

TT EWS

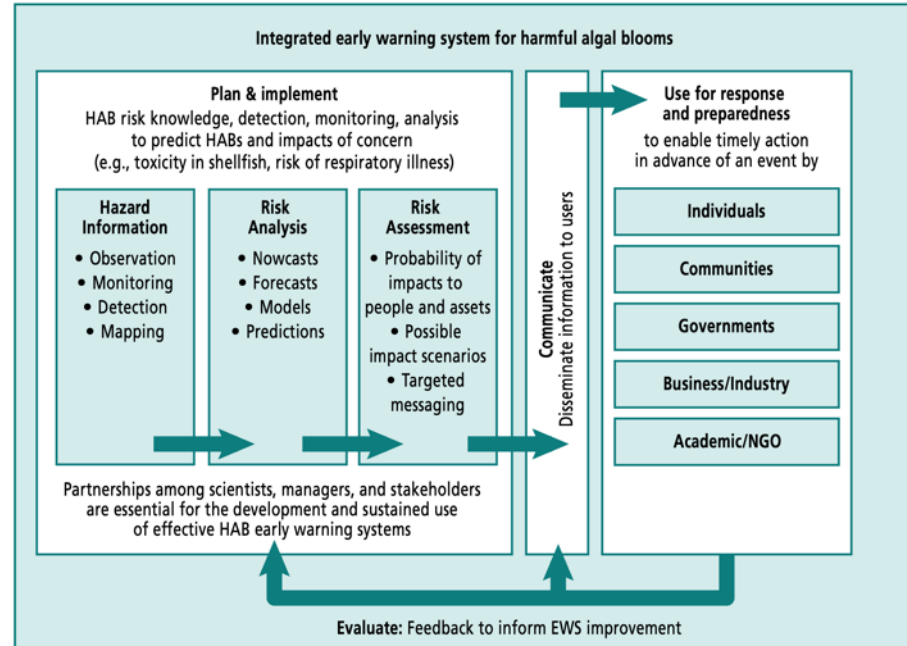
**Task Team on the Early Detection,  
Warning and Forecasting of HAB Events**

Presented by chair Bengt Karlson, Sweden  
[bengt.karlson@smhi.se](mailto:bengt.karlson@smhi.se)

# TT EWS members 2023-2025

<b>Name</b>	<b>Role</b>	<b>Country</b>
B. Karlson	Chair	Sweden
A. Duarte Silva	Member (former chair)	Portugal
D. Clarke	Member + chair of WGHABD	Ireland
P. Mozetic	Member	Slovenia
M. Broadwater	Member	USA
C. McKenzie	Member	Canada
D. Anderson	Member	USA
L. Guzmán	Member	Chile
J.L. Peña	Member	Mexico
L.J. Naustvoll	Member + chair of WGHABD	Norway
G. Doucette	International experts and advisors	USA
A. T. Yñiguez	International experts and advisors	Philippines
M. J. Botelho	International experts and advisors	Portugal
M.Y. Dechraoui Bottein	International experts and advisors	Morocco

# What is an early warning system?



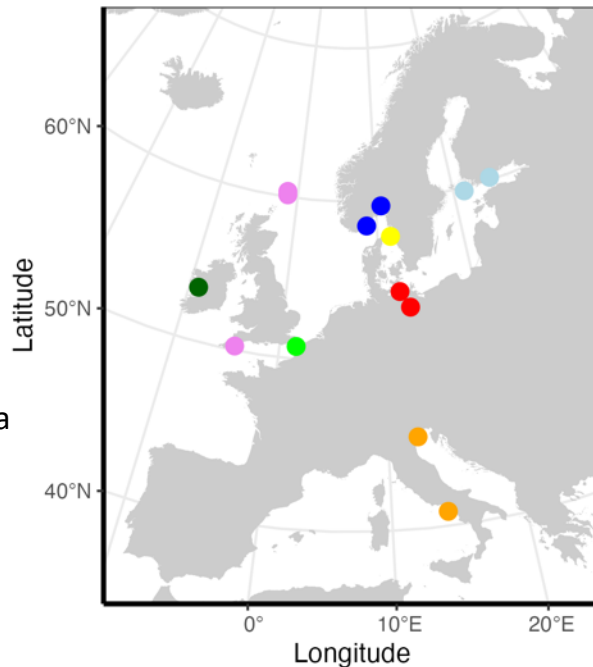
FAO, IOC and IAEA. 2023. *Joint technical guidance for the implementation of early warning systems for harmful algal blooms*. Fisheries and Aquaculture Technical Paper No. 690. Rome, FAO. <https://doi.org/10.4060/cc4794en>

