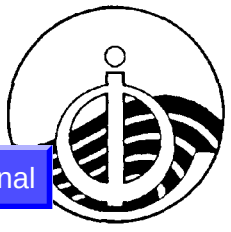
Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies



Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GOOS (J-GOOS)

Third Session

Bangkok, Thailand
16-21 November 1995

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
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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
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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
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I. OPENING

The meeting was opened by Mr. Yihang Jiang of the Intergovernmental Oceanographic Commission (IOC) Sub-Commission for the Western Pacific (WESTPAC) at 09:00 hours on 16 November 1995. He welcomed the participants on behalf of the Executive Secretary of the IOC, Dr. Gunnar Kullenberg, and conveyed Dr. Kullenberg's and his best wishes for the meeting and obtaining the results sought. He briefly informed the meeting of the establishment of the IOC Regional Secretariat noting appreciation to the Government of Thailand for their generous support for the Secretariat Office. Establishment of the Regional Secretariat gives IOC an arm in the region to implement regional programmes as well as the regional aspects of IOC global programmes. The HOTO pilot project in the region could be one of these.

Mr. Yihang then introduced Dr. Suvit Vibulsresth, Secretary-General, National Research Council of Thailand, who greeted the participants and explained the role of the National Research Council in GOOS and such initiatives as SEAWATCH Thailand. He noted that the WESTPAC Region, and especially the South-East Asia Region, is facing the challenge of environment and development. More than 60% of the population live in the coastal areas. The health of the oceans, and in particular the health of the coastal oceans, is a critical topic. He expressed his pleasure in observing from the agenda that a WESTPAC Pilot Project on HOTO will be discussed and the outcome is anxiously awaited,

The Chairman of the Health of the Ocean (HOTO) Panel for the Global Ocean Observing System (GOOS), Dr. Andersen, added his welcome to the participants and thanked Mr. Yihang and his staff for the excellent arrangements for the meeting, both hotel accommodations and facilities, and most importantly staff assistance. He noted the immense task the Panel was facing in the upcoming week and suggested work begin at once to attempt to achieve a final draft of the Strategic Plan for HOTO and develop an outline implementation plan that would consider the initiation of pilot projects and co-ordination with other activities involved in addressing environmental concerns about the marine environment.

2. ADMINISTRATIVE ARRANGEMENTS

The Agenda (Annex 1) was adopted by the HOTO Panel (Annex II). Drs. Huber and Dawson agreed to serve as rapporteurs for the meeting. Mr. Yihang provided the operational details for conducting the meeting at the IOC Sub-Commission for WESTPAC. Dr. Andersen noted that, as before, this work would be accomplished through discussions in plenary, supplemented as the need arose by working groups working outside of or concurrently with the plenary.

3. BACKGROUND INFORMATION

3.1 PRESENT STATE OF GOOS, I-GOOS AND J-GOOS

3.1.1 Report of I-GOOS II

The results of I-GOOS-II were briefly described by Dr. Andersen, specifically noting the recommendations of the HOTO Panel that were forwarded to I-GOOS-II by J-GOOS-II. It was noted that Dr. Rebert, acting Director of the GOOS Support Office, had taken action as requested by I-GOOS-II and participated in the GIPME Officers' Meeting, in June 1995, where several of the recommendations were discussed and advice provided to him for further action.

With regard to the question of the consideration of various commissions and conventions in the development of the Strategic Plan for the HOTO Module, the Panel decided to request the GOOS Support Office to contact these bodies and gather information concerning water quality and consumable fish and shellfish standards. The Chairman will forward this request to the GOOS Support Office.

3.1.2 Report of J-GOOS II

The Summary Report of J-GOOS-II was reviewed by the panel. Panel members considered the remarks made by Drs. McCarthy and Su to be very constructive and agreed that the appropriate parts of the Plan would be reconsidered with these comments in mind. The comments provided by J-GOOS-II were discussed in detail under Agenda Item 5.2.

The Panel took note of the letter from Ms. E. Gross, Executive Director of SCOR that was sent to J-GOOS-II. The Panel thanked SCOR for the offer of support and agreed to take advantage of the offer if and when such support was needed. The Panel instructed the Chairman to forward to Ms. Gross its appreciation of the offer of SCOR.

3.1.3 GOOS Priorities Meeting

Dr. Andersen described the background of the development of the GOOS Priorities Meeting, presently planned to be hosted by the U.S. in Washington in May 1996. In particular, the Panel decided to consider those aspects in the draft GOOS priorities Agreement Document that are related to HOTO Under Agenda Item 6.2. It was reiterated that these priorities would be global, but be comprised of regional constituents.

3.2 STATUS OF THE LIVING RESOURCES MODULE (LMR) OF GOOS

The LMR Module had its first meeting in Costa Rica in December 1993. Dr. Andersen noted that Dr. Brian Rothschild, University of Massachusetts, Dartmouth, is taking the lead in developing the LMR Module, Dr. Andersen reported that he had been in contact with Dr. Rothschild concerning developments in the LMR Module. The Panel took note of the fact that Dr. Rothschild is planning to convene a meeting in mid-January, 1996, to further develop the module. Dr. Bowen agreed to represent the HOTO Panel at this meeting to promote interaction with the Panel, as was specifically suggested by J-GOOS-II. Dr. Bowen was instructed to contact Dr. Rothschild concerning this matter.

3,3 INVOLVEMENT OF IGBP, NATO, AND GEF PROJECTS IN HOTO

3.3.1 JGOFS

Dr. Knap reported that activities in the JGOFS Arabian Sea process Study will be completed with cruises later this year. Time Series programmes in Bermuda and Hawaii should continue through the end of JGOFS in 2003, and there is substantial interest in extending these after that, potentially as a component of GOOS, Another time series programme in the Azores is becoming operational with German funding, and a new programme of cruises to the Southern Ocean will operate in 1996 and 1997. JGOFS will then begin to focus on synthesis and the identification and design of successor projects.

Dr. Andersen reported that the U.S. Department of Energy has terminated its JGOFS activities on carbon measurements on shelf areas and the global survey. This decision is being reconsidered but would have significant adverse impact on JGOFS if not reversed.

3.3.2 LOICZ Core Project of IGBP

Dr. Pernetta, Director of the LOICZ Core Project of the IGBP, briefed the Panel on current developments in the implementation of the project. The Implementation Plan of LOICZ has been approved by the Scientific Committee of the IGBP and was published in 1995. This plan details the nature of the research required to answer the scientific questions outlined in the original science plan of LOICZ.

He informed participants that LOICZ has initiated a number of research activities concerned with quantifying fluxes of carbon, nitrogen and phosphorus in the coastal zone and with the economic valuation of coastal space and resources. In addition, the International Scientific Steering Committee for the Project has recently reviewed nationally funded research that is designated as LOICZ with a view to establishing mechanisms for data management and exchange and the compilation of wider regional and global reviews.

Dr. Pernetta explained that proposals for three regional case studies (i.e., Mediterranean, Southeast Asia, Pacific basin, etc.) remain in the LOICZ Implementation Plan, but that the regional nature of these projects has impeded the provision of funding. The Southeast Asia study is commencing but on a national basis.

The Panel noted that LOICZ probably has stronger links to the Coastal Module of GOOS than to the HOTO Module; the main link between LOICZ and HOTO is with regard to nutrients. It was also noted that Dr. Gomez, a HOTO Panel Member, also chairs the LOICZ Scientific Steering Committee.

3.3.3 GLOBEC

Dr. Andersen, following direction from the IOC Assembly, contacted Dr. Brian Rothschild for the purpose of requesting GLOBEC input to the deliberations of the HOTO Panel and invited him to attend the present meeting. Dr. Rothschild was unable to attend, He did, however, communicate that a decision was taken in Beijing to make GLOBEC a Core Project of IGBP.

Dr. Pernetta re-iterated for the participants that the Scientific Committee of the IGBP had, at its recent meeting in Beijing, approved the Global Ocean Ecosystem Dynamics Project (GLOBEC) as a Core project of the IGBP. He noted that the Science Plan for this project was currently undergoing revision prior to printing and that it would be published in the near future. GLOBEC had four objectives concerned with elucidating multiscale physical forcing of marine ecosystems; the trophodynamic pathways and the role of nutritional quality in food webs; the impacts of global changes on stock dynamics using coupled models; and how changing marine ecosystems will affect the Earth system.

The Panel noted that GLOBEC has higher relevance to the envisaged Living Marine Resources Module of the GOOS than to HOTO.

3.3.4 NATO-TU Black Sea Project

The present status of this project was briefly discussed by Dr. Andersen, who noted that the project is in its 3rd of 5 years. Data collection continues with a view to merge physical circulation and ecosystem modules. A data base is being generated that is being shared between the countries involved. This project is being kept informed of developments in the HOTO Module with a view to the possibility of implementing a pilot project in the region, in collaboration with the GEF Black Sea Environment Programme. A major meeting is being planned for next June where results to date will be presented.

3.3.5 GEF Black Sea Environmental Programme

Dr. Andersen informed the Panel that this programme is in its third year of implementation. An inventory of Black Sea environmental data is being finalized, in collaboration with other programmes active in the region, dating back 20 or more years. Training has and is being provided by the GIPME expert groups to facilitate the initiation of monitoring activities in the region. As a result, all developments with regard to the HOTO Module of GOOS are being provided to this GOOS activity. It is anticipated that a Mussel Watch Project will begin in the near future where the HOTO Scientific Plan and its objectives will be used as guidance,

It was noted that Professors Depledge, Michael Moore (Plymouth Marine Laboratory) and Tony Underwood (University of Sydney) have conducted training exercises in the region on biomarker

techniques and sampling design. These were very successful and the techniques are being built into several programmes. GEF has donated equipment to establish a pesticides analysis laboratory. There is an urgent requirement for contamination data and this new laboratory will collaborate with MESL, MEL, Monaco, in bivalve sampling and analysis. Advance data on land-based sources is being sought.

