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

Copenhagen, 1-4 February 1983

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1. OPENING OF MEETING

1.1 The Chairman, Dr M Parker, opened the meeting at 9.30 hrs on 1 February 1983 and welcomed all the participants. Each participant then introduced himself and indicated his main areas of interest.

2. ADOPTION OF AGENDA

2.1 The Working Group adopted the draft agenda 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.

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

3.1 The Working Group looked over a list of relevant resolutions from the 1982 Statutory Meeting which had been circulated prior to the Working Group meeting.

4. OTHER INTERNATIONAL ACTIVITIES

4.1 JMG - Dr Portmann provided information on the outcome of the meeting of the Joint Monitoring Group (JMG) of the Oslo and Paris Commissions in January 1983 (Doc. WGMPNA 1983/4/1). He reported that the JMG had reviewed the results of its monitoring programme for its first three years. This programme includes the monitoring of mercury and cadmium in biota, sea water and, recently, sediments and PCBs in biota. The JMG recognized the importance of intercalibration exercises and looked mainly to ICES to coordinate them. Dr Portmann reported that the JMG had shown considerable interest in biological effects monitoring studies and would welcome concrete advice from ICES on appropriate techniques to monitor the biological effects of pollution. The ICES sampling protocols for monitoring using marine organisms had been considered again by the JMG and they were readopted, with attention paid to which JMG monitoring objective each protocol corresponded. Dr Portmann further reported that a French national intercalibration exercise on trace metals in sediments which had been open to JMG laboratories would also now be open to ICES laboratories. Finally, regarding the timing of the meetings of JMG versus those of WGMPNA, Dr Portmann noted that there was considerable dissatisfaction in the recent scheduling of these meetings in which JMG meets before WGMPNA during consecutive weeks.

4.2 GESAMP

Dr Topping summarized Dr McIntyre's report on current activities of GESAMP (Doc. WGMPNA 1983/4/2). He stated that the major recent effort within GESAMP during the past few years, the preparation of a report on the state of the Health of the Oceans, was now completed and the report had been published in 1982. At present, GESAMP has six specific studies which are being carried out by separate working groups: (1) the develop-

ment of an oceanographic model for the dispersion of wastes disposed in the deep sea, (2) a review of potentially harmful substances (concentrating on cadmium, tin and lead, at present), (3) an evaluation of the hazards of harmful substances carried by ships, (4) the interchange of pollutants between the atmosphere and the oceans, (5) the marine pollution implications of ocean energy development, and (6) the biological effects of thermal discharges in the marine environment. Additionally, GESAMP has been considering an amendment to its definition of marine pollution to include the alteration of ocean-related physical processes including climate.

4.3 GIPME/GEMSI

Dr Topping reported that a new sub-group of GEMSI (Group of Experts on Methods, Standards and Intercalibration) had been formed on the use of marine organisms in the MARPOLMON programme. This sub-group had carried out a questionnaire survey of laboratories associated with IOC programmes to determine their capabilities to take part in an international monitoring programme using marine organisms and had subsequently carried out an intercalibration exercise on the analyses of trace metals and organochlorines in biological tissues. A workshop on analytical techniques was now being planned to be held in Australia.

4.4 Helsinki Commission

The Environment Officer reported that the Baltic Monitoring Programme of the Helsinki Commission had undergone review during 1982 and somewhat amended guidelines had been adopted for the second stage of the programme, beginning in 1984 (see C.M.1982/E:65 for additional details).

5. BIOLOGICAL EFFECTS STUDIES

5.1 Reports On Methods

5.1.1 Dr Pearce summarized the paper by Dr R N Reid entitled "Recent and Ongoing Benthic Macrofauna Monitoring in U.S.Marine and Estuarine Waters" (Doc. WGMPNA 1983/5.1/1), which had been prepared in response to the call for papers on benthic monitoring activities and their usefulness in biological effects studies, which had been made at the previous meeting. This paper provided brief information on a number of programmes to monitor benthic macrofauna in various coastal areas of the United States, both in fairly clean areas as well as in areas subject to contaminant inputs via dumping or land-based sources. The author concluded that the techniques used to monitor benthic macrofauna in these programmes (generally determining numbers of species, populations of dominant species and indicator taxa (amphipods and certain polychaetes) and overall species composition (via clustering techniques)) are useful in establishing the biological effects of natural and anthropogenic environmental changes. Dr Pearce added that several of the programmes mentioned in the paper were part of a major project to map the benthos of the continental shelf off the East Coast of the USA during the 1970s and 1980s and, thus, establish benchmark information which can enable a better assessment of the effects of dumping toxic wastes in some of these areas. This information will also assist in the studies of the food available to commercially important species of demersal fish.

5.1.2 In the discussion of this paper, it was pointed out that the methods of conducting benthic studies are extremely important to enable changes to be observed when an area comes under stress from, e.g., dumping activities. A suggestion was made that information should also be obtained on the physiological state of the organisms studied in order to be able to interpret the results. It was further stressed that, in order to obtain proper benchmarks of the conditions in an area, studies must be conducted before dumping or other contaminating activities begin. This is, however, impossible in areas subject to discharge of contaminants over many decades.

5.1.3 In this connection, the Working Group noted that the activities of the ICES Benthos Methodics (formerly North Sea Benthos) Working Group on the standardization of methods for the study of benthos would be extremely valuable for the application of benthos monitoring techniques for use in studies of the biological effects of pollution, particularly in dumping grounds.

5.1.4 The Working Group noted that when the results of some of the U.S. benthic studies have been combined they would provide a good general description of the macrobenthos of the continental shelf off the US East Coast. The Working Group further noted that the Benthos Methodics Working Group had proposed a similar type of synoptic benthic survey in the North Sea (see ICES Doc. C.M. 1982/L:39, paragraph 9.3, Annex 5 and Recommendation 2). The WGMPNA welcomed this approach as providing necessary background information for the interpretation of benthos monitoring data gathered from more confined areas, e.g., dumping grounds.

5.1.5 Dr Uthe introduced two papers which had been prepared by several of his colleagues. The first paper, "The Effects of Pollutants and Contaminants on Steroidogenesis in Fish and Marine Mammals" by Drs H C Freeman, G B Sangalang and J F Uthe (Doc. WGMPNA 1983/5.1/2), gave the results of laboratory studies on the effects of several contaminants on steroid hormone metabolism in several species of fish and in the harp seal. The results of these studies showed that changes in steroid hormone metabolism may be used as sensitive indicators of the presence of chemical contaminants. In the second paper, "Adenylate energy charge and ATPase activity: potential biochemical indicators of sub-lethal effects caused by pollutants in aquatic animals", by Drs K Haya and B A Waiwood (Doc. WGMPNA 1983/5.1/3), the possible use of these two biochemical parameters as indicators of the sub-lethal effects of contaminants was discussed. This paper concluded that adenylate energy charge (AEC) and ATPase activity are potentially useful non-specific indicators of sub-lethal contaminant intoxication in marine organisms, however, more research must be done on the actual effects of contaminants on AEC and ATPase activity before they can be useful in assessing the hazards of contaminants.

5.1.6 In the discussion, it was pointed out that the techniques used to determine AEC or ATPase activity are very complicated. Thus, while they are useful in specific laboratory situations, they are difficult to apply on a broad-scale basis. Another complication mentioned with regard to the use of AEC is that the AEC response to particular stressors is different for different species and, thus, the types of AEC responses to various stressors must be studied individually in each species to be used. Nonetheless, it appeared that, while the measurement of AEC may not be useful in the identification of biological effects of pollution, it could be used in the quantification of such effects.

5.1.7 Dr Topping felt that the AEC technique could be useful when monitoring for biological effects around an oil rig and agreed to have a colleague prepare a paper on this subject for the next Working Group meeting. Dr Thurberg agreed to obtain a paper on a relevant study in the United States for the next meeting.

5.1.8 Dr Thurberg then summarized the paper that he and Dr Pearce had prepared on "Biological Monitoring Activities in United States Marine Waters" (Doc. WGMPNA 1983/5.1/4). As in previous years, the Ocean Pulse Program was the most extensive multi-disciplinary programme related to biological monitoring of the marine environment. Dr Thurberg summarized the principal findings on biological effects from the 1981 annual report of this programme. In another programme, caged blue mussels have been used to monitor pollution impact at New York Bight dumpsites. Gill-tissue respiration and scope-for-growth were among the parameters studied and Dr Thurberg reported that pollution stress can be detected very easily with both these indices. Gill-tissue respiration has been shown to be good for Phase I (Identification) in studying biological effects because it is an easy and rapid technique to use, while scope-for-growth has been valuable in Phase II (Quantification) because the information is very useful, although the technique is more complicated.

5.1.9 Dr Pearce highlighted the main points of a paper which he and four colleagues had prepared on "The Use of Phytoplankton and Primary Production Measurements in Environmental Assessment Programs" (Doc. WGMPNA 1983/5.1/5). He stated that based on extensive measurements of phytoplankton primary productivity in Northwest Atlantic coastal and shelf waters, it has been shown that areas receiving nutrients from estuarine systems have a different phytoplankton composition and regular phytoplankton blooms. The highest levels of primary production were found in nutrient enriched areas, such as the New York Bight apex and the Chesapeake Bay plume. Additionally, studies of biomass and species composition of phytoplankton have been carried out along the East Coast of the United States to determine which species account for the greatest productivity; a number of reports will be published with the results of these studies. Algal assays are being used in studies of the chemical quality of the water, to determine whether primary production is supported or inhibited in various bodies of water. Dr Pearce reported that the data from these programmes is used for fish production studies as well as for environmental assessment.

5.1.10 Dr Skjoldal then presented a paper on "Monitoring Primary Production Indices" by Drs Berge and Rey (Doc. WGMPNA 1983/5.1/6). This paper described the development of primary production indices and their variations with time of the year and different locations in Norwegian coastal waters. It was reported that primary production indices have proved to be a useful parameter in evaluating the effects of environmental disturbances, e.g., a major oil pollution situation, but they are complicated to apply and thus presently were not useful for a conjoint monitoring programme.

5.1.11 The Working Group agreed that these papers on the use of primary production determinations in monitoring biological effects were very useful. It was felt that, to advance the consideration of this subject more quickly, it would be valuable to have an overview paper prepared on the application of primary production studies and primary production indices in biological effects monitoring, in the context of the GESAMP guidelines on this subject. To carry out this overview, information should be collected from all members of WGMPNA as well as from members of the former Working Group on Primary Production Methodology. Dr Pearce offered to request a colleague to prepare this overview paper for the next meeting of the Working Group.

