



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

### **Activities 2022-2023 and Plans for 2022-2025**

*July 21st, 2023*

#### **GlobalHAB Scientific Steering Committee members 2020-2021:**

Elisa Berdalet, Institute of Marine Sciences, CSIC, Spain, Chair  
Po Teen Lim, Institute of Ocean and Earth Sciences, University of Malaya, Kuala Lumpur, Malaysia, Vice-chair

Clarissa Anderson, Southern California Coastal Ocean Observing System, Scripps Institution of Oceanography, La Jolla, California, USA  
Neil S. Banas, University of Strathclyde, United Kingdom  
Jeong, Hae Jin, School of Earth and Environmental Science, College of Natural Sciences, Seoul National University, Seoul, South Korea  
Bengt Karlson, Swedish Meteorological and Hydrological Institute, Västra Frölunda, Sweden  
Malin Olofsson, Swedish University of Agricultural Sciences, Uppsala, Sweden  
Heather A. Raymond, Ohio State University, College of Food, Agricultural, and Environmental Sciences, Ohio, US  
Raffaele Siano, Ifremer, DYNECO Pelagos F-29280, Plouzané, France  
Susie Wood, Cawthron Institute, Nelson, New Zealand  
Aletta Yñiguez, Marine Science Institute, University of the Philippines, Diliman, Philippines

Dave Clarke, Marine Institute, Ireland, ICES representative (since 2020)  
Raphael Kudela, University of California, Santa Cruz, USA, liaison to GOOS Bio & Eco Panel (since 2017)  
Vera L. Trainer, National Oceanic and Atmospheric Administration, USA, ISSHA and PICES representative (since 2016)  
Philipp Hess, Ifremer, France, IPHAB representative (since 2023)  
Maggie Broadwater, US, IPHAB representative (since 2023)  
Joe Silke, Marine Institute, Ireland, IPHAB representative (2019-2023)  
Marc Suddleson, liaison to NOAA, US (since 2021)

Henrik Enevoldsen, IOC UNESCO, IOC Science and Communication Centre on Harmful Algae at the University of Copenhagen, Denmark (2016-  
Emily Twigg, Scientific Committee on Oceanic Research, USA (since 2023)  
Patricia Miloslavich, Scientific Committee on Oceanic Research, USA (2020-2023)  
Yun Sun, Junior Professional Officer, IOC Secretariat (2021-2023)



*The GlobalHAB Scientific Steering Committee (SSC) acknowledges the financial and logistic support received from SCOR and IOC during the 2022-2023 period.*

## 1. Meetings of the GlobalHAB SSC

The GlobalHAB SSC held monthly virtual meetings and email communications since the last in person meeting in Glasgow, Scotland, UK in May 13-14, 2022.

When writing this report the third partial renewal of the SSC is on its way expected to be completed in August 2023. Five SSC members step down: Neil Banas, Elisa Berdalet, Bengt Karlson, Po Teen Lim and Susie Wood. An open call for nominations and expression of interest was launched in February 2023 by IOC and SCOR. The term of the new SSC will last until December 2025, with possibility to continue beyond following the next rotation iteration. The members are expected to represent a diverse range of disciplines and their main objective will be to provide guidance on the scoping, implementation, and monitoring of the GlobalHAB Programme. The present SSC has been working on the selection and making contact with scientists to address the different GlobalHAB Themes, while ensuring a biogeographic and gender balance.

## 2. Science highlights in the 2022-2023 period

**2.1. Publication of the "FAO, IOC and IAEA. 2023. *Joint technical guidance for the implementation of early warning systems for harmful algal blooms*. Fisheries and Aquaculture Technical Paper No. 690. Rome, FAO. <https://doi.org/10.4060/cc4794en>", E. Garrido-Gamarro and K. Englander (eds.).**

