Intergovernmental Oceanographic Commission

Workshop report No. 22

Third IOC/WMO Workshop on Marine Pollution Monitoring

organized with the support of UNEP

New Delhi, India, 11-15 February 1980

Unesco

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

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SUMMARY REPORT

The Scientific Workshops of the Intergovernmental Oceanographic Commission are usually jointly sponsored with other intergovernmental or non-governmental bodies. In each case, by mutual agreement, one of the sponsoring bodies assumes responsibility for publication of the final report. Copies may be requested from the publishing bodies as listed below or from the Secretary IOC, Unesco, Place de Fontenoy, 75700 Paris, France.

No.	Title	Publishing Body	Languages
1.	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia /Report of the IDOE Workshop on/; Bangkok, Thailand, 24-29 September 1973. UNDP (CCOP), 138 p.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2.	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974. (Unesco Technical Paper in Marine Science, No. 20)	Division of Marine Sciences, Unesco, Place de Fontenoy, 75700 Paris, France	English Spanish
3.	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish
4.	Report of the Workshop on the Phenomenon known as "El Niño", Guayaquil, Ecuador 4-12 December 1974.	FAO Via delle Terme di Caracalla, 00100 Rome, Italy	English Spanish
5.	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
6.	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English
7.	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/UNESCO/EAC, Nairobi, Kenya, 25 March - 2 April 1976.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English (full text) Extract and Recommendations also in: French Spanish Russian

No.	Title	Publishing Body	Languages
8.	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English
9.	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
10.	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
11.	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
11. Suppl.	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
12.	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, Fort-de-France, Martinique, 28 November - 2 December 1977	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
13.	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, 16-18 January 1978	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
14.	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French
15.	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-east Pacific, Santiago de Chile 6-10 November 1978	IOC, Unesco Place de Fontenoy, 75700 Paris, France CPPS Señor Miguel BAKULA Secretario General de la Comisión Permanente del Pacífico Sur Vanderghem 590 Lima 27 Perú	English Spanish

No.	Title	Publishing Body	Languages
16.	Workshop on the Western Pacific, Tokyo, 19-20 February 1979	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Russian
17.	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English
17. Suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English
18.	IOC/Unesco Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (Unesco reports in marine science, No. 4)	Division of Marine Sciences, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
19.	IOC Workshop on Marine Science Syllabus for Secondary Schools Llantwit Major, Wales, UK, 5-9 June 1978 (Unesco reports in marine science, No. 5)	Division of Marine Sciences, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
20.	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
21.	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
22.	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English French Spanish Russian
23.	WESTPAC Workshop on the Marine Geology and Geophysics of the Northwest Pacific, Tokyo, 27-31 March 1980	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English Russian
24.	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English

No.	Title	Publishing Body	Languages
25.	Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO/UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980	IOC, Unesco Place de Fontenoy, 75700 Paris	English

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SUMMARY REPORT

1. OPENING OF THE WORKSHOP

1 The meeting of the Third IOC/WMO Workshop on Marine Pollution Monitoring was held at the WHO Regional Office for South-east Asia, New Delhi (India). It was opened on 11 February 1980 by Dr. L. Andrén, Assistant Secretary, IOC, who welcomed the participants on behalf of the sponsoring agencies. The meeting was attended by 14 governmental experts, 12 experts invited by the sponsoring organizations, and three observers. The list of participants is attached as Annex III.

2. WELCOMING ADDRESSES

2 Dr. V.G. Podoinitsin, Director of the Unesco Regional Office for Science and Technology for South and Central Asia, addressed the meeting on behalf of his organization. Referring to Unesco's interest in, and contribution to, the field of environmental protection, he stressed the importance of the outcome of the Workshop for the marine pollution research and monitoring programmes of the IOC. He hoped experiences gained during the Pilot Project on Marine Pollution (Petroleum) Monitoring would provide a solid basis from which the new MARPOLMON programme could be developed.

3 Mr. K.N. Johry, Head, International Scientific Collaboration of the Indian Council for Scientific and Industrial Research (C.S.I.R.), New Delhi, addressed the meeting on behalf of his government. He outlined the contribution being made through the National Institute of Oceanography and its activities in co-operation with other nations in the region. In particular, he drew attention to the growing concern for the increasing trends in levels of pollutants other than petroleum being reported in the western coastal regions of India and down the eastern coasts of Africa. He commended the timeliness of the Workshop which would prepare proposals with a view to assessing these problems realistically. Stressing the need to assist developing countries to participate in the programme he regretted that India could not host the training course in marine pollution monitoring that had been planned for autumn 1979.

4 The organization of work was given special consideration. At the outset Dr. Neil R. Andersen was elected Chairman of the meeting. Mr. D. Kohnke was elected Vice-Chairman, and Mr. T.R. McKay, Rapporteur.

5 During a subsequent discussion of which would be the most logical and practical sequence of the items under the Agenda (Annex I) to follow, it was noted that the Workshop was asked to evaluate the scientific results and organizational and operational aspects of the Pilot Project, including the functioning of the IGOSS machinery. It was also asked to evaluate the feasibility and applicability of the methods used during the Pilot Project for monitoring oil in the open ocean.

6 Based on such an overall evaluation, the Workshop was asked to make recommendations [1] as to the feasibility of continuing under MARPOLMON certain activities of the Pilot Project. The Workshop was asked, in particular, to make recommendations on the contents and use of the Operational Plan for MARPOLMON based on the Manuals and Guides No. 7 and related amendments recommended by the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) which met in Tokyo, from 11 to 15 July 1979.

7 Further, the Workshop was asked to consider the possible employment of new techniques for monitoring oil, such as remote sensing, and design plans for new monitoring activities under MARPOLMON for pollutants other than petroleum. It was therefore concluded that a thorough evaluation of the Pilot Project machinery and results should be made before the consideration of an eventual initiation of MARPOLMON. It was therefore agreed to analyze and review all operational aspects of MAPMOPP (including scientific evaluation, and efficiency of the system for the acquisition and handling of data) before entering into a discussion of the main substance of Agenda Item 4.

8 Sessional Working Groups (referred to hereafter as "Working Groups") were formed to review different aspects of the programme under consideration and draft recommendations arising from the discussion of the groups. The terms of reference of the groups were respectively:

Working Group No. 1 - Evaluation of MAPMOPP and drafting of a recommendation on whether or not a monitoring operation would be scientifically justified and whether the basis of the operational plan is still valid.

(Rapporteur: M. Ehrhardt)

Working Group No. 2 - Feasibility of expanding the number of parameters in relation to those of the Pilot Project and the possibility of initiating pilot activities for pollutants other than oil.

(Rapporteur: E. Levy)

Working Group No. 3 - Feasibility of employing remote-sensing techniques for monitoring petroleum and other pollution variables.

(Rapporteur: T. Thompson)

Working Group No. 4 - Feasibility of establishing a digital data base for marine pollution, bearing in mind data generated outside MAPMOPP.

(Rapporteur: K. Hughes)

Working Group No. 5 - Review of the criteria that should be met by National Co-ordinators regarding their duties in an eventual monitoring programme.

(Rapporteur: G. Berge)

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1) Recommendations of the Workshop are given in Annex II.

3. REPORTS ON THE MARINE POLLUTION (PETROLEUM) MONITORING PILOT PROJECT BY THE SECRETARIAT AND NATIONAL CO-ORDINATORS

9 The Workshop was informed by the Assistant Secretary of the sources of the decisions and recommendations of relevant IOC bodies relating to the organization of the Third Workshop:

(i) the First Session of the Joint IOC-WMO Working Committee for IGOSS (Paris, 18-27 September 1978),

(ii) the Eleventh Session of the IOC Executive Council (Mexico City, 26 February - 3 March 1979),

(iii) the Third Session of the Working Committee for GIPME (Malta, 28 May - 1 June 1979),

(iv) the Eleventh Session of the IOC General Assembly (Paris, 15 October - 3 November 1979).

10 The Workshop took note of the decision by the IOC Assembly (Res. XI-6) to transfer the responsibility for marine pollution monitoring in IOC to the Working Committee for GIPME and of the fact that the recommendations of the Workshop would be put before that Working Committee for approval.