# Selected activities 2023-2025

## ICES area Europe

### European IFCB user network

- Near real time data on HAB abundance and distribution
- IFCB in ships of opportunity
- IFCB in fixed locations
- Sharing training data = annotated images
- AI-supported automated identification of HAB-taxa
- Standardisation of data flows and QC is ongoing
  - EMODnet biology
  - OBIS
  - GBIF



- DE - IGB-Berlin (Lake Stechlin)
- DE - IOW
- FI - SYKE (FerryBox Helsinki - Lübeck)
- FI - SYKE (Utö observatory)
- FR - ULCO (Ferrybox English Channel)
- IE - MI (Ferrybox RV Tom Crean)
- IT - ISMAR
- IT - Stazione Zoologica Anton Dohrn
- NO - IMR (Torungen observatory)
- NO - NIVA (Ferrybox Oslo-Kiel)
- SE - SMHI (Ferrybox on RV Svea)
- UK - PML (L4)
- UK - SSF, Coledeep, Shetland
- UK - UHI Shetland, Scalloway, Shetland

- + a few more in Norway, Italy, France and the UK



# Development of a Baltic Sea HAB Early Warning System

## EWS for cyanobacteria

- Tourism
- Recreational activities
- Desalination plants

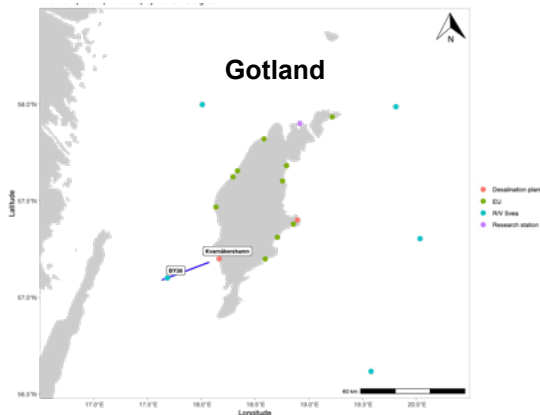
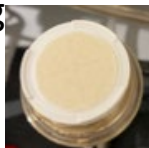
## Modelling

- Advection of HAB
- Life cycle of cyanos
- Effect of climate changes

## Sampling and observations

- Cyanotoxins, phytoplankton
- Sampling at beaches and desalination plants
- Research vessel sampling
- Ferrybox-systems including IFCB
- Glider with bio-optical sensors
- Satellite remote sensing

