participated in the Workshop, which had been co-chaired by Dr. E. Egidius and himself. The cruise had taken place in the German Bight and the southern North Sea.
- 5.1.2 Dr. Dethlefsen stated that the Workshop had been divided into a practical part, in which the participants had the opportunity to test different methods of sampling and diagnosis, and a discussion part, in which eleven contributed papers were presented and extensively discussed. The Workshop identified a variety of methodological shortcomings in current fish disease surveys. Based on the source of error identified, advice was developed on how to reduce the variability in results. Major sources of variance were detected in terms of sampling (fishing gear, fishing methods), sub-sampling and, particularly, the frequency of sampling. The Workshop agreed that fish disease studies have to be designed as long-term investigations. Baselines for prevalence of diseases for each area have to be established, including information on seasonal fluctuations. Repeated sampling at comparable seasons and over several years must be done to obtain representative data. One major point during the Workshop discussions concerned the inclusion of fish disease studies in stock assessment work. It was felt that this could be carried out beneficially if the appropriate training of personnel were ensured and if only a limited number of fish species and diseases were investigated. Major advantages in the combination of these types of studies were seen in the fact that many of the data routinely sampled during stock assessment work are essential for fish disease studies.
- 5.1.3 Dr. Dethlefsen reported that, in summary, the participants at the Workshop had agreed that the Workshop had been very useful and felt that the results obtained will provide a better basis for future cooperative studies of fish disease. The Workshop participants recommended that the report on the results of the Workshop be published in the Cooperative Research Report series and also that, at a suitable future time, another Workshop of this type should be held, perhaps in another area and using different research vessels.

- 5.1.4 The Working Group thanked Dr. Dethlefsen for organizing this Workshop and for giving the overview report on the results.
- 5.1.5 In the discussion, the question was raised as to whether the Workshop had considered the possible relationship between fish disease and body burden of contaminants. The Working Group generally felt that it was important to study the body burdens of contaminants in relation to fish diseases, but it was realized that it is a very complicated issue to attempt to determine which contaminant may be associated with a particular fish disease. Nonetheless, studies of body burdens of contaminants are necessary to obtain a better understanding of fish diseases. In reply to this general question, Dr. Dethlefsen stated that body burden studies will now begin to be included in fish disease surveys.
- 5.1.6 The Working Group then discussed the issue of whether fish disease surveys should be carried out in association with fish stock assessment cruises. It was realized that when fish disease surveys are incorporated into fish stock assessment cruises, only one or two specialists on fish disease can be present on the cruise, thus limiting the survey to one or two species or decreasing the intensity of the survey. Nonetheless, the Working Group generally felt that fish disease surveys should be incorporated into stock assessment cruises whenever possible. It was recognized that this may be the only way for fish disease surveys to be carried out by some laboratories. This had been recommended by Council in C.Res.1982/4:5, and the Working Group reaffirmed its support of this Resolution. In terms of the criteria and methodology to use in the incorporation of disease surveys into stock assessment work, it was noted that Doc. ICES C.M.1983/Gen:8 by Dr. E. Egidius provided information on how these disease surveys can be carried out.
- 5.1.7 The Working Group then considered the recommendation of the Workshop that the report on the results should be published in the Cooperative Research Report series. As the written report was not yet available, the Working Group decided that it could not recommend the publication of a report it had not seen, but it noted that the report would be reviewed by the Working Group on Pathology and Disease of Marine Organisms (WGPDMO) and thereafter by the Marine Environmental Quality Committee and the Mariculture Committee at the 1984 Statutory Meeting.
- 5.1.8 The Working Group then took note of the statements in Section 5 of the 1983 Report of the Working Group on Pathology and Disease of Marine Organisms concerning the relationship between pollution and disease. It was felt that this statement of the WGPDMO highlighted the complexity of the problem and the views expressed were supported by the WGMFNA, which accepts the multifactorial aspects of disease etiology and the fact that this is a very complex issue.
- 5.1.9 Recalling that at its 1983 meeting the WGMFNA had recommended that it hold a one-day joint meeting with WGPDMO in 1984 but that the Council had postponed this joint meeting until 1985 to allow adequate time for preparation, the Working Group discussed which items should be placed on the agenda of this joint meeting.
- 5.1.10 It was suggested that one important item to be discussed would be a map of diseases in the ICES area. WGPDMO was encouraged to take the results of its epidemiological studies and make a map of the occurrence and prevalence

of fish diseases in the ICES area. At the joint meeting, areas of disease "hot spots" could be checked to see whether they correlate with areas of known pollution "hot spots".

- 5.1.11 It was also felt that it would be useful to have an analysis of the studies which positively linked the prevalence of diseases with pollution in a marine area for the parameters that were included in the studies and which lead to the conclusion that a positive correlation exists. From these studies, which have been carried out on the east and west coasts of the United States and in Danish coastal waters, it can be determined which parameters are essential and thus should be included in future studies. Dr. Dethlefsen agreed to look over the papers on the results of these studies and prepare a summary paper for the joint meeting in 1985.
- 5.1.12 Having discussed these issues, the Working Group agreed that the agenda for the joint meeting with WGPDMO should include the following items:
- (1) The role of 'environmental' among other factors in fish disease etiology, including possible relationships between contaminant body burdens and disease.
 - (2) The types of disease most likely to be environmentally influenced.
 - (3) The types of environmental factors most likely to be relevant.
 - (4) The types of disease most likely to be feasible for inclusion in a monitoring programme.
 - (5) Other environmental variables that would be useful to support epidemiological studies.
 - (6) Outcome of epidemiological studies to date, particularly on disease "hot spots".
 - (7) Suggestions for future work.

It was agreed that the Chairman should write to the Chairman of WGPDMO welcoming the proposal for a joint meeting between the two Working Groups, suggesting that the meeting should consist of a one-day overlap at the 1985 meetings of the two Groups, and proposing the above-mentioned items for the agenda.

5.2. Methods

- 5.2.1 The Chairman reported that the ACMP had requested the Working Group to review the 1983 Statutory Meeting papers on biological effects monitoring techniques. Accordingly, the Group was requested to review these papers and the techniques described in terms of how easy they are to apply, how expensive they are in terms of equipment and time required, and how easily the results can be interpreted, so that the techniques can be identified which are the most useful for monitoring the biological effects of marine pollution.
- 5.2.2 The use of macrobenthos studies in monitoring programmes was discussed and, as an introduction to this, two papers were referred to and briefly summarized: Doc. ICES C.M.1983/E:43 on the effects on benthos of activi-

ties around offshore oil platforms and the portion of the Report of the Second Biological Intercalibration Workshop (August 1982, Rønne, Denmark) covering measurements of soft bottom macrozoobenthos in the Baltic Sea (Baltic Sea Environment Proceedings No. 9 (1983)). In introducing C.M. 1983/E:43, Dr. McIntyre suggested that it was a good example of how macrobenthos studies could be effectively used to identify changes in the region of a point source of contamination and to quantify the extent of the area affected. Dr. McIntyre stated that this technique was not useful in dumping areas with low levels of pollution or near point sources where the contaminant levels were low.

- 5.2.3 Dr. Arne Jensen summarized the results of the intercalibration of methods for the study of soft bottom macrozoobenthos, which had been carried out in the framework of the Baltic Monitoring Programme. The results showed that the methods used in this Programme are generally comparable but that repeat intercalibrations should be carried out on the sieving methods and the methods to determine wet weight and dry weight. Dr. Jensen stated that the main aim of this monitoring programme is to determine long-term trends; macrobenthos measurements are accompanied by chemical measurements and monitoring of phytoplankton and zooplankton at the same stations.
- 5.2.4 In the general discussion, it was noted that benthos studies can be expensive in terms of the amount of time and effort required. Additionally, because of the well-known natural variability in benthic communities, the identification of changes which can clearly be attributed to human activities is difficult, except when working on a transect away from a particular source, or unless the effect is large. Examples were given from the Baltic Sea of seasonal changes in the benthos and of cyclic changes of various time periods (7 and 20 years) which make long-term studies necessary. The value of using a 0.5 mm sieve in processing soft-bottom samples was recognized, but since this greatly increases the work, it might not be possible to use this size sieve on all samples.
- 5.2.5 The Working Group concluded that while macrobenthos studies can be valuable, they must be carefully designed in suitable programmes if they are to be effective. For example, benthic techniques can be effective in determining the zone of effects of a point source. However, it is very difficult to interpret the meaning of these benthic changes in terms of possible effects on, e.g., commercial stocks of fish or shellfish. The Working Group felt that it could be useful to consult the Benthos Methodics Working Group on this and other relevant issues and, accordingly, identified two questions to be put forward to that Working Group:
- (1) What are the interrelationships between benthos and fish populations and between changes in benthos and changes in fish populations; and
 - (2) How can one look for changes in the benthos and separate natural changes from man-induced changes?

The Chairman of WGMPNA agreed to write to the Chairman of the Benthos Methodics Working Group posing these questions and then the issue should be discussed at the 1984 Statutory Meeting to confirm this request. Finally, noting that benthic techniques are being intercalibrated for use in the Baltic Monitoring Programme, the Working Group expressed its interest in seeing the results of benthic studies from the Baltic Monitoring Programme and the interpretations possible.

