

Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies



IOC Intergovernmental Panel on Harmful Algal Blooms

Sixth Session

St. Petersburg, Florida, United States of America
17–19 October 2002

UNESCO

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1. INTRODUCTION

1 The IOC 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 to solve some of the problems caused by harmful algae. 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 are also to be seen as IOC follow-ups to the United Nations Conference on Environment and Development (UNCED).

2 The Sixth Session of the Panel was hosted by the United States National Science Foundation (NSF) and was held from 17-19 October 2002 at the Tradewinds Conference Center, St. Petersburg, Florida. The Session was opened by the Chair IPHAB, Dr. Adriana Zingone (Italy), and the Technical Secretary IPHAB, Mr. Henrik Enevoldsen, on behalf of the Executive Secretary IOC, Dr. Patricio Bernal. The Panel was reminded of its importance as a mechanism to advise governments on HAB research and management with the ultimate goal to protect public health and food resources.

3 The Agenda for the Session was introduced by Mr. Enevoldsen and adopted ([Annex I](#) hereto). Dr. J. Martin (Canada) was designated as Rapporteur.

4 The Session was attended by representatives from: Canada, Denmark, Finland, France, Germany, Italy, Japan, Malaysia, Mexico, Morocco, Namibia, New Zealand, Philippines, Spain, Sweden, United Kingdom, United States of America, Uruguay, the Scientific Committee on Oceanic Research (SCOR), International Council for the Exploration of the Sea (ICES), and the International Society for the Study of Harmful Algae (ISSHA). The List of Participants is attached as [Annex V](#) hereto.

5 The Chair recalled the Terms of Reference for the Panel, as set out in Resolution XVI-4 of the Sixteenth Session of the IOC Assembly, March 1991 ([Annex VI](#) hereto) and the objectives in the IOC HAB Programme Plan ([Annex VII](#) hereto). **The Panel noted** that the Twenty-first Session of the IOC Assembly, Paris, 2001 had endorsed all the Recommendations of the Fifth Session of the Panel. The Resolutions of the last IOC Assembly (Twenty-first Session, July 2001) and the Thirty-fifth Session of the IOC Executive Council, Paris, 2002, were introduced.

6 During its Sixth Session the Panel reviewed the actions completed during the intersessional period. The detailed report on HAB Programme developments in the intersessional period is included as [Annex IX](#) hereto. **The Panel noted with satisfaction** that considerable progress had been made and that the Recommendations of the Fifth Session of the Panel had been followed up to very large extent.

7 The objectives in the HAB Programme Plan were affirmed, priorities were set, actions to be taken were discussed and decided upon, and resources were sought, identified and committed to the extend feasible.

8 The Session was organized as six panel discussions: Panel 1 on capacity enhancement was chaired by Dr. Y. Fukuyo (Japan) and introduced by Mr. H. Enevoldsen (IOC); Panel 2 on the GEOHAB Research Programme was chaired and introduced by Dr. P. Gentien (France); Panel 3 on HAB monitoring in coastal GOOS was chaired by Dr. K. Kononen (Finland) and introduced by Dr. A. Zingone (Italy); Panel 4 on regional activities was chaired by Dr. D. Anderson (USA); Panel 5 on seafood safety regulation coordination was chaired by

Dr. B. Reguera (Spain) and introduced by Dr. P. Busby (New Zealand); and Panel 6 on the operation of the HAB Programme, the role of the IPHAB and its future mission was chaired by Dr. R. Azanza and introduced by Mr. H. Enevoldsen (IOC).

9 **The Panel endorsed** a number of intersessional activities to be implemented by Member States and the IOC Secretariat. These activities are summarized in the [Workplan](#) for the IOC HAB Programme 2003–2005, which is included in [Rec. IPHAB-VI.9](#) hereto.

10 A summary of the deliberations made and the decisions taken is given below.

2. PROGRAMME SUPPORT AND DEVELOPMENT

2.1. STAFFING OF THE HAB PROGRAMME

11 The Panel discussed the staffing of the programme and reiterated that dedicating IOC staff to the HAB Programme is crucial for focused development and implementation of the Programme. Member States are urged to consider financial support to, or secondment of, staff to the HAB Programme.

12 **The Panel welcomed and acknowledged** the importance of the continued secondment to the IOC Secretariat by Denmark. The present part-time secondment through the Associate Experts programme ends April 2003 and it is not yet known if there will be a replacement. In the light of the developments within UNESCO and IOC, as well as at the IOC Science and Communications Centres, it is now part of a more comprehensive decentralization strategy (presently being elaborated by the Commission) that the HAB Programme will mainly be coordinated from the IOC Science and Communication Centre in Copenhagen, as is already the case in practice. At the level of the IOC Secretariat will remain the administrative aspects and the overall responsibility. An appropriate level of staffing is still considered to be one senior and one junior staff member (Document IOC-FAO/IPHAB-I/3). **The Panel strongly encouraged** Member States to second staff members to the HAB Programme, and **urged** the IOC Executive Secretary to ensure adequate and continuous staff for the HAB Programme.

2.2. IOC SCIENCE AND COMMUNICATION CENTRES ON HARMFUL ALGAE

13 **The Panel welcomed** the developments and initiatives by the IOC Science and Communication Centres on Harmful Algae established in Copenhagen (Denmark) and Vigo (Spain). The Science and Communication Centres on Harmful Algae are established to provide assistance to Member States, and to developing countries in particular (Document SC/MD/101, para.80). The Panel recalled Resolution XX-3 through which the IOC Assembly endorses the continuation of the Centres and urges Member States to continue to provide the support. The Panel took note of the external review of the Seven-year Report of the Centre in Copenhagen and recommended on future priorities and activities. A summary of the external review is attached hereto as [Annex VIII](#).

14 **The Panel endorsed** that the IOC Science and Communication Centres develop along the lines recommended by the External Review Committee. This development should take into account the revised HAB Training and Capacity Enhancement Programme ([Resolution IPHAB-VI.3](#) and [Annex X](#) hereto), which endorses to continue ongoing activities with increased priority for capacity enhancement in monitoring and management and for activities responding to GEOHAB requirements. **The Panel endorsed** to expand the partnerships in the IOC Science and Communication Centres with relevant scientific institutions in order to provide a broader and longer-term platform for the implementation of capacity-building activities including courses,

workshops, training through research, and individual training. Furthermore, the development of the centres should take into account [Recommendation IPHAB-VI.7](#) on ‘emergency response and development of institutional capacity’.

2.3. REGIONAL IOC HAB GROUPS

15 **The Panel took note** of the results and reports under the regional components of the HAB Programme, WESTPAC/HAB (Western Pacific), IOC/FANSA (South America), and IOCARIBE/ANCA (Caribbean), as well as the first regional HAB workshop in Western Africa, held in November 2002 in Accra, Ghana.

16 **The Panel recognized** that there is a growing concern in North African countries about the negative impact of HAB events in the region. Chronic occurrence of Paralytic Shellfish Poisoning (PSP) and Diarrhetic Shellfish Poisoning (DSP) toxins adversely affect shellfisheries harvesting and exports in Morocco, fish killing dinoflagellates cause mass mortalities in expanding aquaculture facilities in Tunisia, blooms of *Alexandrium minutum*, cause water discolorations that upset the tourist industry in many Mediterranean coastal areas and they may also produce PSP toxins which may be transferred to shellfish and thereby pose a public health risk.

17 **The Panel also recognized** that a considerable number of experts from the region participated in different IOC-sponsored training courses, workshops and symposia, and there is a critical mass of expertise in North African countries that would benefit from the establishment of a regional network. Such a network of experts would promote the exchange of expertise, sharing of information, planning of common methodologies and would provide a synoptic view of common HAB-related problems in the Southern Mediterranean approaches.

18 **The Panel recommended** that initiative be taken to establish a HAB network in North Africa and noted that regional bodies to be invited to cooperate in such an initiative include UNEP-MAP (Mediterranean Action Plan), FAO-COPEMED (Cooperation on Mediterranean Fisheries), Madrid, and the International Council for the Exploration of the Mediterranean Sea. This cooperation would allow the coordination of HAB subjects with experts from Southern European countries.

19 **The Panel expressed** its appreciation and **recognized** the importance of the work carried out by the regional project leaders.

20 **The Panel endorsed** the proposed regional activities of WESTPAC/HAB, FANSA, and ANCA for 2003–2004 (see [Recommendation IPHAB-VI.9](#) and its [Annex](#)).

21 **The Panel adopted** [Recommendation IPHAB-VI.1](#).

3. EDUCATIONAL PROGRAMME ELEMENTS

INFORMATION NETWORK

3.1 HARMFUL ALGAE NEWS

22 The quarterly IOC newsletter *Harmful Algae News* (HAN) on toxic algae and algal blooms has been published since January 1992 and has more than 2000 subscribers. HAN is available in print and via the IOC HAB website. **The Panel reappointed** the Editor (Dr. Tim Wyatt) and the Editorial Board for HAN. **The Panel recommended** continuing to prepare

special issues on selected topics, and that HAN should be issued as regularly as possible, even if some issues would then have relatively few pages.

3.2 DIRECTORY OF EXPERTS: HAB-DIR

- 23 **The Panel noted with regret** that the on-line International Directory of Experts in Toxic and Harmful Algae and their Effects on Fisheries and Public Health, HAB-DIR, has not been accessible at the IOC website for more than a year and urged the IOC Secretariat to give priority to re-establish the HAB-DIR in the format of the new IOC expert database 'OceanExpert'.

3.3 IOC MANUAL ON HARMFUL MARINE MICROALGAE

- 24 **The Panel recalled** that the Fifth Session of the Panel endorsed the preparation of a second revised and expanded edition of the IOC Manual on Harmful Marine Microalgae. The second edition of the Manual has the same editorial team as the first edition: D. Anderson (USA), A. Cembella (Canada), G. Hallegraeff (Editor in Chief), and H. Enevoldsen as Technical Editor. **The Panel noted with satisfaction** that the Manual will be published early 2003 in the UNESCO series 'Monographs on Oceanographic Methodology' at a price of 49.50 Euros. The publication of the Manual has been made possible through the financial support of the Danish Natural Science Research Council, the Danish Ministry of Science and Technology and Innovation, and Danida.

3.4 CO-SPONSORSHIP OF HAB CONFERENCES AND THEIR PROCEEDINGS

- 25 **The Panel noted with satisfaction** the co-sponsorship by IOC of the XHAB Conference, St. Petersburg, Florida, USA, held on 21–25 October 2002, **and recommended** the continued support by IOC of HAB conferences as it has been done since 1987. The support provided by the IOC has been crucial in securing the possibility of attendance by scientists from developing countries.

- 26 Recognizing that the availability of updated scientific literature is often a main handicap for the implementation of appropriate projects in developing countries/economies in transition, and that the dissemination of scientific results on harmful algae needs to be globalized for the sake of comparative studies, **the Panel noted with satisfaction** that the publication/co-publication by IOC of the proceedings of the International Conference on Harmful Algal Blooms, since 1995, has been a major achievement to ensure a world-scale dissemination (through the IOC Science and Communication Centres and partners) of the scientific results presented at these conferences.

- 27 **The Panel recommended** that the IOC Secretariat negotiates with the Conference convenors, and the International Society for the Study of Harmful Algae (ISSHA), on a case-per-case basis, to ensure that this valuable series of proceedings continues to be published in a similar manner.

- 28 **The Panel acknowledged** the valuable contribution of the proceedings of international conferences on HABs as a compendium of latest advances of research on harmful algae and phycotoxins, and recognized that the publication/co-publication of these proceedings by the IOC ensures a wide dissemination of these scientific results on a worldwide scale. Nevertheless, it was also recognized that harmful algae and phycotoxins are a very fast-moving field of research, and **the Panel noted** with concern that proceedings, once they are available, sometimes have to wait too long a time before being printed by the IOC-UNESCO Headquarters publishers, **and recommended** that the IOC Secretariat set printing priorities to ensure that HAB Conference

Proceedings are printed and made available to the HAB scientific community within a reasonable timeframe.

29 **The Panel adopted [Recommendation IPHAB-VI.6](#).**

3.6 TRAINING

30 The Panel discussed a strategic plan for HAB capacity enhancement with identification of needs, and of which countries/organisations can be expected to take on responsibility for the implementation of various components. Furthermore, the development of a framework for regional project clusters for upgrading national HAB management and monitoring capacity was considered as a potential new IPHAB initiative for projects on institutional capacity building in HAB monitoring and management, with a view to be presented to e.g. the World Bank, regional development banks, or similar major funding agencies. The role of IOC would be to coordinate and provide an intergovernmental framework.

31 The Panel noted with satisfaction the development and implementation of the HAB Training and Capacity Building Programme as adopted by the Eighteenth Session of the IOC Assembly. The Panel noted that the training courses and workshops on harmful algae had been successfully implemented, regionally and globally, in 2000–2002 ([Annex X](#)). The Panel strongly encouraged Denmark, Japan and Spain to continue to support IOC capacity-enhancement activities, and welcomed indications from several other Member States who offered to support or to investigate the possibilities of supporting specific training courses or workshops. **The Panel also expressed its appreciation** of the significant support provided by Denmark, Japan, and Spain for training and capacity-building activities.

32 **The Panel adopted** the revised IOC HAB Training and Capacity Enhancement Programme as attached as [Annex X](#) hereto.

33 The Panel discussed possible new ways to assist Member States with emergency expert assistance and institutional capacity-building assistance regarding management and mitigation capabilities.

34 Regarding a mechanism to assist Member States in building national capacity in management and mitigation, including enhancement of associated national research expertise, laboratory facilities, training, curriculum development at relevant educational institutions, improvement or establishment of appropriately designed monitoring systems, etc., **the Panel recognized** that such an undertaking requires funding at a scale far beyond the budget of IOC or other similar specialized organisations. Therefore, the Panel discussed the development of a framework for regional project clusters for upgrading national HAB management and monitoring capacity.

35 **The Panel decided** to explore the feasibility of a mechanism where the IOC establishes consortia of experts with complementary competences. These consortia would work with a number of Member State institutions on project identification and formulation, with a view for Member States to present such projects to e.g. the World Bank, regional development banks, or similar major funding agencies. The consortia may or may not be directly involved in the implementation of projects, depending on the funding sources, the wish of the Member States and availability of the consortia members.

36 **The Panel recommended** that a suitable partner be sought to provide seed money to allow the consortia to be able to respond to indications of interest from Member States and to formulate projects tailored to specific needs within the respective Member States.

37 **The Panel requested** the Chair and Vice-chair to work with the Secretariat in assessing the feasibility of the suggested consortia mechanism, in developing terms of reference for the consortia, in identifying possible consortia members, and to consult the IPHAB by correspondence in the further development of the mechanism.

38 **The Panel adopted** [Resolution IPHAB-VI.3](#).

39 **The Panel adopted** [Recommendation IPHAB-VI.7](#).

4. **SCIENTIFIC PROGRAMME ELEMENTS**

ECOLOGY AND OCEANOGRAPHY

4.1 IOC-SCOR PROGRAMME ON THE GLOBAL ECOLOGY AND OCEANOGRAPHY OF HARMFUL ALGAL BLOOMS: GEOHAB

40 At its Fourth Session the Panel, through Recommendation IPHAB-IV.2, initiated the establishment of a new international research programme on the global ecology and oceanography of harmful algal blooms, GEOHAB. The overall goal of this initiative is to develop the scientific knowledge needed in this field in order to increase the capability of mitigating the impacts of HABs. GEOHAB is established jointly with SCOR, and is intended to help Member States in setting national priorities and in particular to promote the establishment of national, regional and international research programmes.

41 The Chair of the IOC-SCOR Scientific Steering Committee (SSC) for GEOHAB, Dr. Patrick Gentien (France) reported on GEOHAB developments and presented the GEOHAB Science Plan as already adopted by both, SCOR and IOC, as well as the outline of the Implementation Plan. The List of Members and the Terms of Reference for the GEOHAB SSC are attached as [Annex XI](#) hereto. The GEOHAB SSC and the SCOR and IOC Secretariats are still seeking the establishment of an international project office (IPO) for GEOHAB. At the Twentieth Session of the IOC Assembly, June 1999, France offered to host the IPO Office at IFREMER. Complementary funding is being sought as the French offer in its present form is not adequate to fully establish an IPO.

42 Based upon information on GEOHAB advances, the Panel sought to identify IPHAB assistance required in developing the Implementation Plan and establishing an International Project Office (IPO). **The Panel fully acknowledged** that an IPO is required to implement GEOHAB, and that it may need to be established under the joint auspices of the IOC and SCOR.

43 **The Panel expressed its appreciation** of the work of the GEOHAB SSC in preparing the Science Plan.

44 The Panel thereafter focused its discussions on the strategy for the Panel to provide an efficient mechanism for promoting GEOHAB at both the global, regional, and national levels. To this effect, **the Panel formulated** both guidelines to its Members on how to act in the intersessional period, and recommendations to Member States on how to build up GEOHAB. **The Panel adopted** [Resolution IPHAB-VI.4](#) and [Recommendation IPHAB-VI.2](#).

4.2 ICES-IOC WORKING GROUP ON HARMFUL ALGAL BLOOM DYNAMICS

45 The Chair (Dr. J. Martin, Canada) of the ICES-IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD), reported on the achieved results, and new terms of reference were discussed. The 2003 terms of reference are attached as [Annex XII](#) hereto.

46 **The Panel reiterated** the importance of the ICES-IOC WG in having provided, and still providing, a significant part of the basis for the development of GEOHAB and other HAB activities, and focussed its discussions on how to ensure appropriate feedback, from IPHAB to ICES, in order to ensure the continuation of the WGHABD.

47 The Panel discussed the promising technology of molecular probes for detecting and enumerating HAB species. The progress in this field is rapid, and a diverse array of technologies is being developed. Some are either already available, or are being considered for commercial application. Likewise, some are being considered for use in monitoring programmes. Typically, those developing these methods compare their results with at most one or two alternatives. Rarely are multiple methods compared on a range of environmentally relevant samples. Furthermore, in some areas, recent comparisons of some of these methods have revealed significant differences in estimates of cell abundance.

48 As these technical developments continue, the Panel found that it is important that an intercalibration or intercomparison workshop be held in which experts familiar with each detection method would test their methods on common samples. With careful advance planning, such a workshop should highlight problem areas, and indicate areas for further technical development. It should not be a training workshop, but rather a meeting of experts who work together to evaluate and compare methods.

49 Noting that the ICES-IOC WGHABD has proposed a workshop along these lines, and recognizing the importance of this type of activity to all IOC Member States with HAB problems, **the Panel recommended** that the ICES-IOC WGHABD should plan and seek funding for a workshop on “New and classic techniques for the determination of numerical abundance and biovolume of HAB species”. IOC Member States should be encouraged to support such a workshop by providing funds and/or expert participants.

50 **The Panel adopted** [Recommendation IPHAB-VI.4](#).

4.3 ICES-IOC-IMO STUDY GROUP ON BALLAST WATER AND SEDIMENTS

51 The reports of the ICES-IOC-IMO Study Group on Ballast Water and Sediments from the intersessional period were made available. **The Panel endorsed** the continuation of the Study Group and urged IOC to ensure a Representative at the meetings of the Group. The 2003 Terms of Reference of the Steering Group are attached as [Annex XIII](#) hereto.

52 **The Panel recognized** the importance of scientific information on biology and ecology of organisms invading other areas via ship-born vectors, and requested that the Secretariat take initiative to (i) communicate to the SG the scientific opinions of IOC Member States and (ii) inform IOC Member States about the outcomes and advice of the Study Group, and to ensure that advice is based on evidence-based science.

4.4 TAXONOMY

53 The Fourth Session of the Panel established a Task Team on Phytoplankton Taxonomy through Resolution IPHAB-IV.1. The Fifth Session reviewed the progress report from the

Group, and reaffirmed the strong need in the international research and management community for a reference list on potentially harmful algae, and that it is urgent for the Panel to respond to this need.

54 **The Panel noted** with satisfaction that the ‘IOC Taxonomic Reference List’ has been published and serves as a unique reference tool for scientists, students, and monitoring staff.

55 **The Panel decided** to continue the Task Team with revised Terms of Reference. **The Panel adopted** [Resolution IPHAB-VI.1](#).

4.5 TOXICOLOGY AND TOXIN CHEMISTRY

56 The Panel noted the report of the IPHAB Task Team on Aquatic Biotoxins, and recalled Resolution IPHAB-V.2. Noting that the Terms of Reference of this Task Team had not been completed in the intersessional period, the **Panel decided** to discontinue the Task Team but urged the Task Team Members to complete the toxin fact sheets in preparation.

57 **The Panel recognized** that the effects of long-term exposure of humans to low concentrations of algal toxins are poorly investigated, and noted that such effects may potentially seriously influence public health where seafood, drinking water, or other products contain chronic algal toxins levels below regulatory limits, that otherwise would exclude such products from most markets.

58 **The Panel also recognized** the existence of WHO guidelines for algal toxins in drinking water, and the limits set for algal toxins in seafood by regional and national authorities (such as CODEX, APEC, EC), but such existing regulations and guidelines provide no protection for the public for health concerns regarding potential effects of long-term exposure of humans to low concentrations of algal toxins.

59 **The Panel recommended** that a group of experts be established to assess current knowledge gaps on the potential effects of long-term human exposure to low concentrations of algal toxins **and adopted** [Recommendation IPHAB-VI.5](#).

60 The Panel discussed that a common and growing HAB concern in several regions such as IOCARIBE, WESTPAC and the South Pacific countries is Ciguatera Fish Poisoning (CFP). Reports of CFP cases/deaths have been incoming in these regions and no reliable toxin monitoring is in place (unlike other phycotoxins as such as PSP).

61 **The Panel recommended** that CFP research and development of monitoring and management of CFP toxins is addressed in the terms of reference of the ANCA and WESTPAC/HAB and that the two regional groups seek to include the South Pacific in a cross regional focus on CFP.

62 **The Panel adopted** [Recommendation IPHAB-VI.8](#).

5. OPERATIONAL PROGRAMME ELEMENTS

5.1 MONITORING AND RESOURCE PROTECTION

63 The Panel discussed incompatibilities among regulations in various major markets and how it could best address these incompatibilities.

64 The Panel recalled its Recommendation IPHAB-V.5 where the Panel offered itself as a mechanism to strengthen interaction between the relevant expert groups which advice e.g. European Union (EU) and the Asia Pacific Economic Cooperation (APEC) on biotoxin regulations with a view to improve the basis for compatibility, and encouraged the relevant organisations to interact and to request the IPHAB to participate as observer at the principal meetings of their respective expert groups.

65 **The Panel noted** with concern that no real progress had been made in the intersessional period and that incompatibility of regional and/or national regulations on aquatic biotoxins, and the associated potential impediments to trade in seafood products, continued to be an issue of concern.

66 To address more systematically this issue, **the Panel decided** on the terms of reference for an intersessional Task Team. **The Panel adopted** [Resolution IPHAB-VI.2](#).

67 **The Panel recalled** Resolution IPHAB-V.3 on the establishment of a Task Team to draft a document providing guidelines on emergency measures for harmful algal events and to coordinate this with the outcomes of the APEC-IOC International Conference on Harmful Algae Management and Mitigation (HAMM). After revision and approval of the draft document by the ICES-IOC Working Group on Harmful Algal Blooms Dynamics, the Guidelines should be published on both paper and on the IOC HAB Homepage. This decision was based on element 6.3 of the IOC HAB Programme Plan, and recognized the need for a comprehensive source of information and guidance on emergency measures and design and implementation of monitoring and management programmes.

68 **The Panel regretted** that the Task Team had not accomplished its terms of reference due to the fact that the results of the APEC-IOC International Conference on Harmful Algae Management and Mitigation had not been made available sufficiently in advance for the WGHABD to recommend its finalization.

69 **The Panel noted** with satisfaction that the endorsement by the Fifth Session of the publication by IOC jointly with APEC of a major report on design of HAB monitoring strategies had been successfully followed-up. The report is a reedited version of a report prepared by a consortium of international experts and originally published by Hong Kong in cooperation with APEC. The report is published as 'Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters', by D. M. Anderson, P. Andersen, V. M. Bricelj, J J. Cullen, and J. E. Rensel. APEC Report # 201-MR-01.1, Asia Pacific Economic Programme, and IOC Technical Series No. 59, Paris, France, 2001.

