



# GlobalHAB

International coordination to ascertain the effects of Climate Change on the occurrence of Harmful Algal Blooms

Raphael Kudela, Elisa Berdalet, and the GlobalHAB SSC



United Nations  
Educational, Scientific and  
Cultural Organization



Intergovernmental  
Oceanographic  
Commission



# GlobalHAB & Partners



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Keith Davidson – Ex-officio

Henrik Enevoldsen - IOC/UNESCO

Ed Urban - SCOR



# Why GlobalHAB?



The overall **Goal of GlobalHAB** is to improve understanding and prediction of HABs in aquatic ecosystems, and management and mitigation of their impacts.

**The Mission of GlobalHAB** includes the following elements:

- Foster international coordination and co-operative research to address the scientific and societal challenges of HABs, including the environmental, human health and economic impacts, in a rapidly changing world.
- Serve as a liaison between the scientific community, stakeholders and policy makers, informing science-based decision-making.

# Building on the GEOHAB Legacy

## The Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program

MOTIVATION, GOALS, AND LEGACY



By Raphael M. Kudrós, Eliza Bortolot, Henrik Enevoldsen, Grant Pitcher, Robyn Raines, and Ed Urban

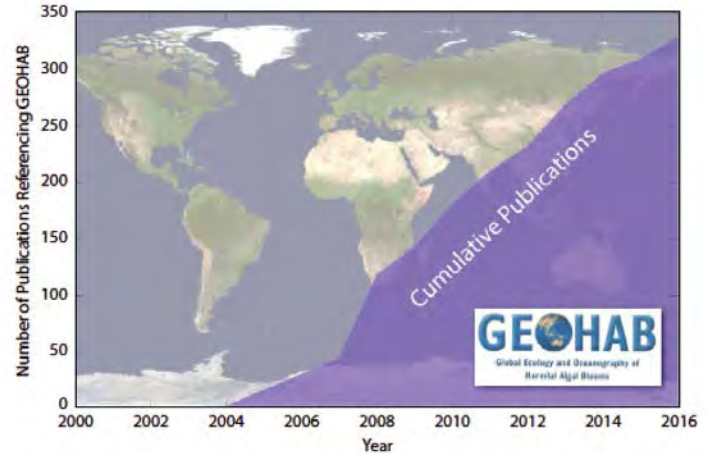


FIGURE 6. GEOHAB is directly acknowledged in or central to 330 publications in 75 journals. Expanding this to include all publications that reference GEOHAB, there were more than 1,000 publications as of 2016.

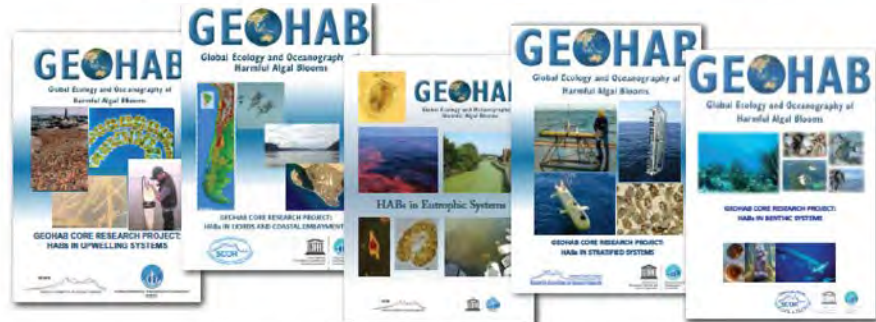


FIGURE 3. Five Core Research Projects provided the backbone for GEOHAB scientific efforts.

# GlobalHAB Themes



## THEME 1. Biodiversity and Biogeography

OVERALL OBJECTIVE: To identify the factors that determine the changing distribution of HAB species, their genetic variability, and the biodiversity of associated communities.

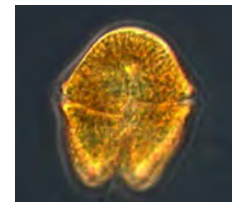
***Determine changes in microalgal species composition and diversity in response to environmental and climate changes***

Support long time series, such as TrendsPO, where biological data are collected, and encourage data analysis focused on different HAB species within an ecological context.

## THEME 2. Adaptive Strategies

OVERALL OBJECTIVE: To determine the adaptations of HAB species and how they help to explain their proliferation or harmful effects.