Dr. Bewers reported on the successful completion of the site visit to Odessa, Ukraine, requested by Dr. Mee to assist in the design and execution of a survey of the northern Black Sea, This visit had been followed by a further visit by Dr. Jean-Pierre Villeneuve, MESL, ILMR, Monaco, to ensure the installation of the necessary instrumentation at the Ukrainian Institute for Research on the Ecology of the Sea.

It was noted that it was difficult to get scientists in the region to appreciate the pragmatic nature of the requirements for data with which to assess the state of the Black Sea. The demand for such data is perceived by many Ukrainian scientists as detracting from their primary interest, which is to conduct marine scientific research. The visiting team had to overcome some of their reservations. It was able to assist in the formulation of a survey design that was both within the capabilities of the Ukrainian Institute and able to provide the most expedient set of data with which to determine the scale of anthropogenic influence on the northern Black Sea environment.

All those involved in the support to the GEF Black Sea Environment Programme expressed their gratitude to Dr. Mee for his guidance and assistance in this work, The direct contact between the BSEP/PCU in Istanbul and the two GIPME Groups of Experts (GEMSI and GEEP) has facilitated an improved contribution to the work under the BSEP and the GIPME officers are very positive about the continuation of this co-operation'.

3.3.6 GEF-UNDP-IMO Regional Programme for Marine Pollution Prevention and Management of the East Asian Seas

The GEF-UNDP-IMO Regional Programme on Marine Pollution Prevention and Management in the East Asian Seas (MPP-EEAS) aims at assisting its eleven participating countries in their efforts to address marine pollution problems arising from both land -and sea- based sources through demonstration projects, ratification of marine pollution-related international conventions, pollution monitoring, capacity building and financing sustainability.

The marine pollution monitoring component of the Programme is particularly relevant to the work of the HOTO Panel. Its major activities include:

(i) establishing a regional network of marine pollution monitoring programmes at the coastal management demonstration sites based on agreed standard sampling and analytical techniques;

(ii) increasing the technical capacity of Cambodia, Vietnam and DPR Korea to participate in regional marine pollution monitoring programmes; and

(iii) contributing to the preparation of the State of Marine Pollution in the East Asian Region Report.

The project will have a finite lifespan, probably 3-5 years, but upon completion could provide the basis for a long-term component of HOTO. The MPP-EAS hopes to establish close consultation and collaboration with the Panel in developing and strengthening its regional and subregional marine pollution monitoring programmes. The project steering committee will meet in Phuket in December 1995.

Mr, Yihang informed the meeting on the co-operation and co-ordination with the project by indicating that the co-ordination of the project needs to be strengthened within existing mechanisms, e.g. GIPME.

3.4 STATUS OF THE DRAFT STRATEGIC PLAN FOR THE HOTO MODULE

The most recent version (i.e. June, 1995) of the Plan, which was developed over the last intercessional period of the Panel was distributed. It was pointed out by Dr. Andersen that it needed revision in light of the guidance provided by J-GOOS-II and additional development of issues relating to human health and LOICZ. With these actions and additional amendments to the Plan, hope was expressed that the product could be submitted to J-GOOS-Ill as a final draft by next April.

3.5 GLOBAL PROGRAMME OF ACTION FOR THE PREVENTION OF MARINE POLLUTION FROM LAND-BASED ACTIVITIES

An Intergovernmental Conference to adopt a Programme of Action for the Prevention of Marine Pollution from Land-Based Activities was held in Washington, D. C., 24 October -3 November, 1995. Dr. Bewers, who represented IOC/UNESCO at the Conference, summarized its main conclusions. The Action Programme addresses financial, institutional and strategic aspects of the protection of the marine environment from the adverse effects of persistent organic chemicals, radionuclides, heavy metals, nutrients, sewage and hydrocarbons, the mobilization of sediments and habitat destruction. It requires the development of national plans for action to restore affected areas and to prevent adverse effects of land-based activities preparatory to a further intergovernmental meeting in approximately 3 years' time. Both regional and international consultative mechanisms and responsibilities are also specified in the Action Programme.

UNEP will provide the Secretariat to this agreement and is charged with undertaking inter-agency consultations to ensure the necessary scientific, financial, institutional and quality assurance support for the Action Programme.

The relevance of this agreement to the HOTO Module of GOOS is that there now exists an international requirement for attention to degradation of the marine, especially coastal, environment from the effects of land-based activities including the introduction of contaminants to the sea. Assessment of coastal marine area degradation by chemicals, radionuclides, sewage, nutrients, habitat modification and sediment mobilization will require scientific information and monitoring. Both of these tasks are identified in the HOTO Module and should also constitute an important part of the Coastal Module of GOOS. It was noted that all the relevant analytes and measurements bearing on the sources of degradation addressed by the Action Programme adopted at Washington are covered by the existing design of the HOTO Module.

4. REVIEW OF THE TERMS OF REFERENCE FOR THE J-GOOS HOTO PANEL

A slight modification in the Terms of Reference was suggested by J-GOOS-II to add monitoring activities. The Panel accepted the suggested change to its Terms of Reference. The issue of co-ordination with other modules was felt to be primarily the responsibility of the GOOS Support Office at this time.

5. COMPLETION OF THE STRATEGIC PLAN FOR THE HOTO MODULE OF GOOS

5.1 INTRODUCTION OF HUMAN HEALTH ISSUES

Dr. Patz presented a general review of the relationships between GOOS and human health issues. All modules except Marine Services have clear human health components/implications. The relationship between ecosystem and human health is receiving increased attention among public health practitioners.

Dr. Patz also requested that the Panel consider the applicability of the Large Marine Ecosystem (LME) approach as a framework for implementation of HOTO. The Panel noted that the 49 identified LME's did not encompass all of the coastal shelf areas and had been defined specifically for fisheries

management purposes, The concept was therefore felt to be inappropriate for use in designing the HOTO sampling strategies.

Dr. Islam presented the status of research on the association of the cholera pathogen *Vibrio cholera* and cyanobacteria. This association is best demonstrated in freshwater environments, but there are marine cyanobacteria that may be potential hosts for V. *cholera.*

The Panel agreed to address sections of the HOTO Strategic Plan to reflect the comparative importance of public health issues and how the HOTO Module can be used to assist and enhance efforts directed at reducing public health risks. In particular, section 4.1.2 of the Plan needs modification to better include naturally occurring as well as introduced pathogens and their effects.

5.2 REVIEW OF J-GOOS-II COMMENTS REGARDING THE HOTO PLAN

The Panel expressed general concern at the apparently high degree of overlap between the HOTO Module and the Coastal and LMR Modules. They felt that this overlap results in large part from the lack of clear definitions of the scope, goals and objectives of the various Modules. The situation is further confused by the existence of differing Terms of Reference (TOR) for the HOTO module. The Panel agreed to base its work upon the Terms of Reference in the HOTO Strategic Plan, with the revision adopted earlier in the meeting.

Particular reference was made to paragraphs 35-42, page 7, of IOC-WMO-lCSU/J-GOOS II/3.

Regarding paragraph 35,

(i) the Panel felt that HOTO should not necessarily be monitoring for climate change effects but that adding the analysis of algae for the purposes of monitoring harmful effects associated with marine algal blooms (i.e., toxins, etc.) would be appropriate.

(ii) Drs. Bewers, Bowen and Depledge agreed to examine the strategic plan with regard to broadening the focus on damage assessment to consider the need for predictive capability.

The points (i.e., paragraph 38) that the physics of the system needed to be considered, and that the HOTO Module should be specific about its measurement requirements viz. the other GOOS modules were well taken. Circulation and other physical parameters will particularly affect sampling design and operational implementation.

The Panel noted and discussed in depth the contents of the TOR for the Coastal Module of GOOS; the Draft Workshop Outline for the LMR Module, and the recommendations for J-GOOS regarding the HOTO Module (Annexes XIII, XII, and XI of the report of J-GOOS-II). The Panel also noted with regret that development of the LMR and Coastal Modules had not proceeded in parallel, that planning for the other two modules was less advanced than that for the HOTO Module, and that this had impaired adequate consideration by the HOTO Panel of potential linkages and interactions with the other modules. Since the measurements planned for inclusion in the other two modules have yet to be specified in detail, the Panel was unable to identify which of these are also required to achieve the objectives of the HOTO Module. As presently outlined there is clearly considerable overlap between the planned components of the HOTO Module and those identified for possible inclusion in the LMR Module.

Of greater concern to the HOTO Panel were the draft TOR for the ad hoc group for the Coastal Module since:

(i) while the Panel recognized the importance of the principle variables now at the core of the existing TOR, the Panel was concerned that their emphasis has evolved at the cost of other, equally important, variables directed at incorporating Coastal and management and human use issues, as originally envisaged in the *"Approach to GOOS";*

(ii) the tasks specified in the TOR make no mention of the need to review coastal management issues and concerns as the basis for identifying variables to be measured, yet the underlying philosophy for the development of GOOS includes such considerations and indeed the definition of the module states that *"This coastal module will provide infrastructure for coastal area management;"*

(iii) these tasks contain no reference to the HOTO Module and the need for the newly established *ad hoc* Panel to review the contents of the HOTO Strategic Plan;

(iv) there is considerable overlap between the definition of the Coastal Module contained in the TOR and those of the HOTO Module; and

(v) no reference is made to the work of the Expert Meeting convened by the IOC in December 1990 to consider and advise on the development of a Long-term Monitoring System for Coastal Phenomena related to climate change, or to the development of the pilot projects proposed by that expert group and subsequently endorsed and approved by the IOC Assembly, a number of which have been initiated. The report of the Expert Meeting provides a scientific rationale for coastal monitoring, statements of principle, details of environmental variables likely to be of importance to the LMR, Coastal, and HOTO Modules of GOOS, and also provides a substantial planning base upon which to develop further the structure and purposes of the coastal module,

The Panel instructed the Chairman of the HOTO Panel to convey these concerns and views to the Secretary of the IOC, the Director of the GOOS Support Office, the Chairman of J-GOOS, and the Chairman of the ad hoc Panel.