5.2 IMPLEMENTATION OF HAB MONITORING WITHIN THE GLOBAL OCEAN OBSERVING SYSTEM (GOOS)

70 Upon request of IOC/GOOS, its subsidiary body (I-GOOS) and the coastal component of GOOS (COOP), **the Panel reviewed** the draft integrated strategic design plan for the coastal ocean observations modules of the global ocean observing system. Furthermore, it was discussed how to assist in the process of developing and defining which information and data should be recommended to be part of a the coastal component of GOOS.

71 **The Panel recognized** that the integrated, strategic design plan for the coastal ocean observations modules of GOOS had been designed with operational observation of HABs as an important constituent, but recalled the rapid development of innovative techniques for detection of HABs on the basis of single species, and that this should be taken into account.

72 **The Panel acknowledged** that the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) is the vehicle for the collection, archiving, distribution and utilization of ocean and meteorological data, and that their Terms of Reference allow for the coastal module of GOOS to include non-physical variables. It therefore recommended that IPHAB cooperate with JCOMM to develop effective systems for the monitoring of harmful species at the appropriate functional level, which would allow detection of changes in marine systems to be made in order to understand and manage coastal ecosystems.

73 **The Panel adopted** [Recommendation IPHAB-VI.3](#).

6. HAB PROGRAMME WORKPLAN 2003–2005

74 **The Panel summarized** the priorities and needs for the next intersessional period and recommended a [workplan](#) for the period 2003–2005 as indicated in Annex II hereto. **The Panel adopted** [Recommendation IPHAB-VI.9](#).

7. OPERATION OF THE IOC INTERGOVERNMENTAL PANEL ON HAB

75 The Panel discussed the operation of the HAB Programme, and the role of the IPHAB and its future mission. The Panel discussed the role and ambitions of the IPHAB the coming years, and a strategy to attract even more Member States to coming sessions of the Panel.

76 **The Panel reconfirmed** that its mission includes initiating and monitoring an improved dialogue between the scientific community with the user community on topics such as management of the coastal zone, aquaculture, industry, etc. The high priority given to HAB training and capacity enhancement and the strengthening of regional activities should be continued. They include cooperation with relevant regional organisations (monitoring implications) on detection, monitoring and management to remove commercial barriers and on safeguarding public health. Finally, cooperation with other relevant regional and international programmes, in order to avoid duplication or repetition of activities; was reconfirmed as a key priority.

77 Hence, the role of IPHAB shall be to continue to serve as a mechanism to make national governments or economies more effective in protecting human lives and in ensuring the sustainable development of aquaculture and fishery activities, through regional and international cooperation and collaboration.

78 The Mission of IOC HAB Programme shall be:

1. To initiate or strengthen existing regional and international HAB programmes that can guide and help national governments in improving their understanding of, and coping mechanisms for HAB events, through enhanced education and effective dialogue with consumers, policy-makers, managers and the general public.
2. To help plan and provide guidance on the implementation of regional and international activities such as workshops and intercalibration in order to harmonize and improve national management of HAB events.

79 **The Panel decided** to continue its activities intersessionally under the co-ordination of the Chair. Dr. B. Reguera (Spain) was elected Chair, and Dr. P. Busby (New Zealand) was

elected Vice-Chair. Dr. R. Azanza declined being considered for re-election and thanked the Panel for being given the opportunity to serve for the last seven years.

80 **The Panel and the Secretariat expressed their gratitude** to Dr. Zingone and Dr. Azanza for their wise and competent chairing of the Panel for the past three intersessional periods.

81 **The Panel stressed the importance** of the attendance of the Chairs of regional IOC HAB groups at IPHAB sessions, and urged the Secretariat to ensure this for the Seventh Session of the Panel.

82 **The Panel recommended** that the Seventh Session be announced to Member States no less than 12 months in advance. Several Members mentioned that they had experienced difficulties obtaining the national support and clearance when the meetings were only announced six months in advance.

83 **The Panel adopted [Recommendation IPHAB-VI.10](#).** **The Panel requested** the Chair to present an Executive Summary, Resolutions and Recommendations to the Twenty-second Session of the IOC Assembly, June 2003.

ANNEX I

AGENDA

- 1. OPENING**
 - 1.1 OBJECTIVES OF THE INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS. DECISIONS TAKEN BY THE IOC ASSEMBLY
- 2. ADMINISTRATIVE ARRANGEMENTS**
 - 2.1 ADOPTION OF THE AGENDA
 - 2.2 DESIGNATION OF RAPPORTEUR
- 3. SUMMARY DESCRIPTION OF THE IOC HARMFUL ALGAL BLOOM PROGRAMME**
- 4. HABP DEVELOPMENTS IN THE INTERSESSIONAL PERIOD:**
 - 4.1 CHAIR, IPHAB AND TECHNICAL SECRETARY'S SUMMARY REPORT ON ACTIVITIES AND IMPLEMENTATION OF IPHAB-V DECISIONS
- 5. NATIONAL STATEMENTS**
- 6. MAJOR ISSUES REQUIRING INTERGOVERNMENTAL COOPERATION**
(INCLUDING INTERACTION WITH OTHER PROGRAMMES AND ORGANISATIONS, AND REGIONAL COMPONENTS OF HABP): PANEL SESSION
 - Panel 1. Capacity building
 - Panel 2. GEOHAB Research Programme:
 - Panel 3. HAB Monitoring in Coastal GOOS:
 - Panel 4. Formulation/endorsement of specific objectives for regional activities
 - Panel 5. Seafood safety regulation coordination:
 - Panel 6. Operation of the HAB Programme, role of the IPHAB and its future mission
- 7. OTHER RELEVANT ITEMS**
- 8. RECOMMENDATIONS OF THE IPHAB, OVERVIEW OF RESOURCES AND NEEDS: WORKPLAN 2002–2004**
- 9. OPERATION OF THE IPHAB**
- 10. ELECTION OF CHAIRS**
- 11. ANY OTHER BUSINESS**
- 12. ADOPTION OF EXECUTIVE SUMMARY AND RESOLUTIONS/ RECOMMENDATIONS**
- 13. CLOSURE**

ANNEX II

RESOLUTIONS AND RECOMMENDATIONS

Code	Title
	Resolutions
Resolution IPHAB-VI.1	Task Team on Algal Taxonomy
Resolution IPHAB-VI.2	Task Team on Biotxin Regulations
Resolution IPHAB-VI.3	IOC/HAB Training and Capacity Building Programme
Resolution IPHAB-VI.4	IPHAB Operation Regarding GEOHAB
	Recommendations
Recommendation IPHAB-VI.1	Regional HABP Development
Recommendation IPHAB-VI.2	Development of GEOHAB
Recommendation IPHAB-VI.3	Implementation of HAB Monitoring within the Global Ocean Observing System
Recommendation IPHAB-VI.4	ICES-IOC Working Group on Harmful Algal Bloom Dynamics (WGHABP)
Recommendation IPHAB-VI.5	Long-Term Effects of Human Exposure to Low Concentrations of Algal Toxins
Recommendation IPHAB-VI.6	HABP Publications
Recommendation IPHAB-VI.7	HABP Emergency Response and Development of Institutional Capacity
Recommendation IPHAB-VI.8	Ciguatera Fish Poisoning
Recommendation IPHAB-VI.9	HABP Workplan 2003–2005
Recommendation IPHAB-VI.10	Operation of the IOC Intergovernmental Panel on Harmful Algal Blooms

RESOLUTIONS

Resolution IPHAB-VI.1

TASK TEAM ON ALGAL TAXONOMY

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the pivotal role of harmful algal taxonomy in training, scientific and monitoring activities in the HAB Programme,

Acknowledging the valuable sources for identification of harmful algae e.g. provided by the *IOC Manual on Harmful Marine Microalgae*, Hallegraeff, G. et al. (eds.), UNESCO 1995 and 2003, and *Identifying Marine Phytoplankton*, Thomas, C. R., (ed.) 1995,

Recalling the recent change of names of many harmful algae,

Noting the instability of names as a source of confusion for ecologists, toxicologists, and monitoring workers,

Recalling further the decisions of the previous Sessions of the Panel regarding the Task Team on Algal Taxonomy,

Acknowledging further the progress of the Task Team and the publication of the IOC Taxonomic Reference List of Toxic Plankton Algae,

Decides, with reference to the HAB Programme Plan, objective 6.2.2, ii (Annex VII of this summary report), to continue the Task Team on Algal Taxonomy with the following terms of reference:

- (i) maintain, complete and update the list of toxic algal species;
- (ii) integrate the list with information on the algal genera that include toxic species and illustrations that may enable the correct identification;
- (iii) organise a Session to be held on nomenclature and taxonomy of harmful algal species at the XIth International Conference on Harmful Algal Blooms (South Africa, October 2004);
- (iv) provide guidelines to reduce nomenclatural instability of harmful algal species;

Decides also that the Task Team will be composed of: Ø. Moestrup (Denmark) Chair, Y. Halim (Egypt), M. Elbraechter (Germany), A. Zingone (Italy), Y. Fukuyo (Japan), M. Faust (USA), S. Fraga (Spain), F.R.J. Taylor (Canada), G. Codd (UK), and G. Cronberg (Sweden);

Notes that the Task Team will continue its work until otherwise decided by the Panel, and that it will work by correspondence and/or meet on an opportunistic basis, as for example during the XIth HAB Conference in South Africa, November 2004, and provide a progress report including a workplan for the intersessional period to the Chair IPHAB.

Resolution IPHAB-VI.2

TASK TEAM ON BIOTOXIN REGULATIONS

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recalling Recommendation IPHAB-V.5 concerning compatibility of regulations on aquatic biotoxins,

Acknowledging the existence of various groups which address the scientific aspects of methodology and legislation with regards to the contamination of seafood with phycotoxins, and that each group generates valuable scientific information that may be used to recommend on regional or national policies [such as those of the Asia Pacific Economic Cooperation (APEC), EU National Reference Laboratories, CEN, AOAC],

Noting with concern that there is limited coordination and exchange of information among these groups,

Noting further with concern the potential incompatibility of regulations and the associated impediments to trade in seafood products,

Decides to establish a Task Team with the following Terms of Reference:

- (i) identify incompatibilities among regulations in various markets;
- (ii) take the initiative to expand the participation in the Task Team (e.g. CODEX, EC, APEC, US FDA, and relevant experts) as required to prepare guidance to ensure international compatibility of methodology and legislation with regards to the control of contamination of seafood with phycotoxins;

Decides that the Task Team will be composed of: Phil Busby (New Zealand) Chair, Arturo Sierra-Beltran (Mexico);

Encourages the relevant organisations to invite the IPHAB Task Team to participate as observer at the principal meetings of their respective groups in order to facilitate international compatibility of applied methodology and legislation with respect to phycotoxins;

Notes that the Task Team is established until otherwise decided by the Panel, and that it will work by correspondence and/or meet on an opportunistic basis, and provide a progress reports, including a workplan, for the intersessional period to the Chair IPHAB.

Resolution IPHAB-VI.3

IOC/HAB TRAINING AND CAPACITY-BUILDING PROGRAMME

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recalling Recommendations IPHAB-II.2 and IPHAB-III.2 concerning the establishment and endorsement of an IOC HAB Training and Capacity-Building Programme,

Recognizing the achievements made in implementing the Programme,

Noting that the IOC HAB Training and Capacity-Building Programme continue to provide the appropriate overall strategy and focus,

Recognizing a need to update the Programme,

Adopts a revised HAB Training and Capacity Enhancement Programme (IOC/IPHAB-V/3, Annex IX) which:

- (i) continues ongoing activities;
- (ii) increases the priority for capacity enhancement in monitoring and management;
- (iii) gives priority to activities responding to GEOHAB requirements;
- (iv) expands the partnership in the IOC Science and Communication Centres with relevant scientific institutions in order to provide a broader and longer-term platform for implementation of capacity-enhancement activities including courses, workshops, training through research, and individual training.

Resolution IPHAB-VI.4

IPHAB OPERATION REGARDING GEOHAB

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Referring to the establishment of the joint SCOR-IOC international science programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) through IOC Resolution EC-XXXI.3 and the associated GEOHAB Science Plan,

Recognizing that GEOHAB cannot be implemented without a strong involvement of the scientific community and funding agencies at national and regional levels,

Decides, that the individual IPHAB members will:

- (i) inform their national representatives at the IOC Assembly about GEOHAB and related IPHAB recommendations and resolutions;
- (ii) encourage the establishment of committees, working groups, mailing lists as appropriate in order to facilitate the coordination of their national activities and international collaboration relevant to GEOHAB, and serve as a focal point for interactions with the GEOHAB-SSC and IPO;
- (iii) examine the possibilities and draft a proposal to include GEOHAB research activities into development projects;
- (iv) in cooperation with the GEOHAB SSC Members, inform relevant regional bodies (e.g. ICES, PICES, HELCOM, OSPARCOM, etc.) about GEOHAB, the related IPHAB-VI Recommendations and Resolutions, and make suggestions for their support and/or action.

RECOMMENDATIONS

Recommendation IPHAB-V1.1

REGIONAL HABP DEVELOPMENT

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recalling the priority of the implementation of IOC programmes at the regional level,

Noting with appreciation the reports of the regional activities within WESTPAC/HAB, ANCA, and FANSA and the preliminary and planned activities in Western Africa,

Recommends that the IOC Secretariat assess the feasibility of undertaking regional HAB activities in three areas: (i) the Benguela region; (ii) Northern Africa; and (iii) the Indian Ocean. Where it is not possible to establish a separate regional group, consideration should be given to expanding the geographic coverage of other regional bodies to include these regions (e.g., to involve Indian Ocean countries in WESTPAC).

Recommendation IPHAB-VI.2

DEVELOPMENT OF GEOHAB

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recalling the establishment of the joint SCOR-IOC International Science Programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) through IOC Resolution EC-XXXI.3 and the associated GEOHAB Science Plan,

Recognizing the benefits of the activities related to the development of the GEOHAB Implementation Plan, especially in providing momentum for national networking,

Recognizing further the role of the IPHAB in supporting and facilitating the development and funding of GEOHAB,

Recommends that the IOC ensure that data quality management and exchange issues relevant to the GEOHAB Programme are given due consideration in the terms of reference for the Group of Experts on Biological and Chemical Data Management Exchange Programme (GE-BCDMEP), and that a GEOHAB representative be included in the GE-BCDMEP;

Recommends also that the national representatives of IOC Member States to the IOC Assembly and Executive Council take the necessary action to assist in the identification and provision of the necessary and sustained support for the IOC-SCOR International Programme Office for GEOHAB.

Recommendation IPHAB-VI.3

**IMPLEMENTATION OF HAB MONITORING WITHIN
THE GLOBAL OCEAN OBSERVING SYSTEM**

The IOC Intergovernmental Panel on Harmful Algal Blooms:

Recalling Recommendation IPHAB-V.3,

Recognizing that the draft *Integrated, Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System*, the reduction of public health risks and the restoration and protection of living marine resources are among the goals of GOOS, within which the operational observation of HABs is an important constituent,

Noting that at its current stage of development the draft Strategic Design Plan does not specify the variables to detect the occurrence of HABs,

Recognizing the rapid development of innovative techniques for detection of HABs on the basis of single species,

Recommends that the IOC Secretariat and the Chair of IPHAB work together with the IOC/GOOS Programme, its subsidiary body (I-GOOS) and the coastal component of GOOS (COOP);

Acknowledging that JCOMM is the vehicle for the collection, archiving, distribution and utilisation of ocean and meteorological data, and that their Terms of Reference allow for the coastal module of GOOS to include non-physical variables,

Recommends that IPHAB cooperate with JCOMM to develop effective systems for monitoring harmful species at the appropriate functional level, which would allow for the detection of detrimental changes in marine systems to be made in order to understand and manage coastal ecosystems.

Recommendation IPHAB-VI.4

**ICES-IOC WORKING GROUP ON
HARMFUL ALGAL BLOOMS DYNAMICS (WGHABD)**

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Noting with satisfaction the progress of the ICES-IOC/WGHABD 2000, 2001, and 2002,

Recognizing the continued valuable contribution of the WGHABD to the development of the IOC-SCOR/GEOHAB Programme,

Recommends that the ICES-IOC/WGHABD continue to exist within its own identity under the joint auspices of ICES and IOC;

Recommends also that the IOC continue to encourage participation in the ICES-IOC/WGHABD of experts in HAB dynamics from IOC Member States outside the ICES area;

Noting further with satisfaction the timeliness of the plans of the WGHAB for a workshop on New and classic techniques for the determination of numerical abundance and biovolume of HAB species,

Urges IOC Member States to support such a workshop by providing funds and/or expert participants;

Requests the WGHABD to take note of the planned 3rd Workshop on Molecular Probe Technology for the Detection of Harmful Algae with a view to possibly merge the two planned activities.

Recommendation IPHAB-VI.5

LONG-TERM EFFECTS OF HUMAN EXPOSURE TO LOW CONCENTRATIONS OF ALGAL TOXINS

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recognizing that the effects of long-term exposure of humans to low concentrations of algal toxins are poorly investigated,

Noting with concern that such effects may potentially influence public health seriously where seafood, drinking water, or other products chronically contain algal toxins below regulatory limits that otherwise would exclude such products from most markets,

Acknowledging the existence of WHO guidelines for algal toxins in drinking water, and the limits set for algal toxins in seafood by regional and national authorities (such as CODEX, APEC, EC),

Noting further that existing regulations and guidelines provide no protection to the public for health concerns against potential effects of long-term exposure of humans to low concentrations of algal toxins,

Recommends that a group of experts be established to assess gaps in current knowledge on potential effects of long-term human exposure to low concentrations of algal toxins with the following terms of reference:

- (i) within two years assess existing knowledge on potential effects of long-term exposure of humans to low concentrations of algal toxins;
- (ii) advise on approaches and methodologies to provide data, which may serve to better assess any potential effects of long-term exposure of humans to low concentrations of algal toxins;
- (iii) submit a manuscript/report to sponsoring organisations.

Recommends further that the WHO be consulted and invited to be partner in a joint task team with the above terms of reference.

Recommendation IPHAB-VI.6

HABP PUBLICATIONS

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recognizing that the lack of updated scientific literature is often a main handicap for the implementation of appropriate projects in developing countries/economies in transition,

Acknowledging that the IOC and its HAB Programme derives great benefit from the cooperative development and sponsorship of working groups, workshops, conferences, training programmes, and the associated publication of reports, conference proceedings and the like,

Noting that all partners in such cooperative activities expect and deserve the significant and timely implementation of responsibilities in the partnerships,

Recognizing further that the publication/co-publication by IOC of the proceedings of the International Conference on Harmful Algal Blooms for the last six years has been a major achievement to ensure a world-scale dissemination (through the IOC Science and Communication Centres and associated partners) of the scientific results presented at these conferences,

Recommends that the IOC Secretariat negotiate with the convenors of the international conferences on HAB, and the International Society for the Study of Harmful Algae (ISSHA), on a case-per-case basis, to ensure that this valuable series of proceedings continues to be published in a similar manner;

Regrets the recent delay in getting the HAB 2000 Proceedings completed as it reflects poorly on the IOC and the sponsorship of the HAB Programme activities;

Recommends the continuation of the policy of co-sponsoring and publishing workshop and conference proceedings;

Recommends also, with regard to the IOC HAB Programme, that the IOC Secretariat pay particular attention to delays encountered in publishing/printing reports and proceedings that are co-sponsored by the IOC with aligned organisations and societies;

Recommends further that the IOC Secretariat implement a system of prioritisation for publications/printing that recognizes the need to provide quality and timely implementation of partnership agreements that involve the publication of proceedings, training manuals, workshop reports, and the like.

Recommendation IPHAB-VI.7

**HABP EMERGENCY RESPONSE AND BUILDING OF
INSTITUTIONAL CAPACITY**

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recognizing the need for a mechanism to efficiently assist Member States in emergency situations as well as a mechanism to advise on development of projects for institutional capacities,

Recommends that the Chair and Vice-chair work with the Secretariat to assess the feasibility of providing Member States and, if feasible, proceeds with the development of an emergency assistance to deal with unexpected or unusual HAB outbreaks;

Recommends also that the Chair and Vice-chair work with the Secretariat to investigate the feasibility to establish a mechanism to assist Member States in formulating and preparing development projects for enhancement of national or regional capability within HAB monitoring, management, and research as follows:

- (i) consider establishing partnership teams of experts in a consortium with broadly based expertise and experience;
- (ii) develop terms of reference for such a consortia;
- (iii) identify possible consortia members;
- (iv) seek a suitable partner to provide seed money to allow a consortium to respond to indications of interest from Member States and to formulate projects tailored to the needs in the respective Member States;

Requests that the IPHAB is consulted by correspondence in the further development of the mechanisms.

Recommendation IPHAB-VI.8

CIGUATERA FISH POISONING

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recognizing that a common and growing HAB concern in several regions such as IOCARIBE, WESTPAC and the South Pacific countries is Ciguatera Fish Poisoning (CFP),

Noting that reports of CFP cases/deaths have been incoming in these regions and that no reliable toxin monitoring is in place (unlike other phycotoxins as such as PSP),

Recommends that CFP research and development of monitoring and management of CFP toxins is addressed in the Terms of Reference of the ANCA and WESTPAC/HAB and that the two regional groups seek to include the South Pacific in a cross-regional focus on CFP.

Recommendation IPHAB-VI.9

HABP WORKPLAN 2003–2004

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Referring to the deliberations of its Sixth Session and the priorities identified prior to the session by WESTPAC/HAB, FANSA and ANCA,

Endorses the implementation of the workplan for the IOC Harmful Algal Bloom Programme as presented in Annex to this Recommendation within the resources available;

Urges Members of the Panel and the IOC Secretariat to identify the required resources.

Recommendation IPHAB-VI.10

**OPERATION OF THE IOC INTERGOVERNMENTAL PANEL
ON HARMFUL ALGAL BLOOMS**

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recommends that the IOC Intergovernmental Panel on Harmful Algal Blooms continue until otherwise decided by the IOC; the Terms of Reference should remain unchanged.