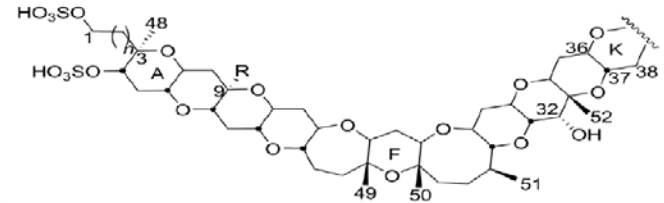
***Define the characteristics of HAB species that determine their intrinsic potential for growth and persistence.***



## THEME 3. Toxins

**OVERALL OBJECTIVE:** To characterize the genetic and environmental aspects of toxin production, to determine the mode of action of selected toxins, and to address several limitations in toxin analysis and field detection.

***Determine the genetic basis of, and environmental influence on, toxin production and gene expression of toxin-producing algae.***



## THEME 4. Nutrients and Eutrophication

**OVERALL OBJECTIVE:** To determine how the availability and utilisation of multiple forms of nutrients influence the occurrence of different types of HABs and their harmful effects.



***Investigate the links between nutrients, climate change and HABs.***

## THEME 5. Freshwater HABs and Cyanobacterial HABs (CyanoHABs) from Marine to Freshwater Systems

OVERALL OBJECTIVE: To develop a global perspective in advancing the science and management of freshwater HABs, and cyanobacterial HABs in marine, brackish and freshwater habitats.

*Develop global interactive map of occurrence of key cyanoHAB species.*



## THEME 6. Benthic HABs (BHABs)

OVERALL OBJECTIVE: To achieve a better understanding of BHABs and to provide tools to manage and mitigate the impacts of these events on human health and the environment.



*Investigate the impacts of climate change and anthropogenically driven changes on BHAB dynamics.*



## THEME 7. HABs and Aquaculture

OVERALL OBJECTIVE: To determine the link between marine aquaculture and HAB occurrence in different regions and to find efficient methods to protect farmed seafood products from HAB impacts.

***Comprehensively review evidence for link(s) between aquaculture and the promotion of HABs in different regions.***



## THEME 8. Comparative Approach

OVERALL OBJECTIVE: Determine the extent to which HAB species, their population dynamics, and community interactions respond similarly within comparable ecosystem types.

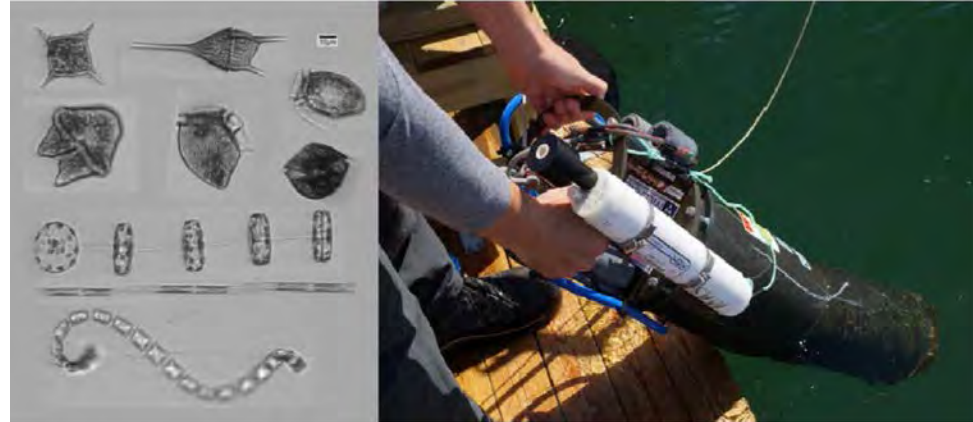
***Quantify the response of HAB species to environmental factors in natural ecosystems.***

Continue the work of GEOHAB towards more detailed, global comparison of phytoplankton time series.

## THEME 9. Observation, Modeling, and Prediction

OVERALL OBJECTIVE: To improve the detection and prediction of HABs by developing capabilities in observation and modeling.

***Establish and endorse the continuation of long-term HAB sentinel sites and encourage their inclusion in climate change observing systems where the data are made freely available in international databases.***



Information for policy makers: scientifically sound information on HAB trends, especially in the context of climate change, to develop policies aimed at the protection and management of coastal resources and human health.

## THEME 10. HABs and Human and Animal Health

OVERALL OBJECTIVE: To increase collaborations among HAB scientists with medical, veterinary, public health, and social science expertise to help understand and minimize the risk of HAB impacts to human and animal health.

*Facilitate the collaborations of HAB researchers with public health experts and decision-makers to conduct long-term surveillance, risk assessments and response plans for the different phylogenetic toxin-induced human diseases.*



## THEME 11. Economy

OVERALL OBJECTIVE: To develop cross-community understanding of the economic impacts of HABs and hence to define methodologies and criteria capable of robustly assessing (at both regional and local levels) the economic costs of HABs, as well as the costs of methods to predict and mitigate HABs.

