



GlobalHAB - the International SCOR-IOC Science Program on Harmful Algal Blooms

Program Activities 2016-2017

GlobalHAB Scientific Steering Committee members

Elisa Berdalet, Institute of Marine Sciences, CSIC, Spain, Chair
Raphael Kudela, University of California, Santa Cruz, USA, Vice-chair

Neil S. Banas, University of Strathclyde, United Kingdom
Michele Burford, Griffith University, Australia
Christopher J. Gobler, Stony Brook University, USA
Bengt Karlson, Swedish Meteorological and Hydrological Institute, Sweden
Po Teen Lim, University of Malaya, Kuala Lumpur, Malaysia
Lincoln Mackenzie, Cawthron Institute, New Zealand
Marina Montresor, Stazione Zoologica Anton Dohrn, Italy
Kedong Yin, Sun Yat-Sen (Zhongshan) University, China

Eileen Bresnan, Marine Scotland Science, United Kingdom, ICES representative
Keith Davidson, The Scottish Association for Marine Science, United Kingdom, Ex-officio

Vera L. Trainer, National Oceanic and Atmospheric Administration, USA, ISSHA and PICES representative

Gires Usup, Universiti Kebangsaan Malaysia, Malaysia, IPHAB representative

Henrik Enevoldsen, IOC UNESCO/ University of Copenhagen, Denmark
Ed Urban, Scientific Committee on Oceanic Research, USA

The GlobalHAB Scientific Steering Committee (SSC) acknowledges the financial and logistic support received from SCOR during this 2015-2017 period. The funds have made possible the meetings of the GlobalHAB SSC to elaborate the Science and Implementation Plan, representation of the program at international meetings and publications completing the work of the GEOHAB programme. SCOR funds will also contribute to the implementation of some initiatives prioritized by GlobalHAB at short-term. The GlobalHAB activity is described next.

1. Development of the GlobalHAB Science and Implementation Plan

Development of the *GlobalHAB Science and Implementation Plan* was initiated by the GlobalHAB SSC during its first meeting, held in Oban, UK (March 2016) and continued afterwards through on-line communications. The first draft version of the Plan was presented at the SCOR Annual Meeting in Sopot, Poland (September 2016) by Elisa Berdalet. Further, a formal initiation of GlobalHAB took place at the 17th International Conference on Harmful Algae (ICHA) (<http://icha2016.com/about/>) with attendance of most members of the GlobalHAB SSC. A Town Hall session dedicated to GlobalHAB was held in October 12, 2016, announced also in *Harmful Algal News* N. 53. The draft of the *GlobalHAB Science and Implementation Plan* and the preliminary webpage setup were presented. The venue facilitated a useful discussion with the international community studying HABs and some implementation initiatives were presented and discussed by the attendees. The meeting allowed the invitation of the international community to participate actively in the program.

In January 2017, the first complete draft of the Plan was sent for evaluation by 9 external reviewers. GlobalHAB SSC members acknowledge the valuable concepts provided by the reviewers, which are contributing to the final version of the *Plan*.

The revised version of the plan was the focus of the second meeting of the SSC, held at the Stazione Zoologica di Napoli (SZN) in Naples (Italy) on March 28-30, 2017. The *GlobalHAB Science and Implementation Plan* follows the legacy of the former GEOHAB program, incorporating new themes and new implementation activities at short (3-year) and long-term (10-year) periods. The link of the scientific themes integrated in GlobalHAB is shown in Figure 1.

