Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Joint Meeting of GEMSI and GEEP Core Groups

Bermuda
12-15 September 1993

UNESCO

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources *(Also printed in French and Spanish)*
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CCPS Working Group on the Investigations of 'El Niño' *(Also printed in Spanish)*
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic *(Also printed in French)*
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico *(Also printed in Spanish)*
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' *(Spanish only)*
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico *(Also printed in Spanish)*
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
78. Third Session of the IOC Group of Experts on the Global Sea-level Observing System
79. Third Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
80. Fourteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
81. Fifth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes

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IV.	REPORT OF GEMSI CORE GROUP MEETING

1. OPENING

Dr. Anthony Knap, Director of the Bermuda Biological Station and Chairman of GEMSI, welcomed the participants to Bermuda and invited them to find time in between the formal sessions to tour the facilities and interact with the staff of the Station. Dr. Knap traced the decision for a joint meeting to the last GIPME Officers' meeting (30 June - 2 July 1993) which agreed that future plans of GIPME require that GEMSI and GEEP increase their co-operation and work together more, based on the progress made over the past five years. He stressed the necessity, given the increased requirements for detailed and rapid regional assessments, for an improvement in the ability to unambiguously detect contaminants and to assess their effects on biological systems.

Dr. John Gray, Acting Chairman of GEEP, also welcomed the participants recalling that following the resignation in the intersessional period of the previous GEEP Chairman, Dr. Brian Bayne, the sponsoring agencies had requested him to steer the affairs of GEEP until a formal election was held to fill the vacant Chair. He expressed thanks and appreciation, on behalf of GEEP, for the work that Dr. Bayne had devoted to GEEP, pointed out that the international recognition that GEEP had achieved was largely due to Dr. Bayne's foresight and vision of the importance of biological effects studies in the management of the marine environment. Dr. Gray and Dr. Underwood were subsequently elected Chairman and Vice Chairman of GEEP by acclamation.

The UNEP Technical Secretary for GIPME and Deputy Director of UNEP (OCA/PAC) Dr. Makram Gerges, expressed UNEP's satisfaction with the progress achieved in the work of GEMSI and GEEP, particularly in responding to requirements of the various regions/projects of its Regional Seas Programme in terms of preparation and reviewing of methodologies and the organization of a series of successful regional workshops. He reiterated the importance of the three Groups of Experts, GEMSI, GEEP and GESREM and their efforts under the umbrella of GIPME, now a joint IOC-UNEP Programme (with IMO officially joining in the very near future) designated to ensure the maximum co-ordination of the marine pollution programmes of IOC and UNEP and the rational utilization of resources of the two organisations.

With the above in view, Dr. Gerges pointed out that the need for expanding the role of the three Groups of Experts to respond to the various needs of the governing bodies of the sponsoring agencies and to achieve tangible results aiming at linking sound scientific data and information to environmental management as required by UNCED's Agenda 21, is a matter which should be discussed at this meeting. This should be with a view to formulating relevant recommendations to be considered for adoption by the forthcoming meeting of the Intergovernmental Panel for GIPME, and for subsequent approval for implementation by the Committee for GIPME at its Eighth Session (GIPME-VIII) in 1994.

The IOC Technical Secretary for GIPME, Dr. Chidi Ibe, conveyed to the participants the warm regards of the IOC Secretary, Dr. Gunnar Kullenberg, and introduced the Provisional Agenda which was adopted without amendments (Annex I).

The List of Participants is attached as Annex II.

It was agreed that issues of common interest to GEMSI and GEEP would be discussed in joint sessions but that for the most part, the two Groups of Experts would meet separately and produce individual reports which are attached as Annexes III and IV.

2. STATUS OF IMPLEMENTATION OF GEEP AND GEMSI WORKPLANS IN THE SECOND GIPME ACTION PLAN

The Joint Secretariat recalled the appraisal of this subject matter undertaken at the last GIPME Officers Meeting (London, 30 June - 2 July) which concluded that nearly all the action items for each of the three Groups of Experts (GEMSI, GEEP and GESREM) specified in the Document IOC/GIPME-VII/3 had been achieved and, in many cases, the targets had been exceeded.

The Meeting agreed that the few outstanding items e.g. the Joint GEEP-GEMSI Mazatlan Workshop on the so-called non persistent pesticides would be transferred to the Third Action Plan.

3. STATUS OF REFERENCE METHODS REVIEW BY GEMSI AND GEEP

Dr. Laurence Mee, Head of the Marine Environment Laboratory, International Atomic Energy Agency (IAEA) and Editor of the UNEP-IOC-IAEA Reference Methods and Technical Bulletins for Marine Pollution Studies (1987 - 1993) presented a paper entitled "Reference Methods for Marine Pollution Studies: Present Studies and Future Developments" jointly prepared by UNEP (OCA/PAC) and IAEA(MEL).

He stated that the Series has grown to well over 70 volumes covering wide ranging aspects of methodology and include "strategic" guidelines which are supported by specific methodological manuals. Dr. Mee said that it was not his intention to foster growth of the series for its own sake and that many of the earlier single contaminant methodologies are being consolidated to more logical practical manuals dealing with entire classes of contaminants.

He expects that the series will probably stabilize at about 40-50 volumes all of which will have to be updated on a regular basis and requested GEMSI and GEEP to consider this policy very carefully.

Referring to his Laboratory, Dr. Mee said that funding for MESL continues to be erratic but due to the certain assurances from the host Agency, IAEA, the future prospects are encouraging but will remain so only if the respective Agencies are fully aware of the significance of this programme to the longer-term goals of marine environmental managements as established in Chapter 17 of Agenda 21 of UNCED.

Concluding, Dr. Mee asked GEMSI and GEEP and the sponsoring Agencies to turn their attention to distribution mechanisms and publicity in an endeavour to more effectively assist with building a viable regional capacity to monitor the state of the health of the oceans within the twentieth century.

4. GEEP-GEMSI INTERACTIONS

The Meeting agreed that identified and emerging issues of concern required the combined input of GEEP and GEMSI for proper resolution and that previous collaboration between the two Groups had been productive and should be strengthened and expanded (see also Sections 2.4 and 4.0 of Annexes III and IV respectively). An assessment of the role of Biological Effects Techniques in Marine Pollution Studies is presented in Section 1.2 of Annex III while GEMSI's assessment of the progress of mass balance approaches is given in Section 2 of Annex IV.

5. GEMSI-GEEP INTERACTIONS WITH GESREM

Dr. Rodger Dawson expressed the satisfaction of the GESREM Chairman at the level of interaction between GESREM and GEMSI-GEEP during the Second GIPME Action Plan. He reiterated that the Workplan of GIPME during the Third GIPME Plan would aim at consolidating such interaction and providing tangible support for the activities of GEMSI-GEEP. The details of future support are presented in sections 4.0 and 5.0 of Annex III and sections 2.4 and 2.5 of Annex IV.

6. INTERNATIONAL AND LARGE-SCALE NATIONAL PROGRAMMES RELEVANT TO GEEP OR GEMSI

Relevant International and large scale programmes were reviewed separately by the two Groups, details of which are presented in sections 2.5. and 6 of Annexes III and IV.

It was resolved that the two groups should play a more pro-active role in the design (where not already done), elaboration and execution of these programmes.

7. GEMSI WORK PLAN FOR THIRD GIPME ACTION PLAN

This is contained in section 7 of Annex IV.

8. GEEP WORK PLAN FOR THIRD GIPME ACTION PLAN

This is contained in sections 2 and 4 of Annex III.

9. RECONSTITUTION OF GEEP AND GEMSI MEMBERSHIPS

The meeting agreed that the current memberships of GEEP and GEMSI had remained largely unchanged for more than 5 years and resolved that it was now time to review the memberships to keep the Groups dynamic, particularly in view of the new directions and emphasis in programme activities for the 1994 - 97 plan period and to respond to the need for various expertise relevant to the work of the Groups. Such a review will emphasize expertise with due attention being paid to geographical distribution.

10. FUTURE MEETINGS

The Joint Secretariat announced that a meeting of the *ad hoc* Panel on Health of the Ocean Module would meet in Paris, 10 - 15 February 1994, in conjunction with a meeting of the Officers of the Joint IOC-UNEP Intergovernmental Panel for GIPME, 16 - 19 February 1994.

GEMSI expressed satisfaction at the level of representation of its membership on the *ad hoc* Panel but GEEP requested greater presence and specifically nominated Drs. Gray and Depledge to attend the Meetings of the *ad hoc* Panel on the Health of the Ocean Module scheduled for February 1994 in Paris.

GIPME-VIII would be convened possibly in Costa Rica, 18 - 22 April 1994, to consider the submissions of the three Groups of Experts on their proposed work plans and budgets for 1994-97 plan period and to produce a consolidated Third GIPME Action Plan (1994-97). The exact dates will depend on negotiations with the host government and would be confirmed in due course.

11. OTHER MATTERS

No other matter of joint interest to the two groups was raised.

12. ADOPTION OF SUMMARY REPORT

After due consideration, the report of the Joint Meeting with its Annexes was adopted with minor ammendments.

13. CLOSING

On behalf of the Joint Secretariat, Dr. Makram Gerges thanked the participants for a job well done and congratulated Dr. Knap and the Staff of the Bermuda Biological Station for being such gracious hosts.

Dr. Anthony Knap expressed the delight of the management and staff of the Biological Station at hosting the meeting. He closed the meeting by 5.30 p.m. on 15 September 1993.

ANNEX I

AGENDA

1. OPENING
2. STATUS OF IMPLEMENTATION OF GEEP AND GEMSI WORKPLANS IN THE SECOND GIPME ACTION PLAN
3. STATUS OF REFERENCE METHODS REVIEX BY GEMSI AND GEEP
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9. RECONSTITUTION OF GEEP AND GEMSI MEMBERSHIPS
10. FUTURE MEETINGS
11. OTHER MATTERS
12. ADOPTION OF SUMMARY REPORT
13. CLOSING

ANNEX II

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ANNEX III

REPORT OF THE GEEP CORE GROUP

1. ORGANISATION OF GEEP

1.1 INTRODUCTION

Dr J. Gray opened the meeting and reviewed the history of GEEP and the status of current members. He pointed out that one of the outcomes of the Bellagio meeting, which was endorsed at the GIPME officers meeting, was recognition of the need to reorientate both the direction and membership of GEEP. Following the resignation in the intersessional period of the Chairman, Dr B. Bayne, the sponsoring agencies had asked Dr J. Gray to take over the chairmanship. It was, however, the members of GEEP that elected the chairman. The GIPME officers' meeting had asked for a meeting of core members of GEEP who were requested to review past activities and to suggest a reorientated workplan.

1.2 ELECTION OF OFFICERS

Dr J. Gray was elected Chaiman for a period of two years and Dr. A. Underwood elected Vice-Chairman for a period of 4 years.

1.3 REVIEW OF PAST ACTIVITIES

From its inception, GEEP has conducted a programme designed to demonstrate that biological effects techniques were sensitive and cost-effective tools in assessing effects of pollutants on the marine environment. Initially GEEP held a workshop in Oslo where a series of biological effects methods were tested both in the field and in a mesocosm experimental system. This workshop resulted in a special volume of an international journal (Marine Ecology Progress Series, Vol. 46, 1988) which is widely regarded as a landmark in establishing the validity of the biological effects approach covering the range from biochemical methods used on individuals to analysis of communities.