11 The Workshop also noted that although Resolution XI-5, by referring to Resolution EC-XI.11, implied that MARPOLMON should start by 1 July 1980, the Assembly had decided to refer development of a future marine pollution monitoring programme (MARPOLMON) to the Working Committee for GIPME, which will not meet until early 1981. In this situation the Workshop recommended (rec. IOC-WMO/MPM-I.1) pending a decision by the Working Committee for GIPME regarding content and the starting date of MARPOLMON, that ongoing observations of the Pilot Project (MAPMOPP) which had been proposed in its report to be included in a future MARPOLMON, should continue after 1 July 1980.

12 The Assistant Secretary also informed the Workshop about other main operational elements and activities such as technical meetings to review progress and provide advice on the scientific aspects of the project, training courses and other TEMA aspects. A questionnaire had been circulated by IOC in December 1979 requesting information from members on ongoing and projected activities under MAPMOPP and of the likelihood of future participation in MARPOLMON. Few responses to that questionnaire had been received, but these few responses gave some useful information which was presented in summary.

13 The Regional Co-ordinators and some of the National Co-ordinators reported on activities in their areas. The Representative of IOCARIBE reported that following the establishment of the IOCARIBE pollution monitoring programme (CARIPOL) in 1976, member countries had adopted MAPMOPP procedures for the oil pollution monitoring components. A Training and Intercalibration Seminar, planned for August 1980 in Costa Rica has already attracted over 35 nominations. Therefore, there is now a need to hold one course in English and one in Spanish.

This interest was taken as an indication of strong support from countries of the region. The fact that a Central American oil pipeline with a capacity for 1.5 million barrels per day is now under consideration, has made more urgent the need for baseline information on petroleum levels as an aid in the formulation of environment protection laws in the region.

14 Dr. R. Sen Gupta, the Indian Ocean Regional Co-ordinator, told the Workshop that progress reports had been received from several member countries participating in MAPMOPP projects in the region. Results indicate that oil pollution levels are relatively high in some sea areas in that region but that more data will be needed to establish trends.

15 Supplies of MAPMOPP log forms previously provided to the Regional Co-ordinator by US/NOAA are now running low. The Workshop proposed that the Secretary IOC assist in arranging for further supplies to countries who requested them.

16 Mr. McKay presented a paper entitled: "A preliminary report on an Australian Inter-Laboratory Collaborative Study on Methods of Analysis of Petroleum in the Marine Environment" (IOC-WMO/MPM-I/INF.2). Ampoules of test materials sent to participating laboratories contained standard amounts of synthetically weathered crude petroleum, lubricating oil and diesel fuel. The methods used by participating laboratories included gas chromatography, thin-layer chromatography and UV-fluorescence spectrophotometry. Problems of reproducibility of some of the techniques used were identified and further workshops will be conducted to review these. The Workshop was informed that details of a future Australian Workshop on the same subject will be made available to IOC and that the possibility of co-ordinating it with appropriate IOC programme components would be explored.

17 Dr. V.M. Gruzinov, Chairman of the Working Committee for GIPME, drew attention to the significance of the resolutions of the Eleventh Assembly of the IOC concerning the implementation of MARPOLMON in 1980 (Res. XI-5) and the transfer of the programme from IGOSS to GIPME (Res. XI-6). He also stated that the priorities to be considered at an early date include the development of techniques and methods, intercalibration of sensors, standards, dissemination of MARPOLMON data and promotion of TEMA in developing countries.

4. CONSIDERATION OF A PLAN OF OPERATIONS FOR THE MARINE POLLUTION MONITORING PROGRAMME WITH REGARD TO PETROLEUM

18 The Workshop listened to introductions of several technical papers which were subsequently discussed with regard to their implication for the petroleum monitoring programme.

19 The results of MAPMOPP. Mr. Kohnke introduced his paper "Results of MAPMOPP: Visual observations and tar ball collections" (IOC-WMO/MPM-I/7) which gave statistical analysis of those data. He reported that more than 100,000 visual observations made during the period from 1975 to the end of 1978 were processed to show that the most polluted regions were: the Red Sea (31% of the visual observations from this region reported oil sightings); the Straits of Malacca (~20%); the Mediterranean and Caribbean Seas (~20%); and the South China Sea (~15%). These areas are crossed by shipping routes with a dense tanker traffic. More than 10,000 additional observations, made in 1979, have not yet been included in the analysis. During the Pilot Project, approximately 6,000 data on the areal concentration of tar balls have been collected. The general results indicate that the areas off the northwest African coast are the most highly polluted, followed by the Sargasso Sea, the sea around Japan, and the Bay of Cadiz. Additional data collected in 1979 in the Indian Ocean region show higher concentration outside shipping lanes than within them. North of the Gulf Stream axis no drifting oil had been reported, and similar observations on the occurrence of

tar balls were taken to indicate insignificant occurrence of oil spills in this area. It is worth noting that the oil pollution observed was comparatively low in the North Sea and in the Baltic Sea, two regions where the ship traffic is very dense, but where oil discharge is strictly prohibited. There was some indication of a temporal decrease of oil pollution in the southern North Sea, but this cannot yet be considered as statistically significant. Tar balls obviously drift over long distances. There is some indication that tar balls originating from the central basin of the Caribbean can pass the Strait of Florida and get into the Gulf Stream. Moreover, they can be trapped in the anticyclonic gyre in the Sargasso Sea. An analysis of the data suggested that the overall mean value for the North Atlantic is about 0.5 mg/m^2. This would indicate that 15,000–20,000 tons of tar were floating on the surface of the North Atlantic Ocean during the MAPMOPP period.

20 The results of the visual observations of oil slicks on the sea and tar balls gave a fairly good impression of the present state of global ocean oil pollution. But Mr. Kohnke also stated that MAPMOPP is still far from providing a quantitative assessment of the marine oil pollution, and the amount and the quality of the data collected did not allow a trend analysis. He expressed the opinion that carrying on with the visual observations would not lead to essentially new knowledge of the regional distribution of oil slicks and their variability.

21 The Workshop felt that more knowledge on the dynamics of the oceans may be obtained from tar ball measurements than from the observation of surface slicks. The relatively short lifetimes of surface slicks make transport studies irrelevant. Tar balls are better for this purpose owing to their greater persistence. Areas of high tar ball concentrations were clearly identified by the MAPMOPP data and this was felt to be a valuable component of the programme. In future, proposals to monitor tar balls should direct special interest more toward regional areas than to open oceans. In such areas co-ordination should be made with the UNEP Regional Seas Programme. Monsoon impact regions were considered to be of particular concern. Current practices and methods appeared to be adequate for the present and produced generally acceptable information. However, improvements in the methods should continue to be sought. It was noted that data collection methods applied are inexpensive, which is an important advantage.

22 Dr. Levy summarized scientific information on dissolved/dispersed hydrocarbon data from his paper entitled: "Results of the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring: Dissolved/dispersed petroleum residus" (IOC-WMO/MPM-I/16). These results and those of other components of MAPMOPP will be published by IOC and a condensed version thereof will be prepared for publication in the open scientific literature. The Workshop noted in this context that data on the concentration of oil residus on beaches and on the concentration of dissolved/dispersed petroleum hydrocarbons are sufficient for some regional assessments, but too sparse for global analysis.

23 Dr. Ehrhardt introduced a paper entitled: "Dissolved/dispersed hydrocarbons, what is the nature of the substances being measured?" (IOC-WMO/MPM-I/6). Since elevated concentrations of fluorescing substances were observed in the vicinity of oil spills, the use of such substances as indicators of oil pollution was suggested. The validity of the methods for measuring concentrations of dissolved/dispersed petroleum hydrocarbons had been questioned, however, because of the unknown nature of the fluorescing material.

24 Polynuclear aromatic hydrocarbons (PAH) which would fluoresce under the conditions of analysis specified for MAPMOPP, are present in petroleum but are also generated by pyrolysis of carbonaceous materials and possibly by microorganisms as well. Detailed analyses of the fluorescing material is the key

to identifying the source of the PAH: those from petroleum are complex mixtures of predominantly alkyl-substituted PAHs whereas those from pyrolysis are "naked" or contain only short substituents. Those arising from micro-organisms would be very simple mixtures because of the specificity of bio-synthetic pathways. Detailed analyses by gas chromatography/mass spectrometry were carried out at the Institut für Meereskunde at Kiel University, Federal Republic of Germany, of organic substances extracted from seawater by carbon tetrachloride and by adsorption onto XAD-2 resin. The results demonstrated the presence of a homologous series of high-boiling-point aliphatic hydrocarbons, a complex mixture of substituted and unsubstituted PAH's, and a variety of aromatic ketones. The last of these are probably environmental oxidation products of the PAHs; the PAHs appear to be derived from both petroleum and, because of a relatively high concentration of unsubstituted PAH in the extracts, to some degree from combustion products, whereas the series of saturated hydrocarbons are directly related to petroleum.