- 5.2.6 The Working Group then considered several papers concerned with the use of oyster larval bioassays to determine biological effects. Dr. Portmann briefly outlined the work which had been described in papers C.M.1983/E:10 and E:13. The aim of this work had been to establish the extent of damage that might be caused by tri-butyl tin (TBT) compounds which are used in anti-fouling paints, but the techniques used were applicable to tests with any substance. Paper C.M.1983/E:13 described classic LC_{50} tests using adults and larvae of a variety of marine species. The tests with adults had been conducted over 86 hours, those with larvae over 48 hours. The larvae used had not been reared specially for the tests, but simply happened to be available at the time of testing, as a result of natural spawning. Paper C.M.1983/E:10 described tests using 1 g oyster spat (*C. gigas*) grown for a period of eight weeks under various regimes of TBT exposure alone and in admixture with sediment. Deformations in shell growth and shell growth inhibition were noted. Dr. Portmann stated that the techniques used were both said to be relatively simple to apply and inexpensive in terms of apparatus required. Test solutions were renewed daily and the only unusual extra expense had been the cost of analysis of the water to ensure that the actual test concentrations were known.
- 5.2.7 Dr. Pearce summarized paper C.M.1983/E:59, which gave the results of bioassays of water quality, as affected by dredged materials, conducted using oyster larvae. The effects were measured by observing changes in the development of larvae during a period of two days. The dredged materials apparently affected the development of the larvae. The bioassay technique is relatively inexpensive, does not require costly, complex equipment, and can be carried out with minimal levels of training. Dr. Pearce stated that reasonably large numbers of replicate experiments can be performed.
- 5.2.8 In the discussion of this technique, it was noted that while the oyster larval bioassay has been used successfully in many cases, the larvae can be sensitive to other factors than pollution. It was also suggested that problems may arise if larvae resulting from artificially induced spawning are used instead of larvae obtained at the natural spawning time. The Working Group concluded that the oyster larval bioassay technique is relatively easy to apply, given the availability of the larvae, and that it is relatively inexpensive, but that its effectiveness may be open to question because of its extreme sensitivity. The technique could be good for quantifying the effects of pollution (Phase 2), but perhaps not so good for use in a wide-scale survey to identify biological effects of pollution (Phase 1).
- 5.2.9 Dr. Pearce provided a brief overview of the adenylate energy charge (AEC) technique, based on the results in paper C.M.1983/E:53 and a review paper by K. Haya and B.A. Waiwood in Aquatic Toxicology. This technique provides an indication of the metabolic energy available to the organism, mainly from ATP. This technique is sensitive in measuring a range of stresses on certain test organisms, but it requires considerable expertise to carry out. The requirements for equipment and apparatus have recently been reduced in complexity, so the appropriate equipment can be found in most laboratories and departments of chemistry. Dr. Pearce reported that the results of recent studies using bivalves as test organisms suggests that they are appropriate for marine pollution monitoring. Moderate numbers of samples can be processed using this technique.

- 5.2.10 The Working Group noted that AEC is a potentially useful non-specific technique which could be applied in the identification phase of biological effects monitoring. However, there are problems in terms of the sophistication of the equipment needed and the appropriate personnel training.
- 5.2.11 The observation of micronuclei due to chromosomal damage, as described in Doc. 1983/E:55, was summarized by Dr. Pearce. He reported that the use of the micronuclei test in genetic observations has shown that there is a relationship between marine water quality and the increased incidence of occurrence of micronuclei in the red blood cells of adult and larval fish. The technique requires technically trained personnel, but not unusually expensive or complex equipment. Samples of red blood cells can be prepared quickly on board a research vessel or in the laboratory. Scoring of the slides is done by microscope, usually in the laboratory. The methodology can be used to screen large numbers of samples relatively inexpensively.
- 5.2.12 The Working Group noted that this technique is a relatively inexpensive one. However, while it is easy to collect the fish and larvae, the extraction of blood from the heart may be rather difficult, especially from the larvae. Trained personnel are needed to identify the micronuclei. This technique is potentially useful in the identification phase. It would also be important to relate the effect to the cause (is it stress or mutagens?) and to understand what effect the presence of micronuclei may have on the fish.
- 5.2.13 It was noted that the implementation of biochemical measurements (e.g., determinations of muscle glycogen and kidney G6PDH) to assess pollution stress (see Doc. C.M.1983/E:57) requires highly trained personnel and state-of-the-art laboratory facilities and equipment. The tests are, however, sensitive to sub-lethal changes which might result from a range of toxic substances, and can provide early warning signals of effects before major population changes might occur. The nature of the methodology precludes the screening of large numbers of samples.
- 5.2.14 Dr. Pearce reported that relatively simple physiological tests, such as the measurement of the cough response in the lobster as reported in C.M.1983/E:58, can be accomplished with inexpensive equipment and moderately well-trained technicians. The results to date demonstrate that sub-lethal change indicative of stress can be estimated quickly and accurately. Large numbers of whole animal replicates can be run simultaneously, depending on the size of the experimental facility.
- 5.2.15 The Working Group noted that this is a promising laboratory and field-based method that is relatively inexpensive and easy and does not require highly trained personnel. The method has potential both for baseline studies as well as studies of point sources of contaminants. However, questions concerning the sensitivity of the method must be examined.
- 5.2.16 It was noted that Dr. J. Payne (Canada) has prepared a fairly comprehensive review on the use of measurements of mixed-function oxygenase (MFO) activity in marine fish for monitoring biological effects. Dr. Pearce agreed to contact Dr. Payne and obtain copies of this paper for discussion at next year's meeting.

- 5.2.17 Mr. Carlberg presented paper WGMFNA 1984/5.2/3 which described a set of simple techniques that have been applied by a group of Swedish scientists in their study of the influence of industrial waste water on blue mussels. The parameters studied were the early development of mussels, shell movement, shell growth and byssal thread formation. The last two parameters were found to be the most sensitive. For the study of shell growth, the researchers had developed a small benthic chamber to make the test applicable to in situ investigations. The byssal thread formation test included both observations on the number of threads and actual measurements of their strength. In this way, it was demonstrated that the mussels have a potentially decreased ability to remain on their substrate. These methods will be included in a major monitoring programme that has been designed for an area outside a petroleum refinery and some petrochemical industries on the Swedish west coast.
- 5.2.18 In the discussion, the Working Group noted that this technique was very interesting because it is inexpensive and simple to apply. It is also good because it is used on a commercially important species and the effects observed are directly relevant to the survival of the organism. There were, however, questions as to whether the methods were sensitive enough for actual field application. Mr. Carlberg offered to keep contact with the scientists using this technique and report back to the Working Group in one or two years on the experiences gained from using this technique in the monitoring programme.
- 5.2.19 In response to a request from last year's meeting of the Working Group, Mr. Carlberg introduced document WGMFNA/5.2/2, which contained a status report on the rotatory flow technique. The Swedish scientists applying that technique held the opinion that it was premature to present an evaluation. However, such a report is in preparation and will most likely be published towards the end of the year. Mr. Carlberg stressed two basic facts about the technique. As the technique measures a condition factor of the test fish as an ultimate response to a number of contributing processes, more basic research is needed to explain what is really measured. The second basic fact is that, in order to compensate for the variability in the response of any species of test fish, it is necessary to perform background measurements on unexposed fish for a full annual cycle. It had been demonstrated that the technique was applicable to a number of pelagic fish, such as cod, perch, roach, bleak minnow and carp. Salmonid fish and demersal fish were unsuitable for testing. It was pointed out that the technique was suitable for laboratory testing of, e.g., dose-response relationships, whereas its applicability to field studies has to be further explored. Concerning the cost of the test procedure, Mr. Carlberg pointed out that the equipment could be constructed for about 8,000 U.S. Dollars, and that the labor involved 3-4 days of work for measurements on two groups of fish, with 25 individuals in the control group and 25 in the exposed group. In addition to that, labor is needed for catching and keeping the fish as well as for the statistical treatment of the results.
- 5.2.20 In the discussion that followed, it was recognized that the method was a promising tool but was complex and perhaps difficult to apply. Based on the forthcoming evaluation, it would be possible to make an assessment of any possible wider applicability of the technique.

5.2.21 In closing the discussion on the topic of biological effects monitoring techniques, it was noted that a number of techniques have been reviewed and commented on. Some of them need further research to develop them for wider application or clearer interpretation. Many of the techniques need chemical back-up work to evaluate the results. The Working Group agreed to continue its work on the evaluation of techniques to monitor biological effects and looked forward to seeing more papers on this subject next year. In addition to a description of the technique, these papers should include an assessment of the ease of application, the cost of application and cost effectiveness (personnel required and equipment), the ease of interpretation of the results, and the applications of the results.

5.3 Workshop on Biological Effects Monitoring Techniques

5.3.1 The Chairman reported that the recommendation from last year's meeting that a Workshop on Biological Effects Monitoring Techniques be held in May 1984 had been accepted by Council in C.Res.1983/2:27. Accordingly, plans had gone forward to hold the Workshop from 21 May to 1 June 1984 with the cruise component on board the R/V Anton Dohrn and the land-based component at the Biological Station on Helgoland, Federal Republic of Germany.