A workshop was held in Bermuda in which biological effects techniques were applied to suites of organisms that had not previously been used as test organisms. This workshop established the fact that biological effects techniques could be transposed to new areas in subtropical habitats with success. Again the results were reported in an international journal (Journal of Experimental Marine Biology and Ecology, Vol. 138, 1990).

Following an approach by the International Council for the Exploration of the Sea (ICES), GEEP co-convened a workshop applying biological effects techniques to the North Sea which has been published in Marine Ecology Progress Series, Vol. 91, 1992. GEEP has therefore been eminently successful in both establishing the relevance and effectiveness of biological effects techniques and in achieving a commendably high rate of publications in first-class journals.

GEEP has maintained a policy of ensuring that scientific results are published in the quality, refereed, scientific journals. As a result, a very large number of such papers has been produced. Of particular success are the three integrated volumes containing the results of the workshops. GEEP will continue to ensure that publications are in major refereed journals, but will commission UN publications where this is appropriate.

In addition to the workshops, GEEP has developed appropriate computer software, manuals and conducted teaching workshops in analysis methods for marine communities in Rovinj and Split (Yugoslavia), Athens (Greece), Alexandria (Egypt), Xiamen (China) and a workshop is planned for Phuket, Thailand (November 1993).

Workshops have been held on biochemical, physiological and pathological methods in Nice, Aberdeen and will be held in Phuket, Thailand.

In addition, 3 manuals have been produced on the use of cytochrome P-450 in fish, on scope for growth in mussels and on methods for analysis of marine community data.

GEEP reviewed its activities and possible future directions in a meeting held at the Rockefeller Foundation's Villa Serbelloni, Bellagio, Italy in March 1991. A report of this meeting is attached (Appendix 1). The conclusions from that meeting provided the basis for the present reorientation of objectives. GEEP recognised that there is a need to: (i) seek to apply these methods in developing countries and (ii) to make such methods more relevant in a management context.

Following the review of past activities, GEEP then discussed other organisational matters relating to membership and stressed the need for clearly defined terms of appointment and redefined objectives for GEEP and agreed the following:

Action 1: Vice-Chairman to investigate with the Technical Secretary for IAEA the publication of the Bellagio report in the Technical Bulletin in Marine Pollution Studies of the UNEP Reference Methods Series.

1.4 AIMS OF THE NEW GEEP

GEEP's previous successes in the development, validation, assessment and dissemination of methods to study biological effects of pollution have led to a need to restructure GEEP's role for the coming years. The effects of pollution are rarely isolated from other complex environmental problems involving interactions between chemical, biological and ecological processes. The larger influences are mostly not primarily chemical - they involve destruction of habitat, increased sediment loadings and transport, changes due to urban infrastructure, over-harvesting of resources, introductions of exotic species, increased UV-B radiation and photosensitization and many other problems. Despite the original drive to develop procedures and methods for measuring biological effects of pollution, many of the techniques developed and fostered by previous GEEP programmes are general, sensitive, reliable, cheap and robust as practical methods for examining the biological effects of a range of environmental disturbances.

Previously, the extent of marine pollution has been described mainly in terms of chemistry. The underlying question about pollution is, however, related to the biological effects of contamination. The recent emphasis on chemical approaches to describing pollution simply reflects the fact that, until now, chemical distribution has been easier to measure than biological effects. This situation has changed markedly in recent years. Several of the measurements of biological effects developed and evaluated by GEEP approach the sensitivity and specificity of those made by analytical chemistry. GEEP workshops have demonstrated that biological effects measurements are in a position to "lead" chemical measurements, (e.g., the Bremerhaven Workshop - IOC Workshop Report no. 94). For example, programmes to assess the "health" of marine ecosystems should be based on preliminary screening using biological approaches, followed by analytical chemical measurements to identify the cause of biological effects. This strategy could be used in proposals such as that embodied in HOTO, or in an expanded "mussel watch".

It is therefore a logical development of GEEP's role to move into new areas of the use of research on biological effects in practical procedures of management in response to environmental problems, while maintaining a core role in the development and assessment of novel techniques and methods as they arise or are required. Inevitably, GEEP will move from a complete focus on primary research on techniques to a mix of concerns for research, training and development of managerial uses of research.

The present report presents a structure for and the aims of GEEP for the period 1994-1998, with a summary of the proposed work-plan to achieve the aims:

(i) To provide procedures for linkage between the available, evaluated results of research into pollution and its effects so that they are better integrated into the management of the marine environment.

(ii) To provide continued integration of training and research by the promotion of better insights into and novel development of techniques and methods for detection and estimation of magnitudes of pollution and other environmental disturbances.

(iii) To provide continued advice on regional and global problems of environmental disturbances, on research methodologies and on capacity building in the regions.

1.5 STRUCTURE OF GEEP

The new structure of GEEP will comprise a Chairman and 5 core group members appointed for periods of 2-5 years. A Vice-Chairman will be elected from the core group members. GEEP recognised that it needs an expert on genetic toxicology possibly as a core group member.

A further 6 non-core group members will be selected by the core group in consultation with the Technical Secretaries to represent geographic regions and regional problems, and in accordance with the rules of procedure of IOC and UNEP and IMO. They too will be appointed for periods of 3-5 years thereby ensuring that there is continuity within the group. The role of non-core group members will be to identify specific regional problems, study sites, local experts, etc. This will permit a register of scientists to be compiled with expertise in diverse aspects of environmental protection. Members of the register will then be co-opted as required to undertake tasks designated by GEEP (for example, running workshops, training course, conducting field studies, etc.).

1.6 CRITERIA FOR SELECTING GEEP PROJECTS

The group considered criteria which would be used in evaluating projects to be carried out during the next few years. These are:

(i) the proposed activity or study should be amenable to GEEP's approaches.

Previous GEEP activities have validated several techniques for measuring biological effects. In any future GEEP activity, it will be important to ensure that the problem is one that is amenable to the GEEP approach, which uses multi-disciplinary techniques at a range of levels of biological organization.

(ii) The proposed activity should offer the opportunity to undertake practical studies.

As one of its future activities GEEP will continue to contribute to practical studies of marine pollution. These will provide a vehicle for the assessment and validation of new approaches to measurements of biological effects. Such studies will ideally evolve from the short-term small-scale to the longer-term and larger-scale.

(iii) The proposed study or activity should lead to general rather than site-specific information.

(iv) The logistic support of the proposed activity should be suitable where possible.

Facilites (including laboratory space, equipment, research vessels and supplies, etc.), housing (for visiting scientists), communications and expertise should, where possible, meet at least basic standards. GEEP recognizes that such studies will be done in developing countries where these standards may not always be met. The development of appropriate techniques should, nevertheless, proceed so that modern approaches are available. GEEP recognises that modification and improvisation may be necessary.

(v) The proposed study should offer the opportunity for GEEP to be involved in the design and management of the project from its very beginning.

GEEP's concept of its role in environmental management (developed below) requires that it participate in all phases of the process, but most importantly at the beginning of a project.

(vi) The proposed study should offer continuity.

GEEP envisages its involvement in any large-scale study as continuing over several years. If GEEP is to make this commitment, proposers of projects must also be prepared to do so.

(vii) The proposed study should have established or identified sources of funding.

Previous GEEP activities have been partially funded by IOC, but have required major funding from elsewhere. This has involved members of GEEP in intensive efforts to raise funds, which is a considerable drain on time and effort. Future GEEP involvement in any large-scale project is therefore likely to go ahead only where major funding is assured.

These criteria were discussed and agreed to by GEEP. Two further points were also considered:

(i) sponsorship of GEEP. The Technical Secretaries encouraged members to seek sponsorship from such bodies as the World Bank or UNDP. Such funding was recommended as appropriate to GEEP's future role. It was resolved that the Chairman and Dr Depledge should pursue this.

(ii) Appointment of a GEEP project manager.

1.7. OTHER ISSUES

1.7.1 Technical support

It is expected that the Technical Secretaries for GEEP will ensure that members are given full background information, including previous GEEP reports and annotated agenda well in advance of meetings and be in attendance throughout the meetings. Secretarial and rapporteurial assistance are expected at meetings.

1.7.2 Proposals to GEEP made intersessionally

Two proposals have been received from Dr A.R.D. Stebbing:

(i) Atmospheric-Benthic Coupling (ABC)- a proposed ICES-IOC research project to be held in the North Sea;

(ii) GEEP Workshop on Environmental Assessment of Coral Reefs to be held in Phuket, Thailand.

GEEP discussed these proposals in the light of the new workplan. GESAMP is currently reviewing the air-sea microlayer and thus GEEP felt that it was premature to consider a research workshop on this topic at this time. Furthermore, since GEEP wishes to be responsive to the regions a research project based in the North Sea would not be a high priority.

GEEP welcomed the proposal for a coral reefs workshop but did not wish to pre-empt other proposals which may come from the regions. This proposal, therefore, will be considered at the GEEP 1994 meeting, together with other proposals coming from the regions and will be given priority using the criteria outlined in 1.6.

2. WORKPLAN FOR GEEP 1993-1998

2.1 INTEGRATION OF RESEARCH ACTIVITIES WITH MANAGEMENT

The success of the previous phase of the GEEP programme has resulted in the development and dissemination of robust methods for detection and estimation of biological effects of pollution. While this will continue to be a focus of attention for GEEP, it is important now to move to a new

phase of integration of such methodologies into the programmes of management of environmental problems.

The problem to be addressed is that the management of environmental issues does not make maximal use of the results of scientific research on biological effects. GEEP will work on a programme to integrate the results of scientific research programmes into procedures of environmental management. GEEP's role will be to assess the best ways to create more interaction in areas such as the definition of the problem to be managed. This often involves better interpretation of the signals coming from recognised biological effects, to ensure that an appropriate interpretation is made before any managerial action begins.

Further areas of better integration of science into management include development of managerial actions based on good understanding of the biological system affected, its links to other systems and the processes that control the organisms in that system. There are also many issues of formal structure of the predictions made by managers when they formulate programmes of action. These need to be explicitly stated so that their appropriateness can be properly evaluated and so that tests of the predictions, in terms of biological effects, can be planned. The predictions should always be tested and this, again, involves proper interactions with the scientific community to ensure that appropriate measures of changes in biological effects are being planned. GEEP will develop a framework for interaction of management and research results.

Finally, there are numerous areas where increased methodological rigor is needed in the design and analysis of biological data collected to examine biological effects and to test or monitor the effects of managerial decisions. This is considered to be a serious deficiency for the future improvements in environmental health of the world's oceans. GEEP will promote training and capacity building in relevant areas of sampling and experimental design.

Task 1. Development of a framework for environmental managerial action.

The key features of the new protocol for Integrated Evaluation of Environmental Management are that:

(i) Definition and prioritization of problems will receive greater attention through an iterative process between managers and scientists;

(ii) Scientists will have input into all phases of the management programme;

(iii) Particular attention will be focussed on ensuring that the outcome of the process of management meets its initial specific goals and, in fact, solves the problem.