25 In document IOC-WMO/MPM-I/11 (see paragraph 44) it was shown that polynuclear aromatic hydrocarbons (PAHs), which enter the sea from a variety of sources may be taken up by marine organisms, and that the toxicity of oil is a consequence of aromatic compounds in solution rather than material present as dispersed droplets. The Workshop noted with respect to many petroleum compounds that it is very difficult to verify the effects on biota and therefore to justify biological monitoring.

26 The Workshop concluded that the fluorescing material measured by the MAPMOPP procedure is not of biological origin, but derived from petroleum and combustion products, and that accordingly, the MAPMOPP fluorescence procedure provides a convenient and economical measure of environmental quality and is an appropriate method for identifying impact areas and for monitoring purposes. To obtain more detailed information these analyses must be supported by gas chromatography/mass spectrometry.

27 Results of sampling and observations made from Russian vessels in the North Atlantic were presented in a paper by E.A. Sobtchenko and others, entitled: "Present State of Pollution in the North Atlantic Surface Waters by Petroleum Hydrocarbons" (IOC-WMO/MPM-I/17).

28 In response to an inquiry concerning the availability of USSR MAPMOPP data, the Workshop was informed that such data have been regularly submitted to WDCs A and B.

29 Japanese data showed the relation between distribution of tar balls and circulation patterns of surface waters in the Western North Pacific and its marginal seas: for example, there was enrichment in convergence zones and on peripheries of eddies (doc. IOC-WMO/MPM-I/8, "Effect of dynamics of surface waters on tar ball distribution in the Western North Pacific and its marginal seas" by T. Suzuoki, M. Matsuzaki).

30 The Representatives of the two MAPMOPP RNODCs reported on data accumulation and problems related to data exchange and processing. In this connection the US NODC proposed the establishment of a digital data base for marine pollutants (Annex V).

31 Intercalibration and intercomparison. The results and experiences from the Intercomparison Exercise under MAPMOPP for analysis of dissolved/dispersed petroleum hydrocarbons were discussed. Dr. A. Zsolnay, Duke University Marine Laboratory (USA) had submitted the report "Intercalibration within the framework of MAPMOPP and MARPOLMON" (doc. IOC-WMO/MPM-I/12) and Dr. S. Carlberg of the Institute of Hydrographic Research, Swedish Board of Fisheries, had contributed the paper "Some comments and experiences from the ongoing intercomparison exercise" (doc. IOC-WMO/MPM-I/13) which scrutinized the analytical procedure.

32 In discussing this subject the Workshop recognized the necessity and value of intercalibration and intercomparison experiments and materials; some problems with the chrysene exercise were pointed out; e.g., low solubility of chrysene, improperly sealed vials, etc. The Workshop suggested that a mixture of crude oils or crude oil with the low-boiling compounds removed would more closely match the material in seawater and would, therefore, be a more suitable reference material. Such a material could serve as a dual reference for fluorescence and for infrared analysis. It was agreed that intercalibration, including that of analyses of dissolved/dispersed petroleum hydrocarbons, must be continued in any future programme.

33 The scientific basis for petroleum monitoring. Based on the various documents referred to above and on the report of the Working Group on "Evaluation of MAPMOPP and drafting of a recommendation on whether or not a monitoring operation would be scientifically justified and whether the basis of the operational plan is still valid", the Workshop discussed, as one of the most important questions before it whether or not the continuation of all or certain elements of the Pilot Project was scientifically justifiable, and therefore whether a petroleum monitoring programme should be recommended.

34 The Workshop adopted with some amendments the report of the above Working Group; it is incorporated in this Report. The Workshop also discussed a draft paper prepared by Dr. Cornford entitled: "Various considerations affecting the feasibility and desirability of continuing petroleum monitoring initiated under MAPMOPP".

35 The Workshop recognized that there are reasons other than scientific ones for converting the Pilot Project into an operational programme, of paramount importance being the sense of usefulness and participation created among developing nations which not infrequently are exposed to oil pollution of their shorelines to a considerable degree. The Workshop considered itself mainly concerned with scientific aspects; nevertheless, it felt that the considerations contained in Dr. Cornford's paper should be brought to the attention of the Working Committee for GIPME. It is therefore attached as Annex IV.

36 The original objective of the Pilot Project was the testing of a world-wide network of observations of certain elements of marine oil pollution and of the ability of this network to produce relevant data. This objective was stated at the First IOC/WMO Workshop on Marine Pollution (Petroleum) Monitoring in Gaithersburg, Maryland, USA, in 1974, and was included in the Report of the Joint IOC/WMO Sub-Group of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project (Washington, D.C., February 1978). Although this objective has been met, as shown by the large number of visual observations of surface oil slicks, the fact should not be overlooked that data from large parts of the world's oceans, notably the Pacific, are still lacking.

37 On the other hand, the data products based on observations and measurements made within the Pilot Project show that the original expectation of the Pilot Project has been exceeded in many respects, as stated in the report of the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), Tokyo, July 1979. A comprehensive picture of the occurrence of surface oil slicks as well as less detailed information on the other three components of the project have emerged from the analysis of collected data.

38 To be in a position to assess the feasibility of an operational oil pollution monitoring programme a new set of objectives has to be defined. One objective would be to obtain the data needed for a full global picture of oceanic oil pollution. Another objective would be to determine trends in those parameters (of oil pollution) the status of which, whether in terms of occurrence or concentration, we can presently describe. In the case of surface oil slicks where the observations are little more than statements of presence ("yes") or absence ("no"), this would hardly be possible, unless the pattern of oil production, transport and utilization changed in the future; there are indications of this (e.g., the detection of hitherto unknown oil reservoirs). An important additional reason for continuing the Pilot Project on an operational basis is the fact that data generated within its framework are used by, and useful to, interested national authorities and international organizations. Also the anticipated production of synthetic fuel by the liquifaction of coal will possibly lead to an increased environmental burden of polycyclic aromatic hydrocarbons which may well be detected even with the present accuracy of the methods of measuring dispersed/dissolved petroleum hydrocarbons in water based on fluorescence techniques.

39 The Workshop recalled that the original objectives of the Pilot Project were as follows (ref. IOC-WMO/MAPMOPP-II/3, Annex VIII): "To exercise the proposed methodology; to involve co-operation among maximum number of countries; to give developing countries an opportunity to develop a basic capability for participation in the Pilot Project".

40 The Workshop considered these objectives have been met. The Pilot Project developed beyond its initial objectives which led to a number of scientific results first summarized in the report of the second session of the Joint IOC-WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project (IOC-WMO/MAPMOPP-II/3, pp. 18-19).

41 As regards the identification of compounds analyzed by spectrofluorometry the Workshop noted that detailed chemical analysis of the fluorescent material measured by the MAPMOPP procedure had proved it to be of a biotic origin, and this eliminated most of the original ambiguities of this method. The fluorescent material extracted with a non-polar solvent is composed mainly of environmental degradation products of fossil fuels and products of high-temperature combustion. Therefore, and because compounds of known toxicity to marine biota were found among these products, their concentrations provide a measure of environmental quality.

42 Based on the assessment made above, the Workshop envisaged the following elements of MARPOLMON:

- Identification of regions of actual or potential environmental concern;
- Assessment of the value of including other components of oil pollution (e.g., surface microlayer, dissolved/dispersed hydrocarbons at greater depths, bottom sediments);
- Assessment of the feasibility and usefulness of including pollutants other than oil;
- Provision of developing countries with an opportunity to expand their capabilities in marine sciences.

43 Conclusions with respect to the future of the main operational elements included in MAPMOPP. As regards these elements the Workshop reached the following conclusions:

(i) Visual observations of oil slicks have provided a useful initial global assessment in most regions of potential concern. These observations have formed the major component in the development of a system for reporting, collecting and disseminating data. There are still several ocean regions that have not been covered by this programme, and information on these areas is still lacking. The project has provided some developing countries with the opportunity to participate in a useful marine pollution research programme which could be carried out with limited resources. Further data collection using the basis provided by MAPMOPP is not likely to contribute substantially to filling the existing data gaps (predominantly outside shipping lanes and fishing zones), nor would significant scientific gain be expected using present methods. However, it was recognized that there are important non-scientific considerations which will need to be taken into account by the Working Committee for GIPME when reviewing the conclusions of the Workshop and deciding on the development of MARPOLMON. It is considered scientifically worthwhile to repeat the visual observations if changes in trends in present petroleum production/transport/consumption patterns develop or if new or more accurate observational and analytical methods become widely available.