5.3.2 The initial discussion of this item took place in a sub-group which met in the evening of 28 February 1984 to commence consideration of the Workshop. Present were: M. Parker (Chairman), A.D. McIntyre, J.B. Pearce, V. Dethlefsen, H. Skjoldal, C. Lima, B. Dybern.

5.3.3 Dr. Dethlefsen informed the sub-group of the current position regarding the Workshop. Following the Council's acceptance of the Workshop proposal, vessel and laboratory facilities were made available in the Federal Republic of Germany. Dr. Thurberg had twice sent circular letters to potential participants, once after the last meeting of WGMFNA, and a second time following the Statutory Meeting.

5.3.4 The response to the circulars was poorer than hoped, possibly due to the constraints on international travel and on the types of methods sought. There were seventeen replies in total. However, three of these related to pathology studies outside the scope of this exercise and one was concerned with chemical monitoring. Three others did not fully meet the criteria laid down in C.M.1983/E:25, and particularly did not produce results within the time of the Workshop. One further submission was concerned with effects on fish eggs which might not be available at the time of the Workshop. Of the remainder, six proposals related to biochemical/physiological techniques suitable for shipboard application and three were bio-assay techniques more suited for a laboratory-based exercise.

5.3.5 The sub-group reviewed the purpose of the Workshop, which had been primarily to demonstrate methods fitting the criteria laid out in C.M.1983/E:25 and subsequently to derive a short list of techniques that could be recommended for use in a biological component to the 1985 baseline studies.

5.3.6 It now appeared that this aim was not achievable, so the sub-group revised the proposals for the 1985 baseline study on biological effects and for the Workshop.

- 5.3.7 The sub-group proposed two lines of action for the 1985 Baseline Study.
- (a) The Chairman will write to the Chairman of WGPDMO, informing him of the excellent opportunity provided by the 1985 baseline studies on contaminants in biota and water to gather biological information over wider areas; and informing him further that WGPMPNA would like to take the opportunity of gathering more extensive data on fish diseases and seeking the advice of WGPDMO on the best approach.
 - (b) All ICES member countries, in the absence of any commonality in methods at present, would be asked to use their own most favoured techniques over much wider areas than normal and especially in areas subject to chemical baseline studies with the aim of
 - (i) gathering data on biological variability (natural and anthropogenically induced) over a wide area, and
 - (ii) assessing the use and sensitivity of the techniques.
- 5.3.8 As a component of subparagraph (b), above, the Workshop will go ahead in May 1984, probably restricted to its seagoing components, but including some methods not exactly fitting the criteria laid out in C.M.1983/E:25 and also a pathology component. Both contaminated and reference areas will be visited, and all techniques will be subsequently assessed
- (a) on the basis of their cost-effectiveness, simplicity, etc., and
 - (b) in terms of the comparability of their results.
- The latter comparison will go some way toward providing a quasi-intercalibration for interpretation of the disparate results expected from the Baseline Study. Furthermore, the results of the Workshop will be known before 1985, so member countries may have an opportunity to consider using the techniques identified. The Workshop would report in the first instance to the Marine Environmental Quality Committee at the 1984 Statutory Meeting.
- 5.3.9 In the continued uncertainty of the participation of Dr. Thurberg, Dr. Dethlefsen will proceed with convening the Workshop and will encourage as many as possible and relevant of those who have submitted proposals to participate in the shipboard exercise.
- 5.3.10 The Working Group discussed and accepted these proposals. It was agreed that 1985 should be considered as the commencement of the Baseline Study. Members of WGPMPNA are asked
- (a) to contact those persons in their countries who have submitted proposals and to encourage them to participate in the shipboard exercise, and
 - (b) to contact national members of WGPDMO to urge that WGPDMO responds positively to the baseline study proposals.
- 5.3.11 The Working Group discussed the unexpectedly small response to the Workshop proposal from member countries and the long-standing difficulties of initiating a biological effects programme. It was considered that this was largely due to a lack of real commitment, in terms of finance and personnel on the part of ICES member countries. Accordingly, the Working Group re-iterated

- (a) the necessity of demonstrating the biological effects of contaminants in pollution studies, given that the definition of pollution depends on biological effects being produced,
- (b) the need for commitment of resources to work in the area of developing, testing, and using techniques for monitoring the biological effects of marine pollution, and
- (c) the necessity of involving more biologists in ICES monitoring and baseline work.

RAPPORTEUR'S NOTE: Owing to further problems concerning adequate participation in the Workshop on Biological Effects Monitoring Techniques, including the unsuitability of several of the techniques for use on board ship, the Workshop was postponed until mid-1985. Further discussions concerning the Workshop and the fixing of new dates will take place at the 1984 Statutory Meeting.

6. PRIMARY PRODUCTIVITY AND NUTRIENTS

- 6.1 In opening the consideration of this topic, the Chairman requested the members to keep in mind two questions: (1) should primary production measurements be included as a biological effects monitoring technique, and (2) should nutrient measurements be included in the 1985 Baseline Study of sea water? The Working Group began by reviewing the papers which had been submitted on this topic.
- 6.2 In the absence of Mr. Folkard, the Review of Nutrients paper (WGMPNA 1984/6/1) was introduced by Dr. Portmann. He pointed out that although the author had attempted to obtain information from other countries, he had had a very limited response and that, as a consequence, the review was based entirely on work conducted in the UK, primarily in England and Wales.
- 6.3 The review emphasized that, although the advent of automatic methods of analysis had greatly increased the capacity of marine scientists to carry out numerous analyses, a number of basic problems remain. The main problems are that, in order to establish baseline levels, it is essential to sample in the winter months and that to obtain a true picture of nutrient availability it was important to include measurements of the organically bound forms of nutrients.
- 6.4 The review indicated that different water masses have different nutrient characteristics and that due to rapid changes in water movements induced by wind-driven currents, considerable care was required in interpreting results. The author had not been able to conclude, on the basis of the data available, whether nitrate levels had increased over the last twenty years, although it was apparent that phosphate levels had increased in much of the area around England and Wales and in the Southern North Sea.
- 6.5 The review concluded with a caution as to how such apparently simple conclusions should be interpreted and emphasized that the necessary methods of processing and analysing nutrient data were not yet fully available. In the author's view, therefore, it would be unwise to attempt any wide-scale baseline study of nutrient levels in the North Sea or elsewhere, if the objective was simply to establish time-trends.

- 6.6 The Working Group accepted that this was the author's view, but concluded that, in view of the associations being drawn between perceived increases in nutrient levels and plankton blooms, both of toxic and non-toxic species, it would be unwise to do nothing. The general feeling was that for assessment of nutrient inputs and other impacts, at least in a number of areas where blooms appear to occur regularly, e.g., the German Bight, work was necessary and that such studies should be encouraged.
- 6.7 The Chairman summarized the paper "Productivity including eutrophication with special reference to the North Sea and river discharges" (WGPNA 1984/6/2). The paper described the annual cycle of primary and secondary production in the North Sea and the associated variations in nutrient levels. Information was given on the supply of nutrients to the various sectors of the North Sea via land runoff and river discharges. The paper concluded that, taking into account the natural year-to-year fluctuations and the long-term variability in primary and secondary productivity, there is no evidence that the increase in nutrients in the North Sea during recent decades has caused any permanent increase or decrease in productivity.
- 6.8 In the discussion of this paper, several members disagreed with the conclusion that there has been no increase in productivity, at least in terms of the area off the west coast of Denmark and in the eastern German Bight.
- 6.9 Dr. Pearce summarized paper C.M.1983/E:63 on the use of phytoplankton measurements in monitoring environmental trends. He stated that studies of phytoplankton and primary production in conjunction with measurements of nutrient loading and hypertrophication are necessary in monitoring programmes designed to demonstrate the long-term effects of diffuse and point sources of organic wastes. The collection of samples and required measurements can be done in conjunction with other cruise activities. The analyses necessary can be done with minimally trained technicians. Broad-scale surveys, i.e., shelf-wide over several degrees of latitude, are labor-intensive, but local investigations in major riverine plumes or coastal waters can be accomplished by small teams. Dr. Pearce stated that such monitoring programmes are of great importance off the northeast coast of the United States owing to the increased frequency of unusual plankton blooms, including of toxic species, and the occurrence of extensive low dissolved oxygen events in bottom waters.
- 6.10 Dr. Jensen informed the Group about the conclusions of a recent Danish report on the occurrence and causes of an event of oxygen deficiency in the bottom waters off the West Coast of Denmark in 1981 and the resultant death of fish in the area affected. The event was caused by a coincidence of several factors. A large amount of run-off from land had taken place in the winter of 1981 combined with a long summer period with stagnant bottom water. The wind was much weaker in September than normal. The last two conditions reduced the supply of oxygen from the surface to the bottom layer. Similar effects were also observed in 1983. Dr. Jensen stated that the meteorological and physical relation in 1981 seemed to be the triggering factor for the oxygen deficiency, although the underlying cause can be found in the increased load of nutrients, especially nitrogen, and a subsequently larger production of organic matter with a larger oxygen demand as a result.