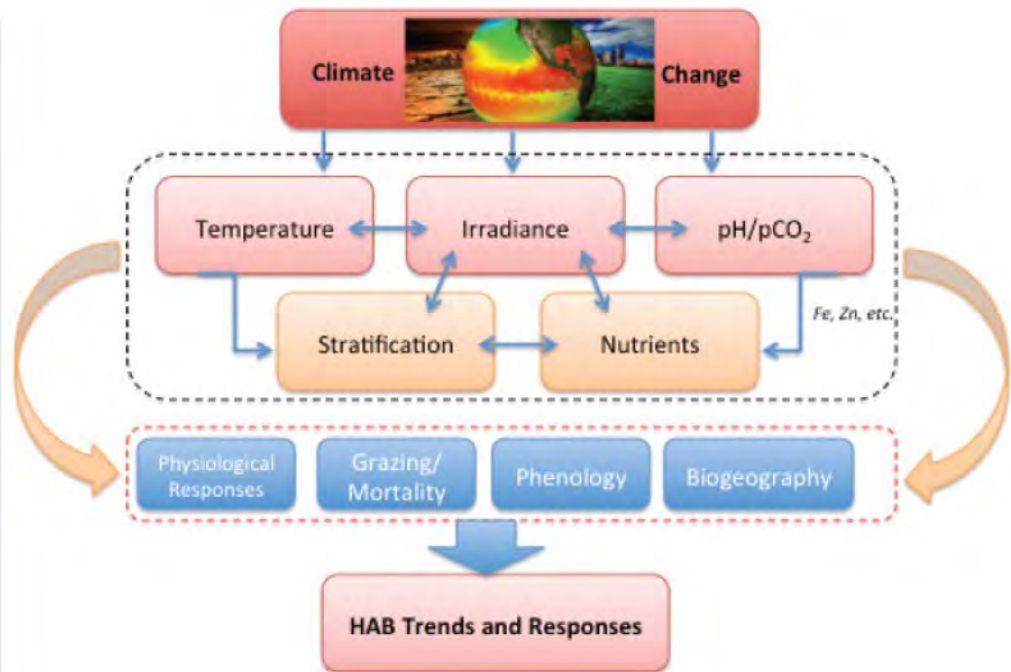
*Evaluate the economic cost/benefit of early warning and mitigation methodologies*

## THEME 12. Climate Change and HABs

OVERALL OBJECTIVE: To understand global patterns in HAB responses to common drivers (thermal windows, stratification, changing levels of CO<sub>2</sub>).

### Specific Objectives for Theme 12

- Understand global and regional patterns in HAB responses to the most common identified drivers.
- Encourage and facilitate the use of data from the “natural laboratory”.
- Encourage experimental work on climate effects on HABs, for example, laboratory and mesocosm experiments, as a base for predictions of climate effects on HABs.



## THEME 12. Climate Change and HABs

OVERALL OBJECTIVE: To understand global patterns in HAB responses to common drivers (thermal windows, stratification, changing levels of CO<sub>2</sub>).

### Specific Objectives for Theme 12 (cont.)

- Support an expansion of the number of comprehensive, region-specific studies integrating biological process data with downscaled climate projections.
- Encourage adoption of best practices in lab and field approaches to investigate HAB responses to climate drivers.
- Create synergies with other international groups to investigate ocean deoxygenation in response to climate change and eutrophication, with a specific focus on HABs.
- Explore the use of paleoceanographic records to understand HAB variability in response to past climate.

The screenshot shows the homepage of the Harmful Algae Event Database (HAEDAT). At the top, it reads "HARMFUL ALGAE INFORMATION SYSTEM" and "Harmful Algae Event Database (HAEDAT) IOC-ICES-PICES". Below this is a navigation bar with links: "Home | Browse Events | Search Events | Add Event | Browse Grids | Contact | Login" and a search box. The main content area is titled "What is the Harmful Algal Information System?" and contains several paragraphs of text describing the system's goals and components. At the bottom, there are logos for the International Society for the Study of Harmful Algae (ISSHA) and other related organizations.

HARMFUL ALGAE INFORMATION SYSTEM

Harmful Algae Event Database  
(HAEDAT) IOC-ICES-PICES

Home | Browse Events | Search Events | Add Event | Browse Grids | Contact | Login

Search

### What is the Harmful Algal Information System?

The Harmful Algal Information System, HAIS, will when fully established consist of access to information on harmful algal events, harmful algae monitoring and management systems worldwide, current use of taxonomic names of harmful algae, and information on biogeography of harmful algal species. Supplementary components are an expert directory and a bibliography.