(ii) Beach-tar measurements continue to be of substantial importance in certain areas for assessing the level of threat posed to coastal resources, providing information in support of coastal oil pollution regulatory measures, and preserving coastal amenities. Continuation of surveillance with the present methods, especially in data-sparse sea areas, is warranted. A substantial increase in input by developing countries is desirable.

(iii) Floating tar ball collections have so far been insufficient to permit calculation of the mass balance of petroleum hydrocarbons and for quantification of weathered residues. Many data-sparse areas still remain, and insufficient information on tar ball variability in time and space warrant the continuation of monitoring and research, with substantially increased activity in developing country regions.

(iv) Measurement of dissolved/dispersed hydrocarbons is essential to an understanding of the pathways and fate of these substances and of their toxic or pathogenic effects upon the marine biological resources which are of particular interest in the coastal waters and semi-enclosed sea areas. There is a definite need to continue efforts initiated within or related to MAPMOPP that comprise a high level of technology transfer; for example the training courses held in Beaufort, USA and in Perth, Australia, as well as exercises such as the Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO/UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-ocean Waters (Bermuda, 10-26 January 1980), which dealt with other types of pollutants.

(v) Intercomparability of sampling and analytical methods is to be strongly encouraged for research and/or monitoring phases, with special efforts to distribute suitable reference materials.

(vi) There is a definite need to make global assessments of ubiquitous marine pollutants such as petroleum hydrocarbons, to estimate global mass balances and global trends in chronic pollution. Regional marine pollution research and monitoring programmes must at some stage be harmonized and collectively reviewed to permit such global assessments to be made. To make an assessment of temporal variations and trends of the level of pollution, measurements at fixed points are fundamental. The Ocean Weather Stations provide excellent platforms for such measurements and it is therefore recommended that maximum use be made of these Stations.

44 Inclusion of additional parameters for study of oil pollution. The feasibility of introducing parameters for study of oil pollution, other than those covered by the Pilot Project was considered in the light of the reports of Working Groups No. 2 and 3 and several contributed papers. Dr. Ehrhardt introduced the paper "Methods for isolating and analyzing polycyclic aromatic hydrocarbon metabolites and toxicity assessment" by Palmork and Solbakken. The paper described the effects of polycyclic aromatic hydrocarbons (PAH) on marine biota, their degradation by mammals and their pathways in micro- and higher organisms. Their toxicity is due to their dissolved components. The Workshop felt that there is a foundation for monitoring these hydrocarbons with a view to evaluating their mass balance, but it was questioned whether we are yet in a position to verify their detrimental effects in the marine environment. Monitoring should be continued in spite of this last limitation since it may well be too late to reverse the damage at the stage when effects have become observable in the marine environment.

45 Dr. Mikhailov presented the paper "Marine surface microlayer petroleum pollution in the North Atlantic" by A.I. Simonov and V.I. Mikhailov (doc. IOC-WMO/MPM-I/INF. 4). The survey of the surface microlayer (defined as a layer of about 220 microns) comprised sampling in the Canary, North Equatorial and Gulf Streams, and in the Sargasso Sea and the North Atlantic Ocean. The authors discussed regional and seasonal variations in amounts of oil samples.

46 Dr. Levy presented a paper entitled: "The screen as a sea-surface sampling device" by R.E. Pellenbarg and W.D. Garrett (doc. IOC-WMO/MPM-I/INF. 1) and referred also to a paper on an "Implementation plan for the determination of the atmospheric contribution" by R.A. Duce. The device was described as simple, cheap and practical for monitoring purposes.

47 Surface microlayer. Based on considerations of Working Group No. 2 the Workshop concluded that sampling this microlayer for petroleum is feasible using the Garrett metal screens. These are easily cleaned and deployed to collect water samples which can then be analyzed according to the MAPMOPP procedure for dissolved/dispersed petroleum residues. Procedures should be carefully described to ensure that participants generate comparable results.

48 Experience has shown that the surface microlayer can only be successfully sampled in calm seas and, indeed, only exists under such conditions.

49 Sampling at greater depths. The Workshop concluded that such sampling can be conducted successfully using conventional oceanographic devices provided precautions are taken to avoid contamination of the samplers from heavily polluted surface waters. These procedures, however, are considerably more involved than the procedure used at 1-m depths.

50 Bottom sediments. Collecting of bottom sediments can be made by grab samplers and analyzed, after extraction, by fluorescence spectrophotometry. Reasonable precautions must be taken to avoid contamination, but the procedures are routine. Because of the composition of sediment extracts, a clean-up procedure may be required which would have to be tested, intercalibrated and included in an extended version of the guide to operational procedures.

51 Of those sampling methods mentioned above, the latter is probably the most relevant to a global/regional programme. Concentrations are higher than in the water, and therefore analytical and contamination problems are reduced. Further, sediments integrate over a period of time and are more or less immobile. Surface microlayers are very transient since they depend so strongly on ambient conditions. Concentrations are generally at least an order of magnitude higher than at 1-m depth. The effect of oil on air/sea exchanges, possible concentration of other pollutants, and impact on organisms at the sea surface make the sampling of the surface microlayer very important.

52 Remote sensing. Dr. Andersen made a brief presentation of a comprehensive report on remote sensing of a large number of ocean parameters including petroleum and other pollutants ("The potential of employing remote sensing techniques on spacecraft in chemical oceanographic research; a preliminary assessment", by N.R. Andersen, doc. IOC-WMO/MPM-I/10). After having explained the basic physical concepts, the paper reviewed the various sensors and carriers giving special emphasis to those most promising for marine pollution monitoring. The Workshop

noted that at the present stage some national airborne systems have been developed and also proven their capabilities in mapping oil pollution and that several satellite systems with ocean mapping capabilities have been or are in operation. For the next 5-year period there are 42 approved or proposed satellite missions, of which a dozen are judged to have proven and/or potential ocean-science capabilities.

53 The Working Group No. 3 on "the feasibility of employing remote sensing techniques for monitoring oil pollution" arrived at the following conclusion which was adopted by the Workshop: "Several airborne sensors such as infrared and microwave scanners may be suitable for tracking oil slicks. For the surveying of larger areas the side-looking airborne radar (SLAR) has proven particularly useful as an independent all-weather, daylight sensor. For oil detection and mapping, a wavelength of 3-5 cm seems to be most efficient. The SLAR covers a swath of 20-50 km on one or both sides of the aircraft. The SLAR has hitherto mainly been used on an experimental basis. Some national systems are, however, being developed that will be in operation in the near future. Such systems will mainly cover areas immediately outside the coastline and are not expected to be used for open-ocean monitoring. For such monitoring, satellite-borne, synthetic-aperture radars (SAR) will be required. Such data from the SEASAT satellite are presently being processed, but no information on the capability to map oil slicks is available. SLAR or SAR will map the extent of a substance having a damping effect on capillary waves and will not give information on its composition. Other sensors may provide this information when an oil slick has been detected by SLAR or SAR. Remote sensing techniques, although not yet fully developed, seem to have a great potential, but will still take a number of years before they become generally operational".

54 The Workshop concluded that remote sensing is now completely applicable for pollution monitoring. In this respect aircraft systems have proven operational capabilities, whereas satellite applications still need further development. Laser induced fluorescence, using Raman backscatter as an internal standard, provides exciting prospects for monitoring of pollutants other than oil. This method provides real-time data for chlorophyll to depths of 30 to 50 m. Remote sensing is already being used from aircraft which could be employed for monitoring of pollutants.

5. PRELIMINARY ASSESSMENT OF THE FEASIBILITY OF INCLUDING POLLUTANTS OTHER THAN OIL IN THE MARINE POLLUTION MONITORING PROGRAMME

55 The Assistant Secretary briefly outlined relevant Resolutions. The Chairman reviewed the results of the Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO/UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-ocean Waters (Bermuda, 10-26 January 1980) in which 35 participants from 13 countries took part. The point most highlighted was that extreme precautions in sampling and analysis were required to arrive at meaningful results. A preliminary report will shortly be distributed by the IOC Secretariat. Dr. J.M. Bewers and Mr. K.H. Palmork are analyzing the data for trace metals and chlorinated hydrocarbon respectively, and their reports are due on 30 August 1980.