- 6.11 Dr. Jensen stated that the report on this event contained several recommendations for further action, both at the national and at the international levels, for example, to improve knowledge about inputs and to reduce the inputs of organic matter and nutrients to the marine environment. Some recommendations are also given for further research studies to improve the knowledge about the processes controlling the turn-over of nutrients in the marine environment.
- 6.12 Dr. Jensen then gave a summary of the results of the Second Biological Intercalibration Workshop (Rønne, Denmark, August 1982). One section of the Workshop concerned the intercalibration of methods to measure phytoplankton primary production. The results had been generally satisfactory, particularly when all laboratories had used the same solution of ^{14}C . Another section had intercalibrated the determination of chlorophyll-a; here also, generally satisfactory results had been obtained when the fluorometric method had been used, but not when a spectrophotometer had been used. The Workshop had also intercalibrated analyses of a number of nutrients. The results showed that manual procedures give more accurate results, but that automatic procedures can be used when they are checked against the manual procedures.
- 6.13 In reviewing the activities in other fora, the Chairman informed the meeting of progress in organizing the ICES Special Meeting on Causes, Dynamics and Effects of Exceptional Marine Blooms and Associated Events to be held on 4-5 October 1984 in Copenhagen. A good set of papers had been received, particularly on eco-physiological aspects. The two days of the meeting will be devoted to sessions on causes (including physical, ecophysiological and time-trend aspects) and effects (including public health and fisheries and mariculture aspects). It is intended that a report will be produced including recommendations for future work.
- 6.14 Dr. Portmann informed the Working Group that the GESAMP working group on the review of potentially harmful substances was proposing to consider nutrients, especially in the context of the incidence of toxic algal blooms.
- 6.15 The Chairman then posed four questions to the Working Group:
- (a) whether the information available suggested that nutrient enrichment and primary productivity warranted further study by the Working Group,
 - (b) if so, what did we mean by nutrients in this context and, in particular, were there other components in addition to N and P which should be considered in relation to primary production,
 - (c) should the Working Group include nutrients in its proposed baseline and monitoring studies, and
 - (d) should primary productivity measurements be included in any programme of biological effects studies?
- 6.16 A wide ranging discussion took place from which a number of points emerged. Though the information in the papers submitted was sometimes contradictory, enough evidence was available to show that at least in some areas changes in primary production had occurred that could be associated with changes in nutrient inputs. It was pointed out that many past studies have examined nutrient concentrations during bloom

events. Very often, though, the changes in primary production result from changing nutrient inputs and other factors occurring prior to the blooms. Furthermore, nutrient flux is more important than nutrient concentration in primary production.

- 6.17 Nutrients are not the only factors involved in primary production; the role of oceanographic and meteorological factors in exceptional blooms was pointed out. Furthermore, it is known, for example, that dinoflagellate blooms actually occur in nutrient-depleted waters. The relationship of primary production to nutrients, particularly N and P, is not simple and various other factors related to nutrient enrichment from land and river inputs, such as natural chelating agents, trace metals, vitamins and growth factors, may also play an important and not-well-understood role.
- 6.18 Bearing in mind the fact that MCWG had recommended against the inclusion of nutrients in the 1985 Baseline Study (though it had called for nutrient measurements in support of other contaminant measurements in the water column), the Working Group considered that the time was not ripe to include nutrient and primary production measurements in cooperative programmes.
- 6.19 The Working Group did however consider this an important subject for further study. ICES member countries were therefore urged to initiate studies of nutrient inputs and fluxes and of primary production and the relationships between the two.
- 6.20 In addition, the Working Group considered that a comprehensive overview of this matter was needed. Work on this overview should commence at the next Working Group meeting following the outcome of the North Sea Conference and the ICES Special Meeting on Exceptional Marine Blooms. Other reports and studies from member countries were also sought. Dr. Pearce agreed to contact the Chairman of the Biological Oceanography Committee to see whether he can identify people who could contribute to this work. The Chairman of WGMFNA will also try to find people who can assist in this work. The persons so identified can form a small sub-group to carry out the preparation of this overview.

7. REVIEWS AND OVERVIEWS OF CONTAMINANTS

- 7.1 The Chairman reminded the Group that overviews of contaminants in the marine environment are carried out for two main reasons: (1) to provide WGMFNA with an assessment of the importance of including a contaminant or group of contaminants in the monitoring programme, and (2) to provide ACMP with material for giving advice to the Regulatory Commissions.
- 7.2 Furans and Dioxins - Dr. O'Sullivan presented a revised version of her paper "Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans," which had received a preliminary review the previous year. The overview provided information on the structure of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), their sources, methods of analysis, occurrence in the environment, and toxicity. Dr. O'Sullivan pointed out that some of the PCDD isomers are among the most toxic chemicals known. These substances are now nearly ubiquitous in terrestrial and aquatic ecosystems, but problems have mainly been associated with inland waters.

- 7.3 In the discussion of this paper, it was noted that the toxicity of one particular isomer, TCDD, to fish occurred at very low concentrations. However, as there are very few data on the concentrations of TCDD and other PCDDs in the marine environment, the Working Group endorsed the conclusions of the MCWG that studies should be encouraged on PCDDs in the marine environment, recognizing that there are very few laboratories who can analyze for these complicated chemicals.
- 7.4 The Working Group agreed that the paper should be forwarded to ACMP and expressed its gratitude to the author, Dr. O'Sullivan, for preparing the paper.
- 7.5 Alkyl-tin Compounds - Dr. Boutier introduced the overview paper on tributyl tin (TBT) which had been prepared by his colleagues Drs. Alzieu and Thibaud. The overview provided information on the production of organo-tin compounds and their various uses, and it was noted that production was expected to rise to 60 000 tonnes annually in 1986. One of the four main uses was in anti-fouling paints, for which purpose tributyl tin compounds are used because of their high toxicity to aquatic organisms. It was noted that the overview included a discussion of the mode of toxic action, toxicity to various aquatic species, details of methods of analysis and the extent of bioaccumulation. It concluded with the suggestion that TBT in anti-fouling paints was the probable cause of difficulties in the culture of oyster species, especially C. gigas, in areas where boat harbours and oyster cultivation sites were in close proximity, as in France and the United Kingdom.
- 7.6 It was agreed that the overview provided a useful summary of the background and problems caused by TBT and that it should be brought to the attention of ACMP. Dr. Portmann indicated that work was still continuing in both France and the UK, and that it seemed likely that TBT might have similar effects on other species, even when used in the copolymer types of anti-fouling paints. It was agreed that the problem was only likely to be local in its extent, although in such situations it could present serious problems. It was agreed that no cooperative monitoring or investigative action was necessary, although it would be worth reviewing the situation next year.
- 7.7 Accordingly, members were asked to consider whether there were likely to be similar problems in their countries. The initial reaction was that there probably were no further problems due to the usual separation of pleasure boating and shellfish culture activities. It was noted that, except where large numbers of commercial or naval ships were present in very restricted waters, problems are unlikely to arise from the use of anti-fouling paints containing TBT on such vessels, due to the much larger water volumes and water exchange normally encountered in areas used by such craft.
- 7.8 In concluding the discussion of this paper, the Working Group expressed its appreciation to the authors, Drs. Alzieu and Thibaud, for preparing the paper.
- 7.9 PAHs - It was recalled that an overview paper on PAHs by Drs. A. Moinet and J. Piuze had been presented at the 1983 Working Group meeting, and that the authors had been requested to revise their paper and merge it with a paper on PAHs prepared by Dr. R. Law for the MCWG. This revised

paper was not available at the meeting. The Working Group expressed the hope that this revised paper would be available for review at its 1985 meeting.

- 7.10 Zinc - A paper entitled "Zinc in the Marine Environment - An Overview" by Dr. P.A. Yeats had been considered and accepted at the 1983 Working Group meeting, but it had been agreed that it should be supplemented with information on the toxicology of zinc in the marine environment and its transfer through marine biological systems. Dr. F. Thurberg subsequently prepared a section to be added to the paper which contained the biological information requested. The Working Group reviewed Dr. Thurberg's additional section and noted that it had concluded that, while seafoods generally contain zinc and oysters, in particular, can concentrate zinc to fairly high levels, generally zinc will not cause problems in the marine environment. The concentrations of zinc are not high enough to affect marine resources or human beings.
- 7.11 In the light of these conclusions, the Working Group discussed whether zinc should continue to be measured in monitoring programmes. The Working Group agreed that in terms of regulatory monitoring programmes, such as the Joint Monitoring Programme of the Oslo and Paris Commissions, it did not appear to be worth-while to monitor zinc concentrations in the marine environment. In terms of the Cooperative ICES Monitoring Studies Programme, however, which is more of a research-based programme, the general opinion was that zinc should be retained in the programme, at least for the near future, because it is simple to analyze and can serve as a tracer metal in certain situations to follow how metals behave and indicate probable levels of other trace metals. While noting that zinc concentrations are generally regulated in fish tissues, measurement of zinc in molluscs gives an indication of the general pollution of an area, as high zinc concentrations often indicate elevated levels of other trace metals.
- 7.12 In conclusion, the Working Group agreed that the full overview paper on zinc should be forwarded to ACMP for its consideration and ultimately to the JMG with the recommendation that zinc not be included in the JMP. The ICES programme will continue to monitor for zinc, but the Working Group will reconsider the issue of whether zinc should be retained in the programme at a future date.
- 7.13 The Working Group expressed its appreciation to Dr. P.A. Yeats for preparing the main overview and Dr. F. Thurberg for preparing the additional biological section.
- 7.14 PCTs - The Working Group then considered the paper "Polychlorinated Terphenyls: A Review," by Mr. A.A. Jensen and Mr. K.F. Jørgensen. This paper was based on "Polychlorinated Terphenyls (PCTs): Use, Levels, and Biological Effects," which was published by the same authors in The Science of the Total Environment 27:231-250. A very short version had been presented at the previous year's meeting; the present version was an expanded review based on the guidelines for overviews.
- 7.15 The report described the production of PCTs and noted that production has ceased in most countries. Some figures were given on the concentrations of PCTs reported in various marine organisms and available inform-

ation was summarized on the effects of PCTs on experimental animals. The paper concluded that there is a need to monitor concentrations of PCTs in the marine environment.

