INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

Ninth Session of the IOC Intergovernmental Panel
on Harmful Algal Blooms

D R A F T
IPHAB STRATEGY
A STRATEGY FOR ENHANCED GLOBAL MANAGEMENT OF HAB

An intergovernmental global partnership of decision makers, policy makers, managers, scientists, international organisations and NGOs to address the growing problem of harmful microalgae. The UNESCO-IOC Intergovernmental Panel on Harmful Algal Blooms was established in 1992 as the organizational framework for such a partnership.

WHY A STRATEGY?

With this strategy for enhanced global management of harmful algal events the IOC of UNESCO wish to visualise the need for and benefits to governments of international cooperation in research, data products, uniform food safety HAB standards to facilitate international trade and capacity building. We also wish to engage and commit stakeholders to take active part in and contribute to the activities. Without such engagement and contribution at the intellectual, financial and governmental level such international cooperation cannot succeed.

VISION AND GOAL

The vision is an international network of national authorities and institutions involved with sea food safety, statutory monitoring of harmful algae & toxins and HAB research, with capacity to adequately manage and mitigate the affects of harmful algae.

The overall goal of the IOC Harmful Algal Bloom Programme is to foster the effective management of, and scientific research on, Harmful Algal Blooms (HABs) in order to understand their causes, predict their occurrences, and mitigate their effects.
WHAT ARE HARMFUL ALGAE?

Phytoplankton blooms, micro-algal blooms, toxic algae, red algae, red tides and harmful algae are all terms for naturally occurring phenomena. About three hundred species of micro-algae are reported to form mass occurrences, so called 'blooms', and nearly one fourth of these species are known to produce toxins. These events are referred to by the generic term, 'Harmful Algal Blooms' (HAB), recognising that, because a wide range of organisms is involved and some species have toxic effects at low cell densities, not all HABs are 'algal' and not all occur as 'blooms'.

WHAT ARE THE NEGATIVE EFFECTS OF HARMFUL ALGAE?

- Fish kills and contaminated seafood
- Toxic effects on humans
- Aesthetic problems affecting tourism
- Marine ecosystem impact
- Technical barriers to seafood trade

Proliferations of microalgae in marine or brackish waters can cause massive fish kills, contaminate seafood with toxins, and alter ecosystems in ways that humans perceive as harmful. A broad classification of harmful algae distinguishes two groups of organisms: the toxin producers, which can contaminate seafood or kill other organisms, and the high-biomass producers, which can cause anoxia and indiscriminate destruction of marine life after reaching dense concentrations. Some HABs have characteristics of both. Although HABs occurred long before human activities began to transform coastal ecosystems, a survey of affected regions and of economic losses and intoxication of humans throughout the world demonstrates that there has been a significant increase in the impacts of HABs over the last few decades and that the HAB problem is now widespread, and serious. However, the harmful effects extend beyond direct economic losses and impacts on human health. When HABs contaminate or destroy coastal resources, the functioning of coastal ecosystems is impaired, the livelihoods of local residents are threatened and the sustenance of human populations is compromised.

Some algal toxins are extremely potent and may be several times more toxic than, for example, cobra venom, and more than a thousand times more toxic than cyanide. At least six human syndromes are presently recognized to be caused by consumption of seafood which is contaminated with algal toxins:

- Amnesic Shellfish Poisoning - ASP
- Ciguatera Fish Poisoning - CFP
- Diarrhetic Shellfish Poisoning - DSP
- Neurotoxic Shellfish Poisoning - NSP
- Paralytic Shellfish Poisoning - PSP
- Azaspiracid Poisoning - AZP

Some of these diseases can be fatal. There is currently no international record of the number of incidents of human intoxication caused by contaminated seafood. Many cases and even fatalities are assumed to pass undiagnosed and hence unreported in the official statistics. In addition to posing serious health risks to consumers of seafood, some microalgae may have devastating effects on fish and other marine organisms, both in the wild and in aquaculture. Several species of microalgae belonging to different taxonomic groups can produce toxins which damage fish gills by haemolytic effects. This has resulted in extensive fish kills with major economic losses. Additional losses may be inferred due to loss of confidence in seafood products by consumers. In coastal areas where tourism is important to the local or national economy, the loss of aesthetic quality due to microalgae proliferations may have severe impacts. HAB species are also of concern as potential invasive species when transported with ballast of ships or aquaculture stocks.
HABs IN THE BROADER CONTEXT

The IOC work with the issue of harmful algae and their effects in the broader context of marine research and management.

