Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

IOC-FAO Intergovernmental Panel on Harmful Algal Blooms

Third Session
Paris, 6-9 June 1995

UNESCO

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Executive Summary

The Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms (IPHAB) was held in Paris 6-9 June 1995. Harmful Algal Bloom (HAB) activities during the past intersessional period were reviewed. The major achivements were: (i) the continuity of programme development and coordination at the HABP Office in Paris; (ii) the establishment of HAB Science and Communication Centres in Copenhagen and Vigo; (iii) publishing and distribution of nine issues of the IOC newsletter on toxic algae and algal blooms, *Harmful Algal News*, to 2000 subscribers; (iv) the production of the IOC directory of Experts on HAB and IOC Manual on Harmful Marine Phytoplankton; (v) provision of literature to developing countries from the IOC Science and Communication Centres; (vi) implementation of the IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins, in Germany for scientists mainly from developing countries; (vii) implementation of a IOC Regional Science Planning Workshop on Harmful Algal Blooms, Uruguay; (viii) the intersessional work of the four Task Teams (i) Algal Taxonomy; (ii) Aquatic Biotoxins; (ii) Design and Implementation of HAB Monitoring Programmea; and (iv) HAB Project Development; (ix) the development of interaction with other IOC Programmes and with governmental as well as non-governmental organizations.

During the third session, the Panel focussed on its intersessional action plan, which is concerned with: (i) staffing situation at the HABP Office in Paris; (ii) presenting the HAB Programme in a brochure; (iii) developing networks; (iv) implementing the HAB Training and Capacity Building Programme; (v) establishing of Working Groups on the transfer of phytoplankton by ballast of ships; Aquatic Biotoxins related to harmful algae; and harmful algal blooms in South America; (vi) developing a stronger linkage between the HAB Programme and GOOS; (vii) making marine biotoxin standards and reference materials available to developing countries. The Panel adopted an intersessional workplan, which included a financial implication.

1. OPENING

1 The Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms (IPHAB-III) was held in Paris, 6 - 9 June 1995. Dr. G. Kullenberg, the Executive Secretary IOC, opened the Session and welcomed the participants (listed in Annex III). Representatives from 21 nations were present.

2 The Executive Secretary IOC recalled that the *ad hoc* Intergovernmental Panel on Harmful Algal Blooms (IPHAB) was formed at the Sixteenth Session of the IOC Assembly, March 1991, in order to identify adequate resources for a broad programme to try solving some of the problems caused by harmful algae.

3 The Harmful Algal Bloom Programme Plan and proposals (Document IOC-FAO/IPHAB-I/3) were adopted by the Seventeenth Session of the IOC Assembly in February-March 1993 and many Delegates expressed the importance of and urgency to adequately address the problem. Several of the activities within the HAB Programme were seen as important IOC follow-up activities to UNCED.

4 The Executive Secretary IOC addressed the critical question of resources and commitments and emphasized that the Panel Members have particular responsibilities in this regard, to help obtain resources for national activities. He stressed the need for application of data, information, and training achievements in relation to follow-up activities to UNCED, and the need to link our knowledge on harmful algae to research on effects of climate variability, and key societal concerns. The linkage is central to the chances of obtaining substantial funding for harmful algae research and capacity building. In light of the resources available he emphasized the importance of focusing and setting priorities of the HAB Programme, and the need to follow-up already implemented activities, in particular the training courses. In this context, it was mentioned that an easily accessible data base which includes participants and types of training, would be useful.

5 The Representative of FAO, Mr. H. Naeve, Fishery Resources Officer, announced that FAO has not been able to justify continued co-sponsorship of HAB and will cease co-sponsorship of the Programme. The decision was due to financial constraints, and a need for FAO to focus its activities. He noted that FAO would continue to cooperate with IOC on harmful algae through GESAMP, and on single activities. FAO will focus on practical aspects with WHO through the CODEX Alimentarius programme. He informed the Panel about an activity of FAO which complements the HAB Programme. FAO has contracted an expert to prepare practical guidelines for establishing national surveillance programmes for the prevention and control of phycotoxins in seafood products. The guidelines are aimed at addressing concerns in developing countries. Copies of the FAO Document will be sent to the IOC HAB Programme Office, and the IOC Science and Communication Centres on Harmful Algae. A summary of the FAO statement is given in Annex VI.

1.1 OBJECTIVES OF THE IOC-FAO INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS

6 The Terms of Reference, as set out in Resolution XVI-4 of the Sixteenth Session of the IOC Assembly, March 1991, (Annex IV), and the objectives of the Panel were recalled by the IOC Secretariat.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

7 The Panel adopted the Agenda as given in Annex I.

2.2 DESIGNATION OF RAPPORTEUR

8 The Panel adopted the proposal of US and Spain to elect of Dr. K. Haya (Canada) as Rapporteur for the Session.

3. SUMMARY DESCRIPTION OF THE HAB PROGRAMME: SCIENCE BACKGROUND AND GOALS

9 The Chairperson, Dr. B. Dybern, summarized the scientific background and goals for the IOC-FAO Harmful Algal Bloom Programme (HAB Programme). He discussed how the occurence of harmful algal blooms are recorded throughout history, yet the public health and economic impacts of these phenomena had increased during the last several decades. This expansion relates in part to the increasing exploitation of coastal waters (due to waste disposal, maritime commerce and other anthropogenic influences), as well as to the dispersal and proliferation of algal populations associated with natural oceanographic and meteorological processes. He emphasized the problem of the transfer of phytoplankton by ships' ballast, and highlighted its importance in relation to harmful algal blooms. Prof. J. Carlton, Maritime Studies Programme, USA, was invited to present a lecture on this topic (Annex XII).

10 There are short-term, medium-term and long-term aspects to the problems arising from harmful algal blooms. In the short-term, the emphasis must be on mitigating the effects of harmful algal events. In the medium-term, the focus will be on understanding, modelling and prediction, with the eventual long-term focus of preventing or eliminating the problems.

11 The overall goal of the HAB Programme, as indicated below, embraces these three time scales as well as a range of related scientific and administrative problems:

To foster the effective management of, and scientific research on, harmful algal blooms in order to understand their causes, predict their occurrences, and mitigate their effects.

There are three major divisions: educational; scientific, and operational. The educational programme element can be separated into 2 branches : information networks; training and capacity building. The scientific programme element can be separated into 3 branches : ecology and oceanography; taxonomy and genetics; and toxicology and toxin chemistry. The operational programme element can be divided into 3 branches : resource protection; monitoring; and public health and seafood safety. There are many interactions between the subjects and actions, e.g., fisheries management questions benefit from knowledge of the ecology and dynamics of blooms; monitoring is based on ecological, oceanographic, taxonomic, and toxicological information.

12 Harmful Algal Bloom Programme Elements and Goals:

13 The detailed HAB Programme Plan is included as Annex V. During the Third Session of the Panel, the Chair pointed out that some of the activities of the HAB Programme needed to be consolidated. The series of training courses, which now include a number of courses related to toxin problems, will be further developed. Amended terms of reference will be given to Task Teams, and Working Groups for different purposes may be established. It was also suggested to further strengthen co-operation with other organizations, and to identify various means of distributing information.

EDUCATIONAL PROGRAMME ELEMENTS

Information Network:
To develop, encourage and maintain the flow of information, technology and expertise to scientists, administrators and the general public

Training:
To promote and facilitate the development and implementation of appropriate training programmes in order to distribute the necessary knowledge and expertise on a global basis.

SCIENTIFIC PROGRAMME ELEMENTS

Ecology and Oceanography:
To understand the population dynamics of harmful algae.

Taxonomy and Genetics:
To establish the taxonomy and genetics of the causative organisms at the appropriate levels.

Toxicology and Toxin Chemistry:
To determine the physiological and biochemical mechanisms responsible for toxin production and accumulation, and to evaluate the effect of phycotoxins on living organisms.

OPERATIONAL PROGRAMME ELEMENTS

Resource Protection:
To develop and improve methods to minimize the environmental and economic consequences of harmful algae.

Monitoring:
To promote and facilitate the development and implementation of appropriate monitoring programmes.

Public Health and Seafood Safety:
To protect public health and ensure seafood quality.

4. HAB PROGRAMME DEVELOPMENTS IN THE INTERSESSIONAL PERIOD

4.1 HARMFUL ALGAL BLOOM PROGRAMME OFFICE

14 At the First Session of the Panel, through Recommendation IPHAB-I.2, the Panel recommended IOC to proceed with the establishment of the HAB Programme Office within the IOC Secretariat. The IOC Assembly (March 1993) endorsed the Recommendation and the Programme Office has now bee n established. Until 1 March 1995 two Associate Experts, Dr. Helle Ravn and Mr. Henrik O. Enevoldsen, were seconded to the HAB Programme by Denmark. Henrik O. Ene voldsen's contract expired on 1 March 1995, after three and a half years service at the HAB Programme Office. The secondment of H. Ravn will continue until 30 April 1996.

15 DANIDA, Denmark, (see below) has provided part of the funds for the continuation of H. Enevoldsen as a staff member of IOC in ord er to establish an IOC Science and Communication Centre on Harmful Algae in Copenhagen. He will be based at the Centre in Copenhagen, but will continue to carry out part of his work at the IOC Secretariat in Paris, and will in particular deal with training and capacity-building activities, as well as with the Centres in Copenhagen and Vigo. On behalf of IOC, the Executive Secretary IOC expressed his great appreciation for the generous support from Denmark and the Danish International Development Aid Assistance (DANIDA).

16 The Representative of Canada informed the Executive Council that Canada would investigat e possibilities for staff secondment during the Twenty-seventh Session of IOC Executive Council. However,

the Panel was informed that Canada at the moment could not support a staff member at the HAB Programme Office. Canada assured that the issue would be kept under consideration.

4.2 ESTABLISHMENT OF HAB SCIENCE AND COMMUNICATION CENTRES

17 The establishment of HAB Programmme activity centres was proposed at the Twenty-fifth Session of the IOC Executive Council (Paris 10-18 March 1992) and the idea was further elaborated at the First Session of IPHAB (23-25 June 1992). At the Seventeenth Session of the IOC Assembly (Paris, 25 February-11 March, 1993) (Document SC/MD/101, para. 80), Denmark and Spain offered to host and establish Science and Communication Centres on Harmful Algae. The main purpose of the Centres is to provide the framework for systematic assistance in training and capacity building to developing countries with respect to harmful algae.

18 The IOC Science and Communication Centre on Harmful Algae in Copenhagen, Denmark, was opened by the Secretary IOC and Prof. Ø. Moestrup, University of Copenhagen, on 5 May 1995. The Centre is staffed by Dr. Jacob Larsen, Associate Professor, Mr. Henrik Enevoldsen, Project Coordinator, and another person to be determined. All staff will take an active part in both the training, research and service activities of the Centre. The Centre is hosted by the Department of Mycology and Phycology at the Botanical Institute, University of Copenhagen, with Professor Ø. Moestrup as the focal point. Activities will focus on training in taxonomy of harmful species and associated services, including a species identification confirmation service. The Centre is sponsored by DANIDA (through the IOC Trust Fund), the University of Copenhagen, the Danish Ministry of the Environment, the Danish Ministry of Fisheries, and IOC for a five-year period.

19 The IOC Science and Communication Centre on Harmful Algae in Vigo, Spain, is expected to open in 1996, and will be hosted by, and located at, the Instituto Espanol de Oceanografia (IEO), Vigo. The Centre will draw on the staff of the Institute under the leadership of Ms. Beatriz Reguera. Activities will concentrate on training in toxin chemistry and ecology, and in co-operation with research institutions in Latin America. Training of small groups of researchers in many areas has been suggested. It is expected that the Centre will be sponsored by the Spanish Ministry of Foreign Affairs (through the IOC Trust Fund), Instituto de Cooperacion Iberoamericana, IEO, and IOC for a five-year period.

20 The activities of the two Centres will be coordinated and coupled as required, and are intended to be complementary.

21 **The Panel acknowledged and welcomed** the establishment of the Centre in Copenhagen, and the efforts for establishing the Centre in Vigo.

4.3 TASK TEAM ON HAB PROJECT DEVELOPMENT

22 The Chair of the Task Team, Dr. D. Anderson, reported on the activities during the intersessional to obtain funds for implementing HAB research and training.

23 The Chairperson had focussed efforts on assistance to the South America Group (see 4.15) and the development of a project proposal on HAB within the Asian Pacific Economic Cooperation (APEC) marine science programme.

24 Support for South America was primarily sought from private US foundations, but so far with no positive result. The project proposal for APEC was finalized and includes a proposed linkage to the IOC HAB Programme in relation to training and capacity building. The APEC proposal was presented in outline. APEC is expected to decide on the proposal later in 1995.

25 Dr. Anderson noted with concern the difficulties in attracting funding, and asked for assistance from the IOC Secretariat in identifying potential donors to whom the Task Team could present proposals.

EDUCATIONAL PROGRAMME ELEMENTS

INFORMATION NETWORK

4.4 HARMFUL ALGAE NEWS, THE IOC NEWSLETTER ON TOXIC ALGAE AND ALGAL BLOOMS

26 A report on the IOC Newsletter on toxic algae and algal blooms "Harmful Algae News" (HAN) was presented by the Editor, Dr. T. Wyatt. The first issue was published in early 1992. Currently, more than 2,000 copies of the HAN are distributed. The interest in receiving HAN on a regular basis has been strong and the number of subscribers is increasing. The Editor reported with regret that the HAN had only been issued three times in 1994 instead of four. Delays were mainly caused by manuscripts which reach the Editor after the deadline. An Editorial Team, composed of regional co-editors (Annex VI), was established in 1993 in order to support the Editor in his efforts to make HAN scientifically and geographically a broad newsletter. With the exception of a few members, the Editor has not received the intended assistance from Team Members in collecting material for HAN.

27 **The Panel gratefully acknowledged** the efforts of Dr. T. Wyatt and **noted** with satisfaction the development of HAN.

4.5 IOC DIRECTORY OF EXPERTS

28 The Secretariat reported on the updated edition of the International Directory of Experts in Toxic and Harmful Algal Blooms and Their Effects on Fisheries and Public Health, first published in 1990. The Directory is being compiled as a joint IOC-NOAA (USA) effort by Dr. A. White of the US National Marine Fisheries Service. The updated and expanded directory will be published by the IOC in 1995. Publication was planned for first half of 1994, but due to the expiration of Dr. White's contract with NOAA, and subsequent lack of manpower at NOAA, the publication was delayed. The Directory will be available on paper and diskette.

29 **The Panel noted** the importance and usefulness of an updated directory of experts and managers and emphasized the need to ensure that experts, managers, monitoring people, and aquaculture experts in developing countries are included. It was suggested by the Panel that the Directory should also be made available on Internet.

4.6 IOC MANUAL ON HARMFUL MARINE MICROALGAE

30 The IOC Manual on Harmful Marine Microalgae, including methodologies, taxonomy, and monitoring and management issues was planned to be published in 1994. Due to difficulties in obtaining manuscripts from the respective authors, it has been delayed. The Manual will include information on the taxonomy, toxicology and epidemiology of harmful algal blooms, and will be distributed freely to institutions in developing countries. The Manual will be published in late 1995 or 1996.

31 **The Panel noted** with satisfaction that the preparation of the Manual is proceeding, and **urged** that the printing and publication of the Manual be given highest priority.

4.7 PROPOSAL TO EC FOR ESTABLISHMENT OF A SCIENTIFIC AND TECHNICAL COOPERATION NETWORK ON HARMFUL PHYTOPLANKTON

32 The proposal for a Scientific and Technical Co-operation Network on Harmful Phytoplankton, "Human Capital and Mobility", to the European Commisssion, Directorate General XII, was submitted for the first time in November 1992. In June 1993 the proposal was rated "B" which means that the proposal is of good quality but will not be funded in its present form. Nevertheless the EC encouraged IOC to re-submit a redrafted proposal. All co-proposers have been requested to provide the Coordinator (IOC) with input and assistance in the redrafting. Very few participants replied to an inquiry by IOC regarding the resubmission of the proposal. Based on the lack of interest, the IOC decided not to reformulate and resubmit the proposal.

4.8 IOCARIBE WORKSHOP

33 The IOCARIBE Workshop on Red Tides and Mass Mortality of Marine Organisms was held in Cumana, Venezuela, 16-19 September 1992. The Recommendations provide specific guidelines for future regional activities, particulary in relation to training. A HAB Network has been established in the Region. The Network will be coordinated by Dr. A. Barbera-Sanchez, CONICIT, Cumana, Venezuela. The IOC Secretariat informed the Panel that it had not received any replies to correspondence with the Workshop organisers and the coordinator of the HAB network that was established during the Workshop.

34 **The Panel noted** the Recommendations of the Workshop and emphasized that they should be taken into account when planning HAB Training and Capacity Building Programme activities. **The Panel expressed concern** that there had been no contact with the coordinator.

4.9 PROVISION OF LITERATURE

35 One hundred copies of the Proceedings of the Sixth International Conference on Toxic Marine Phytoplankton, October 1993, Nantes, France, will be made available to Marine Science Libraries in developing countries. The Proceedings of the Seventh International Conference on Toxic Phytoplankton, July 1995, Sendai, Japan are planned as an IOC publication and will be free to institutions in developing countries.

36 IOC/WESTPAC-HAB has re-published 'Biology, Epidemiology and Management of *Pyrodinium* Red Tides', Proceedings of the Management and Training Workshop, Bandar Seri Begawan, Brunei Darussalam, 23-30 May 1989. Copies are available from Dr. R. Corrales, University of the Philippines.

37 The Representative from Japan, Dr. Fukyo, informed the Panel that sets of 36 photoslides showing HAB organisms and related events were printed and distributed to HAB scientists in the WESTPAC area. Furthermore, one hundred copies were reprinted with the permission of the Japan Fisheries Agency, the copyright holder, to utilize as source material for seminars.

38 **The Panel noted** these initiatives with satisfaction.

4.10 IOC CO-SPONSORSHIP OF INTERNATIONAL CONFERENCES RELATED TO HAB

39 The Secretariat informed the Panel that the HAB Programme co-sponsored the Sixth International Conference on Toxic Marine Phytoplankton, Nantes, France, 1993, and that it will also co-sponsor the Seventh International Conference on Toxic Marine Phytoplankton, Sendai, Japan, 1995. IOC support will cover the participation of scientists from developing countries.

40 Referring to the request of the Second Session of IPHAB, the IOC will, together with IMO, co-sponsor a theme session on ballast water and its ecological and fisheries implications, at the 1995 ICES Annual Science Conference, 21-29 September 1995, Aalborg, Denmark.

41 The HAB Programme will co-sponsor the IXth IUPAC Conference on Mycotoxons and Phycotoxins, May 1996, Rome, Italy.

TRAINING

4.11 IOC-UNEP-WHO-FAO TRAINING COURSE ON QUALITATIVE AND QUANTITATIVE DETERMINATION OF ALGAL TOXINS

42 The IOC Secretariat reported on the IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins which was held at the University of Jena, Germany 18-28 October 1994. The goal of the course was to give the participants a theoretical as well as a practical introduction to qualitative and quantitative determination methods of toxins from marine phytoplankton.

43 The main objectives were: (i) improvement of the participants chemical and toxicological skills for reliable qualitative and quantitative determination of toxins from planktonic algae and contaminated food; and (ii) long-term: The experience obtained will be used in the design of a comprehensive training programme on harmful algae, particularly, in the preparation of a training module on qualitative and quantitative determination of toxins from harmful marine phytoplankton. The training activities focused on improving related human resources as well as technology and knowledge transfer in order to develop national capabilities for the management of harmful algal events. For details see Document IOC Training Course Report No. 29, 1994.

44 **The Panel noted** with satisfaction the successful implementation of the first training course on algal toxins emerging from the HAB Programme, and **commended** the useful documentation of the course.

4.12 THE HAB TRAINING AND CAPACITY BUILDING PROGRAMME

45 The IOC Secretariat referred to the adoption by IPHAB-II of the HAB Training and Capacity Building Programme. The Programme is composed of 3-4 main modules on Taxonomy, Toxin Chemistry and Toxicology, Management Strategies, and Mitigation Techniques (see Annex XIV).

46 **The Panel noted** with satisfaction the development and implementation of the HAB Training and Capacity Building Programme as recommended by the Second Session of the Panel and adopted by the Twenty-seventh Session of the Executive Council. **The Panel noted** that the courses were successfully implemented regionally and globally in 1994-95.

SCIENTIFIC PROGRAMME ELEMENTS

ECOLOGY
and

4.13 ICES-IOC WORKING GROUP ON THE DYNAMICS OF HARMFUL ALGAL BLOOMS

47 Mrs. B. Reguera, Chairperson of the ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms, reported on the work and results of the Working Group. Dr. M.A. De M. Sampayo, Portugal reported on the results of the work on ICES-IOC Workshop on Intercomparison on *In Situ* Growth Rate Measurements (Dinoflagellates), held in Aviero, Portugal, 25-29 July 1994, seen as an activity of the ICES-IOC Working Group.

48 The Working Group met in Vigo, Spain, 7-13 May, 1994, and in Helsinki, Finland, 17-19 May 1995.

49 The activities of this Group can be considered as a development of the "Ecology and Oceanography" scientific element of the Harmful Algal Bloom Programme Plan, by ICES and IOC, (Annex X).

50 The Reports of: (i) The Working Group on Modelling the Population Dynamics of Harmful Algal Blooms, Vigo, Spain, 4-7 May 1994; (ii) The Joint Meeting of the Working Group on Harmful Algal Bloom Dynamics (WG-HABD) and the ICES Working Group on Shelf Seas Oceanography (WG-SSO), Vigo, Spain, 9-10 May 1994; (iii) The ICES-IOC Working Group on Harmful Algal Bloom Dynamics, Vigo, Spain, 11-12 May 1994; and (iv) The ICES-IOC Workshop on Intercomparison on *In Situ* Growth Rate Measurements (Dinoflagellates), Aviero, Portugal, 25-29 July 1994, are all available at the IOC Harmful Algal Bloom Programme Office, Paris.

51 **The Panel recognized** the importance of the efforts of ICES in relation to harmful algae. **The Panel noted** with satisfaction the progress of the Working Group, and with appreciation the constructive cooperation betwen ICES and IOC.

4.14 SCOR-IOC WORKING GROUP 97 ON THE PHYSIOLOGICAL ECOLOGY OF HARMFUL BLOOMS

52 The Chair of SCOR-IOC Working Group 97 on the Physiological Ecology of Harmful Algal Blooms, Dr. D. Anderson, USA, reported that the Group met for the first time in La Rochelle, France, 25-26 October 1993. The Scientific Committee on Ocean Research established the Working Group at its Executive Council meeting, November 1991, to examine available data on the physiological ecology of harmful blooms. The Terms of Reference can be found in Document IOC-FAO/IPHAB-III/3, Annex X.

53 Dr. Anderson informed the Panel that the next meeting will be held at the University of Tokyo, Japan, 10-11 July 1995. The main item on the Agenda will be the continued planning of the "Advanced Study Institute on the Physiological Ecology of Harmful Algal Blooms" for which a proposal has been submitted to NATO, SCOR, and IOC for funding. If funded, the meeting will be held in May 1996 at the Bermuda Biological Station.

54 **The Panel noted** with satisfaction the activities of the Working Group, and the good cooperation with SCOR.

4.15 IOC(COI)-FANSA WORKSHOPS

55 Dr. Silvia Mendez, Uruguay and ROSTLAC, reported on the IOC Regional Science Planning Workshop on Harmful Algal Blooms, held in Montevideo, Uruguay, 15-17 June 1994. The objectives of this Workshop were: (i) to present current status on implementation and research on Harmful Algal Blooms (HAB); (ii) to establish the immediate needs for training and retraining; (iii) to identify priorities for research to be developed in the medium term; and (iv) to promote contacts and exchange of information

on research and control of HAB among the regional experts.