- 7.16 After a discussion of this paper, the Working Group concluded that, given that the production and use of PCTs are in the process of being slowly phased out, there is no need for coordinated work or monitoring of these substances. However, laboratories which have the capability to analyze for PCTs should do so when convenient, so that more recent data on environmental contamination levels will be available.
- 7.17 The Working Group expressed its appreciation to the authors of the overview, Mr. A.A. Jensen and Mr. K.F. Jørgensen, for their efforts in preparing the paper.

8. CONTAMINANT MONITORING

8.1 Coordinated Monitoring Programme

- 8.1.1 At the 1983 Working Group meeting it had been agreed that Dr. Portmann (assisted by Drs. Parker and Uthe) should prepare, for publication in the open scientific literature, a report on the results of eight years of coordinated monitoring. The main object of the proposal had been to give examples of the sequence of data coverage over the period concerned, as supplied by the member countries. Dr. Portmann introduced the paper he had prepared on the subject and explained that although as many as eleven countries had contributed data (out of a possible 14), in general fewer than 7 had contributed data in any one year. It was also noted that although a wide variety of species had been sampled during the eight years, only mussels, shrimps, cod and plaice had been sampled with any degree of regularity.
- 8.1.2 A more detailed examination of the data on where species had been sampled showed that only in two or three areas were data available for more than about four years and that these had all been supplied by only three countries. It was agreed that such information would not be a good advertisement for the programme and that, although the reports on each year were valuable and that in many respects the programme had been a success, it was clear that most countries should have contributed more consistently than had actually been the case.
- 8.1.3 It was, therefore, agreed that no further work should be done on the preparation of actual data tabulations for the areas and species for which data were consistently available. Considerable disappointment was expressed at this decision, which under the circumstances was considered inevitable and members were urged to pay more attention to their obligations to provide data to the new Cooperative Monitoring Programme.
- 8.1.4 In conclusion, the Working Group thanked Dr. Portmann for preparing his paper. It was agreed that, even though the data obtained in the Coordinated Monitoring Programme had not been appropriate to use for a scientific evaluation of the programme, the experience gained had been useful and had led to the advancements reflected in the guidelines for the Cooperative ICES Monitoring Studies Programme.

8.2 Cooperative Monitoring Studies for Contaminants in Biota

8.2.1 Objective (1) - Public Health Protection

- 8.2.1.1 The Environment Officer introduced the report on the results of the Cooperative Monitoring Studies Programme for 1982 received for Objective 1 - human health protection. Data had been received from Belgium, Denmark, England/Wales, the Federal Republic of Germany, Ireland, the Netherlands, Norway and Sweden on heavy metal or organochlorine concentrations in nine species of fish and four species of shellfish. The Environment Officer stated that in certain cases the actual Objective for which the data had been submitted was not clear, so the data not suitable for trend monitoring had been included in the section on monitoring for the protection of human health. The Environment Officer requested the members to comment on the report, preferably in writing, by 30 June 1984.
- 8.2.1.2 In the discussion of this report, it was pointed out that beginning in the 1982 sampling year new guidelines for monitoring had been agreed. However, a number of the results accepted for the 1982 report did not comply precisely with the guidelines. It was, therefore, proposed that only data which conform precisely with the guidelines (published as Appendix 1 to Cooperative Research Report No. 126) should be accepted for inclusion in the report. There was an extensive discussion of this proposal in which it was pointed out that, on the one hand, it is easy for something to go wrong so that the guidelines are inadvertently not adhered to, and on the other hand, the guidelines have been agreed by the Working Group to promote as much comparability as possible in the data submitted for the programme and accordingly the guidelines should be observed as precisely as possible.
- 8.2.1.3 Having considered this question fully, the Working Group agreed that it is important to follow the sampling protocol precisely, as much as any other details that have been agreed for the programme. Data which deviate from these protocols (see "Details to be followed for sample collection, preparation and analysis in the conduct of cooperative monitoring" Appendix 1 to Cooperative Research Report No. 126 (1984)) will not be accepted for publication in the monitoring reports in the future.
- 8.2.1.4 For the 1982 results, for which no warning of the strictness of these requirements had been issued (and probably for 1983 results, as the sampling for that year has already been completed), the results submitted which do not comply with the guidelines in terms of the number of specimens in the sample or whether the organisms were collected in a pre-spawning condition will be accepted but either will be flagged or will be moved to an annex to the report. The ACMP is requested to decide which of these two options should be used.
- 8.2.1.5 The Working Group agreed that the importance of adhering to the sampling protocols should be clearly emphasized. A copy of the protocol should be sent to the ICES Delegates so that they are aware of the requirements of the programme and the necessity of adhering to these requirements. The Environment Officer was requested to send a check-list, containing the key points to be observed when sampling for Objective 1, to all persons who contribute to the programme. The check-list should be filled in and returned with the data.

8.2.1.6 For purposes of deciding compliance with the sampling protocol for Objective 1, it was decided that the number of organisms included in the sample should be within $\pm 10\%$ of the recommended number.

8.2.2 Objective (3) - Trend Monitoring

8.2.2.1 The Environment Officer reported that the results submitted for 1982 for Objective 3 - trend monitoring - for the Cooperative ICES Monitoring Studies Programme had not yet been tabulated or analyzed because the automatic data processing system for contaminants in organisms was not yet operational. She requested guidance from the Working Group as to how these data should be handled, specifically, what kinds of tables should be prepared and what kinds of statistical analyses should be carried out.

8.2.2.2 The Working Group felt that the group of statisticians who have been assisting the WGMFNA on trend monitoring should be enabled to hold a meeting and should be requested to look at the trend monitoring data submitted, with a view to determining how to tabulate and analyze these data. They should also be requested to carry out a preliminary analysis of the 1982 and 1983 trend data from the Cooperative Monitoring Studies programme. This meeting of the statisticians should be held at the end of 1984.

8.2.2.3 Dr. Munk Hansen informed the Group about the results of a meeting on trend monitoring that had been held in Halifax on 31 January to 2 February 1984. The meeting, which was chaired by Dr. J. Uthe, had been held to discuss and draw conclusions from Canadian trend monitoring data. The meeting had discussed a number of statistical questions and had agreed that the statistical problems in trend monitoring are no longer large. An evaluation was made of the cases in which meaningful results have been obtained for trend monitoring and it was determined that meaningful time and space trend data can be obtained in "hot spots", but that the problems increase when trying to monitor small differences on a large scale. The question of the pooling of samples had been raised and several participants in the meeting had felt that there were no statistical reasons not to pool the samples. The participants in the meeting had not been able to come to agreement on whether the results of monitoring contaminant concentrations in fish for time trend analysis can be clearly and unambiguously interpreted.

8.2.2.4 The Working Group welcomed this work of the statisticians and urged them to continue it. The Working Group, therefore, recommended that the group of statisticians who have been assisting WGMFNA on trend monitoring be enabled to hold a meeting (to be convened by Dr. J. Uthe) after the 1984 Statutory Meeting and before the 1985 WGMFNA meeting to review further information on the statistical aspects of trend monitoring and report on this to the 1985 Working Group meeting. The group of statisticians should also review the trend monitoring data collected in the Cooperative ICES Monitoring Studies Programme with a view to determining how to tabulate and analyse these data and should do a preliminary analysis of the 1982/1983 data. (See Recommendation 2, Annex 4). The Chairman agreed to write to Dr. Uthe asking him to convene this group of statisticians.