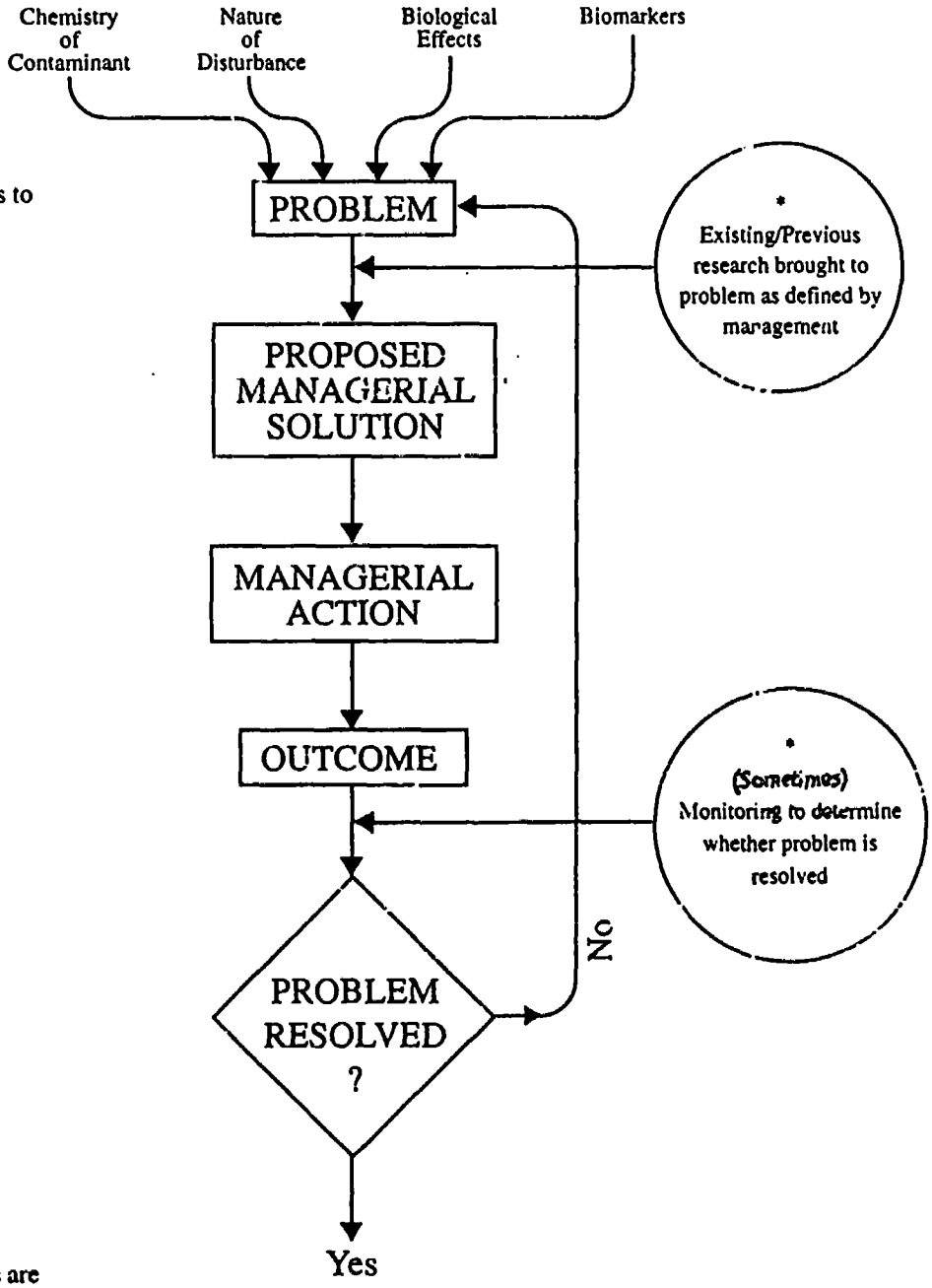
This first aim of the GEEP programme can best be achieved by development, validation and dissemination of information about a novel framework for use of scientific research in environmental management. Developing a robust framework is a primary task which will be achieved by replacing the current and traditional framework (Fig. 1) with an expanded and refined protocol (Fig. 2).

Subtask 1.1

The GEEP Core Group will examine relevant case-histories from different regions and about different environmental stresses, to show how non-experimental management fails and how improved procedures are more likely to provide solutions to managerial problems. This will require a consultancy (at the level of a Postdoctoral Fellow) to search and collate relevant data and examples, to liaise with Regional members of GEEP to identify relevant case-histories and to report to the core of GEEP.

Action 2: The Core Group will work intersessionally and prepare a protocol for GEEP-VI in 1994.

Figure 1. Summary of existing managerial framework for environmental issues, with comments on problems and critical evaluations.



Is the problem appropriately defined? Are the procedures that prioritize responses to problems adequate or satisfactory? How was relevant legislation framed?

Is the proposed solution appropriate and well-based on existing understanding?

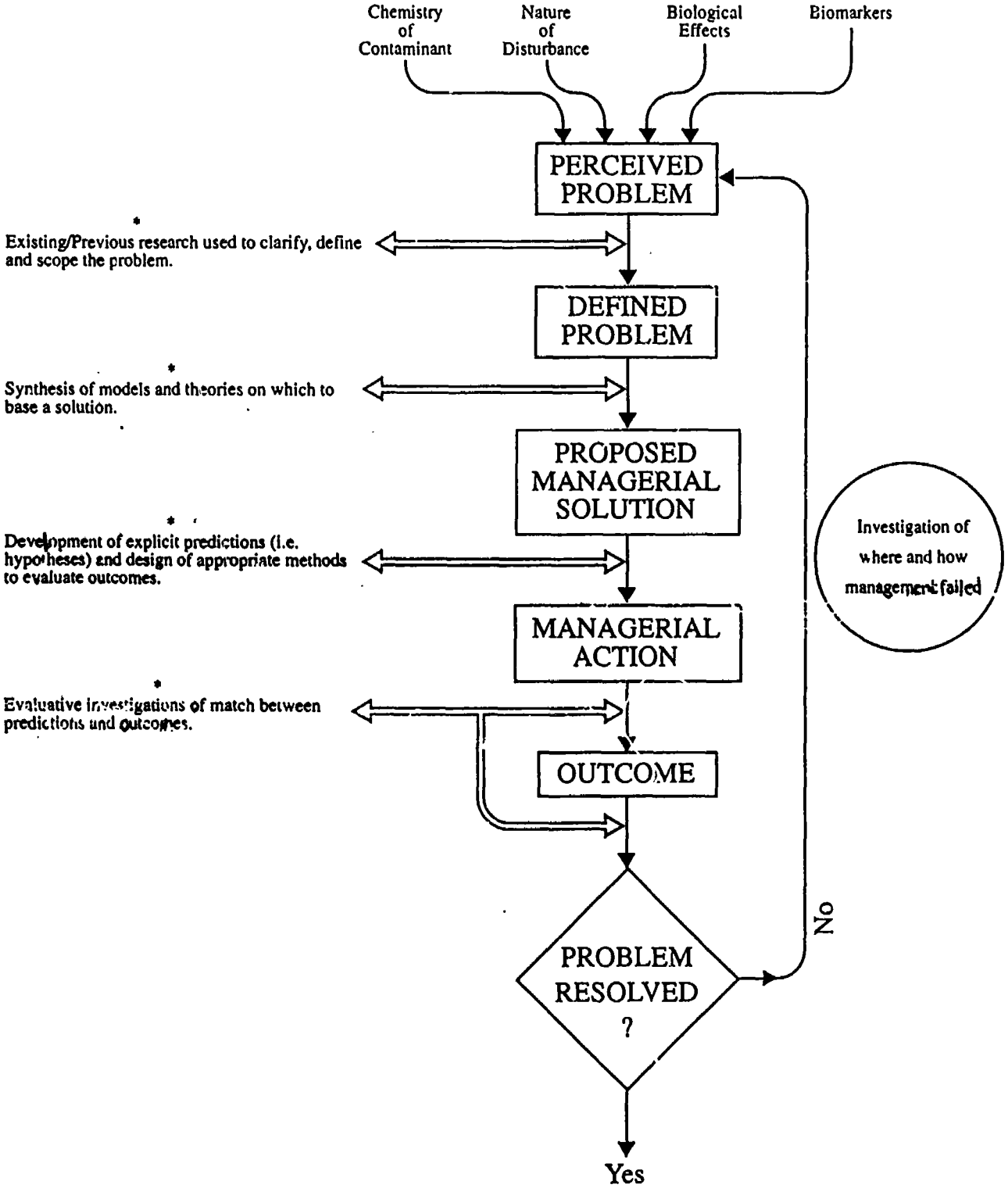
Is the proposed action cost-effective and have the predicted outcomes been identified?

Is the outcome effective and satisfactory in terms of the goals of management of the problem?

Monitoring is often purely for compliance and often for non-specific purposes of assessing "quality". It is not usually to evaluate outcomes of specific managerial action. Is managerial impact on legislation effective and efficient?

* Indicates where previous GEEP activities are relevant in terms of biomarkers and biological effects.

Figure 2. Preliminary framework for environmental management identifying links between available scientific research and management. ⟺ indicates strengthened interactions between scientific results and managerial procedures that will be the focus of GEEP's plan of action.
* indicates areas where increased expertise in experimental and sampling designs would improve managerial and scientific performance.



Action 3: Vice-Chairman to prepare contract specification for a consultant and report to GEEP-VI in 1994.

Task 2. Evaluation of environmental management

The managerial framework will be evaluated in a yet-to-be-determined real-world case by creating a before-after assessment of environmental responses to an anthropogenic disturbance. This Integrated Evaluation of Environmental Management will be a major novel activity for GEEP. It will be concomitant with an interactive review of policies and procedures for management and amelioration of environmental problems and for restoration of disturbed environments. The effectiveness of management will then be evaluated to examine how and where in the process the new framework has increased the worth of environmental protection.

Subtask 2.1

Determine an appropriate case-study (case-studies). This involves liaison with regional members of GEEP and with agencies such as the World Bank, which will be consulted with regard to sponsorship so that the programme can serve both as an educational exercise for trainee scientists in developing countries and as a demonstration of the new strategy for environmental management.

Action 4: Agenda item at GEEP-VI 1994. Regional inputs will be reviewed and selected by GEEP using the criteria in 1.6.1.

Action 5. Agenda item GEEP-VI 1994: Dr. Depledge to contact World Bank and report back to GEEP-VI.

Subtask 2.2

Develop an action plan and research programme for the case-study.

Action 6. Agenda item for GEEP-VI 1994.

2.2 CAPACITY BUILDING

Task 3. Dissemination of an improved protocol for management

The managerial framework will be revised and up-dated in the light of the above and will then be disseminated by appropriate regional training workshops and conferences.

Subtask 3.1

Develop a programme for regional dissemination of recommended managerial framework. This will include Technical Conferences in different regions.

Action 7: Agenda item for GEEP VI 1994 appointment of a Core Group member to plan the first Technical Conference in late 1994.

Task 4. Sampling and experimental design

The whole procedure of environmental assessment and management is dependent on sensible and cost-effective procedures of sampling, experiment and analysis of data. Yet, there are obvious deficiencies around the world, at all levels of environmental sampling, monitoring and management. It is proposed to address some of these by providing a synthesis of relevant procedures and by running regional training workshops.

Subtask 4.1

Commission contract to produce a methodological manual.

Action 8. Technical secretaries to arrange for contract to be issued for production of a Manual on Experimental Design and Analyses for completion by 31st December 1994.