Integrated coastal area management and nutrient loading to the coastal environment
Improved understanding of population dynamics of harmful marine microalgae, modelling capabilities of harmful marine microalgal events, as well as improved capability to model and link global patterns of nutrient input to coastal ecosystem effects in Large Marine Ecosystems, contributes to the overall goal of the IOC to achieve healthier ocean ecosystems and sustainable coastal and ocean environments by means of development and diffusion of scientific research, better information and procedures on which policies can be based.

Global observing systems
The Intergovernmental Panel on HAB works closely with the Intergovernmental Panel for the Global Ocean Observing System on the inclusion of HAB observations in Coastal GOOS and through proactive interaction with the Regional Alliances of GOOS on strengthened HAB monitoring and management.

Climate change
With regard to the impact of climate change on the marine ecosystem, GEOHAB facilitates basic research in the factors that control HAB events and are thus giving answers to how the occurrence of HAB may change as climate change influence fundamental controlling factors from e.g. temperature, pH, nutrient access, to hydrography.

Food safety
Through a Task Team on Marine Biotoxins, the IOC interacts with sister UN agencies FAO and WHO in the area of food safety to provide guidance on marine biotoxin test methods, toxicology and management. Enhancing capacity to monitor and manage HABs is a precondition to seafood safety and is offered via training opportunities, manuals and guides for national agencies responsible for regulatory control of marine biotoxins and seafood safety.
HOW IS IOC IPHAB ASSISTING MEMBER STATES?

The IOC is working with the issue of harmful algae in the context of coastal management, protection of public health, wild and farmed fish and shellfish resource protection, livelihood of coastal populations, tourism, eutrophication, and climate change.

In 1992, IOC established a programme with the overall goal of assisting member states in mitigating the effects of harmful algae. This was in recognition of that no single country held the expertise to understand the mechanisms underlying the occurrence of harmful algae and that many countries were in need of cooperation to build own capacity to research on, monitor and manage harmful algal events.

The Programme is supervised and guided by the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB). The IPHAB is composed of IOC Member State representatives and identifies priorities and resources for the implementation of the Programme.

Within the Medium Term Strategy of the IOC for 2008-2013 and the overall trans-disciplinary Harmful Algal Bloom Programme Plan, the IPHAB focuses on four priorities:

- Training, capacity building and networks for enhanced knowledge and mitigation
- International cooperative research on modelling and forecasting
- An authoritative integrated harmful algal information system

The IOC HAB Programme operates in close cooperation with national institutions and relevant organizations, in particular the Scientific Committee on Oceanic Research (SCOR) the International Council for Exploration of the Sea (ICES), and the North Pacific Marine Science Organization (PICES).
HAB TRAINING, CAPACITY BUILDING AND NETWORK STRATEGY – levels and horizons

**Strategy level:**

**Intergovernmental**
- Overall mission and vision
- Overall objectives
- Overall structure

**Topic**
- What issues?
- Which regions?
- Which services?
- Which beneficiaries?
- What competences?

**Operation**
- How CB can contribute to the overall objectives

**Strategy horizon:**

**Permanent**

- **Strategic aim:** Enhance national capacity to mitigate harmful algal events
- **Key issue:** Target CB to national need and context
- **Values:** Demand and user driven CB

**Periodically**

- **Target:** Be normative*
- **Sub-strategies:** Strengthen institutional partnerships
- **Action plans:** Secretariat and Partners to systematically submit proposals
- **Budget:** E-learn platform, Manuals & Guides

**Current**

- **Rooting:** Careful selection of trainees
- **Implementation:** Via HAB Centres, partners and regional networks
- **Follow-up:** Regular assessment by IPHAB: are we on the right track?