Annex to Recommendation IPHAB-VI.9

IOC HAB PROGRAMME WORKPLAN 2003–2005
(Activities identified as of 31 December 2002 only)

ACTIVITY:	ORGANIZER/ RESPONSIBLE	TARGET GROUP/ Region:	WHERE:	WHEN:	FUNDING IDENTIFIED: In USD		FUNDING REQUIRED TOTAL: In USD	AUTHORITY & REMARKS
					IOC	Ex Bud		
PUBLICATIONS								
HAN pre-press 2 x four issues	IOC SCC HA ¹	Global		Quarterly		2 x 4K	8K	Key activity
HAN Editor	Wyatt	-			2 x 2K		4K	Key activity
HAB MANUAL 2ed	Hallegraeff/ Enevoldsen	Global		2003	5K	45K	50K	IPHAB III-V
Monograph on Real Time Observations of HABs	Babin/Enevoldsen	Global		2004	20K		20K	IPHAB-VI and GEOHAB
HAMM Guidelines	Hall/IOC SCC HA	Global		2000			IOC Series	IPHAB-VI
XHAB Proceedings	Steidinger	Global		2003	7K		20K	IPHAB-VI
HAMM Proceedings	Hall/Enevoldsen	Global		2003?	4K		7K	Pending
Xith HAB Proceedings	Pitcher	Global		2005	7K		20K	IPHAB-VI
COSPONSORSHIP OF CONFERENCES								
XIth HAB	Pitcher	Develop. Country.	Cape Town	2004	10K		Unknown	IPHAB-VI
ICMSS IV 2004	Cusack	Develop. Country	Ireland	2004	7K		Unknown	IPHAB-VI

¹ IOC SCC HA = IOC Science and Communication Centres on Harmful Algae

ACTIVITY:	ORGANIZER/ RESPONSIBLE	TARGET GROUP/ Region:	WHERE:	WHEN:	FUNDING IDENTIFIED: In USD		FUNDING REQUIRED TOTAL: In USD	AUTHORITY & REMARKS
					IOC	Ex Bud		
TRAVEL								
IOC Staff	IOC SCC HA	-		Yearly	3 x 4K	3 x 7K	3 x 15K	
Chair IPHAB Travel	Reguera	-		Yearly	3 x 2K		3 x 2K	
SCIENTIFIC ELEMENTS								
GEOHAB	Gentien/IOC SCC HA/SCOR	-	-	-	3 x 20K	3 x 50KK	3 x 100K	Agreement with SCOR
ICES-IOC WGHABD	Martin/IOC SCC HA/ICES	Develop. Country		Yearly	3 x 4K		Unknown	IPHAB-VI
ICES/IOC/IMO SG	Reguera/IOC SCC HA	Global		Yearly	-		Unknown	IPHAB-V
HABWATCH Workshop	Babin/Cullen	Global	Villefranche -sur-Mer, France	2003	5K	-	175K	IPHAB-VI, GOOS, GEOHAB, ICES- IOC WGHABD
REGIONAL GROUPS								
Regional Working Group Meeting on Harmful Algal Blooms in South America (IOC FANSA)	Guzmann	S-America	To be decided	Yearly	3 x 7K	?	Unknown	IPHAB-VI
Regional Working Group Meeting on Harmful Algal Blooms in the Caribbean (IOC ANCA)	Barbera/Beltran	Caribbean	To be decided	Yearly	3 x 7K	?	Unknown	IOCARIBE and IPHAB-VI
WESTPAC/HAB	Fukuyo	SE Asia	To be decided	Yearly	3 x 5K	(3 x 10K)	Unknown	WESTPAC Budget
West African HAB Pilot Project	IOC SSC HA	Western Africa	To be decided	2003-04	8K			

ACTIVITY:	ORGANIZER/ RESPONSIBLE	TARGET GROUP/ Region:	WHERE:	WHEN:	FUNDING IDENTIFIED: In USD		FUNDING REQUIRED TOTAL: In USD	AUTHORITY & REMARKS
					IOC	Ex Bud		
CAPACITY ENHANCEMENT								
IOC-Danida Training Courses on the Taxonomy and Biology of Harmful Marine Microplankton	IOC SCC HA CPH	Global, Develop. Country	University of Copenhagen , Denmark	Yearly	2 x 10K	Danida IOC TF: 2 X 40K	2 x50	IPHAB-VI
IOC-IEO-AECI Training Course on Toxic Phytoplankton -or Individual training	IOC SCC HA Vigo	Latin America, Develop. Country	Instituto Español de Oceanografía, Vigo, Spain	Yearly	-	3 x 30k Spain	3 x 30	IPHAB-VI
IOC Ocean Portal HAB Component for South East Asia incl. E-learning course on HAB identification	IOC SCC HA CPH	South East Asia	Internet, WS's in Bangkok, Manila, Copenhagen	2003	100K	-	100	UNESCO
IOC Training Course on Qualitative and Quantitative Determination of Algal Toxins	Elbrachter/Luckas	Global, Develop. Country	Germany, to be determined	2004	10K	Univ. Jena: Equip. To be ident. 20K	40	IPHAB-VI
Summer school on statistical analysis of phytoplankton time series	Gentien	Global	To be determined	2004 or 05	10K	Other agencies subject to applic.	Unknown	IPHAB-V IPHAB-VI, GEOHAB
North Africa Workshop on Harmful Algae	IOC SSC HA	North Africa	Tunisia	2003	8K	Danida- IOC-TF: 10 + COPEMED	30	IPHAB-VI

ANNEX III

NATIONAL STATEMENTS

A. CANADA

by Jennifer L. Martin

Fisheries & Oceans Canada

Biological Station, St. Andrews, NB, Canada E5B 2L9

Introduction

Management of Canadian aquaculture and wild fisheries is the mandate of Fisheries & Oceans Canada (DFO) whereas the Department of Health is responsible for food safety and sets the regulatory levels for the acceptable levels for toxins in food. The Canadian Food Inspection Agency (CFIA) monitors shellfish for the presence of toxins of concern in Canada. In addition, DFO has phycotoxin research programmes on both the east and west coasts with focus on aiding the management of the shellfish and finfish resources - wild and aquaculture industries. Additional phycotoxin research is carried out at several universities, other federal governments, the Institute for Marine Biosciences (IMB) (National Research Council), and provincial departments.

This report presents a summary of ongoing research projects and Canadian progress towards implementation of a GEOHAB Canada research network.

Research Projects

Fisheries & Oceans Canada has research programmes on both the Atlantic and Pacific coasts. Harmful algal bloom (HAB) research through the federal government is discussed through the national advisory group that was created in 1987 called the Phycotoxin Working Group (PWG). This group is comprised of a project leader from each of DFO's regions, the national co-ordinator from the CFIA and a representative from the National Capitol region. Included in the mandate for the PWG is the coordination of a Canadian Workshop on Harmful Marine Algae.

Research is also conducted at universities, other government agencies, industry and the private sector. Following is a list of research activities being conducted in Canada.

Population dynamics
Toxin Production
Toxin Toxicity
Uptake and Depuration of toxins
Physiology of Plankton
Chemistry
Optical Imagery
Taxonomy
Oceanography

Communications

- A. Electronic—Phycotoxin mailing list. This bulletin board was initiated to deal with marine phycotoxins and HABs. This list was established in 1994 and has subscribers all over the world and is maintained by Don Richard (CFIA).
- B. Canadian Workshop on Harmful Marine Algae
The 7th CWHMA was held in Nanaimo, British Columbia (May, 2001) and sponsored by

Fisheries & Oceans Canada. Participants were from Canada, Japan, New Zealand, Europe and the United States. A Technical Report was published with abstracts and extended abstracts. The 8th CWHMA will be held in Moncton, New Brunswick in 2003.

GEOHAB-Canada

An initial meeting was held immediately following the 7th Canadian Workshop in Nanaimo, BC to discuss the level of interest in developing a Canadian initiative for contribution to the International GEOHAB programme. A follow-up meeting, sponsored by Fisheries and Oceans Canada, was convened in Montreal (Oct, 2001) with 30 participants from throughout Canada representing government, industry, university and the private sector. The intent was to assess Canadian strengths in the area of HAB research and foster Canadian interest, particularly from fields of research not traditionally associated with harmful algal bloom research. Examples included: virus experts (control of bloom dynamics), optical oceanographers (*in situ* detection of blooms), physical oceanographers (conditions favouring bloom development), and geochemists (redox conditions affecting sedimentary cysts). The title for the initiative "Population Dynamics of Canadian HABs (*Heterosigma*, *Alexandrium* and *Pseudo-nitschia*)" was proposed. Three themes were outlined: 1) population dynamics of key HABs in comparable ecosystems, 2) biologically mediated growth and loss processes, and 3) novel observation systems and data analyses towards improved prediction.

A further workshop, with representation from the international GEOHAB programme, to prepare the Canadian programme, along the lines of the international GEOHAB recommendations, was held in Ottawa in Aug. 2002. Active collaboration (joint field and laboratory) with scientists from other countries is planned. A clear impact of this programme will be the increased possibility of hiring and training of new graduate students and post-doctoral associates who will be given opportunities to learn new techniques and mentor with experts in HAB related fields.

Plans for the upcoming months include: 1) funding is being sought to fund the programme through NSERC (National Science and Engineering Research Council) and Fisheries and Oceans Canada; 2) the production of an explicit Science Plan, following the recommended research themes of the international GEOHAB programme and identification of international collaborators; and 3) submission of the Canadian Science Plan for endorsement by the international GEOHAB Scientific Steering Committee.

The following activities should be encouraged:

- Continuation of training programmes
- Establishment of uniform toxin levels for international trade
- Encouragement of HAB research
- Support of GEOHAB
- Continuation of Harmful Algal Newsletter

B. FINLAND

Finland has a long tradition in several aspects of HABs. The first phytoplankton monitoring programmes started in the sea area off Helsinki in the late 1960s and are therefore among the longest time series of HAB species available on the global scale.

The research on HABs started intensively in 1980s. The main focus of research has been on the ecology and toxicology of cyanobacteria in the Baltic Sea. The research originated from different research traditions (microbiology/ecology) and have progressively developed towards a multidisciplinary approach, involving microbiologists, ecologists and physical oceanographers.

Finland has also actively participated in developing new observation systems and monitoring strategies of HABs, especially the use of Ships of Opportunity in the Baltic Sea Monitoring Programme.

There has not been a specific HAB research programme. However, a new Baltic Sea Research Programme (BIREME) has been established for 2003-2005. The objective of the Programme is to deepen the understanding of conditions for science-based management of environmental issues in the Baltic Sea. Eutrophication is among the main issues of the programme, and the issue of HABs will obviously be addressed. It should be pointed out, that even if the HABs are not the specific focus of the BIREME research programme, the origin of this programme dates back to the heavy cyanobacterial blooms of 1997.

Finland has been active in the development of GEOHAB through participation in the ICES-IOC Study Group of GEOHAB Implementation in the Baltic Sea.

From the Finnish point of view, support and stimulation by IPHAB towards comparative studies of ecosystems such as the Baltic Sea and US estuaries (Chesapeake Bay or Great Lakes) is desirable.

C. GERMANY

Research Activities

German research activities related to HAB are supported by governmental and other funding agencies, they are run by non-governmental institutions and universities but there is no governmental research programme on HABs.

With the end of the year 2000 a five-year research project (TEPS), funded completely by the Ministry of Research and Technology, was terminated in which six German research laboratories were involved. This project was partly done in cooperation with Scottish colleagues. The taxonomy of toxic algae, in particular dinoflagellates and prymnesiophytes and the possible interactions of harmful algae and bacteria were investigated. HPLC-analysis methods for detection of relevant toxins were adapted for use on board research vessels. In addition, rRNA probes of several HAB-species were developed to identify toxic algae in field samples in order to develop early warning systems. The latter topic is continued by the Alfred-Wegener-Institute of Polar and Marine Research. Taxonomic studies are continued at the German Center for marine Biodiversity Research, a department of the Research Institute of Senckenberg.

Current research activities: the Alfred-Wegener-Institute for Polar- and Marine Research and the University of Jena have several EU-supported research-projects related to HAB.

1. BIOHAB—Biological control of harmful algal blooms in European waters: the role of eutrophication. In this project focus is given to termination of HABs by grazers, and allelochemical effects.
2. Euketides—Eukaryotic polyketides in surrogate hosts.
3. MICROPAD—Micro-arrays for the detection of the Abundance and Distribution of pathogenic Protozoa, flagellated Algae and Diatoms.

In cooperation with and financial support from IOC Germany has the capacity to run further training courses on Toxin Analysis as those earlier held at the University of Jena.

D. MEXICO

Report of activities and events during the IPHAB-V and IPHAB-VI inter-sessional period (November 1999 to October 2002).

During the intersessional period 1999-2002, several events occurred along the coasts of Mexico. Unfortunately, poisoning of humans was reported during autumn 2001 and seven children died by PSP.

In the Gulf of Mexico, the usual occurrence of *Karenia brevis* causing an autumn-winter bloom was present during 1999 reaching 2.9 million cells l⁻¹, causing fish, turtle and dolphin mortalities. Also, humans were affected by spray exposure but without major problems. During 2001, the bloom was so extensive that more than 100 days of closures were applied in the Gulf coasts. Cell counts reached 23 million cells l⁻¹ and the toxicity in shellfish surpassed 100 MU/100 grams of meat. The problem affected Tamaulipas, Veracruz and Tabasco.

In the Pacific side of the country, the species that were identified during the major blooms of 1999-2002 were: *Gymnodinium catenatum*, *Noctiluca scintillans*, *Prorocentrum minimum*, *Pseudonitzschia* sp., *Cochlodinium cf. catenatum* and *P. bahamense var compressum*. *G. catenatum* occur in Sinaloa, Colima, Jalisco, Guerrero and Oaxaca. *P. bahamense var compressum* bloomed in Chiapas, Oaxaca and Guerrero. *Cochlodinium cf. catenatum* in Baja California Sur, Sinaloa, Nayarit, Colima and Jalisco. *Pseudonitzschia* sp. Caused sea lions mortality in Baja California, close to the US border.

In this period, at least two National Meetings as well as one major International Meeting deeply cover the subject. Several other meetings have sections dedicated to HABs. Thus, the picture was covered almost completely by the presentations during such events.

- Primer Foro Nacional de Marea Roja, 21 February 2002. Federal Commission for Protection Against Sanitary Risks, Health Ministry. 21 February 2002. Mexico City. e-version.
- XII Reunion Nacional de la Sociedad Mexicana de Planctologia and V International Meeting of the Mexican Society of Planctology. Xalapa, Mexico, 6-9 May, 2002.

E. MOROCCO

The Toxic Event

Atlantic coast

Morocco has coastlines along the Atlantic Ocean (3,000 Km long) and along the Mediterranean sea (500 Km). The first observations of red tides phenomena on the Atlantic Moroccan shores date from 1966. During late summer and early autumn, the years 1971, 1975 and 1982 were marked by contamination of Shellfish (mussels and marine beans) with high level of P.S.P exceeding the public health safety threshold and their consumption was forbidden. In November 1994, an algal bloom of *G. catenatum* occurred in the Atlantic Moroccan shores and caused a sea food poisoning resulting from the consumption of contaminated shellfish (Tahri, 1995b). This caused the severe economical damage to the shellfish industry and generally to the fisheries sector. In October-November 1995, *G. catenatum* had been observed in the limited area around Casablanca and the toxins level recorded didn't exceed 300 µg STX equiv/100 g tissue (Tahri, 1998, Taleb, 1998). In 1996, 1997 and 1998, this species was not detectable in the coastal waters and it was no Shellfish toxicity. In August 1998 extensive red tides occurred in coastal waters between 28° N and 33° N. *Alexandrium minutum*, *Prorocentrum micans*, *Scrippsiella* sp and *Lingulodinium polyedrum* were the main species. In July and August 1999 a progressive monospecific bloom of *Lingulodinium polyedrum* occurred in the same area progressing from North to South, and caused DSP contamination in shellfish tested by mouse bioassay.

Mediterranean

Since 1989, the West Mediterranean coasts, has been affected by Shellfish toxicity. The high levels of contamination by PSP toxins prohibit Shellfish exploitation and consumption at several times in the year. Toxin levels in the cockle reached values exceeded 80 µg STX equiv/100 g tissue all the year while in clam the saxitoxin is non detectable or below the international norm (Taleb, 1997). The causative species of the PSP was the toxic Dinoflagellates *Gymnodinium catenatum* detected in several times of the year and *Alexandrium minutum* detected in summer (Tahri, 1995, Tahri, 1998, Tahri et al., 2002).

Red tide events

In Atlantic, The red tides are observed more frequently since 1995 in upwelling coastal area on July and August. In many cases benthic fish killed by oxygen depletion after the bloom of multispecific Dinoflagellates (*P.micans*, *L.polyedrum*, *G.impudicum*. and *Gonyaulax digitalis*, *G.spinifera*, *Scrippsiella*.).

However, in Mediterranean Coastal waters, the red tides happened during spring (April–May) without fish killing incident. The phytoplankton assemblage is composed by many dinoflagellate and Diatoms species (*Noctulica scintillans*, *Protoperidinium.sp*, *G.impudicum*, *Guinardia flaccida*, *Cerataulina*, *Pseudo-nitzschia.sp*.).

Shellfish production

In Morocco, the shellfish is of great importance for artisan fishery, and an extensive aquaculture industry is developing. Many thousands of people from the coastal communities depend upon these activities for their livelihood.

The Mediterranean Moroccan coast contains an important stock of bivalves, according to Institut National de Recherche Halieutique (INRH, 1994), nearly 2600 tons of bivalves (clams and cockles) having been harvested during the year 1994. In 1995, the exportations had reached 4 thousand tons at 136 millions MAD (MPM, 1996). In 1996, 21,493 tons were commercialised in Casablanca at one Hundred thousand MAD (ONP, 1996).

The actual and aquaculture potential sites enumerated at table.1 show that the Moroccan shores give many kinds of fish and shellfish potentialities to be exploited in the future.

Table1. Potential area of aquaculture in Moroccan shores

SITES	Potential Area (Ha)	Actual Aquaculture	Rearing potentialities
Baie de Ras Kebdana			Sea aquaculture : Wolf (<i>Dicentractus labrax</i>), (<i>Sparus</i>) and mussels
Lagune de Nador	11.500	400Ha -Cages, Longs lines and Wolf, <i>Sparus</i> and <i>Sargus</i> -Anguilles, oyster and clams	
Baie de Calairis	1000		Sea aquaculture (mytiliculture)
Estuaire de Martil	300		Sea aquaculture
Estuaire de Kaâ Sras/ oued laou	150		Sea aquaculture
Baie d'Al jebha	500		(mytiliculture) Pisciculture in cages
Estuaire de Moulouya	1.000		Sea aquaculture (mytiliculture)
Estuaire de Tahadart	2.000 - 3.000		clams, oysters and high commercial value fish.
Estuaire de Loukkos			high commercial value fish.
Lagune de Moulay Bouselham	3.000		Palourdes, Huîtres, Sars, Soles, Turbots et Anguilles.
Estuaire d'Oum R'bia	200		Huîtres, Palourdes
Lagune de Sidi Moussa	250	Clams rearing	Palourdes, Huîtres, Soles, high commercial value fish
Lagune de Oualidia	400	Ostréiculture (5 parcs)	Clams, high commercial value fish
Baie d'Imessouane	1.000		Mytiliculture
Baie de Dakhla	30.000	Ostréiculture	high commercial value fish, Scallops, Algae and Clams
Baie de Cintra	15.0 à 20.00		high commercial value fish, Scallops, Algae and Clams

Monitoring and control programmes

Since 1992, the national network for the monitoring and surveillance of marine waters had been started by the Fisheries Research National Institute (INRH) in M'diq in Mediterranean Sea as a Pilot station (Idrissi et al., 1994). As a response to the November 1994 toxic events, several

stations in the Atlantic and Mediterranean coast were established in the area involved in shellfish production (Fig.1).

The monitoring programme is based on a systematic sampling of the production sites. Water and shellfish sampling is made twice a month, every week or twice a week in the case of a potential toxic species bloom. This programme include the regular analysis based on the identification of potential toxic algae and their concentration in sea water and on determination of PSP and DSP toxins in shellfish by Mouse Bioassay.

The Moroccan legislation related to control of shellfish safety waters involves the delimitation and classification of shellfish growing waters in approved or open areas. For the sake and safety of the public, suspected areas are clearly identified by panels.

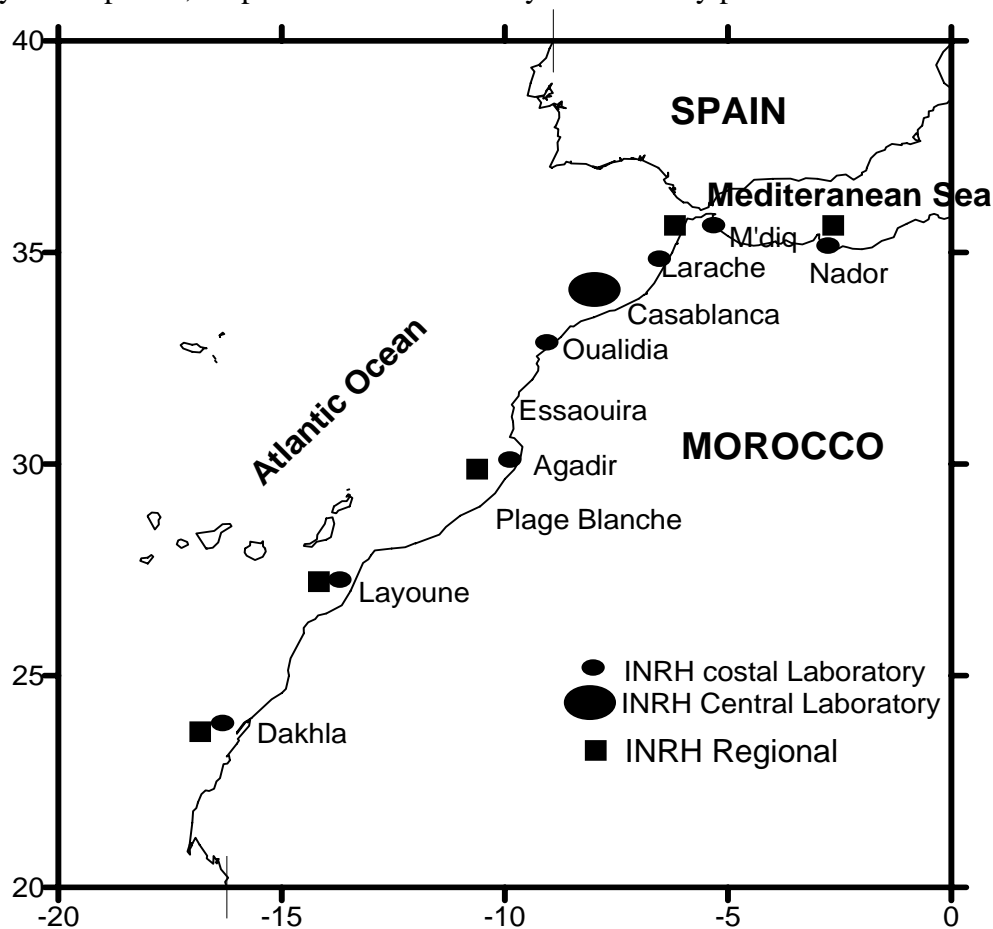


Fig.1: Localisation of Coastal Laboratories for HAB monitoring Program Along Moroccan shores.

Regulatory action and dissemination of information

According to the Circular, the Department of Quality and Marine Medium Safety (QSMM) of Fisheries Research National Institute belonging to Ministry of Fisheries is in charge of routine surveillance of the healthy of sea-products in their medium before harvesting. When toxins are detected in shellfish above the norms (Table.2), data are communicated by fax at the beginning of each day to the Fisheries Ministry and to the Official Veterinary Laboratories (Ministry of Agriculture) who is in charge of the seafood safety after harvesting and during marketing.

Table 2. Toxin detection methods and action limits

Type of toxin	Action limit	Method of analysis
PSP	80µg.100g-1	Mouse Bioassay
DSP	Presence (2 of 3 mice die within 24h)	Mouse Bioassay
ASP	20mg.g-1	HPLC

References

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PROPOSAL DESCRIPTION

1. Objectives

The main objectives of this proposal are to identify the potential risk associated with harmful microalgae in the coasts Morocco, to understand the oceanological phenomena involved and define the palliative actions to take.

2. Timetable for actions to be conducted by Moroccan HAB programme (2003–2006).

TASK	SPECIFIC OBJECTIVES	PLANNING EXECUTION	REQUIREMENTS
Assurance quality for phytoplankton identification	<ul style="list-style-type: none"> Monitoring programme is carried out by the staff of seven scientists in coastal laboratories in need of taxonomic complement training 	2003	<ul style="list-style-type: none"> Organisation of training course on taxonomy under umbrella of IOC Participation in an international inter-calibrate exercises

TASK	SPECIFIC OBJECTIVES	PLANNING EXECUTION	REQUIREMENTS
Spatial and temporal distribution of Hab species	• Mapping of Psp and Dsp toxic species	2003	• Equipment for identification of species by electronic microscopy such as pseudo-nitzschia
	• Guide of Potentially Harmful Species in Moroccan Coastal Waters	2004-2005	
Identification of phycotoxins in natural population of phytoplankton	• Implementation of action limits for toxic species to minimise a risk of HAB damage	2004-2006	• Training course and equipment for toxins identification by HPLC
Population dynamics model	• The inoculum generated by toxic species cyst bed in aquacultural area <i>g.catenatum</i> <i>a.minutum</i> <i>dinophysis</i> <i>pseudo-nitzschia</i>	2003 2004 2005 2006	• Training course for cyst identification and material equipment for phytoplankton culture

F. NAMIBIA

Namibia's priority is to establish a national monitoring unit to test for the presence of HAB toxins in seafood products. The testing procedure provided by this unit must meet the criteria required by the EU and the US in their regulations regarding the import of seafood products. It will be necessary to establish marine micro-algal toxin regulations consistent with international regulations, thereby opening export markets to Namibia.

