



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

Activities 2020-2021 and Plans for 2021-2022

July 3rd, 2021

GlobalHAB Scientific Steering Committee members 2020-2021:

Elisa Berdalet, Institute of Marine Sciences, CSIC, Spain, 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

Tim Davis, Bowling Green State University, Bowling Gree, Ohio, USA

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

Po Teen Lim, Institute of Ocean and Earth Sciences, University of Malaya, Kuala
Lumpur, Malaysia

Raffaele Siano, Ifremer, DYNECO Pelagos F-29280, Plouzané, France

Susan Wood, Cawthron Institute, Nelson, New Zealand

Aletta Yñiguez, Marine Science Institute, University of the Philippines, Diliman,
Philippines

Dave Clarke, Marine Institute, Ireland, ICES representative after April 2020

Raphael Kudela, University of California, Santa Cruz, USA, GOOS Bio & Eco Panel

Vera L. Trainer, National Oceanic and Atmospheric Administration, USA, ISSHA and
PICES representative (2016-ongoing)

Joe Silke, Marine Institute, Ireland, IPHAB representative (2019-2023)

Henrik Enevoldsen, IOC UNESCO, IOC Science and Communication Centre on
Harmful Algae at the University of Copenhagen, Denmark (2016-

Patricia Miloslavich, Scientific Committee on Oceanic Research, USA (2020-)

The GlobalHAB Scientific Steering Committee (SSC) acknowledges the financial and logistic support received from SCOR and IOC during the 2020-2021 period and for the activities postponed to 2022 due to the Covid-19 pandemics.



Top, left: *Noctiluca scintillans* bloom, Salt Spring Island, May, 2 2018; photo credit: Michael Bahrey, "Citizen Science Program in the Strait of Georgia, Canada", a GlobalHAB endorsed project. Top, right: Sea turtle nests threatened by *Sargassum* influxes in the coast of Africa; photo credit: Ester Serrao. Bottom: degraded coral reefs, an habitat susceptible to the occurrence of benthic harmful algal blooms; photo credit: Po Teen Lim.

1. Meetings of the GlobalHAB SSC

The partial renovation took place on May 2020. It was conducted virtually due to the Covid-19 pandemic. Since then, all the communication has been conducted by email and virtual meetings.

2. Science highlights in the 2020-2021 period

2.1. Communications about the GlobalHAB program at international scientific events:

* Representation of GlobalHAB at the "Monaco International Symposium "Human Health & The Ocean in a Changing World", by Elisa Berdalet on behalf of the GlobalHAB SSC

E. Berdalet, C. Anderson, N. Banas, D. Clarke, T. Davis, H. Enevoldsen, H. J. Jeong, B. Karlson, R. M. Kudela, P. T. Lim, P. Miloslavich, R. Siano, J. Silke, V. Trainer, S. Wood, A. Yñiguez. "GlobalHAB (IOC-UNESCO and SCOR): International coordination to assess and minimize the risks of harmful algal blooms impacts to human health.", 3/12/2020, Monaco, virtual meeting.



* E. Berdalet, C. Anderson, N. Banas, D. Clarke, T. Davis, H. J. Jeong, B. Karlson, R. M. Kudela, B. Lapointe, P. T. Lim, J.E. Martinelli Filho, E. Serrao, R. Siano, J. Silke, V. Trainer, B. van Tussenbroek, S. Wood, A. Yñiguez, P. Miloslavich, H. Enevoldsen. " GlobalHAB (IOC-UNESCO and SCOR): Latinamerica contribution to the International coordination for sound knowledge of HABs and management of their impacts.", 12th International Phycological Congress, 22-26 March 2021, Chile (virtual meeting), Keynote lecture.

* E. Berdalet. Taller de Trabajo Grupo ANCA IOCARIBE. Virtual meeting, March 3, 2021. Presentation of the GlobalHAB program with specific focus on the scientific questions concerning HABs in Latinamerica.