56 The Workshop aimed to review the current status concerning research and control of Harmful Algal Blooms in the Southern Cone (South America) and to identify research priorities and impediments to their implementation in the region.

57 The Workshop was a forum which enabled experts from the region to establish contact and to exchange information. They proposed institutionalizing these meetings through the establishment of an IOC Working Group on Harmful Algal Blooms in South America (IOC(COI)-FANSA).

58 The major differences among the participating countries were obvious. Some of the countries do not yet possess basic programmes for monitoring biotoxins or toxic phytoplankton, whereas others are beyond the stage of programme development and could, in the near future, implement regional projects on harmful algal bloom ecology and dynamics.

59 Among the training priorities, the absence of specialists in the HPLC method for toxin analysis in the region is highlighted, as is the need to train experts in other disciplines (oceanography, physics, modelling...) to undertake future multidisciplinary projects.

60 Concerning operational elements, urgent measures are needed for the implementation of monitoring programmes in countries that do not have them, the consolidation of existing programmes and upgrading of knowledge on management measures that will make it possible to protect salmon breeding grounds exposed to harmful blooms.

61 Based on their scientific interest, the participants highlighted the following future projects to be developed: (i) the periodic episodes of PSP occurring in the Rio de la Plata region - the zone of convergence of the cold Malvinas current, the warm Brazilian current and the markedly saline front from the Rio de la Plata Estuary; (ii) the effect of UV radiation on phytoplankton communities in the extreme south of South America (Argentina and Chile, located in the area of the "hole" in the ozone layer, where record values of paralytic shellfish poisoning (PSP) toxicity episodes have been detected); and (iii) the dynamics of harmful blooms and prediction of their occurrence in the region of the Chilean fjords, where aquaculture is becomming intensive.

62 A list of actions was presented, together with recommendations summarizing activities to be implemented by the new group during the inter-sessional period. The Workshop Report is available as Document IOC Workshop Report No. 101.

63 Dr. Mendez informed the Panel that the Second IOC-Regional Science Planning Workshop on Harmful Algal Blooms in South America, will be held in Mar del Plata, Argentina, 30 October - 1 November 1995, and that Dr. Jose I. Carreto, INIDEP, is the local organizer of the Workshop.

64 **The Panel noted** with satisfaction the successful implementation of the first Workshop and the planned Workshop in Argentina.

4.16 WESTPAC AND COORDINATION AND COOPERATION IN SOUTH EAST ASIA

65 Prior to the Third IOC/WESTPAC International Scientific Symposium, 22-26 November 1994, Bali, Indonesia, a joint Seminar on the River Input, WESTPAC-HAB, and Shelf Circulation Groups was held, Dr. Y. Fukyo, WESTPAC HAB Chair, (Japan) informed the Panel that the Seminar had decided to work towards the development of a series of regional field studies to improve the understanding of the population dynamics of the species most frequently causing harm in the region. Dr. R. Corrales, University of the Philippines, is the focal point for the activity. The IOC will endeavor it at all possible to support a

project coordinator in WESTPAC.

66 Referring to Recommendation IPHAB-II.5 on coordination and cooperation in South East Asia, Dr. Fukyo also reported on the IOC/WESTPAC-Japan Training Work shop on Monitoring of PSP Plankton and Shellfish Toxicity.This Workshop will take place at the University of Kitasato, Iwate, Japan, from 17-21 July 1995.

67 Dr. Fukyo also reported that he and Mr. H. Enevoldsen, IOC Secretariat, visited the ASEAN - Canada Marine Science Programme Project Office in Kuala Lumpur, Malaysia to generally improv e cooperation in the region, particularly with respect to training and capacity building. The visit resulted in agreement to increase co-operation and joint action. The mission was co-financed by the University of Tokyo and IOC. The first initiative is to also hold the above mentioned training course in Ambon , Indonesia. A number of other expert missions were carried out in the region during 1993-94 by Dr . Anderson and Dr. Fukyo.

68 **The Panel noted** with satisfaction the successful implementation of the Workshop in Bali and the planned workshop. **The Panel exp ressed** its appreciation of the support from the Japanse Government to activities in WESTPAC, and its gratitude to Dr. Fukyo for his efforts in the WESTPAC Region.

4.17 IPHAB TASK TEAM ON ALGAL TAXONOMY

69 The Task Team was established at the Second Session of IPHAB-II through Resolution IPHAB-II.1 (Document IOC-FAO/IPHAB-II/3, Annex II). The report of the Task Team was presented by th e Chair, Prof. O. Moestrup.

70 The Task Team considered four items were during the intersessional period: (i) the establishment of a communication network: The Task Team recommends the establishment of a network using e-mail. The network will be used to distribute new information on taxonomy and geographic distribution of toxic marine phytoplankton, provide lists of new literature, including books, provide reviews of books on toxic marine phytoplankton. The network should be esta blished at the IOC Science and Communication Centre in Copenhagen, and information for distribution should be sent directly to the Centre by fax, e-mail and mail. The network is intended as a means of rapid communication, supplement to HAN. Informatio n extracted from the network could be included in HAN and supplemented with illustrations; (ii) taxonomic recommendations: Major taxonomic recommendations are to be discussed and decided upon at th e international congresses on toxic algae. The Centre in Copenhagen may be contacted for other advice on taxonomic matters. It is suggested that the Centre in Co penhagen prepares a list of people who are experts on different groups of algae in the different geographical areas and who can be approached fo r identification of toxic algae; (iii) development of identification standards for manuals, referenc e collections, etc. (iv) several initiatives are underway: The IOC Manual on HAB; The ICES Identification Sheets of potential toxic algae (four shee ts have been prepared); CD-ROM, the ETI Centre in Amsterdam has transferred a little book on toxic marine phytoplankton to CD-ROM and this technique offers ne w possibilities; (iv) avoid overlap of activities: information can be distributed via the network and the HAN to avoid overlap; this includes information on meetings, courses, etc. and researchers may submi t information on research projects in their respective laboratories, allowing for better knowledge of which projects are being pursued in the different laboratories.

71 **The Panel reviewed** the Report of the Task Team and **concluded** that the Terms of Reference had been fulfilled.

TOXICOLOGY AND TOXIN CHEMISTRY

4.18 IPHAB TASK TEAM ON AQUATIC BIOTOXINS

72 The Task Team was established at the Second Session of the IPHAB-II through Resolution IPHAB-II.2 (Document IOC-FAO/IPHAB-II/3, Annex II), and Prof. T. Yasomoto was elected Chair of the Task Team. A Progress Report was submitted to IPHAB-III, and was presented by the IOC Secretariat.

73 The Team has been working by correspondence through the IOC Harmful Algal Bloom Programme Office during the intersessional period. Two questionnaires: (i) Identification of Standards and Reference Materials on Aquatic Biotoxins and; (ii) Analytical Procedure for Phycotoxin Detection, were distributed and the results were evaluated. The results will be presented as tables in the different volumes of IOC Manuals and Guides, HAB Publication Series. The US supplied assistance with the preparation of the first volume on Amnesic Shellfish Poisoning (ASP). Japan and IOC co-sponsored Dr. H. Ravn, IOC, to stay at the Tohoku University, Sendai, Japan, to assist the Chairman in finalizing the first volume on ASP, and to draft other volumes. The ASP volume has been finalized and distributed for evaluation by the Task Team Members as well as an expert on the subject, Dr. Michael A. Quilliam, Canada. Two other volumes on Paralytic Shellfish Poisoning (PSP) and Diarrhetic Shellfish Poisoning (DSP) have been drafted. It is suggested that volumes on: Brevetoxins; Neurotoxic Shellfish Poisoning (NSP), Brevetoxin derivatives; Ciguatera Fish Poisons (CFP); Blue-Green Algal Toxins: a) Microcystins, b) Anatoxins, c) Hepatotoxins, d) Nodularins, e) Aphantoxins, f) Lyngbyatoxins, g) Cylindrospermopsin; and Ichthyotoxins, to be prepared. It has also been suggested that the different sections be printed separately.

74 An effort has been made by the HAB Programme Office to strengthen the interaction between the different organizations, programmes, and IOC, to avoid overlap and duplicate of activities and obtain coordination. However, the clear division of tasks between the Organizations represented in the Task Team on Aquatic Biotoxins is still not clear concerning activities in toxin chemistry and toxicology related to HAB.

75 There has been no further development on the availability of marine biotoxin standards and reference materials to developing countries in the intersessional period. The National Research Council (NRC) of Canada expressed at IPHAB-II their willingness to make their materials available. NRC has not been able to make their reference materials and standards available for developing countries, and therefor the Recommendation IPHAB-II.4 has not been fulfilled.

76 **The Panel reviewed** the Report of the Task Team.

OPERATIONAL ELEMENTS

MONITORING

4.19 IPHAB TASK TEAM ON DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES

77 At the Second Session of IPHAB, a Task Team was established through Resolution IPHAB-II.3 (Document IOC-FAO/IPHAB-II/3, Annex II). The Terms of Reference were linked to an IOC-DANIDA-financed project on the same matter. The Chair of the Team and the consultant hired under the Project prepared, jointly with the ICES-IOC Working Group (see 4.2), a questionnaire on HAB Monitoring. The questionnaire was circulated to IOC and ICES Member States. The Progress Report was presented by the IOC Secretariat to the Panel (see Annex XIV).

78 **The Panel reviewed** the Report and **welcomed** the progress of the Task Team.

4.20 SURVEY ON ECONOMICAL IMPACTS OF HARMFUL ALGAE

79 A report on the economical impacts of harmful algae on society has been prepared by an Swedish economist who did a 4 month internship at the IOC Secretariat. A survey among Member States was carried out in order to assess which kind of data and figures existed and were accessible. The Report is based on the results of the survey and a theoretical analysis of the issue, and gives an overview of the broad range of the economical impact harmful algae can have. The estimates of losses are very preliminary, due to the missing or not easily accessible data material. Thus estimates are an attempt and probably strongly underestimates the real losses. The report is presently being reviewed by a number of experts, including members of IPHAB, and pending the result of the review it will be published as most appropriate.

PUBLIC HEALTH
and

80 The Representative of FAO, Mr. H. Naeve, Fishery Resources Officer, informed the Panel of the preparation of an FAO document on practical guidelines for establishing national surveillance programmes for the prevention and control of phyxcotoxins in seafood products.

81 **The Panel welcomed** the preparation of the document by FAO.

5. NATIONAL STATEMENTS

82 National statements providing information on national activities and developments in relation to research and management of harmful algae were presented by Brazil, Canada, Chile, China, Denmark, Egypt, France, Germany, Italy, Japan, Malaysia, Philippines, Portugal, Republic of Korea, Russian Federation, Spain, Sweden, Thailand, United Kingdom, United States of America, and Uruguay. The Statements are summarized in Annex VIII. The Statements of Argentina, Australia, Finland, Germany, and Norway are to be found in IOC-FAO/IPHAB-II/3, Annex VIII.

6. HAB PROGRAMME INTERACTION

6.1 INTERACTION WITH OTHER ORGANIZATIONS

83 At the First Session of the Panel in June 1992 the Representatives of UNEP, CEC, ICES and SCOR outlined their activities related to harmful algae and how these could interact with a global programme on harmful algal blooms (Document IOC-FAO/IPHAB-I/3). At the Second Session the Representatives from WHO (IPCS) and IUPAC were invited to outline their activities related to harmful

algae and how these interact with the HAB Programme (Document IOC-FAO/IPHAB-II/3). At this Session IMO outlined their HAB related activities, and ICES and IUPAC provided an update on their activities.

European Community

84 The IOC Secretariat informed the Panel that Dr. Helle Ravn, IOC HAB Programme Office, had visited the EC (DG-XII and DG-VI) in Brussels during May 1994, to establish, and improve, interaction between the European Commission (EC) and the IOC on HAB related activities. Exchange of information and possible co-sponsorship by the EC of HAB Programme training and capacity building activities on toxin chemistry and toxicology were discussed. Co-operation with the EC is being further developed.

85 Dr. Boenke, EC Measurements and Testing Programme DG-XII, gave a lecture at the Training Course in Jena 1994.

86 The HAB Programme Office is cooperating with the EC Reference Laboratory on Marine Biotoxins, Direccion Territorial en Galicia, Unidad Administrativa de Vigo, Spain, and a representative gave a lecture at the training course in Jena in 1994, and will also give a lecture at the training courses in Denmark and Italy in 1995.

87 **The Panel noted** with satisfaction the effort of the IOC HAB Programme Office to improve interaction with the European Community, and welcome possible coorporation.

ICES

88 The Representative of the International Council for the Exploration of the Sea (ICES) informed the Panel that in 1995 ICES will open a project office at the ICES Secretariat. This will be the Project Office for the North Atlantic Programme of GLOBEC, in particular the Cod and Climate Change Programme. The two Member States, Norway and the United States have provided financial support for the Office. The tasks of the Project Co-ordinator are: (i) co-ordinate regional programmes related to GLOBEC; (ii) facilitate the co-ordination of national GLOBEC programmes from ICES Member Countries; (iii) provide a link between the ICES first stock assessment working group; and (iv) assist in the establishment of environmental and fisheries data bases that are relevant to GLOBEC activities.

89 ICES confirmed their willingness to provide literature related to harmful algal blooms to the IOC Science and Communication Centre in Copenhagen to be distributed to developing countries.

90 **The Panel welcomed** the support of ICES to training and capacity building activities e.g. through the IOC Science and Communication Centre in Copenhagen.

IMO

91 The International Maritime Organization was represented by Dr. Manfred Nauke, Chief, Office of the London Convention (details are included in Annex IX). The main concern of IMO related to harmful algal blooms, was the increase in reports on the transfer of non-indigenous marine species and of pathogens through ships' ballast water discharges, including damage to the environment. It was the view of the IMO Representative that the only long-term viable solution to minimizing the transfer of aquatic organisms through ballast discharge, might be the development of new ships' designs which would e.g. allow the flushing of tanks and continuous exchange of ballast during voyages and facilitate heat treatment of large amounts of ballast, etc. In order to initiate such developments, it is necessary to make all Governments fully aware of the potential catastrophic effects caused by the invasion of non indigenous aquatic species and the spread of novel algae blooms in new geographic areas.

92 The ballast problem was also discussed by Prof. James Carlton, Maritime Studies Programme , Mystic, CT 06355, USA (see Annex XII).

93 **The Panel expressed** its concern about the transfer of non-indigenous marine species throug h ballast of ships.

IUPAC

94 The International Union for Pure and Applied Chemistry (IUPAC) was represented by Dr. J.-M. Frémy (see Annex IX). The IUPAC Commission on Food Chemistry is com posed of eight working groups whose activities focus on mycotoxins, a quatic biotoxins, elemental analysis, natural plant toxins, etc. The current projects of the Working Group on Aquatic Biotoxins are: Collaborative Study of the Solid-Phase Immunobead Assay for Screening for Ciguate ra Related Toxins in Fish; Collaborative Study of the Solid-Phase Immunobead Assay for Screening of Diarrheic Shellfish Poisoning (DSP) Toxins in Shellfish; and Unification of Aquatic Biotoxin Nomenclature.

95 **The Panel welcomed** the interest of IUPAC in chemistry and toxicological aspects of HA B aquatic biotoxins.

6.2 INTERACTION WITH OTHER IOC PROGRAMMES

96 At the two previous Sessions of the Panel sev eral IOC Programmes were presented in detail with a view to providing the Panel with the necessary information to avoid overlap and facilitate interaction. The Programmes presented at the First Ses sion were Training Education and Mutual Assistance (TEMA), the Programme on Global Investigation of Pollution in the Marine Environment (GIPME), the Regional IOC Commissions for the Western Pacific (WESTPAC) and the Caribbean and joint Region s (IOCARIBE).

97 At the Second Session the Expert Groups un der GIPME and the Global Ocean Observing System (GOOS) were introduced. An introduction was also given to IOC follow-up initiatives to the Unite d Nations Conference on Environment and Development - UNCED, and how the HAB Programme links with Agenda 21 and its Conventions (see IOC-FAO/IPHAB-II/3).

GIPME

98 Two levels of activities of the Global Investigation of Pollution in the Marine Environmen t (GIPME) Programme are global and regional marine pollut ion monitoring, MARPOLMON. At the global level, programme implementation is carrie d out by three Groups of Experts: the IOC-UNEP-IAEA Group of Experts on Methods, Standards and Intercalibration (GEMSI), the Group of Experts on Effects o f Pollutants (GEEP) and the Group of Experts on Standards and References Material (GESREM). Th e groups activities under MARPOLMON are pursued through a network of national and regiona l laboratories. GIPME is interes ted in the problem of harmful algal blooms because of the implications for public health and protection of living marine resources.

99 At the GEMSI and GEEP Core Group joint meeting, Bermuda, 12- 15 September 1993 (see Annex X) where harmful algal blooms, algal toxins and eutroph ication were discussed, but further action on these subjects has not been developed.

100 At the Eighth Session of the IOC-UNEP-IMO Commit ee for the Global Investigation of Pollution in the Marine Environment, Costa Rica, 18-22 April 1 994, the GESREM Expert Group identified the need for pigment reference materials as well as materials for various biotoxins - a need which grows i n importance almost daily as more and more incidents of algal toxin poisoning are reported.

101 At the Twenty-Fourth Session of GESAMP, New York, 21-25 March 1994, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) mentioned harmfu l algal blooms as a matter of immediate or increasing concern to the marine environment. The grou p reasserted its concern over the impact of toxic algal blo oms. During the past year, new concern over, *inter*

alia, levels of a ciguatoxin-like substances in spanish mackerel, and the potential relationship betwee n chronic fatigue and ciguatera were identified. Following the Twenty-Fifth Session of GESAMP, Rome, Italy, 24-30 April 1995, WHO expressed its wish to support the establishment of a Working Group o n Aquatic Biotoxins by using the mechanism within the IOC-FAO HAB Programme.

102 **The Panel welcomed** the interest of GIPME Expert Groups and GESAMP in the Panel an d **acknowledged** the work carried out within the Groups and its importance to the HAB Programme.

GOOS
(Extract from Document IOC-FAO/IPHAB-II/3, 6.2 Interaction with other IOC Programmes)

103 *GOOS was initiated by IOC and is now developed by IOC in co-operation with WMO, UNEP and ICSU. It will be developed as a global network, co-ordinated internationally, for systematic ocean observations to meet the need for forecasting climate variability and change; to assess the health or state of the marine environment and its resources, including the coastal zone; and to support an improved decision-making and management process - one which takes into account potential natural and man-made changes in the environment and their effects on human health and resources. GOOS is thus an internationally co-ordinated system for operational data collection (measurements), data analysis, exchange of data and data products, technology development and transfer.*

104 *Five modules of GOOS have been defined which represent user interests and applications. They are inter-related and will share observations, data and data networks and facilities, as needed within the one integrated system. Particularly relevant to harmful algae occurrences are the modules on 'Monitoring and Assessment of Marine Living Resources', 'Assessment and Prediction of the Health of the Ocean' and 'Monitoring of the Coastal Zone Environment and its Changes'. The ad hoc Panel for 'Monitoring and Assessment of Marine Living Resources' had its First Session in San José, Costa Rica, 7-10 December 1993. The Panel for 'Assessment and Prediction of the Health of the Ocean' held its First Session in Paris, 23-26 February 1993.*

105 *Interaction with the relevant Panels, possibly through designation of a HAB expert, should be considered. Collaboration with GOOS is also relevant e.g. in relation to training activities on monitoring of harmful algae.*

106 **The Panel stressed** the fact that some monitoring of the occurrence of harmful algae should be seen as an integral element of the Global Ocean Observing System (GOOS).

6.3 IOC FOLLOW-UP TO UNCED (Extract from Document IOC-FAO/IPHAB-III/Inf.2)

107 *At the Seventeenth Session of the Assembly of the IOC, February-March 1993, it was stressed that the follow-up to UNCED should be considered as a high priority activity for the Commission. An ad hoc Intersessional Working Group on the IOC Follow-up to UNCED was established during the Assembly (Resolution XVII-18, within Document SC/MD/101 Annex II). UNCED fully recognized the need for scientific information and methods for management. The Harmful Algae problem occurs universally and requires urgent scientific and managerial attention. Several areas of concern within the comprehensive programme of action adopted by UNCED, Agenda 21, which include harmful algae; (i) their occurrence can be an indicator of the health of coastal zone waters which is central in, and part of Integrated Coastal Area Management; (ii) the transfer of non-indigenous species through de-ballasting; (iii) the synergistic effects of harmful blooms on stressed ecosystem; (iv) the uncertainty in relation to global climate change and effects of changing radiation balance, including U.V. change, etc.*

108 *The Harmful Algal Bloom Programme is designed to foster the effective management of, and scientific research on, harmful algal blooms in order to understand their causes, predict their occurrences, and mitigate their effects. There is a relationship between this programme and the GOOS Module on the Assessment and Prediction of the Health of the Ocean (see below). This programme includes operational elements concerning resource protection and monitoring, closely related to Article 7 and Annex I of the Convention on Biological Diversity. A number of training and information activities, which in particular refer to Article 12, Article 13 "Public awareness and Education", and Article 17 "Exchange of*

Information" of the Convention on Biological Diversity, have been implemented and planned. (Training Courses, Newsletter and Manual). With respect to Article 8 of the Convention, an ICES-IOC Study Group on the Dynamics of Harmful Algae Blooms and a SCOR-IOC Working Group on the Physiological Ecology of Harmful Algae Blooms have been established (both as parts of the scientific element of the HAB Programme).

109 *Two relevant activities with respect to the Convention of Climate Change, Article 5: "Research and Systematic Observation", are the ICES-IOC Working Group on Dynamics of Harmful Algal Blooms and the SCOR-IOC Working Group 97 on the Physiological Ecology of Harmful Algal Blooms.*

110 *Over the last 20 years, the number of observed blooms of various (phytoplankton) dinoflagellate species have increased throughout the world. Some phytoplankton grown at high light intensities present UV absorbing substances. This phenomena may also provide UV protection to other organisms present in the water column, and may be related to climate change. For example it has been discussed in the literature whether the presence of compounds with high UV absorbance in Alexandrium excavatum and Gyrodinium cf. aureolum from the Southern hemisphere (Mar del Plata, Argentina), is an adaption to photo-protection against deleterious UV radiation. In the Northern hemisphere Phaeocystis pouchetii is reported to form massive near-surface blooms in the marginal ice-edge zone around the Antarctic during spring and summer. This marine phytoplankton contains UV-B protecting compounds. This is an example of a new approach related to climate change which may effect the frequency of global algal blooms (see further Item 7.14). HAB research projects, as parts of the follow-up to UNCED, especially the Convention of Climate Change, article 5, must be developed with respect to environmental parameters such as e.g., sunlight and wind velocity to understand the increased number of certain algal blooms. This could also be prepared as a Global Environmental Facility (GEF) project in close relation to national projects.*

111 **The Panel welcomed** the IOC initiative to actively pursue the decisions of UNCED. **The Panel recognized** the need for taking into account Agenda 21 and the two Conventions when setting priorities for the HAB Programme.

7. SETTING OF PRIORITIES, IDENTIFICATION OF RESOURCES, ACTION TO BE TAKEN, AND RELEVANT INTERACTION WITH OTHER PROGRAMMES AND ORGANIZATIONS

112 Based on Document IOC-FAO/IPHAB-III/Inf. 5, which had been circulated prior to the Session, the Panel repeated the objectives in the HAB Programme Plan (Document IPHAB-I/3). After thorough discussion, priorities were set, action to be taken was suggested, and resources were sought identified and committed. Appropriate interaction with other programmes and organizations were established or identified.

113 **The Panel endorsed** a number of inter-sessional activities to be implemented by Member States and IOC Secretariat. The discussion and the activities to be implemented are summarized below. Each activity, the action recommended, and how it relates to the specific objectives in the Programme Plan can be found in Annex XI.