The Ministry of Fisheries and Marine Resources will be the body responsible for the monitoring system. Initially, training of scientific personnel in all aspects of the monitoring programme, including phytoplankton identification, the monitoring design, and toxin-testing, will be required. This will require international assistance.

G. NEW ZEALAND

The main priority for international cooperation on HAB is to encourage uniformity or acceptance of equivalence of seafood safety requirements for HAB and marine biotoxins in international trade.

H. SWEDEN

In Sweden there is no central national research programme on HABs.

There is individual participation in different projects, including EU-projects on HABs, aiming to an increased understanding of the initiation and cause of HABs. International co-operation within these and new programmes will increase. GEOHAB and EUROHAB are of importance here.

The monitoring and management of HABs in Swedish coastal waters is covered in regional monitoring programmes and in the national monitoring programme. Results are made public by three Information Centres, which have co-operation with neighbouring countries and this co-operation is developing further.

I. UNITED KINGDOM

Monitoring Programme for Toxin-Producing Algae

The UK programme for monitoring of toxin-producing algae and shellfish toxicity is undertaken as part of statutory obligations for the EU Shellfish Hygiene Directive 91/492/EEC. Identification of algae is carried out at three centres representing: Scotland - Fisheries Research Services (FRS) Marine Laboratory at Aberdeen; England and Wales - the Centre for Environment Fisheries and Aquaculture Science (CEFAS) and Northern Ireland - the Department of Agriculture and Rural Development for Northern Ireland (DARDNI). The activities and sampling programmes of the centres is reported on a national level to the National Reference Laboratory on Marine Biotoxins funded by the Food Standards Agency (FSA) of the UK. Action on shellfish closures is operated at the regional level within the FSA.

Summary of Results from 1 April 2001 to 31 March 2002

Paralytic Shellfish poisoning

Alexandrium spp. was found at all three regions. In Scotland this was mainly along the east coast and in the Orkney Islands with maximum numbers of approximately 2,000 cells per litre being recorded. In addition a bloom of *Alexandrium minutum* was recorded in the Outer Hebrides. PSP in shellfish was recorded in these areas at the time of occurrence of the taxa. Maximum level of PSP measured was 245 µg STX per 100 g. PSP levels greater than 80 µg STX per 100 g was also recorded from certain sites on the west coast of Scotland although no phytoplankton samples were collected at these sites.

In Northern Ireland *Alexandrium* was recorded from three sites with a maximum of 180 cells per litre. This was associated with PSP toxicity in mussels.

In contrast very high numbers of *Alexandrium* counted along the south coast of England with a maximum number of 855,000 cells per litre. PSP toxins were not found in flesh samples from this area.

Dinophysis spp. were recorded throughout Scotland. The dominant species were *D. acuta* and *D. norvegica*. At a number of sites DDSP toxins were recorded in association with the presence of *Dinophysis* cells. The maximum cell number recorded was 38,000 cells per litre.

In Northern Ireland *Dinophysis* species were identified in a number of samples throughout the year and a number of DSP toxicity episodes were also recorded.

In England and Wales high numbers of Dinophysis were recorded at one site from the north east of England. DSP was infrequently detected. In the Thames and Bury inlet an atypical DSP positive result was obtained from cockle samples. This is currently under investigation.

Amnesic Shellfish Poisoning

Pseudo-nitzschia spp. was routinely found at Scottish sites with a maximum of 500,000 cells per litre counted. ASP was measured at low levels in mussels and frequently at high levels in *Pecten maximus*. Transmission electron microscopy (TEM) was performed on selected samples and eight different *Pseudo-nitzschia* species were identified, seven of which are potential toxin producers.

The taxa were recorded at a number of sites in Northern Ireland with a maximum of 50,000 cells per litre observer. ASP was only detected in *P. maximus* from one site.

Pseudo-nitzschia spp. were recorded infrequently in England and Wales and ASP levels in *P. maximus* only exceeded the closure limit at one off shore site.

Research Projects

1. The correlation between toxin-producing cells in the water and toxin levels in shellfish

This is a joint project between FRS, CEFAS and the Scottish Association for Marine Science. This examines the relationship between the presence of toxin-producing cells in the water column and toxicity levels in shellfish through high frequency sampling. Molecular examination of toxic species is also being performed.

2. Assessment and validation of a commercial, rapid, qualitative assay for the detection of Amnesic and Paralytic shellfish poisons in the UK monitoring programme and as an end product test (MIST Alert™)

This project was carried out at FRS and funded by the FSA UK. The aim was to use the MIST Alert™ to assess the presence of these toxins in shellfish flesh.

3. Development of methods for and survey recently discovered toxins in UK shellfish

This is carried out at FRS, the University of Westminster and the Institute of Marine Biosciences in Canada. This is funded by the FSA UK. This project involves the isolation of recently discovered marine biotoxins from shellfish for the production of toxin standards and reference material and the development of LC-MS methodologies for their detection. The toxins to be studied are the azaspiracides, yessotoxins, pectenotoxins, spirolides and free fatty acids.

4. Development, validation and assessment of methods for the determination of ASP, DSP and PSP using LC-MS and LC-MS-MS

This project is carried out at FRS and the Laboratory of Government Chemists in London. It involves the comparison of two liquid chromatography mass spectrometry techniques and their application in the determination of marine biotoxins in routine monitoring situations.

5. The causative organism of ASP in Scottish Waters

This is carried out at FRS and funded by the Scottish Executive and the FSA Scotland. This involves transmission electron microscopy of one hundred water samples from Scottish waters to identify *Pseudo-nitzschia* cells to species levels.

6. The effect of sediment disturbance on resting stages of toxic phytoplankton

This is a joint study between CEFAS and the University of Westminster to investigate the impact of sediment disturbance on the distribution and viability of resting stages. The project is funded by the Department of Food and Rural Affairs (DEFRA), London.

Other Relevant Information

1) The collation of UK and Ireland data collected under the Shellfish Hygiene Directive

A Working Group has been set up to undertake as a pilot exercise the collation of data collected by the UK and Ireland in order to:

- Consider ways of analysing and presenting the data, including the use of GIS, to examine spatial and temporal patterns of toxin-producing algae
- Examine possible correlations between toxin –producing algae and shellfish toxins

The data on *Alexandrium* spp. for the period 1996-1998 has been assembled as a model exercise and it is intended to expand the study to cover the entire range of toxic species and associated shellfish toxins measurements from 1996 to present.

Autonomous Mooring Systems

Mooring systems for water quality measurements have been developed for estuarine and coastal waters in the U.K. by CEFAS and DARDNI. A new initiative to develop a profile mooring in deep water of the continental shelf associated with the Met ocean buoys of the U.K. Met Office is being developed by a consortium of U.K. laboratories and funded by DEFRA. These provide information on physical and chemical determinants and phytoplankton.

Priorities of the United Kingdom for international co-operation on Harmful Algal Blooms

The UK has statutory responsibility for protecting its marine environment. In doing so it helps comply with the UK's international obligations under the global London Convention and the OSPAR Convention for protecting the marine environment of the North East Atlantic. It also undertakes its obligations in respect of a number of Directives of the European Union for the protection of the marine environment and human health. Over the past decade these obligations have given rise to a greatly increased monitoring of marine phytoplankton, mainly of toxin-producing algae, and of research into the production and occurrence of algal blooms of high biomass.

Priorities for international co-operation include:

- Provision of certified standards of shellfish toxins.
- Examine the influence of eutrophication and climate change on HABs.
- Extend the development species specific probes for HABs.

- Development of methods for routinely determining the toxicity of phytoplankton cells in field samples
- Maintain quality assurance measures and standards for taxonomy of algal species.
- Maintain and improve quality assurance for the quantitative survey of phytoplankton.

J. UNITED STATES OF AMERICA

Monitoring Programme for Toxin-Producing Algae

Harmful algal blooms (HABs) are now recognized as persistent threats to coastal resources, local economies, and human health in the U.S. Increased attention to the occurrence and problems associated with HABs is being demanded at National and State levels.

National Activities

At the State level, many States have shellfish monitoring programmes in place that include measurements of accumulated toxins in fisheries resources, and these States and others are now adopting State-Federal partnerships for monitoring HABs and responding to HAB events. These partnerships are co-sponsored with the States and at least three Federal agencies (Food and Drug Administration (FDA), National Oceanic and Atmospheric Administration (NOAA), and the Environmental Protection Agency (EPA)). Further, through an interagency programme now in review, States can request Federal assistance for immediate response to HAB events that exceed normal State response capabilities.

The large commitment to HABs at the national level is through an assemblage of various agency activities that address the majority of the eight specific goals of our *National HAB Plan* (Anderson et al., 1993). Basic research on bloom development, persistence, and food web interactions as well as basic ecology, physiology, behaviour, and toxicity of individual HAB species is addressed through several agencies, with the largest and most focused effort being the interagency ECOHAB Programme (Ecology and Oceanography of Harmful Algal Blooms). This Program, established in 1995, has provided research funding through peer and panel review to over 70 projects (6 of them regional studies) with almost US\$60 million contributed by NOAA, EPA, NSF, ONR, and NASA. There are 4 regional studies in progress now (Gulf of Maine *Alexandrium*, Gulf of Mexico *Karenia brevis*, mid-Atlantic *Pfiesteria*, and northeast brown tide). Two new additions to the large regional programmes are a Pacific Northwest *Pseudonitzschia* project, and one on macroalgae in Hawaii. For 2003, NOAA hopes to invest approximately \$4 million in new projects, focusing on the following themes: 1. Prevention, control, mitigation strategies; 2. Development of predictive models, and hopefully forecasts; 3. Regional studies; and 4. Targeted studies: HAB physiology, toxicity, detection, ecosystem effects, etc.

A few agencies also have other non-specific funding programmes that provide support for HAB oceanographic research projects as well. Toxin identification, chemistry, and assay development is primarily centred in three agencies NOAA, FDA, and the NIEHS [National Institute for Environmental Health Sciences]. Developments from these two activities, basic ecology/oceanography and toxin/cell identification and assay development, are rapidly incorporated into the expanding Federal-State partnered monitoring programmes described above.

Seafood safety, including monitoring for HAB toxins, is also an identified Federal responsibility, generally under the purview of the FDA. Research on HAB-human health linkages and toxin pharmacology is focused in two Federal agencies [FDA and the CDC (Centers for

Disease Control)], developing diagnostics for HAB exposure and therapies as well as determining toxin pharmacologies, with intra- and extramural programmes.

This coordinated effort results in a rather comprehensive national research capability for HABs, toxins, and human health, communicated to the national and international community through the Federally supported National Office of Marine Biotoxins and Harmful Algae at the Woods Hole Oceanographic Institution. This national office also works closely with the IOC HAB programme, and is the North American “node” for distribution of conference proceedings and other publications of the IOC.

International activities

The present highlight of attention of the US at the international level is an ongoing discussion about cooperation with the EU on comparative and collaborative science on the ecology and oceanography of harmful algal blooms. This is anticipated as part of International GEOHAB efforts. Explicit EU-NSF cooperation will not preclude the involvement directly of other agencies and governments in projects. Research themes for EU-NSF are yet to be finalized, but will be guided in large measure by the Implementation Plan developed at a recent workshop held in Trieste in September 2002.

NOAA's labs (Northwest Fisheries Science Center in Seattle) and Charleston, SC Lab have continued to assist foreign countries with toxin assays and HAB identification.

With respect to the IOC HAB Programme, the US comments and recommendations about international activities that could be coordinated by IPOHAB include:

Capacity building and training. We note that the IOC Science and Communication Centres in Copenhagen and Vigo have shown clear benefits to the international community through their outreach and training efforts, and continued support for these centers should be provided. US scientists are willing to assist in these activities.

The newsletter, *Harmful Algae News*, is an excellent communication tool, and should be continued.

Regional IOC HAB groups, such as WESTPAC, FANSA, and ANCA are important mechanisms to prioritize, plan, and implement HAB activities throughout the world. Efforts should be made to continue these activities, and to expand their activities. The US does not presently participate in many of these regional groups, but would like to do so in the future.

The GEOHAB Programme represents an important step forward for the scientific aspects of the IOC HAB programme. For GEOHAB to be successful, broad involvement of many countries and agencies is needed. The US is participating in the development and implementation of GEOHAB, and encourages other IOC Member States to do likewise. In particular, supplemental funding for an International Programme Office (IPO) is needed, as is funding for national and international projects that meet GEOHAB guidelines.

Regional and national regulations on algal toxins in seafood products are unfortunately not uniform internationally. The US supports activities that will lead to harmonization of regulations, as this is critical to efficient importation and exportation of seafood potentially contaminated with algal toxins.

Emergency measures needed to respond to harmful algal events are not often known to those responsible for that response, especially in countries with no previous exposure to

particular toxins or toxic events. There is also a need for more broadly based assistance to IOC Member States that lack adequate monitoring and management systems for HABs and their impacts. The IOC Science and Communication Centres have responded to requests for assistance in such situations, as have individual scientists who were contacted by the countries involved. Considerable expertise also exists within the international HAB community on all aspects of HAB monitoring and management. We recommend that the IPHAB consider mechanisms to facilitate the mobilization of this expertise for emergency outbreaks and for capacity building for general HAB monitoring and management.

The Global Ocean Observing System (GOOS) is of great relevance to HAB monitoring and research activities worldwide. A global, long-term observing system for HABS would be of great value in documenting trends and in facilitating monitoring and management efforts, and may lead to prediction and forecasting of HAB events. Continued involvement of HAB scientists and management experts in the GOOS programme is highly recommended, and pilot projects on HABs should be considered by GOOS during programme implementation.

ANNEX IV

LIST OF WORKING DOCUMENTS

Document Code	Title
WORKING DOCUMENTS	
IOC/IPHAB-VII/1 prov.	Provisional Agenda
IOC/IPHAB-VII/1 Add.prov.	Provisional Timetable
IOC/IPHAB-VII/2	Annotated Provisional Agenda
IOC/IPHAB-VII/3 prov.	Executive Summary, Draft Summary Report
IOC/IPHAB-VII/4 prov.	Provisional List of Documents (this document)
IOC/IPHAB-VII/5 prov.	Provisional List of Participants
INFORMATION DOCUMENTS	
IOC/IPHAB-V/3	Report of the IOC Intergovernmental Panel on Harmful Algal Blooms, Fifth Session, Paris, 22-24 November 1999
IOC/IPHAB-VI/Inf.1	Extracts from Thirty-third Session of the IOC Executive Council, Paris, 2000, Twenty-first Session of the IOC Assembly, Paris, 2001(Thirty-fifth Session of the IOC Executive Council, Paris, 2002)
IOC/IPHAB-VI/Inf.2	Information on HABP developments 2000-2002 (Agenda Item 4.1)
IOC/IPHAB-VI/Inf.3	ICES-IOC Working Group on Harmful Algal Blooms Dynamics: Report of the meeting, 20-24 March 2000, Barcelona, Spain Report of the meeting, 11-16 March 2001, Dublin, Ireland Report of the meeting, 7-10 March 2002, Bermuda
IOC/IPHAB-VI/Inf.4	Science Plan of the IOC-SCOR Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Programme (on-line only, http://ioc.unesco.org/hab/FINAL.pdf).
IOC/IPHAB-VI/Inf.5	GEOHAB SSC 2002 and Terms of Reference.
IOC/IPHAB-VI/Inf.6	Report of the IPHAB Task Team on Aquatic Biotoxins
IOC/IPHAB-VI/Inf.7	Overview of IOC training courses on HAB (supressed)
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IOC/IPHAB-VI/Inf.15	Report on IPHAB Task Team on Algal Taxonomy.
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IOC/IPHAB-VI/Inf.17	Planning the preparation of water quality guidelines for desalination
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IOC/IPHAB-VI/Inf.20	HABSEA Portal Project Workplan (on request)
IOC/IPHAB-VI/Inf.21	Report of Workshop on Harmful Algae in West Africa
IOC/IPHAB-VI/Inf.22	ICES/IOC/SCOR Study Group on GEOHAB Implementation in the Baltic
IOC/IPHAB-VI/Inf.23	Global Taxonomy Initiative and the Darwin Declaration
IOC/IPHAB-VI/Inf.24	World Summit on Sustainable Development IOC-IAEA Partnership Initiative
IOC/IPHAB-VI/Inf.25	HABWATCH
IOC Annual Report No. 3	IOC Annual Report 2000 (on request)
IOC Annual Report No. 4	IOC Annual Report 2001 (on request)

ANNEX V

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ANNEX VI

**TERMS OF REFERENCE OF
THE IOC INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS**

RESOLUTION XVI-4

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 organisation 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) organisations 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 organisations, 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. ORGANISATION 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 VII

IOC HARMFUL ALGAL BLOOM PROGRAMME PLAN
(Revised extract from IOC Workshop Report No. 80)

IPHAB-IV REVISION

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 2nd edition of the IOC manual containing standardized methodology for the study of harmful algae.
- (iii) Prepare identification sheets and reference slides for harmful species, preserved material and video documentation, updated as necessary.
- (iv) Maintain and update as necessary the IOC lists of experts grouped according to areas of expertise.
- (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 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, 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 that 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 , v_{max} , allelopathic substances, grazer repellent, 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.
- (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 databases 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 reproducibility 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.

ANNEX VIII

REVIEW OF THE ACTIVITIES OF THE IOC SCIENCE AND COMMUNICATION CENTRE ON HARMFUL ALGAE IN COPENHAGEN, 1995–2001

by Adriana Zingone

Chair of the IOC Intergovernmental Panel on Harmful Algal Blooms—IPHAB
(Summary, 23 April 2002)

Introduction

Following the decision taken at the Fifth Session of the IOC-IPHAB, and in view of the formulation of a new workplan for 2003–2007, a panel was composed with the aim of reviewing the activities of the IOC Science and Communication Centre on Harmful Algae in Copenhagen (for composition of the review panel see Annex 1 hereto). The review was based on the activity report 1995-2001, as well as on personal experiences of Panel Members in interacting with staff from the Centre and in cooperating in some of the activities. The opinions expressed by Panel Members also reflect comments of colleagues and participants to the courses, as well as direct knowledge and use of the outputs delivered by the Centre in its 7-years activity. The present report is a synthesis of the review reports provided by individual Panel Members, which addressed the assigned Terms of Reference:

1. Review in a scientific as well as in a development perspective the results and outputs delivered by the Centre;
2. Assess the impact of the delivered outputs;
3. Advice on the priorities and focus of Centre Phase III (2003-07);
4. Suggest corrections and amendments to the draft report;
5. Provide any other comment and advice.

1) Review in a scientific as well as in a development perspective the results and outputs delivered by the Centre

The Centre has been since its foundation in 1995 a reference point for HAB research, management and training activities. The Centre has clearly met its planned objectives over the years in implementing elements of the IOC Harmful Algal Bloom Programme and has contributed immensely to the development of the global capacity to deal with harmful algae, well beyond the expected outputs of the Programme. The identification, promotion and coordination of activities in so many distinct fields is hardly conceivable considering its limitation of a small number of full-time personnel, relatively small budget and some administrative difficulties. The Project Coordinator, the staff of the Centre, those organisations that have funded and supported the Centre and all contributors to its activities should be congratulated. From a strategic point of view, the close collaboration with a prestigious research groups, namely, the Botanical Institute of the University of Copenhagen, and the exploitation of IOC networks and infrastructures, have provided a unique opportunity, allowing the Centre to fill a big gap in capacity building, coordination and communication in the global HAB scene. The combined use of ‘in-kind’ expertise and local funding opportunities represents a good example for the IOC in setting up any future Centre.

The primary activity of the Centre has been the implementation of a Training and Capacity Building Programme including course modules on taxonomy, ecology, toxin chemistry,

toxicology and monitoring. The Centre is well known and appreciated especially for its training courses on the taxonomy of harmful marine microalgae. The practical nature of these courses, incorporating the opportunity for individuals to study material from their own countries is particularly useful to participants. The geographical distribution of individuals receiving training reflects the focus on assisting developing countries, yet the participation of self-paying trainees from developed countries demonstrates the unique training opportunities offered by the Centre. On the other hand, this helps to raise the general level of expectation of the trainees and allows participants from developing countries to interact with colleagues from developed countries who may later become research partners. Overall, the training activities and provision of teaching material in the field of taxonomy, and the close cooperation with a research Institute focusing on algal taxonomy, is beneficial not only to the field of HABs but also to other science and management fields requiring taxonomic skills, including the management of natural resources and marine biodiversity. It is clear from Table 1 that the focus of training activities diverged rarely from taxonomy. Other relevant aspects of HABs, including oceanographic data gathering and analysis, public health, market impacts, and so on, could be considered as additional foci for activities during Phase III.

The Centre has played a very important role in supporting the publication of HAB literature and its distribution, particularly to the developing world. Various publications compiled by recognized experts are now freely available (in print and online). The Centre's role in coordinating and contributing to the publication of the Manual on Harmful Marine Microalgae certainly represents a strong worldwide impact, if we consider the 2000 copies distributed. The effort in co-ordinating and raising the required funds for the 2nd edition of the Manual is commendable. Other very useful publications in which the Centre has been intimately involved, such as "Design and Implementation of some Harmful Algal Monitoring Systems" and the "International Directory of Experts", have been instrumental not only in building capacity but also in assuring a unified and consistent approach to the development of HAB monitoring systems. The compilation of a HAB bibliographic database has been another very worthy undertaking with considerable benefits to the entire HAB community. With access to Internet, it is now possible to be up to date even in remote parts of the world where physical communication is sometimes difficult. It can be anticipated that there will be important advances in HAB science and management in coming years, and look forward to the Centre continuing this divulgatory activity, and making new ideas and techniques rapidly available to all concerned.

In addition to broad-scale activities that reach any developed countries with an interest (training courses and manuals), capacity-building activities at the Centre include more specific partnerships in individual countries and regions (Vietnam and the Western Indian Ocean). A critical issue in this respect is the choice of countries to involve in specific partnerships, whereby priority should be given to countries/regions that show an ability to support adequate facilities and staffing on a long-term basis. The collaborative work in Vietnam clearly demonstrates the success of this approach in achieving very defined and useful products in a relatively short time. Co-supervision of students from developing countries and the opportunity for scientists to visit and interact with members of both the Centre and the Botanical Institute will no doubt contribute enormously to the development of capacity in the taxonomy of phytoplankton.

The Centre is also active in the scientific cooperation with developed countries e.g. through ICES and in funded projects such as the EU-HABES project. The participation in funded scientific projects is beneficial from the economic point of view, but also in that it allows an effective dissemination of results of relevant scientific research worldwide through the training activities and communication networks of the Centre. Overall, the scientific activities of the Centre are of high quality and represent a very important contribution to the basic knowledge of

algae in general with special application to harmful algae. The scientific perspective may also be evaluated through the original papers published in several important scientific journals in the area of Botany and Ecology.

2) Assess the impact of the delivered outputs

The Centre has a broad range of services and products. It would be worth developing effective and inexpensive means to evaluate the impact of each service and product. This would help focusing activities on the most effective outputs and could provide useful clues to improve specific activities and optimise their impact.

Many indicators of the impact of training and capacity-building activities are listed in the report. The high demand for training courses, and particularly the high number of applications received for the follow-up workshop for experienced participants, is a clear demonstration of the value of these courses to scientists and people involved in HAB monitoring activities. The positive anonymous evaluation by participants is another indicator of the success of the course. The percentage of trainees still active in the field is relatively high, considering that the selection of participants does not exclude people who do not have a position. Especially in developing countries, mainly past participants in the training courses are carrying out work on harmful algae. In a scientific perspective, the impact of the courses can be deduced by the high participation of trainees to the International Conferences on HABs. An alternative indicator of impact could be the analysis of cases where bad taxonomy has led to bad management decisions, and how the latter might have been improved with more accurate identification of the responsible organisms. Such a case needs to be brought forcibly to administrators, many of whom are inclined to perceive taxonomy as a *mere* academic pursuit. To do this, there ought to be significant input from those who have followed these courses and who are now engaged in monitoring in their own countries.