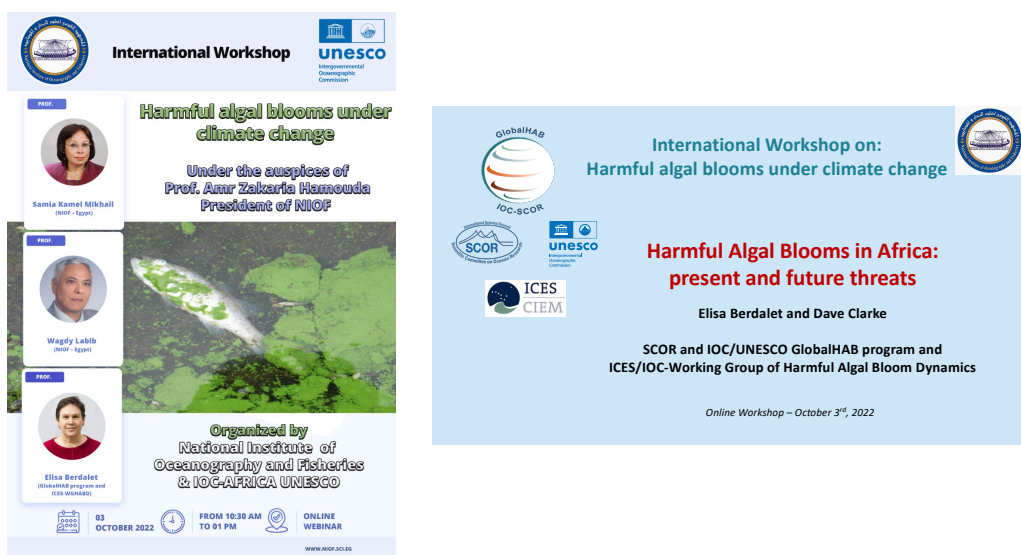


FAO took the lead in the development of a Joint FAO-IOC-IAEA Technical Guidance for the Implementation of Early Warning Systems for HABs. The document will guide competent authorities and relevant institutions involved in consumer protection or environmental monitoring to implement early warning systems for HABs present in their areas (marine and brackish waters), specifically for those affecting food safety or food security (benthic HABs, fish-killing HABs, pelagic toxic HABs, and cyanobacteria HABs).

Several members of the GlobalHAB SSC (Elisa Berdalet, Dave Clarke, Bengt Karlson, Marc Suddleson and Maggie Broadwater) participated as authors, and Henrik Enevoldsen was member of the Secretariat.

## 2.2. Communications about the GlobalHAB program at international scientific events:

\* **E. Berdalet and D. Clarke. October 3, 2022.** Participation in the International Workshop on Harmful Algal Blooms under Climate Change, National Institute of Oceanography and Fisheries (NIOF), Egypt, Hybrid meeting (<https://niof-eg.com/event/harmful-algal-blooms-under-climate-change/>).



\* **E. Berdalet. VI Congreso SOMEFAN, October 3-7, 2022.** Plenary lecture at the Mexican Society for the Studies on Harmful Algal Blooms (<https://www.somefan.org>). "Comprender los Florecimientos Algaes Nocivos y prevenir sus impactos para la protección del medio ambiente y la salud humana (*Understand Harmful Algal Blooms and prevent their impacts for the protection of the environment and human health*)". Review of the HAB events in Mexico and information about GlobalHAB and IOC-UNESCO HAB related activities.

\* **R. Kudela and B. Karlson. JERICO workshop 22-26 May 2023.** A five-day workshop was held focused on *Automated observations of phytoplankton using imaging in flow methods*. The workshop was open to JERICO participants and for other interested scientists involved in Ferrybox (ships of opportunity) and ocean observatories. Bengt Karlson was one of the conveners, while Raphael Kudela presented remotely. Kudela presented twice: "The USA Network N-HABON", and "The IFCB System in California". This was a follow-on from Item 3.2, the GlobalHAB sponsored workshop in Sweden.

## 3. New GlobalHAB activities implemented in 2022-2023

Several activities were implemented by the GlobalHAB program for the 2022-2023 period.

### 3.1. Continuation of the 9-12 May 2022, "[Modeling and prediction of harmful algal blooms, from event response to multi-decadal projections](#)"

The GlobalHAB/Euro Marine Workshop was held on 9-12 May 2022, University of Strathclyde, Glasgow, UK. The workshop was supported by GlobalHAB, NOAA's [National Centers for](#)



[Coastal Ocean Science \(NCCOS\) Competitive Research Program \(CRP\)](#), NOAA's [Integrated Ocean Observing System \(IOOS\)](#), and [EuroMarine](#), and more information was provided in the 2022 Report.

As a continuation of this workshop, the organizers led a session at the ASLO Aquatic Sciences Meeting 2023, held in Palma de Mallorca, Spain, 4-9 June: **SS121 Combining Machine Learning and Process-Based Models in Ecological Prediction**

Neil Banas, University of Strathclyde ([neil.banas@strath.ac.uk](mailto:neil.banas@strath.ac.uk))

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Clarissa Anderson, Scripps Institution of Oceanography / SCCOOS ([cra002@ucsd.edu](mailto:cra002@ucsd.edu))

Rafael Marcé, Catalan Institute for Water Research (ICRA) ([rmarce@icra.cat](mailto:rmarce@icra.cat))

### 3.2. Outcome of the August 22 - 26, 2022, [Mini-symposium on automated \*in situ\* observations of plankton](#), hosted at Kristineberg Marine Research Station, Sweden.