56 Dr. Andersen introduced his paper "The feasibility of monitoring pollutants other than oil" (IOC-WMO/MPM-I/9). The subsequent discussion indicated that some difficulties still stand in the way of a monitoring programme for trace metals

and chlorinated hydrocarbons in the open ocean. However, a programme on trace metals could probably be initiated in nearshore areas and enclosed or semi-enclosed seas where higher concentrations may be expected. It might not be possible to initiate any programme on chlorinated hydrocarbons at present, since a requirement for such a study is a gas chromatograph equipped with a glass capillary column. Monitoring of the sea-surface microlayer using "Garrett-screens" is difficult but feasible.

57 In reply to a question on whether it is sensible to carry out an exercise of the kind done in Bermuda so as to continue a more generalized monitoring scheme in the open ocean, or whether areas with high levels of certain pollutants should be considered for monitoring, Dr. Andersen stated that open-ocean areas cannot at present be deemed useful for the repetition of such an exercise, but that this can be done in areas of high concentrations if sufficient justification exists for undertaking such a programme. It may be very useful to repeat the exercise as appropriate.

58 A present deficiency in data required to construct mass balances of physiologically important trace metals, most particularly in coastal seas and estuaries, warrants increased research and/or monitoring. Expansion of monitoring in semi-enclosed seas will permit prediction of future trends and enable necessary remedial measures to be adopted in such areas to ensure viability of marine resources. Development of monitoring techniques for chlorinated hydrocarbons in coastal marine sediments is also important. These requirements may be met through appropriate extension of the machinery and infrastructure developed within MAPMOPP and will provide valuable technology transfer opportunities for developing countries to monitor potential threats to their coastal marine resources.

59 The Working Group on "the feasibility of expanding the number of parameters in relation to those of the Pilot Project and the possibility of initiating pilot activities for pollutants other than oil" had felt that it is premature to establish a programme for monitoring pollutants other than petroleum in the open ocean. However, there is scientific justification and possibly need for a programme in semi-enclosed seas most particularly in near-shore areas. These are particularly pertinent, since concentrations there are expected to be higher, and effects are more likely to occur. Actions could possibly be taken to improve the quality of the environments in these areas as a consequence of the results expected from the programme.

60 The Workshop therefore suggested that a pilot project should be considered for trace metals and organic pollutants in these areas starting with an assembly of existing data by the RNODCs (if costs are not excessive) and some sampling and analysis.

61 The Workshop concluded that for the open ocean, unless extensive expertise and instrumental capability are available, monitoring of trace elements and chlorinated hydrocarbons is probably not practicable at this stage. For semi-enclosed seas with much higher concentrations a monitoring programme is probably feasible if agreement is reached on the methods to be used. In addition, if an agreed single method for collection is possible, sampling of the sea-surface microlayer may be included in such a monitoring system. An intercalibration exercise is essential to ensuring the validity of the results.

6. INSTITUTIONAL ARRANGEMENTS FOR PLANNING, CO-ORDINATION AND IMPLEMENTATION OF THE MARINE POLLUTION MONITORING PROGRAMME

62 During the Workshop, aspects of this subject had come up, because of the close linkage between these aspects and the scientific components.

63 At the outset of the discussion of this item, the Representative of UNEP made a statement on his organization's view of future international activities in the field of monitoring oil in the open ocean. His statement presented in Annex VI indicated in particular that because of the present financial constraints it is unlikely that further financial support from UNEP for open ocean monitoring of oil would become available.

64 The Workshop then discussed the importance of having effective National Co-ordinators. It is essential that when designating MARPOLMON National Co-ordinators, the Member States take into account the specific requirements of this programme. The incumbent should have a position that ensures effective communication and interaction with different administrative entities involved with the programme, and he or she should have access to sufficient secretarial and financial support, and whatever other resources are required, to be able to perform his task. He should also be given opportunity to represent his country at technical meetings related to the programme.

65 A Working Group (No. 5) had also been established to consider the role and functions of National Co-ordinators for MARPOLMON. Its recommendations were later adopted in plenary and are contained in Annex II (rec. 6, Appendix 1).

66 The Workshop noted with appreciation that the success of the programme of visual observations of oil slicks and other floating pollutants in the MAPMOPP was due to a considerable degree to the existence of the WMO Voluntary Ship Observing Programme. The contribution by the ship's officers is voluntary and free of charge. They are normally willing to co-operate in important programmes other than meteorological ones, provided that this does not conflict with their ordinary duties and that these programmes are not of a permanent nature.

67 Therefore, before instituting a global system of visual observations of oil slicks under MARPOLMON the feasibility of using the WMO Voluntary Ship Observing Programme should be studied.

68 The Workshop considered arrangements to ensure efficient data and information exchange under MARPOLMON. As agreed earlier, the area of responsibility for the Japan RNODC is the Indian Ocean, and the Western Pacific, and that of the US NODC is all other areas. Each RNODC will archive a complete MAPMOPP data set. To this end, data exchange between the RNODCs has been routinely effected. With respect to national submissions and exchange between the RNODCs the following problems or potential problems were however identified:

(i) Duplication of the data held by each RNODC has been a problem. The Data Centres, however, are eliminating such duplication by automatic means.

(ii) Contributing Member States have shown considerable variation and deviation from agreed MAPMOPP reporting formats. Fewer than half of reporting countries have followed adopted formats, units and rules for encoding data.

(iii) National submissions of data so far have been in at least twelve different magnetic tape layouts. This diversity causes considerable difficulty for the RNODCs in the processing of data. This problem will be alleviated by the wider adoption of the OCEAN SYNDARC format.

(iv) Member States should accelerate the flow of MAPMOPP data to the appropriate RNODC through their respective NODCs, where they exist.

69 With a view to making the management of MARPOLMON data more efficient, the Workshop proposed that:

(i) Member States participating in MARPOLMON should forward collected data through their respective Data Centres, if they exist, only to one of the designated Responsible National Oceanographic Data Centres for MARPOLMON. Doing this will help to avoid duplicate submissions of data and will facilitate data processing, archival and retrieval.

(ii) Specifically, countries of the Asian area should direct their data submissions to the Japan Oceanographic Data Center (JODC). Other participating countries should submit their data to the National Oceanographic Data Centre of the United States. Both Centres act as RNODCs for MARPOLMON. Data submissions, or data reporting, should preferably use the MAPMOPP OCEAN SYNDARC Format. If, however, use of the standard MAPMOPP OCEAN SYNDARC is not feasible, submission of the standard log sheets is acceptable.

(iii) Additionally, RNODCs are expected to expeditiously process incoming data including quality-control measures to the extent practicable. It is hoped that automated quality-control procedures will soon be developed by the respective RNODCs, and practised for MARPOLMON data.

(iv) Data received by the RNODC should be assigned unique identification numbers and then regularly exchanged between the RNODCs.

(v) Eventually, the Japan and the US NODCs as RNODCs for MARPOLMON, will archive a complete, world-wide data base for MARPOLMON. Requests for data could then be directed to either of the RNODCs.

(vi) States may submit their data to the World Data Centres for Oceanography directly if they wish to do so.

70 The Workshop adopted the report of the Working Group on "Feasibility of establishing a digital data base for marine pollution bearing in mind data generated outside MAPMOPP". It is attached to this Report as Annex V.

71 The Representative of the US NODC speaking also as a representative of the Working Committee for IODE then made a proposal on behalf of the US NODC for the development of an automated inventory system of operational marine pollution monitoring programmes. A detailed proposal for implementation of the system is found as an appendix to Annex V.

72 The Workshop recommended that the RNODCs for MAPMOPP be now considered as RNODCs/MARPOLMON and be supported as during the pilot project.

7. TRAINING, EDUCATION AND MUTUAL ASSISTANCE (TEMA) COMPONENTS OF THE MARINE POLLUTION MONITORING PROGRAMME

73 Dr. Qasim, as Chairman of the Working Committee for TEMA, referred to some relevant TEMA activities, and stressed his view that the Workshop should identify specific needs for TEMA in future pollution monitoring programmes, particularly in view of the Third Session of the Working Committee for TEMA in Buenos Aires, from 21 to 25 April 1980. Several TEMA requirements and concerns were considered during the Workshop in relation to various elements in the pollution monitoring programme.