Prof. Depledge agreed to provide more detail concerning research needs and operational development of biological distress indicators (i.e., paragraphs 40-41). This will include specific examples of present uses of such indicators, and also address their predictive power.

The J-GOOS request that the HOTO Panel identify bench marks for judging progress in the full implementation of the HOTO Module (i.e., paragraph 42) was questioned by the Panel. It may well be appropriate to construct a plan for regional area implementation (eg. setting up a monitoring system for HAB or protection of edible seafood) that includes bench marks defining the extent of full implementation. However, it is questionable whether such benchmarks, applicable to' specific measurements, would be applicable on a full global scale. It might be more appropriate to represent the extent of global coverage by HOTO on the basis of the progress is regional coverage towards full oceanic implementation.

Bench marks of progress can be related to the priorities chart of the strategic plan as well as the bench marks for progress to be made through setting of research priorities.

The Panel further discussed the meeting report of J-GOOS-II and expressed concern about the relationship between the research and monitoring priority planning carried out by the Scientific Panels and the process of GOOS implementation. Figure 1 of the J-GOOS-II report shows the provision of input through a number of intermediary groups. In discussions on implementation by the HOTO Panel, it was clear that an active connection between the science-based planning group and implementation of GOOS in regions is essential. The description of the Module needs to be continually updated as a living document as GOOS is implemented in the regions, The HOTO Panel would like J-GOOS to consider the development of mechanisms that establish a much more formal link between scientific strategy and implementation.

5.3 REASSESSING/REDEFINING THE CONTAMINANTS/ANALYTES

The Panel re-examined the list of analytes in the Strategic Plan and agreed that it was not necessary to include new analytes or exclude existing ones. It was noted, however, that this issue should be revisited as part of the continual evolution of the Strategic Plan, in concert with the development of an Implementation Plan.

5.4 FINALIZATION OF THE HOTO STRATEGIC PLAN

The HOTO Strategic Plan was modified and finalized in light of the above discussions. This activity occupied the bulk of the third HOTO Panel meeting.

The Panel agreed that the HOTO Strategic Plan should be seen as a continually evolving document that needs to be periodically revisited and updated to reflect new scientific developments and changing international circumstances and priorities. It should be noted that this is a change in the approach that had been taken by the Panel. Essentially it will be an iterative process in combination with development of implementation plans and activities.

6. FOLLOW-ON AND FUTURE ACTIVITIES

6.1 INITIATION OF A HOTO IMPLEMENTATION PLAN

A number of issues and activities relevant to HOTO implementation were discussed. In order to progress in the development of pragmatic early diagnostic tools for the detection and assessment of biological effects it is desirable to obtain funding at national and regional levels. For example, in the UK it may be possible to establish a national programme that can contribute to HOTO. A Thematic Programme has been proposed to NERC which will fulfill specific HOTO objectives (see Annex Ill).

Dr. Knap reported that the EU Marine Science and Technology Programme (MAST) has provided funding for cross-linking of measurement technology. One problem is that data collection agencies are under increasing pressure to charge for data, which reduces data availability and exchange. He was instructed by the Panel to transmit its concern to the Chairmen of J-GOOS and I-GOOS.

Dr. Gray briefly presented some issues related to sampling design. The first was the need for power analysis, that is, determining the level of Type II error (i.e., failing to detect a real change/effect), as opposed to Type I error (i.e., falsely concluding that there is a real change/effect). Unless statistical power is considered at the outset, a monitoring programme may be fundamentally unable to achieve its goals. A key point is that it is essential to receive direction from managers and decision makers as to the magnitude of change that must be detected by a monitoring programme. Achieving an acceptable Type II error rate usually requires accepting an increased Type I error rate.

The second point was that monitoring requires multiple controls, and that at least some of these should be beyond the spatio-temporal scale of the effect/impact in question. The question was raised whether sampling can be designed on a global vs. local scale, and how does one design controls for global impacts.

The third point was the need to design time-series sampling to fit the question being asked. This usually means that sampling at arbitrary regular intervals is inappropriate. Temporally random sampling is often desirable, though this tends to become less important as the length of the time-series increases,

Unlike the Climate Module of GOOS, which is directed towards the observation of global changes, the Health of the Oceans Module is concerned with issues, trends and changes in the state of the marine environment that are ubiquitous or widespread, but do not necessarily reflect the condition of the global marine system. It has been estimated that as much as 90% of all land derived contaminants entering the marine environment remain within the continental shelf seas and while transboundary dispersion of such materials is of national and regional concern, such problems vary in both their nature and scale from region to region. Some problems, such as nutrient enrichment of coastal waters from sewage discharge are universal, while others, such as contamination from hydrocarbons, trace metals and xenobiotic chemicals, are likely to be less ubiquitously and uniformly distributed.

6.1.1 Pilot Project in WESTPAC

It was agreed that discussion of a specific pilot project in the WESTPAC Region could and should be developed in a wider context. Therefore, WESTPAC was discussed not only in this Agenda Item, with what follows, but also under Agenda Items 6.1.2, 6.1.3 and 6.1.4.

While the HOTO Strategic Plan details the universal nature of the HOTO Module, it is clear that the Implementation Plan for the HOTO Module of GOOS must reflect the regional priorities and problems. It is likely that some classes and even, individual analytes and measurements, will be found to be of common interest among all regional components of a Global HOTO; others may be of concern or measured only in regions where the they are considered to be of priority (petroleum hydrocarbons, for example, are likely to differ in priority from region to region). Recognizing this, the HOTO Panel proposed that HOTO Implementation, during its pilot phases, should focus on a minimum of two and preferably seven regional components. Implementation Plans for seven regions (Red Sea; Southeast Asia; North Sea; Arctic Ocean; the Mediterranean, the Black Sea and the NEAR-GOOS Region) should be developed as options for devising blueprints for global implementation and for testing the validity of the basic HOTO design. These regions have been selected specifically to span a range of extremes (i.e., most diverse) in terms of the regionally important issues and problems, the socio-economic conditions and development status of the countries bordering them, and range of latitudes.

It was, therefore, recommend that designated individuals. be assigned the task of developing such blue-prints for a minimum of the two, and preferably seven regions, within a three month period and that subsequent to their completion, the Panel review the blue-prints that have been developed, to compare and contrast the regional plans; to identify the elements of commonality and difference: and to suggest the route to be taken for developing an Implementation Plan for global initiation of the HOTO module of the GOOS, This, of course, will be at the discretion of the J-GOOS.

The Panel agreed to approach implementation by first designing a general framework for implementation and then designing implementation strategies for pilot projects in at least two and preferably seven widely contrasting regions. This will test the robustness of the Strategic Plan and general implementation strategy and serve as a check on the *"Living Document"* approach. Drs. Bewers and Pernetta agreed to prepare a draft implementation framework (See Annex IV). Dr. Halim agreed to begin preparing a strategy for the Red Sea; Dr. Gomez a strategy for Southeast Asia; and Dr. Su a strategy for the NEAR-GOOS Region See Agenda Item 6.1.3 below), Dr. Bewers agreed to prepare a strategy for the Arctic, subsequent to this meeting. The draft strategies for the three regions identified above are contained in Annex IV.

6.1.2 Collaboration with the International Mussel Watch Project

Pacific Rim - The HOTO Panel was reformed that Phase II was discussed at a preliminary workshop organized at the U.N. University in Tokyo in December 1992. This was followed up with further planning at the WESTPAC Symposium in Bali in November 1994. The UNU has been given the responsibility of organizing the Asia Pacific Mussel Watch on behalf of UNEP, IOC and the International Mussel Watch Committee. Dr. Kathy Burns is trying to find Australian funds to extend the programme to the Australian Region and Pacific Ocean. UNU (i.e., Dr. Tanabe, the organizer of this phase of the International Mussel Watch Project) has accepted Monaco as the check laboratory but no such acceptance was made in relation to the laboratory at Texas A&M University. The GIPME Officers at their meeting in June 1995 proposed that both UNU and Monaco be involved in the next round-robin based on the use of GESREM Il. Dr. Manfred Nauke, IMO, at the same meeting, proposed some additional agencies that might be approached for additional funding, and he will be providing addresses to Dr. Dawson for approaches to made from the Southeast Asian region. Dr. Depledge indicated during the meeting that there might be easy mechanisms for including biological condition measurements that could provide supplementary information on the health of theanimals sampled for chemical analysis, This would provide an improved basis for interpreting the incidence of organic chemicals and their effects. It was pointed out that the biological information collected during the American Mussel Watch Programme would be worth examining to see what could be gleaned from it that might aid interpretation of the chemical distributional information. UNU is proposing to hold a meeting in the near future in Italy to carry out more detailed interpretation of the Latin American Mussel Watch data.