Cyanotoxins  
ELISA, LC/MS,  
qPCR



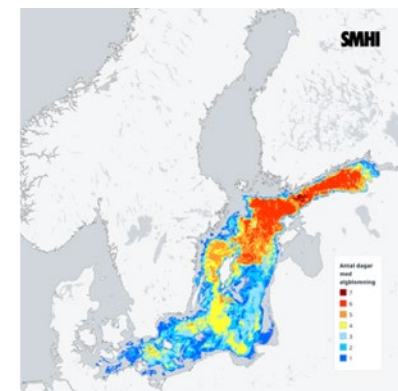
IFCB



Glider



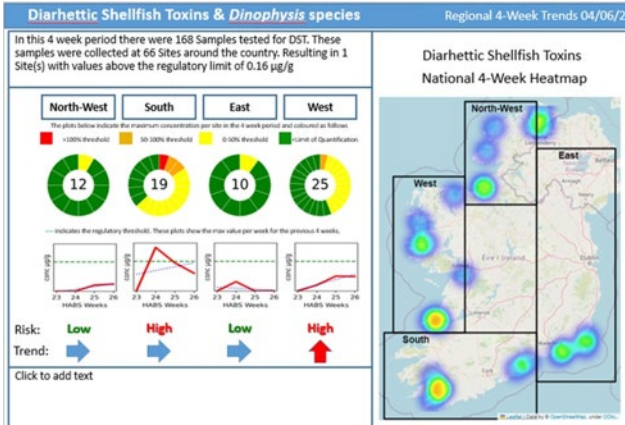
Phycocyanin  
fluorometer



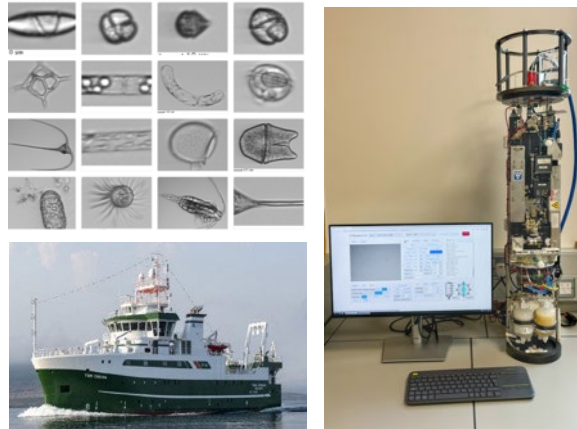
BAWS 7-day composite

# Ireland HAB Predictive Forecasting Activities 2023 - 2025

Ireland's Weekly HABs Bulletin was re-designed to include improved data visualisations using heat maps and graphical trend analysis, now generated via Jupyter Notebooks.



Imaging Flow Cytobot (IFCB) deployed aboard RV Tom Crean, images are relayed to SAMS dashboard portal and classifier.



Cytosub deployed on SmartBay Observatory in Galway Bay.



Software currently being trained on images and spectral signatures to issue automated alerts for HAB species.



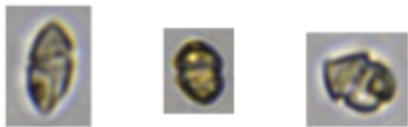
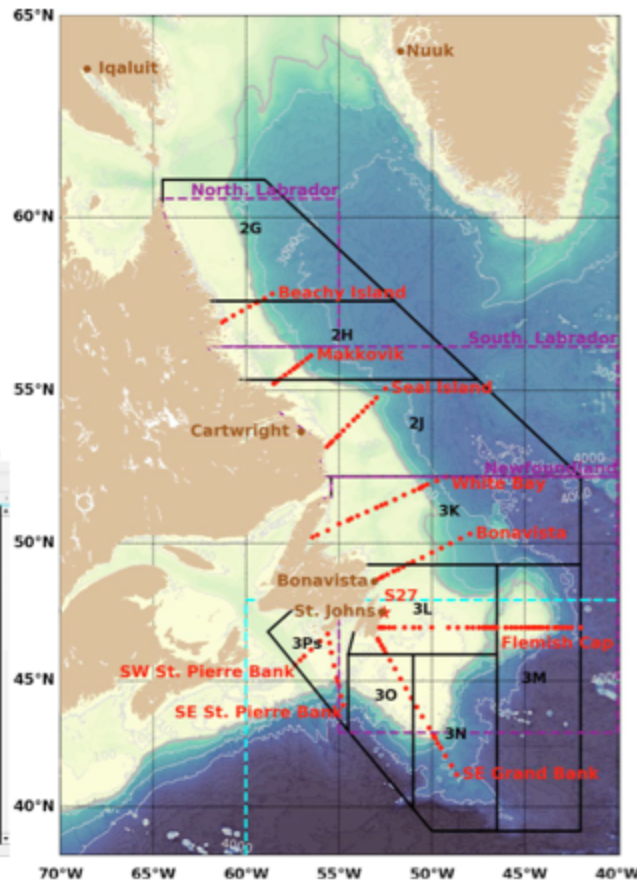
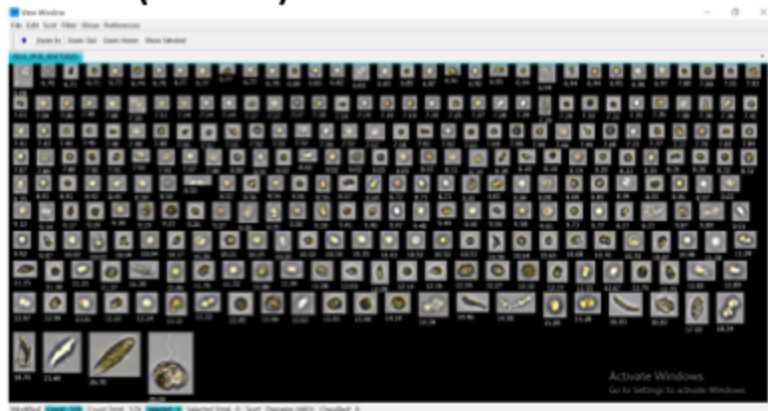