74 Such requirements included training courses, fellowships, expert advice, exchange of scientists, services in intercomparison and standardization programmes, assistance with equipment and data exchange services. The Workshop was informed of the Indian Ocean Regional Training Course for Marine Technicians on Petroleum Monitoring, held in Perth, Australia, from 18 February to 1 March under the sponsorship of IOC and the Government of Australia. Participants from Kenya, Thailand (2), Indonesia, Malaysia, Philippines and the People's Republic of China (2) attended. The course provided operational training in MAPMOPP methods for oil-slick observation, the sampling of floating tar balls and tar balls on beaches, and the sampling and analysis of dissolved/dispersed hydrocarbons. Emphasis was placed on providing opportunities to develop participants' skills to assist them to train others in turn in their home institutions. Sets of samplers for dissolved/dispersed hydrocarbons were obtained through funds provided by the Australian Development Assistance Bureau. These samplers were retained by participants for use in their own programmes.

75 The Workshop, noting that the Working Committee for TEMA was going to be informed of this course, expressed appreciation to the organizers of the course and recommended that further regional courses be considered.

76 The Workshop endorsed fully the recommendation (MAPMOPP ad hoc-II.4) of the meeting of the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), Tokyo, 9-13 July 1979), and recommended that the Secretary IOC bring the requirements of MARPOLMON to the attention of the Working Committee for TEMA and other bodies concerned.

8. ADOPTION OF THE REPORT

77 The Summary Report was adopted after a number of amendments to the text. The Assistant Secretary IOC was asked to extract the Recommendations from the main body of the Report and include them with the recommendations, adopted separately, on the conversion of MAPMOPP into a regular monitoring programme (MARPOLMON), into an annex (No. II) of this Report.

9. CLOSURE OF THE WORKSHOP

78 The Chairman closed the Workshop on Friday, 15 February 1980.

AGENDA

1. Opening of the Workshop

2. Welcoming addresses

3. Reports on the Marine Pollution (Petroleum) Monitoring Pilot Project by the Secretariat and National Co-ordinators

4. Consideration of a Plan of Operations for the Marine Pollution Monitoring Programme with regard to petroleum

5. Preliminary assessment of the feasibility of including pollutants other than oil in the Marine Pollution Monitoring Programme

6. Institutional arrangements for planning, co-ordination and implementation of the Marine Pollution Monitoring Programme

7. Training, Education and Mutual Assistance (TEMA) components of the Marine Pollution Monitoring Programme

8. Adoption of the Report

9. Closure of the Workshop.

RECOMMENDATIONS

Recommendation IOC-WMO/MPM-I.1

CONVERSION OF THE MARINE POLLUTION (PETROLEUM) MONITORING PILOT PROJECT (MAPMOPP) INTO A MARINE POLLUTION MONITORING PROGRAMME (MARPOLMON)

The Third Workshop on Marine Pollution Monitoring,

Having reviewed the results of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) as presented in the documents submitted to the Workshop, including the report of the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), Tokyo, 9-13 July 1979 (IOC-WMO/MAPMOPP-ad hoc-II/3),

Having determined that the objectives of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) were fully met,

Having established that MAPMOPP data are useful to, and are in some cases already being used by, national regulatory agencies, as well as international or intergovernmental organizations concerned with oil pollution,

Considering that a global baseline for marine environmental levels of petroleum hydrocarbons, both natural and generated by man, will provide a basis for various kinds of action,

Having also reviewed the feasibility and desirability of conducting subsequent marine pollution research and/or monitoring leading to an assessment of global marine pollution,

Noting that it is intended to terminate the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) on 30 June 1980 and that the IOC Assembly has resolved to establish a Marine Pollution Monitoring (MARPOLMON) Programme on a permanent basis (Res. IOC XI-5),

Noting that this decision of the IOC Assembly was made subject to a favourable recommendation in this regard by the Third Workshop on Marine Pollution Monitoring (New Delhi, India, 11-15 February 1980),

Considering it undesirable that ongoing data-gathering be interrupted pending a formal endorsement by the Working Committee for GIPME, the Fourth Session of which will not meet till about March 1981,

Recommends that the following elements be incorporated in the preliminary phase of the operational MARPOLMON Programme with the methods and guidelines recommended by the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), Tokyo, 9-13 July 1979, and accepted by the Third Workshop:

(a) the assessment of tar on beaches in selected regions;
(b) the collection and measurement of floating particulate petroleum residues (tar balls) in selected regions;
(c) the determination of concentrations of dissolved/dispersed petroleum hydrocarbons in seawater;

Believes that, although visual observations of floating oil under MAPMOPP have provided a useful initial global assessment in most regions of potential concern, they should not be a specific element of MARPOLMON, in its preliminary phase, but

Recognizing that there are important non-scientific considerations which will need to be taken into account by the Working Committee for GIPME when reviewing the conclusions of and making decisions related to the development of MARPOLMON

Also believes that it would be scientifically worthwhile to repeat visual observations in the open ocean after a lapse of five years, or more, from the present date, or if changes in petroleum transportation patterns occur, or if observational methods become more accurate,

Therefore recommends that, visual observations of floating oil may continue as part of regional marine pollution research and monitoring programmes, and that before incorporating visual observations into MARPOLMON, the advice of WMO should be sought as to the feasibility of using the voluntary ship observing programme,

Considering that Ocean Weather Stations provide useful platforms for fixed-point measurements required for an assessment of temporal variations and detection of trends,

Recommends that maximum use be made of these stations for this purpose.

Recommendation IOC-WMO/MPM-I.2

INCLUSION OF METHODS NOT INCLUDED IN MAPMOPP FOR SAMPLING OR OBSERVATION OF OIL IN SEA WATER

The Third Workshop on Marine Pollution Monitoring,

Realizing the limitations of existing microlayer sampling techniques, and the need for employment of a standard method and intercalibrated analyses, but

Being aware of the considerable scientific interest in microlayer studies,

Also being aware of the fact that sampling at greater depths than 1 m can be conducted successfully using conventional oceanographic sampling devices,

Believing that research into hydrocarbon levels in coastal marine sediments is important, and the associated methods feasible,

Realizing that remote sensing is now applicable to pollutant monitoring and that aircraft-borne sensors are already in use in national oil pollution monitoring programmes,

Recommends that the possibility of including other methods of study of oil pollution be actively explored by the Working Committee for GIPME and through research projects associated with, or related to, MARPOLMON. These methods should include surface microlayer sampling, sampling of dissolved/dispersed hydrocarbons at greater sampling depths, and sampling of bottom sediments, as well as the use of new techniques of observation such as remote sensing as they become readily available.

Recommendation IOC-WMO/MPM-I.3

MONITORING OF POLLUTANTS OTHER THAN OIL

The Third Workshop on Marine Pollution Monitoring,

Taking into account the results of the Workshop on Intercalibration of Sampling Procedures for Estimation of Trace Metals and Chlorinated Hydrocarbons, Bermuda, 11-26 January 1980,

Realizing the special concern over effects of trace metals and chlorinated hydrocarbons in near-shore areas, the need to predict future trends with a view to facilitating remedial measures, and the low levels generally encountered in the open oceans,

Considering it premature at this stage to monitor such pollutants in the open ocean,

Recommends that the Working Committee for GIPME continue to explore the feasibility and desirability of including parameters other than oil in MARPOLMON and that it consider the conduct of a pilot project on the monitoring of trace metals and chlorinated hydrocarbons in near-shore areas, starting with the assembly of existing data and some sampling and analysis.

Recommendation IOC-WMO/MPM-I.4

INTERCOMPARISON AND INTERCALIBRATION REQUIREMENTS

The Third Workshop on Marine Pollution Monitoring,

Noting the relevant considerations by the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum)Monitoring Pilot Project (MAPMOPP), Tokyo, 9-13 July 1979, and its recommendation MAPMOPP ad hoc-II.3,

Having reviewed additional reports on the Intercomparison Exercise (INTCOMP) under MAPMOPP,

Recognizing the necessity and value of intercalibration and intercomparison for MARPOLMON,

Being aware of some problems with the use of chrysene as a calibration standard,

Encourages efforts to ensure intercomparibility of data and intercalibration of sampling and analytical methods for MARPOLMON, with special efforts directed towards preparing and distributing suitable reference materials,

Stresses the importance of continuing the intercalibrations in the petroleum monitoring component of the MARPOLMON programme,

Recommends that the Chairman for the GIPME Group of Experts on Methods, Standards and Intercalibration, assisted as appropriate by other members of that group, develop, on the basis of the conclusions of the Third Workshop, a detailed action plan for an intercomparison exercise for dissolved/dispersed petroleum hydrocarbons under MARPOLMON, and provide advice as necessary during the exercise.