The impact of capacity building through research, e.g. the Vietnam case, is somewhat easier to assess: The completion of a “Guide to the identification of potentially toxic microalgae in Vietnamese waters” and the establishment of a phytoplankton research laboratory at the Institute of Oceanography in Nha Trang are fine examples of these achievements. A guide to the “Potentially harmful microalgae of the Western Indian Ocean” is a further example of a very useful product originating from co-operation with scientists from the Western and Northern Indian Ocean.

There is no doubt that the publications provided by the Centre are a high quality product of enormous impact not only in developing but also in developed countries. Indeed they fulfil the invaluable mission of gathering and coordinating the distribution of all updated information that is needed to carry on research and management activities in the field of Harmful Algae. The demand for a revised second edition of the Manual to be published in 2002 also reflects of the success of this literature. An evaluation system of how the Manuals are used, and a request for user’s suggestions for further improvements, could be useful means to assess and increase the impact of this publication. Other regional manuals and guides are of more specific interest but not less important as many areas of the world still lack this kind of literature.

Concerning the newsletter, despite the high quality of the content and the wide distribution, a weak point has always been the low number of issues delivered per year. The most recent issue available from the Website dates from August 2001. This is partially due to the nature of papers and information submitted, which are mainly based on voluntary contributions from scientists in the field. Relevant news selected from e.g. mailing lists or newspapers, or abstracts of particularly interesting papers on scientific journals, as well as information on

national and international activities concerning HABs, could all provide useful material that would be extremely worth to find in a newsletter. This additional material would raise the number of issues per year, increasing the effectiveness and rapidity of the provision of information. This would however require somebody to work specifically on that.

3) Advice on the priorities and focus of Centre Phase III (2003–07)

The workplan for Phase III looks sound and the strategy of addressing capacity building through training courses, workshops and cooperative research is appropriate to fulfil the overall objectives of the Centre.

There is still a high demand for the “IOC-DANIDA Training Courses on the Biology and Taxonomy of Harmful Marine Microalgae” as observed in the report. Thus, their maintenance in Phase III should be considered a strong priority. The Centre proposes a new organisation for this activity: yearly regional Basic training courses to be held abroad and every second year Advanced workshops to be held in Copenhagen. The welcome innovation of regular Advanced Workshops will surely be of great interest worldwide as a unique opportunity to scientists of different countries to analyse and discuss special topics of harmful algae with colleagues and expertises. In addition, besides morphological criteria for harmful algae identification, the molecular biology methods could also be introduced in more detail at these Workshops. Moving the training courses into developing countries, as regional courses will surely be a positive development. A possible drawback however could be that the use of Electron Microscopes, which is very important during the courses, is not always possible at other institutions. At least some of the basic courses should continue to be held in Copenhagen, with regional courses focusing on several other training activities, including identification based on light microscope morphology, strategies for monitoring systems and counting techniques, for example. Given the rapid advance of HAB studies and recent initiation of GEOHAB, newly established methods and concepts should be incorporated in the training courses modules, emphasizing the ecological and oceanographic aspects. In addition, traditional training courses should be modified to meet the interest of remote educational system via Internet and to accommodate the increasing demand of training at various professional levels. Critical issues that could be addressed or expanded within the context of the IOC SCC programme could include: 1) sampling strategies for harmful algae and related oceanographic parameters; 2) design and implementation of monitoring programmes; 3) data archiving and retrieval; 4) data analysis and application of ecological models.

A goal of the Centre should be to establish a worldwide network of developed and developing country scientists that will operate with support from the Centre. A related goal should be to help establish training from countries like Vietnam to other developing countries in their region. The network of scientist created through the courses should be kept alive and used as a basis for future organisation of monitoring and scientific networks in developing countries. The idea of a second step course is a good strategy to strengthen the relationships among participants to different courses.

It is suggested to expand the cooperative research effort and the backup in coordination of monitoring activities to other developing countries or world regions, building on the foundations that have been laid in Vietnam and East Africa. As an example, the IOCARIBE region is explicitly mentioned as an area needing formal link and increasing cooperation with the Centre. Similar initiatives would among other things reinforce the initial impulse, which has led to attendance of the courses provided in Copenhagen. In addition to the requirement for more substantial staffing and funding, mechanism is needed to identify and select regions that might be the targets for future regional training programmes or cooperative activities, that is, areas that are most in need (or most ready) for the capacity-building and coordination activities that can be

provided by the Centre. The role of the Advisory Committee of the Centre should be strengthened in this respect, which would require expanding its composition as to reflect a balanced contribution of efforts among countries in need. Alternatively, the IOC-Intergovernmental Panel on HABs (IPHAB) should have a major role in the process of planning these activities, which would however imply to refocus IPHAB activities and require a more continued commitment of its Members.

Considering the excellent synergies that have been developed over the past few years, and new directions that are being pursued in HAB monitoring and research, including the recent initiation of GEOHAB, the Centre should explore cooperative activities in oceanographic monitoring strategies for HABs. In particular, training or assistance could be provided in different observation technologies that could be applied for monitoring and management of HABs in developing countries, which is central to the aims of the Coastal Component of GOOS. This capacity building, which emphasizes the ecological and oceanographic aspects of HABs, is also needed for effective international participation in GEOHAB.

4) Suggest corrections and amendments to the draft report

The draft report is overall well written, clear and comprehensive in all aspects. All reported activities and their positive outcomes result extremely credible. Particularly, the frankness about efforts that fell short and remarks on unexpected outcomes have been considered very positively. There are no substantial errors or omissions, although a careful editing is recommended. Remarks on minor corrections are reported separately. Some suggestions to provide additional information and to improve specific sections follow:

- a) Describe in a table or box how the Centre's activities differ from those of the Vigo Centre and WESTPAC/HAB in Tokyo.
- b) Include in chapter 6 (Cooperation With Centre Partners) the subject of Cooperation with Regional IOC Programmes, only mentioned in the Introduction, highlighting the support, direction and encouragement of the Centre to the development and consolidation of FANSA and ANCA activities.
- c) Provide more data on how many requests for assistance of different types are received and how many are declined because of a lack of staff or funding. In this respect, it would be interesting to express the data in Table 1 on number of applications and acceptances in a graph. This can help in maintaining current support and developing new support.
- d) Describe more fully how scientists and managers from developed countries are involved in the Centre's activities. How many scientists, from what countries, are involved?
- e) Clarify how M.Sc. and Ph.D. activities are organised and how their scientific content is planned.
- f) It is not clear from the report how involved are developed country scientists from outside Denmark in conducting the work of the Centre
- g) More information on the proposed "Harmful Algal Bloom Expert System" and on the co-operative research project "Oceanos" would be of interest to the reviewer or reader.
- h) The report identifies communication with Madagascar as a particular problem. It might be wise to remove this specific identification.
- i) Figure 3 needs improvement

- j) It would be useful to include a few highlighted findings and recommendations in the text and/or summary. The document reads well and it is highly credible, hence a few recommendations should carry significant weight.
- k) Are there any plans for broadening the base of the Centre's funding beyond Denmark?

5) Provide any other comment and advice—Conclusions

The reviewers unanimously expressed the judgment that the Centre has been a success, its plans are appropriate and it deserves continued support. The Centre has performed its tasks admirably and with great economy in resources and personnel, and is truly a model programme for other international programmes to emulate. The relatively unique services and training opportunities provided by the Centre are unlikely to meet the high demand. Those funding the Centre should therefore be called upon to continue their support and other potential funding agencies should be made aware of the achievements of the Centre in an attempt to broaden the funding base. Alternative and additional sources of funding should be sought also to allow more countries to fully benefit from training and research supporting activities through e.g. provision of instrumentation.

The Centre should be more and more an international focal point for enlisting the help of scientists and managers from all developed countries. It is important to involve managers, not merely scientists, because of the different perspectives available from managers. For example, managers should be asked to review the Centre's reports, Website, and other products.

Another aspect that has been actually limited by resources in the past years is the adequate advertising and visibility for the Centre, which could also constitute a limitation for the fully exploitation of some services offered, such as the species identification service. It would be desirable for this service to be extended to include the isolation and culture of problem species occurring in areas where this expertise does not exist.

Over the year's people belonging to the staff at the Centre have continuously demonstrated their excellent management capacity and have gained experience through a very broad range of activities, including training, publications, communication and coordination. The plans for the next phase are realistic and credible. All contributors to this review have suggested additional activities as well as the expansion of those presently carried on to other countries and world regions.

It is obvious that new activities suggested can be realised only if more resources become available, and if the administrative difficulties experienced in the past can be overcome. In this respect, the extent and possible directions for future development of activities depends completely on the donors rather than on the Centre staff. More challenging is the role that the Centre could have in organising international cooperation in HAB research and monitoring, and in providing capacity building in new fields as suggested in the previous sections. Indeed, the continuation of ongoing activities would be extremely valuable for the services offered, yet the addition of new challenging tasks would allow to fully exploiting the experience and potentiality gained over the years through so many distinct activities. Moreover, the links to international scientific and monitoring programmes such as GOOS and GEOHAB etc. would be strengthened, which would in turn significantly increase the capacity, influence and impact of the Centre.

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ANNEX IX

**IOC INTERGOVERNMENTAL PANEL ON HARMFUL ALGAL BLOOMS
INFORMATION ON DEVELOPMENTS IN THE INTERSESSIONAL PERIOD**

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Appendix I—An overview of contributions to the IOC for development and implementation of the Harmful Algal Bloom Programme 2000-2002.

PROGRAMME DEVELOPMENT

1. STAFFING

1.1 STAFFING OF THE PROGRAMME OFFICE

The IOC Science and Communication Centre on Harmful Algae in Copenhagen, Denmark, functions in practice as the Programme Office for the IOC HAB Programme. The Centre staff includes one IOC-UNESCO staff, H. Enevoldsen, who is based at the Centre in Copenhagen, but also carries out part of the work at the IOC Secretariat in Paris.

Additionally, Mr. Ole Vestergaard will until April 2003, as the fourth Associate Expert seconded by Denmark to the HAB Programme, work on a half-time basis for HAB activities at the IOC Secretariat in Paris. Ms. Brigitte l'Horty is attached to the Programme on a part-time basis as secretary.

The IOC Secretariat has not been successful in soliciting secondment of additional staff for the HAB Programme.

2. REGIONAL GROUPS AND WORKSHOPS

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

A detailed report of FANSA activities is given in Document IOC/IPHAB-V/Inf.18.

2.2 IOC WORKING GROUP ON HARMFUL ALGAL BLOOMS IN THE CARIBBEAN (COI-ANCA)

A detailed report of ANCA activities is given in Document IOC/IPHAB-V/Inf.19.

2.3 IOC/WESTPAC HAB

A detailed report of WESTPAC/HAB activities is given in Document IOC/IPHAB-V/Inf.14. Workplan of the HABSEA Portal Project is given in Document IOC/IPHAB-V/Inf.20.

2.4 WEST AFRICA

Please see Document IOC/IPHAB-V/Inf.21.

EDUCATIONAL ELEMENTS

3. INFORMATION NETWORK

3.1 *HARMFUL ALGAE NEWS*—AN IOC NEWSLETTER ON HARMFUL ALGAE AND ALGAL BLOOMS

Issues No. 20, 21, 22 and 23 of *Harmful Algae News (HAN)* and special issues on GEOHAB and EUROHAB respectively, have been published. HAN is published whenever there is sufficient material for an issue. The number of subscribers has stabilized to just above 2,000. HAN is produced by the IOC Centres in Vigo and Copenhagen and is supported 'in-kind' by the Botanical Institute, University of Copenhagen and the Spanish Institute of Oceanography.

Subscriptions and back issues are available at <http://ioc.unesco.org/hab/news.htm>

An Editorial Team composed of regional co-editors was established in 1993 in order to support the Editor in his efforts to make HAN a broad newsletter both scientifically and geographically. At IPHAB-III and IV the limited support from the Editorial Team was noted and discussed. The members of the Editorial Team are listed below.

THE EDITORIAL TEAM FOR THE IOC NEWSLETTER "*HARMFUL ALGAE NEWS*" 1993-

EDITOR: Dr. Tim Wyatt, Instituto de Investigaciones Marinas, SPAIN

CO-EDITORS:

Dr. Amelia la BARBERA, FONIAP, VENEZUELA

Dr. Laurita BONI, University of Bologna, ITALY

Dr. José Ignacio CARRETO, Instituto Nacional de Investigación y Desarrollo Pesquero,
ARGENTINA

Dr. Allan CEMBELLA, NRC, CANADA

Dr. Rhodora AZANZA, University of the Philippines, PHILIPPINES

Dr. Einer DAHL, Institute of Marine Research, NORWAY

Dr. Yasuwo FUKUYO, Asian Natural Environmental Science Center, JAPAN

Ms. Itaf GNINGUE, Centre de Recherches Oceanographiques de Dakar Thiaroye, SENEGAL

Dr. Youssef HALIM, University of Alexandria, EGYPT

Dr. Iddya KARUNASAGAR, University of Agricultural Sciences, INDIA

Dr. Anne-Marie LEGRAND, Institut de Recherches Médicales Louis Malardé,
FRENCH POLYNESIA

Dr. Adelaide SEMESI, University of Dar-es-Salaam, TANZANIA

Dr. Sandra SHUMWAY, Department of Marine Resources, USA

An agreement has been drafted by the IOC and Elsevier Publishing that IOC will co-sponsor the new journal 'HARMFUL ALGAE'. The agreement includes that all subscribers of HAN in developing countries are offered 'HARMFUL ALGAE' at a special discount rate. An announcement of the offer will be made in both publications. IOC will help advertise 'HARMFUL ALGAE'.

3.2 HAB SCIENCE AND COMMUNICATION CENTRES

The establishment of HAB Programme 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), 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.

The IOC Science and Communication Centre on Harmful Algae in Copenhagen, Denmark, opened in May 1995. The Centre is staffed by Dr. Jacob Larsen, Associate Professor,

Mr. Henrik Enevoldsen, IOC Project Coordinator, and Dr. Gert Hansen. The Centre is hosted by, and located at, the Botanical Institute with Professor Ø. Moestrup as the focal point at the University. Activities are centred on capacity building in identification of harmful algae and associated services. The Centre is sponsored by DANIDA, the University of Copenhagen, the National Environmental Research Institute, the Fisheries Research Institute, and IOC. Until 2001, the Centre was funded within a UNESCO/DANIDA Framework Agreement, but with the termination of this cooperation late 2001, DANIDA is now supporting the IOC directly. This support is for 2002 about 50% of the support provided previous years, but is expected to return to that former level from 2003.

Following the decision taken at IPHAB-V, and in view of the formulation of a new workplan for 2003–2007, a panel was composed with the aim of reviewing the activities of the IOC Science and Communication Centre on Harmful Algae in Copenhagen (for composition of the review panel see Document IOC/IPHAB-VI/Inf. 9, Annex 1). The review was based on the activity report 1995–2001, as well as on personal experiences of Panel members in interacting with staff from the Centre and in cooperating in some of the activities.

The reviewers unanimously expressed the judgment that the Centre has been a success, its plans are appropriate and it deserves continued support. The Centre should become more and more an international focal point for enlisting the help of scientists and managers from all developed countries. The review concluded that plans for 2003–07 are realistic and credible. All contributors to the review have suggested additional activities as well as the expansion of those presently carried to cover other countries and world regions. More challenging is the potential role the Centre could play in organising international cooperation in HAB research and monitoring, and in providing capacity building in new fields as suggested in the previous sections.

The IOC-IEO Science and Communication Centre on Harmful Algae in Vigo, Spain, was established in October 1996, after a Memorandum Of Understanding was signed between IOC and IEO (Instituto Español de Oceanografía). The Centre is located at the Oceanographic Centre in Vigo. The Centre staff is Mrs. Monica Lion and one assistant, Mrs. Cristina Sexto. The Centre also draws on the scientific staff of the IEO in Vigo, under the coordination of Dr. Beatriz Reguera. The Centre provides advice, and scientific and technical assistance on problems related to monitoring and management of harmful algae events, and the characterization of the microalgae and their toxins (taxonomy, toxin content, ecology). Priority is given to the cooperation with Ibero-american and the Maghrebian research institutions. The Centre is sponsored by the IEO (through the IOC Trust Fund), and IOC. The “Spanish Agency for International Cooperation”(AECI) cosponsors the courses held at the Vigo Centre. The agreement and sponsor shipped was renewed in March 2002 to continue the activities of the Centre for the next five years. An activity Report and work plan are available as Document IOC/IPHAB-VI/Inf.10.

The activities of the two Centres are 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.

The IOC Assembly has expressed its wish to continue the Centres beyond the initial periods through Resolution XX-3.

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 species identification service. The support is for a ten-year period starting from 1995.

3.3 DIRECTORY OF EXPERTS, HAB-DIR

The Directory has been prepared to assist countries facing toxic and harmful algal bloom emergencies by facilitating rapid access to scientists, fisheries managers, public health officials, and physicians dealing with toxic and harmful algal blooms and their consequences to fisheries, aquaculture, and public health. The second edition of Directory was a joint IOC-NOAA (USA) effort, and was published by the IOC in May 1995. As recommended by IPHAB-III, HAB-DIR became a searchable database at the Internet (IOC HAB Homepage: <http://ioc.unesco.org/hab/data1.htm#1>). Unfortunately HAB-DIR has not been accessible for a while as the Global Directory of Experts in Marine and Freshwater Science (GLODIR) of which HAB-DIR is a sub-set, has been remodelled into what is now the Ocean Expert. A similar transformation of HAB-DIR is now being made and HAB-DIR is scheduled to be on-line again by November 2002. The new HAB-DIR can be edited on-line, and new entries can also be submitted on-line.

3.4 REGIONAL DIRECTORY OF EXPERTS AND DATA-BASE

Following the request by the IOC-FANSA Working Group, the UNESCO/ROSTLAC Office in Montevideo has established an IOC-FANSA DATA BASE containing (i) a regional directory of scientists working on phytoplankton and harmful algae problems in South America and (ii) a list of all the scientific publications on phytoplankton and harmful algal blooms available in South America.

3.5 IOC MANUAL ON HARMFUL MARINE MICROPLANKTON

The IOC Manual on Harmful Marine Microplankton (Editors G.M. Hallegraeff, D.M. Anderson & A. Cembella), including methodologies, taxonomy, and monitoring and management issues was published early 1996. The printing was made possible through financial support from the Danish Institute for Fisheries Research and DANIDA. It was printed in 4000 copies but has been out of stock since 2000. IPHAB-IV (1999) decided that a second edition of the manual should be prepared. The editorial team for the first edition accepted to prepare the second edition. The expanded and improved second edition is in print and will be released end 2002 as a volume in the UNESCO Publishing series 'Monographs on oceanographic methodology'. An announcement and pre-order flyer will be distributed at XHAB

3.6 IOC CO-SPONSORSHIP OF INTERNATIONAL CONFERENCES RELATED TO HAB

The HAB Programme co-sponsored the Ninth International Conference on Harmful Algae Blooms, Hobart, Tasmania, 7–11 February 2000. A number of selected papers were published as a special issue of *Phycologia*. The Proceedings, Harmful Algal Blooms (Hallegraeff et al., eds.) was published by the IOC. The stock is kept at the IOC HAB Centres in Copenhagen and Vigo, at the University of Tokyo, and at Woods Hole Oceanographic Institution. The Proceedings are free of charge but a handling fee of USD 30 is charged. The order form can be found at <http://ioc.unesco.org/hab/pub.htm>. The production time was 15 months, which is not acceptable. Furthermore the print quality from the UNESCO print shop is unacceptable and no print proofs (which could have prevented the low quality) were provided. It is highly desirable to maintain the association to the IOC HAB programme to the proceedings but other models for publication should be considered.

The HAB Programme will also co-sponsor the Tenth International Conference on Harmful Algae, St. Petersburg, Florida, 21–25 October 2002. The IOC support will cover the participation of scientists from developing countries. The IOC has offered to be a co-publisher of the Proceedings and is awaiting the decision from the organizers.

The HAB Programme co-sponsored the Fourth International Conference on Molluscan Shellfish Safety, Santiago de Compostela (Spain) from 4–8 June 2002.

The HAB Programme co-sponsored the Second International Conference on Harmful Algae Management and Mitigation, HAMM 2001, which was held at 12–16 November 2001 in Qingdao, China. IOC is expected to publish the proceedings, but has not yet received the manuscripts.

3.7 PROVISION OF LITERATURE

The provision of HAB-related literature to scientists in developing countries has been taken care of by the IOC HAB Centres in Copenhagen, Vigo and through WESTPAC/HAB. More than 1000 book grants were offered in 2000–2002. The most important titles include:

Proceedings of the Ninth International Conference on Harmful Algae Blooms, G. Hallegraeff et al. (eds.), 2002

Floraciones Algaes Nocivas en el Cono Sur Americano, E.A. Sar et al. (eds.), 2002.

Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters, D.M. Anderson et al. (eds.), 2001

GEOHAB. Global Ecology and Oceanography of Harmful Algal Blooms, Science Plan. P. Gilbert and G. Pitcher (eds.), 2001

Manual to Identification of Dinoflagellate Cysts, Fukuyo et al.) 2001 (incomplete title)

Proceedings of the Sixth International Conference on Harmful Phytoplankton, P. Lassus et al. (eds.), 1995

Proceedings of the Seventh International Conference on Toxic Phytoplankton, T. Yasumoto et al. (eds.), 1996

Proceedings of the Eighth International Conference on Harmful Algae, B. Reguera et al. (eds.), 1997

Biology, Epidemiology and Management of *Pyrodinium* Red Tides, Proceedings of the Management and Training Workshop, Brunei Darussalam, 23-30 May 1989

The Genus *Alexandrium* Halim, E. Balech, 1994

Marine Phytoplankton, C. Tomas et al. (eds.), 1997

IOC Manual on Harmful Marine Microalgae, G. Hallegraeff et al. (eds.), UNESCO 1995

Algae, An Introduction to Phycology, C. Van den Hoek et al., 1995

The Biology of Dinoflagellates, F.J.R. Taylor (ed.), 1987

Guide to Toxic and Potentially Toxic Marine Algae, J. Larsen & Ø Moestrup, 1989

Physiological Ecology of Harmful Algal Blooms, NATO ASI Series, D. Anderson et al. (eds.), 1998

Algal Toxins in Seafood and Drinking Water, I. Falconer (eds.), 1993

Phytoplankton Pigments in Oceanography, S.W. Jeffrey et al. (ed.), 1997

Proceedings of the First International Congress on Toxic Cyanobacteria, Ø. Moestrup et al. (eds.), 1996

3.8 HARMFUL ALGAL EVENT DATA BASE, HAE-DAT

The ICES-IOC Working Group on Harmful Algal Bloom Dynamics has recorded events related to harmful microalgae on a regular basis since 1987. Since then, a National Report form has been implemented by national representatives in order to organize, on an annual basis, data on harmful algae events in different countries.

Increasing interest in data analysis led to a proposal in 1997 to create a computer database of these events: the Harmful Algae Event Data Base (HAE-DAT). The main purpose of creating HAE-DAT is to develop a structure for data storage that allows easy integration of data, efficient search tools, and the possibility of conducting powerful data analysis.

Several steps were necessary to develop HAE-DAT. As a first step, an analysis of National Reports was conducted to understand the nature of the information included. Although information was clearly divided into different areas, it was demonstrated that the subdivision of information had to be more detailed. For that purpose a new Harmful Event Data Input Form has been proposed to improve the flow of information as well as to allow data analysis.

This new format has been designed to respond to the interests of managers and scientists working in the different areas related to harmful algae. It is also intended to facilitate the task of professionals reporting the events. The information requested is to be introduced in "boxes" that are clearly defined. In addition, it is possible to complement the report with additional information in the form of text, files (Graphs, maps, etc.) and Weblinks.

In 2000, further modifications were included in the "modified form" presented in Annex 6 of the WGHABD report (Anon. 2000) that make it more user-friendly and directly accessible via the Internet. The new form, together with instructions and a practical example, are now available at the IOC Website: <http://ioc.unesco.org/hab/data33.htm>.

The use of this new form requires careful analysis, at the beginning, as it was highlighted in the WGHABD report (Anon. 2001), but it is estimated that, after a quick adaptation to the new form, future data input may be improved.

It is important to state at this stage that all information included in each report may be useful and that it is not requested that every report provides information in all fields: professionals submitting the report may come from very different areas and have different type of information.