Subtask 4.2

Commission Technical Workshops on experimental and sampling design in Central/South America, Asia/Pacific, African regions.

Action 9. Agenda item for GEEP-VI 1994 Development of a Programme of Technical Workshops.

Task 5.

The changing role of GEEP requires a mechanism by which requests to GEEP for specific technical assistance (e.g. in the operation of training workshops) could be fulfilled. One approach would be to recruit on a consultancy basis a Project Manager to organize such activities. The Technical Secretary advised the group that funds were not available for such a position. The group concluded that the implementation of future projects would be by consultancies organized by GEEP.

Subtask 5.1

Appointment of a GEEP Project Manager.

Action 10. Agenda item for GEEP-VI 1994: The need for a GEEP Project Manager.

2.3 INDICATORS OF ECOLOGICAL CHANGE

Task 6. Extensions of studies of biological effects

Previous work by GEEP has succeeded in demonstrating the utility of certain measures of biological effects of pollution. Two issues remain to be addressed. First, there are other and novel forms of environmental disturbance for which methods have not yet been evaluated. Second, there are still unresolved issues about the degree to which measures at one biological scale are correlated with or indicators of responses at other scales. These issues are to be addressed by GEEP in a workshop planned for 1996.

Action 11. Agenda item: GEEP-VI 1995 appoint a planning group for a workshop.

Subtask 5.1

GEEP will explore extensions of application of current methodologies. For example, some of the techniques that have been used conventionally in the detection of chemical contaminants can also be used to detect general stress effects associated with all kinds of ecological disturbances. Specific examples of these include cellular pathological biomarkers, stress protein responses and altered scope for growth. Alterations in the frequency of natural stress events such as algal blooms that might indirectly reflect anthropogenic activities should also be considered.

Action 12: Agenda item for GEEP-VI 1994 reconsider this issue.

Subtask 6.2

As yet, definitive studies have not been carried out to examine relationships between effects detected at low organizational levels (e.g. biochemical, physiological and molecular/cellular pathological biomarker responses) and those at higher levels (e.g. changes in population dynamics and assemblage structure). If tests for assessing individual health and exposure to stress are to be used as predictors of environmental impact, then this relationship needs to be properly tested. We propose to do integrated multi-level studies at one or more designated sites prior to and following an anthropogenic perturbation as part of the Integrated Evaluation of Environmental Management. The Regional Representatives of GEEP will be called upon to identify suitable problems that might be addressed using this approach. The choice of sites and problems will be integrated with Subtask 2.1. Experts from the Register of scientists will be invited to carry out the programme.

Action 13: Intersessionally the Chairman to coordinate the input from Core Group members of a register of biological effects experts able to take part in training workshops.

Task 7. Future evaluation of new methods for detecting effects

GEEP identified a continuing requirement for novel and improved methods for the evaluation of the effects of environmental stress, including chemical pollutants. Specifically, new biomarkers for assessing genetic damage and cell injury (as predictors of pathology), altered physiology and behaviour and quantification of overt pathology, are all viewed as priorities, in addition to new methods of ecological analysis. Furthermore, there is a clear need to address the use of biological effects techniques in relation to bioremediaton, as well as establishing the time-courses of the underlying processes contributing to the various endpoints used as biomarkers or effects indicators. The previously intractable problem of how to measure effects on populations and larval distribution may be partly resolved through the development of new molecular genetic markers.

Finally, the occurrence of human pathogens in the water and biota of coastal seas is recognized as an increasing problem. Existing techniques can probably be complemented or in some cases superseded by the use of diagnostic molecular pathology kits already developed for clinical tests in humans.

Action 14: Agenda item for GEEP-VI 1994 to reconsider this issue.

Action 15: Agenda item for GEEP-VI 1994 Dr. Moore to report to GEEP 9 on the Workshop of the European Environmental Research Organisation, 1993.

2.4. GEEP-GEMSI INTERACTIONS

The past and future relationship between GEEP and GEMSI was discussed. The two groups had collaborated formally in the Bermuda Workshop (1988) when GEEP had requested advice and input from GEMSI in designing and carrying out the analytical chemical aspects of the Workshop. This had culminated in a number of papers dealing with chemical contaminant distribution in the Bermuda area (see Journal of Experimental Marine Biology and Ecology 138 (1990)). Since then GEEP had provided occasional comments on documents of interest to GEMSI.

In the past GEEP's activities had focussed on evaluating methods to assess the effects of contaminants on marine biota and ecosystems. GEMSI could obviously complement GEEP's expertise by providing appropriate analytical expertise and data. GEEP's role is, however, evolving towards emphasising the provision of advice on biological effects in managing marine systems. Once projects have been identified there will be a need to consider the form of GEEP-GEMSI interactions.

GEEP recognises the need for the two groups to work closely together in responding to questions from IOC or elsewhere and in developing their own initiatives.

Specifically, GEMSI had suggested two areas in which a GEEP-GEMSI interaction might be useful. The first of these was the general question of herbicide and pesticide problems (GEMSI 2.6). GEEP recognises the importance of this question especially in areas such as Mazatlan (the example cited by GEMSI) where intensive agriculture and coastal fisheries must co-exist. To single out this question as a "high priority" topic without considering other potentially important questions (e.g., the potential impact of antibiotics used in aquaculture operations) was judged to be premature.

Action 16: Dr R. Addison will liase with GEMSI Chairman on possible GEEP involvement at a possible Mazatlan workshop.

The second topic identified by GEMSI for possible co-operative studies with GEEP was the question of sediment quality criteria, (physical, chemcal and biological aspects) (GEMSI 2 .7). The problem of sediment toxicity continues to represent a particular difficulty. GEEP recognises that research effort needs to be focussed on the question of bioavailability and how best

to develop methods for assessing the toxicity of both pore water and ingested sediment (e.g. by burrowing macroinvertebrates). Several suggestions were put forward. GEEP welcomes the opportuniy to be represented at a GEMSI workshop.

Action 17: GEEP Chairman and Dr. M. Moore to meet with GEMSI representatives and report back to GEEP VI 1994.

GEMSI have proposed an initiative on eutrophication as a possible GEEP-GEMSI interaction. GEEP propose to evaluate the synopsis of a manual contracted to Dr. R. Elmgren in order to set directions and objectives of future tasks.

Action 18: Technical Secrearies to provide Chairman with a synopsis of Dr. Elmgren's Manual. A report will be prepared for GEEP-VI 1994.

2.5. INTERNATIONAL AND LARGE-SCALE PROGRAMMES RELEVANT TO GEEP

2.5.1 Long term monitoring of coastal and near-shore phenomena related to climate change

The Technical Secretary for UNEP brought to the attention of GEEP the UNEP-IOC-WMO pilot programme and asked GEEP to consider how it could help in the development of this programme. GEEP's techniques and expertise are relevant to studies of many of the responses expected in biological systems as a result of climate change. GEEP can advise on what to study, where and with the appropriate techniques. Such responses are, however, best given in relation to specific hypotheses in given areas. GEEP in its new workplan is developing regional registers of experts both in regional problems and effects studies. Once this is established (late 1994), GEEP will be in a good position to give relevant regional advice.

Already GEEP has identified sampling design protocols as a vital yet neglected area of importance for the proper interpretation of field data. GEEP has commissioned a Manual on this topic and has planned regional workshops to be initiated from 1994. Such workshops should be incorporated within the UNEP-IOC-WMO programme.

Action 19: The Technial Secretaries are asked to disseminate the GEEP workplan as widely as possible so that greater awareness of GEEP's potential input to regional problems can be achieved.

2.5.2 INTERNATIONAL MUSSEL WATCH

The first stage of International Mussel Watch has been completed for organochlorines, PCB's and PAH's. Few chemical hotspots have been identified. One of these few is the Rio de la Plata and Mexico and Nicaragua are the only hotspots on the Pacific coasts. This conclusion does, of course, refer only to hot spots for residues. There may be other hot spots for biological effects. There are 6-7 orders of magnitude difference between best and worst sites. There is no evidence of temporal or seasonal trends and several species have been used with species overlap at some sites.

A network of scientists has been developed in the course of this investigation and this will be of value to GEEP in advising on regional problems in a broader context. The next step is to consider the rest of the regions and this will proceed in three stages:

(i) Pacific Rim
(ii) Indian Ocean and East Africa
(iii) Eastern Atlantic seaboard from Svalbard to S. Africa

There is potential for measurements of biological effects to be coupled with the chemistry in this phase. GEEP reoffered specific suggestions made earlier to Mussel Watch.

Other issues considered generally by the Mussel Watch group included eutrophication, triazione herbicides, fungicides, antibiotics (from aquaculture activities) and pathogens. These latter raise several questions relevant to the GEEP remit, namely should we consider the microbiological implications of over use of fungicides and antibiotics in terms of development

of fungal and bacterial resistance, and accumulation of human pathogens such as viruses and bacteria by edible bivalves.

Action 20: Dr. M. Moore to contact International Mussel Watch and to report back to GEEP-VI (agenda item).

2.5.3 Harmful Algal Blooms

Filter-feeding organisms can take up algal toxins. These may be directly harmful or else may pose a threat to predators, including fish, and to human consumers. GEEP needs to consider methods already available for early detection/prediction of toxic algal blooms and whether there is a research requirement for identification and development of specific biomarkers for the effects of algal toxins.

Action 21: Dr. M. Moore will attend the Harmful Algal Blooms meeting in Paris on behalf of GEEP and report back to GEEP-VI.

2.5.4 Health of the Oceans Module of the Global Ocean Observing System

Health is a characteristic of living systems. Consequently, departures from health can be measured only in terms of biological effects. It is therefore appropriate that a global programme using suites of biological effects techniques should be implemented. It is well-recognised that it is in the coastal zone that "health" problems of the ocean are most acute. Coastal environments are, however, probably the most variable on Earth with regard to physico-chemical and biological factors. It is by no means certain that the spatial and temporal scales that are necessary to separate natural fluctuations from anthropogenic effects can be achieved. Anthropogenic effects at the lower levels of biological organisation (i.e., individual and sub-individual) however, can be identified with a high signal to noise ratio.

With this caveat, there are at least two biological approaches that could potentially contribute to the HOTO programme:

(i) On-line biosensors. - A key aim of the HOTO programme is to utilise remote sensing and in situ recording systems for the automatic collection of physico-chemical data. This approach is also feasible for the collection of physiological data (e.g. heart and ventilatory rates, feeding and locomotor activity) with a range of fish and macroinvertebrates. On-line recording and data storage can be facilitated using either portable PCs or with the aid of telemetry. Sessile organisms, animals in cages and free-living animals fitted with telemeters can be utilised in such studies. These automated systems can operate in the open ocean (using caged animals or organisms attached to rafts and buoys) and in coastal waters (using the forementioned setups but also organisms attached to rocks, etc. or which remain within a restricted range.). This approach can, however only provide a general indication of the well-being of samples of populations of given species at particular sites through time. It has yet to be shown that natural variability in the parameters mentioned earlier can be clearly distinguished from adverse effects due to Man's activities.