Recommendation IOC-WMO/MPM-I.5

OPERATIONAL PLAN FOR A MARINE POLLUTION MONITORING (MARPOLMON) PROGRAMME

The Third Workshop on Marine Pollution Monitoring,

Taking into account the recommendations of the Ad hoc Group of Experts on the Evaluation of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), Tokyo, 9-13 July 1979, on modifications of the methods employed in MAPMOPP, and related guidelines and instructions,

Mindful of the need for all participants to apply uniformly, to the greatest extent possible, the methods recommended for use in MARPOLMON,

Recommends that the IOC publish appropriate documentation on the measurement of petroleum in sea water, based on material developed during MAPMOPP (e.g. IOC Manuals and Guides No. 7), including scientific guidelines and methods concerning uniform interpretation and reporting methods for visual observations of oil, to provide comprehensive technical specifications for future measurements on a uniform basis.

Recommendation IOC-WMO/MPM-I.6

ORGANIZATIONAL ASPECTS

The Third Workshop on Marine Pollution Monitoring

Mindful of the need to ensure broad and effective participation, effective co-ordination and supervision, and continuing availablility of technical and scientific advice,

Recommends that

(i) the Working Committee for GIPME establish a mechanism for timely advice on, and effective supervision and review of, scientific aspects of MARPOLMON;

(ii) the Secretary IOC make every effort to broaden participation and facilitate exchange of information with participants;

(iii) Member States consider strengthening participation in all or most of the main operational components of the programme, announce officially their intention to participate, and designate National Contacts for MARPOLMON to the Secretary IOC in accordance with the guidelines given in the Appendix to this recommendation;

(iv) the Secretary IOC work out, in consultation with the Chairman of the Group of Experts on Methods, Standards and Intercalibration, and other experts as required, a detailed action plan for the implementation of the initial phase of MARPOLMON.

Appendix to Recommendation IOC-WMO/MPM-I/.6

The duties of National Co-ordinators

Each of the participating countries shall appoint officially a National Co-ordinator with the following terms of reference:

"The Co-ordinator shall act as liaison officer between all the participating laboratories and agencies of his country and the IOC system. The liaison covers all matters related to the conduct of the programme, specifically:

1. to identify institutions and other agencies in his country that might participate in the programme and inform the Secretary IOC thereof;
2. to issue from time to time clear guidance and instructions on the programme procedures and practices to the participating laboratories in their native (national language) if possible;
3. to ensure regular collection and submission of data to the relevant national data centre or, where such centres do not exist, be responsible for submitting the data to the appointed RNODC;
4. to be responsible for dissemination of information from the IOC Secretariat or the data centres to the project leaders of the participating national laboratories and other national bodies.

In addition, the National Co-ordinator should annually submit a report to IOC on progress achieved. He should also assist with the briefing of national delegates to the governing bodies of the sponsoring agencies on the programme."

Recommendation IOC-WMO/MPM-I.7

DATA HANDLING AND INFORMATION EXCHANGE

The Third Workshop on Marine Pollution Monitoring

Recalling recommendation MAPMOPP-ad hoc-II.1,

Being aware of the need to further improve reporting speed and adherence to recommended formats,

Further recalling that the Japan RNODC is responsible for the Indian Ocean and that the USNODC is for all other oceans and that submission of data should preferably be to one RNODC only,

Reiterates the need for National Co-ordinators to ensure that all data still at national institutions are delivered through their respective NODCs to the appropriate RNODC/MARPOLMON at an accelerated rate,

Urges the RNODCs to consider further measures to eliminate duplication of data in the RNODCs,

Encourages Member States to submit data preferably on magnetic tape in the IOC OCEAN SYNDARC format for MAPMOPP or as copies of standard logs that are stored on magnetic tapes in a tape layout which facilitates the tasks of the RNODCs, and particularly to adopt the OCEAN SYNDARC format for MAPMOPP for such data reports,

Recommends that the RNODCs process incoming data expeditiously, exercising quality control as much as possible, and assign unique identification numbers to all sets of data to be exchanged,

Requests participants to limit the submission of data on magnetic tape in non-standard format to a minimum,

Further recommends that the RNODCs for MAPMOPP be now considered as RNODCs/MARPOLMON and be supported as during the pilot project.

Recommendation IOC-WMO/MPM-I.8

TEMA REQUIREMENTS

The Third Workshop on Marine Pollution Monitoring,

Noting recommendation MAPMOPP-ad hoc-II.4, which it fully endorses,

Noting further recommendation JWC-IGOSS-I.1,

Being aware of the continued need for specific training on MARPOLMON methods and procedures, and of fellowships, assistance with equipment, and other help to promote effective participation of developing countries,

Recommends continued efforts by the Secretary, IOC to ensure support to participating developing countries in the form of equipment, training and expert advice, and

Recommends that the Secretary IOC bring the requirements of MARPOLMON to the attention of the Working Committee for TEMA at its Third Session (Buenos Aires, April 1980).

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CONSIDERATIONS AFFECTING THE FEASIBILITY AND DESIRABILITY OF CONTINUING PETROLEUM MONITORING INITIATED UNDER MAPMOPP

by A. Cornford

1. Scientific and Technical Considerations

Although the Pilot Project was not originally intended to produce a useable data base, it has moved a large way towards doing so. Deficiencies in methods, area of coverage, and observation reliability were therefore to be expected and should not be the subject of misguided criticism. The assessment of the value of a continuing marine pollution monitoring programme should take into account the following:

(i) Measurements of naturally occurring hydrocarbons and those derived from human activities would provide a foundation for many purposes:

(a) The detection of trends of chronic oil pollution in the world's oceans, and the calculation of mass balances which may help to predict rates of increase from present and future human activities.

(b) The determination of the partitioning of petroleum between the main environmental media and the main forms of oil pollution, thus permitting mass-balance calculations, and assessment of possible detrimental effects on marine biological systems.

(c) Baseline information and knowledge of trends permit assessment of chronic pollution levels - useful when effects-research is at a stage to give meaning to much of the monitoring data.

(ii) A monitoring programme provides a vehicle for fostering marine pollution research leading to the development of improved sampling and analytical methods.

(iii) Baseline (background) oil levels (especially in coastal waters) may assist national authorities (e.g. coast guards) in regulating deliberate petroleum dumping.

(iv) A global marine oil pollution baseline may help international or intergovernmental regulatory agencies such as IMCO to assess the degree of compliance of Member States with oil pollution regulations.

(v) The monitoring of pollution by marine oil permits assessment of atmospheric transport of petroleum pollutants to the oceans.

(vi) Monitoring (especially in coastal seas and major estuarine areas) provides an assessment of sources of high input and of greatest potential danger to living organisms and amenities. In the open ocean, monitoring gives an assessment of spacial and temporal variability of oil pollution and provides an opportunity to evaluate the effects of major oceanic forcing functions (e.g. winds, major circulation patterns, convergence zones, ocean streams, etc.) on global pollutant pathways, distribution and fates. This may provide input for establishing future marine pollution monitoring strategies and determining critical sampling areas.

(vii) The use of inexpensive ships-of-opportunities for monitoring marine petroleum is easier than many other operations. Scientific lessons learned from such monitoring may be considered a cost-effective intergovernmental scientific endeavour.

2. The Relevant Interests and Programmes of Unesco and the IOC

(i) The objectives set for the Pilot Project on Marine Pollution (Petroleum) Monitoring were achieved, so that it was a demonstrable success.

(ii) MAPMOPP and a subsequent Marine Pollution Monitoring Programme are highly visible to the Member States, and serve to foster general support for the marine sciences.

(iii) A loss of the momentum generated by MAPMOPP would have important repercussions on MARPOLMON: the data exchange system might break down; participants once lost may find it hard to rejoin in MARPOLMON.

(iv) MAPMOPP is one of the very few marine science programmes within the capability of all developing countries (at least for visible observations and beach tar observations). Twenty-nine Member States contributed and many more developing nations wish to join now to review and assess their own coastal and offshore conditions.

(v) MAPMOPP has provided, and MARPOLMON could continue to provide, an opportunity for developing nations to lay a foundation for their marine science infrastructure which can be built upon to provide Training, Education and Mutual Assistance.