The HAIS System is being built within the "International Oceanographic Data and Information Exchange" (IODE) of the "Intergovernmental Oceanographic Commission" (IOC) of UNESCO, and in cooperation with WoRMS, ICES, PICES, IAEA and ISSHA.

HAIS components:

- The IOC Taxonomic Reference List of Toxic Microalgae** provides a reference for the use of names and information on each species of toxic microalgae. You can follow its merge into the World Register of Marine Organisms (WoRMS) here.
- The HAEDAT** is a meta database containing records of harmful algal events. HAEDAT contains records from the ICES area (North Atlantic) since 1985, and from the PICES area (North Pacific) since 2000. IOC Regional networks in South America, South Pacific and Asia, and North Africa are preparing to contribute. Guidance on submission of data, disclaimer and questions re HAEDAT can be found here. **The HAEDAT associated Decadal Maps for the North Atlantic**
- The biogeography of harmful algal species, HABMAP within OBIS** (with ISSHA), is in preparation.
- The "Design and Implementation of Some Harmful Algal Monitoring Systems"** data component is presently not available on-line as it is being transferred to the same platform as HAEDAT. This meta-database contains information on the design and implementation of harmful algae monitoring and management systems from all over the world.
- The International Directory of Experts In Harmful Algae and Their Effects on Fisheries and Public Health** is a specialised section of the IOC OceanExpert directory.
- The IOC Bibliographic HAB Data-base** is a specialised section of the Aquatic Science and Fisheries Abstracts (ASFA)

ISSHA



# GlobalHAB: Build on Community Consensus and Success

Harmful Algae 49 (2015) 68–93



Contents lists available at [ScienceDirect](#)

## Harmful Algae

journal homepage: [www.elsevier.com/locate/hal](http://www.elsevier.com/locate/hal)



Harmful algal blooms and climate change: Learning from the past and present to forecast the future



Mark L. Wells<sup>a,\*</sup>, Vera L. Trainer<sup>b</sup>, Theodore J. Smayda<sup>c</sup>, Bengt S.O. Karlson<sup>d</sup>, Charles G. Trick<sup>e</sup>, Raphael M. Kudela<sup>f</sup>, Akira Ishikawa<sup>g</sup>, Stewart Bernard<sup>h</sup>, Angela Wulff<sup>i</sup>, Donald M. Anderson<sup>j</sup>, William P. Cochlan<sup>k</sup>



# HABs & Climate Change Roadmap

- A best practices manual for HAB and climate change research
- Better global assessment of HAB species responses through “Common Garden” experiments
- Retrospective analyses of long-term plankton and cyst core data sets
- Rapid response strategies to investigate harmful algal blooms during major weather or other environmental fluctuations:



# HABs & Climate Change Roadmap

**2013:** ICES/PICES/IOC-GEOHAB Workshop on Harmful Algae Blooms in a Changing World

**2015:** Scientific Symposium on Harmful Algal Blooms and Climate Change

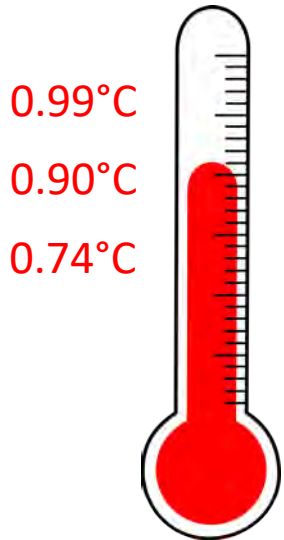
**2017:** Best Practices Manual for HABs and Climate Change