# Selected activities 2023-2025 ICES area North America

## A Direct Comparison of FlowCAM and IFCB during NL Fall Discovery AZMP Missions (2023 & 2024)

C. McKenzie<sup>1</sup>, A. Bungay<sup>1</sup>, G. Maillet<sup>1</sup>, D. Belanger<sup>1</sup>, L. Beazley<sup>1</sup>,  
M. Brosnahan<sup>2</sup>, D. McGillicuddy<sup>2</sup>

- Niskin Whole water samples (5 m, 30m)
- 30 Stations in Oct. Nov. 2023 and 2024
- FlowCAM and IFCB intake (ca. 5m)
- eDNA 2024
- Microscopy
- SEM
- Analysis ongoing



1 DFO, 2 WHOI

# U.S. National HAB Observing Network: NHABON

## VISION

A sustained, national network  
for regional HAB observing

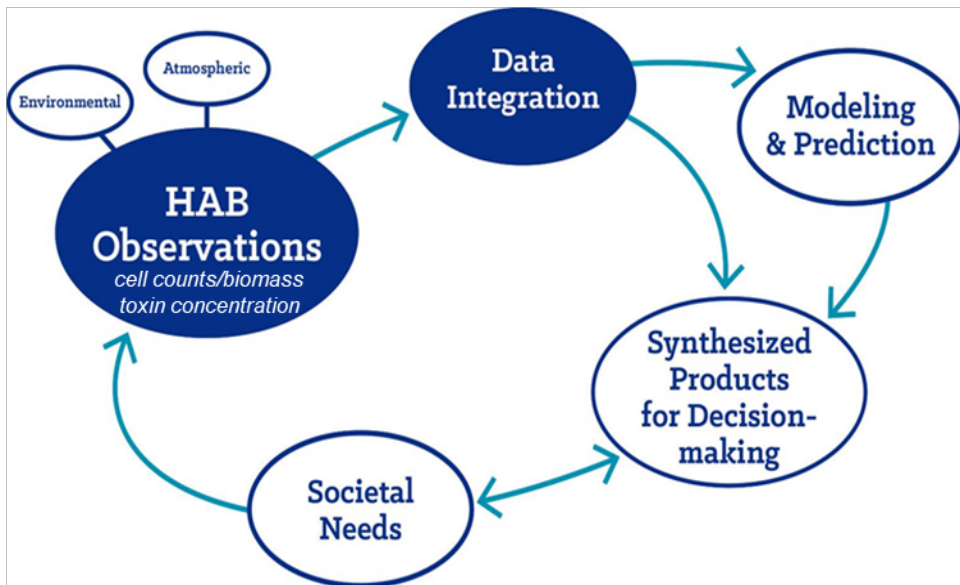


## MISSION: NHABON will deliver sustained observations

- for HAB detection, early warning, and forecasting
- to better understand, predict, mitigate, and manage HABs
- to reduce HAB impacts on society, economies, and the environment
- to better understand national HAB trends and climate impacts