5.1.12 Dr Skjoldal then summarized a paper that he and Dr Berge had prepared giving information on biological effects studies in Norway. These studies include: (1) monitoring the pelagic production system over the Norwegian continental shelf to establish normal conditions and anomalies within each trophic level as a background for assessing the effects of a possible catastrophic pollution incident; (2) benthic monitoring on rocky bottoms below the tidal zone at several sites near Tromsø and in the outer part of the Oslofjord; (3) monitoring Mixed Function Oxidase in the liver of flounder to establish baseline levels and seasonal variations; and (4) studies of pseudobranchial tumours in cod in the Barents Sea.

5.1.13 Dr Carlberg then provided information to update his previous report on biological effects studies in Sweden. He stated that a programme using stereophotography to study benthic conditions now has ten years of results for one site. A five-year multi-disciplinary programme had recently been initiated to study eutrophication in Swedish marine waters. Among others, primary production and soft-bottom benthos will be monitored in the areas under study. Finally, Dr Carlberg stated that a report had recently been made available on the use of the rotatory flow technique in studies of stress effects on fish.

5.1.14 The Working Group expressed interest in the work using the rotatory flow technique and asked Dr Carlberg to present a report at the 1984 meeting evaluating the use of the rotatory flow technique in biological effects studies, including consideration of the costs associated with this technique.

5.1.15 The Chairman then reviewed the progress to date in the Working Group's work on biological effects monitoring. Since the Beaufort Workshop on Monitoring the Biological Effects of Pollution in the Sea in 1979, the Working Group had made some progress in the evaluation of techniques, although much of this work was simply an extension of the work undertaken at the Beaufort Workshop. At its 1982 meeting, the Working Group had adopted the three-part GESAMP strategy towards the application of biological effects monitoring, namely,

(1) Phase I: Identification of potential or actual biological effects of pollution and thus determining "hot spots" of pollution;

(2) Phase II: Quantification of the degree or extent of the effect; and

(3) Phase III: Causation - determination of the cause of the effect.

At the present meeting, the Working Group was attempting to evaluate the techniques in the light of their application within this framework, as well as in terms of their cost effectiveness.

5.1.16 The Chairman considered, however, that the progress had been slow and that there was an increasing demand from JMG, among others, for advice on techniques for effects monitoring. The Chairman saw two tasks before the Group:

(a) a continuation of the process of the evaluation of techniques, which is necessarily a long-term task;

(b) the implementation by the Group of a joint field programme of effects monitoring, to act as a spur to further activities in this area.

5.1.17 On the first issue, the Working Group considered that the process of evaluation should continue initially on the basis of reports from users of the techniques listed in the Beaufort Workshop and GESAMP reports and, subsequently, as information on the various classes of techniques became available, on the basis of critical overviews which would lead to a decision of whether each particular technique should be included or excluded from a list of recommended techniques. The evaluation would be carried out with respect to

the applications within the adopted strategy and the simplicity, cost effectiveness and relevance of the technique.

5.1.18 Regarding the second issue, the Chairman proposed that the first step in the implementation of a field programme would be a baseline study utilising the types of techniques recognised as being useful for the first phase of the GESAMP effects monitoring strategy (identification). In the identification phase, besides chemical baseline studies, biochemical/cytological (or possibly physiological), pathobiological and bio-assay techniques of generalised response had been agreed to be appropriate (see 1982 WGMPNA report, Sec. 5.3 and Annex 4). Any technique to be applied in a first exercise would have to be both inexpensive and simple, since funds were short and the technique would have to be applied in some cases by laboratories with no experience with the chosen methods.

5.1.19 In discussing the first of these two proposals, the Working Group agreed that it was necessary to continue to request reports on techniques of effects monitoring which evaluate the effectiveness of the technique in particular applications, the ease of use, and cost effectiveness, and stressing also the ability to interpret the results obtained from using the technique. In addition to repeating this request for the evaluation of techniques by individual users, the Working Group agreed that, for the most-studied techniques, joint evaluations by several scientists should be requested so that a broader picture could be obtained on the practical aspects of using those techniques.

5.1.20 Regarding the second proposal by the Chairman (in para.5.1.16, above), the Working Group decided to set up a sub-group to consider this issue in more detail and, in particular, to develop a means of selecting one or two techniques which could be used by ICES laboratories in a cooperative biological effects study.

5.1.21 Accordingly, a sub-group consisting of Drs Parker, Pearce, Thurberg, Dethlefsen, Nounou and Pentreath was established to consider this proposal. The discussions of the sub-group were limited to biochemical, cytological, physiological and bio-assay techniques because the question of pathobiology was being dealt with under a different agenda item (see Section 5.2, below).

5.1.22 It was agreed that in the first instance the technique(s) to be used must be inexpensive and simple if they were to be widely applied and that, for comparative purposes over the ICES area, a generalised response method would be more appropriate than a technique responsive to particular contaminants. It was also agreed that as far as possible the response should have some relevance in terms of assessment of damage to the environment and that it was essential that simultaneous chemical analysis of the test organism or water be carried out. Possible problems in selecting comparable test organisms over the whole area were noted; it might be necessary to divide the study into east and west Atlantic components. The sub-group decided that it was not in a position to choose a particular technique.

5.1.23 The Sub-group proposed, and the full Working Group agreed, that a Workshop should be held to demonstrate and evaluate generalised response cytological/biochemical/physiological and bio-assay methods of the type proposed at the Beaufort Workshop. This will be the first step towards selecting techniques for a coordinated biological monitoring programme, and implementing that programme. Dr Dethlefsen proposed the use of the R/V "Anton Dohrn" for a ten-day cruise workshop in the German Bight in May 1984 and he will further request laboratory facilities for the same time-period at the Helgoland laboratory. This will allow for ship-board as well as shore-based testing of samples collected from polluted and control sites during the workshop exercise. The criteria for any proposed monitoring techniques are that they be simple enough for use in broad-based coordinated programmes, that they be inexpensive, and that they be rapid enough to be performed during the workshop.

5.1.24 All members are requested to seek potential participants who are willing to attend the workshop and demonstrate their techniques. Dr Thurberg will prepare and distribute a form to Working Group members requesting information from proposed participants on their techniques, as a preliminary survey to determine the level of interest in the workshop.

5.1.25 The Working Group noted that one goal of this workshop would be to obtain agreement on one or two techniques which could be used in a baseline study of biological effects which could be timed for 1985 to coincide with the baseline study on contaminants in fish and shellfish and the baseline study on trace metals in sea water. Accordingly, the Working Group approved Recommendation 1 (a) that the Biological Effects Techniques Workshop be held in May 1984 to demonstrate appropriate techniques and determine their suitability for use in a cooperative programme, and (b) that approval in principle be given for a baseline study in 1985 using Phase I identification techniques (see Annex 8). Finally, the Working Group invited the ICES/SCOR Working Group on the Study of the Pollution of the Baltic to cooperate in the preparation and conduct of this Workshop.

5.1.26 During the discussion of this baseline study, Dr Nounou suggested that the WGMPNA work to develop a baseline survey using biological effects techniques could usefully be coordinated with work being conducted by the Working Group on Pathology and Disease of Marine Organisms (WGPDMO) on the development of a baseline survey of fish disease incidence. He noted that the WGPDMO fish disease baseline survey needs to be supplemented with synoptic information on environmental conditions in the water column and sediments, on body burdens of contaminants in the organisms studied, and on other potential biological effects. He thus felt that there could be useful cooperation between the two Working Groups in this area.

5.2 Studies of Fish Pathology in Relation to Biological Effects

5.2.1 The Chairman reminded the Group that at last year's meeting several reports on the incidence of fish disease had been considered and the issue of the possible relationship between fish disease and

pollution had been discussed in the context of the possibility of using pathobiology in monitoring programmes on the biological effects of pollution. As a result of this discussion, several questions had been posed to the Working Group on Pathology and Disease of Marine Organisms (WGPDMO) regarding the geographical distribution of fish diseases and the relationship of disease incidence to environmental variables. These questions and relevant information had been submitted via the ACMP to the WGPDMO for consideration at the 1982 WGPDMO meeting.

5.2.2 Dr E Egidius, a member of WGPDMO, summarized the discussion at the 1982 WGPDMO meeting concerning the WGMPNA questions. She stated that the WGPDMO had felt that the WGMPNA was attempting to duplicate WGPDMO work in fish pathology and had, consequently, recommended that the issue of overlap be solved by bringing all pathology work back to WGPDMO. The WGPDMO felt that pathology work is very specialized and that only trained pathologists are able to carry out properly studies of fish disease. In response to the questions posed by WGMPNA, the WGPDMO stated that it will continue its work on the study of fish disease and its causes, including marine pollution, and would report on the results of this work when they become available.

5.2.3 In the discussion, it was recalled that for many years WGMPNA has been looking into techniques that can be used to determine the biological effects of marine pollution. At the 1979 Beaufort Workshop on Monitoring the Biological Effects of Pollution in the Sea, fish pathology had been singled out as one possible means of monitoring the biological effects of marine pollution and, consequently, the WGMPNA had been following up that possibility. Furthermore, when carrying out studies of fish disease incidence, the WGMPNA has recommended that associated environmental data also be collected, both concerning the water column (and possibly sediments) as well as the contaminant burdens in diseased fish.

5.2.4 Dr Dethlefsen reported that he would coordinate, as an activity under ACMP, a cruise workshop to intercompare sampling methodologies for fish disease studies and diagnoses of the diseases most frequently studied in association with biological effects work. He stated that the plans for this workshop have been developed in consultation with several fish pathologists, including the Chairman of WGPDMO. The workshop is planned to be held from 16-27 May 1983 and will begin from Bremerhaven. The main aim of the workshop is to study the problems of sampling methodology, including optimal trawling time, fishing gear and the suite of observations which should be made, including the biological characteristics of the fish. Further information on the workshop can be obtained from Dr Dethlefsen.

5.2.5 In the overall discussion of studies of fish diseases in relation to environmental conditions, there was general agreement that there were two aspects of this work: one aspect involved the identification of disease conditions in fish and studies of etiological factors, and the other aspect was the study of environmental conditions, particularly the distribution of contaminants, which are possible factors in the causation of disease. The expertise concerning the first aspect is found in WGPDMO, while expertise on the second aspect is in WGMPNA. Thus, to study the total

picture of fish disease in relation to environmental contamination, cooperation between the two groups is essential. It was noted, however, that given the broad definition of disease often used, namely, "an aberration from the normal, in morphology or function" as given by Prof. N O Christensen (member of WGPDMO), there were numerous types of biological effects studies (e.g., immunological responses, respiration, standard bioassays, etc.) which may be undertaken within WGMPNA which deal peripherally with aspects of disease as suggested under this broad definition. This further emphasizes the need for making the terms of reference of the two Working Groups absolutely clear.