HAE-DAT has been available since October 1999 at: <http://ioc.unesco.org/hab/data3.htm#1>. It runs currently on Microsoft Access and must be downloaded from the Internet. Within the next six months it will be transformed into another software platform that is more suitable for on-line searches and inputs.

Countries outside ICES as those of the Pacific International Council for the Exploration of the Sea (PICES) and the two IOC regional groups, FANSA and ANCA, have been invited to join HAE-DAT in an attempt to expand it and to turn it into the unifying global database on harmful algal events.

3.9 IOC HAB INTERNET SITE

The IOC HAB Site at <http://ioc.unesco.org/hab> contains information on all ongoing activities under the IOC HAB Programme, including various databases, access to publications, announcements etc. The Site had an average of 67 visits/day in the period June–October 2002 (Netstat). This only includes visitors that entered through the default page. The GEOHAB Site is monitored separately and had an average of ten visits per day in the same period. The Site is maintained by the IOC HAB Centre in Copenhagen, and is updated on daily to weekly basis. It is envisaged that the Site will be transferred to a new software platform, which will allow for e.g. chairs of working groups and regional groups to edit their sites directly.

4. TRAINING

4.1 HAB TRAINING AND CAPACITY BUILDING PROGRAMME

The HAB Training and Capacity Building Programme as adopted by IPHAB-III is composed of 3 to 4 main modules on Taxonomy, Toxin Chemistry and Toxicology, Management Strategies, and Mitigation Techniques.

Implemented courses 2000–2002:

- 4.1.1 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, 14–26 August 2000.
- 4.1.2 IV IOC-AECI-IEO Training Course on Toxic Phytoplankton and Marine Phycotoxins. IOC-IEO Science and Communication Centre on Harmful Algae. Instituto Español de Oceanografía, Vigo, Spain. 1–17 June 2000.
- 4.1.3 I IOCARIBE-ANCA Training Course on Marine Toxins and Harmful Algal Blooms for the Caribbean Countries. CIBNOR. La Paz, Mexico. 24 November–10 December 2000.
- 4.2.4 IOC Workshop-Training Course on Phycotoxins, Cork Institute of Technology, Cork, Ireland, Organized by Dr. Kevin J. James, Director, Ecotoxicology Research Unit, Chemistry Department, Cork Institute of Technology, and Prof. T. Yasumoto. 1-14 September 2000.
- 4.1.5 5th IOC/WESTPAC/HAB Training Course on Ecology and Physiology of Harmful Algae, Chulalongkorn University and Burapha University, Thailand 19–24 March 2001
- 4.1.6 V IOC-AECI-IEO Training Course on Toxic Phytoplankton and Marine Phycotoxins. IOC-IEO Science and Communication Centre on Harmful Algae. Instituto Español de Oceanografía, Vigo, Spain. 6–22 June 2001.
- 4.1.7 IOC-DANIDA Advanced Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, IOC Science and Communication Centre on Harmful Algae Copenhagen, University of Copenhagen, Denmark, 6–17 August 2001.
- 4.1.8 IOC Workshop on Harmful Algal Blooms, University of Accra, Ghana 29 October–2 November 2001.
- 4.1.9 6th IOC/WESTPAC/HAB Training Course on Advanced Techniques on Characterization

of Harmful Algal Species, the Philippine Bureau of Fisheries and Aquatic Resources, and the University of Philippines, 12–19 May 2002.

4.1.10. VI IOC-AECI-IEO Training Course on Toxic Phytoplankton and Marine Phycotoxins: Monitoring programmes on Toxic Phytoplankton and Marine Phycotoxins according to European Union Directives. IOC-IEO Science and Communication Centre on Harmful Algae. Instituto Español de Oceanografía, Vigo, Spain. 10–26 June 2002.

4.2 PLANNED COURSES:

4.2.1. IOC Distant Learning Course in Harmful Algae for South East Asia. Universities of the Philippines, Tokyo, Tasmania, and Copenhagen and the IOC Science and Communication Centre on Harmful Algae Copenhagen, January–May 2003.

4.2.2. IOC-IEO Science and Communication Centre on Harmful Algae. Instituto Español de Oceanografía, Vigo (Spain), 2003–2004: Individual training visits under the supervision of one expert from a Galician Institution.

4.2.3. IOC-DANIDA Advanced Training Course on the Biology and Taxonomy of Harmful Marine Microplankton, IOC Science and Communication Centre on Harmful Algae Copenhagen, University of Copenhagen, Denmark, August 2003 and 2004.

4.2.4. 6th WESTPAC/HAB Course “Advanced Techniques in Identification of Harmful Microalgae”, Kota Kinabalu, Malaysia, 23–30 March 2003. The leader of the course is Dr. Ann Anton of the University of Malaysia Sabah.

4.2.5. IOC-COPEMED Course on Harmful Algal Blooms, Tunisia, 2003.

4.2.6. The UNESCO Regional Office in the Arab States of the Gulf is planning for a GCC (Gulf Cooperation Council) regional training workshop on HAB to take place in 2003. Potentially interested participants are welcome to contact b.boer@unesco.org for further information.

4.3 WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT PARTNERSHIP INITIATIVE

As part of the World Summit on Sustainable Development, Johannesburg 2002, so called ‘partnership initiatives’ have been established. One of these is a project on ‘Application of Nuclear and non Nuclear Techniques for the Monitoring and Management of Harmful Algal Blooms in the Benguela Coastal Region’. This capacity-building project will be implemented from 1 January 2003 to 31 December 2005. The partners are the governments of Angola, Namibia, South Africa, and the International Atomic Energy Agency (IAEA), IOC and AFRA.

The objectives are (i) to transfer identification/quantification capacity for toxic phytoplankton, the receptor binding assay (RBA), and related assays technologies for algal toxins, and (ii), to establish the capability to monitor toxic phytoplankton and to perform receptor assay methods for algal toxins in the Member States laboratories.

The expected results includes (i) equipped laboratory facilities and trained personnel in toxic phytoplankton identification/quantification & Receptor Binding Assay and related assays in participating Member States;(ii) incorporation of the toxic phytoplankton quantification

method and the Receptor Binding Assay technology in national monitoring programmes; (iii) and harmonized approach among national HAB monitoring programmes in the Benguela region. The available resources are US\$ 366,000 for laboratory equipment, training and expert services from IAEA and training materials, manuals and guides, lecturers, and technical backstopping from IOC. Document IOC/IPHAB-V/Inf.24.

SCIENTIFIC ELEMENTS

5. OCEANOGRAPHY AND ECOLOGY

5.1 ICES-IOC WORKING GROUP ON HARMFUL ALGAL BLOOM DYNAMICS— WGHABD

The WGHABD (Chair: Dr K Kononen, Finland) met in Barcelona, Spain from 20 to 24 March 2000, in Dublin, Ireland from 11-16 March 2001, and in Bermuda (Chair: A. Cembella) from 7–10 March 2001. For the reports see Document IOC/IPHAB-VI/Inf.3, the IOC HAB Website, or the ICES Website.

The WGHABD will meet March 2003 in Aberdeen, Scotland, hosted at the FRS Marine Laboratory. The Terms of Reference are included in Document IOC/IPHAB-VI/Inf.3. (Annex XII hereto)

5.2 IOC-SCOR INTERNATIONAL SCIENCE PROGRAMME ON THE GLOBAL ECOLOGY AND OCEANOGRAPHY OF HARMFUL ALGAL BLOOMS—GEOHAB

The efforts of the SCOR-IOC Working Group 97 on the Physiological Ecology of Harmful Algal Blooms, resulted in a NATO-SCOR-IOC Advanced Study Institute on the Physiological Ecology of Harmful Algal Blooms, which was held at the Bermuda Biological Station, 27 May–6 June 1996. The deliberations and recommendations of the WG 97, together with the work of the ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms, provided the basis for formulation of Recommendation IPHAB-IV.2.

Recommendation IPHAB-IV.2 instructed the IOC to develop an international science programme on the Global Ecology and Oceanography of Harmful Algal Blooms jointly with an appropriate organisation. Partnership in the development of the new programme was agreed upon with the Scientific Committee on Oceanic Research (SCOR). SCOR and IOC agreed to form a partnership to develop such a programme for the following reasons:

- Harmful algal blooms have significant and growing impacts on human health and fisheries resources throughout the world;
- Strong political and scientific leadership is needed to co-ordinate international research activities in this area (the IOC Intergovernmental Panel on HAB is in a position to provide the former, and the involvement of SCOR will help to ensure the latter, especially given the globally broad, but thinly distributed expertise);
- The ecological and oceanographic uncertainties about HABs and their impacts are significant and involve all of the oceanographic disciplines as well as numerous coastal habitats and ecosystems; and
- Considerable progress has already been achieved and a framework exists on which an international ecology and oceanography programme can be based.

The first step in the process of developing this programme was an international workshop sponsored by SCOR and IOC which took place at Havreholm, Denmark, from 13 to 17 October 1998. Thirty-seven scientists from twenty countries participated. Subsequently a Scientific Steering Committee (SSC) for GEOHAB was appointed by SCOR and IOC. In 2001 the SSC finalized the GEOHAB Science Plan and started developing the Implementation Plan, which is due early 2003.

The development of GEOHAB has so far received support from IOC, SCOR, The Maj and Tor Nessling Foundation (Finland), US National Aeronautics and Space Administration, US National Oceanic and Atmospheric Administration, US National Science Foundation, and IFREMER (France).

For the composition of the Scientific Steering Committee and Terms of Reference please see Document IOC/IPHAB-VI/Inf.4. (Annex XI hereto)

For the Implementation Plan Draft please see Document IOC/IPHAB-VI/Inf.5, or the IOC HAB Website.

5.3 ICES/IOC/SCOR STUDY GROUP ON GEOHAB IMPLEMENTATION IN THE BALTIC SEA

The Study Group met first time in Dublin, Ireland, from 12–13 March 2001 under the Chairmanship of Dr K Kononen (Finland), to create a plan for the implementation of GEOHAB in the Baltic Sea, and to plan coordinated multi-ship field experiments in support of GEOHAB in the Baltic.

The next meeting of the Study Group was in Stockholm, Sweden, 24 November 2001, where the terms of reference were to (i) continue the planning of GEOHAB implementation in the Baltic, (ii) plan a meeting combined with an open workshop for the spring 2002 to discuss and finally develop the Baltic project, including the co-ordination of field experiments to be implemented 2002–06; (iii) prepare application to the GEOHAB SSC for endorsement of the Baltic project and the planned workshop; (iv) and to estimate the biomass and impacts of the *cyanobacteria* blooms in the Baltic Sea, and assess the ecosystem effects of this.

As from 2003 Professor Markku Viitasalo from the Finnish Marine Institute (markku.viitasalo@fimr.fi) has taken over as chair of the study group. The reports of the SGGIB are available as Document IOC/IPHAB-VI/Inf.22, on the IOC HAB and ICES Websites.

5.4 EUROPEAN HAB RESEARCH

Through Recommendation IPHAB-IV.5 the Panel encouraged a focused European research initiative on HAB. The follow-up, and independent initiative by European HAB scientists led to the preparation of the EUROHAB Science Plan of the European Commission. The IOC HAB Programme has jointly with the European Commission prepared a special issue of Harmful Algae News on EUROHAB (August 2003).

A promising development is a joint European Commission (EUROHAB)—US National Science Foundation (ECOHAB) initiative to develop a joint research programme on HAB. A workshop was held in Trieste, Italy, 4–8 August 2003 to identify high priority areas of joint research within a geosciences framework.

5.5 TRANSFER OF HARMFUL ALGAL SPECIES VIA BALLAST WATER

IPHAB-II requested the IPHAB Chair and the Programme Office to further investigate the possibilities and need for interaction with the activities of IMO and ICES. IPHAB-III adopted Recommendation IPHAB-III.3 on a Working Group on Transfer of Phytoplankton by Ballast of Ships. In response to this recommendation a Joint ICES-IOC-IMO Study Group on Ballast Water and Sediments was established. The ICES/IOC/IMO Study Group on Ballast Water and Sediments [SGBWS] has later been renamed the "ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors [SGBOSV]".

The SGBOSV worked by correspondence in 2000, met 19–20 March 2001, Barcelona, Spain, and in Gothenburg, Sweden, 18–19 March 2002.

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

The Chair is Dr. Stephan Gollasch (GoConsult), Bahrenfelder Str. 73a , 22765 Hamburg, Germany, E-mail: SGollasch@aol.com. The Study Group suggested holding its annual meeting in March 2003 in Vancouver, British Columbia, Canada. However, neither meeting venue nor dates are confirmed yet.

The reports are available at <http://www.ices.dk/reports/> and as Document IOC/IPHAB-VI/Inf.13, and the IOC HAB and ICES Websites.

6. TAXONOMY AND GENETICS

6.1 IPHAB TASK TEAM ON ALGAL TAXONOMY

The Task Team was established through Resolution IPHAB-II.1. The Terms of Reference were modified by IPHAB-III. and IV. Chair is Professor O. Moestrup. The IOC Taxonomic Reference List of Toxic Plankton Algae is available at http://ioc.unesco.org_hab/data4taxlist.htm

6.2 GLOBAL TAXONOMY INITIATIVE AND THE DARWIN DECLARATION

The international scientific and environmental community formulated the Darwin Declaration on the taxonomic impediment in recognition that nearly every country is deficient in taxonomic capacity. As a response, the parties to the Convention on Biological Diversity have adopted the Global Taxonomy Initiative (GTI). The parties to the Convention on Biological Diversity (CoP-5) have endorsed the concept of a GTI to promote a concerted effort between funding agencies, national governments and NGOs to link taxonomic capacity building to the effective implementation of the Convention on Biological Diversity.

The Global Taxonomy Initiative Programme of Work advocates use of BioNET-INTERNATIONAL sub-regional networks to promote taxonomic capacity enhancement. BioNET-INTERNATIONAL is a global network for taxonomic capacity building to support sustainable development. It is comprised of sub-regional networks of developing country institutions (South-South) supported by a consortium of developed country expert institutions (North-South). More details can be found at www.bionet-intl.org. The Darwin Declaration, the GTI and BioNET INTERNATIONAL are strong tools in fundraising for research and capacity enhancement in relation to HAB and should be taken into account and used wherever feasible.

The IOC is cooperating with CDB/GTI and BioNET INTERNATIONAL in this respect, but the use of the Darwin Declaration, the GTI and BioNET INTERNATIONAL at the national and regional level is also crucial.

7. TOXICOLOGY AND TOXIN CHEMISTRY

7.1 IPHAB TASK TEAM ON AQUATIC BIOTOXINS

The Progress Report was submitted to IPHAB-VI. Document IOC/IPHAB-VI/Inf.6.

7.2 WHO GUIDELINES FOR THE DESALINATION OF SEAWATER

The IOC HAB Programme took part in a WHO/UNEP/ROPME Consultation on planning the preparation of water quality guidelines for desalination, which took place in Manama, Bahrain from 28–31 May 2001.

Desalination of sea water as a source of drinking water is a growing industry and WHO and UNEP have taken this initiative to assess the risks of transfer from seawater to drinking water of various contaminants, one group being bio-toxins of algal origin.

The Report is available as Document IOC/IPHAB-VI/Inf.17.

OPERATIONAL METHODS

8. MONITORING

8.1 MONITORING AND MANAGEMENT STRATEGIES FOR HARMFUL ALGAL BLOOMS IN COASTAL WATER

As a follow-up to the cooperation between the IOC and the Asian Pacific Economic Cooperation (APEC) on the HAMM Conferences (see item 3.6) and training courses, APEC and IOC has co-published *Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters*, by D. . Anderson, P. Andersen, V.M. Bricelj, J. J. Cullen, and J. E. Rensel. APEC Report # 201-MR-01.1, Asia Pacific Economic Programme, and Intergovernmental Oceanographic Commission of UNESCO, Technical Series No. 59, Paris, France. The APEC HAB project supported the editing and printing of this report, and the IOC took care of distribution. The 268-page report provides a broad review of the many programmes, technologies, and policies used worldwide in the monitoring and management of harmful algal blooms in coastal waters.

8.2 IOC-ICES META DATABASE ON DESIGN AND IMPLEMENTATION OF HAB MONITORING PROGRAMMES: MON-DAT

The MON-DAT meta-data-base contains information on the design and implementation of harmful algae monitoring and management systems from all over the world. The data are by no means comprehensive and do not as yet include all countries which have monitoring and management plans for harmful algae.

The initial compilation of information was carried out within the ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms, and the establishment of the database was made possible through the financial support of the Danish agency for development assistance, DANIDA. The first survey for information on HAB monitoring was made in 1995/96 and a

summary of the results was published as IOC Technical Report No. 44. The base was updated in 2000/01.

MON-DAT is available at <http://ioc.unesco.org/hab/data2.htm#1> where the questionnaire for up-dating can also be found. A transfer of MON-DAT into a new software is scheduled for 2002-2003.

8.3 COMMON GOALS AND COOPERATION BETWEEN THE HAB PROGRAMME AND GOOS

Since the formulation of the HAB Programme Plan, the need for a linkage to long-term, national and international monitoring programmes has been acknowledged, to identify trends and cycles in the frequency of HABs in relation to suspected climatological, hydrographical or trophic causes, (IOC/IPHABV/Inf. 3,6.3.2, ii).

To ensure this linkage, and following recommendation IPHAB-III.6, representatives of the IPHAB were placed on the three GOOS panels dealing with biological variables, i.e. the Health of the Ocean (HOTO), Living Marine Resources (LMR) and Coastal GOOS (C-GOOS) panels. IPHAB representative on the three GOOS panels are Profs. Y. Halim, K. Richardson and A. Zingone, respectively. Activities of IPHAB Members in these panels have resulted in the fulfillment of recommendation IPHAB-IV.8 to consider phytoplankton species composition as a high impact variable to be included as a routine part of monitoring programmes. Within the C-GOOS panel, two pilot projects were proposed focusing on HABs, one dealing with *Pyrodinium bahamense* blooms in the south-east Pacific and the other on a network of monitoring ventures and a retrospective analysis of phytoplankton data series in European seas. Common goals and possible linkages between the HAB Programme and GOOS were outlined in the Document IOC/IPHAB-VI/Inf.8.

The Draft Integrated Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System is available as Document IOC/IPHAB-VI/Inf.8.

APPENDIX I

**Extra-budgetary contributions to the IOC for development and implementation of the
IOC Harmful Algal Bloom Programme 2000-2002**

<u>EXTRA-BUDGETARY CONTRIBUTIONS TO THE IOC:</u>	US Dollars
<p>Denmark:</p> <ul style="list-style-type: none"> - DANIDA: Science and Communication Centre on Harmful Algae, 2000, 2001 and 2002 contribution (including partially one IOC Staff Copenhagen/Paris): - DANIDA; one IOC staff, Paris, April 2000–April 2003: - Natural Science Research Council (for HAB Manual): - Ministry of Research, IT and Development (for HAB Manual) 	<p>543.000</p> <p>180.000</p> <p>20.000</p> <p>26.000</p>
<p>Japan:</p> <ul style="list-style-type: none"> - WESTPAC/HAB Training Courses on Monitoring of Toxic Plankton and Shellfish Toxicity, (1996–2004), 2000–2002: 	<p>60.000</p>
<p>Spain:</p> <ul style="list-style-type: none"> - INSTITUTO ESPAÑOL DE OCEANOGRAFÍA: IOC-IEO Science and Communication Centre on Harmful Algae, Vigo, staff and maintenance for 2000–2002: 	<p>315.000</p>
<p>(Canada, US):</p> <ul style="list-style-type: none"> - Travel support for IOC staff through overall contribution to the IOC TF: 	<p>5.000</p>
<p><u>SPONSORSHIP OF ACTIVITIES:</u></p> <p>Denmark:</p> <ul style="list-style-type: none"> - National Environmental Research Institute, Support for the IOC Science and Communication Centre 2001–2002 contribution: - DANIDA: Survey of Potentially Harmful Algae in Vietnamese Waters (training through research and provision of equipment) 2002–2004: <p>Japan:</p> <ul style="list-style-type: none"> - WESTPAC Training Courses, approximate for 2000–2002: <p>Spain:</p> <ul style="list-style-type: none"> - INSTITUTO ESPAÑOL DE OCEANOGRAFÍA: Support for the IOC Science and Communication Centre at the Oceanographic Centre in Vigo, Spain for 2000–2002 (Travels support): - Vigo Training Courses 2000–2002: - Edition and publication of the book “Floraciones Algales Nocivas en el Conosur Americano”: - AECI (Spanish Agency for International Cooperation), Scholarships for the participants in the Training activities at Vigo Centre for 2000–2002: <p>US-NOAA/NSF: GEOHAB SSC via SCOR</p>	<p>13.000</p> <p>609.000</p> <p>60.000</p> <p>75.000</p> <p>19.000</p> <p>9.600</p> <p>24.000</p> <p>~25.000</p>
<p><u>IN KIND CONTRIBUTIONS:</u></p> <p>ICES Identification Leaflets for Phytoplankton for at IOC training courses.</p>	

ANNEX X

HAB TRAINING AND CAPACITY ENHANCEMENT PROGRAMME

Contents:

- 1. Introduction**
- 2. Elements of the Training and Capacity Enhancement Programme**
 - 2.1 Training Modules
 - 2.2 Individual Training
- 3. Feasibility Studies**
- 4. Implementation**
- 5. Funding**

1. INTRODUCTION

Within the framework of its Ocean Sciences Programme the IOC is implementing a programme on Harmful Algal Blooms (HAB). The Programme is governed by an IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB). IPHAB has given high priority to training and capacity-enhancement 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 capacity enhancement 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 and capacity-enhancement 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 present document is the third revised Training and Capacity-Enhancement Programme adopted by the IPHAB.

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-enhancement activities of the HAB Programme should also be seen as a follow-up to UNCED, and in particular as a response to Articles 12 and 13 "Public Awareness and Education", and Article 17 "Exchange of Information" of the Convention on Biological Diversity (CBD).

The harmful algae in question are marine micro-algae which cause mass mortality of marine organisms, problems to tourism, damage to aquaculture, toxicity of shellfish or even fatalities 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 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 events 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 aqua-culturists. Involvement of, and coordination with, local

organisations and institutions involved in the management of living marine resources should be an integrated part of any planning and implementation of capacity-enhancement activities.

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

IPHAB initially 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) the 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 fellowships and grants (IOC-UNESCO and bi-lateral) which will allow individuals from developing countries to work for a period at relevant advanced laboratories.

The specific themes of activities were first identified through two IOC workshops held in September 1992 with the goal to identify training needs in developing countries in relation to harmful algae, and a survey carried out by correspondence in 1993. Between 1994 and 2002 priorities and focus have been confirmed or revised by subsequent sessions of the intergovernmental Panel and through surveys among former trainees and at international HAB meetings.

The IOC HAB programme has produced a number of manuals that have served as central references in the capacity-enhancement activities implemented to date. In particular, the IOC *Manual on Harmful Marine Microalgae* [Hallegraeff, G.M. et al. (eds.), IOC Manuals and Guides No. 33, UNESCO 1995] has been crucial and valuable feedback from trainees has been integrated in its revised edition (2003). The review process for the Manual has also helped fine-tune the content of IOC short-term courses on HAB to better serve needs in Member States. The second edition of the Manual therefore provides a strengthened tool for training purposes.

2. ELEMENTS OF THE HAB TRAINING AND CAPACITY BUILDING PROGRAMME

The training and capacity enhancement activities are focused around five different modules, individual training, and training through research. The module concept is a flexible framework for HAB Programme training activities, and a way to structure the planning of its activities. The title of each module thus encompasses courses at various levels and with varying content. The aim is to offer each module as a basic as well as an advanced course. 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 with

strong experience within a given field, whereas the basic courses, to the extent possible, will be held regionally.

Training Modules:

- 1) Identification and Taxonomy of Harmful Marine Microalgae;
- 2) Phycotoxin Chemistry and Toxicology;
- 3) Design and Implementation of HAB Monitoring Programmes;
- 4) Risk Assessment, Contingency Planning, and Management;
- 5) Theme workshops and regional interdisciplinary workshops/courses on HAB.