(ii) Global Environmental Effects Studies. - A second complementary approach involves the use of biomarkers. The International Mussel Watch Program has shown that "hotspots" where pollutant residue concentrations are high can be detected. Such studies do not however, indicate whether biological effects have occurred at these sites, nor whether adverse biological effects occur at sites where pollutant residue concentrations are not markedly elevated. It therefore seems appropriate to use a limited range of exposure/effect biomarkers to detect biological damage in one or more key species at field sites throughout the World. This Global Environmental Effects Study (GEES) could represent a major component of the HOTO programme in which biological effects of pollution and other environmental perturbations in coastal regions are charted on a global scale.

Refinement and evaluation of on-line physiological monitoring systems could become a joint activity unbder the HOTO programme.

Action 22: Dr. Depledge will liaise as appropriate with the HOTO project and report back to GEEP-VI, (agenda item).

2.5.5 Black Sea Programme

Following a presentation by the Technical Secretary of the IAEA on the environmental programme for the Black Sea region, GEEP considered a number of possible contributions. The following workshops could be offered: training on biological effects techniques (from experimental design, toxicology, cellular pathology, benthic community analysis).

A number of the activities outlined above may be carried out in conjunction with the Black Sea Programme. For example, development of the use of biomarker techniques (Task 6 above) in the assessment of environmental quality.

Action 23: The Chairman would ensure that GEEP was represented at future meetings of the steering committee of the Black Sea Programme.

Action 24: L. Mee to contact Chairman of GEEP.

3. TIMETABLE

1994: Contract for preparation of a Manual on Experimental Design and Analysis.

Full GEEP meeting, 6 core plus 6 regional members possibly at Victoria, Canada.

Technical Conference at a regional site, (core GEEP plus regional member plus local scientists and managers). Consultant to identify and collate case-histories relevant to GEEP's new management strategy.

Black Sea Training on biological effects techniques (from experimental design, toxicology, cellular pathology, benthic community analysis).

1995: Core group meeting in primary regional area.

Training workshop in primary regional area.

2 Training workshops in other regions.

Full GEEP meeting.

Workshop testing linkages across biological effects techniques.

Biosensor development for HOTO and Development of Global Environmental Effects System.

Total cost over 5 years $5 million).

Intercalibration exercise of a biological effects technique 1997.

Core GEEP meeting at primary regional site.

After Impact Technical Conference.

Contract for Manual on Online Monitoring techniques.

Contract for Manual on Interactive Management.

Intercalibration exercise of a biological effects technique.

4. BUDGET

1994: GEEP funds/external funds.

Contract for preparation of a Manual on Experimental Design and Analysis US$ 6000.

Full GEEP meeting 6 core plus 6 regional members possibly at Victoria, Canada US$ 30.000.

Technical Conference at a regional site, (core GEEP plus regional member plus local scientists and managers) US$ 30.000.

Consultant to identify and collate case-histories relevant to GEEP's new management strategy US$ 30,000.

Black Sea Training on biological effects techniques (from experimental design, toxicology, cellular pathology, benthic community analysis) US$ 40,000.

1995: GEEP funds/External funds.

Core Group Meeting in primary regional area US$ 20,000.

Training Workshop in primary regional area US$ 40,000.

2 Training Workshops in other regions US$ 80,000.

Full GEEP meeting US$ 30,000.

Workshop testing linkages across biological effects techniques US$ 100,000.

Biosensor development for HOTO and Development of Global Environmental Effects System (Total cost over 5 years US$ 5 millions) US$ 100,000.

Intercalibration Exercise of a Biological Effects Techniques US$ 40,000.

1997:

Core Group Meeting at primary regional site US$ 20,000.

After Impact Technical Conference US$ 40,000.

Contract for Manual on On-Line Monitoring Techniques US$ 6,000.

Contract for Manual on Interactive Management US$ 6,000.

Intercalibration Exercise of a Biological Effects Techniques US$ 30,000.

5. LIST OF ACTIONS

Action 1: Vice-Chairman to investigate with the Technical Secretary for IAEA the publication of the Bellagio report in the Technical Bulletin in Marine Pollution Studies of the UNEP Reference Methods Series.

Action 2. The Core Group will work intersessionally and prepare a protocol for GEEP-VI in 1994.

Action 3. Vice-Chairman to prepare contract specification for a consultant and report to GEEP-VI in 1994.

Action 4. Agenda item at GEEP-VI 1994. Regional inputs will be reviewed and selected by GEEP using the criteria in 1.6.1.

Action 5. Agenda item GEEP-VI 1994: Dr. Depledge to contact World Bank and report back to GEEP-VI.

Action 6. Agenda item for GEEP VI 1994.

Action 7. Agenda item for GEEP-VI 1994 appointment of a Core Group member to plan the first Technical Conference in late 1994.

Action 8. Technical secretaries to arrange for contract to be issued for production of a Manual on Experimental Design and Analyses for completion by 31st December 1994.

Action 9. Agenda item for GEEP-VI 1994 Development of a Programme of Technical Workshops.

Action 10. Agenda item for GEEP-VI 1994: The need for a GEEP Project Manager.

Action 11. Agenda item: GEEP 1995 appoint a planning group for a workshop.

Action 12. Agenda item for GEEP-VI 1994 reconsider this issue.

Action 13. Intersessionally the Chairman to coordinate the input from Core Group members of a register of biological effects experts able to take part in training workshops.

Action 14. Agenda item for GEEP-VI 1994 to reconsider this issue.

Action 15. Agenda item for GGEP-VI 1994 M. Moore to report to GEEP 9 on the Workshop of the European Environmental Research Organisation, 1993.

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Action 20. Dr. M. Moore to contact International Mussel Watch and to report back to GEEP-VI (agenda item).

Action 21. Dr. M. Moore will attend the Harmful Algal Blooms meeting in Paris on behalf of GEEP and report back to GEEP-VI.

Action 22. Dr Depledge will liaise as appropriate with the HOTO project and report back to GEEP-VI, (agenda item).

Action 23. The Chairman would ensure that GEEP was represented at future meetings of the steering committee of the Black Sea Programme.

Action 24. L. Mee to contact Chairman of GEEP.

ANNEX IV

REPORT OF THE GEMSI CORE GROUP

1. OPENING OF THE MEETING

2. STATUS OF IMPLEMENTATION OF THE GEMSI WORKPLAN IN THE SECOND GIPME ACTION PLAN

This item was discussed in some detail. GEMSI felt that most of the projects listed on the last workplan had been completed except for a few cases which will be carried on to the next Workplan session. In most cases the targets had been exceeded. The Group noted that a number of new Manuals had been reviewed and the upcoming JGOFS Protocols were being assembled by GEMSI and printed by IOC. The group has had significant input into the UNEP Reference methods series (See agenda item 3). Various workshops had been carried out successfully; however, the Mazatlan exercise is being re-scheduled for 1994. Some progress was made with respect to regional assessments and with mass balances. The Open Ocean Baseline study is moving ahead with the most recent cruise on the RV HUDSON allowing for organic and inorganic measurements in the North Atlantic. A major assessment of GEMSI training workshops was carried out as a means of defining a new programme design for future training Workshops.

3. STATUS OF REFERENCE METHODS

A discussion paper was presented by the series editor, Laurence Mee. He pointed out the marked improvements made in presentation and style of the methods and also recommended the consolidation of many single-contaminant methods into more comprehensive manuals. Several manuals of lesser relevance to the objectives of GIPME or UNEP's Regional Seas Programme are being withdrawn. Further improvements in the review mechanism were also proposed. The meeting agreed to continue with the policy of regarding the series as a primary product of the Expert Groups and to further develop the Technical Bulletins as a medium for communicating significant developments in methodology to the regions. It was agreed that particular care is required in the review process and that all publications in the series would be submitted to rigorous review, irrespective of whether they are generated at the initiative of, and by, GIPME bodies or cooperating national or international institutions. In the case of GEEP, methods generated prior to the institution of the new review process would now be submitted to critical review and modified if necessary and appropriate. It was also agreed that an initial synopsis of each method would be reviewed by the appropriate Expert Group prior to issuance of a contract to the selected author. This should assist authors and reduce the workload during the subsequent review of the completed manuscript by the Expert Group. As part of the review mechanism, scientists from the regions shall be consulted in order to ensure that the needs of developing country laboratories are addressed. The Groups considered each of the documents programmed for review or future production. The future participation of IMO in the production of these documents was welcomed and a desire was expressed that FAO should be more fully integrated into the review mechanism. Two entirely new Technical Bulletins were proposed by the Groups of Experts. The first is a report of developments in techniques for assessing the biological effects of pollutants, based upon the report of the Bellagio meeting of GEEP. The second is a "Compendium of principles and advisory guidelines on marine environmental protection" to be contributed by IMO and reviewed by GEMSI. Proposals for a number of other Technical Bulletins will be formulated intersessionally. During the GEMSI and GEEP Core-Group discussions, it was mentioned that there were occasions in which regions were faced with advising governments on the threats associated with marine exploitation activities and/or the design of associated surveillance or monitoring programmes. Relevant guidance on such topics was often available within other regions or within the international marine environmental protection community but such information was seldom widely disseminated enough for individuals in other parts of the world to be aware of it. Accordingly, a potentially useful Technical Bulletin might be an assembly of such information accompanied by a cross-referenced index to enable such information to be easily evaluated in the context of requirements in different regional marine areas. It is therefore proposed that a draft Technical

Bulletin be prepared containing selected, and reviewed, guidelines, technical advice, surveillance programme designs, and evaluations of specific issues carried out within the international marine environmental advisory community (e.g., ICES/ACME) and within existing regional and global agreements (e.g., the London, OSPAR and Helsinki Conventions). Each entry would contain a reproduction, with appropriate acknowledgment of source, of the texts of specific advice, technical assessments and guidelines broadly relevant to regional marine environmental concerns. These texts would be preceded by a paragraph qualifying the terms of reference for the material reproduced indicating to what questions and topics it might be regarded as relevant. The entire volume of the Technical Bulletin would also contain a detailed index that would allow easy direction and access to material related to specific topics. It is proposed that GEMSI prepare a draft of this material that could be augmented with additional entries proposed by the other GIPME Expert Groups thereafter. GEMSI should endeavour to complete a first draft by the end of 1994. The editor of the Methods Manuals series announced his recent resignation as head of the Marine Environmental Studies Laboratory in order to take up the post of Coordinator of the Black Sea Environmental Programme. He reassured the meeting that the series will continue to be edited at MESL with the strong support of UNEP and IOC. A new IAEA Technical Secretary will be appointed shortly.

4. GEEP-GEMSI INTERACTIONS

The group will be working together on a number of issues and this is reflected in the Workplans for both groups. Regional Assessments will require some co-ordination between the two groups as will the planning of several Workshops during the next three years.

5. GEMSI INTERACTIONS WITH GESREM

Dr. Dawson presented a report at the request of Dr. Calder, Chairman of GESREM. The Group has prepared its workplan for the next two years and has listed the following areas where the Group's expertise will be employed.

(i) Development of seawater-based nutrient reference materials.

(ii) Development of stable reference materials for marine algal pigments.

(iii) Development of reference materials for marine algal toxins.

(iv) Promotion of wider availability and distribution of reference materials for inorganic carbon in seawater.

(v) Improve training and prepare guidance on the use of standard reference materials in developing countries.

(vi) Promote the preparation of reference materials for "non-persistent" pesticides.