The overall plan, with vision, objectives, topics and operation, for HAB training capacity building and networks is described in the ‘HAB Training and Capacity Enhancement Programme’ as adopted by IPHAB-VI. The Programme is composed of 4 main modules on species identification, toxin chemistry and toxicology, design of monitoring, and management.

Explanatory notes to strategic model:

**Strategic aim:** What will we do for Member States?

**Key issue:** What do we have to be good at?

**Values:** What should characterize our work?

**Target:** What is most important to achieve in the period?

*Normative: Set norms for relevant HAB training; develop concepts, manuals, guides.

**Sub-strategies:** How do we reach targets, what actions do we take?

**Action Plans:** What shall we do, who and when?

**Budget:** How will we spend the money?

**Rooting:** How to achieve understanding for and ownership of strategy?

**Implementation:** How to do it?

**Follow-up:** Are we on the right track?
The overall plan, with vision, mission, objectives, topics and operation, for international cooperative research on HAB is described in the Science and Implementation Plans for the SCOR-IOC Global Ecology and Oceanography of Harmful Algal Blooms Programme GEOHAB (www.geohab.info). The GEOHAB Programme is composed of 5 programme elements on upwelling systems, eutrophication, stratified systems and fjords & coastal embayments, and is implemented through a number of Core Research Projects.

Explanatory notes to strategic model:

**Strategic aim:** What will we do for Member States?
**Key issue:** What do we have to be good at?
**Values:** What should characterize our work?

**Target:** What is most important to achieve in the period?
**Sub-strategies:** How do we reach targets, what actions do we take?
**Action Plans:** What shall we do, who and when?
**Budget:** How will we spend the money?

**Rooting:** How to achieve understanding for and ownership of strategy?
**Implementation:** How to do it?
**Follow-up:** Are we on the right track?
The overall strategy, with vision, objectives, topics and operation, for an authoritative integrated harmful algal information system is described in the Plan for the IPHAB-IODE Harmful Algal Information System (HAIS). The HAIS system is composed of 5 data elements on HAB species biogeography, HAB events, HAB species taxonomy, HAB monitoring practices, and a HAB expertise roster.

Explanatory notes to strategic model:

**Strategic aim:** What will we do for Member States?
**Key issue:** What do we have to be good at?
**Values:** What should characterize our work?

**Target:** What is most important to achieve in the period?
**Sub-strategies:** How do we reach targets, what actions do we take?
**Action Plans:** What shall we do, who and when?
**Budget:** How will we spend the money?

**Rooting:** How to achieve understanding for and ownership of strategy?
**Implementation:** How to do it?
**Follow-up:** Are we on the right track?
BENEFICIARIES AND STAKEHOLDERS

The immediate beneficiaries of the activities of the programme are

- institutions and industries with regulatory responsibilities in relation to seafood safety, biotoxin monitoring, human or ecosystem health, or environmental monitoring;

- institutions or research teams working on the dynamics, modelling and forecasting of harmful algal events

- the individual decision maker, manager, scientist or specialist benefitting from information, data and networks activities.

The enhanced capacity of these immediate beneficiaries contributes to enhance the capability of economies, governments and fishery, seafood trade, tourism etc industry to manage and mitigate the effects of harmful algae.

The true stakeholders in international cooperation on harmful algae are thus a broad section of society that depend on, or interfere with, marine resources and the marine environment.
The IOC strives at governmental and institutional ownership of the activities initiated and coordinated by the IOC and of the concerted action in and among Member States and individual stakeholders. Such ownership and the associated engagement and contribution are essential to successful international cooperation. Examples of how various stakeholders contribute are:

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Can contribute and benefit by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governments</td>
<td>• participation in IPHAB&lt;br&gt;• financial support&lt;br&gt;• in-kind sponsorship and hosting of activities&lt;br&gt;• dissemination of IOC information and news to national institutions and private sector</td>
</tr>
<tr>
<td>Institutions</td>
<td>• Involvement, investment and participation in research programmes, working groups, regional networks and support to their staff for participating actively.&lt;br&gt;• Financial support to specific activities.&lt;br&gt;• in-kind sponsorship and hosting of activities&lt;br&gt;• provide viewpoints and feedback on IOC activities to their Governments (IOC National Committees)</td>
</tr>
<tr>
<td>Private sector</td>
<td>• Partnerships in implementation of capacity building and research activities&lt;br&gt;• Sponsorship of activities in return for visibility and acknowledgement</td>
</tr>
<tr>
<td>Research teams</td>
<td>• Involvement, investment and participation in research programmes, working groups, regional networks</td>
</tr>
<tr>
<td>Individual scientists, experts, managers</td>
<td>• Actively participate in working groups, research programme, workshops, networks, subscribe to Harmful Algae News and provide feedback inside their organisations and to their leaders about IOC cooperation and activities</td>
</tr>
</tbody>
</table>
IMPLEMENTATION STRATEGY:
SCIENCE AND COMMUNICATION CENTRE AND REGIONAL NETWORKS

The IOC is implementing its HAB activities through an IOC Science and Communication Centre on Harmful Algae. The Centre is composed of a main unit hosted at University of Copenhagen, Denmark, and a complementary unit hosted at the Spanish Institute of Oceanography in Vigo. The Centre furthermore consists of a consortium of national institutions that have committed to take on responsibility for and contribute to, the implementation of the activities. In this way, IOC Member States actively contribute to international cooperation and at the same time achieve a deep rooting of the IOC programme at the institutional level. An equally important mechanism for implementation and concerted action is the IOC regional networks and working groups on harmful algae established in the Caribbean, South America, Western Pacific, North Africa and North Atlantic.

METRICS OF IMPACT ASSESSMENT

The achievements of the IOC HAB Programme are reviewed and valuated every second year by the IOC Intergovernmental Panel on HAB. The Panel assess needs, decide on priorities and identify funding or funding opportunities.

At the overall level the achievements are assessed by the IOC Assembly every second year and as a part of IOC achievements by the UNESCO General Conference every second year. This assessment and the feed back from Member Sates are taken as indication of the impact of activities at the national level. Particular attention is made to the effects the accomplishments have had in e.g. uniformity and international trade, monitoring practices, focus of national and regional research agendas, and the extend to which concerted action among Member States occurs.
ACHEIVEMENTS AND PLANNED DELIVERABLES

Training, Capacity Building and Networks

ACHEIVEMENTS:
The IOC has jointly with national institutional partners trained more than 600 individuals from countries all over the world in need to enhance their capabilities to monitor and manage harmful algal events. In particular the IOC offers international training courses in harmful algal identification and toxicity testing. The faculty is composed of experts from leading research institutions world wide. The courses are open to applications from all qualified individuals, but priority is given to those charged with HAB monitoring and management in developing countries. The Courses have become a reference for qualification in some Member States and since 2006 the courses in identification are upon passed examination giving certification in identification.

To facilitate knowledge exchange and regional cooperation, the IOC has established professional networks in four IOC regions which focus on training, expert assistance, exchange of information, planning of coordinating activities, inter-calibration as well as cooperative research projects.

- WESTPAC/HAB: Western Pacific Working Group on HAB
- FANSA: Grupo COI sobre Floraciones de Algas Nocivas en Sudamerica
- ANCA: Grupo COI sobre Algas Nocivas en el Caribe

As global network support the IOC publish a newsletter on toxic algae and algal blooms; HARMFUL ALGAE NEWS. It reports on HAB events around the globe, ongoing research activities, training courses and workshops, publications and more. The newsletter has more than 2000 subscribers and is free of charge. Harmful Algae News and subscription requests are also available on the IOC HAB website.

The IOC and UNESCO has published and co-published a number of comprehensive manuals and guides to research and management of harmful algae. The ‘Manual on Harmful Microalgae’ in the series UNESCO Monographs on Oceanographic Methodology is a comprehensive manual on methodologies, identification, toxicity and toxin analysis, monitoring and management of harmful algae. In the same series is a Monograph on “Real-time Coastal Observing Systems for Marine Ecosystem Dynamics and Harmful Algal Blooms: Theory, Instrumentation and Modelling”.