PROGRAMME SUPPORT

7.1 STAFF

114 The present secondment by Denmark of Dr. Helle Ravn, Associate Expert, to the HAB Programme Office will end during 1996. The secondment of additional staff to the Programme Office is crucial to the continued strong development of the HAB Programme. An appropriate level of staffing was considered to be one senior and one to two younger staff members (see Document IOC-FAO/IPHAB-I/3, Annex VII).

115 The Representative of the United States referred to the Seventeenth Session of the IOC Assembly, March 1993, when the United States indicated their willingness to wholly or partly provide support for a Senior Assistant Secretary for OSLR. A number of Member States informed the Panel that they as Panel

Members would investigate the possibility for secondments by their respective countries. It was emphasised that both individuals with scientific and /or administrative experience would be suited for secondment, and that it is not a requirement to be a high level expert. Nevertheless it was also recognized that the continued development of the programme would benefit greatly from the experience and network of a senior HAB scientist at the programme Office.

116 If a Member State considering a secondment, is unable to find a suited or available candidate for the secondment at the national level, it was suggested to second a qualified individual from a developing country facing severe problems caused by harmful algae.

117 **The Panel decided** to make a call in Harmful Algae News for staff for the Programme Office.

118 **The Panel recognized** the need for staff to co-ordinate and help implement the Programme. **The Panel strongly encouraged** Member States to second staff members to the HAB Programme Office, and **urged** the Secretary IOC to pursue the secondment of a Senior assistant Secretary for OSLR and/or HAB. **The Panel adopted** Recommendation IPHAB-III.1.

7.2 SCIENCE AND COMMUNICATION CENTRES

119 Through the WESTPAC-HAB Chair Dr. Y. Fukuyo, IOC/WESTPAC-HAB has received significant support from Japan for a period of ten years, to conduct training courses and capacity building in the WESTPAC region and to provide a species identification confirmation service. The identification service will be offered in co-operation with the IOC Science and Communication Centre in Copenhagen. Japan expressed its wish to consider the establishment of a Science and Communication Centre on Harmful Algae. Although the funds provided by Japan are for WESTPAC/HAB activities, Dr. Fukuyo suggested that participants from outside the region could also participate if alternative support could be found.

120 The Representative of the USA also expressed the interest in establishing a Science and Communication Centre. The US Centre at Woods Hole Oceanographic Institution is, *inter alia*, intended to be responsive to the needs of the IOC and the IPHAB. Specific training, communications and research activities will be defined during the intersessional period. The US Centre will work with the IOC during that period to identify sources of funding and expertise for these activities.

121 **The Panel welcomed** the proposal to investigate the possibility of establishing Science and Communication Centres in Japan and the USA. **The Panel considered** that four Science and Communication Centres would be sufficient and appropriate for the time being.

7.3 TASK TEAM ON HAB PROJECT DEVELOPMENT

122 The Second Session of the Panel established a Task Team on HAB Project through Resolution IPHAB-II.4 (Document IOC-FAO/IPHAB-II/3, Annex II), Chaired by Dr. D. Anderson.

123 To facilitate the work of the Team, it was suggested that the IOC Secretariat generates a list of agencies which are potential sources of funding, and provide it to the Team. It was pointed out that the Team can also be reactive in addition to being proactive, in the sense that regional groups can request the assistance of the Team to find funding for the projects they themselves have developed.

124 The Third Session reviewed the progress report from the Task Team, revised the Terms of Reference and **the Panel decided** to continue the work of the Task Team to help prepare and seek resources for regional HAB activities. **The Panel adopted** Resolution IPHAB-III.1.

7.4 BROCHURE ON THE HAB PROGRAMME

125 **The Panel endorsed** the preparation of a brochure on the HAB Programme outlining the goals, the main activities, contact points, etc. The brochure should be addressed to administrators, politicians, funding agencies, and the general public, and produced in as many languages as possible.

126 Sweden offered to assist in the preparation and sponsor the production of the brochure.

EDUCATIONAL PROGRAMME ELEMENTS

INFORMATION NETWORK

7.5 HARMFUL ALGAE NEWS, THE IOC NEWSLETTER ON TOXIC ALGAE AND ALGAL BLOOMS

127 The Editor noted that his term as Editor had ended, but that he was prepared to continue, if approved by the Panel. **The Panel urged** Dr. T. Wyatt to continue as Editor and he accepted. **The Panel** encouraged the IOC Secretariat to continue its efforts, and to distribute the Newsletter as widely as possible. **The Panel suggested** that the HAN should be presented on Internet in the future as well as in the printed form.

7.6 DISTRIBUTION OF REFERENCE BOOKS AND PROCEEDINGS

128 The Panel was requested to advise on how literature could be made available to research and management institutions in developing countries (HAB Programme Plan 6.1.1, vii).

129 The Representative of ICES confirmed their willingness to assist in providing literature. ICES invited the Staff of the IOC Science and Communication Centre in Copenhagen to select the literature of interest to the HAB Programme.

130 The Representative of FAO offered to send relevant FAO publications to the IOC/HAB Programme Office and to the IOC/HAB Centres.

131 **The Panel urged** its Members to bear in mind the provision of free copies of relevant publications whenever they have a chance to facilitate such an arrangement.

7.7 COMPUTERIZED DATABASES

132 The Panel had a general discussion on the need for, and the feasibility of, establishing various databases in relation to harmful algae. There was general agreement that computerized databases in principle are useful and should be established whenever possible, and preferable be made available through WorldWideWeb (WWW). Relevant bases would be on e.g. taxonomy (ETI, see Report from IPHAB-II), experts within the field, culture collections and a bibliographic base specifically on HAB literature, bases with data that frequently requires up-dating to be really useful.

133 Another long standing topic of discussion is a data base on harmful algae occurrences. ICES has discussed this within its working groups over the last few years, but so far it has no been possible to agree on the content or mobilize adequate enthusiasm to initiate the project. A major problem lies in the lack of uniformity of data, and most data are probably not digitized. ICES expressed its continued interest in the subject. The United States expressed interest in databases on computerized methods/techniques and the related training.

134 The IOC Science and Communication Centre in Copenhagen will establish a bibliographic data-base on HAB literature and make it accessible through WWW. The Centre is also investigating the possible completion of a computerized taxonomic data-base on toxic algae which was initiated a few years ago in cooperation between the Expert Centre on Taxonomic Identification (ETI) in Amsterdam, The Netherlands, and the Botanical Institute, University of Copenhagen. The Directory of HAB experts, which was jointly prepared by the NOAA National Marine Fisheries Service of the United States and IOC, will be made accessible as well through WWW.

135 The Panel reached no specific decisions in relation to establishment of HAB related data-bases, but underlined the necessity of exploring needs and possibilities.

TRAINING

7.8 HAB TRAINING AND CAPACITY BUILDING PROGRAMME

136 During the discussion of training activities already proposed (see below) several Member States offered support or to investigate possibilities of support for specific training courses or workshops. Japan will support several activities for the next ten years in the WESTPAC Region and Spain will investigate possibilities for co-operation in the IOCARIBE Region based on the Recommendations of the IOCARIBE Cumana Workshop (item 4.7). Both Denmark and Spain will provide support through the Science and Communication Centres.

137 Several Panel Members expressed concern about the follow-up to training course and training activities in general. An important aspect is to draw on individuals which have received high level training, as trainers at in-country or regional courses, and to use them as focal points, with the appropriate link to IOC National Committees, for future selection of trainees. In some cases follow-up training of individuals which have followed "training of trainers" courses is required. More attention in the selection of trainees should be given to the fact that many of them go back to an empty laboratory. In this respect it was suggested that more resources should be put into funding equipment e.g. microscopes, in case a microscope of a reasonable quality is not available at the trainees home institution.

138 **The Panel stressed** the importance of making the trainees home institution aware of the content of the training received, in order to improve the chances of optimal benefit from the acquired knowledge.

139 **Planned courses 1995-96:**

IOC/WESTPAC-Japan Training Workshop on Monitoring of PSP Plankton and Shellfish Toxicity, Japan, 17-21 July 1995.

IOC/WESTPAC-ASEAN-Canada Training Course on Harmful Algae, Ambon, Indonesia, 1995, organized with the support of Japan.

IOC-DANIDA Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, IOC Science and Communication Centre on Harmful Algae Copenhagen, University of Copenhagen, Denmark, 31 July-11 August 1995.

IOC-SAREC-DANIDA Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, University of Mauritius, Mauritius, 1996.

IOC-UNEP-WHO-FAO-Italy Training Course on Toxin Chemistry and Toxicology related to Harmful Algal Blooms, University of Trieste, Italy, 3-12 September 1995.

MAST-IOC, 6th Advanced Phytoplankton Course, Taxonomy and Systematics, Zoological Station Anton Dohrn, Napoli, Italy, 24 September-14 October 1995.

140 **The Panel agreed** that an important component of the 'HAB Training and Capacity Building Programme' is provision of equipment and extensive training of individuals. **The Panel adopted** Recommendation IPHAB-III.2. The 'HAB Training and Capacity Building Programme' is included as Annex XIII.

SCIENTIFIC PROGRAMME ELEMENTS

ECOLOGY
and

7.9 TRANSFER OF HARMFUL ALGAE SPECIES VIA BALLAST WATER

141 The Second Session of IPHAB recognized that the problem of transfer of harmful algae via ballast water was of major concern. Most international bulk carriers transport cargo in one direction only, and use water as ballast when empty.

142 Several Panel Members expressed their wish for IOC and IMO to make governments aware of the problem. The need for scientific institutions to emphasize the importance of minimizing the transfer of organisms by ballast was equally recognized. National institutions, IOC, IMO, and ICES have a joint complementary responsibility to bring an appropriate level of attention to the problem.

143 Referring to the recognition the Panel made at its Second Session of the efforts of IMO and ICES within the field of ballast water, **the Panel recommended** that the establishment of a joint mechanism for addressing the scientific questions be investigated. **The Panel adopted** Recommendation IPHAB-III.3.

7.10 LONG-TERM TREND MONITORING OF CHANGES IN PHYTOPLANKTON SPECIES COMPOSITION OVER DECADEL TIME-SCALES

144 **The Panel reiterated** its support to the Continuous Plankton Recorder (CPR). The proposed expansion of CPR to coastal routes will increase the value of CPR data in the evaluation of long term trends in the occurrence of harmful algal events. **The Panel stressed** the need for the CPR to be developed and implemented to monitor dinoflagellates more efficiently.

145 **The Panel urged** Member States and relevant organizations to support the CPR.

146 As another way of assessing long term trends in the occurrence of toxic algae, **the Panel considered** it important to promote studies of old medical records to trace occurrences of shellfish toxicity.

7.11 IOC(COI)-FANSA WORKING GROUP

147 **The Panel took note** of the results and recommendations of the IOC Regional Planning and Science Workshop, Montevideo, Uruguay, 15-17 June 1994 (IOC Workshop Report No. 101, p.10)(see 4.15). **The Panel recommended** that an IOC Working Group on Harmful Algal Blooms in South America (IOC(COI)-FANSA) be established, **and further recommended** the Terms of Reference for the group.

148 **The Panel adopted** Recommendation IPHAB-III.4.

7.12 CYST STUDIES

149 Referring to the HAB Programme Plan, Objective 6.2.1., xi, **the Panel concurred** that there is a need for intensified studies of dinoflagellate cysts, including, inter-alia, cyst-mapping, and training in cyst identification. Dr. A. Zingone remarked that the interest in cyst studies was very strong among the applicants for the Advanced MAST-IOC Phytoplankton Course. Considering the importance of cyst studies, for examples the elucidation of natural dinoflagellate distribution and seed beds, it was suggested that it would be useful to establish a group to focus and promote research on cysts.

150 The Representative of the United States suggested training at Woods Hole Oceanographic Institution in cyst studies, as a possible training activity at WHOI. Identification of dinoflagellate cysts is included in the taxonomic courses held within the HAB Programme.

TAXONOMY
and

7.13 ADVISORY GROUP ON ALGAL TAXONOMY

151 **The Panel recalled** how the number of manuals and reference books on (harmful) phytoplankton taxonomy has been increasing (e.g.: Marine Phytoplankton, C.R. Thomas ed., 1993; Red Tide Organisms in Japan, Y. Fukuyo ed., 1990; ICES Identification Sheets) and the IOC Manual on Harmful Marine Microalgae. **The Panel recognized** that there is a continous need to help coordinate the various efforts, to avoid overlap, to make taxonomic recommendations, and to develop identification standards for preparation of manuals, reference materials and training standards. **The Panel recommended** to promote organization and conduction of regional intercomparisons of identification for quality assurance. Objective 6.2.2 (vii) in the HAB Programme Plan is adjusted accordingly (see Annex XI), and refer to the HAB Programme Plan, objective 6.2.2, ii.

152 **The Panel decided** to transform the intersessional Task Team on Taxonomy of Harmful Algae (see 4.17) into an Advisory Group for the Science and Communication Centre in Copenhagen. **The Panel adopted** Resolution IPHAB-III.2.

7.14 CULTURE COLLECTIONS

153 Referring to the HAB Programme Plan, Objective 6.2.2. (iv), **the Panel concurred** that it would be difficult to establish a single international culture collection of harmful algl species. The strengthening of regional collections and existing collections seemed more feasible and practical. An important tool is to have complete directory of which cultures are available from which collections. An attempt of this, has been made by R. A. Anderson et al., and will be included in the IOC Manual on Harmful Marine Microalgae. It was noted by several Panel Members that the Science and Communication Centres could be important as back-up collections for regional and local collections.

TOXICOLOGY
and

7.15 TASK TEAM ON AQUATIC BIOTOXINS

154 The Second Session of the Panel established a Task Team on Aquatic Biotoxins to initiate and stimulate interaction between relevant organizations and Member States (Resolution IPHAB-II.2, see 4.18). **The Panel recommended** that the tasks on aquatic biotoxins in relation to harmful algae be charged to a new working group. The Task Team will, however, continue its efforts until the working group can be established. **The Panel urged** the Executive Secretary IOC to investigate the possibilities of establishing such a working group jointly with one or more relevant organizations. The Panel recommended that the tasks on aquatic biotoxins in relation to harmful algae be charged to a new working group. The Task Team will, however, continue its efforts until the working group can be established. **The Panel adopted** Recommendation IPHAB-III.5.

7.16 AVAILABILITY OF MARINE BIOTOXIN STANDARDS AND REFERENCE MATERIALS TO DEVELOPING COUNTRIES

155 Marine biotoxin standards are essential for the protection of human health with respect to the effects of harmful algae on fisheries and shellfish aquaculture. Many developing countries rely heavily upon this food source, and have an increasing need for materials and standards. Currently, some standards are made available without charge to developing countries upon request to the U.S.A. and Japan. However, recent developments by the National Research Council (NRC) of Canada have greatly increased the quantity and

availability of such materials. The importance of availability of standards and references is described in Annex XV. Unfortunately, the NRC is obliged to charge for all its materials on a cost-recovery basis.

156 **The Panel considered** it to be of the highest priority to facilitate the provision of toxin standards and reference material to developing countries in addition to training in methods of chemical analysis of phycotoxins. **The Panel reiterated** its Recommendation IPHAB-II.4.

OPERATIONAL PROGRAMME ELEMENTS

MONITORING

7.17 DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES

157 The Planned Conference on Design and Implementation of HAB Monitoring Programmes (see 4.19) was discussed. **The Panel recommended** that monitoring and management questions be addressed in parallel, so as to link monitoring results to problem solution. Some Panel Members specifically mentioned the need of their countries for workshops on mitigation techniques.

158 In order to continue the work on HAB monitoring and management **the Panel decided** to continue the IPHAB Task Team on Design and Implementation of HAB Monitoring Programmes. **The Panel adopted** Resolution IPHAB-III.3.

7.18 LINKAGE BETWEEN GOOS AND THE HARMFUL ALGAE BLOOM PROGRAMME

159 **The Panel reiterated** that monitoring of the occurrence of harmful algae should be seen as an integrated element in the Global Ocean Observing System (GOOS), and that this should be remembered when designing and implementing national monitoring programmes which will be linked to GOOS. **The Panel urged** GOOS to incorporate long term monitoring of phytoplankton, including dinoflagellates.

160 **The Panel agreed** that HAB monitoring programmes should be developed through GOOS and that it was therefore very important to establish close links with GOOS bodies, particularly those dealing with the design and planning of the modules on Assessment and Prediction of the Health of the Ocean (HOTO) and the Monitoring and Assessment of Marine Living Resources. Dr. Halim was appointed to represent IPHAB in HOTO.

161 **The Panel requested** its Chairperson to communicate with the Chairperson on the IOC Committee of GOOS and, in particular, with the GOOS Panels on Health of the Ocean and Marine Living Resources on the possible ways of interaction between HAB and GOOS.

162 **The Panel also agreed** that close collaboration will be required with GOOS to support the continuation and expansion of the CPR survey recommended for use within the IOC-UNEP-WMO Pilot Monitoring Activity on plankton structure in coastal waters. **The Panel adopted** Recommendation IPHAB-III.6.

PUBLIC HEALTH
and

7.19 PROTECTION OF PUBLIC HEALTH

163 **The Panel concluded** that human health related problems of phycotoxins, should be addressed to JECFA (FAO-WHO Joint Expert Committee on Food Additives (see Document IOC-FAO/IPHAB-II/3,

items 6.1, 7.7, 7.15, and Annex IX) for consideration. **The Panel decided** to approach WHO/IPCS and/or the Codex Alimentarius Commission, to initiate a process for a JECFA evaluation of aquatic phycotoxins.

8. COORDINATION AND COOPERATION IN SOUTH EAST ASIA

164 The Second session of the Panel paid serious attention to the need for cooperation and coordination of HAB related activities in South East Asia. Developments in this respect were reported under item 4.16.

165 **The Panel noted** with awareness, and showed positive interest to, the information provided on the developments of an APEC proposal for a marine science programme and its HAB component. The HAB component of the APEC programme was drafted by Dr. D. Anderson (USA), and takes into account areas of mutual interest and potential cooperation between APEC and IOC/WESTPAC-HAB. **The Panel urged** the Chair of the Panel, during the intersessions to follow the development of the APEC project closely, and advice on further action to the HAB Programme Office and IPHAB-IV.

9. OPERATION OF THE IOC-FAO INTERGOVERNMENTAL PANEL ON HAB

166 **The Panel decided** to continue its intersession activities under the co-ordination of the Chair. Dr. A. Zingone, Italy, was elected as Chair, and Dr. Rhodora Corrales, Philippines, was elected as Vice-Chair.

167 **The Panel expressed** its gratitude to the outgoing Chair, Dr. B. Dybern (Sweden) for his considerable efforts in promoting the work of the Panel. The Panel also expressed their thanks and appreciation of the work and dedication displayed by staff of the IOC Secreatriat.

168 **The Panel recommended** that the next Session should be held in 1997. **The Panel adopted** Recommendation IPHAB-III.7.

10. ADOPTION OF RESOLUTIONS AND RECOMMENDATIONS

169 **The Panel adopted** an Executive Summary, and a set of resolutions and recommendations which summarized the findings of the Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 6-9 June 1995. The Resolutions and Recommendations are included as Annex II.

170 **The Panel requested** the outgoing Chair to present the Executive Summary Report, Resolutions and Recommendations to the Eighteenth Session of the IOC Assembly, planned for 13 to 27 June 1995, in Paris.

11. CLOSURE

171 In his concluding remarks, the outgoing Chair noted the fair amount of success of the HAB Programme. The Programme has been consolidated, and some Member States have taken on responsibility for implementation of parts of the Programme.

172 He noted the weak points to be staffing of the Programme Office, and to some extend the regional perspective. He underlined that the regional activities needs to be strengthened, for example what is the situation in Africa with respect to harmful algae?

173 He also noted how the Panel had found a good approach in relation to cooperation around marine biotoxins through joint action with other organizations. There is now also a clearer idea on how to cope with the management issue, through the action planned by the IPHAB Task Teams.

174 He thanked the Panel, and underlined that he had learned a lot, and also that the work with the Panel had given him valuable inspiration for work in other fora. He also thanked the HAB Programme Office for good cooperation.

175 The Chairperson thanked the Rapporteur for his support during the Session. He closed the meeting at 18.00 and informed the Panel that the date for the Fourth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms would be communiated when the dates of the Twenty-ninth Session of the IOC Executive Council were fixed.

ANNEX I

AGENDA

1. OPENING

1.1 OBJECTIVES OF THE *AD HOC* INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS. DECISIONS TAKEN BY THE IOC EXECUTIVE COUNCIL

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA
2.2 DESIGNATION OF RAPPORTEUR

3. SUMMARY DESCRIPTION OF THE OSLR HARMFUL ALGAL BLOOM PROGRAMME (HABP)

4. HABP DEVELOPMENTS IN THE INTERSESSIONAL PERIOD:

4.1 IOC AND FAO ACTIVITIES
4.2 OTHER ORGANIZATIONS AND PROGRAMMES
4.3 ADDITIONAL RELEVANT ACTIVITIES

5. NATIONAL STATEMENTS

6. PROGRAMME ELEMENTS AND ACTIVITIES REQUIRING ACTION AND IDENTIFICATION OF RESOURCES, SETTING OF PRIORITIES

6.1 EDUCATIONAL ELEMENTS
6.2 SCIENTIFIC ELEMENTS
6.3 OPERATIONAL ELEMENTS

7. OVERVIEW OF RESOURCES AND NEEDS

8. HABP INTERACTION

8.1 INTERACTION WITH OTHER IOC PROGRAMMES AND REGIONAL COMPONENTS OF HABP
8.2 INTERACTION WITH OTHER ORGANIZATIONS (UN, ICES, SCOR, EU, etc.)
8.3 FOLLOW-UP TO UNCED

9. RECOMMENDATIONS OF THE IPHAB

10. OPERATION OF THE IPHAB

11. ELECTION OF CHAIRMAN

12. ANY OTHER BUSINESS

13. CLOSING

ANNEX II

RESOLUTIONS AND RECOMMENDATIONS

Code	Title
	Resolutions
Resolution IPHAB-III.1	Task Team on HAB Project Development
Resolution IPHAB-III.2	Advisory Group on Algal Taxonomy
Resolution IPHAB-III.3	Task Team on Design and Implementation of HAB Monitoring Programmes
	Recommendations
Recommendation IPHAB-III.1	Staffing of the HAB Programme Office
Recommendation IPHAB-III.2	HAB Training and Capacity Building Programme
Recommendation IPHAB-III.3	Working group on transfer of phytoplankton by ballast of ships
Recommendation IPHAB-III.4	Working group on harmful algal blooms in South America (IOC(COI)-FANSA)
Recommendation IPHAB-III.5	Working group on aquatic biotoxins related to harmful algae
Recommendation IPHAB-III.6	Linkage between the HAB programme and GOOS
Recommendation IPHAB-III.7	Operation of the IOC Intergovernmental Panel on Harmful Algal Blooms

Resolution IPHAB-III.1

TASK TEAM ON HAB PROJECT DEVELOPMENT

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing that the need for resources is most pronounced in developing countries and that developed countries could assist in filling these needs,

Noting that participation in on-going activities of other NGO's and GO's on harmful algae could be of great benefit to developing countries,

Recognizing that multilateral aid agencies such as UNDP, and the Global Environmental Facility (GEF) could be a significant source of support for HAB training and capacity building in developing countries,

Noting that the IOC has access to agencies, individuals, and programmes that are relevant to the HAB Programme, but requires the specific knowledge of experts to design and articulate proposals,

Decides to continue the operation of an *ad hoc* Task Team to work with the HAB Programme Office and with regional working groups to prepare and submit proposals to appropriate agencies, with the Terms of Reference to:

(i) establish a communications network linking Task Team members;

(ii) obtain from the HAB Programme Office an annotated list of national, bilateral, and multi-lateral agencies, NGOs and other potential funding programmes that can be distributed to regional working groups as needed;

(iii) respond to requests from regional HAB working groups and assist those groups in formulating, writing and submitting proposals to specific agencies;

(iv) assist the regional working groups in promoting their proposals within national and international agencies involved in the decision process;

(v) when possible, initiate discussions with national, international, and NGO funding sources to promote projects which are then referred to regional working groups for further action;

(vi) identify national and international conferences on topics related to HAB incidence and make efforts to present papers or posters that communicate HAB issues to a wide audience that includes policy-makers in related disciplines;

(vii) prepare a progress report to be submitted to IPHAB-IV;

Decides also that the *ad hoc* Task Team will be composed of Dr. D.M. Anderson (USA), Dr. S. Méndez (Uruguay), Ms. B. Reguera (Spain), Dr. B. I. Dybern (Sweden) and Dr. Y. Fukuyo (Japan). The Task Team will be led by the Chair and of the Panel and will include the Vice-Chair of the Panel;

Notes that the Task Team will work by correspondence and will meet on an opportunistic basis. The HAB Programme Office (IOC) will inform Task Team members of meeting possibilities. Costs related to meetings will not be covered by the IOC.