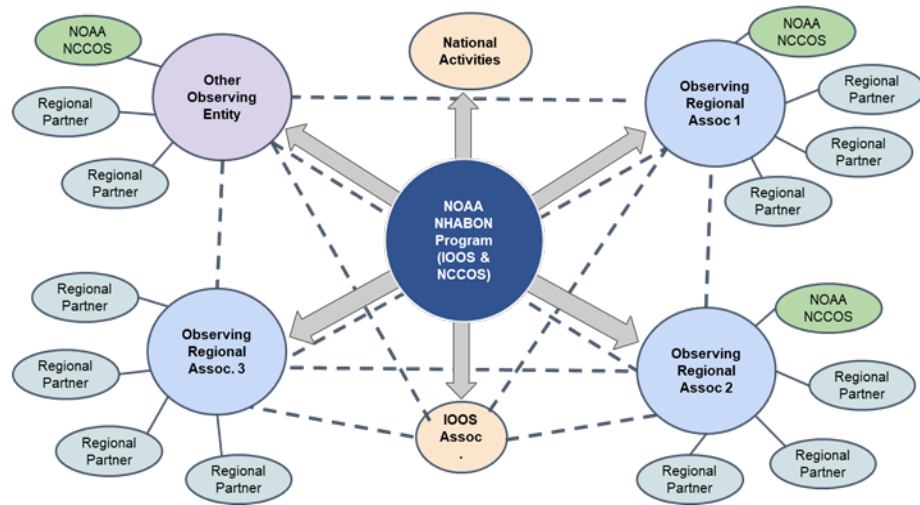
# Regional HAB Observing System



*HAB observations support early warnings and forecasts that are key to keeping communities safe.*

# Proposed NHABON Infrastructure

*NOAA coordinates with U.S. IOOS Regional Associations and other observing entities, and connects federal, tribal, state, regional, and local partners to improve HAB monitoring and management, integrate observing capabilities and data, and deliver products operationally.*



# Selected activities 2023-2025 Africa



- Intergovernmental Oceanographic Commission's HABs programme conducted follow up expert missions on Early Warning System development and capacity enhancement for predictive HAB forecasting in Morocco and Namibia in 2024.
- The workshop on "Monitoring Methods and Data Management for Establishing an Early Warning System (EWS) for Harmful Algal Blooms (HABs) in Morocco" was held in Casablanca during December 2nd - 6th 2024, sponsored by UNESCO/IOC and hosted by L'Institut National de Recherche Halieutique, INRH, Casablanca, Morocco.
- A "Scientific meeting on data needs and code of practice for establishing an Early Warning system (EWs) for Harmful Algal Blooms (HABs) in Namibia" was held in Swakopmund, Namibia during 28th October to 1st November 2024 sponsored by UNESCO/IOC and hosted by Ministry of Fisheries and Marine Resources (MFMR).