Caribbean Sea - The HOTO Panel - was informed that the First Phase of the IOC-UNEP International Mussel Watch Project had been successfully carried out during 1991 and 1992. More than 300 samples from almost 80 sites along the South American, Central American and Caribbean coastlines were collected. Samples from all sites were shipped to a central analytical laboratory at Texas A&M University and the IAEA laboratory in Monaco. Analyses focused on chlorinated pesticides and PCBs. Analyses of other chemicals of environmental concern may be undertaken in the future using archived samples. It was pointed out that this initial phase has

(i) generated high-quality data on chlorinated pesticide and PCB concentrations in the Central/South American-Caribbean Region;

(ii) served as a *"field test"* (e.g., pilot project) of a large international marine monitoring programme for chemical contaminants;

(iii) created a western hemisphere international network of coastal environmental scientists; and

(iv) provided a forum for training and discussing analytical results; and 50 created the institutional structure for a global scale coastal monitoring programme.

Indian Ocean - The International Mussel Watch Project - in the Indian Ocean is in the preliminary stages of planning, It is expected that it will sample sites along the Indian, East African and Mauritius coasts. It will also include two specific studies:

(i) an investigation of the possibilities of identifying species of mussels and oysters, using molecular markers (i.e., comparison of DNA sequences), and

(ii) test and calibration of storage and analytical techniques for sample tissue. Preliminary studies have already been carried out in the later study. At present it is anticipated that the support of this phase will be provided by SIDA-SAREC (Sweden), IOC and UNEP, probably going to the Swedish Museum of Natural History in Stockholm.

6.1.3 Collaboration with NEAR-GOOS

Prof. Su briefed the Panel on the status of WESTPAC programmes, particularly the Northeast Asian Regional GOOS (NEAR-GOOS). NEAR-GOOS involves studies of the Bohai Sea, Sea of Japan, East China Sea, and Yellow Sea, and is supported by the countries surrounding the area. The Programme will involve the collection, processing, and exchange of data, and dissemination of interpretive products, from a network of existing buoys and tide stations, satellite receiving stations, as well as standard oceanographic sections. Variables to be measured are primarily physical and include temperature, salinity, current speed and direction, wave climate, sea level, meteorological data. Some chemical variables including nutrients, dissolved oxygen, and pH will also be measured. GTS data will be down-loaded to the NEAR-GOOS System as an important source of information for the operation of the Programme. One outcome will be to demonstrate operational oceanographic monitoring capability for GOOS. A NEAR-GOOS plan will be presented at the WESTPAC Ill meeting in February 1996, Prof. Su said that WESTPAC welcomes interaction with HOTO with regard to the Project.

6.1.4 Collaboration with other programmes/projects

The HOTO Panel agreed that the International Coral Reef Initiative and the UNEP-lOC-WMO-IUCN Pilot Project on Monitoring Coral Reefs were relevant to GOOS and fall within the scope of the objectives of the HOTO Module,

The Panel reiterated its request that the GOOS Support Office identify the various conventions relevant to HOTO with regard to standards and related issues, It was felt that in general links to the various conventions will arise on a regional basis as pilot projects come on line.

6.2 HOTO PANEL INPUT TO GOOS PRIORITIES DOCUMENT

The HOTO Panel discussed the November, 1995 draft version of this document in detail and noted a major discrepancy between perceived measurement priorities compared to those discussed in HOTO Panel reports (Figure 2, as an example). It is important that this be resolved. Accordingly, the HOTO Panel directed the Chairman to bring to the attention of J-GOOS, Annex V of this report, which details HOTO concerns.

7. FUTURE ACTIVITIES

7.1 MEMBERSHIP/COMPOSITION

The HOTO Panel discussed implementation and the future role of the present Panel. The members felt that it would be challenging to move the HOTO Strategic Plan into an implementation phase for a few specific regions. This action would develop a usable framework for such activities and the HOTO Panel expressed interest in developing an operational plan as a model for other regions (See Agenda Item 6.1), It is clear that the membership of the Panel should be supplemented with experts from the regions of interest. The Panel noted, however, that the development of Regional Implementation Plans would only be achieved if proper resources and funds are identified and allocated by the sponsoring agencies or national sources for such purposes.

7.2 REPORT TO J-GOOS-Ill

The HOTO Panel instructed Dr. Andersen to provide the Chairman of J-GOOS a copy of this summary report, when finalized, and to report to J-GOOS-III, April, 1996, on its contents,

7.3 INTERACTION WITH OTHER BODIES

The HOTO Panel felt that in addition to other bodies identified in this report, it would be beneficial to interact with ICES and PICES, It was felt that with regard to ICES, the best mechanism for this linkage would be through EURO-GOOS, particularly in light of the proposal being submitted to NERC (See Annex Ill), With regard to PICES, it was felt that this organization should be approached directly, However, before doing this, guidance should be sought from J-GOOS,

7.4 FURTHER WORK/ACTION ON THE HOTO STRATEGIC PLAN

The HOTO Panel felt that the Strategic Plan could be completed through correspondence, making use of the progress made at this meeting. This final draft would be then submitted to J-GOOS-III for further action, if any, that was deemed necessary, With regard to further work of the Panel, reference was made in Agenda Item 7.1 to embarking on the development of an Implementation Plan through the mounting of pilot projects in various regions. The Panel recognized that this is a matter for J-GOOS to decide,

7.5 DATE AND VENUE FOR THE NEXT SESSION OF THE HOTO PANEL

Based on the substance of Agenda Item 7,3, consideration of this will only be entertained after J-GOOS makes its recommendations on any further work that the Panel should undertake.

8. CLOSURE

The Chairman thanked all the participants of the meeting for devoting their time and energies to meeting the objectives of the HOTO Panel. He particularly thanked Mr. Yihang and the support staff for all their dedication in getting all the work done in a timely manner and with outstanding quality. The meeting was adjourned at 15:00 hours, 21 November 1995.

ANNEX 1

AGENDA

1. OPENING

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

2.2 DESIGNATION OF A RAPPORTEUR

2.3 CONDUCT OF THE SESSION AND OPERATIONAL DETAILS

3. BACKGROUND INFORMATION

3.1 PRESENT STATUS OF GOOS, I-GOOS AND J-GOOS

3.1.1 Report of I-GOOS II
3.1.2 Report of J-GOOS-II
3.1.3 GOOS Priorities Meeting, May 1995, Washington, DC, USA

3.2 STATUS OF THE LIVING MARINE RESOURCES (LMR) MODULE OF GOOS

3.3 INVOLVEMENT OF IGBP, NATO AND GEF PROJECTS IN HOTO

3.3.1 JGOFS
3.3.2 LOICZ
3.3.3 GLOBEC
3.3.4 NATO-TU Black Sea Project
3.3.5 GEF Black Sea Environmental Programme
3.3.6 GEF/UNDP/IMO Regional Programme for Marine Pollution Prevention and Management of the East Asian Seas.

3.4 STATUS OF THE DRAFT STRATEGIC PLAN FOR THE HOTO MODULE

3.5 LBS MEETING (WASHINGTON, DC, OCTOBER 1995) RESULTS AND IMPACT ON HOTO

4. REVIEW THE TERMS OF REFERENCE FOR THE J-GOOS HOTO PANEL

5. COMPLETION OF THE STRATEGIC PLAN FOR THE HOTO MODULE OF GOOS

5.1 INTRODUCTION OF HUMAN HEALTH ISSUES

5.2 REVIEW OF J-GOOS-II COMMENTS REGARDING THE HOTO PLAN

5.3 REASSESSING/REDEFINING THE CONTAMINANTS/ANALYTES

5.4 FINALIZATION OF THE HOTO STRATEGIC PLAN

6. **FOLLOW-ON AND FUTURE ACTIVITIES**

6.1 INITIATION OF A HOTO IMPLEMENTATION PLAN

6.1.1 Pilot Project in WESTPAC
6.1.2 Collaboration with the International Mussel Watch Project
(a) Pacific Rim
(b) Caribbean Sea
(c) Indian Ocean
6.1.3 Collaboration with NEAR-GOOS
6.1.4 Collaboration with other programs/projects

6.2 HOTO PANEL INPUT TO GOOS PRIORITIES DOCUMENT

7. FUTURE ACTIVITIES

7.1 MEMBERSHIP/COMPOSITION

7.2 REPORT TO J-GOOS-lll

7.3 INTERACTION WITH OTHER BODIES

7.4 FURTHER WORK/ACTION, IF REQUIRED, ON THE HOTO STRATEGIC PLAN

7.5 SUGGESTIONS FOR DATE AND VENUE OF NEXT HOTO PANEL ACTIVITY TO J-GOOS

8. CLOSURE

ANNEX II

LIST OF PARTICIPANTS

1. PANEL MEMBERS

Prof. Dr. Neil R. Andersen (Chairman)
University of Maryland
Horn Point Environmental Laboratory
P. O. Box 775
Cambridge, MD 21613 USA
Tel: 410-221-8479 (Private)
410-228-8200 Ext. 8479
Fax: 410-476-5490
E-mail: andersen@hpel.cees.edu

Dr. J. Michael Bewers
Head, Marine Chemistry Division
Bedford Institute of Oceanography
P.O Box 1006 Dartmouth
N.S. Canada B2Y 4A2
Tel: 902-426-2371
Fax: 902-426-6695
E-mail: m_bewers@bionet.bio.dfo.ca

Assoc. Prof. Dr. Robert E. Bowen
University of Massachusetts
Environmental Sciences Program
Boston, M.A 02125-3393, USA
Tel: 617-287-7443
Fax: 617-287-7474
E-mail: bowenr@umbsky,cc.umb.edu

Prof. Dr. Michael Depledge
Director
Plymouth Environmental Research Centre
University of Plymouth
Drake Circus, Plymouth
PL 48 AA UK.
Tel: +44 1752233-038
Fax: +44 1752233-039
E-mail: mdepledge@plymouth.ac.uk