PLANNED DELIVERABLES 2008-2013:
The priorities for 2008-2013 are to further develop the series of training courses and constantly adopt course content to the needs of research and management institutions in Member States. The platform is extensive use of e-learning and the partner agreements with a number of national institutions with internationally recognised expertise in HAB. The IOC Science and Communication Centres on HAB will continue to facilitate or implement cooperative research projects to enhance research capacity in developing countries.

The regional networks are self driven, and their continued development depends on the initiative of the participation institutions. IOC will strive provide seed funding for activities.

Manual and guides will be developed to serve the needs of international research programmes as well as to fill gaps in relation to emerging technologies and application of these both research and in routine monitoring for resource protection and/or as part of larger marine observation systems.
ACHEIVEMENTS AND PLANNED DELIVERABLES

Cooperative Research and Scientific Working Groups

ACHEIVEMENTS:
GEOHAB is a joint IOC-SCOR international science programme on the Global Ecology and Oceanography of Harmful Algal Blooms. It is a programme aiming to coordinate research and cooperation in order to develop international capabilities for assessment, prediction and mitigation of harmful algal events. The mission of GEOHAB is to foster international cooperative research on HABs in ecosystem types sharing common features so as to facilitate the comparison of the key species involved and the oceanographic processes that influence their population dynamics. The scientific goal of GEOHAB is to improve prediction of HABs by determining the ecological and oceanographic mechanisms underlying the population dynamics of harmful algae, integrating biological, chemical and physical studies supported by enhanced observation and modelling systems. Thus, the key problem is to understand the critical features and mechanisms underlying the population dynamics of HAB species in a variety of oceanographic regimes. This understanding can be used as a basis for monitoring and predicting the occurrence, movement, toxicity, and environmental effects of HABs. In turn, monitoring and prediction are essential for management and mitigation of HABs. The ICES-IOC Working Group on Harmful Algal Bloom Dynamics has been established to focus on the physical, chemical and biological interactions associated with harmful algal blooms, and identifies main gaps in current research. The Group also collects and assesses national HAB event reports, maps HAB events and summarises the information in the harmful algae event database on a regional, temporal and species basis. The IOC is jointly with ICES and IMO improving the knowledgebase for control of harmful organisms and pathogens in ballast water. The ICES-IOC-IMO Working Group on Ballast of Ships and other Vectors critically review and report on the status of ballast water research with an emphasis on new developments in ballast water treatment technology, risk assessment, ballast water sampling devices, and selection of ballast water exchange zones to contribute to guidelines currently in preparation by IMO. Also, the group continuously review shipping vectors, prepares a Ballast Water Sampling Manual and works on a draft Code of Best Practice for the Management of Ships Hull Fouling and a Code of Best Practice for Port Sampling.

PLANNED DELIVERABLES 2008-2013:
GEOHAB is in the period of implementation and delivery of results. The GEOHAB Scientific Steering Committee will implement the GEOHAB Core Research Projects, organise framework activities for both Core research and GEOHAB affiliated national research, and will synthesise research results. IOC will continue to co-sponsor the ICES-IOC Working Group on Harmful Algal Bloom Dynamics as a mechanism to review critical research issues, as a feedback mechanism for GEOHAB and to compile data for the Harmful Algae Information System. The IOC will continue to cosponsor the ICES-IOC-IMO Working Group on Ballast of Ships and other Vectors until finalisation of the draft manuals and codes of practice, expectedly by the entry into force of the IMO Ballast Water Convention.
ACHEIVEMENTS AND PLANNED DELIVERABLES

Data products for research and management

ACHIEVEMENTS:
A data base is established on harmful algal events as an on-line system in cooperation with the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organisation (PICES) and is gradually being expanded to cover the entire globe. It provides a structure for data storage that allows easy integration of data, efficient search tools, and the possibility of conducting data analysis. Another data compilation is a meta-database with information on the design and implementation of harmful algae monitoring and management systems from all over the world, and there is an on-line international directory of experts in harmful algae and their effects on fisheries and public health. As the common backbone for the data products is the IOC Taxonomic Reference List of Toxic Plankton Algae.