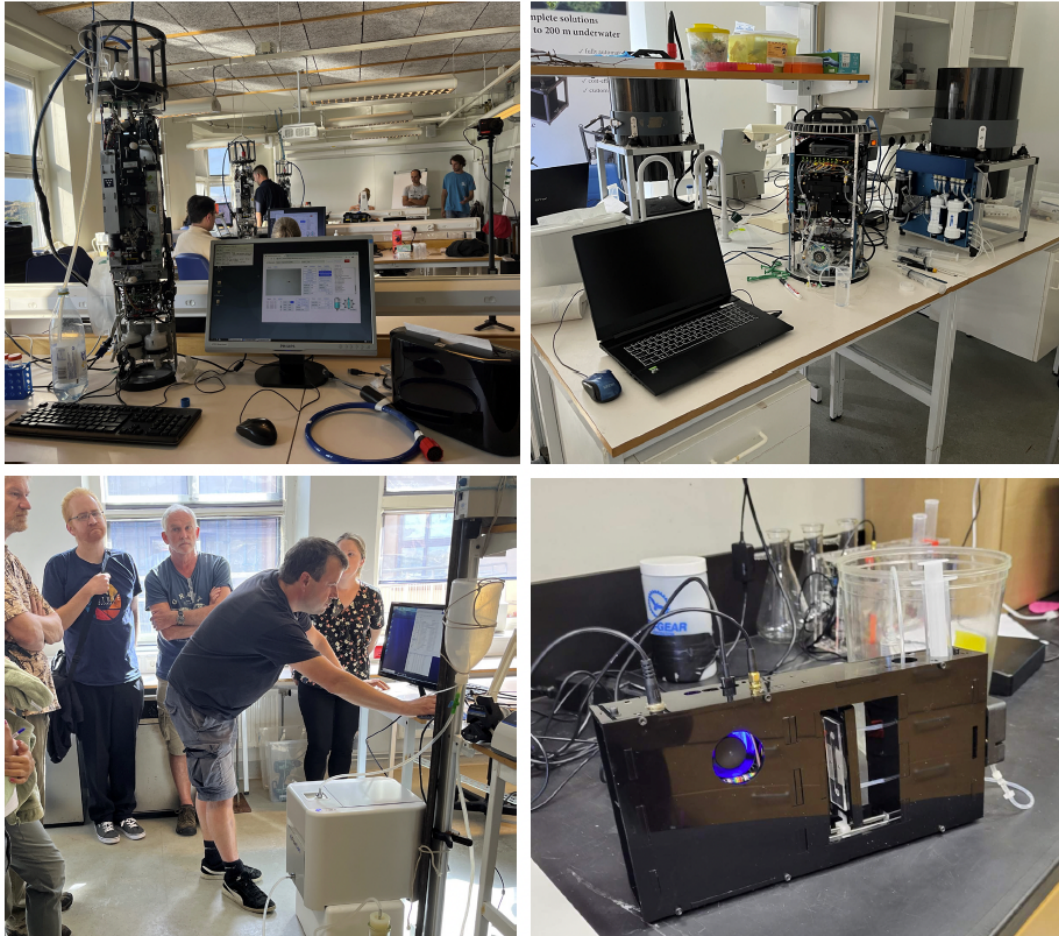
This mini-symposium aimed to bring together experts on, and users of, automated *in situ* imaging systems to present methods and recent results, and to share experiences. Another aim was to carry out a comparison of results when analysing plankton communities quantitatively. Early career scientists were particularly encouraged to attend the symposium.



*Participants of the GlobalHAB mini-symposium on automated plankton observations*

Part of the symposium was available on line, and presentations were made by participants not on-site. After the activity, most of the presentations were made available as pdf's on the GlobalHAB web site <http://www.globalhab.info/activities>.

A summary of the mini-symposium conclusions was published in [Harmful Algal News 71, December 2022](#).