5.2.6 The Working Group then discussed the project of WGPDMO to conduct a baseline survey of fish disease incidence and felt that this would be very useful also to WGMPNA as the results would enable it to look at the disease "hot spots" and determine contaminant concentrations and study other environmental conditions in those marine areas.

5.2.7 In conclusion, the WGMPNA agreed that it would generally not wish to see the original fish pathology data, but rather agreed that these data should first go to WGPDMO for analysis and interpretation. The WGMPNA would then like to see a section of the WGPDMO report providing information and interpretations of fish disease data so that they can be used by WGMPNA in evaluating the use of studies of fish disease incidence as a biological effects monitoring tool. In terms of the interpretation of data on fish pathology, the WGMPNA mentioned in particular the usefulness of obtaining maps showing the occurrence of diseases in fish, in particular disease "hot spot" areas, so that the WGMPNA could then look into the possible correlation with contaminant levels in the marine environment of the areas of high disease incidence.

5.2.8 The WGMPNA further agreed that, to promote communication and cooperation with WGPDMO, it would be very useful to hold a one-day joint meeting between the two Groups. It could be profitable to hold this joint meeting already in 1984. The Working Group decided to return to this question when discussing the recommendation for its next meeting under Agenda Item 10.

6. CONTAMINANT MONITORING

6.1 1981 Coordinated Monitoring Report

6.1.1 The Environment Officer presented the draft 1981 Coordinated Monitoring Report, the last in this series which will be replaced by reports on the results of Cooperative Monitoring Studies from 1982. Data had been submitted by Belgium, Denmark, England/Wales, the Federal Republic of Germany and Ireland.

6.1.2 In the discussion, members from the Netherlands and the United States indicated that data had been or would be submitted. Members from other countries which had not submitted data were encouraged to look into whether appropriate data could be made available. A deadline for submission of additional data of 8 April 1983 was set. A question was raised concerning the reporting of data on PCB isomers; this was referred to the Marine Chemistry Working Group for advice.

6.1.3 The Working Group expressed dismay at the long delay in the preparation for publication of the 1978-1980 Coordinated Monitoring Reports. The Environment Officer reported that the 1978 and 1979 Reports were in press and that, as a result of an ACMP decision, the 1980 and 1981 Reports would be published together. The Working Group expressed dissatisfaction with the delay and urged that a higher priority be given to these reports. The Environment Officer pointed out that there would be a shorter delay in the publication of the reports if the data were submitted by the deadline and not over a period of one year, with close to half the data being submitted after the draft report has been prepared.

6.1.4 The Coordinated Monitoring Programme having come to an end (to be replaced by the Cooperative Monitoring Studies), the Working Group considered what further work could be carried out on the 8-year set of data from the Coordinated Monitoring Programme. It was agreed that, firstly, the Programme and its results should be the subject of a paper in the open literature and, secondly, that the data set should be subjected to trend analysis (possibly leading to a second publication in the open literature). The question of trend analysis of the data set was put back for discussion under Agenda Item 6.5.

6.1.5 In considering the type of paper needed, the Working Group agreed that it should synthesise the 8 years of data and indicate the extent to which the programme had met its original aims. It should, as far as possible, attempt to assess the implications for public health and environmental quality of the data reported, but should clearly indicate the precautions needed in interpretation, especially with respect to intercalibration results during this period.

6.1.6 It was agreed that Dr Portmann, with the assistance by correspondence of a small review group, including Drs Parker, Topping and Uthe, would try to prepare this synthesis paper for review by the full Working Group at its next meeting. The final, agreed paper would thereafter be submitted to ACMP for approval for publication in the open literature. It was noted that, in the meantime, as requested by ACMP, the Environment Officer would be preparing a supplement to the Six-Year Review of the Coordinated Monitoring Programme covering the years 1980 and 1981. This could be of assistance to the overall review.

6.1.7 The Working Group then reviewed the need for its continued involvement in contaminant monitoring programmes, in view of the fact that the Joint Monitoring Group of the Oslo and Paris Commissions had adopted for its more limited monitoring programme the monitoring protocols which the WGMPNA had developed for the ICES Cooperative Monitoring Studies. The Working Group considered this subject in view of the possibility that questions may arise concerning an overlap or duplication of monitoring programmes between JMG and ICES.

6.1.8 The Working Group agreed that for the forseeable future there is no likely replacement for the North Atlantic-wide programme of ICES. This programme covers a wider geographical area, a wider range of species and a wider range of contaminants than any other programme and is the sole provider of information for some contaminants and species. Some aspects of the programme (e.g., trend analysis) still require further research and the demands of this programme have led and are still leading to the development of new techniques for sampling, storage and analysis by MCWG. The ICES approach to evaluating the

results is different from the approach used by the regulatory commissions and allows a flexibility in handling new problems which leads to further improvement in monitoring capabilities. Furthermore, the carrying out of the full sequence of work in the monitoring programme is essential to the formulation of the advice that ICES gives to the regulatory agencies.

6.2 Automatic Processing of Contaminant Data

6.2.1 The Environment Officer introduced the ICES Interim Reporting Format for Contaminants in Fish and Shellfish which had been prepared by a Sub-group of the Marine Data Management Working Group for reporting data to ICES in connection with the Cooperative Monitoring Studies programme. This reporting format contains three types of forms: a Fish/Shellfish Contaminant Master, a Specimen Data Form, and a Tissue Data Form. The Fish/Shellfish Contaminant Master serves as the master record for the data obtained on one species from one station or area. It provides general information on the sample and where it was obtained. The Specimen Data Form is the record for the data on the individual characteristics (length, weight, sex, age, etc.) of the organisms in the sample. Finally, the Tissue Data Form is used to record the concentrations of contaminants in each of the tissues analyzed from the organisms. The Environment Officer then explained in detail how each of these forms should be completed.

6.2.2 It was noted that there were two items which had not yet been finalized with regard to the reporting format. These were the development of a method code for the determination of fat weight and the development of method codes for the techniques used to analyze for the contaminants. The Working Group agreed that the Marine Chemistry Working Group should be requested to consider this matter and decide on the basis to be used for the development of these methods codes.

6.2.3 In considering the issue of the establishment of a data bank in ICES on contaminants in marine organisms, the question was raised of to whom these contaminant data would be available and on what conditions, if any. There was some feeling in the Group that, given the variable quality of the data, there was a possibility of misinterpretation by persons unfamiliar with the limitations on the comparability of the data. The Working Group decided to postpone further consideration of this issue until the next meeting and requested the Environment Officer to provide a written statement of the procedures developed by the Council concerning the release of data held within ICES, to assist in the further discussion of this matter.

6.2.4 While clarification of the question of to whom the contaminant data may be made available remained pending until the next meeting, the Working Group nonetheless agreed that some type of guidelines concerning the validity and comparability of the data should be developed for distribution along with the data whenever a request has been made by persons who are not members of the Working Group. It was felt that an ultimate goal would be the development of quantitative criteria on the validity and reliability of data, prepared on a contaminant by contaminant basis. It was suggested that, to assist in this work, the Marine Chemistry Working Group could be requested to look into the establishment of criteria to evaluate a laboratory's past performance on the basis of its results in an intercalibration exercise, thus providing a way of interpreting the validity of the data produced by

this laboratory. Recognizing that this work will take time, the Working Group agreed that, for use in the interim, short guidelines should be prepared which spell out the necessity of looking at intercalibration results and other relevant information when interpreting the data on contaminant concentrations in organisms. Drs Portmann and Topping agreed to develop these guidelines. The Working Group later reviewed these proposed guidelines and adopted them as attached as Annex 3.

6.2.5 Dr Pearce presented a paper entitled "Environment Data Management in the Northeast Fisheries" by Dr J Le Baron which described the methods used to analyze marine pollution data in the United States and the data products which are obtained.

6.3 Intercalibration

6.3.1 The Chairman of MCWG, Dr Bewers, reported that the MCWG had, at its 1982 meeting, prepared a summary of the progress which had been made so far in establishing the intercomparability of sampling and analytical procedures for the measurement of various classes of contaminants in several marine matrices. This summary, which is attached to the report of the 1982 MCWG meeting (C.M.1982/C:1) as Annex 5, contains a very brief description of previous quality control activities, an assessment of the current status with regard to analytical and sampling capability, and an outline of future needs for intercomparison exercises that can be used to assist in the proving of measurement techniques for contaminants in the marine environment. Dr Bewers anticipated that the MCWG will be updating and revising this document during its future meetings and, ultimately, the summaries of the history and status of quality control procedures for each class of contaminants in each marine matrix might achieve the degree of comprehensiveness and detail achieved in Dr G Topping's evaluation of ICES intercalibration activities in respect to trace metals in biological tissues. This latter paper, which was presented at the NATO Advanced Study Institute in Erice, Italy, in 1981, will soon be published in a book entitled "Trace Metals in Seawater", edited by C S Wong (Plenum Press). There appears to be considerable value in producing similar assessments for other marine materials and contaminants and it is to be hoped that this might be achieved during the next one or two years.

6.3.2 The Working Group welcomed this report, which it had sought from MCWG, and agreed that such a report should be continuously updated as new exercises were completed. The Working Group noted that the following intercomparison exercises were being planned by the MCWG: (1) the Seventh Intercomparison Exercise on Trace Metals in Biota (which is being planned to interface with the 1985 Baseline Study of Contaminants in Fish and Shellfish, (2) the Second Intercomparison Exercise on Analyses of Petroleum Hydrocarbons in Biological Tissues, and (3) an intercomparison of analyses of polycyclic aromatic hydrocarbons in biological tissues.

6.3.3 The Working Group was informed that the ACMP, at its 1982 meeting, had considered the intercalibration work which has been conducted so far by the MCWG and the MCWG's evaluation of the status of this work contained in Annex 5 to the 1982 MCWG report, and decided that a new approach is now possible for trace metals and certain organochlorines in biological tissues, for which good analytical comparability has been achieved among most participating laboratories. This approach

recognizes that the need is now for intercalibration exercises for these contaminants which are conducted essentially as a method for quality assurance of the data provided under cooperative monitoring programmes, with a periodicity compatible with these programmes (every 4 to 5 years). Blind samples could be available throughout the period between exercises to meet the needs of new laboratories or new analysts engaging in marine pollution work. This programme has been named the ICES Quality Assurance Programme.