Editors: M. Wells, M. Burford, A. Kremp, M. Montresor, G. Pitcher, G. Usup

**2019:** Special issue on "Harmful Algae and Climate Change",  
in *Harmful Algae*. M. Wells & C. Gobler (eds)

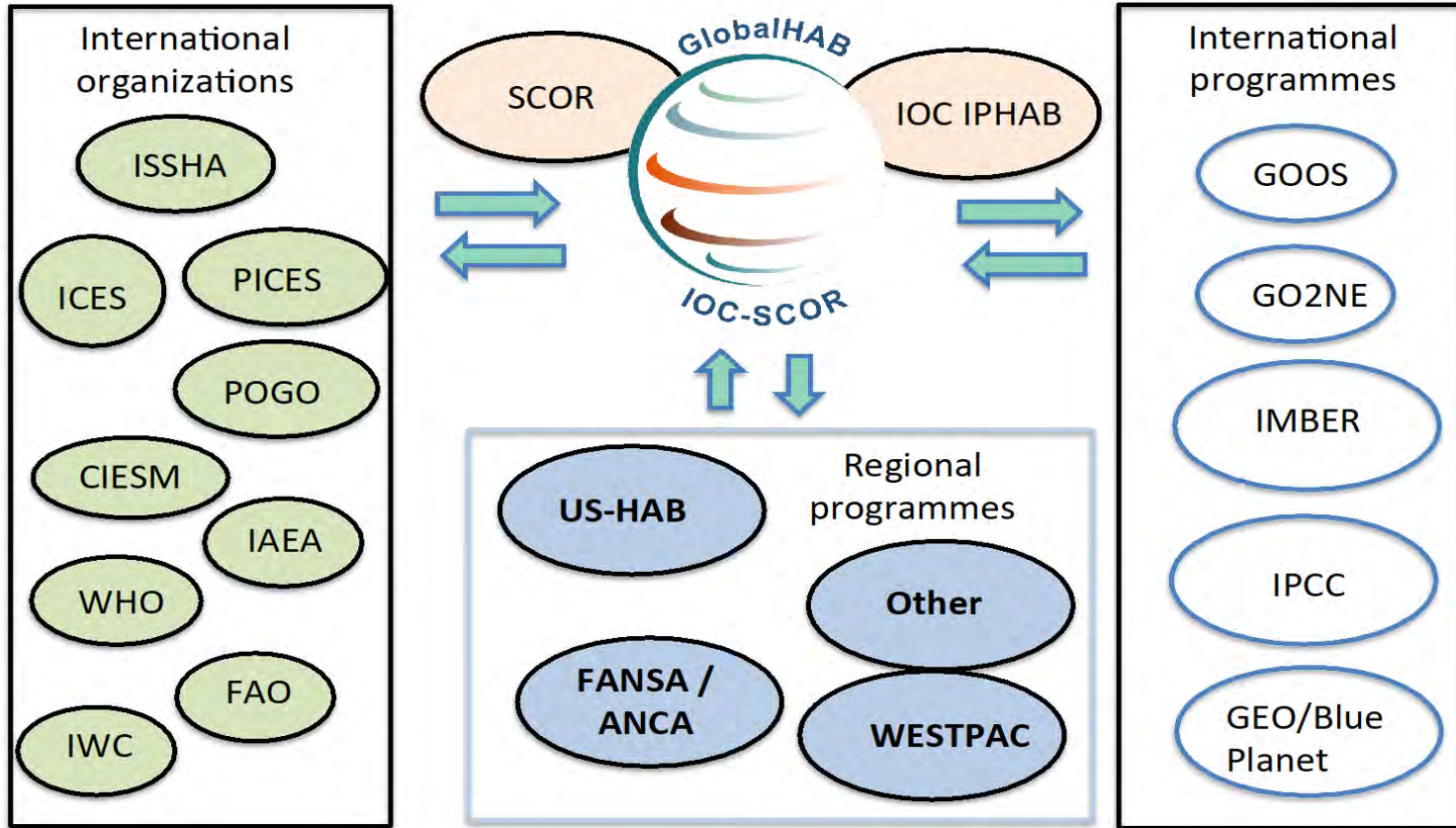
**2020?:** Scientific Summary for Policy Makers

(following IPCC Special Report on Oceans and Cryosphere)