Many of these activities will involve the participation of members of GEMSI and GEEP and some of the "newer" materials proposed are designed to support the needs of WOCE and JGOFS. Ongoing actions of GESREM include the certification of a reference material for trace metals in bivalve tissue (GESREM-1) and preparation of a research material with recommended values for organochlorine pesticides, PCB congeners, PAH and toxic trace elements (GESREM-2). Preparation of a large batch of highly contaminated freeze dried mussel tissue together with certification for organics will be the basis of a further reference material (GESREM-3) and is expected to proceed in 1994. All of these materials can be made available to regional programmes even though the certification is still ongoing between NRC-Canada, NIST and IAEA. A workbook on the proper use of reference materials for quality assurance in the quantitation of organochlorine and PCB residues has been prepared by one of the analytical laboratories involved in the IMW programme with the assistance of NOAA, and is currently under review. Reference materials for selected algal toxins should soon be available. Efforts in the preparation

of a stabilized seawater nutrient material are well advanced. A workshop sponsored by US-NOAA and the Group of Experts is planned for 7-8 December 1993, where the current status of these reference materials as well as efforts in preparing a matrix/based plant pigment standard will be discussed. GESREM will also be represented at the IOC-FAO *ad hoc* Intergovernmental Panel on Harmful Algal Blooms (IPHAB) to be held in Paris, 14-16 October 1993. Some members will also attend the 6th International Symposium on Toxic Phytoplankton in Nantes, 17-21 October 1993, where the issue of reference materials will be discussed. Dr. Dawson, who is also assisting in the preparation of the plant pigment material, will attend these meetings and also represent GEMSI. Dr. Moore will attend the IPHAB as the GEEP representative. The Chairman of GESREM had requested information from GEEP concerning the need for a certified resorufin standard. It was felt by GEEP that this may no longer be necessary since the method may eventually be replaced and a recent workshop had concluded that the purity of commercially available reorufin could easily be estimated by molar absorbance measurements. It is to be expected that GEMSI and GESREM will continue to coordinate their efforts, and collaborate in efforts to produce new reference materials for compounds of concern.

6. RELATIONSHIP WITH OTHER PROGRAMMES

6.1 JGOFS

The chairman, Dr. Knap, provided an overview on GEMSI's role in helping to provide some methodological oversight to some of the JGOFS measurement protocols especially within the Arabian Sea region. At present, there are three workshops in planning stages in the Region, in Mombasa, Pakistan and possibly Oman. To date, the workshop at the most advanced stage of planning is that to be held in Mombasa in November 1993. Dr. Bernt Zeitzschel, Germany, has taken the lead in this programme and it is intended that training will be offered to a wide group of IOC member states from the Arabian Sea area. The protocols used will be the draft JGOFS protocols currently under revision by the Chairman of GEMSI. Should these protocols not be in final form for the meeting, a set of protocols used by the US JGOFS time series group at Bermuda, BATS (Bermuda Atlantic Time-series Station) will be used for the programme. One or more scientists form the BBSR will be attending the meeting as instructors. Dr. Knap also mentioned that the Time series site at Bermuda and in Hawaii have been the sites for the training of Pakistani scientists over the past year with two scientists at Bermuda and one in Hawaii. Dr. Niaz Rizvi, Director of the National Institute of Oceanography, Karachi, Pakistan visited Bermuda in September to provide for additional training opportunities for Pakistani scientists and it is planned that such training take place before the end of the year with 4 more scientists from Pakistan. NIO have also scheduled a training programme from scientists from the region and IOC have agreed to provide funds for two BBSR time series scientists to travel to Pakistan and provide training. It was decided by GEMSI that the success of the Mombasa Workshop should be evaluated in the light of other training programmes in the region. Dr. Knap also mentioned the need for a contaminant assessment of the region as his attendance at an Arabian Sea meeting held in Karachi, had identified serious contamination issues and training needs for the area. This was discussed further in agenda item 7. The Chairman also mentioned the possibility of a training exercise to be held in Oman, however there were no further details on this. GEMSI stressed its interest in the JGOFS programme and expressed its willingnes to help whenever it can be of assistance.

6.2 LOICZ

The Chairman of GEEP, Dr. Gray, provided an overview of the Land Ocean Interface with the Coastal Zone programme. A Science Plan has been developed and a Implementation Plan is being prepared. The Dutch have agreed to host the programme office in Texel. The current chairman is Dr. Patrick Holligan and Dr. John Pernetta is the Programme Manager. LOICZ will be looking at water fluxes to the sea on a global basis with each national programme responsible for its own funding. International programmes in developing nations will probably be partially funded by some of the core countries interested in those regions. The GEMSI group discussed the relationship with LOICZ and suggested that there are various areas of overlap. The data quality issue is one where GEMSI could provide input, however the regional assessments

currently carried out by GEMSI would have a very direct impact on the programme. The group felt that Dr. Herb Windom should be the GEMSI liaison with the LOICZ programme as his background on land sea fluxes would be important in this area. Dr. Knap will contact Dr. Windom.

6.3 GOOS

Dr. Bewers presented an overview of the Health of the Ocean Module for the Global Ocean Observing System prepared at a Panel Meeting in 1993. As three of the GOOS Ad hoc Panel were members of GEMSI, the HOTO module had a significant input from chemists. Although some aspects of biology were covered in the draft report of the group, more input from biologists especially biological effects scientists was needed. Three of the members of GEEP have been identified as possible future members of the HOTO Panel. In a general discussion, the GEEP members provided two areas where they thought they could develop HOTO with more remote, automated, and on-line biological effects measurements. This Panel will be re-convened by Dr. Neil Andersen in early 1994, in order to finalize the report.

6.4 INTERNATIONAL MUSSELWATCH (IMW)

Dr. Dawson provided a report of the status of the implementation of the IMW during the first operational phase in South, Central America and the Caribbean. The International Mussel Watch Committee had met prior to the GEMSI session (Sept 6-10, 1993) to review the results of the first phase, a final report of which is expected by the end of the year. Samples from some 80 stations around the South American continent have been analyzed for organochlorine pesticides and PCB congeners. In addition, half of the stations collected have been analyzed for PAH by the Field Scientist Dr. Sericano. The chlorinated hydrocarbon analyses were split between the GERG laboratory, Texas A&M University and the MESL Laboratory in Monaco. Intercalibration and QA/QC between the two laboratories was very satisfactory and the Committee felt confident that the data sets were of sufficient quality to allow for a reasonable assessment of the contamination of the coastal environment of the region with chlorinated biocides and industrially- derived PCB's. A full interpretation of the data will be presented after the host country scientists involved in the field collections have had the opportunity to comment on the results. In general, concentrations in bivalve tissues are relatively low around much of the coast line. Elevated levels at certain sites correspond to concentrations currently found at many North American sites and the causes for the higher levels and their possible effects on populations is an area requiring further research at the national or sub-regional level. As a result of what is considered a very successful exercise, a regional cadre of active, qualified scientists have been identified which will form the basis of a network on which to strengthen environmental efforts in the region. The Project Secretariat is seeking funding from Foundations to support follow-up activities. In addition, a training workshop in Nicaragua in late 1993, as well as visits of experts to South American laboratories are being planned by MESL, Monaco to provide additional training to scientists from Central and South America to continue routine measureemnts of chlorinated pesticides. No specific action is requested of GEMSI, either in the completion of the initial phase of the IMW or in the expected follow-up other than the Group's usual support in the form of providing guidance on standards, reference methods and reference materials on a request basis.

The regional network of scientists should also be kept informed of any new developments in methodology arising from GEMSI activities. A number of valuable lessons have been learned from this ambitious programme that will be useful in the future extensions of the project and which may greatly simplify the planning and operation in other regions of the world. The next phase calls for the immediate extension of the project to two new regions in parallel closely followed by development of a programme covering the remaining coastal areas of the extensive eastern Atlantic. The planning of the Pacific Rim or Asia-Pacific phase will proceed immediately and will include three sub-regions, the Northwest Pacific, the ASEAN countries and the South Pacific roughly corresponding in geographic coverage to that of the UNEP Regional Seas Action Plans as well as the IOC WESTPAC member states. Initial planning workshops with scientists in the region to define the sampling sites, collection and analysis strategies, and to disseminate

reference materials and standards will take place in early 1994. To ensure continuity in the programme, one or both of the central analytical laboratories involved in the initial phase will analyze the samples together with Dr. Tanabe's laboratory in Japan. These laboratories will take part in periodic QA/QC exercises to, once again, ensure the comparability of the data. Splits of samples will be retained by host country laboratories for analysis where facilities allow. In a parallel fashion, the planning workshops with scientists from the Indian Ocean Region will begin in early 1994. The mussel watch effort in the remaining ocean seaboard of the East Atlantic will begin to be developed in early 1995. The suite of analytes will continue to be primarily restricted to organochlorine pesticides and PCBs. Discussion with members of GEEP indicated that collections of digestive glands of bivalves may be a useful extension to examine histopathological markers of effects. It would , however, be difficult to collect other samples for biological effects studies given the logistics of the planned exercises. Sediment samples may be included as part of the sampling protocol in the event that such an archive may be useful for the study of the distribution of new generation pesticides which do not bioaccumulate.

6.5 SMALL ISLANDS

Dr. Knap discussed the new group on small island ecosystems and climate change. There will be a meeting November 8-10, 1993 in Martinique that he will attend as an IOC representative. This should allow for the beginning of an assessment of the Caribbean region.

7. GEMSI WORKPLAN FOR 1994-1996

What follows is a draft plan for GEMSI. In developing this plan, various "new contaminant" concerns are addressed. The timing for the activities is based on the present knowledge of the work schedule for the Group. Where possible, budget items in thousands (K) of US dollars are provided. An asterisk * denotes an activity for both GEEP and GEMSI interaction with the cost of the activity being the total for both groups. The X's reflect an ongoing activity of the group and no specific cost is associated with this other than the convening of Expert Group Meetings. The parenthetical letters (e.g. A) represents the priority assigned to the activity by the Group. Below a short description is given of each activity. In the open ocean baseline section the 30/750K reflects the IOC share/and overall cost of the programme.

7.1 SESSION MEETING

Funds need to be allocated for a regular GEMSI meeting in 1994 and in 1996. Cost: 30 K; 1994 priority A. Cost: 30 K; 1996 priority A.

7.2 AD HOC GROUP MEETING

Funds need to be allocated for a GEMSI ad hoc group meeting in 1995. Discussion on all activities of the group need to be updated and intersessional work evaluated, revised and set for the next year. Cost, 20K; 1995 priority A and B, Method Development.

7.3 MANUALS AND REFERENCE METHODS

GEMSI reviews manuals continuously. New manuals are being considered for production. This cost reflects the IOC portion of the manuals. The manuals to be prepared are training Manuals for the JGOFS programme in regional areas. Obviously, if manuals are not produced, there will not be related costs. As the Reference Methods are supported directly be UNEP, no cost is associated with this activity. Cost: 25 K; for 3 years.

7.4 ALGAL TOXINS

GEMSI members will work intersessionally with the Algal toxin reference materials produced by GESREM over the next three years to both evaluate and interact with the preparation of these compounds.