Prof. Dr. Edgardo D. Gomez
Marine Science Institute
University of the Philippines
Tel: 63-2922-3921 ; 922-3959
Fax: 63-2924-7678
E-mail: admin@msi.upd.edu.ph

Prof. Dr. John S. Gray
Section of Marine Zoology, Marine Chemistry
Biological Institute, University of Oslo,
P. O. Box 1064 Blindern, 0316 Oslo, Norway
Tel: 47-2285-4510
Fax: 47-2285-4438
E-mail: j.s.gray@bio.uio.no

Prof. Dr. Youssef Halim
Faculty of Science
Alexandria 21511
Egypt
Tel: 203 5869661
Fax: 203 5457611
E-mail: hummon@alex.eun.eg

Dr. Michael E. Huber (Co-Rapporteur)
Scientific Director
Orpheus Island Research Station
P.O Box 4
Halifax, QLD 4850, Australia
Tel: 61-77-777336 ext 21
Fax: 61-77-777336
E-mail: michael.huberr@jcu.du.au

Dr. Anthony H. Knap
Director
Bermuda Biological Station for Research, Inc
Ferry Reach
Bermuda GE.01
Tel: 441-2971880 ext. 244
Fax: 441-297-0860
E-mail: knap@bbsr.edu

Jonathan Patz, MD, MPH
Research Associate
Dept. Occupational & Environmental Medicine
615 W. Wolfe St. Rm.#704
Balto MD 21205-2179
Tel: 202 2605874
Fax: 202 2606405
E-mail: jpatz@phnet.sph.jhu.edu

Dr. Md. Sirajul Islam
Scientist & Head, Environmental Microbiology Laboratory
IC DDR, B. GPO Box-128
Dhaka-1000, Bangladesh
Tel: 600171 -8/2405
Fax: 880-2-883-116
E-mail:
sislam%cholera@external.ait.ac.th

II. SECRETARIAT, IOC SUB-COMMISSION FOR WESTPAC

Mr.Yihang Jiang
Deputy Director
IOC Regional Secretariat
196 Phaholyothin Rd., Chatuchak
Bangkok 10900, Thailand
Tel: 66-2561 5118
Fax: 66-25615119
E-mail: oijyh@chulkn.chula.ac.th

III. WESTPAC

Prof. Dr. Jilan Su **(Chairman)**
Second Institute of Oceanography
State Oceanic Administration
P.O. Box 1207
Hangzhou, Zhejiang, 310012, China
Tel: 86-571-884-0332
Fax: 86-571-807-1539
E-mail: sujil@bepc2.ihep.ac.cn

IV. GLOBAL CHANGE PROGRAMS

Dr. John C. Pernetta
LOICZ Project Director
LOICZ Core Project Office
NIOZ, P.O. Box 59
1790 AB Den Burg, Texel
The Netherlands
Tel: 31-222-369404
Fax: 31-222-369430
E-mail: loicz@nioz.nl

Dr. Antony Knap
JGOFS Representative
(See above)

V. INTERNATIONAL MUSSEL WATCH PROJECT

Prof. Dr. Rodger Dawson **(Co-Rapporteur)**
Chesapeake Biological Laboratory
University of Maryland
p. O. Box 38
Solomons, MD 20688, USA
Tel: 410-326-7394
410-326-4281 (General No.)
Fax: 410-326-7210
E-mail: dawson@cbl.cees.edu

VI. OBSERVERS

Ms. Kim-Looi Chung
Programme Officer
Regional Coordinating Unit
East Asian Seas Action Plan
UNEP, 10th floor UN building
Rajadamnern Ave. Bangkok 10200
Thailand
Tel: 662-288-2084
Fax: 662-267-8008
E-mail: chngorg.unescap@un.org

Prof. Dr. Manuwadi Hungspreugs
Department of Marine Science
Chulalongkorn University
Phya Thai Rd. Bangkok 10330, Thailand
Tel: 662-218-5409
Fax: 662-251-1951
662-218-5409
E-mail: hmanuwad@netserv.chula.ac.th

Ms. Sunee Suvapepun
Director of Bangkok Marine Fisheries Development Center
Marine Fisheries Division, Fisheries Department
89/1 Charoenkrung 58,
Soi Sapanpla Yannawa
Bangkok 10120 Thailand
Tel: 662-211 -4981-2
662-211-4180 .
Fax: 662-211-0461

Dr. Suvit Vibulsresth
Secretary-General
National Research Council of Thailand
196 Phaholyothin Road
Chatujak
Bangkok 10900 Thailand
Tel: 662-579-2281
Fax: 662-561-3035

ANNEX III

ASSESSMENT AND PREDICTION OF THE HEALTH OF THE OCEANS (HOTO)

This is a proposal to the NERC Marine Science and Technology Board for a Thematic Research Programme by Prof. M. H. Depledge, Plymouth Environmental Research Center, University of Plymouth and Prof. M. N. Moore, Plymouth Marine Laboratory/CCMS.

1. OVERVIEW

Two billion people world-wide rely directly on the productivity of the oceans for their food supply. The oceans also exert crucial influences on global energy cycles and biological processes upon which all life depends. The UK Government is committed to sustainable development of the oceans. This entails effective utilization of marine resources and maintenance of environmental quality through the rigorous control of waste releases into the seas, To achieve this end, it is necessary to devise more effective ways of assessing the well being of marine biota, and to develop predictive capabilities regarding the impacts of natural and anthropogenic stresses on marine ecosystems.

An international programme, the Global Ocean Observing System (GOOS), is currently being established to monitor physico-chemical changes in the World's oceans. This will provide the basis for more accurate weather forecasting, long term assessment of climatic change and detection of alterations in ocean currents. However, to assess the health of marine biota and predict ecological changes, it has been necessary to develop a special module of GOOS, the Health of the Oceans (HOTO) Module, The purpose of this document is to propose a UK HOTO research programme which will bean integral component of the overall HOTO Module of GOOS and which will address the coastal and shelf sea problems of the UK.

II. BACKGROUND

It is widely accepted that the open oceans have not been significantly impacted by Man's activities to date (see GESAMP reports). In contrast, the shelf and coastal seas around UK are under heavy pressure from diverse stressors including toxic chemicals, radionuclides, increased UV-B radiation, nutrient enrichment, hypoxia, pathogen-induced disease, land reclamation and habitat disturbance. It is the responsibility of environmental managers and legislators to regulate anthropogenic stressors and prevent over-exploitation of the seas, to ensure maximum commercial utility, while preserving an acceptable and sustainable environmental quality, In the UK, high quality, in-depth research which is relevant to the above issues has been pursued with vigor over many years, in diverse disciplines including environmental chemistry, molecular toxicology, cellular pathology, ecology, ecophysiology and ecotoxicology. The knowledge accumulated now needs to be brought together in the context of sustainable development and potential threats to human health.

III. PURPOSE & AIMS

The purpose of the proposed programme is

(i) to bring together relevant scientific approaches and knowledge to permit holistic assessments of the status of marine ecosystems around the UK and elsewhere;

(ii) to develop a predictive risk capability regarding likely changes and trends in marine ecosystems that will result from the politics and management action of the UK Government; and

(iii) to create a research programme that will involve young scientists in multi-disciplinary environmental research, thereby providing excellent scientific training in diverse areas, coupled with the team building necessary to meet environmental challenges of the future.

The proposed thematic programme is aimed at stimulating operational research which leads to:

(i) the development and validation of hypotheses and techniques which address specific deficiencies either in conceptual or methodological aspects of marine ecotoxicology (examples are provided below);

(ii) the development of pragmatic, multi-variate approaches which combine measurements made at several different levels of biological organization to reveal characteristic patterns of population, community and ecosystem response associated with environmental perturbation. This is analogous to the epidemiological approach that has been used so successfully in medicine; and

(iii) the development of effective computer models which contribute to risk prediction and which are based on a mechanistic understanding of physically - and chemically - induced changes in populations and communities of marine biota.

IV. DESCRIPTION & WORK PROGRAMME

A thematic programme cannot hope to address all of the components relevant to a comprehensive environmental health assessment. However, two specific areas where research is urgently required can' be identified and will form the core of the programme. These are:

(i) the holistic interpretation and utilization of diverse environmental data obtained from studies carried out at several levels of biological organization (ranging from the molecular to the ecosystem level);

(ii) the prediction of risk to marine ecosystems based on robust ecotoxicological models of exposure and effect.

The work programme will address specific deficiencies either in conceptual understanding or in measurement techniques which have impaired risk assessment in the past. For example, there is a lack of predictive ability regarding; concentrations of contaminants in tissues and the biological effects they give rise to; how intra - and inter - specific variability influences responses to contaminants/physical disturbances; identification of species that are particularly susceptible to specific stressors; how temporal and spacial ecological changes relate to sub-organismal markers/indicators of contaminant exposure. This latter topic complements research on the development of biomarkers which will be a component of the NERC Environmental Diagnostics Programme. With,' regard to techniques and measurement procedures, suitable methods for assessing behavioral abnormalities associated with physical and chemical disturbances are currently unavailable and there is also a lack of assessment procedures for use in specific habitats (e.g., to specifically assess pollutant impacts on the biota of rocky shores, sandy beaches and especially, benthic muds).