Resolution IPHAB-III.2

ADVISORY GROUP ON ALGAL TAXONOMY

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the growing need to help co-ordinate the various efforts of organizations and institutions in relation to harmful algal taxonomy,

Recalling the decision of the Second Session of the Panel to establish a Task Team on Algal Taxonomy, and the Terms of Reference for the Task Team set out in Resolution IPHAB-II.1,

Recognizing that those Terms of Reference have been fulfilled in the intersessional period, and that the results have been reported to the Third Session of the Panel,

Recognizing the need for scientific back-up to the activities on taxonomy at the IOC Science and Communication Centres,

Decides, with reference to the HAB Programme Plan, objective 6.2.2, ii (Annex V), to transform the *ad hoc* Task Team into an Advisory Group for the Centre in Copenhagen, in order to initiate, catalyze and activate interaction between organizations and institutions which have activities concerning taxonomy of harmful algae;

Decides also that the Advisory Group will be composed of: Prof. Ø. Moestrup (Denmark) Chair, Dr. Y. Halim (Egypt), Dr. M. Elbrachter (Germany), Dr. A. Zingone (Italy), Dr. Y. Fukuyo (Japan),Dr. S. Fraga (Spain);

Notes that the Advisory Group is established until otherwise decided by the Panel, and that it will work by correspondence.

Resolution IPHAB-III.3

TASK TEAM ON DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the need for a comprehensive source of information and guidance on design and implementation of monitoring programmes,

Noting the importance of efficient information and decision networks for minimizing the impacts of HAB events and protecting the public health from the dangers of toxic fish and shellfish,

Recalling the decision of the Second Session of the Panel to establish a Task Team on Design and implementation of HAB Monitoring Systems, and the Terms of Reference for the Task Team set out in Resolution IPHAB-II.3, and the decision of IPHAB-II to organize an international workshop directed towards improved design of monitoring programmes in order to protect resources,

Decides that the workshop should be organized as a combined conference/training workshop;

Recognizing the results of the Task Team in the intersessional period as reported to the Second Session of the Panel,

Decides to continue the *ad hoc* Task Team, to initiate, catalyze and activate interaction between organizations and institutions which have activities concerning management and monitoring, with the

Terms of Reference to:

(i) finalize and publish the Report where examples of monitoring systems on harmful algae from all over the world are presented in detail;

(ii) assist in the organization of an international conference/training workshop directed toward s improved design of monitoring programmes in order to protect resources;

(iii) advise the GOOS Health of the Ocean and Coastal Modules on methods on monitoring HAB's, their impacts and associated environmental variables;

(iv) prepare a progress report to be submitted to IPHAB-IV;

Decides also that the *ad hoc* Task Team will be composed of: Dr. K. Tangen (Norway), Chair, Ms. J . Martin (Canada), Mr. S. Stephen (Canada), Dr. C. Belin (France), Dr. J.A. Ordoñez (Philippines), Dr. B. Dybern (Sweden), Dr. S. Hall (USA), Dr. Choo Poh Sze (Malaysia), Mr. H. Enevoldsen (IOC);

Invites further Member States, in particular developing countries, with special interest in design an d implementation of monitoring programmes on harmful algae to participate in the activities of the Tas k Team;

Notes that the Task Team will work by correspondence and will meet on an opportunistic basis. The HAB Programme Office (IOC) will inform Task Team members of meeting possibilities. Costs related t o meetings will not be covered by the IOC.

Recommendation IPHAB-III.1

STAFFING OF THE HAB PROGRAMME OFFICE

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recalling the Terms of Reference for the HAB Programme Office (IOC-FAO/IPHAB-I/3, Annex VIII) and the level of staffing recommended,

Recognizing the importance of the present secondment by Denmark of one staff member with respect to the development and implementation of the HAB Programme,

Noting that the present level of staffing of one person (contract expiring April 1996) of the Programme Office is not adequate,

Reiterating that it is essential to have one additional staff to co-ordinate and help implement th e Programme, if the present pace of development and implementation are to be maintained,

Noting that three types of staff can be seconded to the HAB Programme office by Member States:

(i) direct secondment of junior and senior professionals

(ii) secondment of Associate Experts through the UNESCO Associate E xperts Scheme (usually young people)

(iii) support for M.Sc., Ph.D., or Ph.D. students to work as Interns at the Programme Office at the IOC secretariat for a 3-6 month period (Interns are provided with a contract but only a symboli c salary),

Encourages strongly Member States to second staff to the HAB Programme Office, either through full secondments or through pooling of resources.

Recommendation IPHAB-III.2

HAB TRAINING AND CAPACITY BUILDING PROGRAMME

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recalling Recommendation IPHAB-II.2 on the HAB Training and Capacity Building Programme, and the related documentation on resources and needs in relation to HAB research and training in Member States,

Recognizing the necessity to ensure an adequate geographical coverage of the HAB Programme,

Recognizing in this effect the strong need to promote access to equipment and the extensive training of selected individuals in regions that lack adequate facilities and properly trained personnel,

Noting that the IOC can only provide very limited support for equipment and extensive individual training,

Recommends, with reference to the HAB Programme Plan, objective 6.1.2, ii (Annex V to this Report), that Member States and the IOC Secretariat intensify their efforts to make adequate equipment and specialized training available to institutions and individuals respectively;

Urges in general Member States to continue to assist in the identification of resources for the implementation of the "HAB Training and Capacity Building Programme".

Recommendation IPHAB-III.3

WORKING GROUP
ON TRANSFER OF PHYTOPLANKTON BY BALLAST OF SHIPS

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the need to minimize the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediment discharge,

Recognizing further the need of obtaining more knowledge on phytoplankton species carried by ballast water and sediments in inter- and trans-oceanic ships;

Noting that IMO and ICES are addressing the problem,

Recommends that:

(i) the Secretariats of the IOC, IMO and ICES consider the possibility of establishing a joint working group to address the problem and find solutions as regards to the transfer of phytoplankton by water discharges from ships;

(ii) that the draft terms of reference be prepared at an informal meeting between IOC, IMO and ICES at the ICES 1995 Annual Science Conference, Aalborg, Denmark, 21-29 September 1995, for consideration by the relevant bodies of IOC, IMO and ICES with a view to their adoption.

Recommendation IPHAB-III.4

WORKING GROUP ON HARMFUL ALGAL BLOOMS IN SOUTH AMERICA (IOC(COI) - FANSA)

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the necessity of co-ordinated activities within the framework of the Harmful Algal Bloom Programme in South America at a regional level,

Recalling the recommendations of the IOC Regional Scientific Planning Workshop on Harmful Alga l Blooms" held in Uruguay, 15-17 June 1994 (IOC Workshop Report No. 101, p. 10),

Recommends the establishment of an IOC Regional Working Group on Harmful Algal Blooms in South America (IOC(COI)-Grupo de Trabajo Regional sobre Floraciones Algales Nocivas en Sudamerica , FANSA) under the chair of Dr. S. Méndez (Uruguay) to:

(i) improve the scientific basis for monitoring and management activities in the region, including the planning and development of workshops for intercalibration of common techniques;

(ii) collate and discuss annual national reports on harmful algal blooms;

(iii) plan and propose the development of regional projects, based on the priorities identified during the 1st. Regional Scientific Planning Workshop, to ensure the supply of human resources an d equipment for a minimum period of 3 to 5 years;

(iv) strengthen the communication network which has alr eady been created between the national focal points, and include the IOC Science an Communication Centres on Harmful Algae;

(v) promote the exchange of expertise and communication on the different elements of the HA B programme between Member States;

(iv) invites interested Member States to participate in the Working Group.

Recommendation IPHAB-III.5

WORKING GROUP ON AQUATIC BIOTOXINS RELATED TO HARMFUL ALGAE

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Considering the growing need for aquatic biotoxin reference materials and standards, and the need for accurate methods to measure aquatic biotoxins in algae, seafood, human consumers and other components of the marine food web,

Noting that WHO and IUPAC are interested in, and working with, the subject,

Noting further the work of the GESREM, the GEMSI and the GEEP of GIPME

Recommends that the IOC takes the initiative together with other interested parties (e.g. WHO, IUPAC) to establish a working group to initiate, catalyze and activate interaction between organizations an d Member States which have activities concerning toxin chemistry and toxicology with respect to toxi c marine phytoplankton, with terms of reference to:

(i) facilitate mechanisms for supply of aquatic biotoxin standards and reference materials, especially to developing countries suffering the economic impacts of harmful algal blooms;

(ii) facilitate improvement of sensitive, specific and reproducible methods for measurement of aquatic biotoxins in toxic phytoplankton and seafood;

(iii) promote the development and implementation of alternative inexpensive methods to replace animal testing that can be used as rapid screening procedures prior to analytical identification of toxin composition;

(iv) facilitate assessment and communication of risks to humans due to exposure to the toxins through consumption of seafood or by direct contact, and suggest management measures to ensure seafood safety;

(v) establish a communication network related to aquatic biotoxins from harmful algae;

(vi) prepare relevant documents on toxin chemistry and toxicology related to harmful algae;

Recommends also that the IOC Secretariat investigates the possibility to establish the working group jointly with WHO, IUPAC and other interested and relevant Organizations;

Recommends further that Prof. T. Yasumoto (Japan), Dr. J.-M. Fremy (IUPAC) and Dr. J. Ramsdell (USA) together with the IOC Secretariat, Dr. H. Ravn, will initiate and activate the working group if established;

Invites Member States and Organizations with interest in aquatic biotoxins related to harmful algae, (e.g. FAO, WHO, UNEP, IUPAC, IST, ISO, EU, AOAC, IAEA) to support and take an active part in the participation of the working group if established;

Notes that the *ad hoc* Task Team on Aquatic Biotoxins established at IPHAB-II (Resolution IPHAB-II.2) will continue its work until a working group is established.

Recommendation IPHAB-III.6

LINKAGE BETWEEN THE HAB PROGRAMME AND GOOS

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Recognizing that the provision of information on the timing and magnitude of blooms of harmful algae represents an essential ocean service that should be articulated as part of the IOC-GOOS Programme's societal justification,

Recommends that the IOC Secretariat and the Chair of the IPHAB work with the IOC-GOOS programme, its subsidiary bodies (I-GOOS and J-GOOS), and the Health of the Ocean and Coastal module working groups, to incorporate during planning and implementation, monitoring facilities to acquire long-term, high resolution observations on the occurrence, distribution, impacts, and densities of harmful and noxious algae and associated environmental parameters;

Also recommends that efforts be made to place a member of the Panel on the GOOS Health of the Oceans Panel (and other GOOS panels as appropriate) who has expertise in aspects of the biology of HABs; and

Further recommends that the IPHAB member of the Health of the Oceans Panel specified above report progress on GOOS activities related to HABs at the IPHAB-IV.

Recommendation IPHAB-III.7

OPERATION OF THE IOC INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms,

Noting the withdrawal of FAO as co-sponsor of the Panel,

Noting the positive interest of UNEP in the OSLR/HAB Programme expressed at the Twenty-sevent h Session of the IOC Executive Council,

Recommends that the Joint IOC-FAO Intergovernmental Panel on Harmful Algal Blooms continue as the IOC Intergovernmental Panel on Harmful Algal Blooms. The Terms of Reference should be the same as those for the IOC-FAO Panel;

Urges the Secretary IOC to pursue the possibility of having UNEP as a cosponsor the Panel.

ANNEX III

LIST OF PARTICIPANTS

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ANNEX IV

TERMS OF REFERENCE OF THE *ad hoc* IOC-FAO INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS

The IOC Assembly, at its Sixteenth Session, Paris 7-21 March 1991, adopted the following resolution with respect to the formation of an *Ad hoc* Intergovernmental Panel on Harmful Algal Blooms in order to identify adequate resources for a sufficiently broad programme to solve some of the real problems caused by algal blooms;

Resolution XVI-4

AD HOC INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS

The Intergovernmental Oceanographic Commission,

Recalling that the IOC, at the Fourteenth Session of its Assembly, endorsed the development of the sub-programme on Harmful Algal Blooms, and that the Twenty-third Executive Council, through its Resolution EC-XXIII.1, endorsed the programme development so far,

Being aware of the increasing socio-economic risks posed by toxic algae and harmful algal blooms to marine organisms, fisheries, aquaculture, human health and the coastal environment,

Approves the formation of an *Ad hoc* Intergovernmental Panel on Harmful Algal Blooms, with the Terms of Reference shown in the Annex hereto;

Invites FAO to co-sponsor the *Ad hoc* Panel;

Invites Member States which intend to be involved in the implementation of a programme on Harmful Algal Blooms to nominate their representatives for the *Ad hoc* Panel and inform the Secretary IOC accordingly;

Decides to review, at the Seventeenth Session of the Assembly, the Terms of Reference of the *Ad hoc* Panel, in conjunction with the Commission's review of the overall organization of the OSLR Programme;

Instructs the Secretary to convene the First Session of the *Ad hoc* Panel as soon as possible.

Annex to Resolution XVI-4
Terms of Reference
of the *Ad hoc* Intergovernmental Panel on Harmful Algal Blooms

1. FUNCTIONS

The *Ad hoc* Intergovernmental Panel on Harmful Algal Blooms is established to meet the scientific, managerial, implementation, and resource needs of the Harmful Algal Blooms Programme.

The Panel will carry out the following functions:

1.1 Review and identify programme requirements;

1.2 Promote efficient and cost-effective implementation of the HAB programme and prepare recommendations on this implementation to the Assembly and Executive Council;

1.3 Identify the resources necessary to meet HAB programme needs;

1.4 Ensure effective interaction and communication with regional intergovernmental (e.g., ICES, ICSEM and GFCM) as well as regional and global non-governmental (e.g., SCOR) organizations involved in research on toxic algae and harmful algal blooms; and

1.5 Report to the Twenty-fifth Session of the Executive Council and the Seventeenth Session of the Assembly.

2. COMPOSITION

The membership of the *Ad hoc* Panel is open to Member States of IOC (and FAO, if it agrees to co-sponsor the Panel) which have declared to the Secretary IOC their involvement or intention to participate in the development and implementation of the Harmful Algal Bloom Programme on a global, regional, or national scale. The Panel shall include the Chairman of the OSLR Guiding Group of Experts, representatives of IOC regional and other subsidiary bodies, and of other interested international organizations, particularly SCOR. Invitations to participate in Panel activities may be extended to scientific experts at the request of the Panel and with the approval of the Secretary of the IOC.

3. ORGANIZATION OF THE SESSIONS

3.1 The Panel will, prior to the closure of each Session, elect from its members a Chairman who will serve in that capacity until the closure of the next Session.

3.2 The Sessions shall, in principle, be arranged without financial costs to IOC. Sessions will be conducted, documentation will be provided, and the report of each session will be prepared in English and in other working languages of the Commission as appropriate and required.

3.3 Secretariat support for the Panel will be provided by the Secretary IOC.

ANNEX V

IOC-FAO HARMFUL ALGAL BLOOM PROGRAMME PLAN

(**Revised extract from IOC Workshop Report No. 80**)

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6.1. EDUCATIONAL PROGRAMME ELEMENTS

6.1.1 Information Network

Goal: To develop, encourage and maintain the flow of information, technology and expertise to scientists, administrators and the general public.

Objectives:

i) Produce a regular newsletter for reporting bloom occurrences, recent publications, meetings, new techniques, requests for assistance and general information.

ii) Prepare and publish a manual containing standardized methodology for the study of harmful algae (this book could be modelled after the UNESCO Phytoplankton Manual).

iii) Prepare identification sheets and reference slides for harmful species, preserved material and video documentation, updated as necessary.

iv) Compile lists of experts grouped according to areas of expertise, updated as necessary.

v) Ensure rapid communication of harmful events, new problem species, methodologies and other common information to researchers, administrators and medical personnel.

vi) Prepare, distribute and maintain fact sheets on toxin for administrators, the medical community and the general public.

vii) Facilitate worldwide distribution of reference books, conference proceedings and equipment.

viii) Ensure the distribution of material with respect to public safety and education.

6.1.2 Training

Goal: To promote and facilitate the development and implementation of appropriate training programmes in order to distribute the necessary knowledge and expertise on a global basis.

Objectives:

i) Facilitate workshops and training programmes on taxonomy, ecology, toxin extraction and analysis, management strategies, public health and safety and mitigation techniques.

ii) Promote access to equipment and the extensive training of selected individuals in regions that lack adequate facilities and properly trained personnel for toxin analysis.

6.2.1 Ecology and Oceanography

Goal: To understand the population dynamics of harmful algae.

Objectives:

i) Develop the necessary understanding of bloom dynamics of harmful algae, which includes the phases of bloom progression (excystment or bloom initiation, exponential growth, aggregation, toxicity, as well as death, grazing, encystment, sinking or dispersal) and the succession of phytoplankton species.

ii) Develop numerical models (and eventually reliable predictions) of toxic blooms based on hydrodynamic, chemical and biological principles as well as the unique hydrography, chemistry and plankton composition determined by regional research programmes.

iii) Determine the role of nutrients (total amounts and ratios) in the dynamics of harmful algal events; investigate the relative importance of natural versus anthropogenic sources.

iv) Elucidate the importance of human activities in the dispersal of certain harmful species (e.g., via ship ballast water; transfer of shellfish stocks).

v) Derive quantitative relationships among the biological, physical and chemical parameters with respect to the bloom-forming species which can be used in a local management context through predictive models and management strategies.

vi) Determine the ecological role of toxicity in the population dynamics of toxic species and the consequences of toxicity to living resources.

vii) Design appropriate experimental and field studies to develop the required understanding of the hydrography, ecology and oceanographic conditions controlling the population dynamics of harmful species.

viii) Determine the ecophysiological capabilities of causative species (K_ρ, v_{max}, allelopathic substances, grazer repellant, life-cycle strategies).

ix) Establish long-term trend monitoring stations to document changes in phytoplankton species composition and associated physical and chemical variables over decadal time-scales.

x) Develop studies on cyst assemblages to document the areal distribution of harmful, cyst-forming species in order to identify risk areas for harmful algal blooms.

xi) Encourage analysis of sediments, especially from anoxic basins, that can provide evidence (cysts, frustules, etc.) for the prior occurrence of harmful species in regions where recent introductions are suspected.

6.2.2 Taxonomy and Genetics

Goal: To establish the taxonomy and genetics of the causative organisms at the appropriate levels.

Objectives:

i) Develop and maintain the capability to recognize, characterize and identify harmful species by morphological criteria, including ultrastructural and phenotypic variability and also by different life stages such as resting cysts.

ii) Establish a group to make taxonomic recommendations and to develop identification standards for preparation of manuals, reference materials and training standards.

iii) Determine the genetic heterogeneity within species and isolates with respect to mating compatibility and molecular characteristics.

iv) Support existing and establish new regional culture collections specializing in harmful species and create a centralized international culture collection of harmful species.

v) Promote the development of new, rapid, automated identification, discrimination and counting techniques such as, image analysis, flow cytometry and immuno-labelling.

vi) Encourage and enable the development of computerized taxonomic data bases of harmful species.

vii) Organize and conduct intercalibration exercises.

6.2.3 Toxicology and Toxin Chemistry

Goal: To determine the physiological and biochemical mechanisms responsible for toxin production and accumulation and to evaluate the effect of phycotoxins on living organisms.

Objectives:

With respect to physiology:

i) Establish the biosynthetic pathways of toxin production in algae including defining the role of endo- or exocellular bacteria and viruses.

ii) Determine the physiological mechanisms underlying variable toxicity among strains of species or within single strains grown under different conditions.

iii) Define the toxin accumulation, chemical conversion and depuration processes in contaminated seafood.

iv) Determine the processes of toxin degradation.

With respect to chemistry:

v) Isolate, identify and/or elucidate the structure of toxins.

vi) Prepare and supply toxin standards and reference materials.

vii) Develop new chemical analytical methods for toxins, specifically:

1. alternative assay methods to replace such tests as mouse and other bioassay organisms, while improving the sensitivity, specificity and reproductibility of all methods; and

2. simple field assay kits.

With respect to toxicology:

viii) Define the fate and effects of algal toxins in the marine food web.

ix) Elucidate mechanisms of toxicity to marine animals.

x) Determine the mechanisms responsible for the mass mortalities of fish and other marine organisms caused by toxic substances.

xi) Establish pathological indicators to determine toxins responsible for mortalities and other impacts.

6.3 OPERATIONAL PROGRAMME ELEMENTS

6.3.1 Resource Protection

Goal: To develop and improve methods to minimize the environmental and economic consequences of Harmful Algae.

Objectives:

i) Assist managers in designing, evaluating and improving cost-effective procedures for selecting and protecting aquaculture sites; applying methods for early warning of toxicity and mass mortalities; and developing management strategies.

ii) Assist managers in applying scientific results as quickly and effectively as possible to resolve management, mitigation, public safety, public education and public relations problems.

iii) Assist managers in developing strategies and procedures for protecting the tourist and amenity value of coastal areas.

6.3.2 Monitoring

Goal: To promote and facilitate the development and implementation of appropriate monitoring programmes.

Objectives:

i) Provide a source of information and guidance on design and implementation of monitoring programmes.

ii) Interact with, and encourage, long-term regional, national and international monitoring plans and programmes to identify trends and cycles in the frequency of harmful algal blooms, their resulting toxicity for marine life, and suspected causes (e.g., climatological, hydrographical, or nutrient changes).

iii) Ensure the compatibility (e.g., techniques, type of data collected) of plankton and toxin monitoring programmes with basic studies of algal bloom dynamics and ecology.

6.3.3 Public Health and Seafood Safety

Goal: To protect public health and ensure seafood quality.

Objectives:

i) Facilitate monitoring for toxic species and seafood toxins.

ii) Encourage standardization of methods for toxin detection and levels for market closure.

iii) Facilitate testing of techniques for the mitigation of noxious blooms: (e.g., forced sedimentation, aeration, sea surface scum collection).

iv) Where appropriate, assist with measures to avoid or mitigate harmful events.

v) Develop antidotes against seafood toxins.

[graphic not available]

ANNEX VI

OPENING STATEMENTS

A. Opening Statement of Dr. B. I. Dybern, Chair, IOC-FAO Intergovernmental Panel on Harmful Algal Blooms

Harmful algal blooms occur worldwide and damage to resources and human health is also reported worldwide amounting to hundreds of millions of dollars, not to mention fatal cases in man.

In order to get a better understanding of the complicated mixture of factors which cause the blooms and to obtain a basis for managerial measures in order to decrease the effects, the IOC-FAO *ad hoc* Panel on Harmful Algal Blooms was set up according to a Resolution of the IOC Assembly in March 1991 with co-operation of FAO.

The setting up of the Panel is on line with the emphasis given to management and conservation of living resources at the UN Conference on Environment and Development in Rio de Janeiro in 1992.

The work of the Panel is based on a comprehensive Programme Plan comprising about 40 projects divided into three main categories:

(i) educational elements
(ii) scientific elements
(iii) operational elements

The Panel held its First Session in June 1992 when the Programme Plan was finally elaborated. It was also decided to produce a Manual on Methods and Techniques for Investigations on Marine Microalgae, an updated Directory of Specialists and a Newsletter on Harmful Algal Blooms. A series of Training Courses was also initiated. Contacts with other organizations working on HABs in one way or another were also begun.