GlobalHAB Themes

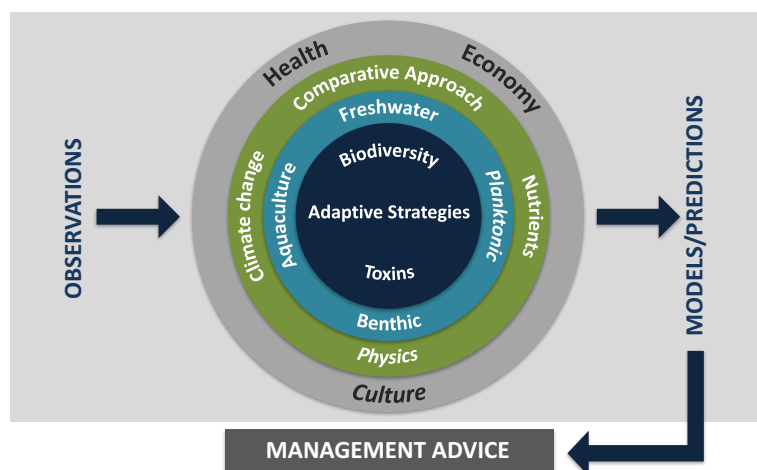


Figure 1. Themes integrated in GlobalHAB. Note that the terms "Physics", "Planktonic" and "Culture" refer to general aspects developed within the different Themes, and are included in the scheme to emphasize the multidisciplinary aspects included in GlobalHAB.

2. Meetings of the GlobalHAB SSC members

As mentioned, the GlobalHAB SSC held its second meeting at the Stazione Zoologica di Napoli (SZN) in Naples (Italy) on March 28-30, 2017. The meeting included plenary and small working groups sessions to deal with the following agenda items:



- 1) Advance towards the finalization of the *GlobalHAB Science and Implementation Plan* considering the reviewers' comments received. Expected to be finished by mid-2017.
- 2) Select a realistic set of Implementation Activities for the next short period (2017-2019) and establish the agenda to implement them, based on point 1) and including the reviewers' comments. The list of the first prioritized activities is presented in section 3.

3) Revise the GlobalHAB Website, expected to be active in mid-2017 at www.globalhab.info.

4) Analyse different issues that posed some urgency during the year: research on *Sargassum* and macroalgal blooms, coordination with the IOC GO₂NE program, a SCOR WG proposal on "HABs and Aquaculture", a proposal to NERC for an International Program Office at SAMS (UK), and collaboration with the multiagency Global Ciguatera Strategy (of IOC-IAEA-FAO-WHO).

5) Participate in developing conceptual structure of a Good Practices Manual to investigate HABs and Climate Change. Mark Wells attended the meeting to facilitate the discussion of a first draft submitted to the SSC in advance. A second draft was produced and it was agreed that GlobalHAB will support the production of the Manual. Furthermore, the SSC will suggest an editorial team covering geographic diversity and scientific expertise to address the content of the manual.

3. Future work-plan for 2017-2019

Some of the activities to be conducted in the 2017-2019 period include:

1) Review paper to identify the knowledge gain and existing gaps on the biogeography and biodiversity of selected taxa. Leader: M. Montresor.

2) Session on HAB biogeography at the 18th International Conference on Harmful Algae (ICHA), in Nantes (France) 2018, in collaboration with ISSHA and ICHA organizers. Contact person: M. Montresor.

3) Coordination with the IPHAB Task Team to implement the multi-agency IOC-IAEA-FAO- WHO "Global Ciguatera Strategy". Nexus persons: E: Berdalet, H. Enevoldsen. Contact people: P. Hess, M. Chinain, P. Tester and M.-Y. Dechraoui Bottein (IAEA).

4) Workshop about the mode of action of fish-killing microalgae (and other related issues), in coordination with the Task team on "Fish-killing HABs". Contact person: A. Cembella, P.J. Hansen.

5) Endorsement of the inter-laboratory validation study on mass spectrometry methods of PSP-toxin analysis. Leader: L. Mackenzie, CEFAS-Cawthron activity.

6) Special issue on "Harmful Algae and Climate Change", in *Harmful Algae*, by 2019. Co-editors: C. Gobler and M. Wells.

7) Good Practices Manual. Nexus person: E: Berdalet. Leader: M. Wells.

8) Co-organization and participation in the activities of the IOC GO₂NE network. Nexus: R. Kudela. Leader: G. Pitcher.

9) Establish a Working Group on Macroalgal Blooms (*Sargassum*, *Ulva*). Contact people: E. Berdalet, C. Gobler, K. Yin. Leader: B. Lapointe.