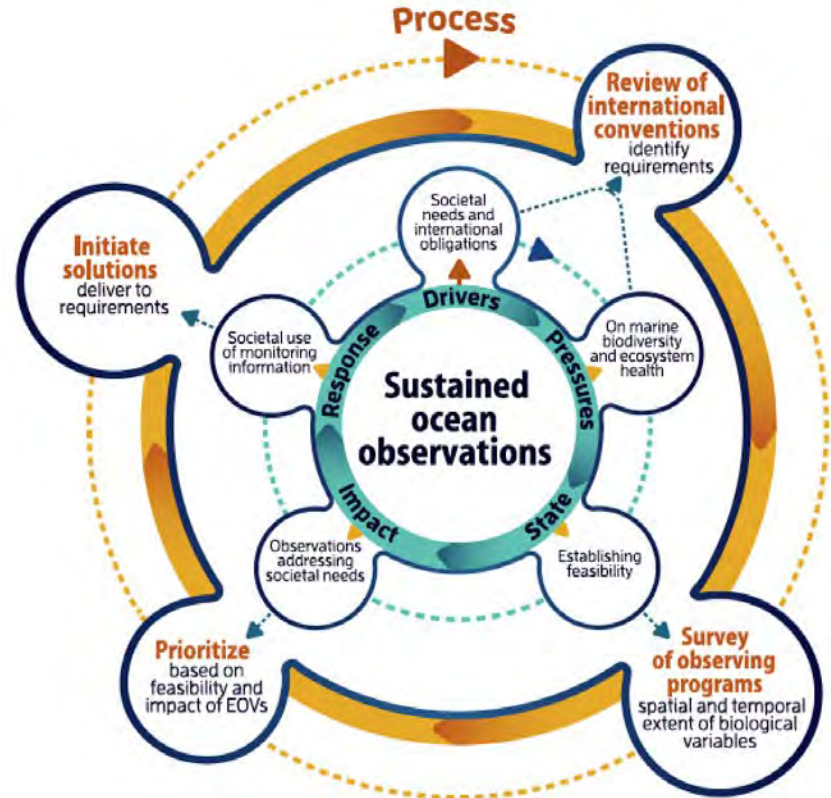
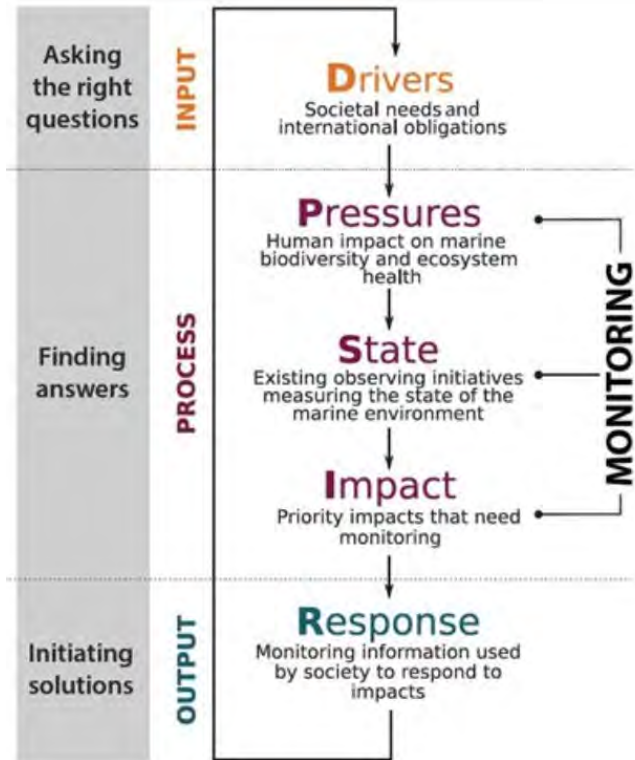




***Interaction with international programmes that have HAB research as a term of reference is fundamental for the success of GlobalHAB***