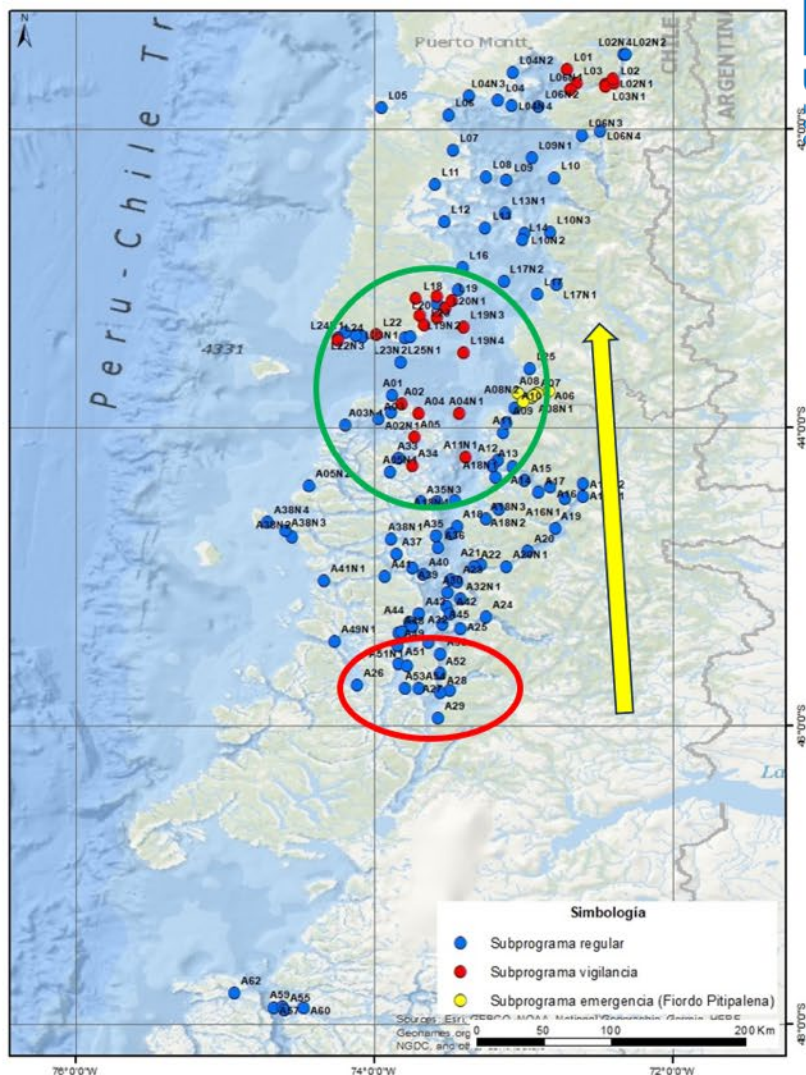
# CHILE

## EARLY WARNING BASED ON

## *Alexandrium catenella* RELATIVE ABUNDANCE IN CHILEAN FJORDS

- a) To anticipápte PST risky levels in shellfish (mussels)
- b) To determine affected areas by *A. catenella* blooms
- c) To anticipápte bloom's end according to meteorological and hydrographical conditions

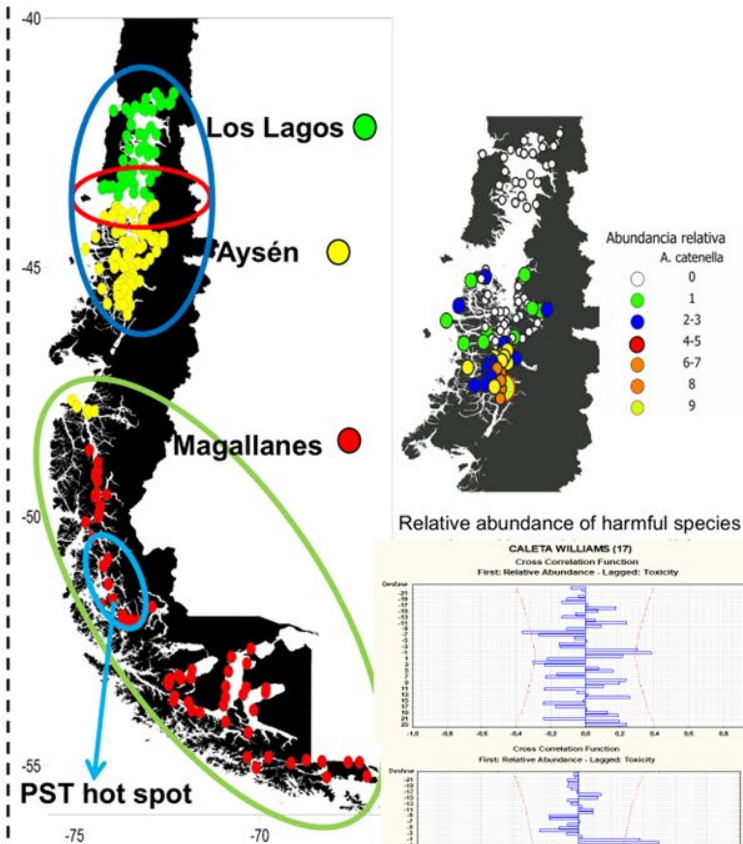
- a) Using cross correlations time series of PST levels in mussels and relative abundance of *Alexandrium catenella* in net simples, risky PST levels can be anticipated in 30 days, even 60 days.
- b) Particle tracking simulation is activated to follow spatial and temporal behaviour of *A. catenella* bloom; the simulation encompasses a máximo lapse of 10 days.
- c) The particle tracking simulation will be activated when at least three sites from the sampling area have a relative abundance of  $\geq 5$ .