10) Development of the GOOS Phytoplankton EOVS (Essential Ocean Variable), which includes HABs,

http://goosocean.org/index.php?option=com_content&view=article&id=14&Itemid=114. Contact person: R. Kudela

4. Representation of the program at international events.

Information about GlobalHAB has been provided by:

- E. Berdalet at OCEANEXT: Interdisciplinary Conference, Nantes, France, 8-10 June 2016; "Multidisciplinary and coordinating initiatives to prevent and mitigate the impacts of HABs".

- P.T. Lim at the WESTPAC workshop on the development of a research strategy for HABs, Institute of Oceanography, Nha Trang, Vietnam, 19-21 Dec 2016, and at the IOC WESTPAC-HAB Workshop, 10th IOC WESTPAC Conference in Qingdao, China, from 17-20 April 2017.

- E. Berdalet, on behalf of the SSC, presented the Report of GlobalHAB Activities for the period 2015-2017 at the XIII Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, UNESCO, Paris, 3-5 May 2017. The program was positively welcome and very interesting feedback was received, which will contribute to the implementation of the program.

5. GEOHAB Synthesis Products

At the official end of GEOHAB, some synthesis products were still in progress and GlobalHAB has taken responsibility to see them completed. These products include the following:

5.1. A special issue published in *Oceanography* magazine (The Oceanographic Society) Volume 30, March 2017: <https://tos.org/oceanography/issue/volume-30-issue-01>

Title: *International Cooperation in Harmful Algal Blooms Science*

Guest Editors: Raphael Kudela, Henrik Enevoldsen and Ed Urban

Sponsors: Grant OCE-1243377 from the U.S. National Science Foundation to the Scientific Committee on Oceanic Research for GEOHAB activities; the Intergovernmental Oceanographic Commission of UNESCO; and the University of Copenhagen. Additional funds were provided by the Ida Benson Lynn Endowment, University of California Santa Cruz.



Papers:

[GEOHAB–The Global Ecology and Oceanography of Harmful Algal Blooms Program: Motivation, Goals, and Legacy](#)

Kudela, R.M., E. Berdalet, H. Enevoldsen, G. Pitcher, R. Raine, and E. Urban. 2017. GEOHAB–The Global Ecology and Oceanography of Harmful Algal Blooms Program: Motivation, goals, and legacy. *Oceanography* 30(1):12–21, <https://doi.org/10.5670/oceanog.2017.106>.

[Harmful Algal Blooms in Eastern Boundary Upwelling Systems: A GEOHAB Core Research Project](#)

Pitcher, G.C., A.B. Jiménez, R.M. Kudela, and B. Reguera. 2017. Harmful algal blooms in eastern boundary upwelling systems: A GEOHAB Core Research Project. *Oceanography* 30(1):22–35, <https://doi.org/10.5670/oceanog.2017.107>.

[Harmful Algal Blooms in Benthic Systems: Recent Progress and Future Research](#)

Berdalet, E., P.A. Tester, M. Chinain, S. Fraga, R. Lemée, W. Litaker, A. Penna, G. Usup, M. Vila, and A. Zingone. 2017. Harmful algal blooms in benthic systems: Recent progress and future research. *Oceanography* 30(1):36–45, <https://doi.org/10.5670/oceanog.2017.108>.

[Harmful Algal Blooms in Fjords, Coastal Embayments, and Stratified Systems: Recent Progress and Future Research](#)

Berdalet, E., M. Montresor, B. Reguera, S. Roy, H. Yamazaki, A. Cembella, and R. Raine. 2017. Harmful algal blooms in fjords, coastal embayments, and stratified systems: Recent progress and future research. *Oceanography* 30(1):46–57, <https://doi.org/10.5670/oceanog.2017.109>.

[Globally Changing Nutrient Loads and Harmful Algal Blooms: Recent Advances, New Paradigms, and Continuing Challenges](#)

Glibert, P.M., and M.A. Burford. 2017. Globally changing nutrient loads and harmful algal

blooms: Recent advances, new paradigms, and continuing challenges. *Oceanography* 30(1):58–69, <https://doi.org/10.5670/oceanog.2017.110>.