7.5 NEW CONTAMINANTS

The meeting reconfirmed GEMSIs concerns in pursuing the study of new contaminants. It was felt that the issue warrants more than a watching brief and should have a primary position on the Group's workplan for the next biennium. Specific issues are listed as follows (not in order of priority):

7.5.1. New Generation Pesticides

There is sufficient evidence to warrant development and testing of methods for organophosphorus pesticides (in sediments and water), n-methyl carbamates (in sediments and water), triazine herbicides in all phases and synthetic pyrethroids. Special concerns were voiced concerning the increasing use of a variety of fungicides, particularly in the tropics, with relatively little known about their environmental chemistry. Antifouling agents are a special concern since organotins are still in widespread use and new agents have been introduced as replacements in regions where restrictions have been applied, again in the absence of knowledge of their environmental chemistries.

7.5.2. Chemical Contaminants in Domestic Sewage

These are introduced in huge amounts and span a wide diversity of compounds. Specific concerns were expressed for organic surfactants, pharmaceuticals (particularly hormones) and derivatives formed through sewage chlorination or ozonation

7.5.3. Chemicals Employed in Mariculture Operations

These include pharmaceuticals (antibiotics, growth hormones, sex reversal hormones etc.) as well as biocides (fungicides, herbicides, molluscacides etc.) GEMSI proposes to conduct a targeted workshop together with GEEP to evaluate the impact of organophosphorus and carbamate pesticides on biota of a tropical lagoon (see nest section). Plans are being made to develop an intercalibration exercise for such compounds in sediments and water to be conducted by laboratories making such measurements. A more comprehensive discussion of chemicals used in mariculture operations and of chemical consituents in sewage was deferred to the next full session of the Group when review materials can be assembled.

7.5.4. Workshops

In 1994 a Joint GEMSI-GEEP Workshop on New Contaminants and their Effects in Impacted Tropical Lagoons will be held. A combined GEEP-GEMSI research/training workshop to evaluate linked chemical and biological analyses of the environmental fate and effects of non-persistent pesticides and other contaminants in the coastal zone of Mazatlan, Mexico. This will invólve 2 GEEP participants. The site has been selected to take advantage of regional resources and will be held in November 1994. Cost: 50 K; priority A. Background The proposed GEMSI-GEEP study builds upon a four year EEC sponsored study carried out by a cooperative research collaboration between the MESL laboratory in Monaco and UNAM, Mazatlan. The study resulted in the publication of findings concerning the significance of new generation pesticides and their relative stability's when associated with sediments. Circumstantial evidence from the region suggests an impact of such pesticides on larval shrimp during periods of heavy application, and recent studies of these pesticides in the dissolved phase, revealed concentrations of endosulfan (post application) perilously close to the LC-50 values for Mysid shrimp. Not all of the pesticides known to be applied in the location were assessed in this study due to the inavailabity of analytical methods at the time. At the present, anything less than acute biological effects have not been assessed. The urgency of such assessments stems from the fact that the region is one targeted for aquaculture developments (particularly for shrimp and not atypical of productive tropical lagoons worldwide) and happens to be an important wildlife reserve (for migratory birds). Since GEMSI and GEEP have access to techniques to address these issues, and noting that similar concerns have been expressed by other countries in this and other regions, a specifically targeted technical workshop is proposed. The proposed scope of workshop techniques is to evaluate techniques for measurement of organophosphorus compounds (GC-FPD, GC-NPD), carbamates (HPLC-postcolumn adduct fluorescence),endosulfan (GC-ECD) and triazines (HPLC/GC) in seawater

and lagoon sediments. Sampling Strategy: The study is proposed to take place in the Altata Lagoon, Sinaloa, Mexico. The objective will be to examine a concentration gradient from the known source (irrigated neighboring croplands) to the relatively clean open lagoon areas. It should be pointed out that this will not be along a salinity gradient, typical of temperate estuaries, but that this is a standard feature of most lagoons where circulation and mixing determine the salt regime. Water column, dissolved phase samples, will be collected along the "expected" chemical gradient transect together with subjacent surface sediments for chemical analysis. Samples will be collected in parallel for assays of biological effects. Samples will be staged, processed and analyzed at the UNAM research station in Mazatlan. Participants: GEMSI and GEEP Specialists (The EEC have agreed to co-sponsor European participants in this workshop if a formal proposal is made). It is envisaged that three GEMSI specialists and up to three GEEP specialists (depending upon the suite of measurements chosen) will participate in the workshop. Four local scientists from Mazatlan and other Mexican institutions would also participate. Two central American specialists would also be invited (from Costa Rica and Nicaragua) where similar environmental problems to the region have been recently highlighted as issues of concern.

The outputs will take the form of scientific publications of the findings in the open scientific literature's well as efficient testing of recently introduced reference methods under realistic field conditions. A report providing suggested management actions for the case study and strategies for similar programs in other settings are predicted to be tangible outputs of this exercise Cost $ 50K; Priority A.

7.5.5. Sediment Quality Criteria

The group noted that a key element in describing the marine environment particularly in the context of regional assessments, is the description of such objective criteria for the quality of sediments. A further specific application of such objective criteria is in respect of the movement of sediments for navigational and capital dredging, coastal construction projects, coastal protection and remediation. In these instances sediments may be dumped at designated disposal sites at sea or on land, or they may be re-used in some beneficial way. The management of such activities frequently involves sediments with a substantial burden of contamination requires careful consideration. Disposal of dredged material at sea is regulated internationally by the London Convention (1992) and specific guidelines have been prepared to assist contracting parties in assessing the impact of disposal at sea within a permitting process. The overall framework for the implementation of the London Convention has been reviewed and revised the London Convention's Scientific Group and a coherent "Waste Assessment Framework" has been assigned for adoption. The subsidiary guidance on disposal of dredged material will be reviewed starting in 1994 and central to the discussion will be the means of assessing sediment quality in physical, chemical and biological terms. At a national level a range of approaches has been described for assessing sediment quality in terms of numerical limits for a range of contaminants and also in terms of tiered approaches involving increasing scrutiny using biological assessment techniques. There is , however, no widely accepted procedure for describing the quality of sediments in terms of the fate and scale of potential adverse effects of contaminants under either their existing or proposed location. Since dredging and other activities involving sediments disturbance are global and noting that not all coastal sites are Contracting Parties to the London Convention (1972), it is appropriate for a group under the auspices of GEMSI-GEEP review the approaches which have been described and to take advantage of new research activities with a view to preparing and objective, practical basis for assessing sediment quality. It is therefore proposed to convene a Workshop in 1994 to discuss and formulate a practical approach to Sediment Quality Assessment, leading to a field exercise in Bombay in 1996. Cost 20K; Priority A.

7.5.6. Eutrophication

Widespread concern is being expressed about increasing introduction of nutrients into the marine environment, particularly coastal and marginal sea areas having restricted exchanges with offshore waters. Indeed, in some regional marine areas, eg the North Sea, strong international commitments have been made to reducing nutrient inputs from land-based sources as a preventative measure. The rationale for such action is to reduce the

incidence of blooms of nuisance algae, associated adverse effects on tourism, and changes in the oxygenation of coastal waters. To these may be added concerns about the possible connection between eutrophication and the growth of toxic algae that pose risks to both marine organisms and human consumers of seafood. The main difficulty in the context of assessments of eutrophication is determining the extent to which increased primary production is resulting from increased discharges of nutrients to the sea and the extent to which such changes can be regarded as deleterious in the sense of compromising marine resources and amenities that warrant protection. The is a need for the formulation of a procedure for assessing, on a sound scientific basis, the temporal trends in nutrient fluxes and biological productivity of marine coastal regimes in a manner that permits an objective evaluation of the need for management intervention. It is proposed to establish a GEMSI-GEEP Joint Sub-group to develop and test such a procedure in the period 1994-1996. The testing of the procedure would take place in a representative marine area and a coastal location in Indonesia, close to a centre of population, would appear to be ideal. A workshop in Indonesia is therefore planned for 1996 as a means of completing the work of the Joint Sub-group:

(i) To define a procedure for determining the direction and extent of trends in algal production relating to changing nutrient inputs to coastal marine areas;

(ii) To define procedures for assessing the adverse consequences of increased nutrient inputs to coastal waters, especially threats to marine resources and amenities;

(iii) To test the overall procedure at a Workshop at a coastal site in Indonesia in 1996;

(iv) To provide detailed specification of the procedure and the results of its testing to both GEMSI and GEEP in 1997. Cost OK;

7.5.7. **Sea of Marmara**

The Sea of Marmara is a critical connection between the Black Sea and the Mediterranean. It is a deep (1500 m), almost totally enclosed water body linked to the Black Sea by the narrow Bosphorus channel and to the northern Aegean by the Dardenelles. It is known to be highly contaminated, particularly as a result of effluent from Istanbul (pop. at least 9 million) and the industrial area of Izmir. The Bosphorus is stratified, with surface inflow to the Sea of Marmara from the Black Sea. Though an international waterway, the Sea of Marmara is a Turkish internal sea. The proposed activity would be a cooperative venture with Turkish scientists and would be prepared following full consultation and approval of the Turkish delegation to IOC. The aim of the activity is to evaluate loads and fluxes of critical contaminants in the Sea of Marmara and to prepare a mass balance. This, in turn, would provide essential information for the eventual assessment of contaminant fluxes in the Black Sea itself. It would thus make a vital scientific contribution to the Black Sea Environmental Management Programme and test the approach to mass balances developed in the past ten years of GEMSI activities. A planning meeting for this activity is proposed (followed Turkish delegation approval) in 1994 in Istanbul. This will result in a series of activities in 1995 culminating in a full practical workshop and mass balance evaluation. Cost OK; priority A - GEMSI meeting in Istanbul.

7.5.8. **In 1995:**

Eutrophication

Subgroup for the planning for the planning of the Workshop in Indonesia to be convened Cost 15K; priority A.

7.5.9. **Sediment Quality**

Follow up meeting and planning meeting for exercise in Bombay in 1996. Cost 15K; priority A 3) Sea of Marmara/ Mass Balance. Carry out Workshop Cost 65K; Priority A.

7.5.10. **In 1996:**

Eutrophication

Activity to be carried out in Indonesia Cost 50K; priority A.

Sediment Quality Criteria Workshop

This would be a joint GEEP-GEMSI activity held in Bombay, India. Cost 65K; Priority A.

Effects of Mariculture Workshop

The rapid expansion of coastal aqua culture and the trend towards intensification have been recognized as causing ecological change. The deposition of organic material and the use of bioactive compounds, including antibiotics and pesticides, both have a significant impact on these areas. A planning meeting is required to plan a workshop for this problem. This will be a joint GEEP-GEMSI activity. Cost: 15 K; priority B.

Black Sea Assessment

GEMSI will be actively promoting the preparation of regional assessments and providing advice and assistance to regions for their preparation. It will also be furthering the acquisition of boundary flux measurements for regional marine areas for incorporation into mass-balance calculations for aiding the evaluation of state and trends in contamination. The experiments planned for the Sea of Marmara in 1995 should provide data and information directly relevant to fluxes of contaminants between the Aegean and the Black Seas. Accordingly, GEMSI can both contribute to and benefit from an association with the Black Sea Assessment process in 1996. An invitation for GEMSI involvement in the Black Sea Assessment has been issued and should be accepted so that GEMSI can assist in the finalization of this assessment and also glean valuable insights relevant to other regional marine assessments. Cost 15K; priority A.

Intercalibrations

Continue with a brief for evaluation of regional and global intercalibration exercises. In 1995 and 1996 allocate funds for an intercalibration exercise on non-persistent pesticides Cost: 20 K; priority A.