2.2. PICES Report

In October 2019, the international workshop “*Evaluating, reducing and mitigating the cost of harmful algal blooms: a compendium of case studies*”, was held in Victoria, British Columbia, Canada as part of the Annual Meeting of the North Pacific Marine Science Organization (PICES), with the co-sponsorship of GlobalHAB. The outcomes of that meeting are presented in the PICES Report:

Trainer, V. L. (2020) (Ed.). "*GlobalHAB: Evaluating, Reducing and Mitigating the Cost of Harmful Algal Blooms, a Compendium of Case Studies.*" PICES Sci. Rep. 59. ISBN 978-1-927797-40-2 / ISSN 1198-273X. It includes 8 chapters:

Chapter 1. *GlobalHAB Workshop: Evaluating, Reducing and Mitigating the Cost of Harmful Algal Blooms, a Compendium of Case Studies. Introduction.* V. L. Trainer, K. Davidson, K. Wakita, E. Berdalet, M. Suddleson, G. Myre, D. Trethewey.

Chapter 2. *Evaluating the economic impacts of harmful algal blooms: Issues, methods, and examples.* D. Jin, S. Moore, D. Holland, L. Anderson, W.-A. Lim, S. Jardine, S. Martino, F. Gianella, D.-H Kim.

Chapter 3. *Situation, Management and Economic Impacts of Cochlodinium in Korea*. W.-A. Lim, D. Kim, K. Wakita.

Chapter 4. *An economic assessment of ciguatera outbreaks – an island model*. C. Trick, L. Anderson, E. Berdalet, W.P. Cochlan, P. Wang, M.L. Wells.

Chapter 6. *Estimating and mitigating the economic costs of Harmful Algal Blooms (HABs) on commercial and recreational shellfish harvesters*. J. Mardones, D.S. Holland, L. Anderson, V. LeBihan, f. Gianella, A. Clement, V.L. Trainer.

Chapter 7. *The economic impacts of harmful algal blooms on salmon cage aquaculture*. K. Davidson, S.L. Jardine, S. Martino, G. Myre, L.E. Peck, R.N. Raymond, J. J. West.

Chapter 8. *Commonalities and Summary recommendations*. V. Trainer, R. Kudela, T. Yoshida, V. LeBihan, W. Cochlan, W.-A. Lim, D.-H. Kim, et al.



2.3. Global Harmful Algal Bloom Status Report

The first Global HAB Status Report is an initiative of IOC UNESCO with the support of IAEA, ICES, PICES and ISSHA. The GlobalHAB SSC followed and supported the initiative. In order to develop and launch the first Global HAB Status Report a network of data providers for OBIS-HAB and HAEDAT was established and an Editorial Team for the First Global HAB Status Report was established together with a data flow structure. A data compilation template for HAB data in OBIS was developed and reviewed and is in use (https://github.com/iobis/habtemplate/blob/master/habtemplate_a_v4.xlsx). This will allow to complement, and add value to data already in OBIS with baseline observations recorded in the literature. Data compilation, upgrade and adjustments to the data systems (HAEDAT as well as the OBIS-HAB data entry template) were conducted and additionally, the Editorial Team for the GHSR developed the outline of the GHSR and chapters were finalized in June 2021. Regional summaries on HAB based on OBIS, HAEDAT and the literature constitute a special issue of the [Elsevier Journal Harmful Algae in 2021](#), *Global Harmful Algal Bloom Status Reporting*, H. Enevoldsen, G. Hallegraeff, A. Zingone (eds.), Harmful Algae Vol. 102, including 13 papers. Currently, a new data portal for HAEDAT is in development (<http://dev.iobis.org/haedat/>).

2.4. March 2018 to October 2020. E. Berdalet has been participating, in representation of GlobalHAB, at the CLEFSA project activities "*Emerging threats on human health in Europe due to climate change*". CLEFSA was a project of the European Food Safety Agency (EFSA) that explored the risks of food intoxication in future climate change scenarios. CLEFSA included aquatic biotoxins in the European landscape. E. Berdalet collaborated in the analysis through online communication and attendance to the first meeting (April 2018, funded by GlobalHAB). The final Report (<https://efsa.onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2020.EN-1881>) was finished on June 2020 and presented virtually on October 8th, 2020. Information about

this study was provided at the *Harmful Algal News 65*, 17-18 (Figure 1 in HAN 65 is shown below).