6.3.4 It was noted that many organisations (including JMG, EEC, GEMSI, UNEP) were now carrying out intercalibrations, and that there was a need for coordination of these activities. In many cases, in reality, ICES either coordinated exercises for these groups or participated in their exercises. However, there were some exercises being carried out about which few ICES members were aware. Dr Bewers, as Chairman of MCWG, said that the MCWG would endeavour to keep up-to-date with these other activities and will continue to provide summaries of the type presented in the 1982 MCWG report.

6.4 Reviews On Marine Contaminants

6.4.1 Dr Bewers, as Chairman of the Marine Chemistry Working Group, made a proposal on behalf of the MCWG for a division of labour between the two Working Groups in the preparation of overviews or reviews on marine contaminants. MCWG proposed that it would deal with matters relating to the physico-chemical aspects of contaminants, namely, their production and discharge, transport mechanisms and deposition of the contaminant in the marine environment, and the movement and fate of the contaminant in the marine environment. The WGMPNA would deal with matters related to the ecology, toxicology and effects of the contaminant on human health and in the marine environment. After discussion, the WGMPNA accepted this division of work between the two Groups (see Annex 4 for full list of section headings), which would apply from the time of this meeting. It was expected that either the MCWG would prepare the physico-chemical sections first for transmission to WGMPNA or, more usefully, that the two components would be worked on simultaneously by members appointed from each group. This would enable requests for advice from external organizations, such as the JMG, to receive information in as broad and comprehensive a manner as possible.

6.4.2 It was appreciated, however, that there will also be cases in which reviews will be stimulated by one or the other of the two Working Groups for informational purposes (i.e., not strictly in response to requests for information and advice from other organizations). In these cases, the individual Working Group may choose to carry out a review wholly within its own areas of interest and expertise. Reviews carried out for the WGMPNA would then contain a section on production and discharge in addition to the sections on biological aspects. Correspondingly, reviews carried out for MCWG would contain a section on the distribution and concentrations of the contaminant in sea water, sediments and biota in addition to the physico-chemical sections.

6.4.3 HCBD - Dr Kerkhoff presented an overview she had prepared on hexachloro-1, 3-butadiene (Doc. WGMPNA 1983/6.4/1). This paper reviewed the physical properties, production, use and discharges of HCBD and its toxicology and occurrence in the environment. On the basis of this work, Dr Kerkhoff stated that it appears that HCBD contamination problems are mainly restricted to local areas near discharges, primarily in fresh water environments, and that little

problem can be expected in the marine environment. She also stated that because HCBD contamination is accompanied by HCB contamination, it would generally suffice to monitor for HCB except in areas known to be affected by HCBD discharges.

6.4.4 The Working Group thanked Dr Kerkhoff for her very useful paper. In the discussion, reservations were expressed concerning the recommendation that HCB be used as the indicator for possible HCBD contamination, given that HCB has a short residence time in the marine environment. It was agreed, however, that one should only analyze for HCBD in areas near where it is discharged as a waste product. Questions were posed on the possible effects of HCBD on human health and Dr Portmann indicated that he may have some information on this subject. In concluding the discussion on this paper, the Working Group agreed that it should be forwarded to ACMP after amendment.

6.4.5 Toxaphene- Dr Reutergårdh introduced a review paper on toxaphene (Doc. WGMPNA 1983/6.4/2) which he and Dr Uthe had prepared. The paper provided information on the uses of toxaphene, its distribution in the environment, including concentrations in marine organisms, and its toxicity.

6.4.6 In the discussion of this paper, the great difficulties encountered in analyzing for toxaphene were pointed out. There are over 13 000 theoretical congenerates of toxaphene and the commercial formulations are different from the forms of toxaphene found in biota. Thus, the analytical problems are much more complicated than those for PCBs.

6.4.7 The Working Group agreed that this was a very useful paper and that it should be forwarded to ACMP for its consideration, after a few minor amendments have been made. In consideration of the difficulties of analyzing for toxaphene, the Working Group requested the MCWG to start work on the analytical questions for the determination of toxaphene in marine samples.

6.4.8 PCTS- Dr Jensen presented a brief summary of a review paper "Polychlorinated Terphenyls (PCTs). Use, Levels and Biological Effects" prepared by Allan Astrup Jensen and Kjeld F Jørgensen for publication in "The Science of the Total Environment". The summary paper (Doc. WGMPNA 1983/6.4/3) gave brief information on the concentrations of PCTs in various aquatic organisms and on toxic effects of PCTs. The report stated that the most important ecological hazard of PCTs is the possible disturbance of the reproductive system of higher animals.

6.4.9 Noting that this was a very brief summary of a more extensive paper, the Working Group thanked the authors for their work and asked them, through Dr Jensen, whether a broader summary could be prepared, using the subject headings as given in Annex 4. If the authors agree, the Working Group looked forward to reviewing this more extensive overview paper at its next meeting.

6.4.10 Zinc- The paper "Zinc in the Marine Environment - An Overview" (Doc. WGMPNA 1983/6.4/4) by Dr P A Yeats was introduced by Dr Bewers. He stated that, as the paper had been prepared for the MCWG, it covered the concentration ranges of zinc in various freshwater and marine compartments, the transport and distribution of zinc in the ocean and an estimate of zinc fluxes through the marine environment. The paper did not, however, cover the toxicology of zinc nor the transport of zinc through the biological compartment. Dr Bewers stated that the paper had been prepared because of a concern that zinc may be coming out of steady state in the marine environment, but that this had been shown not to be the case.

6.4.11 The Working Group agreed that this was a very good paper from the marine chemical standpoint and that it should now be supplemented with information on the toxicology of zinc in the marine environment and its transfer through marine biological systems. Dr Thurberg agreed to prepare sections on these aspects for the next meeting of the Working Group.

6.4.12 PAHs - Dr Bewers then presented the paper "Contamination de l'Environnement Marin par les Hydrocarbures Aromatiques Polycycliques" (Doc. WGMPNA 1983/6.4/5) by Drs A Moinet and J Piuze. This paper discussed the origin of PAHs in the marine environment, various aspects of the geochemistry of PAHs, and the toxic effects of PAHs in the marine environment. The report concluded that, given the effects of PAHs in the marine environment, PAHs should be included in marine pollution monitoring programmes.

6.4.13 The Working Group thanked the authors of this paper for their contribution. Noting that Dr R Law had prepared an overview on PAHs for the 1982 MCWG meeting, the Working Group requested Drs Moinet and Piuze to work together with Dr Law to merge the information in their two papers and include other available information e.g., on the uptake, metabolism, and excretion of PAHs by marine organisms. This revised paper would then be considered by the WGMPNA and the MCWG at their 1984 meetings.

6.4.14 Nutrients- Dr Portmann presented a nutrient review paper for the North Sea and the Irish Sea which had been prepared by Dr A R Folkard. The paper reviewed the studies carried out by United Kingdom laboratories in the North Sea and Irish Sea over the past three decades and concluded that there has been an increase in inorganic phosphate levels in the waters of the coastal zones of the Southern Bight of the North Sea, around the shores of Liverpool Bay and close to the Isle of Man. The author felt, however, that the time is not yet ripe to determine baseline concentrations of nutrients in the North Sea, and thereafter conduct annual sampling at agreed positions during the winter months to monitor any changes that may occur, because the appropriate methods of data treatment and analysis have not yet been developed which would permit the establishment of a meaningful baseline.

6.4.15 Several other members summarized the results of long-term studies of nutrient concentrations. In these studies, observations of increased concentrations of nutrients were followed by a finding of increased phytoplankton primary production. It was further noted that in certain areas the decay of heavy phytoplankton blooms may cause oxygen depletion in the deep water.

6.4.16 The Working Group agreed that additional information should be collected on this subject. Accordingly, all members with information on nutrient concentrations in sea water, including

a) geographically synoptic data,

b) long-term series at one or more stations, or

c) data on inputs of nutrients indicating the relative significance of natural and anthropogenic sources,

should send this information to Dr Folkard (MAFF Fisheries Laboratory, Lowestoft) to help him complete his paper. Additionally, papers on these topics were also encouraged for presentation at the next Working Group meeting.

6.4.17 It was noted that if Dr Folkard's paper can be completed by the next Working Group meeting, it could be used in relation to the two-day Special Meeting on Causes, Dynamics and Effects of Exceptional Marine Blooms and Associated Events, which will be held immediately prior to the 1984 Statutory Meeting.

6.4.18 Dr Dethlefsen then presented the paper he and Dr H von Westernhagen had prepared on "Oxygen deficiency and effects on bottom fauna in the eastern German Bight, 1982". The condition of low dissolved oxygen had caused the death of a number of benthic organisms and demersal fish, including plaice and dab, and had stressed those that had been able to survive. Dr Dethlefsen concluded that the low dissolved oxygen situation is the most severe water quality change seen in terms of short-term impact; it kills or severely affects bottom fauna and influences the uptake and effects of heavy metals on survivors.

6.4.19 It was agreed that low oxygen events create some of the most serious biological effects problems observed, but it is not clear whether these low oxygen conditions are created by pollution or by a natural sequence of events. The Working Group agreed that it would be very useful to have more papers on this subject and encouraged members to obtain relevant papers for the next meeting.

6.5 Cooperative Monitoring Studies-Trend Monitoring

6.5.1 The Working Group considered several papers giving the results of additional studies of trend monitoring during the past year. The first paper was "Trend analyses of element levels in mussels and seaweed - progress report after two years samplings at unpolluted localities in Godthåb Fjord, West Greenland" by Dr M Munk Hansen. Dr Munk Hansen summarized the main findings from this study in which statistical models were used to determine the importance of sampling year with respect to the concentrations of trace metals found in several species of seaweeds and in blue mussels. The results for seaweed showed that there was an interaction between place and year and also that different species gave a different trend. For mussels, there was both a place effect and a year effect. Dr Munk Hansen pointed out, however, that although the results obtained in this study are highly statistically significant, their actual importance must still be evaluated. One may, for example, be able to correct for these effects by taking into consideration changes in the concentrations of certain co-variant elements.

6.5.2 Mr Lassen then summarized the conclusions of four papers which had been presented at the 1982 Statutory Meeting on trend monitoring (Doc. C.M.1982/E:25, E:26, E:27, E:28) by himself, Dr Munk Hansen and Dr Jensen. Mr Lassen pointed out that the work on trend monitoring so far has assumed that the natural variability in contaminant concentrations between years was low but that the within year variability was high owing, e.g., to the effects of the seasons. However, Dr Munk Hansen's work has now shown that for one species in a contaminated area in the Arctic the between year variability is quite large and if this factor is similarly large for all species and areas, then trend monitoring using marine organisms would not appear to be feasible.