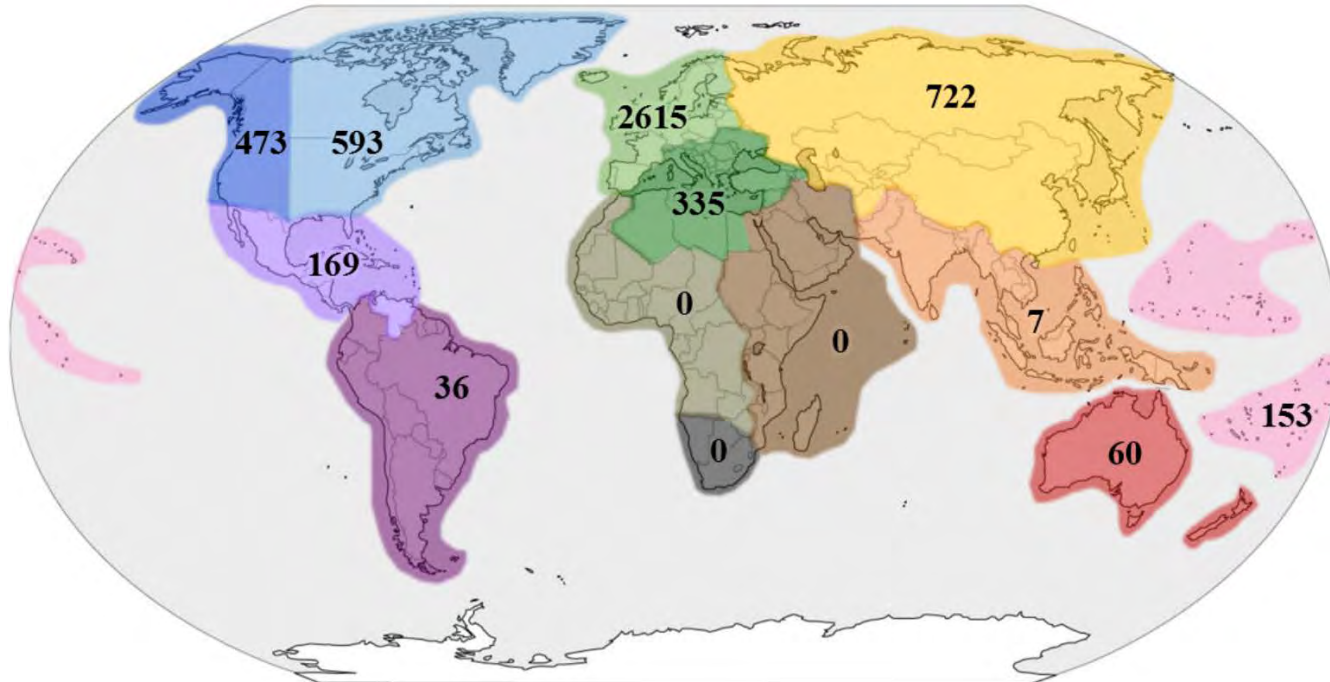


# Phytoplankton Biomass & Diversity: GOOS Essential Ocean Variables



# Global Harmful Algal Bloom Status Report

*Number of HAB records in OBIS by region*



# http://globalhab.info



## Global Harmful Algal Blooms



- [HOME](#)
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- [RESOURCES](#)
- [ORGANIZATION](#)
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### SUSTAINABLE DEVELOPMENT GOALS



In the broader picture GlobalHAB contributes to improved management of HABs as an ocean hazard through improved preparedness and early warning systems contributing to UN Sustainable Development Goal 11, target 11.5 and Priority 4 and Global target 7 of the Sendai Framework on Disaster Risk Reduction (UNISDR) 2015-2030.