According to a Recommendation during the Session, a Programme Office was established at IOC Headquarters in the intersessional period after the meeting.

The Second Session of the Panel was held in October 1993. Four Task Teams were established on:

(i) algal taxonomy
(ii) aquatic biotoxins
(iii) design and implementation of monitoring of HABs
(iv) programme development

These Task Teams functioned during the intersessional period after the Session in close co-operation with the Programme Office. The latter also administered several other activities, e.g., a series of Training Courses, assistance to developing and other countries, and strengthening of the co-operation with other organizations and bodies within and outside the IOC community.

Through the assistance of DANIDA and the University of Copenhagen, Denmark, an IOC Science and Development Centre was inaugurated at the University on 5 May 1995. It marks a big step forward in the development of HAB activities and a necessary decentralization of this global programme. It will mainly deal with taxonomical problems and training activities. A similar Centre in Vigo, Spain, was planned during the period. Newly established HAB programmes in the USA will also be attached to the activities initiated by the Panel.

During this Third Session of the Panel some of the HAB Programme activities have to be further consolidated. The series of training courses, now also including a number of courses related to toxin problems, will be further developed, terms of reference for Task Teams will be updated and revised, and Working Groups for different purposes may be established. It will be suggested to further strenthen co-operation with other organizations and to intensify the distribution of information in various ways.

B. Statement by Mr. Heiner Naeve
Representative of the Food and Agriculture Organization
of the United Nations (FAO)

The Harmful Algal Blooms Programme (HAB) which is a major current activity within OSLR, represents an area of substantial concern with respect to FAO's interest in coastal fisheries resources, aquaculture development, and food safety. However, in view of the reallocation of resources at FAO and the pressure of problems of even more crucial current concern, FAO is unable to allocate significant resources (either in staff activity of funding) to justify continued co-sponsorship of HAB. I might say that we have been aware that it has been felt that FAO has, in the past, provided less support than might be expected from a full co-sponsor of these activities. And we really are unable to argue with this point of view. In fact, we would tend to agree that co-sponsorship should indeed imply a much greater commitment than FAO has been able to offer. Thus, we feel that it is preferable for everybody to formally recognize that FAO is no longer in a position to co-sponsor the programme. However, we will certainly hope to continue to maintain mutually beneficial interaction with IOC on these issues.

Having the floor, I would like to take the opportunity to inform you about an activity of FAO, complementary to the HAB programme. FAO has contracted an expert to prepare practical guidelines for establishing national surveillance programmes for the prevention and control of phycotoxins in seafood products, specifically aimed at addressing needs prevailing in developing countries. This document is envisaged to contribute to the numerous efforts by FAO and WHO, including the various tasks of the Codex Alimentarius Commission, in assisting government agencies to identify suitable means and develop viable measures to ensure safey and quality of seafood for human consumption. We have the first draft of the document in hand which is currently undergoing thorough internal review. Later this year, we hope to have available the revised draft which we would like to share with members of this Panel for comment. We do not think that this endeavour, being clearly management-orientated, grossly overlaps with the work of your Task Team on Aquatic Biotoxins; it will be complementary and thus contribute to our joint efforts in the field of harmful algal blooms.

ANNEX VII

PROGRAMME DEVELOPMENT

1. Staffing

1.1 ☻ Staffing of the Programme Office

Until 1 March 1995 two Associate Experts, Dr. Helle Ravn and Mr. Henrik Enevoldsen, were seconded to the HAB Programme by Denmark. Henrik Enevoldsen's contract expired on 1 March 1995, after three and a half years service in the HAB Programme Office. The secondment of H. Ravn will continue until 1 May 1996.

The project on the IOC Science and Communication Centre on Harmful Algae in Copenhagen, Denmark (Danida) has partly provided the funds for the continuation of H. Enevoldsen as a staff member of the IOC. He will be based at the centre in Copenhagen, but will continue to carry out part of his work at the IOC Secretariat in Paris, and will in particular deal with training and capacity-building activities, as well as the Centres in Copenhagen and Vigo.

With the establishment of the Centres in Copenhagen and Vigo, additional manpower will work specifically with the implementation of the international parts of the programme.

At the Twenty-seventh Session of the IOC Executive Council, Canada indicated that it might second an expert on harmful algae to the IOC Secretariat. So far there has been no indication from Canada as to if and when this could be possible.

2. Workshops

2.1 ☺ IOC Regional Science Planning Workshop on Harmful Algal Blooms, Montevideo, Uruguay, 15-17 June 1994

During IPHAB-II, the Uruguayan Delegate proposed that a Regional Scientific Planning Workshop should be held on Harmful Algal Blooms. The objectives of this Workshop would be: (i) to present a state of the art on the elements for implementation and research on Harmful Algal Blooms (HAB); (ii) to establish the immediate needs for training and retraining; (iii) to identify priorities for research to be developed in the medium term; and (iv) to promote contacts and exchange of information on research and control of HAB among the regional experts. Through Recommendations IPHAB-II.2 and IPHAB-II.3, the Intergovernmental Panel accepted the proposal to hold such a Workshop.

The Workshop aimed at reviewing the state of the art concerning research and control of Harmful Algal Blooms in the Southern Cone (South America) and identifying research priorities in the region and impediments to their implementation.

The Workshop was a forum which enabled experts from the region to establish contact and to exchange information. They proposed institutionalizing these meetings through the establishment of a Working Group on Harmful Algal Blooms in South America (FANSA).

The major differences among the participating countries were obvious. Some of the countries do not yet possess basic programmes for monitoring biotoxins or toxic phytoplankton, whereas others are mostly beyond the stage of programme development and could, in the near future, implement regional projects on harmful algal bloom ecology and dynamics.

Among the training priorities, the absence of specialists in the HPLC method for toxin analysis in the region is highlighted, as is the need to train experts in other disciplines (oceanography, physics, modelling...) to undertake future multidisciplinary projects.

Concerning operational elements, urgent measures are needed for the implementation of monitoring programmes in countries that do not have them, the consolidation of existing programmes and upgrading of knowledge on management measures that will make it possible to protect salmon breeding grounds exposed to harmful blooms.

Based on their scientific interest, the participants highlighted the following future projects to be developed: (i) the periodic episodes of PSP occurring in the Rio de la Plata region - the zone of convergence of the cold Malvinas current, the warm Brazilian current and the markedly saline front from the Rio de la Plata Estuary; (ii) the study of the effect of UV radiation on phytoplankton communities in the extreme south of South America (Argentina and Chile, located in the area of the "hole" in the ozone layer, where record values of paralytic shellfish poisoning (PSP) toxicity episodes have been detected); and (iii) the dynamics of harmful blooms and prediction of their occurrence in the region of the Chilean fjords, where aquaculture is becoming intensive.

A list of actions was presented, together with recommendations summarizing activities to be implemented by the new group during the inter-sessional period.

The Workshop Report is available as Document IOC Workshop Report No. 101.

2.2 ☻ **Second IOC Regional Science Planning Workshop on Harmful Algal Blooms**, Mar del Plata, Argentina, 30 October-1 November 1995

2.3 ☺ **IOC/WESTPAC Joint River Input-Harmful Algal Blooms-Shelf Circulation Seminar,** Bali, Indonesia, 20-21 November 1994

Prior to the Third IOC/WESTPAC International Scientific Symposium, 22-26 November 1994, Bali, Indonesia, a joint Seminar of the River Input, WESTPAC-HAB, and Shelf Circulation Groups was held. With respect to HAB the Seminar decided to work towards the development of a series of regional field studies to improve the understanding of the population dynamics of the species most frequently causing harm in the region. Dr. R. Corrales, University of the Philippines is the focal point for the activity.

EDUCATIONAL ELEMENTS

INFORMATION NETWORK

3.1 ☻ ***HARMFUL ALGAE NEWS* - an IOC newsletter on harmful algae and algal blooms;**

Issue No. 11 of *Harmful Algae News* has been published. HAN is intended as a quarterly newsletter, but in 1994 practical aspects prevented more than three issues being published. As of 1 May 1995 the total number of subscribers was more than 2,000. The Editorial Team is composed of regional co-editors and was established in 1993 in order to support the Editor in his efforts to make HAN a broad scientifical and geographical newsletter. With the exception of a few members, the Editor has not received the intended assistance from Team members in collecting material for HAN. The members of the Editorial Team are listed below.

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3.2 ☻☺ Establishment of HAB Science and Communication Centres

The establishment of HAB Programmme activity centres was proposed at the Twenty-fifth Session of the IOC Executive Council (Paris 10-18 March 1992) and the idea was further elaborated at the Firs t Session of IPHAB (23-25 June 1992). At the Seventeenth Session of the IOC Assembly (Paris, 25 February-11 March, 1993), Denmark and Spain offered to host and establish Science and Communication Centres o n Harmful Algae. The main purpose of the Centres is to provide the framework for systematic assistance i n training and capacity building to developing countries with respect to harmful algae.

The IOC Science and Communication Centre on Harmful Algae in Copenhagen, Denmark, wa s opened by the Secretary IOC and the Rector of the University of Copenhagen, on 5 May 1995. The Centre is staffed by Dr. Jacob Larsen, Associ ate Professor, Mr. Henrik Enevoldsen, Project Coordinator, and one more to be determined. All staff will take an active part in both the training, research and service activities of the Centre. The Centre is hosted by the Department of Mycology and Phycology, Botanical Institute, University of Copenhagen with Professor Ø. Moestrup as the focal poi nt. Activities will be focus on training in taxonomy of harmful species and associated services, includi ng a species identification confirmation service. The Centre is sponsored by DANIDA (thr ough the IOC Trust Fund), the University of Copenhagen, the Danish Ministry of the Environment, the Danish Ministry of Fisheries, and IOC for a five-year period.

The IOC Science and Communication Cen tre on Harmful Algae in Vigo, Spain, will open during the summer of 1995, and will be hosted by, and located at, the Insti tuto Espanol de Oceanografia (IEO), Vigo. The Centre will draw on the staff of the Institute under the leadership of Ms. Beatriz Reguera. Activities will be concentrated on training in toxin chemistry and ecology, and in cooperation with research institutions in Latin America. The Centre is sponsored by the Spanish Ministry of Foreign Affairs (through the IOC Trust Fund), Instituto de Cooperacion Iberoamericana, IEO, and IOC for a five-year period.

The activities of the two Centres will be coordinated and coupled as appropriate, and are intended to be as complementary as possible. Both Denmark and Spain have provided part of the resources for the Centres to the IOC Trust Fund. Details on the activities of the two Centres will be provided during the IPHAB-III.

In addition to the Centres IOC/WESTPAC-HAB has, through the WESTPAC-HAB Chair Dr. Y. Fukuyo, received significant support from Japan to conduct training courses and capacity building in the WESTPAC region and to provide a to confirm species identification.

3.3 ☻ Directory of Experts

As a joint IOC-NOAA (USA) effort, an updated and expanded edition of the international Directory has been prepared to assist countries facing toxic and harmful algal bloom emergencies. The Directory facilitates rapid access to scientists, fisheries managers, public health officials, physicians and others experienced in dealing with toxic and harmful algal blooms and their consequences to fisheries, aquaculture, and public health.

Publication was planned for early 1994, but due to expiration of Dr. Allan White's contract with NOAA, and subsequent lack of manpower at NOAA, the publication was delayed until May 1995.

3.4 ☻ IOC Manual on Harmful Marine Microplankton (Editors G.M. Hallegraeff, D.M. Anderson & A. Cembella)

The IOC Manual on Harmful Marine Microplankton, including methodologies, taxonomy, and monitoring and management issues was planned to be published in 1994. Due to difficulties in in obtaining manuscripts from the respective authors, publication of a preliminary version took place only in June 1995. The Manual will be used at the HAB Programme training courses in 1995, and after eventual adjustments will be finally published in 1996.

3.5 ☻ IOC co-sponsorship of International Conferences related to HAB

The HAB Programme co-sponsored the Sixth International Conference on Toxic Marine Phytoplankton, Nantes, France, 1993, and will also co-sponsor the Seventh International Conference on Toxic Marine Phytoplankton, Sendai, Japan, 1995. The IOC support will cover the participation of scientists from developing countries.

The HAB Programme will co-sponsor the IXth IUPAC Conference on Mycotoxons and Phycotoxins, May 1996, Rome, Italy.

3.6 ☻ Provision of literature

One hundred copies of the Proceedings of the Sixth Conference will be available from the IOC Science and Communication Centre for Marine Science Libraries in developing countries. The Proceedings from the Sendai Conference are planned as an IOC publication which will be provided free.

IOC/WESTPAC-HAB will re-publish 'Biology, Epidemiology and Management of *Pyrodinium* Red Tides', Proceedings of the Management and Training Workshop, Bandar Seri Begawan, Brunei Darussalam, 23-30 May 1989. An additional 100 copies are available at the HAB Programme Office.

TEMA has re-published the red tide algal monograph.

3.7 ☺ Proposal for a SCIENTIFIC AND TECHNICAL COOPERATION NETWORK ON HARMFUL PHYTOPLANKTON, "HUMAN CAPITAL AND MOBILITY", European Commission, Directorate General XII.

The Proposal was rated "B" by the EC indicating that it was not funded in its present form. The Proposal was refered to as being of high quality, but due to restricted availability of funds the Project was not selected for funding. The EC encouraged resubmission of the Proposal. Only very few participants replied to an inquiry by IOC regarding resubmission of the Proposal. Based on the lack of interest, the IOC decided not to reformulate and resubmit the proposal.

TRAINING

4.1 ☺ **IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitativ e Determination of Algal Toxins,** University of Jena, Germany, 18-28 October 1994

The goal of the course was to give the participants a theoretical as well as a practical introduction to qualitative and quantitative determination methods of toxins from marine phytoplankton.

The main objectives were: (i) improvement of the participants chemical and toxicological skills for reliable qualitative and quantitative determinat ion of toxins from planktonic algae and contaminated food; and (ii) Long-term: The experience obtained will be used in the design of a comprehensive training programme on harmful algae, particulary, in the preparation of a training module on qualitative and quantitativ e determination of toxins from harmful marine phytoplankton. The training activities focused on improvin g related human resources as well as technology and knowledg e transfer in order to develop national capabilities for the management of harmful algal events.

For details see Document IOC Training Course Report No. 29.

4.2 ☺ **Follow-up to: IOCARIBE Workshop on Red Tides and Mass Mortality o f Marine Organisms** , Cumana, Venezuela, 16-19 September, 1992

This Workshop was reported on in the report of IPHAB-II. The recommendations of the Workshop for regional activities were detailed and valuable. Unfortunately, the IOC Secretariat has not received an y replies to correspondance with the Workshop organisers or the coordinator of the HAB network established during the Workshop.

4.3 ☻ **Development of the HAB Training and Capacity Building Programme**

The Training Programme as adopted by IPHAB-II is to be composed of 3-4 main modules o n Taxonomy, Toxin Chemistry and Toxicology, Ma nagement Strategies, and Mitigation Techniques. Please see Document IOC-FAO/IPHAB-III/Inf.6.

Planned courses:

4.3.1 ☻ IOC/WESTPAC-Japan Training Workshop on Monitoring of PSP Plankton and Shellfis h Toxicity, Japan, 17-21 July 1995.

4.3.2 ☻ IOC/WESTPAC - ASEAN-Canada Training Course on Harmful Algae, Ambon , Indonesia, 1995, organized with the support of Japan.

4.3.3 ☻ IOC-DANIDA Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, IOC Science and Communication Centre on Harmful Alga e Copenhagen, University of Copenhagen, Denmark, 4-16 August 1995.

4.3.4 ☻ IOC-SAREC-DANIDA Training Course on t he Biology and Taxonomy of Harmful Marine Microplankton, University of Mauritius, Mauritius, 1996.

4.3.5 ☻ IOC-UNEP-WHO-FAO-Italy Training Course on Toxin Chemistry and Toxicology related to Harmful Algal Blooms, University of Trieste, Italy, 3-12 September 1995.

4.3.6 ☻ MAST-IOC, 6th Advanced Phytoplankton Course, Taxonomy and Systematics, Zoological Station Anton Dorhn, Napoli, Italy, 24 September-14 October 1995.

4.4 ☻ Training and cooperation in the WESTPAC Region

To improve cooperation in the region in general, and p articularly with respect to training and capacity building, Dr. Y. Fukuyo, WESTPAC HAB Chair, and Mr. H. Enevoldsen, IOC Secretariat, visited th e ASEAN-Canada Marine Science Programme Project Office in Kuala Lumpur, Malaysia. The visit resulted in a agreement to increase cooperation and joint action. The mission was co-financed by the University o f Tokyo and IOC. The first initiative is to hold the above mentioned training course in Ambon, Indonesia. A number of other expert missions was carried out in the region during 1993-94 by Dr. Anderson and Dr . Fukuyo.

4.5 ☻ Joint IOC-European Commission (EC) training and capacity building activities

To establish, and improve, interaction between the European Commission (EC) and the IOC, Dr . Helle Ravn, IOC HAB Programme Office, visited the EC (DG-XII and DG-VI) in Brussels during May 1994. Exchange of information and possible co-sponsorship by the EC of HAB Programme training and capacity building activities on toxin chemistry and toxicology was discussed. Dr. Boenke, the EC Measurements and Testing Programme DG-XII, provided a lecture at the Training Course in Jena 1994, and will give a similar lecture at the Training Course in Trieste, Ita ly 1995. The HAB Programme Office is also cooperating with the EC Reference Laboratory on Marine Biotoxins, Direccion Territorial en Galicia, Unidad Administrativa de Vigo, Spain, and a represe ntative assisted, and will assist, with a lecture at the training courses in Jena 1994, and Denmark and Italy 1995 respectively.

SCIENTIFIC ELEMENTS

ECOLOGY AND OCEANOGRAPHY

5.1 ☺☻ SCOR-IOC Working Group 97 on the Physiologic al Ecology of Harmful Algal Blooms, La Rochelle, France, 25-26 October 1993.

For the Terms of Reference and Report of the first meeting, please see Document IOC-FAO/IPHAB-III/Inf.4. The next meeting will be held at the University of Tokyo, Japan, 10-11 July 1995. The main item on the Agenda will be the c ontinued planning of the "Advanced Study Institute on the Physiological Ecology of Harmful Algal Blooms" for which a proposal has been submitted to NATO, SCOR, and IOC for funding. If funded, the meeting will be held in May 1996 at the Bermuda Biological Station.

5.2 ☺☻ ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms

The Group met in Vigo, Spain, 7-13 May, 1994, and in Helsinki, Finland, 17-19 May 1995. For the reports the Working Group please see Document IOC-FAO/IPHAB-III/Inf.3.

5.3 ☻ Transfer of Harmful Algal Species via Ballast Water

IPHAB-II requested the HAB Chair and th e Programme Office to further investigate the possibilities and need for interaction with the activities of IMO and ICES, and to report back to IPHAB-III.

At the Twenty-seventh Session of the IOC Executive Council, June 1994, the IMO representativ e expressed IMO interest i n the subject, and IMO offered to co-sponsor a session on the subject at the Seventh International Conference on Toxic Marine Phytoplankton, July 1995, Sendai, Japan.

A special Theme Session on Transfe r on "Ballast Water: Ecological and Fisheries Implications" will be co-sponsored by the IOC and IMO at the September 1995 Annual ICES Science Conference. The Session will be chaired by Professor J. T. Carlton, Williams College, USA, and with respect to HAB, IOC has invited Dr. G. Hallegraeff, Australia, to give a lecture on transfer of harmful algal species via ballast water.

The Chair IPHAB participated in the meeting of the ICES Working Group on Introductions an d Transfers of Marine Organisms, Kiel, Germany, 10-13 April 1995.

IMO is currently working on a set of "Guidelines for Minimizing the Introduction of Unwante d Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharge".

TAXONOMY AND GENETICS

6.1 ☻ IPHAB TASK TEAM ON ALGAL TAXONOMY

The Task Team was established through Resolution IPHAB-II.1. Chair is Prof. O. Moestrup. Th e Progress Report will be submitted to IPHAB-III.

TOXICOLOGY AND TOXIN CHEMISTRY

7.1 ☻ IPHAB TASK TEAM ON AQUATIC BIOTOXINS

The Task Team was established through Resolution IPHAB-II.2. Chair is Prof. T. Yasomoto. Th e Progress Report will be submitted to IPHAB-III.

The Team has been working by correspondence through the IOC Harmful Algal Bloom Programme Office during the intersessional period. Two questionnaires on (i) Identification of Standards and Reference Materials on Aquatic Biotoxins and on (ii) Analytical Procedure for Phycotoxin Detection have bee n distributed and the results have been evaluated. T he results will be presented as tables in the different sections of the document. The US has supplied assistance with the prepa ration of the first session on Amnesic Shellfish Poisoning (ASP). Japan and IOC co-sponsored Dr. H. Ravn, IOC, to stay at the Tohoku University, Sendai, Japan to assist the Chairman, Prof. T. Yasumoto, in finalizing the first session on ASP, and to draft othe r sections. The ASP section has been finalized and distributed for evalua tion by the Task Team Members as well as an expert on the subject, Dr. Michael A. Quilliam, Canada. Two other sections on Paralytic Shellfis h Poisoning (PSP) and Diarrhetic Shellf ish Poisoning (DSP) have been drafted. It is suggested that sections on: Brevetoxins; Neurotoxic Shellfish Poisoning (NSP), Brevetoxin derivatives; Ciguatera Fish Poisons (CFP); Blue-Green Algal T oxins: a) Microcystins, b) Anatoxins, c) Hepatotoxins, d) Nodularins, e) Aphantoxins, f) Lyngbyatoxins, g) Cylindrospermops in; and Ichthyotoxins, to be prepared. It has also been suggested that the different sections be printed separately.

An effort has been made by the HABP Office to strengthen the interaction between the differen t organizations, programmes and IOC, and to avo id overlap of activities. However, this the boundaries between Organizations represented on the Task Team on Aquatic Biotoxins are still not clear concerning activities in the field of toxin chemistry and toxicology related to HAB.

There has been no further development on th e availability of marine biotoxin standards and reference materials to developing cou ntries in the intersessional period. The National Research Council of Canada has expressed their willingn ess to make their materials available, but Recommendation IPHAB-II.4 has not been fulfilled.

OPERATIONAL ELEMENTS

MONITORING

8.1 ☻ IPHAB TASK TEAM ON DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES

The Task Team was established through Resolution IPHAB-II.3. The Terms of Reference are linked to an IOC-DANIDA-financed project on the same matter. The Chair of the Team and the consultant hired under the Project have prepared a questionnaire on HAB Monitoring jointly with the ICES/IOC Working Group (see 4.2), which has been circulated to IOC and ICES Member States. The Progress Report will be submitted to IPHAB-III.

8.2 ☻ IOC/WESTPAC Workshop on long-term monitoring of HAB

The Workshop is planned for 1996-97.