6.5.3 There was a preliminary discussion of these questions during which it was reported that trend analysis has recently been started on up to eight years of British data for mercury, copper and zinc concentrations in a number of species from a number of areas. The results available so far have shown significant trends for mercury concentrations in some species from some areas. It was agreed that further discussion of this subject should take place in a sub-group under the chairmanship of Mr Lassen. This sub-group should carefully consider the results of all intersessional activities on trend monitoring and decide whether any changes in the current protocol for trend monitoring are warranted. It should also consider what other studies should be undertaken to clarify some of the unsolved issues.

6.5.4 The Sub-group met on Wednesday afternoon, 2 February, and on part of Thursday morning. Mr Lassen thereafter informed the full Working Group of the results of the discussion. He stated that the Sub-group had reviewed the results of the multiple linear regression analysis of data on contaminants in fish obtained by three countries, but that these results were not completely consistent. A basic problem in this regard was that there are not enough data on the functional relationship between various biological parameters and contaminant concentrations. Given that only three countries (Canada, Denmark, and the United Kingdom) have been involved in these studies so far, the Sub-group felt that there was a great need for other countries to conduct regression analyses on their data and welcomed the initiatives of Belgium, the Federal Republic of Germany and Sweden in this regard. Mr Lassen reported that, after having considered all the information available, the Sub-group did not feel that any amendments needed to be made to the guidelines for trend monitoring which had been agreed at the 1982 Working Group meeting. The Sub-group suggested, however, that the possibility be considered for the analysis of trace metals in bone, as a more stable tissue for the determination of long-term trends. Finally, the Sub-group recommended that a meeting should be held for persons involved in time trend analysis to conduct a detailed examination of the issues. This meeting would be particularly useful after all the ICES coordinated monitoring data have been accessioned onto the ICES computer. The full Sub-group report is attached as Annex 5.

6.5.5 The Working Group thanked the Sub-group for their work, noting in particular that the Sub-group had stated that no changes need to be made to the sampling guidelines for trend monitoring at the present time. The Working Group encouraged the conduct of further studies

on trend monitoring by a larger number of laboratories so that a broader base of information may be made available to assist in the clarification of the basic issues associated with the use of marine organisms to study time trends in concentrations of contaminants.

6.6 Cooperative Monitoring Studies-Baseline Study of Contaminants in Biota

6.6.1 Dr Portmann, Coordinator of the planning group for the baseline survey on contaminants in organisms, presented the sampling protocol which had been developed intersessionally based on comments to a proposal that had been circulated to members of WGMPNA and the ICES/SCOR Working Group on the Study of the Pollution of the Baltic.

6.6.2 Before carrying out a detailed review of these plans, the Working Group discussed the reasons why a baseline study of contaminant concentrations in fish and shellfish should be conducted in 1985, given that a similar exercise had been carried out in 1975. The following reasons were cited for the 1985 baseline study. First, one of the original aims of the WGMPNA was to establish the relative degree of contamination in the various areas of the North Atlantic. At the time of the 1975 baseline survey, the analytical ability was poorer so that one could only see order-of-magnitude differences between areas and identify "hot spots". In the 1985 baseline study better data, especially on trace metals, will be obtained owing to the considerable improvement in analytical techniques and, if a mussel-watch type component is included, differences between areas of close to a factor of two could probably be identified. Secondly, the 1975 exercise was supposed to have been conducted simultaneously on both sides of the Atlantic, but in actual fact it took three years to obtain all the data and many different species were studied, making comparisons difficult or impossible. In the 1985 baseline study, it is hoped to have a more synoptic picture of the levels of contaminants in only several species (mussels and a few species of fish) over the North Atlantic. Thirdly, under the former Coordinated Monitoring Programme, monitoring was conducted annually; now, however, there is a reduced frequency of monitoring in the new Cooperative Monitoring Studies and the baseline study is one component of this new programme.

6.6.3 Having thus agreed to the value of the baseline study, particularly in terms of trace metals, the Working Group reviewed the details of the plans. The analysis of the following trace metals was considered mandatory: mercury, copper, zinc, cadmium, lead and arsenic. In addition, given the excellent opportunity to establish baseline concentrations of other trace metals, analysis was also encouraged for: chromium, nickel, selenium, vanadium, tin and manganese. Concerning organochlorine compounds, the following were designated as mandatory: HCH, HCB, dieldrin, PCBs, and op and pp DDT, DDE and DDD. It was recognized that a new intercomparison exercise on the analysis of organochlorines would be needed prior to the baseline survey and that only a few laboratories would be able to produce results of the requisite comparability. It was hoped that these laboratories would be able to carry out some additional analyses so that good data on organochlorines could be obtained for several geographical areas.

6.6.4 The Working Group then considered the species of organisms to be studied and agreed that mussels (Mytilus edulis) should be considered essential. Mussels should be collected at sites along the coast of each country, with special attention to known or suspected "hot spots".

Of the fish species, cod (or hake) should be sampled at all the agreed areas and one species of flatfish should be sampled in addition. The flatfish recommended were flounder, dab and plaice, with special emphasis on the first two species. The Working Group agreed that size ranges of mussels and the fish species should be specified so that fish of approximately the same age would be sampled. For mussels, it was agreed that the size range would be 2-5 cm, and preferably at the lower end of this range. Proposals were given for the size ranges of the fish species but it was agreed that Drs Portmann and Topping would revise these to obtain a narrow age range in the "middle age" for each fish species.

6.6.5 In order to obtain an appropriate division of sampling and analytical effort and ensure a good geographical coverage, it was agreed that all members should write to Dr Portmann concerning which areas they will sample. Dr Portmann will then assemble all this information to make sure that there is a good coverage of the various geographical areas.

6.6.6 Having agreed to all the details in the baseline survey plans, the Working Group attached them to its report as Annex 6. It was noted that the ICES/SCOR Working Group on the Study of the Pollution of the Baltic would consider these plans at its meeting at the end of March 1983.

6.6.7 The Working Group then turned its attention to several questions raised by Dr McIntyre when he had reviewed the proposals for the baseline study. It was felt that most of Dr McIntyre's questions had already been addressed during this discussion or during the consideration of biological effects monitoring under Agenda Item 5. Concerning his question on whether other species than commercial fish and shellfish should be included, the Working Group agreed that certain seaweeds should be considered in connection with a future baseline study and requested that relevant papers on this topic be made available for the 1984 Working Group meeting.

6.7 Baseline Study of Trace Metals in Coastal Waters

6.7.1 It was recalled that at last year's meeting, the Working Group had recommended that, pending a satisfactory outcome of the Fifth Round Intercalibration on Trace Metals in Sea Water (5/TM/SW) (Nantes, September 1982), a baseline survey of trace metals in sea water should be conducted in the shelf seas and coastal waters of the North Atlantic in 1985, to interface with a proposed IOC baseline survey of trace metals in deep waters of the North Atlantic. Dr Bewers reported that IOC had not yet developed further plans for its deep ocean baseline survey. Regarding the outcome of 5/TM/SW, Dr Bewers stated that the results of this intercalibration would not be available until mid-1983, but they would hopefully point to specific procedures of filtration which should be used in studying trace metals in sea water. The results of this intercalibration should also give a good idea of the level of intercomparability of data from the participating laboratories.

6.7.2 The Working Group agreed that the progress in the past four years in the development of techniques for measuring trace metals in sea water had been very good. It was felt that, after the results of 5/TM/SW are available, enough would be known about appropriate methods for the

MCWG to be able to develop guidelines for the sampling, pre-treatment and analysis of trace metals in sea water. The next question then concerned the strategy for where to sample; it was felt that this should include both coastal waters and the end members in terms of an estuary.

6.7.3 In discussing the value of a baseline survey on trace metals in sea water, the Working Group noted that information on trace metal concentrations in water was important both to understand the concentrations of trace metals in organisms as well as to learn about the transport and distribution of contaminants after their discharge to the marine environment. Accordingly, the Working Group reaffirmed that a baseline study of trace metal concentrations in coastal waters and shelf seas would be very useful and should be carried out in 1985, as recommended at the 1982 meeting. This baseline survey was needed in order to obtain valid information on the concentrations of dissolved trace metals in coastal waters. Additionally, the experience gained in carrying out this study would enable the development of useful scientific advice to the Joint Monitoring Group on appropriate techniques for monitoring trace metals in sea water.

6.8 Sediments

6.8.1 The Working Group took note of the second report of the Working Group on Marine Sediments in Relation to Pollution (WGMS) (Doc. C.M.1982/E:6) and discussed it in the light of the great interest of WGMPNA in the work of WGMS because the results are needed for application to WGMPNA marine pollution monitoring work. The WGMPNA was particularly interested in the issue of intercalibration exercises on analytical methods and encouraged the WGMS to consider its needs with regard to the analysis of trace metals in sediments and devise an intercalibration accordingly. The WGMPNA felt that there were two important questions regarding the analysis of trace metals in sediments, the first being the determination of the exchangeable fraction ("contaminant fraction") of trace metals and the second being the determination of the "bioavailable fraction". While the WGMPNA agreed that in the long run the second question, on bioavailability, is the most important, it is a very complex and difficult issue and will require much work. On the other hand, the first question, on the determination of the exchangeable fraction, could be resolved in a relatively short time. The WGMPNA encouraged the WGMS in its work and recommended that ICES member countries be encouraged to study the bioavailability of contaminants in sediments (see Recommendation 2 in Annex 8).

6.8.2 The WGMPNA also took note of a list of questions which the ACMP had posed to WGMS and agreed that answers to these questions would be very useful to WGMPNA and also to the Joint Monitoring Group in their pollution monitoring work.

6.9 Inputs

6.9.1 The Working Group noted that, with regard to riverine inputs of contaminants, the ACMP had adopted a methodology for the measurement of gross riverine inputs of trace metals and organohalogens (contained in Annex 6 to the 1982 ACMP Report)(Coop.Res.Rep.No.120 (1983)). The Council had thereafter encouraged ICES member countries to carry out assessments of gross riverine inputs of trace metals and organohalogens using this methodology and report the results to ICES (C.Res.1982/4:7).