Information emerging from the above studies will be subjected to multi-variate analysis procedures. These very powerful tools have already proved invaluable in detecting contaminant effects at the community level, and have been used with great effect in other disciplines such as chemical engineering. It is proposed that multi-variate approaches be further developed to use in the analysis of diverse arrays of chemical and biological data to provide an integrated view of environmental health. Recognition of characteristic patterns of response in affected ecosystems will provide a novel means of environmental assessment and generate pragmatic tools to aid environmental managers in the identification of vulnerable systems,

The improved mechanistic understanding of how specific environmental disturbances impact vulnerable species will form the basis of predictive models. Although computer modeling techniques have been widely used in the prediction of physico-chemical changes in the marine environment, much less attention has been paid to ecotoxicological modeling. Current databases, supplemented with information to be derived from the proposed programme will provide sufficient basis to begin exploring the use and validation of ecotoxicological risk assessment models.

V. REQUIREMENTS

To carry out the proposed programme input will be required from ecotoxicologists (especially those involved in tissue residue analysis, the measurement of biological responses in individuals, populations and communities and in monitoring changes in ecosystem processes) as well as experts in multi-variate statistical analysis and computer modeling. This expertise is to be found in Universities, Research Institutes and Industry. Promising new concepts and techniques from environmental chemistry, molecular biology, ecology, medical toxicology, chemical engineering and mathematics argue strongly for integrated research council involvement (e.g., NERC, BBSRC, MRC, EPSRC) and industrial collaboration (e.g., ZENECA Ltd., etc.).

VI. BENEFITS OF THE PROPOSED PROGRAMME

The programme will result in the operational application of ecotoxicological tools for environmental assessment as well as the development of predictive models which will contribute to the improved management of the shelf sea around the UK. By helping to sustain this vital ecosystem, the programme will contribute directly to sustaining exploitable resources of economic importance as well as environmental quality. Effective assessment and predictive protocols will also contribute to the EuroGOOS and international GOOS programmes, providing a showcase for UK research expertise. The proposal relates directly to three of NERC's environmental issues (T1, T4 & T5) and to the challenges for marine science (C2 and C4).

VII. USERS

The data, tools, models and protocols derived from the research will be of direct use to those concerned with environmental health and predicting future risks to sustainable resources. This will include Government Departments (MAFF, DOE< SOAFD) and regulatory agencies (Environment Agency, NRA, HMIP) which already committed to EuroGOOS, Other potential users include food/fishing, oil, chemical, environmental engineering and consultancy, reinsurance and pharmaceutical industries, The research will also contribute to the attainment of the environmental objectives of the European Union. Finally, the research and products of the programme will help to promote the implementation of the Global HOTO Module of GOOS,

ANNEX IV

FRAMEWORK FOR THE PREPARATION OF THE REGIONAL BLUEPRINTS FOR HOTO

DRAFT

It is proposed that regional blueprints be prepared to test the comprehensiveness and applicability of the HOTO Strategic Plan, to facilitate the identification of the "Core" set of analytes that will need to be measured universally, and to identify suitable regions for the establishment of pilot phase activities. For ease of comparison between these blueprints, they should adhere to a common framework, or layout, as described below.

The document should be prefaced by an introductory section that defines the subject region, development status trends and provides other necessary background to the identification of management goals and questions presented in Section 1 below.

Section 1: Regional Management Goals

A clear statement of the regional management goals that necessitate the implementation of the HOTO module of GOOS in the region concerned. These should include precise management objectives in terms of the anticipated benefits from the implementation of the HOTO module.

Section 2: Priority Measurements and Observations

A listing of the priority measurements and observations of regional concern related to the management issues identified in section 1.

This listing should include:

(i) details of which of HOTO analytes should be measured in the region;
(ii) details of the specific measurement or analyte(s) within each cluster [e.g. which specific algal toxin(s)];
- a categorization of the chosen analytes in terms of their perceived ease of measurement in the region concerned;
- a categorization of the relative importance (high, medium or low) of the analytes to be measured (This ranking should reflect the management issues, development trends and elements of scientific uncertainty.); and

(iii) details of additional analytes or measurements considered to be of importance to the region not listed in the HOTO Strategic Plan but which might constitute components of other GOOS Modules.

Section 3: Sampling Strategy

A preliminary sampling strategy that determines:

- the locations of the sampling sites at which the measurements are proposed to be made;
- the temporal distribution of measurements proposed to be made;
- the relationships between the management issues of concern, the sampling strategy and the proposed statistical analyses to be applied to the data; and
- the detection limits required to monitor the progress towards achievement of the management goals.

Section 4: Data Products

- A description of the anticipated data products and their relationship to the management issues development concerns and issues of scientific uncertainty identified in Section 1.
- An identification of the potential user groups and envisaged use of the anticipated data products.

Section 5: Linkages with Other GOOS Modular Activities

- A description of the relationships and linkages between the proposed HOTO blueprint for the region and other modules such as the Living Marine Resources and Coastal modules of the GOOS.

RED SEA

1. **DESCRIPTION**

A. PHYSICAL

A deep (2200 m) semi-isolated and narrow basin. Connected to the Indian Ocean by a narrow and shallow sill, it extends northwest to almost temperate latitudes. In this sea, tropical habitats and communities, coral reefs, mangroves, and sea grasses reach their northernmost limit.

In the Red Sea, the physical system, as well as the biological trends, are to a large extent governed by the monsoon pattern over the Indian Ocean, in addition to the aridity of the climate and the semi-isolation of the basin.

Circulation in the northern Indian Ocean is driven by the winter monsoon introduces nutrient rich surface water to the Red Sea. Winter is the productive season in the Red Sea, but it is also the season of recruitment for a large number of pelagic species and of planktonic larvae of benthic organisms.. Both productivity and biological diversity, therefore, are subjected to the monsoon cycle. On the other hand, there is a south to north decreasing gradient in both diversity and productivity. This reflects on the fish and shrimp stocks. This pattern is likely to become altered, with unpredictable consequences, following any disruption of the monsoon cycle resulting from climate change.

The south to north gradient is no less distinct for other physical and biological characteristics. Surface salinity rises, reaching exceptionally high values (e.g., 42o/oo) in the north, a salinity to which the biota are adapted. A northward shifting of the rainy zone in association with potential climate change would increase precipitation and runoff, disrupting the ecosystem. The increased nutrient and suspended matter inputs with runoff would add their impact.

B. DEMOGRAPHY AND POPULATION DISTRIBUTION

The population is very unevenly distributed. Two large cities, Jeddah and Suez. Two other industrial cities in Saudi Arabia. Smaller towns: Aqaba in Jordan, Eilat in Israel, Pt Sudan.

Jeddah: 2 million inhabitants (35 thousand before WW-II).
Suez: One half million, expected to grow to a million around the year 2000, due to internal migrations.

In between the urban centers, large very sparsely populated coasts. However, previously unpopulated coasts along the Egyptian Red Sea are now being gradually urbanized.

The Red Sea is bordered by 8 countries (Egypt, Israel, Jordan, Saudi Arabia, Sudan and Yemen).

II. RESOURCES

- Commercial, artisanal and subsistence fisheries. Fun fish, shrimps, crabs and molluscs (including cephalopods) provide a living for a large sector of the coastal zone population in Egypt, the Sudan, Eritrea and Yemen. (Landings?)

- Shells, broken pieces of coral and other marine materials are used for the manufacture of curios and souvenirs.

- Offshore oil production, mainly in the Gulf of Suez where there are about 30 fields.

- Eco-tourism is intensive and continuously developing along the Egyptian Red Sea coast. More and more new resorts are being established in new areas along the coast. Large scale resorts are underway also in Eclat and along the Gulf of Aqaba. There are plans to develop tourism in Eritrea. No tourism on the east coast.

III. LAND BASED ACTIVITIES

A. URBAN AND INDUSTRIAL ACTIVITIES

Suez: Raw and partially treated mixed sewage.
Fertilizer plant: ammonia and others, air pollutants.
Cement factory: airborne dust with heavy metals.
Oil refineries: contaminated cooling water.
Water treatment: thermal pollution.
Litter on beaches.

Aqaba: Phosphate ore dust spiles during shipping.

Eclat: Sewage pollution,

Jeddah: Raw and partially treated sewage.
Oil industries: contaminated cooling water, oil hydrocarbons and PAHs.
Cement factory.
Water treatment.
Larger scale desalination plants: brine with some trace elements.

Yanbu (Saudi Arabia)': Oil and oil derivatives.

Safga and Qoseir (Egypt): Phosphate ore spills.

B. COASTAL DEVELOPMENT

- Coastal reclamation. Alterations of the coastline for new marinas. Infilling. (Horghada and Jeddah)
- Sand and cement dust from building activities: silting and smothering.

C. TOURISM AND TOURIST RESORTS

- Impacts on bottom communities by sports divers.
- Reclamation of turtle nesting beaches for recreation.
- Fuel oil contamination by sea craft and noise pollution.
- Spear fishing.
- Incentive for overfishing to meet the increased demand for food leading to local depletion.
- Small desalination plants.
- Domestic waste water: mostly treated.

D. OIL PRODUCTION, LOADING, LANDING AND TRANSPORT

- Maritime tanker transport.
- Pipeline terminals in Saudi Arabia and the Gulf of Suez.
- Offshore production.
- Oil industry.

VI. PRIORITY CONCERNS

A. MEASUREMENTS AND ANALYTES

Apart from oil, the physical aggressions on the coastal habitats, often with irreversible consequences, appear to be of greater significance than the introduction of contaminants in this sea.

Oil :
Oil hydrocarbons and PAHs are pervasive. The Red Sea environment receives more oil per square km than any other regional sea. More critical areas are the ship lanes, the coast of Saudi Arabia between Jeddah and Yanbu and the Gulf of Suez. The levels of hydrocarbons need to be assessed throughout the Red Sea, together with their impacts on coral reefs, mangrove aerial roots and mud flats. It has been claimed that oil pollution affects the reproductive cycle of corals and might be responsible for some of the coral diseases.