*Instruments used in the mini-symposium: Three Imaging FlowCytobot's (IFCB's) (top left) and two Cytosense/Cytobuoy's (top right), with their water proof housing removed during laboratory work, and the FlowCam 8400 (bottom left) and one FlowCam Macro (not shown) were used during the mini-symposium. The FlowCam Macro is shown in the photo. Bottom right: A PlanktoScope built by Maci Wigginton at Ocean & Earth Sciences, Old Dominion University. Source: [www.planktoscope.org](http://www.planktoscope.org). Image published in Fig. 3 of HAN 71, 2022.*

**3.3. Research on *Sargassum* Influxes.** Since the launch of GlobalHAB in 2016, *Sargassum* influxes were considered an emerging HAB case and a GlobalHAB Subcommittee was established to identify, in collaboration with the international community, the main research questions to understand the population dynamics of *Sargassum*.

GlobalHAB in collaboration with GESAMP and the EuroSea European project, is working on the elaboration of a White Paper on current fundamental scientific understanding of *Sargassum* population dynamics and research gaps to complement the UNEP “SARGASSUM WHITE PAPER: Turning the crisis into an opportunity” (<https://www.unep.org/cep/resources/publication/sargassum-white-paper-turning-crisis-opportunity>). The White Paper is intended to provide valuable support and scientific input for the growing programmes of work sargassum monitoring and management. This information will form the base for policy instruments and tools which deal with sargassum management.





It will describe the State of Art of fundamental scientific research on this recent sargassum bloom.

An open IOC-SCOR GlobalHAB call for a consultancy to lead the White Paper in collaboration with the GlobalHAB *Sargassum* Subcommittee and GESAMP was launched in November 2022. The selected applicant, Dr Shelly-Ann Cox, elaborated two progress reports on April and May 2023, and the final document is expected to be delivered by end of July 2023.

### 3.4. A quantitative PCR (qPCR) workshop.

The activity, organized by Raffaele Siano, aims to foster the integration and the application qPCR/dPCR methodologies to improve HAB monitoring and to develop early risk alert systems. Four virtual workshops have been conducted during the last year by international experts on application of these molecular tools on HAB research and monitoring. After this preparatory work, the experts will held an in person workshop in Hiroshima (Japan) on November 3-5, 2023, prior to the International Conference on Harmful Algae ([ICHA2023](#), November 5-10, 2023). The aims of this last workshop are:

- 1) compare and contrast qPCR/dPCR methods in the context of all eDNA approaches,
- 2) establish how and to what extent qPCR/dPCR could be used in monitoring of HABs considering the limits of the methods,
- 3) select target species to be monitored with qPCR at a global scale,
- 4) agree on common protocols adapted to HAB monitoring systems, and
- 5) identify gaps and expand on existing international guidelines.

At the ICHA2023, the first results of the workshop will be presented and discussed in order to gain consensus for the initiative.

Note that this activity was presented in the GlobalHAB Report to SCOR in 2022. Although initially planned to be held in China or Malaysia, holding it back to back with the ICH2023 was found the most convenient in terms of carbon foot print, cost and travelling time.

### 3.5. GlobalHAB International Workshop on Solutions to Control HABs in Marine and Estuarine Waters

The workshop, that builds on lessons learned from freshwater HAB control, will be held within the [PICES conference](#) in Seattle, October 27, 2023:



#### W3: TCODE/MEQ Topic Workshop GlobalHAB International Workshop on Solutions to Control HABs in Marine and Estuarine Waters

##### Co-sponsors:

[GlobalHAB](#), [NOWPAP](#), [SCOR](#)

##### Duration:

1.5 day

##### Convenors:

Vera Trainer (USA), *corresponding*  
Quay Dortch (USA)  
Marc Suddleson (USA)  
Pengbin Wang (China)  
Natsuko Nakayama (Japan)  
Don Anderson (USA)  
Mark Wells (USA)  
Heather Raymond (USA)  
Hae Jin Jeong (Korea)  
H. Dail Laughinghouse (USA)

##### Invited Speakers:

[Nobuharu Inaba](#)

(Chemicals Evaluation and Research Institute, Japan)

[Jorge Mardones](#)

(Center for Harmful Algal Studies, Instituto de Fomento Pesquero, Chile)

[Tae Gyu Park](#)

(National Institute of Fisheries Science (NIFS), Korea)

[Kaytee Pokrzywinski](#)

(HAB Forecasting Branch, NOAA, USA)

[Heather Raymond](#)

(College of Food Agricultural and Environmental Sciences, Ohio State University, USA)

[Zhiming Yu](#)

(Key Laboratory of Marine Ecology & Environmental Sciences, Institute of Oceanology, Chinese Academy of Sciences (IOCAS), China)