☺ indicates activities in progress or already carried out
☻ indicates activities to be carried out in the future

APPENDIX

AN OVERVIEW OF DIRECT AND SPECIFIC CONTRIBUTIONS TO THE IOC FOR DEVELOPMENT AND IMPLEMENTATION OF THE IOC-FAO HARMFUL ALGAL BLOOM PROGRAMME 1994-95

EXTRA-BUDGETARY CONTRIBUTIONS TO THE IOC TRUST FUND SPECIFICALLY FOR HAB:

		US Dollars
Denmark: (DANIDA)	Development of the HAB Training and Capacity Building Programme, Modules on Monitoring and Management, 1994-1995:	78.720
	Science and Communication Centre on Harmful Algae, five-year project, 1995 contribution (including partially one IOC Staff Copenhagen/(Paris):	242.000
	One IOC staff, Paris:	65.000
Japan:	Training Courses on Monitoring of Toxic Plankton and Shellfish Toxicity (1996-2004), foreseen for 1996:	30.000
Spain:	Science and Communication Centre on Harmful Algae, five-year project, foreseen 1995/96 contribution:	-
Sweden: (SAREC)	Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, Mauritius, 4-14 September 1995:	20.000
UNEP:	Training Course, Jena, Germany, October 1994: (Mediterranean Action Plan)	15.000
(Canada, Japan, US):	Travel support for IOC staff through overall contribution to the IOC TF:	5.000

SPONSORSHIP OF ACTIVITIES:

Denmark:	Danish Fisheries Research Institute, Danish Environmental Research Institute, University of Copenhagen, Support for the IOC Science and Communication Centre for five years, 1995 contribution (including one Centre staff):	109.500
Germany:	Training Course University of Jena, October 1994:	-
Italy:	Training Course Trieste, September 1995:	22.000
Japan:	WESTPAC Training Courses (approx. for 1995) >:	60.000
Spain:	Support for the IOC Science and Communication Centre at Instituto Espanol de Oceanografia for five years, 1995 contribution:	-
FAO:	Training Course Trieste, September 1995:	7.000
Philippines, Indonesia:	WESTPAC Training Courses (approx.):	5.000

IN-KIND CONTRIBUTIONS:

EU:	European Community, Environment Institute; 50 copies of "Microphyte Toxins", by G . Premazzi and L. Volterra. To be distributed at IOC Training Courses.
USA:	NOAA, preparation of the International Directory of Experts in Toxic and Harmful Algal Blooms.

ANNEX VIII

NATIONAL STATEMENTS

THIS ANNEX IS NOT AVAILABLE IN THIS VERSION OF TH E REPORT. IT IS AVAILABLE ONLY IN THE PRINTED VERSION .

ANNEX IX

INTERACTION WITH OTHER ORGANIZATIONS

A. Statement by Mr. Manfred Nauke
Representative of the International Maritime Organization (IMO)

The Panel was informed that since the early 1980s there had been increasing reports on the transfer of non-indigenous marine species and of pathogens through ballast water discharges, including reports on damage tothe environment and related economic loss caused by the invasion of *Mnemiopsis leidyi* (ctenophore) in the Black Sea, and the invasion of *Dreissena polymorpha* (zebra mussel) in the Great Lakes. These concerns resulted in the adoption by the IMO Assembly in 1993 of Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ship's Ballast Water and Sediment Discharges (IMO Resolution A774 (18)). They offered guidance to national maritime administrations on the management of ballast water and associated sediments, but they are not legally binding.

Recently encountered problems in connection with the spreading of algal blooms in geographical areas where they were previously unknown, was reason for several IMO Member States to urge the Organization to implement one of the provisions of the UNCED Agenda 21, Chapter 17, concerning the need for the development of legally binding rules on ballast water management. However, the Marine Environment Protection Committee (MEPC) has not yet decided on this need, but has established a Ballast Water Working Group to consider the various possibilities. There was still a number of countries which considered algal blooms as natural phenomena, caused by the eutrophication of coastal zones and climatological changes. The increasingly alarming reports were also thought to be due to improved scientific methodologies in the detection of species and toxins.

The options on ballast water management techniques offered in the IMO Guidelines include:

(i) certification by port authorities that ballast loaded in their areas was clean, i.e., free of unwanted species;

(ii) exchange of ballast water and flushing out of sediments at deep ocean areas, preferably at water depths of more than 2,000m;

(iii) application of ballast water and sediment treatment techniques and processes;

(iv) discharge of ballast water and sediment into special shore-based facilities for their treatment and ultimate disposal.

The IMO representative noted the many problems identified in the application of each of the options. These problems are related to the lack of internationally accepted standardized methodologies for sampling and analysis of ballast (e.g., of 8,000 tonnes) at deep ocean, as specified for each ship by classification societies; and the many trials carried out without success for various treatments: thermal treatment, ultrafiltration, ozonation, biocides, etc. These were either prohibitively expensive, presented additional safety risks to ships and personnel, or resulted in additional environmental damage.

It was the view of the IMO representative that the only long-term viable solution to minimize the transfer of aquatic organisms through ballast discharge, might be the development of new ships' design which would e.g., allow flushing of tanks and continuous exchange of ballast during voyages, facilitate heat treatment of large amounts of ballast, etc. To initiate such development, it was necessary to make all Governments fully aware of the potential catastrophic effects caused by the invasion of non-indigenous aquatic species and the spreading of novel algae blooms in new geographic areas.

B. Statement by Dr. Jean-Marc Fremy
Representative of the International Union of Pure and Applied Chemistry (IUPAC)

As mentioned during IPHAB-II, the Commission on Food Chemistry (CFC) of the International Union of Pure and Applied Chemistry (IUPAC) has an active Working Group on Aquatic Biotoxins. This Working Group is co-chaired by Professor Yasumoto (Japan) and Professor Park (USA).

The current projects of this Working Group are as follows:

(i) Collaborative Study of the Solid-Phase Immunobead Assay for Screening for Ciguatera-Related Toxins in Fish. Project Report 75/93 (Prof. Park).

(ii) Collaborative Study of the Solid-Phase Immunobead Assay for Screening of Diarrheic Shellfish Poisoning (DSP) Toxins in Shellfish. Project Report 76/93 (Prof. Park).

(iii) Unification of Aquatic Biotoxin Nomenclature. Project 77/93 (Prof. Yasumoto).

The IUPAC/CFC is very open to co-operation with IOC and more information regarding projects can be made available from:

Secretary of the CFC
Dr. J-M. Fremy
CNEVA/LCHA
43, rue de Dantzig
F-75015 Paris (France)
Fax: +33 (1) 45 31 29 94; e-mail: vapa10@calvacom.fr

Project Co-ordinator of the CFC
Dr. H. Vaessen
Eckhoornlaan, 45
NL-3734 GW Den Dolder (The Netherlands)

The following meetings are planned:

(i) An International Workshop on Ciguatera will be held 8-10 November 1995 in Santo Domingo (Dominican Republic). This workshop is sponsored by IUPAC, UNESCO and FAO. IOC is a project partner. The contact person is:

Professor D. Park
Food Science Department
Louisiana State University
Baton Rouge, LA 70803-4200 (USA)
Fax: +1 (504) 388 5300

(ii) The IXth IUPAC International Symposium on Mycotoxins and Phycotoxins will be held 27-31 May 1996 in Rome (see First Announcement???). The contact person is:

Dr. Marina Miraglia
Istituto Superiore di Sanita
viale Regina Elena
I-00161 Rome (Italy)

ANNEX X

INTERACTION WITH OTHER IOC PROGRAMMES

INTERACTION BETWEEN GIPME AND THE HAB PROGRAMME

The Global Investigation of Pollution in the Marine Environment (GIPME) Programme:

The overall objective of the Global Investigation of Pollution in the Marine Environment (GIPME) Programme is to provide a scientifically sound basis for the assessment and regulation of marine contamination and pollution. The GIPME Programme consists of three groups of experts: GEMSI, GEEP and GESREM.

The Group of Experts on Methods, Standards and Intercalibration (GEMSI)

The work of GEMSI is to provide for scientific and technical basis regional conducting chemical monitoring activities and baseline measurements.

The future work plans of GEMSI include a number of areas of marine research and monitoring which should be brought to the attention of the members of the HAB panel.

An ongoing programme to study riverine inputs of contaminants to the oceans, as part of the GIPME mass balance approach, is now focussing on the input of nutrients. The first workshop on this topic was recently held in the WESTPAC Region.

A new focus will be placed on modern contaminants including herbicides and their impact on the coastal zone. Their effects include e.g. disappearance of seagrass beds and the use of such herbicides in the control of "noxious" algal blooms. Attention will also be given in the future to other recognized sources of contamination specifically the widespread use of pharmaceuticals (antibiotics, growth hormones, etc.) in mariculture and hitherto unanalyzed contaminants in sewage (for example the products of chlorination of raw sewage). A joint GEMSI/GEEP working group will begin to address the issue of Eutrophication and attempt to better define the phenomena from a chemical and biological standpoint.

GEMSI's role in all these new areas will remain to provide advice on methods standards and intercalibration as well as to respond to needs for training in regional programmes.

The Group of Experts on Effects of Pollution (GEEP)

The work of GEEP is to ensure an accurate evaluation of the effects of contaminants (either simply or in complex mixture) upon components of the marine ecosystem (either on the single species level or the ecosystem level). GEEP is evaluating means for assessing the biological impact of contamination, and recommending the most effective procedures in regional and global programmes.

GEEP's remit is to address the biological effects of pollution and disturbance of the marine environment. The effects of pollution are rarely isolated from other complex environmental problems and these frequently involve interactions between chemical, physical biological and ecological processes. This inter-dependance needs to be kept in the forefront when considering the development of procedures and methods for measuring biological effects. In fact, many of the techniques developed for chemically - induced effects, and fostered by GEEP are also highly practical for assessing the impact of a range of environmental disturbances on the health of marine organisms, populations and communities.

The problem of the impact of algal toxins on marine organisms has considerable conceptual parallels with GEEP's concern with the biological impact of chemical contaminants. In essence there are four key questions to be addressed that are common to both problems. These are outlined below.

(i) What are the fate and effect of algal toxins/toxic contaminants in the marine food web?

(ii) How do these chemicals or their metabolites exert their toxicity and cause cell injury leading to pathology and death of fish and other marine animals ?

(iii) Can molecular, biochemical and cellular pathological indicators or biomarkers be derived from these mechanistic studies, which will provide diagnostic and predictive "early warning distress signals" of damage to the health of marine animals?

(iv) Are there interactions between the effects of algal toxins and anthropogenic pollutants?

The solution to these problems can be addressed jointly by GEEP and IPHAB by clearly identifying the need for appropriate biological effects indicators. These must be soundly based and would be envisaged as endpoints of mechanistic studies. Cellular and histo-pathology may be particularly useful in identifying biomarkers of toxic damage. This type of approach is probably readily applicable in most of the regions affected by algal toxins. This will also have the added advantage that as immuno-detection methods for specific toxins become more readily available, they can be applied directly to histological tissue sections.

GEEP is now addressing the integration of its methodologies into programmes of management of environmental problems. GEEP's role will be to assess the best ways to create more interaction in areas such as the definition of the problem to be managed and ways of determining its effective resolution. The framework for environmental managerial action developed by GEEP is probably also appropriate to many of the problems being addressed by IPHAB.

The Group of Experts on Standards and Reference Materials (GESREM)

The work of GESREM is to ensure a proper use of certified and working reference materials related to pollution in the marine environment.

The responsibilities of GESREM cover development of instrument calibration solutions and certified reference materials for all analytes of importance to the work of the IOC. These analytes include both inorganic and organic constituents, both natural and anthropogenic. At its Third Session in Brussels on 22-24 September 1992, twelve classes of materials were discussed at length (The report is Document IOC-IAEA-UNEP/GESREM III/3). Of these twelve, perhaps three are of direct interest to IPHAB, viz Inorganic Nutrients in Seawater, Pigments and Algal Cultures and Algal Toxins. The toxins are probably the case of greatest short-term importance. Some solutions of phycotoxins are currently available from the U.S. Food and Drug Administration, and the BCR of the EEC has initiated a program to develop shellfish reference materials for Paralytic Shellfish Poisons (PSPs). A publication describing results of an inter-laboratory comparison of analyses for saxitoxin has been prepared by Dr. Van Egmond of Bilthoven, the Netherlands (in press, "Food Additives and Contaminants"). However, the National Research Council of Canada (NCR) appears to have established a lead currently in the case of ASP, DSP and PSP toxins. Standard solutions of representative compounds of all three classes are now available from NRC, as are shellfish tissue reference materials for the first two.

It is important to distinguish between the meaning of the term "standards" as used by GESREM and similar bodies such as ISO, and the more colloquial meaning. A "certified standard" is a solution whose concentration has been confirmed by more than one independent analytic technique. The NRC marine toxin standards are of this type. On the other hand, one loosely speaks of "standards" which one can use for optimizing chromatographic conditions, training new operators, etc. These latter need not to be so pure (and indeed are probably better if they contain some known impurities in order to evaluate chromatographic performance) and are much cheaper to produce. Both kinds are probably necessary for the purposes of IPHAB.

Unfortunately, NRC is legally obliged to charge for these materials on a cost-recovery basis. It will be important to find a mechanism whereby these expensive materials can be made available to developing countries, in order to fulfill the goals of IPHAB. In addition, participation of NRC scientists in training programs, particularly with respect to quantitative chemical analysis, could be done under the auspices of IPHAB and/or GESREM. A very efficient mechanism for detailed technology transfer has been found to involve visits of a few months at the NRC laboratories in Halifax, by scientists from other institutions. The good offices of IOC (IPHAB and/or GESREM) in arranging and funding such visits would greatly facilitate such arrangements.

GEMSI and GEEP
(Extract of Document IOC/GEMSI-GEEP-I/3 Joint Meeting of GEMSI and GEEP Core Groups, Bermuda, 12-15 September 1993)

Annex III - Report of the GEEP Core Group

2.5.3: Harmful Algal Blooms

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

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

Annex IV - Report of the GEMSI Core Group

7.4 Algal Toxins

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

7.5.6 Eutrophication

Widespread concern is being expressed about increasing introduction of nutrients into marine environment, particularly coastal and marginal sea areas having restricted exchanges with offshore waters. Indeed, in some regional marine areas eg the North Sea, strong international commitments have been made to reducing nutrient inputs from land-based sources as a prenventative measure. The rationale for such action is to reduce the incidence of blooms of nuisance algae, associated adverse effects on tourism, and changes in the oxygenation of coastal waters. To these may be added concerns about the possible connection between eutrophication and the growth of toxic algae that pose risks to both marine organisms and human consumers of seafood. The main difficulty in the context of assessments of eutrophication is determining the extent to which increased primary production is resulting from increased discharges of nutrients to the sea and the extent to which such changes can be regarded as deleterious in the sense of comprimising marine resources and amenities that warrant protection. There is a need for the formulation of a procedure for assessing, on a sound scientific basis, the temporal trends in nutrient fluxes and biological productivity of marine coastal regimes in a manner that permits an objective evaluation of the need for management intervention. It is proposed to establish a GEMSI-GEEP Joint Sub-Group to develop and test such a procedure in the period 1994-1996. The testing of the procedure would take place in a representative marine area and coastal location in Indonesia, close to a centre of population, would appear to be ideal. A workgroup in Indonesia is therefore planned for 1996 as a means of completing the work of the Joint Sub-group:

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

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

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

(iv) To provide detailed specification of the procedure and the results of its testing to both GEMSI and GEEP in 1997. Costs 0K.

GIPME
(Extract of Document IOC-UNEP-IMO/GIPME-VIII/3 Eight Session of the IOC-UNEP-IMO Committee for the Global Investigation of Pollution in the Marine Environment, Costa Rica, 18-22 April 1994)

4.1.3: Group of Experts on Standards and Reference Materials (GESREM):

In addition, the Group has identified the need for pigment reference materials as well as materials for various biotoxins - a need which grows in importance almost daily as more and more incidences of algal toxin poisoning are reported.

6.3 Ocean Science and Living Resources (OSLR) including Harmful Algal Blooms (HAB)

The Chairman remarked that there appered to have been little development in the collaboration of the OSLR Programme and GIPME during this intersessional period, adding that the GIPME Groups of Experts could provide useful contributions to the OSLR programme in general and to the HAB programme in particular.

The IOC Technical Secretary informed the Committee that indeed one representative each from GESREM and GEEP made useful input in the deliberation of the Meeting of the Joint IOC-FAO Intergovernmental Panel on Harmful Algal Blooms (Paris, 14-16 October 1993) and were co-opted into the Task Team on Aquatic Biotoxin Chemistry and Toxicology.

The Committee re-stated that GIPME stands ready to lend assistance to OSLR in complementing its programme.

The ROPME representative informed the Committee that on three occasions, fish have died due to algal blooms in ROPME area.

IOC Secretariat pointed out that the HAB programme is currently working on the UVB impact on phytoplankton.

One of the Canadian representatives informed the Committee that increased irradiance by U.V.B. caused partly by ozone depletion can penetrate depths of 30 m. and the biological significance of these fluxes has yet to be determined.

Extracts of the Report of the Twenty-fourth Session of GESAMP
New York, 21-25 March 1994

10. Matters of immediate or increasing concern with regard to the status of the marine environment

Algal Blooms

10.5 The group reasserted its concern over the impact of toxic algal blooms. During the past year, new concern over, *inter alia*, levels of a ciguatoxin-like substances in spanish mackerel, and the potential relationship between chronic fatigue and ciguatera were identified.

ANNEX XI

PROGRAMME ELEMENTS AND ACTIVITIES REQUIRING ACTION AND IDENTIFICATION OF RESOURCES, SETTING OF PRIORITIES

(Agenda item 6)

OVERVIEW OF ONGOING AND IMPLEMENTED ACTIVITIES

(Agenda item 4)

This document is based on the HAB Programme Plan (Document IOC-F AO/IPHAB-I/3). In order to obtain an overview of **Programme Elements and Activities req uiring action and identification of resources** and **ongoing and implemented Activities** these have been inserted in the Programme Plan in boxes:

PROGRAMME ELEMENTS AND ACTIVITIES REQUIRING ACTION AND IDENTIFICATION OF RESOURCES

ACTION:

in shaded boxes

and,

OVERVIEW OF ONGOING AND IMPLEMENTED ACTIVITIES

in non-shaded boxes

PROGRAMME SUPPORT MATTERS

Staff: At present there is one Associate Expert seconded to the HAB Programme Office by Denmark; Dr. Helle Ravn. Her assignment ends on 31 April 1996. As stressed at IPHAB-II, the secondment of experienced staff to the IOC Secretariat is essential for the continuing strong development of the HAB Programme. A Post Description can be found in Annex VII, IOC-FAO/IPHAB-I/3. At the Twenty-seventh Session of the IOC Executive Council, Canada indicated that it would consider a secondment. ACTION: **Recommendation IPHAB-III.1 was adopted.**

IPHAB-II established a Task Team on HAB Project Development through Resolution IPHAB-II/4. FOLLOW-UP ACTION: **The Panel adopted Resolution IPHAB-III.1.**

A brochure on the HAB Programme should be prepared. The brochure should outline the goals of the HAB Programme, the main activities, contact points, etc., and should be addressed to administrators, politicians, funding agencies, and the general public. IPHAB-II endorsed its preparation. The Programme Office needs the technical and financial support of a Member State.
ACTION: **The Panel endorsed the preparation of a brochure.**

IOC Science and Communication Centres on Harmful Algae: The establishment of HAB centres has been offered by Denmark and Spain. The Centres are complementary and coordinated by the IOC Secretariat. The Centre in Denmark opened on 5 May 1995 and the Centre in Spain is expected to be operational during summer 1995. Documents: IOC-FAO/IPHAB-III/Inf. 1, IOC-FAO/IPHAB-III/Inf. 2, and IOC-FAO/IPHAB-I/3.

6.1. EDUCATIONAL PROGRAMME ELEMENTS

6.1.1 Information Network

Goal: To develop, encourage and maintain the flow of information, technology and expertise to scientists, administrators and the general public.

Objectives:

i) Produce a regular newsletter for reporting bloom occurrences, recent publications, meetings, ne w techniques, requests for assistance and general information.

The IOC newsletter Harmful Algae News is published quaterly and is distributed in 2000 copies. The Editor is Dr. Timothy Wyatt. In 1993 an Editorial Team was identified. Document IOC-FAO/IPHAB-III/Inf 2

ii) Prepare and publish a manual containing standardized methodology for the study of harmful algae (this book could be modelled after the UNESCO Phytoplankton Manual).

The Manual was expected to be ready at the end of 1993, but the manuscript is not expected to be complete until July 1995, due to difficulties in obtaining the various chapters from the authors. The Manual will hereafter be printed in a preliminary version to be tested at the IOC 1995 training courses. The Chief Editor is Dr. Gustaaf Hallegraeff, University of Tasmania, Australia. Document IOC-FAO/IPHAB-III/Inf 2.

iii) Prepare identification sheets and reference slides for harmful species, preserved material and vide o documentation, updated as necessary.

This will, inter alia, be addressed by the HAB Centres. The experience from the preparation of the ICES Identification Sheets will be drawn upon, and the further development and geographical expansion of the ICES Sheets will be supported. Dr. Y. Fukuyo, University of Tokyo, has received the permission of ICES to adapt the ICES Sheets to become more relevant to the IOC/WESTPAC region. A series of photo-slides of harmful plankton and related events is in preparation. Video documentation is under preparation in cooperation with ETI, Amsterdam.

iv) Compile lists of experts grouped according to areas of expertise, updated as necessary.

An updated Directory of Experts has been in preparation since 1992, and was expected to be published in the first half of 1994. Unfortunately the preparation of the manuscript has been severely delayed by various circumstances beyond the control of the Programme Office. The Directory is expected to be published during the second half of 1995 as a joint IOC and NOAA (USA) effort.

v) Ensure rapid communication of harmful events, new problem species, methodologies and othe r common information to researchers, administrators and medical personnel.

This should be facilitated by the Science and Communication Centres, and is expected to include an Internet facility. ACTION: **Endorsed, see Summary Report 7.2 and 7.7.**

vi) Prepare, distribute and maintain fact sheets on toxin for administrators, the medical community and the general public.

IPHAB-II concluded that the problem of phycotoxins as related to human health, should be addressed to the FAO-WHO Joint Expert Committee on Food Additives (JECFA). IPHAB-II decided to approach WHO/IPCS (International Programme on Chemical Safety). IPCS has informed JECFA of IOC's interest to include phycotoxins in JECFA. JECFA was forthcoming, but stressed the importance of initiative from governments. ACTION: **Endorsed, see Summary Report 7.19.**

vii) Facilitate worldwide distribution of reference books, conference proceedings and equipment.

As far as possible this will be addressed by the HAB Programme Office and the Science and Communication Centres. Discounts on various publications are currently being negotiated with publishers etc. For details see Document IOC-FAO/IPHAB-III/Inf.2.
ACTION: **Endorsed, see Summary Report 7.6.**

viii) Ensure the distribution of material with respect to public safety and education.

6.1.2 Training

Goal: To promote and facilitate the development and implementation of appropriate training programmes in order to distribute the necessary knowledge and expertise on a global basis.

Objectives:

i) Facilitate workshops and training programmes on taxonomy, ecology, toxin extraction and analysis, management strategies, public health and safety and mitigation techniques.

The outline of the HAB Training Programme was adopted by IPHAB-II as outlined in Document IOC-FAO/IPHAB-III/Inf 6. Implemented and planned courses are listed in Document IOC-FAO/IPHAB-III/Inf.2. Additional funds for the further development and implementation are required.
ACTION: **The Panel adopted Recommendation IPHAB-III.2.**

ii) Promote access to equipment and the extensive training of selected individuals in regions that lac k adequate facilities and properly trained personnel for toxin analysis.

The IOC can only provide very limited support for extensive training. In 1994 only one Study Grant was provided by the HAB Programme. In order to increase the possibilities for extensive training, and to include the provision of equipment in the HAB Training and Capacity Building Programme, direct cooperation with Institutions which has the required expertise is required in both the fund raising process and the training itself. ACTION: **Endorsed, see Summary Report 7.8.**

6.2 SCIENTIFIC PROGRAMME ELEMENTS

6.2.1 Ecology and Oceanography

Goal: To understand the population dynamics of harmful algae.

Objectives:

i) Develop the necessary understanding of bloom dynamics of harmful algae, which includes the phases of bloom progression (excystment or bloom initiation, exponential growth, aggregation, toxicity, a s well as death, grazing, encystment, sinking or dispersal) and the succession of phytoplankton species.

ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms
Document IOC-FAO/IPHAB-III/Inf.3.

ii) Develop numerical models (and eventually reliable predictions) of toxic blooms based o n hydrodynamic, chemical and biological principles as well as the unique hydrography, chemistry and plankton composition determined by regional research programmes.

iii) Determine the role of nutrients (total amounts and ratios) in the dynamics of harmful algal events ; investigate the relative importance of natural versus anthropogenic sources.