Trace metals:
Areas of concern appear to be localized: downstream from desalination plants and from industrial centers. TBT would presumably be of significance in and around harbors and marinas.
An example of natural contamination is provided by some deep sea benthic organisms where the levels are higher than for coastal organisms. This is suspected to be related to emissions from the deep Red Sea hydrothermal vents.
A baseline survey of selected trace metals in selected biota needs to be carried out at relatively large intervals.

Algal toxins:
There are no reports of algal toxicity in the Red Sea. However, there are toxic fish.

Nutrients:
The Red Sea is comparatively poor in nutrients.
Nutrients, as contaminants, occur near fertilizer plants and sewage outfalls. Phosphate ore dust is sparingly soluble, but it IS said to cause “phosphate poisoning” to corals by disturbing their rate of calcification. No eutrophication has been observed in the Red Sea and no Red Tide outbreaks have been reported.

Sewage:
The open Red Sea is clean, but some localized areas receive raw or partially treated sewage: Eclat, Suez Bay, the coastal waters and lagoons near Jeddah. In these areas human pathogens need to be monitored in water and sea food.

Suspended particulate material:
SPM occurs naturally as an effect of wind blown sand and occasional flash floods. Their occurrence is increased where coastal construction activities are taking place and where cement factories are established.

Order of priority for contaminants in the Red Sea (See Table 5 in the HOTO Strategic Plan):

High	Medium	Low
Oil	Human pathogens	Herbicides/pesticides Radionuclides Pharmaceuticals
PAHs	Litter/tar balls	Oxygen
SPM	Trace metals Nutrients	Toxins Synthetic organics

B. BIOLOGICAL HEALTH

The approach to biological health as developed in the HOTO Strategic PIan provides adequate monitoring guidelines for the Red Sea with a view to sustainable development of its resources. Human activities in this sea impact biodiversity, cause changes in community structures and habitat loss, There are important populations of endangered species in this area (marine mammals, marine turtles and some birds [e.g., the osprey]).

A health survey of the main coastal habitats, communities and populations and of human impacts is a priority. The survey should be carried out according to agreed uniform methodological guidelines as recommended by the HOTO Strategic Plan.

V. INFRASTRUCTURE

The countries of the region have adopted the “Convention for the Conservation of the Environment of the Red Sea and Gulf of Aden” in 1982 with a Protocol concerning “Oil-and other hazardous substances in case of emergency”. They have created an autonomous organization, PERSGA, the General-Secretariat of which is hosted by Jeddah. GEF is sponsoring three programs in the Red Sea, in Egypt, in the Gulf of Aqaba and in Eritria. A contingency center is being established in Sharm-el Sheikh.

Marine laboratory facilities are available in Aqaba, Suez, Ghardaga, Port Sudan and Jeddah. Capacity building and training are needed but at different levels. Equipment is the limiting factor.

Variables which can be measured: nutrients, human pathogens, oil hydrocarbons, pigments, productivity, some biological aspects, sediments and trace metals. QA/QC needs to be improved.

SOUTHEAST ASIAN SEAS

Southeast Asia represents a fast developing area with a burgeoning population. The majority of the population is coastal since much of the land mass is insular. This maritime character of many communities emphasize their dependence on both the marine environment and the marine resources. Consequently, the condition or health of the ocean is of primary concern to the region.

I. DESCRIPTION

A. PHYSICAL AND BIOLOGICAL SETTING

The Southeast Asian Seas may be defined as the marginal seas bordering insular Southeast Asia, the Indochinese and Malayan peninsulas, and the Burmese coast. The countries concerned include the seven, Member States of ASEAN, viz., Brunai Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam plus Cambodia and Myanmar.

Insular Southeast Asia includes more than 20,000 islands principally grouped into the Indonesian and Philippine archipelagoes. Continental Southeast Asia represents the extreme tropical extension of the Asian mainland consisting of two peninsulas. Subtidally this land mass extends to the Sunda shelf which includes the western half of the Indonesian islands and reaches the southwestern Philippines through Borneo. This fragmented land mass represents the nexus of the Pacific and Indian Oceans and experiences a varying monsoon regime.

Given this physical setting, the Southeast Asian Seas are endowed with abundant living marine resources that are heavily exploited. In addition, these marine waters harbor the most diverse shallow coastal ecosystems, with many taxa of fish, invertebrates and marine plants having their center of distribution here. Of particular note are the coral reefs and mangrove forests.

Fish protein may represent some 50% of the protein intake of Southeast Asians. Hence, capture fisheries and aquiculture represent major industries. Additionally, a flourishing ornamental trade in marine products exists. Although major rookeries of marine turtles are found in the region, the

exploitation of these species are contributing to their endangered status.

Non-living resources are extracted from coastal water in several countries, notably oil and gas, tin and aggregates.

B. SOCIO-ECONOMIC OVERVIEW

As previously mentioned, the population of Southeast Asia is predominantly coastal. The littoral communities continue to grow vigorously both from natural increase and from migration. There is rapid industrialization in the coastal area due to better accessibility to contracts both local and international. Consequently, the major population centers, including several capitals, are coastal.

The development of the coastal zone is not limited to population and industrial centers. Many wetlands of the region, particularly mangrove swamps, have been transformed into areas for agriculture and aquiculture, leaving less and less existing in their natural state. However, due to the natural beauty and attraction of some areas, coastal tourism is a growing industry that both prevent and destroys the environment. As a consequence of these trends, land-use conflicts often arise.

C. MANAGEMENT ISSUES

Among the management issues of concern that may be addressed by the HOTO Module of GOOS are the following:

- harmful algal blooms and eutrophication
- sewage discharge and shellfish contamination
- over exploitation of marine resources
- destruction of coastal ecosystems
- marine pollution

D. REGIONAL ARRANGEMENTS

Many of the countries in the region adhere to international conventions such as the London Convention (1972), MARPOL (1983/1986), UNCLOS (1982) and the Convention on Biological Diversity (1993) which relate to the marine environment and marine resources, However, there is no uniformity in membership. There is no single regional agreement to which all are party. However, many states take part in the following regional programs:

- UNEP Regional Seas (COBSEA)
- IOC WESTPAC
- GEF/UNDP/IMO Marine Pollution Prevention and Management

In addition to the above, there have been a number of regional projects concerned with coastal resource management that have involved more than half of the countries. The following projects, completed and on-going, have contributed greatly to capacity building and in fostering regional collaboration:

- ASEAN/Australia Marine Science Project
- ASEAN/US Coastal Resources Management Project
- ASEAN/Canada Marine Science Project
- ASEAN/Korea Marine Science Project

In spite of the above, the Association of Southeast Asia Nations (ASEAN) has shied away from evolving a regional convention or protocol for marine pollution prevention, although they adhere to the non-binding regional seas action plan (with the exception of Brunei Darussalam).

E. REGIONAL CAPACITY AND REQUIREMENTS

As mentioned above, several regional marine science projects have contributed to capacity building over the past decade, Needless to say, there is a diversity of capability among the nine

countries, with some of the ASEAN Member States more advanced than others. There is also a wide diversity in the economics and, hence, financial resources of the nine countries, with the newly industrializing countries (NIC's) of Sigapore, Malaysia and Thailand having better conditions in this regard.

In spite of the above, even the better endowed countries will need assistance in mobilizing a HOTO Module for GOOS. This need will be best met in terms of additional technical training in QA/QC and also in the acquisition of supplementary equipment for monitoring. In the case of a few countries a fair number of trained manpower exists so that their needs will be more in terms of financial assistance. For two or three countries the requirements are more substantial both in terms of training and infrastructure.

II. REGIONAL MANAGEMENT GOALS

The maintenance and, in some cases, the rehabilitation of a desirable marine environment in Southeast Asia become important from the perspective of public health, food supply and economic considerations.

The dependence of many people in the region on seafood for protein highlight the public health and food supply issues. Edible shellfish and finfish must be safe for human consumption an all places at all time. This points to the need to monitor and, if possible, eliminate contamination of living marine resources by both harmful algal blooms and microbial contamination. These blights also adversely effect the quantity of food supply. Over and above these negative influences on the food supply, the integrity of coastal habitats must be preserved from both physical and chemical stresses in order to ensure favourable conditions for secondary production.

The conservation of both coastal ecosystems and coastal resources is also favourable for economic development particularly where coastal tourism is involved. The exotic nature of tropical coasts and the marine life found there make the countries of the region prime tourist destinations for the developed countries of both the West and the East.

III. PRIORITY MEASUREMENTS

In the assessment and monitoring program envisaged for HOTO, the following contaminants are suggested according to priority concern:

High	Medium	Low
algal toxins	herbicides/pesticides	synthetic organics
human pathogens	oil	pharmaceuticals
nutrients	litter/plastics	trace metals
phytoplankton pigments	PAHs	
suspended particulate matter	dissolved oxygen	

In addition to the above, there must be monitoring of the condition of coastal ecosystems, particularly coral reefs and mangrove forests. The abundance of marine life, both in terms of fish stocks and ornamental species, should also be monitored.

IV. SAMPLING STRATEGY

A. LOCATIONS

Participating countries will designate critical habitats near population centers and in remote areas:

- traditional fishing grounds
- coral reefs
- mangrove forests

B. TEMPORAL CONSIDERATIONS

- dry season
- wet season

V. DATA PRODUCTS AND USES

NEEDS TO BE ADDED

VI. RELATIONSHIPS

The concerns of the HOTO Module may intersect to some degree with those of the Living Marine Resources and the Coastal Modules. This is particularly true with respect to the food supply concerns and the condition of coastal ecosystems, particularly coral reefs. With respect to the latter, the proposed Global Coral Reef Monitoring Network may be considered as a common system relevant to two or more modules of GOOS.