- 8.2.2.5 The Working Group agreed that trend studies should continue according to the current guidelines in 1984. While an enormous amount of effort should not be devoted to such studies, it was agreed that ICES member countries should be encouraged to continue to carry out trend monitoring to increase the supply of data available for use in analyzing and evaluating this technique.
- 8.2.2.6 To enable a better evaluation and interpretation of the results of trend monitoring, the Working Group agreed that basic research should be encouraged on factors and underlying biological processes which contribute to variations in the concentrations of trace metals and other contaminants in fish tissues and in other biota. Accordingly, the Working Group adopted a recommendation encouraging ICES member countries to initiate basic research on the biological mechanisms underlying the uptake, distribution between organs, metabolism and release of contaminants in species used for monitoring purposes. (See Recommendation 1, Annex 4.) It was agreed that all papers on these activities should be presented to the Marine Environmental Quality Committee and also to the Working Group, so that at its next meeting the Working Group could plan future work studying the factors controlling the levels of contaminants in fish and shellfish.
- 8.2.2.7 A paper entitled "Monitoring studies of s-DDT and PCB levels in fish from the Swedish west coast and a comparison of trends in the Kattegat and Baltic Proper areas" by Dr. M. Olsson and Dr. L. Reutergårdh was presented. This paper summarized the results of Swedish monitoring studies of s-DDT and PCBs in marine biota during the period 1969 to 1982. The data indicated a decrease in concentrations of s-DDT of about 90% and a decrease in PCB concentrations of about 50% in the muscle tissue of herring from the Kattegat as well as from the Baltic Sea during that period. This decrease also seems to be valid for cod muscle tissue from the Kattegat and egg homogenates from guillemots from the Baltic Proper. The data showed that as the percentage of the original DDT decreased, the percentages of the metabolites, mainly DDE, increased over time.
- 8.2.2.8 In the discussion of this paper, it was noted that there could be no statistical problems with such obvious results concerning trends.
- 8.2.2.9 Dr. Grimås presented the paper "Fat amount - a factor to consider in a determination of heavy metals in cod liver," which he had prepared with several colleagues. The paper gave the results of Swedish investigations on trace metal concentrations in cod liver, which show a strong negative correlation between the fat amount and the zinc concentration in all six sets of samples. Copper and lead concentrations are also negatively correlated with fat content in all cases. Only for one station and one year was the correlation coefficient not significant for cadmium. Dr. Grimås stated that the results indicate that the metals are mainly associated with fractions other than the fat fraction in liver. Since the fat content varies between 2 and 70% in the material, there is a dilution factor of larger than three. Thus, the relative amount, especially of zinc, should be rather constant in the fractions other than fat.
- 8.2.2.10 In the discussion, it was pointed out that the data were presented on a dry weight basis, which excluded potential metals which are associated with the water phase in liver. It was suggested that the corre-

lation proposed be tested using concentrations obtained on a fresh weight basis of the livers.

8.2.2.11 Noting the recommendation in the paper that fat content be determined in liver when analyzing for trace metals, the Working Group agreed that, whenever possible, members should try to include measurements of the fat content of liver when determining concentrations of trace metals in fish livers, especially in cod liver.

8.2.2.12 Dr. Munk Hansen summarized his paper "Fish bone as material for trend monitoring." He stated that he had carried out the study on which this paper was based as a result of the suggestion made at the 1983 Working Group meeting that analyses of bone might be useful for evaluating trends in trace metal levels. For this study, samples of muscle, liver and bone had been taken from spotted wolffish obtained from three localities in Greenland, which included highly contaminated areas as well as reference areas. The hypothesis of the study was that, if no differences in trace metal levels in the various fish tissues were found between the areas studied, it would be unlikely that time trends in metal concentrations would be reflected. Based on the results, it was concluded that for this species

- (a) cadmium cannot be monitored by analyzing muscle, liver or bone;
- (b) copper may possibly be monitored by analyzing bone;
- (c) lead may be monitored by analyzing liver or bone, however, bone seems preferable due to constancy throughout the year;
- (d) zinc cannot be monitored by analyzing muscle, liver, or bone.

8.2.2.13 In the discussion of this paper, it was agreed that these were interesting conclusions, but that they were applicable to this species only. Members were encouraged to carry out similar studies on species of fish which they normally monitor; such studies can be another component to the research on the influence of biological factors on trace metal concentrations, which was advocated in paragraph 8.2.2.6, above.

8.2.2.14 It was pointed out in the discussion that, in terms of spotted wolffish, the constancy in the concentrations of zinc may make the concentrations of this metal a tool for the investigation of the concentrations of other elements. Thus, if zinc concentrations should change in the species monitored, this would be an indication that other environmental variables have changed - variables that also have an influence on the concentrations of other elements.

8.2.3 Objective (2) - Baseline Study

8.2.3.1 In order to consider the position regarding the 1985 Baseline Study of Contaminants in Fish and Shellfish, a sub-group was established with Dr. Barros as chairman. This sub-group used as a basis for its discussions a document prepared by Dr. Portmann, Coordinator of the Baseline Survey, summarizing the intended participation by various countries as indicated to him in the replies he had received directly to a circular letter sent out in July 1983. On the basis of this document and discus-

sions on the detailed proposals, the sub-group was able to report to the Working Group that coverage of the Baltic Sea seemed likely to be good in terms of areas sampled, species collected and analyses of all the mandatory metals and, in most cases, also organochlorine compounds. Although the initial response had suggested that the coverage would be less complete for the North Atlantic, promises made during the course of the meeting suggested that coverage might be equally good for the eastern North Atlantic, although the same could not be said for the western side.

- 8.2.3.2 It was noted that most countries had indicated that they intended to analyse most, if not all, of the mandatory metals, that is, mercury, copper, zinc, cadmium, lead and arsenic, and that the results of the first phase of the Seventh Intercalibration Exercise on Trace Metals in Biological Tissues had suggested that this would be feasible, except perhaps for arsenic and lead. It was also noted that most respondents had indicated that they intended to analyze for PCB and organochlorine pesticide residues.
- 8.2.3.3 The Group was informed that the Marine Chemistry Working Group had not been able to recommend analyses for PCBs and organochlorine pesticide residues owing to unresolved methodological difficulties. As it is anticipated that appropriate methods will be available in a few years, the WGMFNA strongly recommended that participants in the Baseline Study hold sub-samples of materials for analysis in reserve for subsequent analysis when the methods have been agreed. It was felt that this reserve material would be particularly important in terms of the analysis of organochlorines, but could also be used for certain metals, e.g., arsenic and lead, for which the results are not yet comparable. It was realized that in most cases the storage of these samples would probably mean standard deep-freeze storage (-20°C); analysts were recommended to look at the advice prepared by the ACPM on this issue. (See 1982 Report of the ICES Advisory Committee on Marine Pollution, Cooperative Research Report No. 120, paragraphs 52-55 and Annex 4.)
- 8.2.3.4 Having reached this overall conclusion, a number of WGMFNA members felt that the analysis of PCB and organochlorine pesticide residues at the time of the Baseline Study should not be completely discouraged, but rather felt that laboratories that wished to analyze for these contaminants should feel free to do so on a portion of the material collected, retaining a sub-sample of this material in deep-freeze storage for subsequent re-analysis as recommended in the previous paragraph.
- 8.2.3.5 In the light of the reports considered earlier on the behaviour of zinc in fish liver, muscle and bone and in mussels, it was agreed that some doubts must be held about the value of including zinc in the planned study, but no firm recommendations were agreed not to analyze for this metal.
- 8.2.3.6 On other points of detail, it was agreed that mussels should be collected from positions in the intertidal zone where the animals are exposed to the sea for six hours during each tidal cycle. Where possible, animals should be collected from rocks, to reduce the chance of quantities of sediment being found within the animal. Mussels growing on man-made structures should be avoided, if possible. (Full details can be found in "Guidelines for the Use of Biological Material in First

Order Pollution Assessment and Trend Monitoring" by G. Topping (Scottish Fisheries Research Report Number 28, 1983).) Concerning the requirement that fish sampled be two years old, it was agreed that herring should be around 2½ years old, i.e., two-ring fish should be used.

- 8.2.3.7 It was agreed that in order to finalize the details of the plans, all members should write to Dr. Portmann confirming the accuracy of the details in the paper on Baseline Study Plans, or giving corrections and additions, not later than 30 May 1984. Dr. Portmann should then revise the summary in time for it to be available at the Statutory Meeting for the Marine Environmental Quality Committee and ACMP. The final plans for the Baseline Study and the Guidelines for sampling, sample preparation and reporting of data in connection with the conduct of the Study should be distributed to all participating laboratories as soon as they are available.
- 8.2.3.8 Finally, it was noted that the MCWG had suggested that it should review the draft report on the results of the Baseline Study at its 1987 meeting. It was agreed that this would be valuable and it was suggested that MCWG should also be asked to review the annual cooperative monitoring reports.
- 8.2.3.9 The Working Group then turned to the issue of the possible use of seaweeds in a baseline study, in response to a request by ACMP that the Group look into the use of seaweeds as biological indicators or in chemical monitoring programmes. Dr. Munk Hansen reported on the results of studies comparing the concentrations of trace elements, including some rare earths, in samples of Mytilus edulis and Fucus vesiculosus from the Kangerdluarssuk area of Greenland. The results showed that Fucus provided more useful results for some trace elements, while Mytilus was better for other trace elements. For example, concentrations of zinc in Fucus showed clear site differences depending on the level of contamination, while zinc concentrations in mussels showed little variation with site. Similarly, for copper, large differences in concentrations were found in the seaweed collected at different sites, whereas mussels did not show such differences. On the other hand, lead concentrations in mussels showed very clear differences depending on the contamination of the site, while such differences were not observed using seaweed. Dr. Munk Hansen concluded that seaweed can be a good indicator for certain trace metals. One disadvantage of using seaweeds is that they are constantly taking up metals so that only the young parts should be analyzed. For Fucus, the exact age of the thallus cannot be determined. Additionally, it has been established that different species of seaweed give somewhat different results for trace metals.
- 8.2.3.10 The Working Group noted that, on the basis of this information, it appeared that seaweeds could be useful in monitoring certain trace metals. There are still, however, a number of open questions concerning the use of seaweed. It was agreed that seaweeds could not be recommended for inclusion in the Baseline Study at the present time, but that further papers should be requested on the use of seaweeds in pollution monitoring programmes.