SCOR-IOC Working Group 97 on the Physiological Ecology of Harmful Algal Blooms
Document IOC-FAO/IPHAB-III/Inf.4.

iv) Elucidate the importance of human activities in the dispersal of certain harmful species (e.g., via ship ballast water; transfer of shellfish stocks).

As requested by IPHAB-II, cooperation with IMO has been initiated in this matter since IMO is already concerned about problems related to transfer of ballast water. A separate session on the matter is included in programme of the Seventh International Conference on Toxic Marine Phytoplankton, Sendai, Japan, 1995. IOC is also co-sponsoring a Theme Session on Transfer of Marine Species by Ballast Water at the 1995 ICES Annual Science Conference.
ADDITIONAL ACTION: **Recommendation IPHAB-III.3 was adopted by the Panel, see Summary Report 7.9.**

v) Derive quantitative relationships among the biological, physical and chemical parameters with respect to the bloom-forming species which can be used in a local management context through predictiv e models and management strategies.

vi) Determine the ecological role of toxicity in the population dynamics of toxic species and th e consequences of toxicity to living resources.

vii) Design appropriate experimental and field studies to develop the required understanding of th e hydrography, ecology and oceanographic conditions controlling the population dynamics of harmful species.

Prior to the Third IOC/WESTPAC International Scientific Symposium, 22-26 November 1994, Bali, Indonesia, a joint Seminar of the River Input, WESTPAC-HAB, and Shelf Circulation Groups were held. With respect to HAB the Seminar decided to work towards the development of a series

viii) Determine the ecophysiological capabilities of causative species (K_ρ, v_{max}, allelopathic substances, grazer repellant, life-cycle strategies).

SCOR-IOC Working Group 97 on the Physiological Ecology of Harmful Algal Blooms. Document IOC-FAO/IPHAB-III/Inf 4.

ix) Establish long-term trend monitoring stations to document changes in phytoplankton specie s composition and associated physical and chemical variables over decadal time-scales.

The proposed expansion of the Continuous Plankton Recorder (CPR) route-net to coastal routes (Gulf of Guinea, Argentinean Coast) will increase the value of CPR data in the evaluation of long-term trends in the occurrence and frequency of harmful algal events. The CPR should be developed or complemented to monitor dinoflagellates more effectively, and to act in support of process studies of finite duration (IOC/Inf-869) ACTION: **Endorsed.**

x) Develop studies on cyst assemblages to document the areal distribution of harmful, cyst-formin g species in order to identify risk areas for harmful algal blooms.

xi) Encourage analysis of sediments, especially from anoxic basins, that can provide evidence (cysts , frustules, etc.) for the prior occurrence of harmful species in regions where recent introductions ar e suspected.

Although not an activity of the HAB Programme, the work in Manila Bay, By Y. Fukuyo, E.F. Furino, K. Matsuoka, and C.L. Gonzales presented at the Third International IOC/WESTPAC Scientific Symposium, provides an example of recent developments in the field.

6.2.2 Taxonomy and Genetics

Goal: To establish the taxonomy and genetics of the causative organisms at the appropriate levels.

Objectives:

i) Develop and maintain the capability to recognize, characterize and identify harmful species b y morphological criteria, including ultrastructural and phenotypic variability and also by different life stages such as resting cysts.

ii) Establish a group to make taxonomic recommendations and to develop identification standards fo r preparation of manuals, reference materials and training standards.

Task Team on Taxonomy on Algal Taxonomy, established by IPHAB-II through resolution IPHAB-II.1

iii) D

etermine the genetic heterogeneity within species and isolates with respect to mating compatibility an d molecular characteristics.

iv) Support existing and establish new regional culture collections specializing in harmful species an d create a centralized international culture collection of harmful species.

A first step in this effort is the relevant Chapter in the IOC Manual on Harmful Marine Microplankton which includes information on harmful algae culture collections worldwide. The culture collections at the IOC Science and Communication Centres are accessible, and are potential locations for a centralized international culture collection of harmful species.
ADDITIONAL ACTION: **Endorsed.**

v) Promote the development of new, rapid, automated identification, discrimination and countin g techniques such as, image analysis, flow cytometry and immuno-labelling.

vi) Encourage and enable the development of computerized taxonomic data bases of harmful species.

The efforts of the Expert Centre on Taxonomic Identification (ETI), Amsterdam, to develop a computerized taxonomic data base of harmful species should be actively supported. The data base is developed in cooperation with the Botanical Institute, University of Copenhagen. The Centre there will pursue the completion of the data base in cooperation with ETI. The establishment of additional bases will be worked on by the Centres.
ADDITIONAL ACTION:

vii) Organize and conduct intercalibration exercises.

This could be organized by the Task Team on Algal Taxonomy eventually drawing on the Science and Communication Centres.
ACTION: **The Panel adopted Resolution IPHAB-III.2.**

6.2.3 Toxicology and Toxin Chemistry

Goal: To determine the physiological and biochemical mechanisms responsible for toxin production an d accumulation and to evaluate the effect of phycotoxins on living organisms.

Objectives:

With respect to physiology:

i) Establish the biosynthetic pathways of toxin production in algae including defining the role of endo- or exocellular bacteria and viruses.

ii) Determine the physiological mechanisms underlying variable toxicity among strains of species o r within single strains grown under different conditions.

iii) Define the toxin accumulation, chemical conversion and depura tion processes in contaminated seafood.

iv) Determine the processes of toxin degradation.

With respect to chemistry:

v) Isolate, identify and/or elucidate the structure of toxins.

vi) Prepare and supply toxin standards and reference materials.

As recommended by IPHAB-II the HAB Programme Office contacted the National Research Council of Canada (NRI) with a view to finding a mechanism whereby the Canadian reference materials could be made available to developing countries. So far is has not been feasible for NRI to make the standards and reference materials freely available. The Expert Groups under GIPME (GESREM, GEEP, GEMSI) should be strongly encouraged to emphasize their relevant activities. Cooperation should be sought with e.g. EU (SM&T), IUPAC, IST, and interested Member States.
NEW ACTION: **The Panel reiterated its Recommendation IPHAB-II.4, see Summary Report 7.16.**

vii) Develop new chemical analytical methods for toxins, specifically:

1. alternative assay methods to replace such tests as mouse and other bioassay organisms, whil e improving the sensitivity, specificity and reproductibility of all methods; and

2. simple field assay kits.

The Expert Groups under GIPME (GESREM, GEEP, GEMSI) should be strongly encouraged to emphasize their relevant activities. Cooperation should be sought with e.g. EU (SM&T), IUPAC, AOAC, IST, and interested Member States to make simple test kits available in particular to developing countries. ACTION: **The Panel adopted Recommendation IPHAB-III.5.**

With respect to toxicology:

viii) Define the fate and effects of algal toxins in the marine food web.

ix) Elucidate mechanisms of toxicity to marine animals.

x) Determine the mechanisms responsible for the mass mortalities of fish and other marine organisms caused by toxic substances.

xi) Establish pathological indicators to determine toxins responsible for mortalities and other impacts.

6.3 OPERATIONAL PROGRAMME ELEMENTS

6.3.1 Resource Protection

IPHAB-II considered it appropriate that the development of the entire Programme Element should be pursued drawing on the expertise and experience of FAO. The HAB Programme Office has sought the advice of FAO on appropriate action.
ACTION: **Endorsed.**

Goal: To develop and improve methods to minimize the environmental and economic consequences of Harmful Algae.

Objectives:

i) Assist managers in designing, evaluating and improving cost-effective procedures for selecting and protecting aquaculture sites; applying methods for early warning of toxicity and mass mortalities; and developing management strategies.

Extra-budgetary funds (DANIDA) are available to start the development of an activity. Suggestions from the Panel for appropriate experts to assist the Programme Office would be welcomed.
ACTION:

ii) Assist managers in applying scientific results as quickly and effectively as possible to resolve management, mitigation, public safety, public education and public relations problems.

iii) Assist managers in developing strategies and procedures for protecting the tourist and amenity value of coastal areas.

6.3.2 Monitoring

The entire Programme Element should also be seen as an element of GOOS.

Goal: To promote and facilitate the development and implem entation of appropriate monitoring programmes.

Objectives:

i) Provide a source of information and guidance on design and implementation of monitorin g programmes.

A Chapter in the IOC Manual on Harmful Marine Microplankton will address management and monitoring (in general) in relation to harmful algae. Based on the advice of IPHAB-II, a supplement will be an IOC publication where examples of monitoring systems from all over the world are presented in detail. The report is prepared by the Task Team on Design and Implementation of HAB Monitoring Programmes. The Project is receiving support from DANIDA. An international workshop on monitoring is planned for 1996. ADDITIONAL ACTION: **The Panel adopted Resolution IPHAB-III.3, see Summary Report 7.17.**

ii) Interact with, and encourage, long-term regional, national and international monitoring plans an d programmes to identify trends and cycles in the frequency of harmful algal blooms, their resultin g toxicity for marine life, and suspected causes (e.g., climatologic al, hydrographical, or nutrient changes).

iii) Ensure the compatibility (e.g., techniques, type of data collected) of plankton and toxin monitorin g programmes with basic studies of algal bloom dynamics and ecology.

Independently of the IOC, a proposal entitled "Standardization and Intercalibration of Monitoring Methods for Phytoplankton Analysis, SIMPA" has been submitted to the Commission of the European Union for an European initiative. ACTION ON THE PART OF IOC: **Endorsed.**

6.3.3 Public Health and Seafood Safety

WHO should be consulted and cooperated with in the development of the Programme Element.
ACTION: **Endorsed.**

Goal: To protect public health and ensure seafood quality.

Objectives:

i) Facilitate monitoring for toxic species and seafood toxins.

ii) Encourage standardization of methods for toxin detection and levels for market closure.

iii) Facilitate testing of techniques for the mitigation of noxious blooms: (e.g., forced sedimentation , aeration, sea surface scum collection).

iv) Where appropriate, assist with measures to avoid or mitigate harmful events.

v) Develop antidotes against seafood toxins.

ANNEX XII

EXOTIC SPECIES IN THE SEA: BIOLOGICAL INVASIONS AND MARINE BIODIVERSITY

SUMMARY OF LECTURE BY PROF. J.T. CARLTON

The lecture by Professor J. T. Carlton on the transfer of marine organisms by ship's ballast water, is summarized in the following article which was published in the International Marine Science Newsletter (IMS Newsletter No.75/76):

The animals and plants of the world's oceans are in motion in a way that they may never have been before. Only since the 1980s,

- the American comb jelly (ctenophore) *Mnemiopsis leidyi* has invaded the Azov and Black Seas, rendering yet another blow to the once-productive anchovy fisheries of those regions; it has now entered the Mediterranean Sea;

- the Japanese shore crab *Hemigrapsus sanguineus* appeared on the Atlantic coast of North America, and has now spread from Chesapeake Bay to Cape Cod, where it can become locally common;

- the southern hemisphere mussel *Perna perna* has invaded the Gulf of Mexico, colonizing the Texas and Mexican coasts, while the Indo-Pacific mussel *Perna viridis* has invaded the Caribbean, both mussels establishing "monoculture" - like populations on jetties, mangroves, and other hard substrates;

- the Atlantic green crab *Carcinus maenas* has invaded the central California coast and established new beachheads in Tasmania, while the Chinese mitten crab *Eriocheir sinensis* has become common in San Francisco Bay, both crabs with striking reputations as, respectively, predators and bioeroders;

- Asian copepods have appeared in Eastern Pacific bays and estuaries ranging from the Chilean fjords to Los Angeles harbor, and from San Francisco Bay to the Columbia River; evidence from one study in San Francisco Bay demonstrates that invasive copepods may impact native zooplankton abundance;

- common Japanese species, such as the kelp *Undaria pinnatifida*, the seastar (starfish) *Asterias amurensis*, and various dinoflagellates, have appeared in southeastern Australia; the first two have become sufficiently abundant to have potential community-level impacts, while the dinoflagellates, in huge numbers, have caused red tides that impacted shellfishery operations;

- the green alga *Caulerpa taxifolia*, in the form of a warm temperate genotype which may find its origins within the aquarium industry, has formed luxuriant monospecific beds from the Adriatic Sea to France;

- the American Atlantic polychaete worm *Marenzelleria viridis* is now spreading abundantly through northern European estuaries, while the Chinese clam *Potamocorbula amurensis* is now one of the most abundant marine organisms in the estuary of San Francisco Bay;

- novel harmful algal blooms have occurred in large numbers around the world, and some of these, while not caused by ballast water, might possibly be due to species newly inoculated by ballast water; and

- the Eurasian zebra mussels *Dreissena polymorpha* and *Dreissena bugensis*, the Eurasian waterflea (cladoceran) *Bythotrephes cederstroemi*, and three species of European fish, the ruffe *Gymnocephalus cernua* and the gobies *Proterorhinus marmoratus* and *Neogobious melanostomus*, all appeared within a few years of each other in North America's Great Lakes.

[photograph Black jelly-fish Macotias inexpectata - recently invaded San Francisco Bay, California (1992).

[photo here not included]

Does this seem like a long list? It may well be - but this entire issue of the IMS Newsletter would, in fact, be filled if we simply listed the invasions of nonindigenous species of marine protists, viruses, invertebrates, seaweeds, seagrasses, and fish that have occurred in the coastal seas of the world's continents in the past 15 to 20 years.

In the world's seas, species are on the move. Why? Why now? And so what?

In the waning decades of the 20th century we have seen the waxing of global transportation mechanisms that rapidly move marine, brackish, and freshwater organisms around the world in a matter of hours and days, fundamentally eclipsing the natural barriers that created the incredible biodiversity of the oceans.

The primary human-mediated vectors are shipping (and particularly ballast water), the vast mariculture (aquaculture) industries with their only modestly regulated flow of shrimp, bivalve mollusks (clams, oysters, mussels, and scallops), and finfish around the world, and the equally vast aquarium industry that moves ornamental fish, invertebrates, and algae in similar astronomical numbers on a daily basis.

With an estimated more than 3,000 species of animals and plants in motion on a daily basis in ships' ballast tanks, and with hundreds of species of mariculture and aquarium industry animals and plants in motion in jumbo jets on an hourly basis, that accidental (and sometimes intentional) invasions of alien species should occur is, in retrospect, no surprise. That there are more and faster ships and more and faster airplanes, and that we have invested nearly 30 years in the environmental amelioration of coastal systems to improve water quality (and thus reduce coastal pollution that might possibly have previously deterred certain invasions) are two possibilities within a family of hypotheses (that also include increased pollution as favouring other invasions) as to why such phenomena appear to be increasing today.

Should we be concerned about these invasions? The answer is, of course, not simple. Within the public-political arena (and thus within the eyes of the popular press), we are usually driven by only two concerns: are their direct economic or human health impacts? But within the ecological and environmental arenas, we are further concerned with the broader issues of how and why coastal biodiversity could change in the face of invasions, and what the long-term impacts on community and ecosystem structure and function could be.

Even without considering the broad suite of ecological changes that may occur, there are clear reasons for concern:

- the zebra mussel *Dreissena polymorpha*, a major fouling organism, can reduce a one-metre diameter water pipe to 15 cm and, only since 1988, has spread from Lake Erie to Oklahoma in the American midwest, to New Orleans in the south, and to New York in the east.

- shellfish (bivalve mollusc), shrimp and fish diseases, transported by the same industries seeking to culture these organisms, cost tens, if not hundreds, of millions of dollars of damage each year to the mariculture industry.

- the comb jelly-fish *Mnemiopsis leidyi* became so abundant in the Azov and Black Seas - described as standing stocks of hundreds of millions of metric tons - that the zooplankton populations declined precipitously, and along with them the important anchovy fisheries of Russia, Ukraine, Bulgaria, Romania, and Turkey.

- cholera virus, transported in ballast water, was carried from South America to the Gulf of Mexico, infesting shellfish beds in Alabama.

- and, of course, exotic species invasions - whether hydroids, worms, clams, crabs, seasquirts, fish, or algae - can have profound impacts on the abundance and diversity of coastal ecosystems. These impacts may range from alterations in trophic pathways to the replacement of once-diverse communities by one or a few species - the latter now happening with the invasion of the seaweed Caulerpa in the northwestern Mediterranean.

These economic, social, industrial and ecological impacts provide the drive to seek ways to reduce the number of future invasions in the oceans - just as agricultural quarantine systems seek to reduce the number of invasions on land.

To consider methods to reduce ballast-mediated invasions, the International Maritime Organization (IMO), through its Marine Environmental Protection Committee (MEPC), has established international voluntary guidelines based upon earlier Canadian, US, and Australian regulations, while an MEPC Ballast Water Working Group considers further directions.

In addition, Australia, New Zealand, Japan, Canada, the USA, Germany, Sweden, the UK, Ireland, Israel, and other countries have all established commissions, committees, and research programmes on ballast water. In the mid-1990s, while some 45 other options are under consideration, ships are encouraged to undertake open-ocean exchange of coastal ballast water, when the safety of ship and crew permit such operations.

Countries and international agencies are further considering methods to minimize the spread of marine diseases. Mechanisms for international discussion and coordination are provided by meetings such as: (i) the International Conference on Preventing Spread of Aquatic Animal Diseases through International Trade (Paris, June 1995), sponsored by the Office International des Epizooties, and (ii) the ICES/IMO/ IOC session on ballast water (Aalborg, Denmark, 21 September 1995), during the ICES annual meeting.
In the meantime, new biological invasions will continue, with new species being added to some marine communities at the rate of perhaps more than one a year. These constant and fundamental changes in coastal communities around the world argue in a compelling fashion for detailed, long-term, and careful studies of marine biodiversity, supported by - indeed, only permitted by - a resurgence of support for the taxonomic and systematic sciences. These studies will provide the foundation that will permit us to assess the scale and, eventually, the fundamental importance, of how the oceans are changing, in part as a result of human activities.

James T. Carlton, Professor of Marine Sciences and Director of Maritime Studies, Williams College - Mystic Seaport, Connecticut, USA. He also chairs the ICES Working Group on Introductions and Transfers of Marine Organisms, and was Co-Chair of the US National Research Council's Committee on Marine Biological Diversity.

ANNEX XIII

HAB Training and Capacity Building Programme

Content:

1. Introduction:

Within the framework of the joint IOC-FAO Ocean Science in Relation to Living Resources Programme (OSLR) the IOC has developed and is now implementing a sub-programme on harmful algal blooms (HAB). The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms has given high priority to the initiation of training activities on harmful algae (IOC-FAO/IPHAB-I/3 and IOC-FAO/IPHAB-II/3), and recommended (Recommendation IPHAB-II.2) that a HAB Training and Capacity Building Programme be prepared and implemented. This need for training is reflected in the various scientific and operational elements of the Harmful Algal Bloom Programme, which all have training as an important component. The training programme should also be seen as an element of the IOC's programme on Training Education and Mutual Assistance in the marine sciences (TEMA).

The HAB Programme is designed to foster the effective management of, and scientific research on, harmful algal blooms in order to understand their causes, predict their occurrences, and mitigate their effects. Training, information, and capacity building activities of the HAB Programme, should also be seen as a follow-up to UNCED, and in particular as a response to Article 12 and 13 "Public Awareness and Education", and Article 17 "Exchange of Information" of the Convention on Biological Diversity.

Within the Training Element of the HAB Programme, the overall goal is the development of a comprehensive training programme composed of modules on selected aspects of harmful algae events. The Training and Capacity Building Programme focus on improving related human resources as well as technology and knowledge transfer in order to develop national capabilities for the management of harmful algal events.

The harmful algae in question are marine micro-algae which cause problems, damage or even due to their toxin production or simply by their mass occurrences. Fisheries, aquaculture, natural marine living resources in general, human health, tourism and other societal activities are often severely affected with the subsequent economic losses. There appears to be global spreading and increase in the number of harmful algal events.

The lack of technical and managerial skills is acute in many parts of the world where harmful algal events are a continued and severe threat to health and marine living resources. The building up of local or regional scientific, technical and managerial expertise and capacity is crucial in the management of harmful algae event

in order to minimize negative economic and societal effects. The training needs are thus both at the scientific/technical level and at the basic level related to local fishermen and aquaculturists. The proposed training programme should encompass both levels. Involvement of, and coordination with, local organizations and institutions involved in management of living marine resources should be an integrated part of the planning and implementation of the training programme.

The IOC-FAO Intergovernmental Panel on Harmful Algal Blooms in particular recommended (Recommendation IPHAB-II.2) that,

(i) all HAB related training and capacity building activities should be implemented after thorough assessment of capabilities of the trainers and their facilities;
(ii) selection of applicants should be done in consultation with the IOC and/or FAO Secretariats and the respective Member States;
(iii) the Training Programme include regional courses on various topics and regional aspects, taking into account the knowledge and capabilities of the participants;
(iv) the Training Programme include specialized courses in specialized laboratories with the view to train future trainers;
(v) the Training Programme include individual training supported through fellow-ships and grants (IOC-UNESCO and bi-lateral) which will allow individuals from developing countries to work for a period at relevant advanced laboratories;

The Panel urged Member States to assist in the identification of resources for the implementation of the 'HAB Training and Capacity Building Programme'.

The themes of the training activities have been developed based on the results of two IOC workshops held in September 1992 with the goal to identify training needs in developing countries in relation to harmful algae (Annex 2 and 3), and a survey which was carried out in 1993 (Annex 4). The Work shops and the survey also clearly and strongly identified the need for the various courses (see Annexes).

The IOC Manual on Harmful Marine Microalgae and the supplements in the HAB Publication Series (IOC Manuals and Guides No. 31), are intended as central references in the Training Programme.

The training activities organized through the IOC Science and Commincation Centres on Harmful Algae does not exclude training activities organized by other scientific institutions. Experience from the pilot courses and the Centres can be drawn upon in the planning and implementation of courses organized by a number of institutions as required and appropriate.

2. Elements of the HAB Training and Capacity Building Programme:

The training and capacity building activities are focus around five different modules, and individual training. The module concept is a flexible frame for HAB Programme training activities, as a way to structure the planning of activities. The title of each Module thus encompasses courses at various levels and with various content. Each Module will be offered as basic and as advanced courses. Each course has to be adjusted to whether it is regional or global in scope and to the requirements of the participants. The advanced courses will typically be centralized courses at institutions wilth strong experience within a given field, whereas the basic courses to the extend possible will be held regionally.

Training Modules:

1) Taxonomy of Harmful Marine Phytoplankton;
2) Toxin Chemistry and Toxicology;

3) Design and Implementation of Monitoring Programmes;
4) Risk Assessment, Contingency Planning, and Management;
5) Theme workshops, and regional interdisciplinary work shops/courses on HAB.

Individual training:

1) Fellowships and Study Grants.

2.1 Training Modules:

2.1.1 The Taxonomy of Harmful Marine Microplankton

Goal: The goal is to give the participants a theoretical as well as a practical training in identification of harmful marine microplankton.

Objectives:

i) Improvement of the participants taxonomic skills in order to enable them to make reliable identification of phytoplankton species causative of harmful algal events.

ii) Long-Term: The trained individuals will serve as national and regional resource persons and help develop national capabilities, where relevant and appropriate combined with regional courses or work shops.

The reliable identification of causative species is crucial in the management of harmful algae events, but the lack of taxonomic skills is acute in many parts of the world. In any phytoplankton monitoring programme, and especially with respect to harmful phytoplankton, the reliable identification of the occurring species is the first step towards a decision on what measures should be taken to mitigate possible undesirable effects.

The module was developed based on the first course which was held as an IOC-Danida Course, 16-28 September 1993 at the University of Copenhagen as a pilot course, and has been further developed by the IOC Secretariat, University of Tokyo and the University of Copenhagen. The implementation of the Module is, inter alia, linked to the IOC Science and Communication Centre on Harmful Algae in Copenhagen.