Individual training:

- 1) Fellowships and Study Grants;
- 2) Training Through Research.

2.1 Training Modules

2.1.1 Identification and Taxonomy of Harmful Marine Microalgae

Goal:

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

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 workshops.

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 a pilot course held as an IOC-Danida Course, 16-28 September 1993 at the University of Copenhagen, and further developed by the IOC Secretariat, and the Universities of Tokyo and 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 workshops.

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 etc. 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 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 and during subsequent courses.

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

Goal:

The goal of the module is to improve the theoretical as well as the practical background of the participants to enable Member States to choose the most appropriate and cost-efficient type of monitoring.

Objectives:

- i) Introduction to different strategies of monitoring harmful algae, and to provide a forum for exchange of experience with and among ongoing monitoring programmes.
- ii) Long-term: the trained individuals will serve as national and regional human resources to help develop national monitoring programmes.

Improved monitoring schemes may also be addressed through workshop-seminars where administrators and planners of monitoring programmes can meet and exchange experiences. 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 cooperative projects on the building up of appropriate monitoring systems in those countries. Resource material for the module includes the IOC-ICES inventory 'MON-DAT' describing various HAB monitoring programmes worldwide. The inventory is as a source of inspiration for improved monitoring and as the background for international exchange of experience. Also the APEC-IOC Technical Report No 59 'Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters' (Anderson, D.M. *et al*, APEC, Singapore and IOC, Paris, France, 2001), is an important tool for this module.

The implementation of the module implies close cooperation and assistance from individuals and institutions with experience in the 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.

The module has been developed in a specific course held as an IOC-IEO Course ('Monitoring programmes on Toxic Phytoplankton and Marine Phycotoxins according to European Union Directives', 10–26 June 2002) at the IOC-IEO Science and Communication Centre on Harmful Algae in Vigo, Spain and also in a general way during previous courses.

There is a linkage between this module and the Global Ocean Observing System (GOOS), which includes operational elements concerning resource protection and monitoring, closely related to Article 7 and Annex I of the UNCED Convention on Biological Diversity.

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 primarily implemented as regional workshops. APEC-IOC Technical Report No 59 'Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters', (Anderson, D.M. et al., APEC, Singapore and IOC, Paris, France, 2001) is an important tool for this module.

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 may not be enough participants or interest for the more specialized training courses. Such workshops have been requested by several regions, in particular developing countries, where the same individuals are sometimes responsible for several, or all functions, in relation to harmful algal events.

2.2 Individual Training:

2.2.1 Fellowships and Study Grants

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

2.2.2 Training Through Research

It is an integrated part of the capacity-enhancement strategy of the IOC HAB Programme to facilitate the establishment and funding of 'training through research' opportunities to enhance national research, teaching, and monitoring capabilities. This will be addressed through initiatives by the IOC Science and Communication Centres on Harmful Algae, the regional components of the programme, and through suitable national partners.

3. FEASIBILITY STUDIES

Detailed and regular 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.

Initially a survey was made of IOC Member States through the circulation of two questionnaires concerning training needs in relation to harmful algae. The results provide the basic background for the identification of regions and laboratories suitable for more detailed feasibility studies, which should also identify the appropriate level of the courses and the target groups. The background for the present programme consists of 'Extract of the Harmful Algal Bloom Programme: TRAINING', Recommendations, BMTC-IOC Workshop (IOC Workshop Report No. 80), Recommendations, IOCARIBE Workshops, IOC Survey (1993 and 1999), which can be found in the report of the Third Session of the IPHAB, Annex XIII. The regular feasibility studies will currently be incorporated in the workplan of the HAB Programme.

4. IMPLEMENTATION

The implementation of specific capacity-enhancement activities will be decided upon and endorsed as an integrated part of the workplan for the IOC HAB Programme as decided by the IPHAB. The IOC Science and Communication Centres on Harmful Algae and regional partners shall play a key role in the implementation and development of mechanisms to fund implementation. The activities organized through the IOC Science and Communication Centres on Harmful Algae do not exclude training activities to be organized within the IOC HAB Programme by other scientific institutions. Furthermore, the experience from IOC activities is available upon request to assist other initiatives which wish to plan and implement capacity enhancement.

5. FUNDING THE HAB TRAINING PROGRAMME

The IPHAB urges Member States to assist in the identification of resources for the implementation of the HAB Training and Capacity-Enhancement Programme. In addition, geographically-balanced proposals prepared on the basis of this document and needs identified in relevant regions, will be submitted for funding to potential donors by the IOC Secretariat and the Science and Communication Centres.

In addition to the direct funding of training activities, the sponsorship by manufacturers of equipment will be sought whenever relevant. Technology transfer and establishment of local and regional facilities should be included to the extent possible in all capacity-enhancement activities.

An overview of the HAB Training and Capacity Building Programme, including resources identified, will be prepared for each session of the IPHAB.

OVERVIEW OF IOC HAB TRAINING COURSES AND WORKSHOPS

MODULE:	LEVEL, No. of participants:	TARGET GROUP/ Region	WHERE	WHEN	NEED IDENTIFIED WHERE	FUNDING IDENTIFIED in USD
<i>TAXONOMY OF HARMFUL MARINE MICROPLANKTON</i>						
Course name: IOC-Danida Training Course on the Taxonomy of Harmful Marine Phytoplankton Organizer: Prof. O. Moestrup, University of Copenhagen	M.Sc, Ph.D 15	Global, developing countries	University of Copenhagen, Denmark	16-28 August 1993	HABP Plan, Pilot Course	Danida- IOC-TF: 42K IOC: 10K Total: 52K
Course name: IOC-Danida Training Courses on the Taxonomy and Biology of Harmful Marine Microplankton Organizer: IOC Science and Communication Centre on Harmful Algae, (Moestrup, Larsen, Fukuyo, Matzuoka, Enevoldsen	Advanced M.Sc./Ph.D 15	Global, developing countries	University of Copenhagen, Denmark	August 1995 1996 1997 1998 1999 2000 2001	HABP Plan BMTS WS HAB Survey 1 st IOC-Danida Training Course. Survey 1999	Danida- IOC-TF: 50 K/course
Course name: MAST-ONR-IOC 6 th Advanced Phytoplankton Course	Advanced M.Sc, Ph.D. 20	Global, self- paying	Zoological Station Anton Dornh, Napoli, Italy	24 Sep.-14 Oct. 1995		MAST, ONR

TAXONOMY OF HARMFUL MARINE MICROPLANKTON						
Course name: IOC-SAREC-Danida Training Course on the Taxonomy and Biology of Harmful Marine Microplankton Organizer: IOC Science and Communication Centre on Harmful algae, Cph.(Dr. Larsen), Dr. F.R.J. Taylor. Univ. of British Columbia	Basic M.Sc. 15	IOCINCWIO	University of Mauritius	5-14 Febr. 1996	IOCINCWIO-III Implementation Plan	IOC: 30K NAI: 4K TEMA: 6K SAREC: 20K Danida: printed material, equipment Total: 30K
Course name: IEO-AECI Training Course on Toxic Phytoplankton Organizer: IEO, Centro Ocean. de Vigo, Spain (B.Reguera)	M.Sc./ Ph. D 6	Latin America, developing countries	Centro Oceanográfico de Vigo. Instituto Español de Oceanografía, Vigo, Spain	13-28 Feb.1996	IPHAB	Funded by AECI and IEO AECI:5K IEO: 5K
Course name: IOC/WESTPAC Training Course on Species Identification of Harmful Microalgae Organizer: Dr. Yasuwo Fukuyo, Asian Natural Environmental Science Center, the University of Tokyo, Tokyo, Japan	M.Sc./Ph.D, 10	WESTPAC	Asian Natural Environmental Science Center, the University of Tokyo, Tokyo, Japan	28 February - 8 March, 1997	WESTPAC-HAB	Funded by Japan
Course name: IOC-FURG-DANIDA Training Course on the Biology and Taxonomy of Harmful Marine Microplankton Organizer:	M.Sc, Ph.D. 20	South America	University of Rio Grande, Rio Grande, Brazil	3-14 March 1997	COI-FANSA	FURG and national Brazilian: 27 K IOC: 8K WESTPAC/HAB- Japan:4K DANIDA:10K

Dr. Clarisse Odebrecht, University of Rio Grande (FURG); IOC Science and Communication Centre on Harmful Algae, Copenhagen.						
Course name: IOC-NorFa Training Course on the Taxonomy and Biology of Harmful Marine Microplankton Organizer: IOC Science and Communication Centre on Harmful Algae, Copenhagen	Advanced M.Sc./Ph.D. 18	Baltic Sea	Tvärminne Zoological Station, Finland	16-22 Aug. 1997	NorFa	Nordic Research Academy (NorFa):18K IOC: 2K Total: 20 K
Course name: IOC/WESTPAC Training Course on Species Identification of Harmful Microalgae Organizer: Asian Natural Environmental Science Center, the University of Tokyo	M.Sc, Ph.D. 10	WESTPAC	Asian Natural Environmental Science Center, the University of Tokyo, Tokyo, Japan	22-30 Aug. 1997	WESTPAC-HAB	Funded by Japan
Course name: IOC-APEC Training Course on the Identification and Monitoring Harmful Marine Microplankton Organizer: IOC Science and Communication Centre on Harmful Algae, Copenhagen	Basic M.Sc. 12	APEC	University of Copenhagen, Denmark	11-19 Oct. 1997	APEC	APEC: 10K IOC: 10K Self paying participants Danida: printed material, equipment
Course name: 7th advanced Phytoplankton Course on Taxonomy and Systematics Organizer: Dr. A. Zingone, Zool. Sta. A. Dorhn, Napoli, Italy	Advanced M.Sc, Ph.D. 20	Global, self paying	Stazione Zoologica A. Dohrn di Napoli, Italy	10-30 May 1998		MAST, ONR, IOC-UNESCO

TAXONOMY OF HARMFUL MARINE MICROPLANKTON						
Course name: IOC-NorFa Training Course on the Taxonomy and Biology of Harmful Marine Microplankton Organizer: IOC Science and Communication Centre on Harmful Algae, Copenhagen	Advanced M.Sc./Ph.D. 18	Baltic Sea	Vörtsjärv Limnological Station, Estonia	1-9 Sept. 1998	NorFa	Nordic Research Academy (NorFa):18K IOC: 2K Total: 20 K
Course name: IOC-IEO-AECI Training Course on Toxic Microalgae and Marine Phycotoxins Organizer: IOC Science and Communication Centre on Harmful Algae, Vigo (J. Diogene, A. Aguilera, B. Reguera, M. Lion)	M.Sc./ Ph. D 12	Latin America and African countries	Centro Oceanográfico de Vigo. Instituto Español de Oceanografía, Vigo, Spain	June (17 days) 1998 1999 2000 2001	IPHAB	Spain IOC TF: 16 K AECI: 9K IEO: 10K Total: 35K
TOXIN CHEMISTRY AND TOXICOLOGY						
Course name: IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins Organizer: Prof. B. Lukas Univ. of Jena, Germany	Advan. M.Sc., Ph.D. 12	Mediterranean, global	Friedrich- Schiller University of Jena, Germany	Oct. 1994	HABP Plan BMTc WS HAB Survey	UNEP: 15K IOC: OSLR: 5K TEMA: 8K Univ. Jena: Equipment and accommodation Japan: equipment Total: 45K
Course name: IOC-UNEP-WHO-FAO-Italy Training Course on Toxin Chemistry and Toxicology related to Harmful Algae Organizer:	Advanced M.Sc., Ph.D. 10	Developing countries, East Med., Black Sea	University of Trieste	3-12 Sep. 1995	HABP Plan BMTc WS HAB Survey	IOC: 8.4K MAP: 1.6K FAO: 7 K Univ. of Trieste: 22K Japan: equipment

Prof. R.D. Loggia, Dr. A. Tubaro						Total: 39K
Course name: IOC-AECI-IEO Training Course on Analytical Methods for the Detection of Marine Toxins Organizer: IOC Science and Communication Centre on Harmful Algae Vigo (Reguera)	Basic M.Sc., Ph.D. 10	Latin America and African Countries	IEO, Vigo, Spain.	25 June-6 July 1997	IOC-FANSA	Spain IOC TF: 16K AECI: 9K IEO: 10K Total: 35K
Course name: IOC-UNEP Training Course on Qualitative and Quantitative Determination of Algal Toxins Organizer: Prof. B. Lukas University of Jena, Germany	Advanced M.Sc., Ph.D. 12	Global	Friedrich- Schiller University of Jena, Germany	2-12 March 1999	HABP Plan BMTCS WS HAB Survey	UNEP: ?K IOC: HAB 8K Univ. Jena: equipment, Total: 40K
Course name: IOC Training Course on Phycotoxins Organizer: Dr. Kevin J. James, Director, Eco- toxicology Res. Unit, Chemistry Dept, Cork Inst of Technology, Cork, Ireland	Advan. M.Sc., Ph.D. 14	Global	Cork Institute of Technology, Cork, Ireland	1-14 Sep., 2000	IPHAB	CIT: 13,5K IOC: 12,5K requested EU and WHO subject to application
<i>RISK ASSESSMENT, CONTINGENCY PLANNING AND MANAGEMENT OF HARMFUL ALGAL EVENTS; DESIGN AND IMPLEMENTATION OF MONITORING PROGRAMMES</i>						
Course name: IOC-Japan Training Workshop on Monitoring of PSP Plankton and Shellfish Toxicity Organizer: Dr. Y. Fukuyo, Univ. of Tokyo, Dr. M. Kodama, Kitasato Univ.	Basic, M.Sc., Ph.D. 15	WESTPAC	Kitasato University	17-21 July 1995	HABP Plan BMTCS WS HAB Survey WESTPAC WS	IOC: 11K Japan: 30K Kitasato Univ: 5K Total 46K

RISK ASSESSMENT, CONTINGENCY PLANNING AND MANAGEMENT OF HARMFUL ALGAL EVENTS; DESIGN AND IMPLEMENTATION OF MONITORING PROGRAMMES						
Course name: IOC-APEC Symposium: Harmful Algal Management Organizer: IPHAB Task Team and APEC	Managers, Administrators, Scientists 40-60	Global	Subic Bay, Philippines	9-14 May 1999	HABP Plan, BMTIC WS,	Danida funds for prep. of WS: 15K IOC: 15K APEC: remainder 30K
Course name: VI IOC-AECI-IEO Training Course on Toxic Phytoplankton and Marine Phycotoxins: Monitoring programmes on Toxic Phytoplankton and Marine Phycotoxins according to European Union Directives Organizer: IOC Science and Communication Centre on Harmful Algae, Vigo (M. Lion)	Scientists 10	Latin America and African Countries	Instituto Español de Oceanografía, Vigo, Spain.	10-26 June, 2002.	IPHAB	Spain IOC TF: 16K AECI: 9K IEO: 10K Total: 35K
THEME WORKSHOPS, AND REGIONAL INTERDISCIPLINARY WORKSHOPS						
Course name: WESTPAC- LIPI - P30 Seminar on HAB Organizer: Mr. D.J. Praseno, P30 LIPI	Basic, Admin. and Scientists 30	WESTPAC	Research and Development Centre for Oceanology, LIPI, Indonesia.	8 Nov. 1993	WESTPAC-II	Japan: 5K Indonesia: 3K Total: 8K
Course name: WESTPAC: China Workshop HAB Organizer: Dr. Qi Yuzao, Jinan University	Basic M.Sc. 10	WESTPAC	Guangzhou, China	21-26 Nov. 1993	WESTPAC-II	Japan: 5K China: 3K Total: 8K
Course name: WESTPAC - PAMS - Thailand Workshop on HAB	Basic, admin., tech., scientists 20	WESTPAC	Iloilo, Philippines	May 1994	WESTPAC-II	Japan: 3K Indonesia: 1K CIDA: ?K

<p>Organizer: Dr. R.A. Corrales, Univ. of the Philippines, Dr. A. Marasigan, Univ. of the Phil. in the Visayas.</p>						
<p>Workshop name: IOC Regional Science Planning Workshop on Harmful Algal Blooms Organizer: Dr. Silvia Mendez, INAPE, Uruguay</p>	M.Sc., Ph.D. 22	Scientists South America	INAPE, Montevideo, Uruguay	May 1994	IPHAB-II	IOC: MTD 4K Total: 4K
<p>Workshop name: Second IOC Regional Science Planning Workshop on Harmful Algal Blooms Organizer: Dr. Jose I. Carreto, INIDEP, Argentina</p>	M.Sc., Ph.D.	Scientists South America	INIDEP, Mar del Plata, Argentina	Oct. 1995	1 st Workshop	IOC: 10K
<p>Workshop name: Third IOC Regional Science Planning Workshop on Harmful Algal Blooms (COI-FANSA-III) Organizer: Leonardo Guzman</p>	M.Sc., Ph.D.	Scientists South America	Instituto Fomen Pesquero, Puenta Aremas, Chile	28-30 July 1997	2 nd workshop	IOC
<p>Course name: International Seminar on Red Tides, risks for human health and development Organizer: Raul Koch</p>	M.Sc., Ph.D.	Scientists South America	Puerto Varas, Xa Region, Chile	3-5 August 1999	IOC FANSA	Health Ministry, Regional Government, IOC
<p>Course name: Regional S-American Course on HAB, methodologies for marine biotoxins Organizer: Karim Keisser</p>	M.Sc., Ph.D.	Scientists South America	Public Health Institute, Santiago, Chile	8-12 November 1999	III IOC FANSA	FURG IOC Ministry of Science and Technology

RISK ASSESSMENT, CONTINGENCY PLANNING AND MANAGEMENT OF HARMFUL ALGAL EVENTS; DESIGN AND IMPLEMENTATION OF MONITORING PROGRAMMES						
Course name: IV Regional Working Meeting on Harmful Algae Blooms in S-America (COI/FANSA) Organizer: Virginia Garcia	M.Sc., Ph.D.	Scientists South America	FURG, Rio Grande University, Brazil	Jan. 2000	III IOC FANSA	IOC 10 K + local sponsorship
Course name: WESTPAC-LIPI-P30 Red Tide training Course Canada Training Workshop on Harmful Algae Organizer: Mr. D.P. Praseno, P30 LIPI, Dr. Yasuwo Fukuyo, Univ. Tokyo	Basic, M.Sc. 10	WESTPAC ASEAN	LIPI, Ambon, Indonesia	13-18 Nov. 1995	WESTPAC-II	IOC: Japan: 5K Indonesia 3K
Course name: IOC/WESTPAC In-Country Training Courses/ Organizer: Asian Natural Environmental Science Center, the University of Tokyo, Tokyo,	Basic, M. Sc.	WESTPAC				
<i>IOC/WESTPAC-Philippines: Dinoflagellate Identification</i>	9		BEFAR, Manila, Philippines	6-9 Dec. 1995	WESTPAC-II	Japan 3K BEFAR 10K
<i>IOC/WESTPAC-Vietnam: Phytoplankton Monitoring and Identification in Eastern Indonesia</i>	8		Int. Of Ocean,, Haiphong Vietnam	12-15 Nov. 1996	WESTPAC-III	Japan 15K Vietnam 3K
<i>IOC/WESTPAC-Indonesia: Phytoplankton Monitoring and Identification in Eastern Indonesia</i>	15		Res. and Develop. Centre for Oceanology, Jakarta, Indonesia	18-22 Nov. 1996	WESTPAC-III	Japan 15K Indonesia 3K
<i>IOC/WESTPAC-Malaysia: Identification of PSP Plankton</i>	15		Univ. Malaysia, Saba, Kota Kinabalu, Malaysia	9-11 December, 1996	WESTPAC-III	Japan 15K Malaysia 5K

Course name: IOC/WESTPAC In-Country Training Courses/ Organizer: Asian Natural Environmental Science Center, the University of Tokyo, Tokyo, Japan,	Basic, M. Sc.	WESTPAC				
<i>IOC/WESTPAC-UPV: Red Tide Seminar Workshop</i>	20		Univ. Phil; in the Visayas, Philippines	17 May 1996	WESTPAC-II	Japan 5K Phil. 10K
<i>IOC/WESTPAC-PSU: Seminar on HAB</i>	20		P. of Songkla Univ., Hat-Yai, Thailand	12-16 Dec. 1997	WESTPAC-III	Japan 25K Thailand 5K
<i>IOC/WESTPAC—UPV: Red Tide Seminar Workshop</i>	20		Univ. of the Phil. in Cebu	17-21 Nov. 1998	WESTPAC-III	Japan 35K Philippines 5K
<i>IOC/WESTPAC- Chinese Taipei: Red Tide Seminar Workshop</i>	13		National Taiwan Univ., Taipei	3-7 April 1999	WESTPAC-III	Japan 5K C. Taipei 50K
<i>IOC/WESTPAC – Hong Kong: Red Tide Seminar and Training Course</i>	20		Agriculture and Fisheries Dept., Hong-Kong	6-10 Dec. 1999	Request	Japan 5K Hong –Kong 50K
6thIOC/WESTPAC/HAB Training Course on Advanced Techniques on Characterization of Harmful Algal Species Organizer: The Philippine BFAR, Univ. of Philippines, Asian Natural Environmental Science Center, the University of Tokyo, Tokyo, Japan.	M.Sc./ Ph.D.	9	The Philippine Bureau of Fisheries and Aquatic Resources, and the University of Philippines,	12-19 May 2002	WESTPAC-HAB	Japan 16K

ANNEX XI

TERMS OF REFERENCE AND RULES OF OPERATION GEOHAB SCIENTIFIC STEERING COMMITTEE (As of November 1999)

The international programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB), is cosponsored by the Scientific Committee on Oceanic Research (SCOR), and, the Intergovernmental Oceanographic Commission (IOC). The programme will be developed and implemented by a Scientific Steering Committee (SSC) with the following terms of reference discussed at its first meeting (November 1999):

- To oversee the development of a Science Plan for the international SCOR/IOC programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) and to submit it within one year for the approval of the sponsors of the programme and subsequent publication. The SSC should ensure that the Science Plan has input from the international HAB scientific community.
- To develop a detailed Implementation Plan for GEOHAB taking into account input from the scientific community, for presentation and approval by the sponsors and publication within two years.
- To coordinate and manage the resulting activities in accordance with the GEOHAB Science and Implementation Plans.
- To collaborate, as appropriate, with organisations such as ICES, PICES, etc. and related programmes such as GLOBEC, LOICZ, and the emerging Global Ocean Observing System.
- To ensure effective communication between related national and regional HAB research efforts.
- To report regularly to SCOR and IOC, and to other bodies as needed, on the state of planning and accomplishments of GEOHAB.

The GEOHAB SSC, its Officers, subsidiary groups and International Project Office shall operate in accordance with the guidelines established by SCOR and IOC.

Operating Procedures for the SSC

The Scientific Steering Committee of GEOHAB (henceforth referred to as SSC), is sponsored by the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC). The two organisations are jointly responsible for the appointment of the Chairperson, Vice-Chair and Members. .

The primary functions of the GEOHAB SSC are to:

- provide scientific guidance to and oversee the development, planning and implementation of the program;
- encourage publication of results with an appropriate form of acknowledgment of SCOR and IOC support and that of other agencies and organisations as appropriate;
- encourage the promotion and wide awareness of GEOHAB in the science community;

- demonstrate progress and achievements of the project through the definition and monitoring of milestones and results;
- provide on request, scientific advice and assistance to the international community in the planning of national and regional HAB research, which is designed to contribute to the overall goals of the international GEOHAB program.
- encourage national governments, regional and international funding agencies to support the implementation of the GEOHAB programme and the achievement of GEOHAB goals through the provision of adequate support to the necessary national, regional and international research activities with the help of the IOC Intergovernmental Panel on HABs and other relevant bodies;
- encourage collaboration between GEOHAB and other international programmes and agencies concerned with the scientific study and assessment of harmful algal blooms; and
- recommend to SCOR and IOC:
 - a Chairperson for appointment by SCOR and IOC;
 - Members for appointment to the committee by SCOR and IOC;
 - a Vice-Chair for appointment by SCOR and IOC; and,
 - such amendments to these terms of reference as may prove necessary from time to time.