CLEFSA project identifies Harmful Algal Blooms as a threat to food safety resulting from climate change



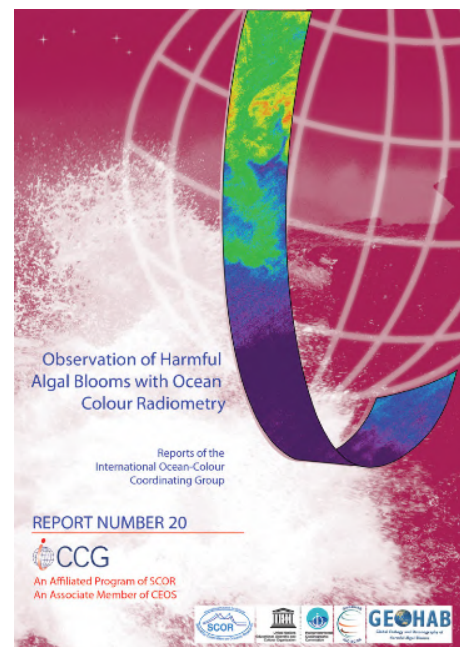
Fig. 1. Organizations involved in the CLEFSA project

2.5. Observation of Harmful Algal Blooms with Ocean Colour Radiometry, Edited by: Stewart Bernard, Raphael Kudela, Lisl Robertson Lain and Grant Pitcher

The IOCCG/GlobalHAB report (#20) IOCCG Report Number 20, 2021 was finished on April 2021 (<https://ioccg.org>).

The report is also available through Ocean Best Practices using the doi: <http://dx.doi.org/10.25607/OBP-1042>.

The Second Institute of Oceanography (China) has kindly offered to print hardcopies of the report. To request a copy of the report, please complete the form at: <https://ioccg.org/form-ioccg-report-20/> .



3. New activities to be implemented in 2021-2022

Several activities had been planned for the 2020-2021 period, which, unfortunately were postponed due to the Covid19 pandemics. When submitting this report, the following activities have been rescheduled.

- June 2021 - November 2021. GlobalHAB Webinar Series - Modelling and Prediction of Harmful Algal Blooms

In June 2021, an online series of open seminars and discussions have started to address the grand challenge of predicting harmful algal blooms. This monthly series will be delivered by six experts and the topics will cover size-based models, acclimation models, model validation, and machine learning etc. The detailed schedule is listed below.

Date	Time	Speaker	Title
29 June 2021	9 am US Western = 12 pm US Eastern = 5 pm UK = 12 am China	Jim Cloern	Phytoplankton Community Variability: Some Rules and Rule Breakers
15 July 2021	9 am US Western = 12 pm US Eastern = 5 pm UK = 12 am China	Androniki Tamvakis	Using Machine Learning algorithms for HAB prediction
31 Aug 2021	5 am US Western = 8 am US Eastern = 1 pm UK = 8 pm China	Aletta Yniguez	Using the individual-based approach for HAB modelling: from HAB species to shellfish toxicity
20 Oct 2021	9 am US Western = 12 pm US Eastern = 5 pm UK = 12 am China	Michael Parsons	Modeling considerations for benthic HABs
3 Nov 2021	9 am US Western = 12 pm US Eastern = 5 pm UK = 1 am China	Onur Kerimoglu	Accounting for flexible phytoplankton physiology, and relevance to modelling HABs
16 Nov 2021	9 am US Western = 12 pm US Eastern = 5 pm UK = 1 am China	Rick Stumpf	Making Useful Models for Forecasting Harmful Algal Blooms

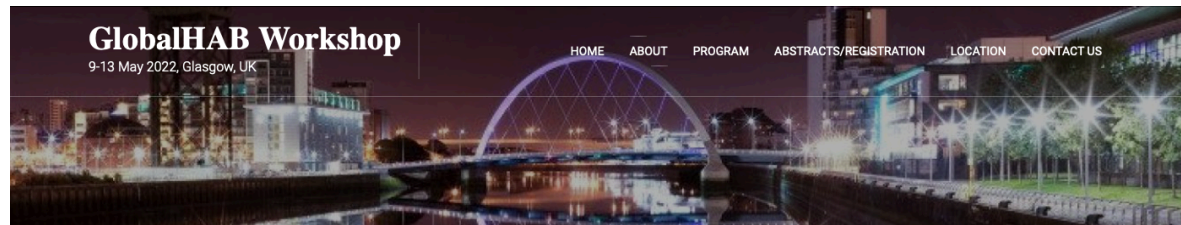
- 9-13 May 2022. "Modelling and prediction of harmful algal blooms, from event response to multi-decadal projections"