Other activities

Review Regional Seas activities on a continual basis and provide expertise when required. Funds are to allocated for GEMSI members to represent IOC in regional meetings so that assessments of capability and regional problems can be made Cost 45K for three years; priority A. The Comprehensive Plan for GIPME (IOC, 1976) and the Strategic Framework for GIPME (IOC, 1984) both emphasize the role of contamination and pollution assessments for the purposes of determining the requirements for management action to prevent or rectify pollution problems in the marine environment. The GIPME Programme has now developed to a stage that much information and data have been obtained in the various regional marine pollution programmes under the GIPME umbrella. However, limited attention has been paid to how these data can be incorporated into coherent, and objective, assessments as a means of determining progress, identifying priorities for the further acquisition of information and improvement of scientific and technical infrastructure, and for identifying cases in which management action is warranted. Accordingly, the planned re-evaluation of the strategic and logistical development of the Programme, 10 years after the previous evaluation (IOC, 1984) provides an opportunity to define steps towards rectifying this deficiency as well as taking account of the recommendations of UNCED embodied in Agenda 21. Some components of regional marine environmental assessments have already been considered at an Ad-Hoc GEMSI Sub-Group meeting in 1991 (IOC, 1991). The objectives of the GEMSI assessment process were:

(i) to identify contamination/pollution issues of concern within regions and their relative priorities;

(ii) to review the basis for the identification/selection of priority concerns;

(iii) to assess the nature and intensity of effort applied to the study and assessment of issues and their likely effectiveness. Clearly, regional marine environmental assessments that would be valuable benchmarks in assessing the progress of regional GIPME elements would be expected to cover a much broader range of topics and would address other criteria. These would include other anthropogenic influences on regional marine environments such as physical disturbances, destruction of habitats, extraction of marine resources, loss of amenities, etc. uses of the marine environment and its resources and amenities that warrant protection, identification of deficiencies in information, data, or understanding that do not permit an objective judgement as to the severity of an issue to be made and, accordingly, warrant the acquisition of further survey, research or monitoring information to permit an objective assessment to be made; identification of issues which on the basis of information and data acquired to date do not appear to be of much significance; definition of the priorities for management action in the context of existing damage, or potential threats, to the marine environment and its resources and amenities.

In order to assess threats to local and regional marine environments and to contribute to the overall assessment of the health of the oceans, regional bodies should be encouraged to prepare regional marine environmental assessments as soon as possible. These would also provide a basis for GIPME to evaluate outstanding requirements for assistance, training, and technological infrastructure in order to deal with priority issues in each region. GIPME and its Expert Groups would then be able to improve the targeting of their activities to regional needs and providing enhanced support for regional activities. Furthermore, if the regional assessments were prepared on a coherent and comparable basis, it would greatly simplify the overall evaluation of marine environmental quality and also enable identification of the commonalties in the requirements of regions as well as unique problems requiring special attention. In order to promote the preparation of regional assessments, to assist the regions in this process, and to gain an improved appreciation of the issues perceived in each region, GEMSI proposes to establish a liaison mechanism among its membership and individual regions by identifying in each region appropriate individuals who can both participate in GEMSI activities and provide a mechanism for enhanced communication between the Expert Group and the regions. The main focus of the enhanced interaction between GEMSI and the various UP Regional Seas and IOC/MARPOLMON programmes should be to promote, and assist in, the preparation of regional assessments. Each region should consider preparing marine environmental assessments as a means of ensuring that primary attention is devoted to the most serious compromises of marine resources and amenities and potential threats to them. To this end, GIPME should consider the format for regional marine assessments to be prepared by GESAMP (GESAMP Task Group activity led by IMO but supported by IOC and UNEP) and, if this is suitable, promote its use by the regional bodies within the UNEP Regional Seas and MARPOLMON programmes as a basis for the preparation of assessments during 1994-95. The GESAMP format should be available in late March, 1994, immediately following the XXIV Session of GESAMP in the Caribbean.

(iv) Evaluate International Mussel Watch program on a continual basis.

(v) Keep a watching brief on other mussel watch activities, especially national programs from regional areas.

(vi) Continue developing QA and QC guidelines and provide them to the regional areas.

7.5.11. Mass balances

At the core GEMSI meeting it was concluded that the philosophy inherent in the mass-balance approach underlies the design of all recent and future GEMSI activities. Accordingly, as a complement to earlier work on the

improvement of measurements of contaminants in the marine environment, recent and planned workshops emphasize either inputs (e.g. river fluxes) or removal pathways (sediments) for monitoring and assessment purposes. These various foci are required for both the implementation of the GIPME Programme, which stresses mass-balance construction as a valuable component of contamination assessment, and the UNEP Regional Seas activities. The recent stress on boundary fluxes within GEMSI activities reflects the conclusions and recommendations of IOC Technical Series No. 25.

8. RIVER INPUT MEASUREMENTS AND MASS-BALANCE ASSESSMENTS

GEMSI has previously conducted workshops on measurements for determining riverborne fluxes of substances to the sea (References). An important recent development in the field of riverine flux measurements is the formulation of the Land-Ocean Interactions in the Coastal Zone (LOICZ) Programme. This programme has the objective of estimating fluxes through the ocean boundary of a wide range of materials including sediments and chemical contaminants. The programme is effected through national contributory activities but insufficient detail was available about the specific nature of such national activities. In view of the interest of GIPME in contaminant fluxes from land to sea, it would seem appropriate for GEMSI to obtain more information about the LOICZ programme with a view to evaluating how its results might be used for GIPME purposes and to determine if GEMSI might be able to improve global coverage through specific activities in developing regions. Accordingly, a member of GEMSI will be charged with obtaining information on the design and planned activities of LOICZ so that a more complete evaluation of this issue can be made at the next GEMSI meeting. This discussion should also be combined with a reconsideration of the role of mass-balances within GIPME, especially the any outstanding needs for additional boundary flux measurements for the construction of mass-balances. In recognition of the above GEMSI will continue to work on atmospheric measurements of contaminants and calculation of fluxes, provide input to the Global Ocean Flux measurements as requested and continue Open Ocean Baseline.

9. OPEN-OCEAN BASELINE STUDIES

In the analysis of the GIPME programme leading up to the strategic analysis of the programme published as IOC Technical Series No. 25 (IOC, 1984), the concept of an oceanic baseline for contemporary contaminant levels was developed. The open-ocean baseline survey was intended to provide an improved estimation of the standing stock of chemical contaminants in the deep ocean basins for the purposes of mass-balance calculations as envisaged in the design of GIPME. The design of a baseline survey of the Atlantic Ocean was developed by a GEMSI Sub-Group in 1985 (Yeats, Blanton and Bewers, 1985) and subsequently adopted by GEMSI and the scientific committee for GIPME. The geographical diversity of the deep ocean stations proposed for this survey ruled out the use of a single cruise to occupy all stations. Accordingly, it was proposed to adventitiously sample geographically close groups of stations on suitable cruises. An offer of shiptime on board the FS METEOR made by the Federal Republic of Germany during a planned cruise in the South Atlantic enabled four of the baseline stations to be occupied on a single cruise in 1990. This cruise (13 March - 15 April 1990) occupied stations nos 4, 5, 7, and 9 of the Atlantic Open-Ocean Baseline Study shown in Figure 1 below (the original station enumeration was retained). Sampling on the cruise comprised two components: vertical profiles in four basins of the eastern Atlantic and sequences of closely-spaced surface samples collected while the ship was underway between stations. Unfortunately, it was not possible to include measurements of organohalogens in this first cruise and, accordingly, the samples obtained were intended only for baseline measurements of trace elements. The results obtained from the cruise are to be published shortly in a volume of Marine Chemistry. The second baseline cruise was undertaken 8 August - 1 September 1993 on board the Canadian Survey Ship HUDSON. This cruise occupied a series of stations in the northern North Atlantic on a cruise track across the southern Labrador Sea into the eastern Atlantic, then north into the Denmark Strait, eastward to the north of Iceland and into the Scotland-Iceland passage, terminating in Reykjavik, Iceland. Stations 1 and 2 of the original Atlantic Baseline Study, as well as additional deep stations were occupied on this latter cruise. This cruise has only just been completed but all planned sampling was successfully undertaken. Samples were collected

Figure 1 - GEMSI Membership

Last name	First name	Country	Organics	Inorganics	SED	SW	JGOFS	IMW	Land/Sea	Atmosphere	Region
Knap	Anthony	Bermuda	O	I		X	X			X	Open Ocean
Bewers	Michael	Canada		I	X	X			X		Open Ocean
Dawson	Roger	UK	O		X			X			Coastal
Duinker	Jan	GDR	O			X	X			X	Open Ocean
Farrington	John	US	O		X			X			Coastal
Mee	Laurence	UK	O		X			X	X		Coastal
Windom	Herb	US			X	X			X		Coastal
Secretariat											
Campbell	John	IMO		I	X				X		Coastal
Readman	Jim	IAEA	O		X				X		Coastal

for both trace element and trace organic contaminant analysis. Some preliminary discussions have already taken place regarding a third cruise. It seems likely the most ideal year for this cruise would appear to be 1995. It is conceivable that application will be made for U.S. shiptime to undertake the occupation of baseline stations in the remaining baseline stations in the northwestern, western equatorial and southwestern Atlantic. The Atlantic Ocean was chosen as the subject of the Open-Ocean Baseline because of its relative importance as a formation region for deep waters. Some expressions of interest in the design and conduct of a Pacific Ocean baseline have been made by Japanese agencies. It may thus be appropriate for GEMSI to undertake the design of complementary Open-Ocean Baseline Survey for the Pacific Ocean during the period of the next planning cycle.

9.1. IN 1994:

Meeting to evaluate the results of the Second Atlantic Baseline Study Cruise in the United States or Canada, November 1994 (ca. 8 persons). This meeting will also deal with preparations for a Third Atlantic Baseline Cruise in 1995 if suitable shiptime can be obtained. Cost: 10 K; priority A.

Meeting to develop a design for a Pacific Ocean Baseline Survey. Should be held during the period Jan, 1994 - Sept, 1994 as a GEMSI Sub-Group Meeting (About four people) Cost: 10 K; priority A.

9.2. IN 1995:

Western Atlantic Cruise

Cost: 750 K (Cost to IOC: 30K) priority A.

9.3. IN 1996:

Pacific Cruise

Cost: 750K (Cost to IOC: 30K) priority A.

Meeting to plan Phase IV in Indian Ocean Cost: 15K; priority A.

10. MEMBERSHIP

The Group evaluated the Work Plan and the need for membership and have proposed the following names as an initial group of members. Not all of the members will neccessarily be needed for the full GEMSI meetings. In addition other experts names will be added for specific tasks in this next three year period. The Chairman will contact the proposed membership to find their willingness to serve. Past members of GEMSI will also be contacted and thanked for their service to the Group.

11. FUTURE MEETINGS

Both items were discussed and the group noted that the Workplans would have an improtant input into both the GIPME Panel and HOTO meetings. The Chairman will be available for the GIPME-VIII meeting.

82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
83. Seventh Session of the JSC Ocean Observing System Development Panel
84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region
92. Fifth Session of the Joint IOC-JGOFS CO_2 Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System
97. Joint Meeting of GEMSI and GEEP Core Groups