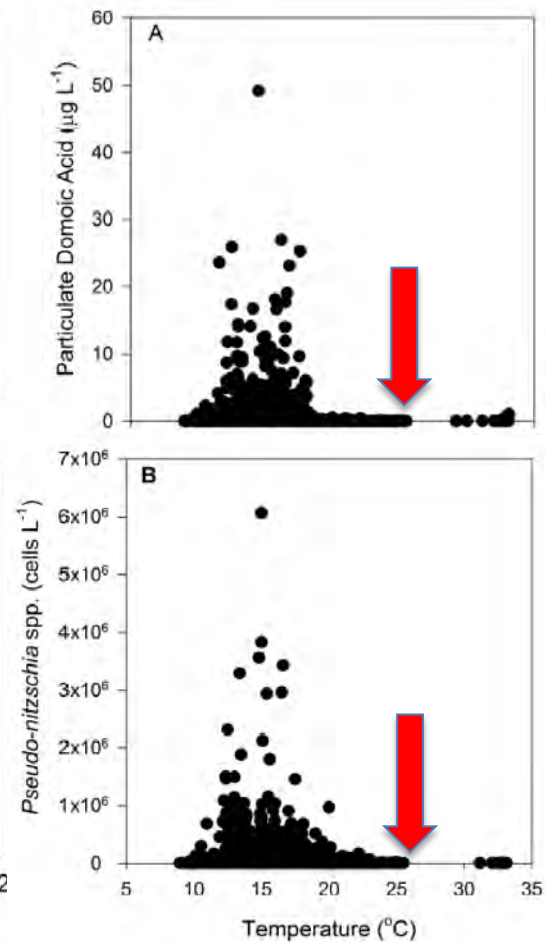
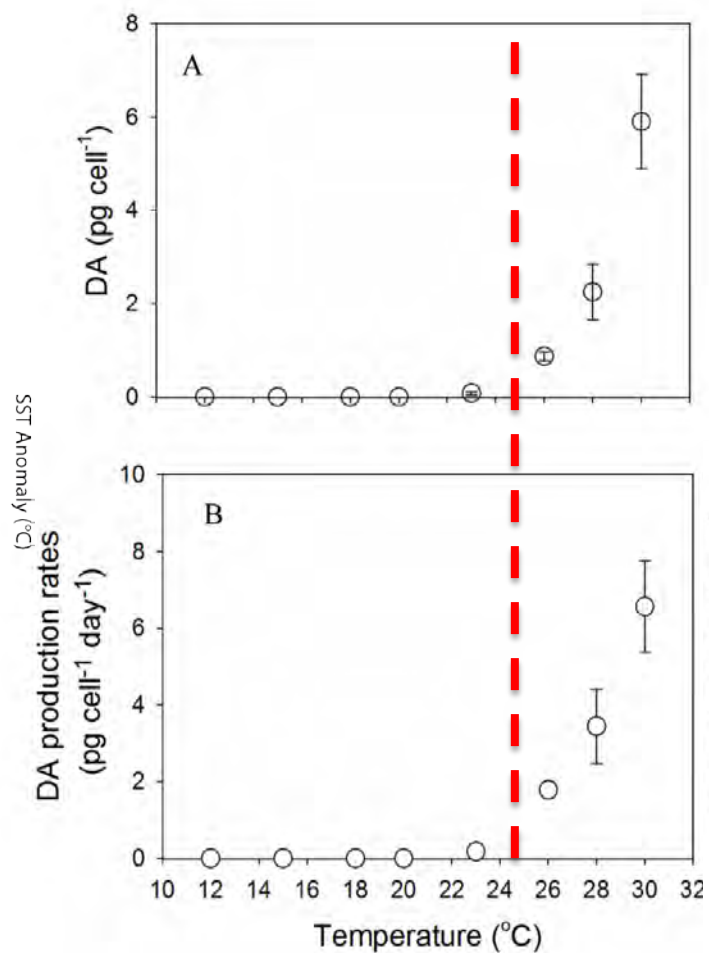
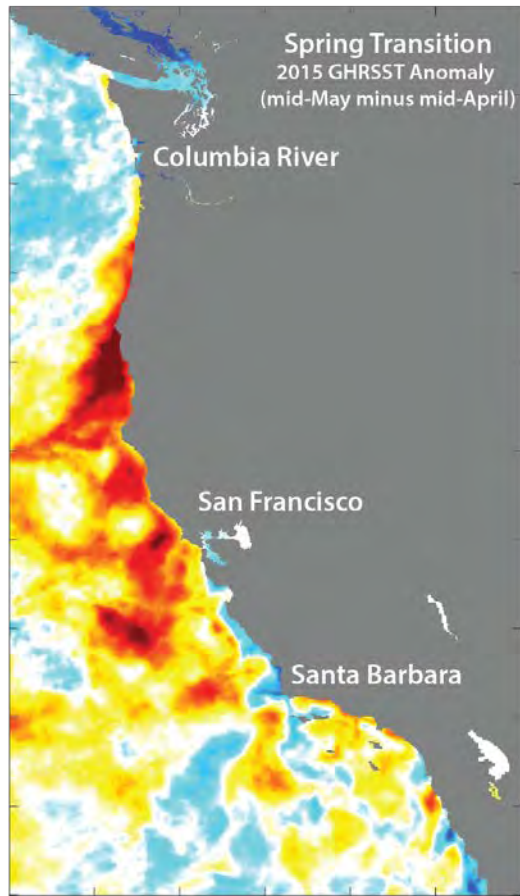
News & Events

[Scientific Steering Committee Meetings](#)

Global Harmful Algal Blooms - GlobalHAB - an international

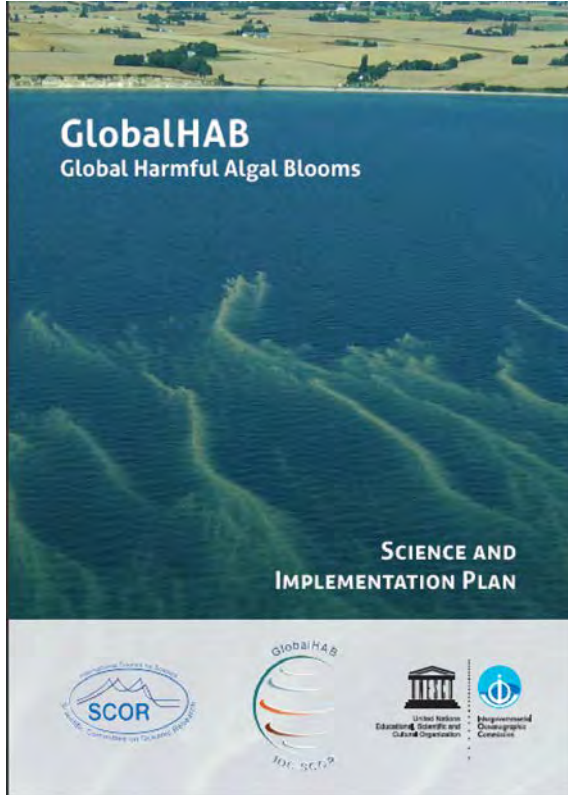
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