A 4-day workshop is planned to be held in Glasgow, UK. The organising committee consists of Neil Banas, David McKee, Bingzhang Chen, Paul Udom (University of Strathclyde), Clarissa Anderson (Scripps / SCCOOS), Dave Clarke (Marine Institute), Alette Yniguez (University of Philippines), Bengt Karlson (Swedish Meteorological and Hydrological Institute), Keith Davidson, Dmitri Aleynik (Scottish Association of Marine Science), and Dennis McGillicuddy (Woods Hole Oceanographic Institution), and is also coordinating with Katja Fennel and Marion Gehlen, chairs of the Marine Ecosystem Analysis and Prediction Task Team (MEAP-TT) of the GODAE OceanView programme.

Prediction of harmful algal blooms is a grand challenge that requires multidisciplinary dialogue among physical scientists, biologists, computer modellers, and technologists, as well as community stakeholders and the government and industry end-users of prediction systems. **This 4-day workshop will combine oral and poster presentations, round-table discussions, and tutorials** in order to

- 1) increase awareness of the range of modelling and observational tools that are in our community toolbox (or should be);
- 2) help the HAB community speak with one voice regarding climate-change impacts on the global ocean;
- 3) help scientists and technologists develop creative approaches to meeting the needs of coastal communities, governments, and industry worldwide.

The workshop is a project of [GlobalHAB](#), with support from NOAA's [National Centers for Coastal Ocean Science \(NCCOS\) Competitive Research Program \(CRP\)](#), NOAA's [Integrated Ocean Observing System \(IOOS\)](#), and [EuroMarine](#).



This workshop was postponed from May 2020 because of Covid-19. The online series of open seminars and discussions on the same topic described above are being used as an opportunity to generate ideas and organise preliminary working groups for the in-person meeting, via a Slack site that already has 142 registered members.

- **June 13 - 18, 2022.** A *Mini-symposium on automated in situ observations of plankton*, is planned to be hosted at Kristineberg Marine Research Station, Sweden.

In recent years novel in situ instrumentation has been developed for automated high frequency HAB detection in near real time. Also instruments for observing grazers, e.g. microzooplankton and multicellular zooplankton are becoming available commercially. These instruments are now being adopted in research and also in monitoring programmes. The aim of the mini-symposium is to bring together experts on, and users of, in automated in situ imaging systems, novel sampling equipment etc. to present methods, recent results and to share experiences. Another aim is to carry out a comparison of results when analysing plankton communities quantitatively. Young scientists is one target group of the symposium. After the main symposium a young scientist's data workshop for data processing and report/article writing is planned. The organizers secured enough funds from different institutions, including co-fund from GlobalHAB.

Venue

Kristineberg Marine Research Station, Fiskebäckskil, Sweden
This well-equipped field station is located at the mouth of the Gullmar fjord on the Swedish west coast, adjacent to the North Sea. More information is available at:



<https://mi.gu.se/kristineberg-marina-forskningsstation> (select English in menu)

Information is shown at:

<http://www.globalhab.info/activities/globalhab-activities>

The Mini-symposium was initially planned for on June 1-6, 2020, but was postponed because of disruption caused by Covid-19.