PLANNED DELIVERABLES 2008-2013:
With respect to data products work will be initiated in 2008 to integrate and expand the existing data products into a Harmful Algae Information System (HAIS). This system will be developed as a joint activity with the International Oceanographic Data exchange Programme (IODE) of the IOC and in partnership with ICES, PICES, ISSHA, and OBIS.
Content as requested by IPHAB:
- Focus areas including economic and social justifications
- Priorities
- Deliverables
- Metrics of impact assessment
- Implementation schedules
- Identification of stakeholders

Assumptions and dilemmas:
- Expectations and perceptions of what an IOC programme can/should deliver are almost as many as there are potential readers of this document.
- A strategy we see as clear and focussed may or may not be perceived as such as recipients have different interpretations of what we write.
- Who are the recipients? Higher level managers and politicians i.e. typically officials at higher level than IPHAB members. Our recipients/readers are a very inhomogeneous group.
- What do we want to achieve? Raise the visibility and impact of IPHAB at both national governmental levels as well as among other UN agencies. More funding, better/higher level IPHAB participation? Acknowledgement?
- The format we present the strategy in (paper, glossy, e-document) influences who will read it and how they read it
- The document will be at the web site as a template which can be adopted to a specific context, e.g. regional, country specific or target audience and can be printed in smaller quantities.

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D R A F T content for overview:

- Why a Strategy?
- Vision and Goal
- What are Harmful Algae?
- What are the Negative Effects of Harmful Algae
- HABs in the Broader Context
- How is IOC Assisting Member States?
- HAB Training, Capacity Building and Network Strategy – levels and horizons
- International Cooperative HAB Research Strategy – levels and horizons
- Harmful Algal Information Strategy– levels and horizons
- Beneficiaries and Stakeholders
- Ownership and Contributions
- Implementation Strategy
- Metrics of Impact Assessment
- Achievements and Planned Deliverables
ANNEX:

Resolution IPHAB-VIII.1

VISUALISING THE IPHAB STRATEGY FOR ASSISTING MEMBER STATES IN THE MITIGATION OF HARMFUL ALGAL EVENTS

The IOC Intergovernmental Panel on Harmful Algal Blooms,

Recalling IOC Executive Council Resolution EC-XXXIX.1, on the IOC Draft Medium Term Strategy 2008-2013;

Noting in particular the High-Level Objectives and Associated Activities:

1. Prevention and reduction of the impacts of natural hazards;
2. Safeguarding the health of ocean ecosystems;
3. Management procedures and policies leading to the sustainability of coastal and ocean environment and resources;

Recognising the advice relative to IPHAB provided by the Advisory Group for the IOC Ocean Science Section, November 2005, in particular the need to develop linkages with other initiatives such as those addressing nutrients, climate change and coastal zone management;

Reiterates that meaningful development and implementation of the IOC HAB Programme has to be with appropriate linkages and cooperation with the other activities of the Commission as well as cooperation with other organisations as required by the context;

Recalling the priorities set out in the HAB Programme Plan (Document IPHAB-VIII-3 Annex V);

Recognizing the need to raise the visibility and impact of IPHAB at both national governmental level as well as among other UN agencies;

Decides to develop a strategy document within the context of the IOC Medium Term Plan for 2008-2013 identifying the deliverables of IPHAB to governments. The document should have a format that will facilitate communicating to higher level managers and politicians the benefits, accomplishments and future plans of the IPHAB and participating in and financially supporting it. The strategy document should address:

- Focus areas including economic and social justifications
- Priorities
- Deliverables
- Metrics of impact assessment
- Implementation schedules
- Identification of stakeholders

Notes that the above analysis should be retrospective as well as prospective - i.e. looking from the beginning of the programme and towards future needs;

Decides to establish a Task Team on Strategy to:

1) work by correspondence to assist the IOC Secretariat in the preparation of the document;
ii) circulate (within 6 months) a draft document and a dissemination plan to the IPHAB for review;

iii) finalise (within 8 months) the document;

Decides that the Task Team that will consist of R. Magnien (United States) as Chair, L. Guzman (Chile), P. Busby (New Zealand). The Chair may establish the membership of the Task Team as required to address the Terms of Reference.

Financial implication: 5.000 USD for design, printing and distribution.