8.3 Baseline Study of Trace Metals in Coastal and Shelf Waters

8.3.1 Progress in planning

8.3.1.1 The Working Group was informed that, at the recent meeting of the Marine Chemistry Working Group, the results of the Fifth Round Intercalibration on Trace Metals in Sea Water had been reviewed and it was concluded that a reasonable number of laboratories were now able to carry out accurate and precise measurements of trace metals in sea water. Accordingly, the MCWG recommended that a Baseline Study of Trace Metals in Coastal Waters be carried out. In addition to trace metals, data should be obtained on temperature, salinity, nitrate, phosphate and silicate, to enable a better interpretation of the trace metal data. As the MCWG had felt that several laboratories who may wish to participate in the study did not yet have sufficient expertise in sampling and sample storage, the MCWG had proposed that several reference stations for sampling of sea water be identified. According to this proposal, samples of sea water from these stations should be taken and analyzed by the laboratories which have demonstrated the necessary expertise. Other laboratories should obtain sea water samples at the nearest reference station and analyze them for the appropriate substances. When these laboratories obtain the same results as the more experienced laboratories, they can begin work on the Baseline Survey. For this reason, the MCWG has recommended that the Baseline Survey take place over a period of three years. The details concerning the sampling plan, use of the reference stations, etc. will be described in a paper prepared by several MCWG members which will be presented at the 1984 Statutory Meeting.

8.3.1.2 The WGMFNA noted this information with interest. While the Working Group was pleased to learn that the MCWG felt that the baseline survey could be carried out, it felt that it could not approve the study without seeing the actual plans for how it would be carried out. As baseline and monitoring programmes are a function of WGMFNA, it was agreed that this Working Group should endorse the programme before it goes forward. The Working Group agreed, therefore, that the paper giving the plans for the baseline study, prepared by members of MCWG, should be circulated intersessionally to all members of WGMFNA to permit them to comment on the paper before it is presented at the 1984 Statutory Meeting. In connection with the mid-term ACMP meeting in June, members of WGMFNA can take the opportunity to discuss the draft proposals in detail with members of MCWG, so that any amendments can be made in adequate time before the Statutory Meeting. The WGMFNA will then consider the plans at its meeting in 1985 for final approval.

8.3.1.3 The Working Group noted that the MCWG had suggested that measurements of total polynuclear aromatic hydrocarbons (PAHs) in sea water using the ultra-violet fluorescence (UVF) technique could also be made, if desired. The WGMFNA agreed that measurements of PAHs in sea water would be a useful component in the baseline study and, accordingly, recommended that analyses of total PAHs using UVF be included in the baseline study of contaminants in sea water.

8.3.2 Time trend monitoring of contaminants in sea water

8.3.2.1 It was reported that ACMP had raised the question of time trend monitoring of contaminants in sea water and has requested the Working Group to discuss the matter, considering the following points:

- time scale/sampling frequency;
- Eulerian or Lagrangian ordination of sampling points;
- choice and identification of water mass; and
- choice of contaminants.

8.3.2.2 In the discussion of this topic, it was noted that time trend monitoring of nutrients in sea water has been carried out fairly successfully in some areas, but not in others. It appeared that studies directed toward point source monitoring provide more useful information than broad-scale surveys. It was noted that the work being carried out in the Baltic Sea on temporal and spatial patchiness in the distribution of, e.g., substances in the water column was very relevant to this issue. Additionally, the experience that will be gained from the Baseline Study on Trace Metals in Sea Water will provide some useful background information on this subject. Accordingly, the Working Group agreed to consider this issue again after further experience has been obtained from the patchiness studies and the baseline survey in sea water.

8.4 Sediments

8.4.1 The Working Group was informed about the outcome of the meeting of the Working Group on Marine Sediments in Relation to Pollution (WGMS), which had taken place the previous week. At that meeting, the WGMS had reviewed final plans for the conduct of an intercalibration exercise on the analysis of trace metals in sediments using various methods of acid digestion and had discussed the preliminary results of an intercalibration of methods for the analysis of Baltic Sea sediments, which was conducted in preparation for a pilot study of contaminants in Baltic sediments. The WGMS had also reviewed detailed reports on the progress achieved so far in the pilot studies of sediments in the German Bight and in the Skagerrak. The WGMS had initiated work in regard to the assessment of the bioavailability of contaminants in sediments.

8.4.2 The WGMFNA took note of this information with interest, noting that the various intercalibration activities point to the possibility of including sediments in a monitoring programme in the not too distant future. The Working Group also noted that in 1983 the WGMS had agreed to guidelines for the use of sediments in marine pollution monitoring programmes. These guidelines provide very useful information on how to monitor contaminants in sediments according to three levels of complexity of analysis of the sediments. These guidelines have been published as Annex 2 ("The Potential Role of Sediments in Pollution Monitoring") to the 1983 Report of the ICES Advisory Committee on Marine Pollution (Cooperative Research Report No. 124 (1983)). The Working Group agreed that it will review these guidelines at its 1985 meeting and will then decide on whether a monitoring programme on contaminants in sediments should be drawn up and, if so, what type of a programme this should be.

9. REGIONAL ASSESSMENTS

- 9.1 Dr. Pearce informed the Group about an environmental assessment of the mid-Atlantic Bight that had been recently completed. This assessment covers the outer shelf area and gives an update of the characterization of the 106-mile dumpsite area. The assessment was developed along the lines agreed by ICES in 1982-1983 (as published in Annex 3 to the 1983 Report of the ACMP (Coop. Res. Rep. No. 124)). The assessment contains information on the physical oceanography of the region, the sediment characteristics in the outer shelf area, and data on nutrients, phytoplankton and zooplankton biomass, fish, benthos, etc. Dr. Pearce stated that the report contains a great deal of information and could not have been an effective document if it had been limited to the 30 pages suggested in the guidelines for the preparation of regional assessments. Dr. Pearce offered to provide copies of this assessment to all Working Group members.
- 9.2 Dr. Pearce further stated that an assessment of the shelf-wide area is in the final stages of completion and will be available in early spring. An assessment is also beginning for the coastal areas, but this will not be completed for some time. He offered to distribute copies of these reports when they become available.
- 9.3 The Working Group noted this information with interest and looked forward to seeing the reports.
- 9.4 Dr. Jensen reported that an assessment of the inputs of toxic substances to the Øresund and the concentrations of toxic substances in the different compartments of the marine environment is being carried out by Denmark and Sweden. This follows an earlier assessment of the hydrographic conditions, nutrients and benthos in this area, which took place in 1981. This assessment report will not be translated into English.
- 9.5 Dr. Stockman reported that an assessment is being carried out of the Dutch coastal area; this will not be translated into English.
- 9.6 Dr. Weichart stated that an assessment of the German Bight area will be published in a few months. He hoped to present this assessment report at the next Working Group meeting.
- 9.7 Dr. McIntyre mentioned that an assessment is presently being prepared of the area off the east coast of Scotland. This report will be ready in May, in time for consideration by ACMP at its mid-term meeting in early June.
- 9.8 Dr. Dybern reported that an assessment of the Skagerrak/Kattegat area is under preparation by the Working Group on Pollution-Related Studies in the Skagerrak and Kattegat. This assessment is being prepared according to the ICES guidelines and will contain six chapters comprising summaries of the relevant information. The first draft of the assessment will be reviewed in early spring and the final document would hopefully be ready by the time of the next WGMFNA meeting.

- 9.9 The Working Group noted that at its next meeting, assessments will probably be available for the mid-Atlantic shelf area off the USA and for the Skagerrak/Kattegat area. The Working Group encouraged this and other work on the subject.
10. ANY OTHER BUSINESS
- 10.1 No items of business were raised under this point.
11. REPORT, ACTION LIST AND RECOMMENDATIONS
- 11.1 The Working Group looked over the various sections of the report which had been prepared and approved them for inclusion in the overall report of the meeting.
- 11.2 The Working Group considered the list of intersessional activities and approved it. This Action List is attached as Annex 3.
- 11.3 The Working Group then considered its recommendations and endorsed Recommendation 1, encouraging research into biological mechanisms affecting the concentrations of contaminants in marine organisms, and Recommendation 2 on the meeting of the group of statisticians (See Annex 4).
- 11.4 The Working Group discussed its next meeting and recommended that it meet for 5 days (including the joint session with WGPDMO) at ICES headquarters in the first quarter of 1985 to consider the results of the joint meeting with WGPDMO in relation to the use of fish disease in biological effects monitoring, to review papers on techniques of biological effects monitoring, to review papers on primary productivity and nutrient fluxes, to review the progress in the Cooperative ICES Monitoring Studies Programme and particularly the trend monitoring component, to review plans for the Baseline Study of Trace Metals in Sea Water, and to review the work of WGMS with a view to considering the possibility of developing a programme for monitoring contaminants in marine sediments. The one-day joint session with the Working Group on Pathology and Disease of Marine Organisms should take place on Tuesday or Wednesday of the week of the meeting. The meeting should be held back-to-back with the meeting of MCWG. The full recommendation for the next meeting is contained in Recommendation 3 (Annex 4).
- 11.5 Having completed the business of the meeting, the Chairman raised the question of how effectively the Group has been carrying out its work. He felt that there were two major problems: (1) there is an insufficient number of biologists on the Group to handle effectively the work on biological effects monitoring, and (2) the report of the Working Group should be considered in greater detail by the Marine Environmental Quality Committee to determine whether the Group is meeting their needs; at present, the WCPNA report is mainly only considered by ACMP.
- 11.6 In the discussion of these questions, the Group agreed that the lack of biologists on the Working Group has indeed hampered its work, resulting in very slow progress in biological work. Some members felt that

efforts should be made to have more biologists appointed to the Group, while others felt that a Sub-Group on Biological Effects Monitoring should be formed which could meet once per year. Membership on this Sub-Group should also be open to scientists from the Baltic Sea area.