- **2021.** The "Best Practice Guidelines for the Study of HABs and Climate Change", editorial team constituted by Mark Wells (chair), Michele Burford, Anke Kremp, Marina Montresor, Grant Pitcher and Gires Usup, is going to be finished soon. The document has been externally reviewed and it is under the formatting stage. It will be open to the international community to provide inputs for a certain period of time. It includes 6 chapters:

The Manual includes the following chapters:

Introduction (Editorial Board)

Chapter 1 - Observing changes in HABs over time — Long Term Observations (Richardson AJ, Eriksen R, Hallegraef GM, Rochester W, Pitcher GC, Burford M)

Chapter 2 - HABs under global change: Experimental conditions and approaches (Van de Waal DB, Bach L, Berdalet E, Brandenburg KM, Suikkanen S, Wohlrab S, Hansen PJ, Krem A)

Chapter 3. HABs under global change: Experimental conditions and approaches (Hennon G, Seftom J, Schaum E, Dyhrman S, Godhe A)

Chapter 4. Databases for the study of harmful algae, their global distribution and their trends (Zingone A, Escalera L, Bresnan E, Enevoldsen H, Provoost P, Richardson A, Hallegraef G)

Chapter 5 - Understanding Responses of HAB Species to climate change through experimentation (Dyhrman S, Godhe A, Hennon G, Seftom J)

Chapter 6 - Future Perspectives in Modeling Harmful Algal Bloom (HAB) responses to Climate Change (Hense I, Anderson CR, Hamilton D, Chapra S)

Funds for the working meeting of the editorial team to start the organization of the Manual in April 2018 were provided by GlobalHAB. The final edition is receiving the support of IOC. The initiative of the Best Practices Manual for HAB and Climate Change is in line with the activities of SCOR WG149 that is focusing on Changing Ocean Biological Systems (COBS) and particularly on "How will biota respond to a changing ocean?" (<https://scor149-ocean.com/>).

- **Spring 2022. Open Science Meeting (OSM) on *Sargassum* Influxes.** This OSM is aimed to identify the main research questions to understand the population dynamics of *Sargassum*. GlobalHAB constituted a *Sargassum* subcommittee to organise this OSM. The new theme and the subcommittee were announced in [Harmful Algal News 66, p.11 December 2020](#) (New GlobalHAB Theme: *Sargassum* blooms, by E. Berdalet and H. Enevoldsen). Initially planned for May 2020, it was postponed due to the Covid19 pandemics. It will be hosted by Universidad

Autónoma Nacional de México (UNAM) and it is co-organized by GlobalHAB, GESAMP, the EuroSea European project, and other entities investigating *Sargassum* arrivals. New information will be shown soon at the GlobalHAB site.

Meanwhile, a note was also submitted to [HAN 66, by Brian Lapointe](#) (member of the *Sargassum* Subcommittee): "The recurring Great Atlantic *Sargassum* belt impacts the Caribbean and South Florida".

Harmful Algae News

AN IOC NEWSLETTER ON TOXIC ALGAE AND ALGAL BLOOMS
No. 66 - December 2020 · www.ioc-unesco.org/hab

The Recurring Great Atlantic *Sargassum* Belt Impacts the Caribbean and South Florida

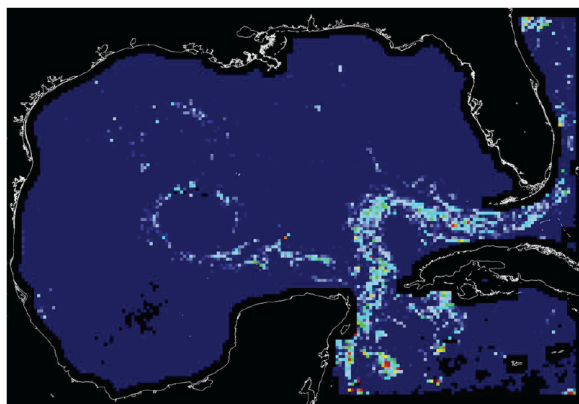


Fig. 1. MODIS satellite image of *Sargassum* transport from the Caribbean through the Yucatan Channel and into the Loop Current and Florida Current on July 16, 2020

 United Nations Educational, Scientific and Cultural Organization	 Intergovernmental Oceanographic Commission
Content	
Featured article: The Recurring Great Atlantic <i>Sargassum</i> Belt (by Brian Lapointe) 1	
Benthic HABs Ciguatera event from imported reef fish in New Zealand 4 1 st report of <i>Ostreopsis</i> in a tropical lagoon in the Gulf of Guinea 6	
Other HAB impacts Monetary impact of toxic <i>Dinophysis</i> spp. on Scottish shellfish farms 8 Bloom of <i>Cylindrotheca closterium</i> in SE Gulf of Mexico 10	
Networking and Science Communication New GlobalHAB Theme: <i>Sargassum</i> Blooms 11	