6.9.2 In terms of atmospheric input of contaminants to the sea, it was noted that studies have been conducted in certain areas, e.g., the Firth of Forth, the Clyde Estuary, the Belgian coast, and the United States Atlantic coast, on the atmospheric deposition of contaminants. In some of these areas, the atmospheric deposition of certain trace metals was found to be as large as the input via rivers. The Working Group then considered whether it should prepare an overview paper on atmospheric deposition, combining together the results of the various studies. After discussion, the Working Group agreed that it would be better to wait a year before beginning to prepare such an overview. This would also provide time so that a forthcoming GESAMP report on atmospheric deposition studies in the Mediterranean could be considered before doing any further work.

7. REGIONAL ASSESSMENTS

7.1 The Chairman reminded the Group that at its last meeting the subject of regional assessments of the health of the marine environment had been discussed and it had been agreed that guidelines for the conduct of regional assessments should be prepared intersessionally and presented to the relevant Committees during the 1982 Statutory Meeting. The guidelines had subsequently been drafted by a small group, consisting of Drs Bewers (Coordinator), Jensen, McIntyre, Parker, Pearce and Portmann, and presented as Doc.C.M.1982/E:22.

7.2 Dr Bewers then summarized the guidelines contained in C.M.1982/E:22. According to these, the objective of the regional assessments would be to provide a succinct review of the kinds and degrees of anthropogenic disturbances to a marine area in the context of existing knowledge of physical, chemical, and biological conditions. The framework was developed to facilitate the preparation of intercomparable assessments so that the relative extent of anthropogenic disturbances in different marine areas can be seen. The approach to be used in the development of regional environmental assessments will be to have summaries prepared of the physical, chemical and biological conditions of an area and then to indicate to what extent anthropogenic activities have influenced each of these conditions. In these sections, gaps in the knowledge and understanding of the conditions should also be identified. Finally, an attempt should be made to summarize the conditions in the area and to assess on a multidisciplinary basis the types and extent of anthropogenic influences on the environment.

7.3 Noting that these Guidelines had been accepted by the relevant Committees and that the Council had recommended (C.Res.1982/4:10) that such regional assessments should be carried out for the various coastal areas of the North Atlantic, the Working Group then discussed the implementation of this Council Resolution. Dr Pearce reported that an assessment of the state of the New York Bight has been started, in which the guidelines in C.M.1982/E:22 have been used. This assessment is expected to be completed in mid-1983. Mr Hill stated that it would be useful to have an assessment of the Irish Sea and offered to try to provide some material for the next meeting.

7.4 Mr Nielsen proposed that, as a basis for an assessment of the German Bight, a workshop or symposium should be held in Hirtshals in 1984 to discuss the pollution situation in the German Bight. The Working Group supported this proposal for a workshop and expressed the hope that persons from countries other than Denmark and the Federal Republic of Germany will attend the workshop and contribute to the deliberations.

7.5 The Working Group was informed that a new Working Group on Pollution-Related Studies in the Skagerrak and Kattegat had been established at the 1982 Statutory Meeting (C.Res.1982/2:3). One of the terms of reference of this new Working Group was to prepare an assessment of the environmental situation in the Skagerrak-Kattegat area with regard to natural conditions and anthropogenic influences. The WGMPNA noted this information with interest and agreed that C.M.1982/E:22 should be transmitted to it for consideration when conducting an assessment of its region.

7.6 In concluding the discussion on the implementation of the regional assessment guidelines, the Working Group agreed that some useful initiatives were being taken and looked forward to seeing the results of this work when available.

8. FUTURE WORK

8.1 No discussion was held on this topic as it was felt that adequate discussion of future work had taken place under the previous agenda items.

9. ANY OTHER BUSINESS

9.1 There were no other items brought up at the meeting.

10. APPROVAL OF ACTION LIST, RECOMMENDATIONS, AND PARTS OF THE REPORT

10.1 The Working Group reviewed several sections of the report and approved them as amended. The Action List, attached as Annex 7, was reviewed and approved.

10.2 The Working Group approved Recommendation 1 on a Workshop on Biological Effects Monitoring Techniques and Recommendation 2 encouraging studies on the bioavailability of contaminants in sediments (see Annex 8).

10.3 The Group then discussed its next meeting in the context of the meetings of other ICES Working Groups and the meeting of the Joint Monitoring Group. Several members expressed the opinion that ideally WGMPNA should meet before the JMG and after the MCWG. Given the fact that the JMG usually meets at the end of January, however, it was recognized that it was somewhat difficult to ensure that WGMPNA could meet prior to JMG. With regard to other ICES Working Groups, the WGMPNA agreed that in 1984 it would prefer to meet after WGMS and MCWG have met and that, if possible, it would like to have a one-day joint meeting with the Working Group on Pathology and Disease of Marine Organisms.

10.4 Given the above scheduling considerations, the Working Group did not propose dates for its 1984 meeting, but recommended that it meet for four days in Copenhagen with the following terms of reference:

(1) to consider the implementation of the baseline study of contaminants in fish and shellfish and the baseline study of trace metals in sea water,

(2) to review the implementation of biological effects studies,

(3) to consider developments in trend monitoring,

(4) to review progress in the conduct of regional assessments, and

(5) to consider the environmental impact of excessive nutrient concentrations in the marine environment.

The full recommendation is contained in Annex 8.

11. CLOSURE OF THE MEETING

11.1 As there was no other business, the Chairman thanked the members for their participation and closed the meeting at 14.30 hrs on 4 February 1983.

ANNEX 1

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

Copenhagen, 1-4 February 1983

AGENDA

1. Opening of meeting
2. Adoption of agenda
3. Actions of Council and ACMP, and related ICES activities
4. Other international activities
5. BIOLOGICAL EFFECTS STUDIES
   - 5.1 Reports on methods
   - 5.2 Pathology
6. CONTAMINANT MONITORING
   - 6.1 1981 Coordinated Monitoring Report
   - 6.2 Automatic processing of contaminant data
   - 6.3 Intercalibration
   - 6.4 Reviews on marine contaminants
   - 6.5 Cooperative Monitoring Studies - Trend Monitoring
   - 6.6 Cooperative Monitoring Studies - Baseline study of contaminants in biota
   - 6.7 Baseline study of trace metals in coastal waters
   - 6.8 Sediments
   - 6.9 Inputs
7. REGIONAL ASSESSMENTS
8. Future work
9. Any other business
10. Approval of action list, recommendations, and parts of report
11. Closure of meeting

ANNEX 2

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ANNEX 3

Qualifier/Disclaimer/Warning Paragraph
(For use when distributing data on contaminant levels in organisms)

In response to your request for information held in the ICES data system the attached tabulations/print-out of data is supplied. It must be emphasized that the data provided are raw data as supplied to ICES and the following points should be noted. (1) Although reasonable precautions have been taken to supply only valid information, experience over the years has shown that analytical performance is steadily improving but at different rates in different laboratories. (2) Intercalibration exercises are conducted by ICES from time to time and the contributing laboratories all participate in these. The results are published in the Cooperative Research Report series and they should be consulted before conclusions of a comparative nature are drawn. (3) Concentrations of residues vary in different tissues, between species and seasons, condition of the organism, etc.

These factors must be taken into account before conclusions are drawn. In case of doubts, it is strongly recommended that the source laboratory be asked to comment on the problem.

ANNEX 4

CONTAMINANT OVERVIEW PAPERS (Section headings for 3-4 page reports)

A. Physico-chemical aspects (for Marine Chemistry Working Group)

1. Production and discharges
2. Transport mechanisms and deposition in the marine environment
3. Movement and fate within the marine environment

B. Biological aspects (for WGMPNA)

1. Distribution and concentrations in sea water, sediments and marine trophic levels
2. Toxicology
3. Implications and public health aspects

ANNEX 5

REPORT FROM THE DISCUSSIONS ON STATISTICAL ANALYSES IN TIME TREND MONITORING OF CONTAMINANTS

1. Participation

M Bewers (only Wednesday)
M Munk Hansen
H Hill
A Jensen
H Lassen (Chairman)
J Pentreath
J Portmann (only Thursday)
D Scott
J Uthe (only Thursday)

The Group met on Wednesday afternoon (2 February 1983) and part of Thursday morning.

2. Dr D Scott reported on a preliminary analysis using multiple linear regression (MLR) techniques with the total burden of a contaminant as the dependent variable as opposed to the concentration of the contaminant, as previously used. These findings suggest that in terms of time trends, the concentration model and the tissue burden model both give similar conclusions. Dr Scott said that more models needed to be screened and he will report back to the Council Meeting in 1983.

3. Mr Hill reported preliminary results from MLR analyses applied to United Kingdom data. In some cases, time trends appear to be evident in some areas for some of the trace metals. Some further development is underway and the results will be reported at the 1983 Statutory Meeting.

A preliminary comparison of the data sets analysed from the United Kingdom and Canadian samples showed some tentative consistencies in the case of identification of effects when, e.g., a decreasing trend in a particular metal was evident, and both sets of data indicated that a trend was more apparent in demersal than in pelagic species.

The Group was informed that similar analyses are being carried out in Belgium, the Federal Republic of Germany and Sweden.

4. The statistical analyses of contaminant data from finfish have been an issue since 1977 and extensive analyses on three sets of data have been presented.

Metals

Cod	Gulf of St Lawrence
Flounder	Kattegat, Great Belt and the Sound
Spotted wolffish)	
Greenland halibut)	Fjord at West Greenland
Greenland cod)	

Organochlorines

Cod	Gulf of St Lawrence
Herring	West of Scotland

These data sets consistently indicate that a substantial amount of the total variation is due to variations in the biological parameters (length, weight, age, fat content, etc.).

In all data sets, differences in contaminant levels between years have been found for some elements. In some cases, these differences can be accounted for by a linear time trend in the contaminant levels, while for other data sets such an interpretation of the year-to-year variations is dubious.