[GlobalHAB: A New Program to Promote International Research, Observations, and Modeling of Harmful Algal Blooms in Aquatic Systems](#)

Berdalet, E., R. Kudela, E. Urban, H. Enevoldsen, N.S. Banas, E. Bresnan, M. Burford, K. Davidson, C.J. Gobler, B. Karlson, P.T. Lim, L. Mackenzie, M. Montresor, V.L. Trainer, G. Usup, and K. Yin. 2017. GlobalHAB: A new program to promote international research, observations, and modeling of harmful algal blooms in aquatic systems. *Oceanography* 30(1):70–81, <https://doi.org/10.5670/oceanog.2017.111>.

5.2. A monograph on the application of Ocean Colour satellite techniques for the study of HABs. It is planned for publication in the *IOCCG Report* series. This book is the result of the collaboration between GEOHAB and the International Ocean Colour Coordination Group (IOCCG), with Steward Bernard, Raphael Kudela and Grant Pitcher as editors. The document will be structured around several representative case studies of HABs. Expected to be submitted to the printer in mid-2017.

5.3. A book published by Elsevier, under their *Ecological Studies* series.

Editors: Pat Glibert, Elisa Berdalet, Michele Burford, Grant Pitcher and Mingjiang Zhou.

Expected date of publication: Mid-2017 (to be send to the publisher in May 2017).

Chapters (updated list in March 2017):

	Chapter title	Authors
1	Preface	Glibert, Berdalet, Burford, Pitcher, Zhou
2	Harmful Algal Blooms: What they are, why they are harmful, where they are occurring, and the importance of understanding their ecology and oceanography	Glibert, Berdalet, Burford, Pitcher, Zhou
3	Introduction to the GEOHAB Program	Kudela, Berdalet, Enevoldsen, Pitcher, Raine, Urban
4	Harmful algal bloom expansion in concert with a sea of other global changes	Glibert et al.
5	Harmful algal blooms in a changing ocean	Wells and Karlson
6	The role of life cycle characteristics on harmful algal bloom dynamics	Azanza, Brosnahan, Anderson, Hense, Montresor
7	Mixotrophy in HABs: Who, When, Why, Web interactions, and What Next	Flynn, Mitra, Glibert, Burkholder
8	Nutrients and HABs: Resource availability, substrate ratios, dynamic kinetics and flexible nutrition	Glibert, Heil, Wilkerson, Dugdale
9	Key questions and recent advances on HABs in upwelling systems	Pitcher, Figueiras, Kudela, Moita, Reguera, Ruiz-Villareal
10	Key questions and recent advances on HABs in eutrophic systems	Glibert, Allen, Bouwman, Burford, Zhou
11	Key questions and recent advances on HABs in fjords and coastal embayments	Roy, Montresor And Cembella
12	Key questions and recent advances on HABs in stratified systems	Berdalet, Reguera, Yamazaki, Jenkinson, Raine

13	Key questions and recent advances on HABs in benthic systems	Berdalet and Tester
14	Overview of harmful algal blooms in Asia	Furuya, Iwataki, Lim, Lu, Azanza, Kim, Fukuyo
15	Harmful algal blooms in the coastal waters of China	Yu, Lu, And Liang
16	Green tides of the Yellow Sea: massive free-floating blooms of <i>Ulva prolifera</i>	Dongyan Liu, Mingjiang Zhou
17	<i>Noctiluca</i> blooms in the Arabian Sea and Gulf of Thailand	Goes et al.
18	Recent Advances in Modeling of Harmful Algal Blooms	Peter J.S. Franks
19	Advancements in observing systems, instrumentation and operational tools for HABs	Glibert et al.
20	Emerging HAB research issues in freshwater environments	Burford, Hamilton, Wood
21	Mitigation and Control of HABs	Zhiming Yu, Xiuxian Song, Xihua Cao, Yang Liu
22	GlobalHAB	Berdalet, Kudela, Urban, Enevoldsen, Banas, Bresnan, Burford, Davidson, Gobler, Karlson, Lim, Mackenzie, Montresor, Trainer, Usup, Yin