(vi) Concerted effort in closed and semi-enclosed seas and in coastal areas would permit certain data gaps to be filled by developing countries and would thereby interface well with the UNEP Regional Seas Programme and other marine science activities with TEMA components.

(vii) The related existing infrastructure including not only the observation system but also the developing data system, and experience gained, would be eroded if the programme were to be terminated completely. The development of a Marine Pollution Monitoring Programme would benefit considerably from the existing global weathership network now under pressure of withdrawal.

(viii) Global marine pollution research and monitoring contributes to the achievement of various WMO and UNEP objectives embodied in such programmes as World Weather Watch (WWW), First GARP Global Experiment (FGGE), Global Environmental Monitoring System (GEMS), etc.

REPORT OF THE WORKING GROUP ON THE FEASIBILITY OF ESTABLISHING A DIGITAL DATA BASE FOR MARINE POLLUTION, BEARING IN MIND DATA GENERATED OUTSIDE MAPMOPP

For over five years the US NODC has been involved in the establishment of a large digital data base. Data are derived from diverse marine pollution investigations. These observational programmes are generally in support of environmental protection and assessment associated with Outer Continental Shelf oil and gas development and marine transportation. The digital data base so maintained now contains on the order of hundreds of thousands of observations of contaminants from US coastal areas. Some entries are, however, from open-ocean areas.

Recently, an extensive marine monitoring programme has begun to develop in the US to collect regularly chemical, biological, physical and geological oceanographic data associated with marine sewage outfalls. Data will be routinely submitted to the US NODC for processing, archival and subsequent retrieval for use in permitting procedures.

In order to handle these new complex data forms, and in anticipation of the receipt of vast amounts of data on marine pollution, the US NODC has been required to develop new concepts and practices of oceanographic data management. Two of the most recent and helpful tools in this regard are the widespread adoption of a hierarchical, numeric taxonomic code for reporting biological species and, for chemical species, the use of a system of reporting based on codes established by the American Chemical Society. The US NODC has also developed a few automated routines for the quality control of incoming data as well as some programmes for generating data products.

In summary, notwithstanding problems associated with sampling and detection of extremely low levels of contaminants in ocean waters, means do exist at present for the accession, archival and output of marine contaminant data. In conclusion, necessary practices and technologies to acquire and process marine pollution data seem to be readily available to data processing facilities world-wide.

PRELIMINARY PROPOSAL FOR IMPLEMENTATION OF AN INVENTORY OF OPERATIONAL MARINE POLLUTION MONITORING PROGRAMME

by W. Hughes

Purpose: To facilitate the world-wide exchange of descriptive information on marine pollution monitoring programmes. This will enable wider exposure than would ordinarily be possible to a wide variety of monitoring programmes for purposes of programme design, analysis and data exchange.

Background: An interactive, commercially based hardware and software system has been adopted by the US Environmental Data and Information Service to accept, store and array information about programmes and samples collected during the First GARP Global Experiment. A copy of the FGGE-oriented questionnaire is given on page 2. This system has so far accepted and processed several hundreds of data submissions. Many users are presently accessing this system from within the US, Canada and abroad.

Method: In conjunction with, and through the auspices of the Inter-governmental Oceanographic Commission, the US NODC proposes to expand and maintain the above-mentioned system to collect descriptive information on operational marine pollution monitoring programmes. Use of the WC/IODE system of National Co-ordinators as distribution and collection points will be solicited. A questionnaire proposed for this system is attached.

Tasks:

1.	Finalize questionnaire (US NODC/IOC)	Fall 1980
2.	Distribute forms through IODE National Co-ordinators to Member States	Winter 1980
3.	Begin input to computer system	Summer 1981
4.	Printer out-put	Winter 1981

INVENTORY OF OPERATIONAL MARINE POLLUTION PROGRAMMES
(OMPP)

PROJECT NAME: _____

PURPOSE OF INVESTIGATION: _____

_____

GEOGRAPHICAL BOUNDARIES OF THE AREA INVESTIGATED:

LATITUDE _____ LATITUDE _____

LONGITUDE _____ LONGITUDE _____

OR GEOGRAPHICAL DESIGNATION:

DATES: STARTING _____ ENDING _____

DY/MO/YR DY/MO/YR

SPONSORING ORGANIZATION: NAME _____

ADDRESS: _____

SAMPLING PROGRAMME: _____

MEDIUM: _____ _____ _____ _____ _____

ATMOSPHERE WATER SEDIMENTS ORGANISMS OTHER

LIST OF POLLUTANTS INVESTIGATED: _____

ANALYTICAL METHOD(S): _____

AVAILABILITY OF RESULTS: _____ _____ _____

REPORT DATA OTHER

APPROXIMATE DATE: _____

CONTACT FOR ADDITIONAL INFORMATION ON FINAL RESULTS

NAME: _____

ADDRESS: _____ TELEPHONE: _____

REMARKS: _____

_____

_____

STATEMENT BY THE UNEP REPRESENTATIVE,
by C. C. Wallen

The representative of UNEP expressed his appreciation of the interesting technical material presented at the Workshop and of the thorough technical discussions. UNEP had noted with appreciation that the Pilot Project, to which the Environment Fund had provided support of nearly one million dollars, had been a success in providing a baseline for the global distribution of oil over the oceans, a test of the IGOSS system for operations, and information about the usefulness of the applied methods. However, it was UNEP's opinion that a continuation on a permanent operational basis of the activities carried out during the Pilot Project was not warranted, because it was not clear that as continuation of global monitoring of oil with the techniques used in the pilot project would provide additional information of sufficient environmental significance and interest. Likewise UNEP felt that the recent Bermuda intercalibration exercise on methods for sampling and analysis of trace metals and chlorinated hydrocarbons had shown that operational monitoring of these pollutants in the open ocean is hardly warranted at this stage, either from the point of view of existing concentration levels or from the point of view of practicality.

In view of the fact that UNEP had already provided considerable support to open-ocean monitoring through the Pilot Project and the intercalibration exercise and would prefer to direct available means towards activities under the Regional Seas Programme, it was not likely that under present financial constraints further support to open ocean monitoring of oil would become available. However, UNEP would follow with interest any programme for continued or new activities in the field of monitoring oil in the world's oceans which IOC would organize globally or in different parts of the world with the basic aims to develop improved methodology and techniques. It was felt in particular that the experience of the Pilot Project would perhaps provide a basis for selection of regions in the oceans where special efforts could be undertaken testing improved technique for monitoring of oil and for exploring the possibilities for monitoring other components of oil than was treated during the Pilot Project. The use of ocean weather ships for such testing and exploration in selected ocean areas was to be encouraged.

With particular regard to visual observations of oil slicks the representative of UNEP felt that the usefulness of repeating the exercise carried out during the Pilot Project after an interval of 5 to 10 years, might be considered, taking into account the development of remote sensing techniques which is expected to take place in the meantime.

LIST OF ACRONYMS

CARIPOL	Caribbean Petroleum Monitoring Programme (IOCARIBE)
FGGE	First GARP Global Experiment
GC-MS	Gas Chromatography - Mass Spectrometry
GARP	Global Atmospheric Research Programme
GEMS	Global Environmental Monitoring System (UNEP)
GEMSI	Group of Experts on Methods, Standards and Intercalibration
GIPME	Global Investigation of Pollution in the Marine Environment
IODE	International Oceanographic Data Exchange
IGOSS	Integrated Global Ocean Station System (IOC-WMO)
IMCO	Inter-Governmental Maritime Consultative Organization
IOC	Intergovernmental Oceanographic Commission
IOCARIBE	IOC Association for the Caribbean and Adjacent Regions
INTCOMP	Intercomparison Exercise (MAPMOPP)
JODC	Japan Oceanographic Data Centre
MAPMOPP	Marine Pollution (Petroleum) Monitoring Pilot Project (IGOSS)
MARPOLMON	Marine Pollution Monitoring Programme (GIPME)
MED-I	IOC/WMO/UNEP Pilot Project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters (of MED POL)
MED POL	Co-ordinated Mediterranean Pollution Monitoring and Research Programme (UNEP)
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Centre
NOSS	National Oceanic Satellite System (US)
RNODC	Responsible National Oceanographic Data Centre
SAR	Synthetic Aperture Radar
SLAR	Side-looking Airborne Radar
TEMA	Training, Education and Mutual Assistance in the marine sciences
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WC	Working Committee (of IOC)
WDC	World Data Centre (for oceanography)
WMO	World Meteorological Organization
WWW	World Weather Watch