2.1.2 Toxin Chemistry and Toxicology in relation to Harmful Algae

Goal: The goal of the course module is to give the participants a theoretical as well as a practical introduction to methods used for qualitative and quantitative determination of toxins from marine phytoplankton, and an overview of state of the art in marine biotoxin research.

Objectives:

i) Improvement of the participants chemical and toxicological skills in order to enable them to make reliable qualitative and quantitative determination of toxins from planktonic algae and contaminated food.

ii) Long-term: The trained individuals will serve as national and regional resource persons and help develop national capabilities, where relevant and appropriate combined with regional courses or work shops.
The reliable quantitative and qualitative determination of toxins, especially with respect to harmful microalgae, is an important step towards a decision on which measures should be taken to mitigate

undesirable effects associated with harmful algal events, such as closure and opening of markets e.t.c. Unfortunately the lack of knowledge on toxin chemistry and toxicology is acute in many parts of the world.

The Module was developed based on a pilot course, which was held as an IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins, 18-28 October 1994 at Friedrich-Schiller University of Jena, Germany, and has been further developed by the IOC Secretariat. The implementation of the Module will, inter alia, link to the IOC Science and Communication Centre on Harmful Algae in Vigo.

2.1.3 Design and Implementation of Monitoring Programmes in relation to Harmful Algae

Goal: The goal of the course module is to improve the theoretical as well as the practical background of the participants in order for Member Sates to choose the most appropriate and cost efficient monitoring.

Objectives:

i) Introduction of different ways of monitoring harmful algae, and to provide a forum for exchange of experience with ongoing monitoring programmes.

ii) Long-term: The trained individuals will serve as national and regional resource persons and help develop national monitoring programmes.

The IOC is jointly with ICES providing an inventory describing the various HAB monitoring programmes worldwide. The inventory is intended as a source of inspiration for improved monitoring and as the background for international exchange of experience. Improved monitoring schemes will also be adressed through workshop-seminars where administrators and planners of monitoring programmes can meet and exchange experience. For developing countries with poorly developed or without monitoring programmes the workshops would be a forum for advice, cooperation and inspiration and could potentially result in cooperation projects on the building up of appropriate monitoring systems in those countries.

The Module is developped by the IPHAB Task Team on Design and Implementation of HAB Monitoring Programme, and by using external consultants funded by Danida. The implementation of the Module currently requires assistance from individuals and institutions with experience in relation to planning and implementation of monitoring of harmful algae. The Module will in particular focus on monitoring associated with shellfish fishing-farming, and marine aquaculture in general.

There is clear relationship between this Module and the Global Ocean Observing System (GOOS). In particular to its Module on the Assessment and Prediction of the Health of the Ocean. This GOOS sub-programme includes operational elements concerning resource protection and monitoring, closely related to the Article 7 and Annex I of the UNCED Convention on Biological Diversity. The HAB Training and Capacity Building Module on Design and Implementation of Monotoring Programmes are thus linked to GOOS and should also be seen as a follow-up to UNCED.

2.1.4 Risk Assessment, Contingency Planning and Management of Harmful Algal Blooms

Algal Blooms are a major constraint to the sustainable development of coastal aquaculture in many parts of the world. There is a need to include environmental issues, such as the assessment of risks of harmful

algal blooms, into the overall management scheme for aquaculture development as a part of coastal zone management plans. In the past, licensing authorities and the industry have not considered algal blooms as an important factor in defining site selection criteria in many developing countries.

There is therefore a training need at all levels on how existing management schemes (decision models) employed elsewhere can be effectively used.

The Module is not yet developped, but funds have been made available by Danida for this purpose.

2.1.5 Theme Workshops, and Regional Interdisciplinary Workshops

Goal: The goal of the module is to address the need for interdisciplinary workshops in regions where there might not be participants enough, or interest, in more specialized training courses. Such work shops have been requested by severel regions, in particular developing countries, where it is the same individuals who are responsable for several or all fuctions in relation to harmful algal events.

2.2 Individual Training:

2.2.1 Fellowships and Study Grants

Within the Training Education and Mutual Assistance Programme (TEMA) of the IOC there is a possibility for scientists from developing countries to obtain support for longer or shorter stays at research institutions in another IOC Member State. The IOC Science and Communication Centres on Harmful Algae in Copenhagen and Vigo also offers possibilities for shorter or longer individual training/supervision.

3. Feasibility studies:

Detailed feasibility studies to specify the need for the respective modules and the facilities for implementation in the regions severely affected by harmful algae are central for a successful implementation of training activities.

A survey has been made to IOC Member States through circulation of two questionnaires concerning training needs in relation to harmful algae. The results provide the basic background for identification of regions and laboratories suitable for a more detailed feasibility studies which should also identify the appropriate level of the courses and the target groups. The above mentioned survey was initiated by the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms in 1992. Annexes 1-3 will also serve as background for the detailed feasibility studies in relation to each Module/course.

The feasibility studies will currently be incorporated in the implementation plan. The Training Programme, with scientists/technicians as well as local fishermen and fish-farmers as the target group, is envisaged to be implemented in the regions most severely affected by harmful algae. It is crucial that these training activities be coordinated with those carried out through bilateral/regional cooperation.

4. Funding the HAB Training Programme:

The Programme is expected to be implemented over a 5 year period with an estimated cost in the range of 800 to 900.000 US$. This rough estimate is based on 2-4 courses of each module, 2-3 Workshops-seminars, and a number of fellowships-grants. Cost estimates are based on the experience from TEMA courses in

general and the HAB courses implemented in 1993 and 1994.

A geographically balanced and comprehensive training programme, based on modules and an implementation plan related to identified needs in the relevant regions, will be submitted, complete or partial, for funding to potential donors. The IOC-Danida cooperation in relation to training will hopefully serve as inspiration for similar cooperation with other Member States. The IPHAB has a vital role to play in the establishment of such cooperation with the view to fund the HAB Training and Capacity Building Programme.

In addition to the direct funding (cash) of training activities, the possible sponsorship by manufactures of equipment should be investigated. Technology transfer and building up of local and regional facilities should be included to the extend possible in all training activities. As an example, Japanese manufactures of laboratory equipment supports the Toxin Chemistry and Toxicology Module.

An overview of the HAB Training and Capacity Building Programme, including the Courses and resources identified prior to the Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, is presented in Table 1.

[TABLES ON TRAINING COURSES AVAIALBEL IN PRINTED VERSION ONLY]

ANNEX XIV

REPORTS OF THE TASK TEAM CHAIRMEN

TASK TEAM ON ALGAL TAXONOMY

Prof. Ojvind Moestrup (Chairman)

This Task Team was set up at the Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms in Paris, 1993. The Task Team was asked to consider four main items and these will be reported on separately below:

(i) To establish a communication network (e.g., by fax or e-mail)

The Task Team recommends the establishment of a network using e-mail. The network will be used to distribute new information on taxonomy and geographic distribution of toxic marine phytoplankton, provide lists of new literature, including books, provide reviews of books on toxic marine phytoplankton, etc. The network should be established at the new HAB Centre in Copenhagen and information to be distributed should be sent directly to the Centre by fax, e- or snail-mail. The network is intended as a means of rapid communication, supplementing the Harmful Algae News, whose editor will be able to extract information from the network and supplement this with illustrations or otherwise, and include it in the HAN.

(ii) To make taxonomic recommendations

Major taxonomic recommendations are to be discussed and decided upon at the international congresses on toxic algae (cf. discusssion on Alexandrium in Lund). The Centre in Copenhagen may be contacted for other advice in taxonomic matters. It is suggested that the Copenhagen Centre prepares a list of people who are experts on different groups of algae in the different geographical areas and who can be approached for identification of toxic algae.

(iii) Develop identification standards for manuals, reference collections, etc. Several initiatives are under way:

a) The IOC Handbook on Harmful Algal Blooms;
b) The ICES Identification Sheets of potentially toxic algae. Sheet No.3 is in press *(Prorocentrum)*;
c) CD-ROM. The ETI Centre in Amsterdam has transferred the little book on toxic marine phytoplankton by Larsen and Moestrup to CD-ROM and this technique offers tremendous possibilities, limited only by lack of time; the number of species included can be increased, ecological and toxicological data can be added, high-quality videos of the live organisms can be included. These possibilities need to be explored by the Centre in Copenhagen, in co-operation with colleagues elsewhere.

(iv) Help to avoid overlap of activities

Information can be distributed via the network and the Harmful Algae News to avoid overlap. This includes information on meetings, courses, etc., and researchers may submit information on research projects in their respective laboratories, allowing for better knowledge of what projects are being pursued in the different laboratories.

TASK TEAM ON AQUATIC BIOTOXINS

Prof. Takeshi Yasumoto (Chairman)

The Team has been working by correspondence through the IOC Harmful Algal Bloom Programme Office during the intersessional period. Two questionnaires on (i) Identification of Standards and Reference Materials on Aquatic Biotoxins and on (ii) Analytical Procedure for Phycotoxin Detection have been distributed and the results have been evaluated. The results will be presented as tables in the different sections of the document. The National Oceanic and Atmospheric Administration, USA has supplied assistance with the preparation of the first session on Amnesic Shellfish Poisoning (ASP). Japan and IOC co-sponsored Dr. H. Ravn, IOC, to stay at the Tohoku University, Sendai, Japan to assist the Chairman in finalizing the first session on ASP, and to draft other sections. The ASP section has been finalized and distributed for evaluation by the Task Team Members as well as an expert on the subject, Dr. Michael A. Quilliam, Canada.

Two other sections on Paralytic Shellfish Poisoning (PSP) and Diarrhetic Shellfish Poisoning (DSP) have been drafted.

It is suggested that sections on: Brevetoxins; Neurotoxic Shellfish Poisoning (NSP), Brevetoxin derivatives; Ciguatera Fish Poisons (CFP); Blue-Green Algal Toxins: a) Microcystins, b) Anatoxins, c) Hepatotoxins, d) Nodularins, e) Aphantoxins, f) Lyngbyatoxins, g) Cylindrospermopsin; and Ichthyotoxins, to be prepared.

The sections will be printed as individual volumes in the IOC Manuals and Guides No. 31 called HAB Publication Series. The volumes are prepared as supplements to the IOC Manual on Harmful Marine Microalgae.

An effort has been made by the HABP Office to strengthen the interaction between the different organizations and programmes and IOC, and to avoid overlap of activities.

Considerations

We have to make it clear that IOC, FAO, and IUPAC, AOAC are different bodies having different policies: IOC/HAB more concerned about HAB members who are largely biologists and oceanographers; FAO monitoring products; IUPAC, AOAC analytical analytical chemical methods and standardizing the methods and reference materials.

IOC aims to prepare user-friendly documents by incorporating requests from members and asking evaluation by members. The users in our mind are largely biologists, oceanographer, and toxicologists. IUPAC and AOAC are bodies consisting mostly of chemists and analytical chemists.

In the absence of reference materials, which are needed for standardization of methods, I think it is too early to focus on recommend, or standardize special analytical methods.

New methodologies in biological tests are making a rapid progress; cell assays, enzyme-inhibition assays, channel binding assays etc.. Biologists are more familier with this type of assays than with chemical assays. The aim of the documents of the Task Team is to provide users with the information about all the potential assay methods for their selection and to show the advantage and disadvantage of each method. Emphasis is also laid on identification of the source of references. Perhaps in future, we may discuss standardization of various methods.

IPHAB TASK TEAM ON DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES

Dr. Karl Tangen (Chairman)

The work of the Task Team has concentrated on the preparation and distribution of a Questionnaire o n HAB monitoring.

1. Status of the Questionnaire
2. Preliminary results
3. Status of the Report
4. List of content of the Report

1. Status of the Questionnaire

The Questionnaire was finalized in February 1995, and was distributed (in print as well as on diskette) to IOC Member States Action Addresses world wide, wherefrom it was distributed to institutions/individual s actively taking part in HAB monitoring. The Questionnaire was als o distributed to ICES Delegates in all ICES countries. The completed Questionnaires were returned to IOC in Paris, and thereafter passed to the Tas k Team Chair Dr. Karl Tangen and Dr. Per Andersen who will compile the data and prepare a report on th e results.

As of 31 May 1995, 42 questionnaires from the following countries/regions have been received:

Argentina	att. Dr. Jose Carreto
Bangladesh	att. Dr. A. K. M. Nazrul-Islam
Brazil	att. Dr. Clarisse Odebrecht
Cameroon	att. Dr. Jean Folack
Canada	att. Dr. Jennifer Martin
Chile	att. Dr. Alejandro Clement
Columbia(Pacific)	att. Dr. Jairo Orlando Suzunaga Leon
Columbia(Carribean)	att. Dr. Sigfredo Velandia Rocha
Denmark	att. Dr. Helle Emsholm/Dr. Hanne Kaas
Finland	att. Dr. Kaisa Kononen
France	att. Dr. Chaterine Belin
Germany	att. Dr. N. Wassmund
Germany	att. Dr. Jeanette Gobel
Greece	att. National Centre for Marine Research (NCMR)
Iceland	att.
Mauritius	att.
Norway	att. E. Dahl
Portugal	att. Dr. Sampayo
Quatar	att. Abdullah H. Al Kubaisi
Spain (Balearic Islands)	att. SEAMASA - V. Forteza
Spain (Galicia)	att.
Spain (Catalonia)	att.
Spain (Valencia)	att.
Sweden	att. Ulf Larsson & Susanna Hajdu
Sweden	att. Gunnar Aneer
Sweden	att. Lars Edler
Sweden	att. Kristineberg Marine Res. Station
Tonga	att. `Elenoa `Amanaki
UK-Scotland	att. MAFF
UK-Scotland	att. SOAFD
UK-Scotland	att. Elsebeth Mcdonald

UK-England & Wales att. Mick Pearson
UK-England & Wales att. K. J. Whittle
UK-England & Wales att. MAFF
UK-Northern Ireland att. S. I. Heaney
Uruguay att. Silvia Mendez
USA:
State of Connecticut att. Donald Mayo/Malcolm C. Shute
State of Washington:
(incl. Puget Sound) att. Rita Horner
Coast of Maine att. John Hurst
State of California att.
USA-"New York" att. Robert Nuzzi
Venezuela att. Amelia la Barbera Sanchez

Important countries which have not yet responded:

China
Ireland
Italy
Japan
New Zealand
The Philippines

It is very important that the countries who have decided to respond to the Questionnaire do it as soon as possible, as the dead-line for in-put to the Report is 15 June 1995. Questionnaires received after this date will not be incorporated in the present Report, but will, together with all other responses, be available for further study on request to IOC and ICES.

2. Preliminary results

At present we have only a very preliminary overview of the results of the Questionnaire. As expected the monitoring programmes tend to fall into 3 major categories:

1. Well structured and well focused routine programmes devoted to monitoring and management of HAB's in relation to mussel harvesting and/or fish farming.

2. Programmes run as integrated parts of the general environmental monitoring, with no specific focus on the detection of HAB's for management use.

3. No monitoring programme on HAB.

Differences in the methodological approach between countries/regions reflects basic differences in physical and biological regimes as well as the local strategy of the mussel harvesting, fish-farming or fisheries in general.

Some countries/regions express their needs for and wishes to develop HAB monitoring programmes, and that guidelines for setting up programmes are needed.

3. Status of the Report

A crucial part of the Report is based upon the answers to the questionnaire on design of Harmful Algal Bloom (HAB) Monitoring Systems. The Report will available in September 1995.

4. List of contents of the Report

Design of Monitoring Programmes related to Harmful Algae
(P. Andersen, Bio/consult as, Johs. Ewalds Vej 42-44, 8230 Aabyh ϕj, Denmark)

Content

ANNEX XV

INFORMATION ON THE TOXICOLOGY AND TOXIN CHEMISTRY SECTION OF THE SCIENTIFIC ELEMENTS OF THE HAB PROGRAMME

The goal and objectives of the toxicology and toxin chemistry section of the scientific elements are described in document IOC-FAO/IPHAB-II/3, Annex V, 6.2.3.

Toxin chemistry

With respect to chemistry, it is essential to know the chemical structure of the toxins and to get possession of sufficient standards and reference materials of a very high level of purity. The toxins produced by phytoplankton belong to the highest toxic class of toxins, and are very often produced in low quantities in microorganisms. To obtain sufficient reference materials and standards, the toxins have to be isolated either from monocultures of phytoplankton or from contaminated shellfish.

Toxins can be accumulated in shellfish filtrating the water containing toxic phytoplankton. On the other hand, the toxins can be changed chemically or degraded in the shellfish through enzymatic reactions, and the toxicity may therefore be changed during these reactions.

The process of isolating toxins is very complicated and a large amount of phytoplankton or an intense bloom of toxic algae if shellfish are used, is needed for extraction and isolation in order to prepare reference materials or standards. The isolation procedure for many toxins is very difficult since the toxins can be sensitive to, e.g. light, oxygen etc., during the extraction and isolation procedure, and the toxins can be chemically changed thereby.

Why are the standards and reference materials so important?

(i) to perform reliable monitoring of seafood containing phytoplankton toxins

(ii) to be able to develop and use new chemical analytical methods for quantitative and qualitative determination

(iii) to be able to study the physiological aspects of the toxin production in phytoplankton

(iv) to study the toxic aspects of a harmful algal bloom.

Toxicology

With respect to toxicology, research on the toxicity in the food web can be performed without knowing the toxins. Normally, toxicology tests are performed on animals, e.g. mice or rats. In many countries tests on animals are not permitted, which complicates toxicological investigations.

New methods have been developed, but these methods are often specific to certain toxins and will therefore not cover the range of unknown and unidentified toxins.

For monitoring purposes, by knowing that the phytoplankton species contain expected toxins, the toxicology tests can be supported or replaced by chemical analytical determinations. In both cases, pure standards or reference materials are needed.

Pure, identified and structure elucidated toxins are needed in order for scientific investigations

to: define the fate and effects of algal toxins in the marine food web; elucidate mechanisms of toxicity to marine animals; determine the mechanisms responsible for the mass mortalities of fish and other marine

organisms caused by toxic substances; and establish pathological indicators to determine toxins responsible for mortalities and other impacts.

Physiology

With respect to physiology and physiological mechanisms, it has still not been established, for many toxic and harmful algae, as to why, under what ecological conditions and in which way the phytoplankton produce toxins. Ecological changes, physical as well as chemical changes in the environment have been shown to produce changes in toxin production, as well as toxin composition, in the phytoplankton.

Pure structure elucidated and identified toxins are needed in order to be able to: establish the biosynthetic pathway of toxin production in algae, including the definition of the role of endo- or exocellular bacteria and viruses; determine the physiological mechanisms underlying variable toxicity amoung strains of species ; within single strains grown under different conditions, define the toxin accumulation, chemical conversion and depuration processes in contaminated seafood; and finally, detemine the processes of toxin degradation.

Activities in the field of toxicology and toxin chemistry

During the intersessional period prior to IPHAB-III, the development of several activities in the field of toxicology and toxin chemistry have been encouraged:

(i) As recommended by IPHAB-II the HAB Programme Office contacted the National Research Council of Canada (NRI) with a view to finding a mechanism whereby the Canadian reference materials could be made available to developing countries. So far is has not been feasible for NRI to make the standards and reference materials freely available.

(ii) The Task Team on Aquatic Biotoxins has prepared information documents on aquatic biotoxins to be printed by IOC in the near future.

(iii) The establishment of the IOC Science and Communication Centre on Harmful Algae Vigo, will assist the IOC in facilitating training and capacity building in the field of toxicology and toxin chemistry, especially in Spanish-speaking developing countries.

(iv) Encourage a stronger interaction between experts group of GIPME (GEEP, GESREM, GEMSI), EU (DG XII and DG VI), IUPAC, AOAC, IST, and other UN Organizations in the field of toxicology and toxin chemistry.

ANNEX XVI

GLOSSARY OF ACRONYMS AND SPECIAL TERMS

AOAC	**A**ssociation of **O**fficial **A**nalytical **C**hemists
APEC	**A**sia **P**acific **E**conomic **C**ooperation
ASEAN	**A**ssociation of **S**outh **E**ast **A**sian **N**ations
BMTC	**B**remen **M**aritime **T**raining **C**entre
CEC	**C**ommission of the **E**uropean **C**ommunities
CFC	**C**ommission of **F**ood **C**hemistry
CIDA	**C**anadian **I**nternational **D**velopment **A**gency
CNEVA	**C**entre **N**ational d'**E**tudes **V**étérinaires et **A**limentaires (France)
CONICIT	**C**onsejo **N**ational de **I**nvestigaciones **C**ientificas y **T**ecnologicas (Venezuela)
CPR	**C**ontinuous **P**lankton **R**ecorder
DANIDA	**D**anish **I**nternational **D**evelopment **A**gency
DSP	**D**iarrhetic **S**hellfish **P**oisoning
EEC	**E**uropean **E**conomic **C**ommunity
ETI	**E**xpert **C**entre on **T**axonomic **I**dentification
FAO	**F**ood and **A**griculture **O**rganization of the **U**nited **N**ations
GEEP	**G**roup of **E**xperts on the **E**ffects of **P**ollutants
GEF	**G**lobal **E**nvironment **F**acility
GEMSI	**G**roup of **E**xperts on **M**ethods, **S**tandards and **I**ntercalibration
GESAMP	**G**roup of **E**xperts on the **S**cientific **A**spects of **M**arine **P**ollution
GESREM	**G**roup of **E**xperts on **S**tandards and **R**eference **M**aterials
GIPME	**G**lobal **I**nvestigation of **P**ollution in the **M**arine **E**nvironment
GO	**G**overnmental **O**rganization
GOOS	**G**lobal **O**cean **O**bserving **S**ystem
IAEA	**I**nternational **A**tomic **E**nergy **A**gency
ICES	**I**nternational **C**ouncil for the **E**xploration of the **S**ea
ICSU	**I**nternational **C**ouncil of **S**cientific **U**nions
IMO	**I**nternational **M**aritime **O**rganization
IOC	**I**ntergovernmental **O**ceanographic **C**ommission
IOCARIBE	**IOC S**ub-**C**ommission for the **Carib**bean and Adjacent Regions
IPCS	**I**nternational **P**rogramme on **C**hemical **S**afety
IST	**I**nternational **S**ociety of **T**oxinology
IUPAC	**I**nternational **U**nion of **P**ure and **A**pplied **C**hemistry

JECFA	**J**oint **E**xpert **C**ommittee on **F**ood **A**dditives
JSPS	**J**apanese **S**ociety for **P**romotion of **S**cience
MAP	**M**editterranean **A**ction **P**lan
MARPOLMON	**M**arine **P**ollution **M**onitoring
MAST	**M**arine, **S**cience and **T**echnology
MEDPOL	Co-ordinated **M**editerranean **P**ollution **M**onitoring and **R**esearch **P**rogramme
NATO	**N**orth **A**tlantic **T**reaty **O**rganization
NRC	**N**ational **R**esearch **C**ouncil (Canada)
NSF	**N**ational **S**cience **F**oundation
OSLR	**O**cean **S**cience in **R**elation to **L**iving **R**esources
PICES	North Pacific Marine Science Organization
PSP	**P**aralytic **S**hellfish **P**oisoning
SCOR	**S**cientific **C**ommittee on **O**ceanic **R**esearch
TEMA	**T**raining **E**ducation and **M**utual **A**ssistance in the **M**arine **S**ciences
UNCED	**U**nited **N**ation **C**onference on **E**nvironment and **D**evelopment
UNDP	**U**nited **N**ations **D**evelopment **P**rogramme
UNEP	**U**nied **N**ations **E**nvironment **P**rogramme
UNESCO	**U**nited **N**ations **E**ducational, **S**cientific and **C**ultural **O**rganization
UV	**U**ltra **V**iolet radiation
VCP	**V**oluntary **C**ontribution **P**rogramme
WESTPAC	**IOC** Sub-Commission for the **West**ern **Pac**ific
WG	**W**orking **G**roup
WHO	**W**orld **H**ealth **O**rganization
WMO	**W**orld **M**eteorological **O**rganization