In undertaking these responsibilities the SSC shall collectively:

- meet at least once a year, to review progress in the development and implementation of the GEOHAB and to advise the Chair, Vice-Chair and programme staff on the scientific developments which should be initiated or undertaken between meetings;
- prepare plans and guidelines for the conduct of meetings, workshops, and conferences designed to assist the SSC in executing its functions;
- prepare and revise, as necessary, criteria for the identification of national and regional research which contributes to the goals of GEOHAB;
- develop guidelines for the preparation, publication and distribution of substantive and technical reports resulting from GEOHAB research; from the work of the GEOHAB Programme Office; and, from related activities of GEOHAB;
- develop and devise a methodology for monitoring and assessing progress;
- advise the programme office staff on the necessary actions required of the office in support of the work of the SSC and,
- consider such other matters as are brought to the attention of the SSC by individual members, the programme staff, or the sponsors.

The Chairperson and Members of the Scientific Steering Committee are selected for their expertise and serve in their individual capacities. They will be appointed for three-year terms and may, with justification, be invited to serve a second term. They are expected to:

- attend in full, the meetings of the Scientific Steering Committee. Members who fail to attend two SSC meetings will normally be asked to retire from the SSC;
- be willing to expend considerable effort between SSC meetings;
- provide the best possible scientific information and advice concerning their field of

expertise as it relates to the goals elaborated in the Science and Implementation Plans for the GEOHAB program;

- provide scientific advice to the Chairperson and programme officers on the development and implementation of the GEOHAB program;
- represent the interests of the programme at relevant scientific meetings;
- provide a written report to the International Programme Office within one month of attendance at a meeting at the expense of the IPO;
- provide a two-way channel of communication between the Scientific Steering Committee and the national and where possible, regional and international research communities;
- organize, convene and conduct meetings as shall be agreed by the SSC;
- keep the IPO and Chairperson of the SSC fully informed of all actions directly or indirectly related to the program; and
- assist in securing financial and other support for the execution of GEOHAB research, adopted and approved by the Committee.

The Chairperson of the Scientific Steering Committee is expected to:

- chair the meetings of the Committee;
- undertake advocacy on behalf of the project and enlist wide international participation in the project;
- work closely with the IPO in implementing agreed activities between meetings of the Committee;
- report periodically to SCOR and IOC on the progress of GEOHAB and seek their assistance in addressing difficulties encountered in its implementation.

The Vice-Chair of the Scientific Steering Committee is expected to:

- chair the meetings of the committee in the absence of the Chairperson;
- undertake advocacy on behalf of the project and enlist wide international participation in the project; and
- assist the Chair and the programme staff in implementing agreed activities between meetings of the Committee.

Responsibilities of the International Programme Office

The International Programme Office (IPO) will assist the GEOHAB SSC in planning and carrying out new scientific research; it will also serve as a much-needed channel of communication between scientists working in different countries on various scientific aspects of harmful algal blooms. An important early task of the IPO will be to assist the SSC in collecting information on national and regional programmes of HAB research relating to ensure that the project makes effective use of existing activities and assists in the identification of areas of unnecessary duplication of effort.

The general tasks of an International Programme Office are as follows:

- administering the project on a day-to-day basis, under the long term guidance of the SSC

- coordinating research efforts, and planning and coordinating research campaigns and field programmes;
- providing project advocacy and promotion, enlisting wide international participation in the project;
- maintaining needed connections with relevant national and regional projects;
- ensuring effective coordination with other international research programmes;
- disseminating information and research results through the Harmful Algae News and other appropriate publications;
- monitoring and assessing the progress of the project and the activities of the SSC;
- securing support for the operation of the Office; and
- coordinating the development of a GEOHAB Data System Plan. This should address issues of data quality, data set creation, metadata and catalogues, data archiving, data standards, external cooperation and linkages to data agencies, networking and distribution of data, and future instrumentation needs.

In addition, the IPO is expected to

- provide day-to-day support to the work of the Committee both individually and collectively; and
- provide the technical Secretariat for the meetings of the SSC and other meetings convened by the SSC within the framework of GEOHAB.

ANNEX XII

ICES-IOC WORKING GROUP ON HARMFUL ALGAL BLOOM DYNAMICS

The **ICES-IOC Working Group on Harmful Algal Bloom Dynamics** [WGHABD] (Chair: J. L. Martin, Canada) will meet in Aberdeen, UK from 17–20 March 2003 to:

- a) compare and assess historical and retrospective data sets on phycotoxins in shellfish, related to phytoplankton abundance, and phytoplankton community structure with reference to HAB population dynamics;
- b) review the reports and products of recent workshops on molecular probe technology, and the development of technologies of direct use in studies of field populations of HAB species, with special attention to novel approaches that were not considered in the 2002 meeting;
- c) evaluate the outcome of the Workshop: “Contrasting approaches to understanding eutrophication effects on phytoplankton” (CM2001/2C:05) from a HAB perspective;
- d) review effects of HABs on survival and fecundity of wild fish, and the relationship (if any) to recruitment;
- e) prepare a resolution for a workshop on “New and classic techniques for the determination of numerical abundance and biovolume of HAB-species – evaluation of the cost, time-efficiency and intercalibration methods”;
- f) evaluate the usefulness and feasibility of creating HAEDAT maps directly from the HAEDAT-database;
- g) review the application of methods for the detection and quantification of phycotoxins in eukaryotic microalgae and cyanobacteria, and related components of pelagic food webs, in coastal marine and brackish waters of the ICES area;
- h) review the previous submissions to HAEDAT with a view to improving the accuracy of the information and increasing the utility of the database;
- i) report on the ECOHAB-EUROHAB Workshop on joint research on HABs;
- j) consider the potential of ITIS as a common taxonomic system within ICES.

ANNEX XIII

**STUDY GROUP ON BALLAST AND OTHER SHIP VECTORS
VANCOUVER, CANADA, 24–25 MARCH 2003**

2ACME05

The ICES/IMO/IOC Study Group on Ballast and Other Ship Vectors [SGBOSV] (Chair: S. Gollasch, Germany) will meet in Vancouver, Canada from 24–25 March 2003 to:

- a) report on progress in ballast water research and prepare a practical assessment of the currently implemented and planned ballast water control and management technologies;
- b) intersessionally support the Ballast Water Working Group of the International Maritime Organisation's Marine Environment Protection Committee (IMO MEPC BWWG);
- c) conduct and report on a global review of the significance of vectors, especially ballast water and hull fouling, taking into account that the ban of TBT-containing antifouling paints will change the pattern of use of antifoulants;
- d) discuss and report on risk assessment approaches relevant to ballast water management, considering implementations of mandatory risk assessment procedures by some jurisdictions;
- e) determine means to further advance opportunities for coordinated measurements of invasion across countries and mechanisms to share and coordinate relevant data (e.g., on invasion pattern).

SGBOSV will report by 15 April 2003 for the attention of ACME and the Mariculture and Marine Habitat Committees.

Monday, 24 March 2003

8:45 AM	Arrival of participants	
9:00 AM	Opening of the Meeting	
	Welcoming Remarks (Dr. Laura Richards Regional Director-Science Branch)	0:05
	Logistics (telephone, FAX, Internet, Photocopying, etc.) (D. Kieser, Canada)	0:05
	Brief Introduction of Participants (Name, Institution, Nature of Interest)	0:25
	Review of Terms of Reference	0:10
	Review of the Agenda: Changes, Corrections, Additions	0:05

Session I

Progress Reports of Shipping Studies, Risk Assessment and Related Initiatives

9:50 AM	Progress Report of the GloBallast Programme. Announcement of 1st GloBallast Workshop on Guidelines and Standards for Ballast Water Sampling, and 2nd GloBallast R&D Symposium (S. Raaymakers, GloBallast Programme, IMO)	0:20
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10:10 AM	Merchant Vessel Fouling Risks of Sea Chests (A. Coutts, New Zealand - presentation given by C. Hewitt, New Zealand)	0:10
10:20 AM	Ballast Water - Testing for Risk (C. ten Hallers-Tjabbes, Netherlands)	0:15
10:35 AM	Update of Ballast Water Exchange in Regional Seas (T. McCollin, U.K.)	0:20
10:55 AM	Coffee Break	0:20
11:15 AM	Offshore Ballast Water Exchanges in the North Atlantic Ocean: Comparing Effectiveness on Different Phytoplankton and Zooplankton Groups (N. Simard - presenter -, S. Plourde & M. Gilbert, Canada)	0:20
11:35 AM	Implications of Open Ocean Ballast Water Exchange (H. Behrens, Norway)	0:20
11:55 AM	Great Lakes NOBOB and Low Salinity BWE Study Update: Progress and Challenges (D. Reid, USA)	0:20
12:15 PM	Progress Report on the Swedish AquAliens Project and Information on the Finnish Project BITIS (I. Wallentinus, Sweden)	0:10
12:25 PM	PICES objectives. Introduction to PICES WG15 - Harmful Algal Blooms (M. Taylor, Canada)	0:20
12:45 PM	Lunch Break	1:15

Session II

Ballast Water Treatment (BWT) and Standards

2:00 PM	A Summary of Experimental Research Designed to Assess the Response of Marine Plankton Exposed to a Cyclonic-UV Ballast Water Treatment System (T. Sutherland, Canada)	0:20
2:20 PM	Shipboard and Laboratory Evaluations of Ozone and UV Light for Ballast Water Treatment (R. Herwig & J. Cordell, USA)	0:20
2:40 PM	Peraclean Ocean - an Environmentally Friendly and Effective Treatment Option for Ballast Water (R. Fuchs, Germany)	0:15
2:55 PM	BWT Hamann Wassertechnik and the ATS - Testing Ballast Water Treatment Options with Surrogate Organisms (M. Voigt, Germany)	0:15
3:10 PM	Progress Report of the Bremen Ballast Water Treatment Project (C. Bahlke, Germany)	0:15
3:25 PM	New R&D-Project on Ballast Water Treatment in Germany. The Objectives (A. Kornmüller, Germany)	0:15
3:40 PM	MARTOB Results: Biological Effectiveness and Assessment Criteria for BW Management Systems (TBA, United Kingdom)	0:15
3:55 PM	Coffee Break Video presentation during coffee break BWT experiment in Brazil - the ANVISA Project (15 minutes)	0:20
4:15 PM	Recent Work to Develop an Improved Method of Ballast Treatment with Filtration and UV (A. Cangelosi, USA)	0:20
4:35 PM	Findings from an International Workshop on Analytical Methods/Tools for Evaluating Ballast Water Treatment Performance (A. Cangelosi, USA)	0:20
4:55 PM	New BWT option (M. Todman, UK & D. Minchin - presenter -, Ireland)	0:10
5:05 PM	SGBOSV Input to MEPC48 (S. Gollasch, Chair)	0:05

5:10 PM Progress Report of the IMO Ballast Water Working Group - MEPC48 and Intersessional Meeting, March 2003 (M. Hunter, U.K.) **0:20**

Session III

Round Table Discussion

5:30 PM Round Table Discussion: **1:00**
Ballast Water Standards

- Scientific justification for Ballast Exchange at least 200nm from nearest land and at least 200m depth

- BW discharge standard: No more than 25 viable ind/l zooplankton greater than 10 µm; and no more than 200 viable ind/ml phytoplankton greater than 10 µm; and specified indicator microbes shall not exceed specified concentrations.

- Species to be used for BWT tests

6:30 PM Adjournment of Day 1

Tuesday, 25 March 2003

9:00 AM Opening of Day 2

Review of today's Agenda **0:05**

Announcements, incl. notes from participants by correspondence **0:15**

Session IV

Ballast Water and Bioinvasions Management

9:20 AM The Vancouver Port Authority's Ballast Water Management Programme (M. Cormier, Canada) **0:30**

9:50 AM British Columbia/West Coast Ballast Water Management Working Group (P. Lim, Canada) **0:20**

10:10 AM Change in the Sea State? Developing a Regional Ballast Water Management for Northwestern Atlantic (J. Pederson, USA) **0:15**

10:25 AM Coastal Ballast Water Exchange on the West Coast of North America: Developing a Regional Plan (K. McDowell, USA) **0:15**

10:40 AM An Update on the EPA ETV Ballast Water Treatment Verification Protocol (C. Hunt, USA) **0:20**

11:00 AM Coffee break 0:30

11:30 AM New Zealand's Approach (C. Hewitt, New Zealand) **0:20**

11:50 AM Managing the Marine Bioinvasion Threat - Science and Policy in Australia (K. Hayes, Australia) **0:20**

12:10 PM ICZM and Remote Sensing. The Use of Satellite Images to Identify Algal Bloom Free Regions for Ballast Water Exchange (S. Gollasch & H. Rosenthal - presenter -, Germany) **0:20**

12:30 PM Lunch 1:30

Session V

Update on Case Histories of Selected Invaders and Databases

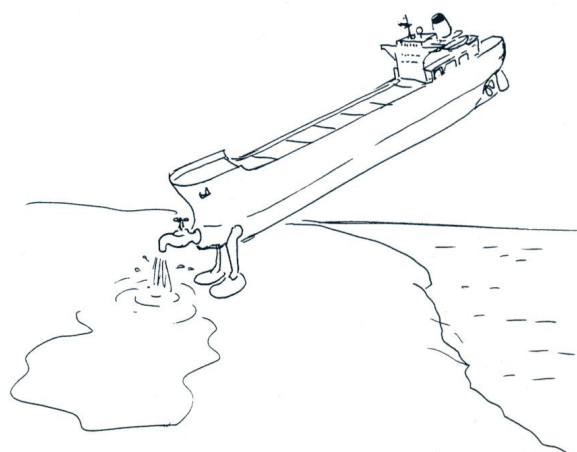
2:00 PM Plankton Invasions of U.S. West Coast Estuaries with two Case Studies, and a Synopsis of Invasive Species in the Columbia River Estuary (J. Cordell, USA) **0:20**

2:20 PM	First Occurrence and Introduction of MSX Disease in Canada (D. Kieser, Canada)	0:20
2:40 PM	Introduction, Spread and Potential Impact of the Recently Introduced Red King Crab, <i>Paralithodes camtschaticus</i> , in Coastal Subarctic Norway (L. Jørgensen, Norway)	0:20
3:00 PM	Food Consumption of the King Crab in Russian Waters of the Barents Sea (I. Manushin, Russia)	0:15
3:15 PM	The Northern Adriatic: A Potential Donor area of NIS in the Mediterranean Sea (A. Occhipinti, Italy)	0:20
3:35 PM	ERNAIS & Bioinvasions Book - the European Perspective (S. Gollasch, chair)	0:05
3:40 PM	German Standardization Group on Ballast Water (C. Bahlke, Germany)	0:05
3:45 PM	Coffee Break Video presentation during coffee break BWT experiment in Brazil - the ANVISA Project (15 minutes)	0:20

Session VI

Round Table Discussion

4:05 PM	Round Table Discussion: Ballast Water Treatment Standards Cooperation with PICES Statement of the SGBOSV Meeting to be submitted to IMO MEPC49 Model Groups and Examples of Possibly Suitable Test Species to Verify the Effectiveness of Ballast Water Treatment Options (ETV Approach)	1:15
	Summary of Findings of Study Group	0:20
	Concluding Remarks	0:10
	Planning of Next Meeting	0:10
6:00 PM	Adjournment of the Fifth Meeting of the SGBOSV	



THE solution to the ballast water problem: Deballast to shore-based reception facilities (D. Masson, Member of the French Delegation at IMO MEPC greets SGBOSV).

ANNEX XIV

LIST OF ACRONYMS

AOAC	Association of Official Analytical Chemists
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of South East Asian Nations
DANIDA	Danish International Development Agency
DSP	Diarrhetic Shellfish Poisoning
ETI	Expert Centre on Taxonomic Identification
FAO	Food and Agriculture Organisation of the United Nations
GEEP	Group of Experts on the Effects of Pollutants
GEF	Global Environment Facility
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms
GOOS	Global Ocean Observing System
IAEA	International Atomic Energy Agency
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IMO	International Maritime Organisation
IOC	Intergovernmental Oceanographic Commission
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IPHAB	Intergovernmental Panel on Harmful Algal Blooms
ISSHA	International Society for the Study of Harmful Algae
PICES	North Pacific Marine Science Organisation
PSP	Paralytic Shellfish Poisoning
SCOR	Scientific Committee on Oceanic Research
UNCED	United Nation Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WESTPAC	IOC Sub-Commission for the Western Pacific
WHO	World Health Organisation

In this Series	Languages
Reports of Governing and Major Subsidiary Bodies , which was initiated at the beginning of 1984, the reports of the following meetings have already been issued:	
1. Eleventh Session of the Working Committee on international Oceanographic Data Exchange	E, F, S, R
2. Seventeenth Session of the Executive Council	E, F, S, R, Ar
3. Fourth Session of the Working Committee for Training, Education and Mutual Assistance	E, F, S, R
4. Fifth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S, R
5. First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions	E, F, S
6. Third Session of the <i>ad hoc</i> Task team to Study the Implications, for the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime	E, F, S, R
7. First Session of the Programme Group on Ocean Processes and Climate	E, F, S, R
8. Eighteenth Session of the Executive Council	E, F, S, R, Ar
9. Thirteenth Session of the Assembly	E, F, S, R, Ar
10. Tenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific	
11. Nineteenth Session of the Executive Council, Paris, 1986	E, F, S, R, Ar
12. Sixth Session of the IOC Scientific Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S
13. Twelfth Session of the IOC Working Committee on International Oceanographic Data Exchange	E, F, S, R
14. Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Havana, 1986	E, F, S
15. First Session of the IOC Regional Committee for the Central Eastern Atlantic, Praia, 1987	E, F, S
16. Second Session of the IOC Programme Group on Ocean Processes and Climate	E, F, S
17. Twentieth Session of the Executive Council, Paris, 1987	E, F, S, R, Ar
18. Fourteenth Session of the Assembly, Paris, 1987	E, F, S, R, Ar
19. Fifth Session of the IOC Regional Committee for the Southern Ocean	E, F, S, R
20. Eleventh Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Beijing, 1987	E, F, S, R
21. Second Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Arusha, 1987	E, F
22. Fourth Session of the IOC Regional Committee for the Western Pacific, Bangkok, 1987	E only
23. Twenty-first Session of the Executive Council, Paris, 1988	E, F, S, R
24. Twenty-second Session of the Executive Council, Paris, 1989	E, F, S, R
25. Fifteenth Session of the Assembly, Paris, 1989	E, F, S, R
26. Third Session of the IOC Committee on Ocean Processes and Climate, Paris, 1989	E, F, S, R
27. Twelfth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Novosibirski, 1989	E, F, S, R
28. Third Session of the Sub-Commission for the Caribbean and Adjacent Regions, Caracas, 1989	E, S
29. First Session of the IOC Sub-Commission for the Western Pacific, Hangzhou, 1990	E only
30. Fifth Session of the IOC Regional Committee for the Western Pacific, Hangzhou, 1990	E only
31. Twenty-third Session of the Executive Council, Paris, 1990	E, F, S, R
32. Thirteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, New York, 1990	E only
33. Seventh Session of the IOC Committee for the Global Investigation of Pollution in the Marine Environment, Paris, 1991	E, F, S, R
34. Fifth Session of the IOC Committee for Training, Education and Mutual Assistance in Marine Sciences, Paris, 1991	E, F, S, R
35. Fourth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1991	E, F, S, R
36. Twenty-fourth Session of the Executive Council, Paris, 1991	E, F, S, R
37. Sixteenth Session of the Assembly, Paris, 1991	E, F, S, R, Ar
38. Thirteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Baja California, 1991	E, F, S, R
39. Second Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1992	E only
40. Twenty-fifth Session of the Executive Council, Paris, 1992	E, F, S, R
41. Fifth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1992	E, F, S, R
42. Second Session of the IOC Regional Committee for the Central Eastern Atlantic, Lagos, 1990	E, F
43. First Session of the Joint IOC-UNEP Intergovernmental Panel for the Global Investigation of Pollution in the Marine Environment, Paris, 1992	E, F, S, R
44. First Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1992	E, F, S
45. Fourteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 1992	E, F, S, R
46. Third Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Vascoas, 1992	E, F
47. Second Session of the IOC Sub-Commission for the Western Pacific, Bangkok, 1993	E only
48. Fourth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Veracruz, 1992	E, S
49. Third Session of the IOC Regional Committee for the Central Eastern Atlantic, Dakar, 1993	E, F
50. First Session of the IOC Committee for the Global Ocean Observing System, Paris, 1993	E, F, S, R
51. Twenty-sixth Session of the Executive Council, Paris, 1993	E, F, S, R
52. Seventeenth Session of the Assembly, Paris, 1993	E, F, S, R
53. Fourteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Tokyo, 1993	E, F, S, R
54. Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1993	E, F, S
55. Twenty-seventh Session of the Executive Council, Paris, 1994	E, F, S, R
56. First Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Melbourne, 1994	E, F, S, R
57. Eighth Session of the IOC-UNEP-IMO Committee for the Global Investigation of Pollution in the Marine Environment, San José, Costa Rica, 1994	E, F, S
58. Twenty-eighth Session of the Executive Council, Paris, 1995	E, F, S, R
59. Eighteenth Session of the Assembly, Paris, 1995	E, F, S, R
60. Second Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E, F, S, R

61.	Third Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1995	E only
62.	Fifteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Papetee, 1995	E, F, S, R
63.	Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1995	E, F, S
64.	Fifteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange	E, F, S, R
65.	Second Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E only
66.	Third Session of the IOC Sub-Commission for the Western Pacific, Tokyo, 1996	E only
67.	Fifth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Christ Church, 1995	E, S
68.	Intergovernmental Meeting on the IOC Black Sea Regional Programme in Marine Sciences and Services	E, R
69.	Fourth Session of the IOC Regional Committee for the Central Eastern Atlantic, Las Palmas, 1995	E, F, S
70.	Twenty-ninth Session of the Executive Council, Paris, 1996	E, F, S, R
71.	Sixth Session for the IOC Regional Committee for the Southern Ocean and the First Southern R Ocean Forum, Bremerhaven, 1996	E, F, S,
72.	IOC Black Sea Regional Committee, First Session, Varna, 1996	E, R
73.	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Fourth Session, Mombasa, 1997	E, F
74.	Nineteenth Session of the Assembly, Paris, 1997	E, F, S, R
75.	Third Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1997	E, F, S, R
76.	Thirtieth Session of the Executive Council, Paris, 1997	E, F, S, R
77.	Second Session of the IOC Regional Committee for the Central Indian Ocean, Goa, 1996	E only
78.	Sixteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Lima, 1997	E, F, S, R
79.	Thirty-first Session of the Executive Council, Paris, 1998	E, F, S, R
80.	Thirty-second Session of the Executive Council, Paris, 1999	E, F, S, R
81.	Second Session of the IOC Black Sea Regional Committee, Istanbul, 1999	E only
82.	Twentieth Session of the Assembly, Paris, 1999	E, F, S, R
83.	Fourth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1999	E, F, S, R
84.	Seventeenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Seoul, 1999	E, F, S, R
85.	Fourth Session of the IOC Sub-Commission for the Western Pacific, Seoul, 1999	E only
86.	Thirty-third Session of the Executive Council, Paris, 2000	E, F, S, R
87.	Thirty-fourth Session of the Executive Council, Paris, 2001	E, F, S, R
88.	Extraordinary Session of the Executive Council, Paris, 2001	E, F, S, R
89.	Sixth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, San José, 1999	E only
90.	Twenty-first Session of the Assembly, Paris, 2002	E, F, S, R
91.	Thirty-fifth Session of the Executive Council, Paris, 2001	E, F, S, R
92.	Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Lisbon, 2000	E, F, S, R
93.	Eighteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Cartagena, 2001	E, F, S, R
94.	Fifth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2001	E, F, S, R
95.	Seventh Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Mexico, 2002	E, S
96.	Fifth Session of the IOC Sub-Commission for the Western Pacific, Australia, 2002	E
97.	Thirty-sixth Session of the Executive Council, Paris, 2003	E, F, S, R
98.	Twenty-second Session of the Assembly, Paris, 2003	E, F, S, R
99.	Fifth Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Kenya, 2002 (* Executive Summary available separately in E, F, S & R)	E*
100.	Sixth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, St. Petersburg (USA), 2002 (* Executive Summary available separately in E, F, S & R)	E*