5. Dr Pentreath made some remarks with regard to trend analysis studies and the physiological aspects of fish biology. First of all, he considered that trend analysis in finfish would primarily be of value as far as "edible fraction" analysis was concerned, but that analyses of other tissues could be useful in providing corroborative supporting evidence (or the lack of it) in an observed trend in that edible fraction. As far as the physiological basis of elemental uptake is concerned, there is, at present, insufficient evidence to suggest an a priori reason that a metal will co-vary more with one parameter of length, weight or age than another. There is, however, some evidence to suggest that turnover times of metals are likely to vary considerably from organ to organ, from species to species, and from one metal to another. Fish are, therefore, not likely to be any better as long-term indicators than any other material. Physiological studies do indicate, however, that some tissues may be used as internal stores, or "sinks", and that the rate of turnover in these tissues will be long. It may, therefore, be useful to analyse, for example, bone tissue for metals such as zinc, lead and chromium to indicate long-term trends in an area, whereas liver tissue (or muscle) may reflect more recent inputs, which could vary highly with season and/or with diet. Quite clearly, the more data which are available, the better the chances of a suitable interpretation. Such extra data are not merely those of a chemical nature but of organ size in relation to body weight, state in sexual cycle, migratory movements and so on. It should also be noted that because the quantity of, for example, a metal in a fish organ will be a function of the chemical form of the element, its concentration in the food, the efficiency of absorption, its turnover time/excretion rate, the conversion efficiency of food and so on, fluctuations from year to year (i.e., short-term variations) may be as much affected by one parameter - or a combination of them - as another, within the same population, i.e., variations are not due solely to changes in the concentration in the food or the environment generally. This of course is a matter for interpretation of such "trend" data as become available. Analysis of data as proposed in the "trend" programme should be strongly encouraged, however, because it will in turn help the physiologist to collect evidence that certain tissues can, for example, regulate or co-regulate metals, how fast they do respond to changes in input to an environment, and thus be in a position to provide better advice on monitoring programmes.

6. The discussion led to an attempt to systemize the basic parameters which should be considered when selecting a tissue or organ in which to look for a specific contaminant. These were:

   (a) Residence time, and

   (b) Whether the compound is regulated/co-regulated or unregulated in that specific tissue.

Depending on these, the most suitable organ for time trend analysis can be determined. An attempt was made to tabulate the important parameters. Although the table is not complete, it is appended for general interest.

7. An overview of studies reported to WGMPNA and elsewhere (Phillips, 1982) suggests that a power function relationship between the contaminant levels and biological parameters is generally found. In a number of studies, simple linear relationships fit just as well, possibly due to the limited range of the biological parameters contained in the respective data sets. In these cases, a power function relationship may give as good a fit to the data as a linear one and may be preferable since the samples themselves are often log normally distributed. There does not appear to be any generally applicable biological evidence to suggest that one of these relationships is generally preferable to the other. These relationships may well vary with area/species and possibly with overall level of contaminants.

8. The importance of accurately estimating the noise (random fluctuations plus unaccounted fluctuations) in the system was stressed. This estimation is inherent in the MLR technique, but the point of dispute which was brought up at the ICES 1982 Council Meeting was how much of this variation is due to random fluctuations and what proportion may be ascribed to variations between years, caused by unmonitored (possibly unmonitorable) biological conditions, such as changes in diet, migration, etc.

9. The conclusions of these discussions may be formulated as follows:

(i) The Group was not presented with any information which suggested that amendments should be made to the guidelines for trend monitoring laid down at the 1982 WGMPNA meeting. Of the biological variables listed, all appear to have significance for some areas, species or contaminants.

(ii) The Group recognizes that year-to-year differences in contaminant levels in various fish tissues have been found and that in some cases time trends have been identified. Clearly, the development of trend analysis should be continued. There is an urgent need for more data to be analysed and the Group welcomed the initiatives taken in Belgium, the Federal Republic of Germany and Sweden in this regard. Separating the noise fluctuations is important in determining the significance of the time trend parameters.

(iii) Further studies will be greatly facilitated when the data from the ICES coordinated monitoring programme is computerised.

The Group recommended that a 2 - 3 day meeting of people involved in time trend analysis would be useful in order to provide an opportunity for detailed examination of specific time trend analysis.

Such a meeting could be even more useful when all the ICES coordinated monitoring data are easily accessible on the ICES computer.

APPENDIX

FINFISH

Contaminant	Best organ	Residence time	Regulated/Co-regulated	Remarks
Hg	Muscle	>1 yr	No	
Cd	Liver	>1 year[1)]	No?	
Pb	Bone? Liver?	?	?	
Cu			Yes	Widely-ranging fluctuations found
Zn	Bone?	>1 yr	No?	
Cr	Bone?	?	?	
As	Muscle	20-30 days	?	
Organo-chlorines	Muscle Liver Any fatty organ	>1 yr	No	

1) Measured in whole fish

Note! In considering the basic measurements which should be reported along with the concentration data so as to allow the important variables to be included in the MLR analysis, weight, length, and age are considered important in all cases (especially weight of organ/total tissue analyzed) /precise details of the weights to be recorded can be found in the expanded guidelines being prepared/ but fat content is also important especially for Cu, Zn, As, and organochlorines.

ANNEX 6

PROPOSED BASELINE STUDY OF CONTAMINANTS IN FISH AND SHELLFISH - 1985

1. Objective. To provide a snapshot of the "health" or state of the marine environment, described in terms of contaminant levels throughout the area of interest, which is the North Atlantic and the Baltic Sea, by the analysis of fish and shellfish collected from as many sites as possible. These sites should be distributed throughout the area of interest in such a way as to give adequate coverage to the whole area, appropriately weighted to reflect the distribution of fish resources and fishing activity and ensure that the expected sources of contamination are adequately covered.

According to the three separate objectives of monitoring using biological material, agreed by the Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic and the ICES/SCOR Working Group on the Study of the Pollution of the Baltic (Appendix 1), such a study relates to objective 2 and implies a desire to collect data which will allow at least a first order assessment of relative levels of contamination. The data so collected would not be suitable for comparison of trends (objective 3 in Appendix 1), except perhaps in terms of relative position in a sort of contaminant league table. Equally, the data probably would not be usable for an assessment of potential risk to human health through consumption of the fish or shellfish (objective 1 in Appendix 1).

2. Basic Requirements. If the data are to be used for comparative purposes of the type indicated above, it is essential that known sources of difference be eliminated. To this end, it is imperative that the sample material used be as comparable as possible. Many countries, and at least as many laboratories, will be taking part in the exercise and it will also be essential that the possibility of differences in levels of contamination being caused by analytical differences should be eliminated as far as practicable and, at an absolute minimum, be identifiable.

In order to meet the data quality requirements, an analytical intercalibration exercise must be conducted, for all the contaminants which will be studied, in which all laboratories expected to take part in the survey must participate. Plans are currently in hand for an exercise on mercury, cadmium, lead, copper, zinc, arsenic, etc., and for PAHs. If other contaminants are to be studied, they must be specified and the planned exercises must be extended to cater for them or special exercises must be instituted; an obvious gap are the organochlorine compounds normally considered of interest, e.g., HCH, dieldrin, DDT and its metabolites, PCBs, etc.

In order to ensure that the sample material is as comparable as possible, experience has shown that a sample should consist of at least 25 fish or, if mussels are used, at least 50 individuals. The fish selected should be species which are representative of the area in question, i.e., they should not be very recent immigrants to the area or on passage through the area. Samples of the same fish species, wherever they are collected, should be of the same or similar size. It has been agreed that mussels should be 20-50 mm in size and preferably as close to the 20 mm end of this range as possible. All species should be collected prior to spawning so as to ensure that all are in approximately the same "condition". This latter requirement may well mean that samples are collected at different times of the year in different areas. In order to ensure samples of the type specified, it will be essential to take advice from fisheries biologists and to involve them in the sampling programme.

3. Which contaminants should be included? Previous ICES studies have dealt with trace metals and organochlorine pesticide and PCB residues and experience from intercalibration exercises to date suggests that it would be very difficult to achieve a satisfactory level of agreement in a "new" substance before 1985. This does not preclude inclusion of new substances, but it does auger caution. Accordingly, it is suggested that only the following substances should be considered as mandatory:

Metals: Mercury[*], copper, zinc, cadmium, lead and arsenic[*]

Organochlorine compounds: HCH, HCB, op and pp DDT, DDE and DDE, dieldrin and PCBs.

While the metallic analytes listed above for inclusion in the programme are confined to elements for which there exists current concern regarding environmental contamination, it should be appreciated that the programme will offer an opportunity to establish baseline distributions for other elements. Participating laboratories are therefore urged to include additional inorganic analytes, especially those contained in the following list:

Cr, Ni, Se, V, Sn, Mn.

Similarly, the same tissues could be analyzed for a wider range of organic substances, in particular, hydrocarbons and polycyclic aromatic hydrocarbons, toxaphene and chlordane.

4. Species to be used in the study. Species in which ICES has had some interest in the past include mussels, brown shrimps, cod, whiting, haddock, hake, pilchard/sardine, herring, mackerel, plaice, Greenland halibut, sole and flounder. The Oslo and Paris Commissions have expressed a particular interest in brown shrimps, mussels, cod, plaice, mackerel, flounder and sole; although reservations have recently been expressed by the JMG about using the latter species.

For a study of the type proposed it will probably be impossible to collect samples of the same species throughout the entire area, but obviously the minimum number of species should be used. Taking account of various known interests and perceived species availability, it is suggested that attention be focussed on:

Cod	- Gadus morhua	OR in the southern part of the area
Hake	- Merluccius merluccius	
plus Herring	- Clupea harengus	
Flounder	- Platichthys flesus	
Plaice	- Pleuronectes platessa	
(Dab	- Limanda limanda)	
and Mussels	- Mytilus edulis	

[*] Contaminants thus marked should be analysed in the muscle tissue of fish or in mussels, all others should be analysed in the liver tissue of fish and in mussels.

Note! Discussions at the 1983 WGMPNA meeting suggest that it might be preferable to determine copper, zinc, and lead in bone tissue rather than liver tissue when analyzing fish. A decision on this awaits advice from MCWG.

It should be noted that cod or herring and cod, flounder and plaice are strongly recommended by the Helsinki and Oslo/Paris Commissions, respectively, and so emphasis should be placed on collection of samples of these species whenever possible. Mussels should be collected at coastal sites so as to give a good shoreline coverage throughout the area. The collection of mussels is considered to be essential.

Mussels should be collected prespawning and should fall within a 20-50 mm size range, preferably keeping the size range as small as practicable and towards the low end of the size range. For mussels collected in the Baltic Sea, the maximum size should be 30 mm.

It had initially been hoped that it would be feasible to avoid possible physiological difference problems introduced by spawning and the need to age individuals, so as to eliminate the consequences of age-dependent accumulation factors. The intention was to recommend a narrow size range such that there would be a good probability that all fish of that size would be prespawning 2-year-old fish. Unfortunately, an examination of fish catch data shows that such a recommendation is not possible. The size range necessary to span, e.g., all 2-year-old cod from the entire ICES area would be so large that in one area the largest 2-year-olds would be equivalent to 3- or even 4-year-old fish from a colder water area or a slower growing stock. The time of year is also important in suggesting a range, as fish grow rapidly at certain times. Data from the North Sea suggest that growth is slowest in the first two quarters and that if 2-year-old fish of any of the five (six) species are selected, few fish will be sexually mature.