NORTH-EAST ASIA REGIONAL HOTO (NEAR-HOTO)

I. DESCRIPTION

NEAR-HOTO will encompass the Japan Sea, Bohai Sea, Yellow Sea and East China Sea. The countries involved will be Russia, Japan, China, DPRK and ROK. Within this project three components can be defined.

A. The BOHAI SEA and the YELLOW SEA form a semi-enclosed sea. Its water renewal takes place mainly in the winter through wind-driven Yellow Sea warm currents originating from the East China Sea (Kuroshio). During the summer its lower layer is occupied by a large cold water pool left over from the winter. Thus, in the summer limited water renewal is channeled through the tidal fronts close to the west coast of Korea. The largest river discharge is from the Huanghe River. However, in recent years, there is an increasingly prolonged period of time of no run-ff (and thus no sediment discharge) from the Huanghe River because of the heavy diversion of water upstream.

This is a rapidly developing region, especially in the last ten years. The industrial development and oil exploration (in the Bohai Sea) is accompanied by heavy commercial shipping.

There are probably 2-3 hundred million people living within 100 km of the coast in this area Most of the city and industrial sewage discharges are untreated.

Aquiculture is highly developed along the Chinese coast. Diseases associated with aquiculture and red tides occur frequently.

This is a traditional fishing area for Chinese, Korean and Japanese fisheries. Overfishing is a problem and stocks of several species of high economic values have declined drastically. The coastal states are aware of the environmental problems in this area. National monitoring programs of varying extent exist in these coastal states. However, there is no coordinated effort in carrying out these monitoring activities, although as far back as 1987 a forum on transboundary environmental issues in the Yellow Sea was held in Hawaii. This forum was well attended by scientists and administrators from countries in this area.

There are many issues of scientific uncertainty, e.g., its circulation is not well understood such that the water renewal time in this area is unknown and that the transport routes of sediments from the Chinese coast to the Korean coast is still speculative.

B. In many ways THE JAPAN SEA IS A MINI-OCEAN OF THE WORLD. Compared to its size it has a limited exchange of surface water with the East China Sea and the Pacific Ocean. There is practically no direct exchange of water below 100 m with the seas outside. The Japan Sea has a deep

basin and its intermediate and bottom waters are all produced over its northern shelves. The renewal times for these waters are quite short, however. The bottom water, for example, is renewed in tens of a year (?).

Inflow from the East China Sea is about 1-5 sv which brings in heat and salt to the Japan Sea. This inflow is called the Tsushima Current. One branch of this current flows northeastward along the coast of Japan. Another branch flows northward along the coast of Korea to about 38 degrees North (?) And then turns to cross the Japan Sea over the abyssal basin.

This area is an important fishing ground. There are existing monitoring programs conducted in Japan, Russia and the Republic of Korea, but these programs are not coordinated.

C. The EAST CHINA SEA IS LARGELY A SHELF AREA. However, the Kuroshio also flows through its eastern part over the Okinawa Trough with a transport rate' of about 25 sv. In addition, throughout the year there is a persistent Taiwan Warm Current flowing into this area from the South China Sea and a persistent Tsushima Current flowing out of the Japan Sea. It is expected that the renewal time for this area is short.

The Changjiang River, the fourth largest in the world, discharges directly into this sea, bringing with it heavy nutrient loads (mostly from the rice fields) from its drainage area. The river also has a high sediment load (about 500 million tons per year).

Population within 100 km of the coast in this area is probably about 200 million. However, the drainage area of the Changjiang River also has a population probably around half a billion.

Both the coastal area and the Changjiang River basin will likely soon see the fastest economic growth in China. Again, there is little treatment of the municipal and industrial waste discharge.

Commercial shipping is heavy here with frequent collisions involving large ships (two major collisions happened southwest of Kyushu within the last two years).

Major oil and gas exploration is likely in this area in the near future

Traditional fishing grounds for China, Korea and Japan. Overfishing is a problem and many important species are on the verge of extinction.

Aquiculture is an important industry along the coast. Diseases associated with aquiculture ponds are perennial and red tides occur frequently.

There are national monitoring programs within each coastal state but no existing agreements on coordination exist. In 1991 a forum on transboundary environmental issues was held in Dalian, China.

Although there have been quite a few circulation studies conducted in this area, much remains unknown because of the complexity of its dynamics.

V. SAMPLING STATIONS OF NEAR-GOOS

Sampling stations of NEAR-GOOS can serve as a basis to expand on NEAR-HOTO.

ANNEX V

HOTO PANEL OBSERVATIONS ON THE DRAFT DOCUMENT PRIORITIES FOR THE GLOBAL OCEAN OBSERVING SYSTEM of 1 November 1995

DRAFT

The document that was reviewed outlines the background and purpose of the Priorities Agreement Meeting to be held in Washington, D.C. in May 1996. This meeting has been proposed as a vehicle for reaching consensus on priorities and urgencies regarding the national support and the implementation of GOOS.

The HOTO Panel comments on this document are of two types: first, relating to the approach to the identification of priorities for the implementation of GOOS; and, second, the specifics of the draft document. These observations are made to assist in the further refinement of the document preparatory to its use as a background, or working, paper for the Priorities Agreement Meeting.

CONTEXT AND APPROACH

The document proposes a mechanism or approach to the identification of priorities or commonalities in the suite of measurements to be incorporated into an operational GOOS. However, this approach has clearly been devised primarily in the context of the requirements of the Climate Module of GOOS which is used throughout for illustrational and exemplar purposes. The HOTO Panel has reservations about this approach because it may be of limited suitability for defining measurement requirements within other modules of GOOS. For example, the Climate Module, as conceptually develop by the OOSDP, must incorporate a global basis for the measurements required to meet the objectives of this Module. In the case of the HOTO Module, few of the measurements required to satisfy its objectives require global scope. Rather, some measurements will be of sufficiently high priority in all regions to warrant being made universally which, in turn, creates a global context for the measurements concerned. However, there may well be a majority of specific measurements that are required in only a small number of regional areas. It should be stressed here, that the analytes specified in the HOTO Module document prepared by the HOTO Panel, are actually analyte groups or packages, within which specific analytes selected for regional implementation may well differ among regions. Take, for example, algal toxins. Some specific toxins will be urgently required for management purposes in some regions because they are already identified as posing threats. In other regions, other specific toxins may well be of management concern. Accordingly, the selection of toxin measurements will differ among regions although all regions may well have an algal toxin component of the HOTO Module.

The HOTO Panel therefore urges that the basis for the identification of priorities outlined in the document be re-examined to ensure that it is universally applicable to the specification of measurements in all GOOS Modules.

In the view of the HOTO Panel, priority measurements (i.e., essential analytes) are likely to fall into four categories:

(i) measurements that are required for reasons of truly global concern;

(ii) measurements that need to be made universally throughout the coastal marine environment for reasons of commonality among regional management concerns;

(iii) measurements that are required in most coastal regions of the world ocean; and

(iv) measurements that will be priorities in individual regions only.

How will such categories of analytes be dealt with in the process of identifying priorities at the Priorities Agreement Meeting? As a caveat to the above discussion, the issue of ranking among the assignments of the various modular priorities also needs to be considered. However, this is a matter of cross-cutting significance extending beyond the existing terms of reference of the HOTO Panel.

The HOTO Panel has embarked on the process of elucidating the extent of measurements falling into the above categories by initiating the preparation of *"blueprints"* for the measurement requirements in a few regions representing quite diverse conditions, both environmentally and socio-economically, where the diversity of management requirements should be evident. These *"blueprints"* will be used to identify measurements falling into the above four categories and to reexamine the overall HOTO Plan to ensure that it is universally applicable and comprehensive, with the Plan itself serving as a living document which is updated periodically through iteration with regional applications. The HOTO Panel would then proceed to identify the most appropriate region(s) for pilot implementation of the HOTO Module of GOOS.

SPECIFICS

The HOTO Panel noted the proposed categories of *"parameters"* (i.e., variables) to be assigned priority specified in the document, as illustrated by Figures 1-3. The Panel questions the wisdom of assigning priorities to the *"most important"* measurements in categories 1 (existing measurement systems available) and 2 (measurement systems needing augmentation) alone. In the HOTO Panel's view, the "important" measurements for which existing measurement systems exist should be assigned equal, if not greater priority, than that assigned to more important measurements for which the measurement systems still require improvement. Thus, the *"Sustained Operation/ System"* advocated in the document, in the HOTO Panel's view, needs reconsideration.

This latter concern in fact explains, in large part, many of the HOTO Panel's reservations about the assignments of analytes/variables/measurements to *"Most Important', "Important"* and *"Least Important or Undetermined Importance"* in Section 5 entitled GOOS Parameters and Observing Systems. For example, the assignment of *"coastal sediment"* (i.e., sediment mobilization and sedimentation) to the *"Least Important"* category reflects a major flaw in the proposed priority evaluation scheme. Sediment mobilization and sedimentation is a major cause of marine coastal degradation and involves measurements that are straightforward, accurate and precise and can be effected with widely invested contemporary methodology. It is one of the most important of the variables in the entire suite of analytes considered by the HOTO. Such mis-assignments should be corrected, most appropriately through a re-examination of the category selections for priority measurements as advocated in the preceding paragraph.

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
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans
104. Fifth Session of the IOC Consultative Group on Ocean Mapping
105. Fifth Session of the IODE Group of Experts on Marine Information Management
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GOSS