Also, the GlobalHAB *Sargassum* subcommittee has participated and contributed to the organization of a UNEP-GPMN series of webinars to progress on the scientific needs and opportunities to address the problems associated to *Sargassum* blooms. The webinars series highlighted the diversity of entities and researchers working on different aspects of *Sargassum*, as it can be noticed in the titles of the five webinars. The information from these webinars will be used to organize the OSM.

- 26 May 2020. *Sargassum* in the Caribbean and West Africa: Key Challenges, Responses and Collaboration
- 21 July 2020. The Science of *Sargassum*
- 22 September 2020. *Sargassum* challenges, responses, and collaboration in West Africa
- 30 November 2020. *Sargassum* in the Wider Caribbean Region - Challenges, responses, and synergies
- 10 June 2021. The *Sargassum* Challenge: Opportunities for collaboration between West Africa and the Wider Caribbean Region

SARGASSUM WEBINAR SERIES

A joint series by UNEP, IOC UNESCO, GESAMP, GlobalHAB-IOC-SCOR

Second Webinar: The Science of Sargassum Agenda

Tuesday 21 July 2020

East Africa: 17:00-19:00|West Africa: 15:00-17:00|Jamaica: 09:00-11:00

Time (Kenya time)	Agenda item	Discussant/Facilitator
17:00-17:10	Welcome Remarks	<ul style="list-style-type: none">• UNEP: UNEP Chief Scientist/Director Science Division• IOC-UNESCO: César Toro (IOCCARIBE)• <i>Facilitator</i>: Mahesh Pradan Ecosystems Division-GPA, UNEP
17:10-17:30	Part 1: Biology and impact of pelagic sargassum species	<ul style="list-style-type: none">• Brigitta van Tussenbroek (UNAM)• <i>Facilitator</i>: Joana Akrofi, Science Division, UNEP
17:30-17:50	Part 2: Monitoring sargassum from space	<ul style="list-style-type: none">• Mengqui Wang (USF)• <i>Facilitator</i>: Joana Akrofi, Science Division, UNEP
17:50-18:10	Part 3: Turning a hazard into an opportunity: commercialization of sargassum in the Caribbean	<ul style="list-style-type: none">• Anne Desrochers, UWI-CERMES, FAO-CC4FISH.• <i>Facilitator</i>: Joana Akrofi, Science Division, UNEP
18:10-18:45	Interactive Discussions Q & A	<ul style="list-style-type: none">• <i>Facilitator</i>: Peter Kershaw (GESAMP)
18:45- 19:00	Conclusions & Way forward/White paper on Sargassum Science	<ul style="list-style-type: none">• César Toro (IOC-UNESCO)• Elisa Berdalet, GlobalHAB -IOC-SCOR• Joana Akrofi UNEP, Science, Division

4. Revision of the endorsed projects

With the support of Ms Sun Yun, GlobalHAB contacted all the endorsed projects to update their information indicating their achievements by March 2021 as [shown in the GlobalHAB webpage](#).

GlobalHAB acknowledges the contributions of the endorsed project to the implementation of the GlobalHAB scientific objectives, and encourages new endorsements.

5. Funding considerations and future funding plans

The GlobalHAB activities that required physical meetings have been postponed due to the Covid19 pandemic. SCOR authorized GlobalHAB to use the remaining funds, 33000 USD in 2021-2022. This extension will allow conducting the planned activities and produce the scientific outcomes papers, new knowledge, training and coordination to implement the GlobalHAB science plan.

Similarly, GlobaHAB got permission to use the funds until 2024 from NOAA's National Centers for Coastal Ocean Science (NCCOS) Competitive Research Program (CRP) via the US National HAB Office through the IOC Science and Communication Centre on Harmful Algae at University of Copenhagen, Denmark, for the postponed activities due to the Covid'19.