- 11.7 Dr. Dybern, Chairman of the Marine Environmental Quality Committee, stated that the problems discussed have been the same for many years and that it was time to make changes in the way the work is carried out. He stated that some of the items discussed by the Working Group, e.g., regional assessments, could be discussed in MEQC instead. He also felt that too much of the Working Group's time was devoted to discussions of routine monitoring and proposed that this should be handled by a small group of scientists, who could report briefly on the results of their work to the full Working Group. He further proposed that a study group be set up to consider the relationships between the various pollution-related Working Groups and MEQC and ACMP.
- 11.8 The Working Group agreed with the suggestion that consideration should be given to whether some of the items handled by the Working Group should be discussed in MEQC instead. The Working Group also agreed with the proposal that routine monitoring issues should be handled by a small group working interessionally. Finally, the Working Group agreed that a study group should be set up to look at the relationship between the pollution Working Groups and MEQC and make proposals for changes. It was agreed that this study group should be chaired by Dr. Pearce, as former Chairman of MEQC, and should include the present Chairman of MEQC, Dr. Dybern, and the Chairmen of the following Working Groups: Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic, Working Group on Marine Sediments in Relation to Pollution, Marine Chemistry Working Group, the ICES/SCOR Working Group on the Study of the Pollution of the Baltic, as well as the Chairman of ACMP and the ICES Environment Officer. It was agreed that Dr. Pearce would write to all members of this study group to encourage discussions on this topic and to send discussion papers around. An informal meeting can be held during the early part of the 1984 Statutory Meeting and the subject can be discussed in the Marine Environmental Quality Committee. The Working Group agreed that the discussions of this study group should be considered informal and that the Working Group should be informed of its conclusions at its next meeting, before any recommendations go higher up in the ICES structure.

12. CLOSURE OF MEETING

- 12.1 On behalf of the Working Group, the Chairman thanked the host Institute, the Instituto Nacional de Investigaçao das Pescas, for hosting the meeting and expressed warm gratitude to the staff members who had provided such excellent service to the meeting.
- 12.2 The Chairman then thanked all participants in the meeting for their work at this meeting and also over the past four years of his chairmanship. Having completed four years in the chair, the Chairman stated that he would now retire from that position. He thanked all who had made his work so interesting and wished the Group all success in the future.

- 12.3 The Working Group then thanked the Chairman for his excellent work in the chair and for always being patient and encouraging discussions.
- 12.4 The Chairman then closed the meeting at 15.00 hrs on 2 March 1984.

ANNEX 1

WORKING GROUP ON

MARINE POLLUTION BASELINE AND MONITORING STUDIES IN THE NORTH ATLANTIC

Lisbon, 28 February - 2 March 1984

A G E N D A

1. Opening of Meeting
2. Approval of Agenda
3. Actions of Council and ACMP, and related ICES activities
4. Other International Activities
5. Biological Effects Studies
 - 5.1 Fish Pathology
 - 5.2 Methods
 - 5.3 Workshop on Biological Effects Monitoring Techniques
6. Primary Productivity and Nutrients
7. Reviews and Overviews of Contaminants
8. Contaminant Monitoring
 - 8.1 Coordinated Monitoring Programme
 - 8.2 Cooperative Monitoring Studies for Contaminants in Biota
 - 8.2.1 Objective (1) - Public Health Protection
 - 8.2.2 Objective (3) - Trend Monitoring
 - 8.2.3 Objective (2) - Baseline Study
 - 8.3 Baseline Study of Trace Metals in Coastal and Shelf Waters
 - 8.3.1 Progress in planning
 - 8.3.2 Time trend monitoring of contaminants in sea water
 - 8.4 Sediments
9. Regional Assessments
10. Any Other Business
11. Report, Action List and Recommendations
12. Closure of Meeting

ANNEX 2

WORKING GROUP ON

MARINE POLLUTION BASELINE AND MONITORING STUDIES IN THE NORTH ATLANTIC

Lisbon, 28 February - 2 March 1984

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ANNEX 3

ACTION LIST

The following intersessional activities have been agreed:

1. Dr. Dethlefsen has agreed to review papers which have shown a positive link between disease prevalence and pollution in a marine area and prepare a summary paper on the results of these studies and the parameters that linked disease with pollution, for consideration at the joint meeting with WGPDMO in 1985. (Paragraph 5.1.11)
2. The Chairman has agreed to write to the Chairman of WGPDMO welcoming the proposal for a joint meeting between the two Working Groups, suggesting that the meeting should consist of a one-day overlap at the 1985 meetings of the two Groups, and proposing the items mentioned in paragraph 5.1.12 for the agenda. (Paragraph 5.1.12)
3. The Chairman has agreed to write to the Chairman of the Benthos Methodics Working Group posing the questions listed in paragraph 5.2.5 prior to a discussion of this issue at the 1984 Statutory Meeting. (Paragraph 5.2.5)
4. Dr. Pearce has agreed to contact Dr. J. Payne to obtain copies of his review paper on the use of measurements of mixed-function oxygenase activity for monitoring biological effects, for next year's Working Group meeting. (Paragraph 5.2.16)
5. All members are requested to encourage the preparation of papers evaluating the usefulness and effectiveness of particular biological effects monitoring techniques, including information on the ease of application, the associated costs, and the ability to interpret the results obtained. (Paragraph 5.2.21)
6. The Chairman has agreed to write to the Chairman of WGPDMO informing him of the topics stated in Paragraph 5.3.7(a).
7. All members are requested to contact national members of WGPDMO to urge that WGPDMO responds positively to the baseline study proposals. (Paragraph 5.3.9(b))
8. Dr. Pearce agreed to contact the Chairman of the Biological Oceanography Committee to see whether he can identify people who can contribute to the preparation of a comprehensive overview of nutrient inputs and fluxes and of primary production and of the relationships between the two. The Chairman of WGPMPNA will also try to find people who can assist in this work. (Paragraph 6.19 - 6.20)
9. All members are requested to comment on the draft 1982 Cooperative ICES Monitoring Studies Report in writing to the ICES Environment Officer by 30 June 1984. (Paragraph 8.2.1.1)

10. The ICES Secretariat should send a copy of the protocol for the Co-operative ICES Monitoring Studies Programme to ICES Delegates so that they are aware of the requirements of the programme. The Environment Officer should send a check-list, containing the key points to be observed when sampling for Objective 1, to all persons who contribute to the programme. (Paragraph 8.2.1.5)
11. The Chairman agreed to write to Dr. J. Uthe asking him to convene an ad hoc Group of Experts on Statistics. (Paragraph 8.2.2.4)
12. All members should write to Dr. J. Portmann confirming the accuracy of the details in the paper on Baseline Study plans, or giving corrections or additions, not later than 30 May 1984. Dr. Portmann should then revise the plans for them to be available for the 1984 Statutory Meeting. (Paragraph 8.2.3.7)

ANNEX 4

RECOMMENDATIONS

Recommendation 1

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that ICES member countries be encouraged to initiate basic research into the biological mechanisms underlying the uptake, distribution between organs, metabolism and release of contaminants in species of fish and shellfish used for monitoring purposes.

Recommendation 2

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that the group of statisticians assisting WGMFNA on trend monitoring issues hold a 2-3 day meeting (to be convened by Dr. J. Uthe) at ICES headquarters in December 1984 (or January 1985) to consider the statistical aspects of trend monitoring and to look over the trend monitoring data collected in the Cooperative ICES Monitoring Studies Programme with a view to determining how to tabulate and analyze these data, and to conduct a preliminary analysis of the 1982/1983 data.

Recommendation 3

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that the next meeting of the Working Group be held for 5 days in the first quarter of 1985 at ICES headquarters to carry out the following:

- (1) consider the results of the joint meeting with the Working Group on Pathology and Disease of Marine Organisms with regard to the use of fish disease observations in biological effects monitoring studies;
- (2) review methods for biological effects monitoring and proposals for the Workshop on Biological Effects Monitoring Techniques;
- (3) review papers on primary productivity and nutrient fluxes;
- (4) review progress in the Cooperative ICES Monitoring Studies Programme and, particularly, statistical aspects of trend monitoring and progress in research on factors affecting contaminant levels in organisms;
- (5) review plans for the Baseline Study on Trace Metals in Sea Water and endorse;

- (6) review the work of the Working Group on Marine Sediments in Relation to Pollution with a view to considering the possibility of a monitoring programme for contaminants in sediments and developing plans for such monitoring.

A one-day joint session with the Working Group on Pathology and Disease of Marine Organisms should be held on Tuesday or Wednesday of the week of this meeting to discuss matters to be agreed by the two Working Groups.

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