The workshop will focus on control efforts on the organisms themselves, either killing them or removing cells and/or toxins from the water, not in prevention or mitigation. The international workshop will engage participants with expertise in research, development, and implementation of promising estuarine and marine HAB control approaches. Participation of early career ocean professionals and scientists from under-represented communities is encouraged. Participants will discuss technical, environmental compliance and public perception challenges and explore solutions to these common barriers. In depth discussions of existing control methods and strategies used in different regions/countries will be fostered. The workshop findings will summarize the worldwide approaches in HAB control as

a scientific report or as a collection of papers in a special issue of the journal *Harmful Algae*.

### 3.6. White Paper on *Fish-Killing Algal Blooms and Ichthyotoxins: Prevention, Mitigation and Control*.

This document is now under revision and it will be presented at the International Conference on Harmful Algae ([ICHA2023, November 5-10, 2023](#)). This is the outcome of the "Advanced International Colloquium and Technical Workshop", held in October 8-11, 2019 in Puerto Varas, Chile, under the auspices of IOC-IPHAB and GlobalHAB, with the support of the government of Chile through CORFO and collaboration of CREAN-IFOP. Ten invited participants (D.M. Anderson, A.D. Cembella -WG chair-, O. Espinosa, L. Guzman, G.M. Hallegraeff, P.J. Hansen -acting chair-, H. Hégaret, T.O. Larsen, J. Mardones, M. Iwataki, L. MacKenzie) reviewed state-of-knowledge and addressed gaps in knowledge to develop strategies for technological and scientific approaches to mitigate impacts of fish killing algal blooms.



**Venue: Puerto Varas, Chile**  
**Dates: 8th – 11th October, 2019**

The workshop included closed sessions with presentations and discussions within the participants group, and an Open session with public from the area and offered in streaming as well. A white paper, , with the outcomes of the workshop is under process.

## 4. GlobalHAB contribution to the IOC HAB program

**4.1. Participation in the Sixteenth Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms. March 27-29, 2023.** E. Berdalet represented GlobalHAB at the IPHAB meeting. The 2021-2023 GlobalHAB Report to IOC was shown with Dave Clarke, Bengt Karlson and Mark Wells who provided details of some of the activities conducted by GlobalHAB in that period.

During the meeting the IOC FAO IPHAB, analyzed the role and tasks related to international research on HABs. IOHAB recognized that *"to fully realize the benefits of the accumulated investments in GlobalHAB and to continue to have an international programme focusing the HAB research agenda, it is desirable to revisit and revise the HAB research priorities for the time beyond 2025"*.

Thus, IPHAB requested the IOC-SCOR GlobalHAB Scientific Steering Committee to:

- i) review the GlobalHAB Science and Implementation Plan with a view to present to IPHAB-XVII what it recommends as the main elements of an international HAB research programme after 2025 focusing on understanding HABs in the context of global sustainability;
- ii) assess the ideal organization of and partnerships for such an international research program after 2025;
- iii) recommend to IPHAB-XVII whether an international HAB research programme after 2025 should be as a continuation under the name GlobalHAB or under a new name.

*This request will be assumed by the new GlobalHAB SSC and addressed in the following period.*



**4.2. Collaboration with the Harmful Algal Bloom Solutions (HAB-S) Programme.** This is a proposed action for the UN Decade of Ocean Science for Sustainable Development by the IOC-FAO IHAB, that was presented at the Thirty-second Session of the Assembly of the Intergovernmental Oceanographic Commission (UNESCO) in Paris, June 22, 2023. The key elements of HAB-S were highlighted in the session "Shaping Our Future Ocean: The IOC/UNESCO contribution to the Ocean Decade. GlobalHAB will be a HAB-S partner.



## The Harmful Algal Bloom Solutions Programme HAB-S

A Proposed Action for the UN Decade of Ocean Science for Sustainable Development  
Led by the FAO-IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB)



Food and Agriculture  
Organization of the  
United Nations



unesco

Intergovernmental  
Oceanographic  
Commission



NCCOS | NATIONAL CENTERS FOR  
COASTAL OCEAN SCIENCE

### ***5. New GlobalHAB activities to be implemented in 2023-2025. Funding considerations and future funding plans***

When this report is delivered, funds from SCOR have been used in all planned activities until 2023, described in this and former documents.

The GlobalHAB SSC will analyze potential activities contributing to the implementation of the programme in 2025, and seek for the necessary funds.