It is, therefore, recommended that fish be collected in the first six months of the year and that samples should be aged to ensure only 2-year-old fish are analysed.

(The following details of sizes of two-year-old cod from three areas around the United Kingdom in the four quarters of 1980 serve to illustrate the problems encountered.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Northern North Sea Area IVa	30-45	30-45	35-55	45-55
Central and Southern North Sea Areas IVb and c	32.5-57.5 (40.5)	32.5-57.5 (43)	37.5-72.5 (49)	42.5-77.5 (58.5)
Irish Sea Area VIIa	32.5-67.5 (45)	27.5-62.5 (47.5)	42.5-72.5 (52)	47.5-72.5 (61)

Sizes are in cms and relate to range on the upper line and to mean on the lower line, in parentheses).

5. Division of sampling/analysis effort to achieve optimum coverage for minimum effort. It is essential that the available analytical resources be used to the maximum effect so as to ensure adequate coverage of the entire area. Samples of fish and mussels should therefore be analysed on a bulked basis. (Note details of exactly how samples should be prepared are reproduced in Appendix 1).

The pattern of fishing effort, particularly on the European continental shelf, is complex and the adjacent shore is not necessarily an indication of the country exerting maximum fishing effort in an area. However, for the purposes of this exercise it is suggested that each country take responsibility for sampling the selected species in waters within 25 miles of its coast. In the event that a country cannot find sufficient resources for such a programme, "volunteer" help from another country may be necessary.

In order to ensure that as many areas as possible are sampled with the minimum of overlap, all participants are required to inform Dr J Portmann, Fisheries Laboratory, Remembrance Avenue, Burnham-on-Crouch, Essex CM0 8HA, England, by 1 October 1983, of their intentions regarding sampling and analysis and the number of additional samples they can handle in order to achieve coverage of the more open areas.

Recognising the doubts concerning organochlorine analyses, if any "qualified" laboratory can volunteer to do even a fair duplicate analysis for areas being sampled by other laboratories, they should also inform Dr Portmann as soon as possible.

APPENDIX 1

DETAILS TO BE FOLLOWED FOR SAMPLE COLLECTION, PREPARATION AND ANALYSIS IN THE CONDUCT OF COOPERATIVE MONITORING

Monitoring, using fish or shellfish as indicator species, may be conducted for one of the following three purposes (objectives):

1) The provision of a continuing assurance of the quality of marine foodstuffs with respect to human health.

2) The provision over a wide geographical area of an indication of the health of the marine environment in the entire ICES North Atlantic area.

3) To provide an analysis of trends over time in pollutant concentrations in selected areas, especially in relation to the assessment of the efficacy of control measures.

SAMPLING

Samples to meet Objective 2 (Samples to be collected every 5 years starting in 1985)

a) A sample should consist of 25 fish or 50 mussels.

b) Fish should be selected so as to be representative of the area in question, i.e., should not be very recent immigrants to the area or on passage through. Each sample should consist of the same or similar sized fish.

c) Mussels should be between 20 and 30 mm in size, if possible. Animals as large as 50 mm may be taken if insufficient numbers of small animals are available.

d) Sampling should take place prior to spawning of the species concerned, if possible.

e) Samples should be collected from as many locations as practicable throughout the ICES area.

STORAGE AND PRETREATMENT OF SAMPLES PRIOR TO ANALYSIS

General - ie all three objectives

a) Fish samples should be collected ungutted and preserved (deep frozen) as soon as practicable after collection; length and weight should be determined before freezing.

b) Mussels should be held live in clean (settled) sea water from the area of collection for 12-24 hours to allow discharge of pseudo-faeces. The shell length of each individual, even if used as part of a composite, should be measured as a maximum value regardless of direction of orientation.

c) After cleaning and measuring the mussels, the individual animals should be carefully freed from their shells by cutting the adductor muscle. The shell cavity liquor can then be drained and discarded by placing the opened shells vertically on a filter funnel for 5 minutes. The remaining shell contents may then be preserved either individually or as pooled samples.

To meet Objective 2

a) In order to reduce the number of analyses which have to be performed, pooled samples may be used. These should be prepared as described below and analysed in duplicate.

b) An equivalent quantity of muscle tissue must be taken from each fish, e.g., a whole fillet of every fish. If the total quantity of tissue so yielded would be too large to be handled conveniently, the tissue may be sub-sampled, but a fixed weight proportion of each tissue must then be taken, e.g., 10% of each whole fillet or 10% of each whole liver, the sub-samples being taken after homogenisation of the whole fillet/liver or, in the case of a fillet, in the form of a number of complete transverse sections, distributed evenly along the length of the fillet (e.g., one of every 10 slices).

REPORTING OF RESULTS

For Objective 2

Results should be reported on a wet weight basis along with details of the size range of the sample ($\bar{X}$, S.D., range) and details of site, date and method of collection, preservation details (if appropriate) and brief details of the methods of analysis used; if PCBs were analysed for, these details should include the technical PCB formulation or the individual chlorinated biphenyls used for standards and the method of quantitation used.

a) In addition, results of analyses of mussels for metals should also be reported on a dry weight basis. All results of analyses for organochlorine compounds must be reported also on an extracted fat weight basis or as a minimum be accompanied by a fat weight determination result.

b) Dry weight determinations should be carried out in duplicate by air-drying to constant weight at 105°C of sub-samples of the material analysed for the pollutants.

c) Fat weight should be determined on a sub-sample of the extract used for the organochlorine compound analyses. The results should be accompanied by a brief description of the method used for extraction.

General

Results should be submitted to the ICES Environment Officer not later than 30 June of the calendar year following collection of the samples. These results should be accompanied by the name of the contributing laboratory(s) and the name of an individual contact in the event of queries. The contributors should specify the most recent ICES intercalibration exercise in which they took part. A brief commentary on the data is also required.

ANNEX 7

ACTION LIST

The following activities were agreed by the Working Group members listed.

1. Dr Topping agreed to request a colleague to prepare a paper on the use of adenylate energy charge measurements as a technique for monitoring biological effects around an offshore oil rig. Dr Thurberg agreed to obtain a paper on a relevant study in the USA for the next meeting (Paragraph 5.1.7).

2. All members should request information from colleagues, including members of the former Working Group on Primary Production Methodology, on the application of primary production studies and primary production indices in biological monitoring and send this information to Dr Pearce by 31 July 1983. Dr Pearce offered to request a colleague to consider this and other information and prepare an overview paper on this subject, in the context of the GESAMP guidelines, for the next Working Group meeting (Paragraph 5.1.11).

3. Dr Carlberg is requested to prepare a paper evaluating the use of the rotatory flow technique in biological effects studies, including considerations of the costs (Paragraph 5.1.14).

4. 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 5.1.19).

5. Dr Thurberg will develop a questionnaire to determine which scientists carrying out biological effects monitoring studies suitable for a baseline study (Phase 1 of the strategy for biological effects monitoring) would participate in a Biological Effects Techniques Workshop to demonstrate their techniques.
All members should encourage their relevant colleagues to participate in this Workshop. Dr Dethlefsen will determine what laboratory and research vessel facilities can be made available (Paragraphs 5.1.23 and 5.1.24).

6. Based on the results of the inquiries in item 5, above, Drs Parker, Thurberg and Dethlefsen should prepare a paper giving more detailed plans for the Workshop and present this paper to the 1983 Statutory Meeting.

7. All members with additional data for the 1981 Coordinated Monitoring Report should submit them immediately to the ICES Environment Officer (Paragraph 6.1.2).

8. Dr Portmann will coordinate the preparation of a report on the eight years of results of the Coordinated Monitoring Programme for review at the 1984 Working Group meeting (Paragraphs 6.1.4 to 6.1.6).

9. The Environment Officer should provide a written statement on ICES procedures for the release of data contained in ICES data banks for consideration at the 1984 meeting (Paragraph 6.2.3).

10. Dr Jensen agreed to request the authors of the overview on PCTs to prepare a broader overview paper on PCTs, following the subject headings in Annex 4 (Paragraphs 6.4.8 and 6.4.9).

11. Dr Thurberg has agreed to prepare a statement on the toxicological aspects of zinc in the marine environment, for addition to the zinc overview paper (Paragraphs 6.4.10 and 6.4.11).

12. Drs Piuze and Moinet and Dr R Law should work together to merge their respective papers on PAHs and add missing information, for presentation at the WGMPNA and MCWG meetings next year (Paragraphs 6.4.12 and 6.4.13).

13. All members with information on nutrient concentrations covering

    a) geographically synoptic data,
    b) long time series at one or more stations, or
    c) data on inputs of nutrients indicating the relative significance of natural and anthropogenic sources,

    should send this information to Dr Folkard (Fisheries Laboratory, Lowestoft, Suffolk NR33 OHT, England) by 30 September 1983. Papers on these topics are also encouraged for presentation at the next Working Group meeting (Paragraph 6.4.16).

14. All members should write to Dr Portmann by 1 October 1983 and inform him which areas they will sample in the 1985 Baseline Survey of Contaminants in Fish and Shellfish and Dr Portmann will take steps to ensure good geographical coverage (Paragraph 6.6.5).

15. Dr Pearce will provide members with copies of the summary report of the assessment of the New York Bight, when they become available (Paragraph 7.3).

16. Mr Hill will try to have some material on an assessment of the environment of the Irish Sea available for the next meeting (Paragraph 7.3).

17. Mr Nielsen will distribute information on a workshop/symposium on the pollution situation in the German Bight, when available (Paragraph 7.4).

ANNEX 8

RECOMMENDATIONS

Recommendation 1

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that a Biological Effects Techniques Workshop be held in May 1984 to provide for the demonstration of appropriate techniques for monitoring the biological effects of marine pollution and to determine the suitability of these techniques for use on a cooperative basis, e.g., in a baseline survey.

Recommendation 2

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that ICES member countries be encouraged to study the bioavailability of contaminants in sediments and to report the results to ICES.

Recommendation 3

The Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic recommends that the Group meet for four days at ICES headquarters to consider:

(a) the implementation of the baseline study of contaminants in fish and shellfish and the baseline study of trace metals in sea water,

(b) the implementation of biological effects studies,

(c) further developments in trend monitoring,

(d) progress in the conduct of regional assessments, and

(e) the environmental impact of excessive nutrient concentrations in the marine environment.

If possible, the meeting should be arranged so that a one-day joint meeting may be held with the Working Group on Pathology and Disease of Marine Organisms.