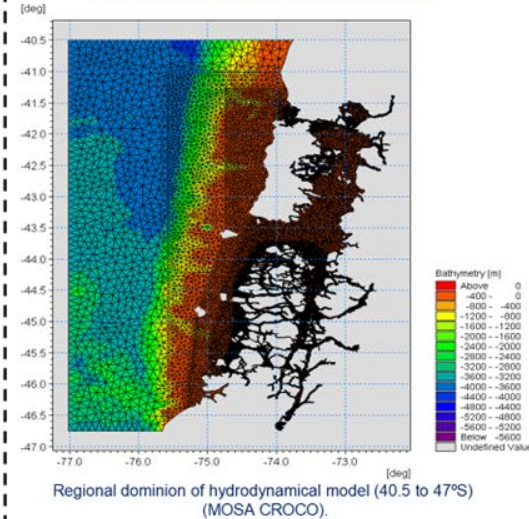


# Abundance early warning (MOSA CROCO and Parti-MOSA models)

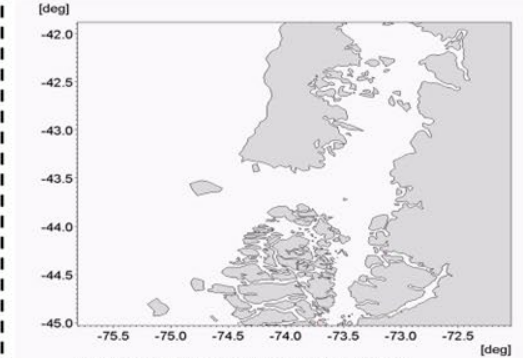
## 1.- Monitoring data (early warning)



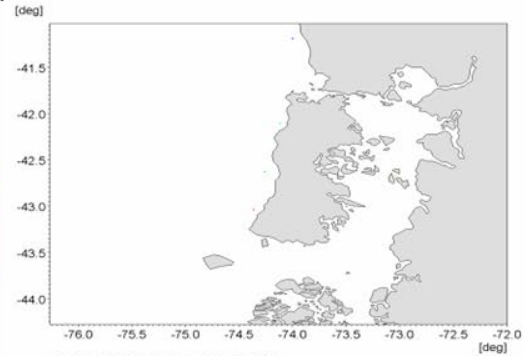
## 2.- Numerical simulation



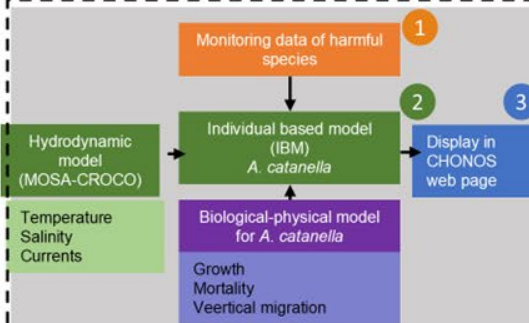
## 3.- Numerical outputs



Output with South winds

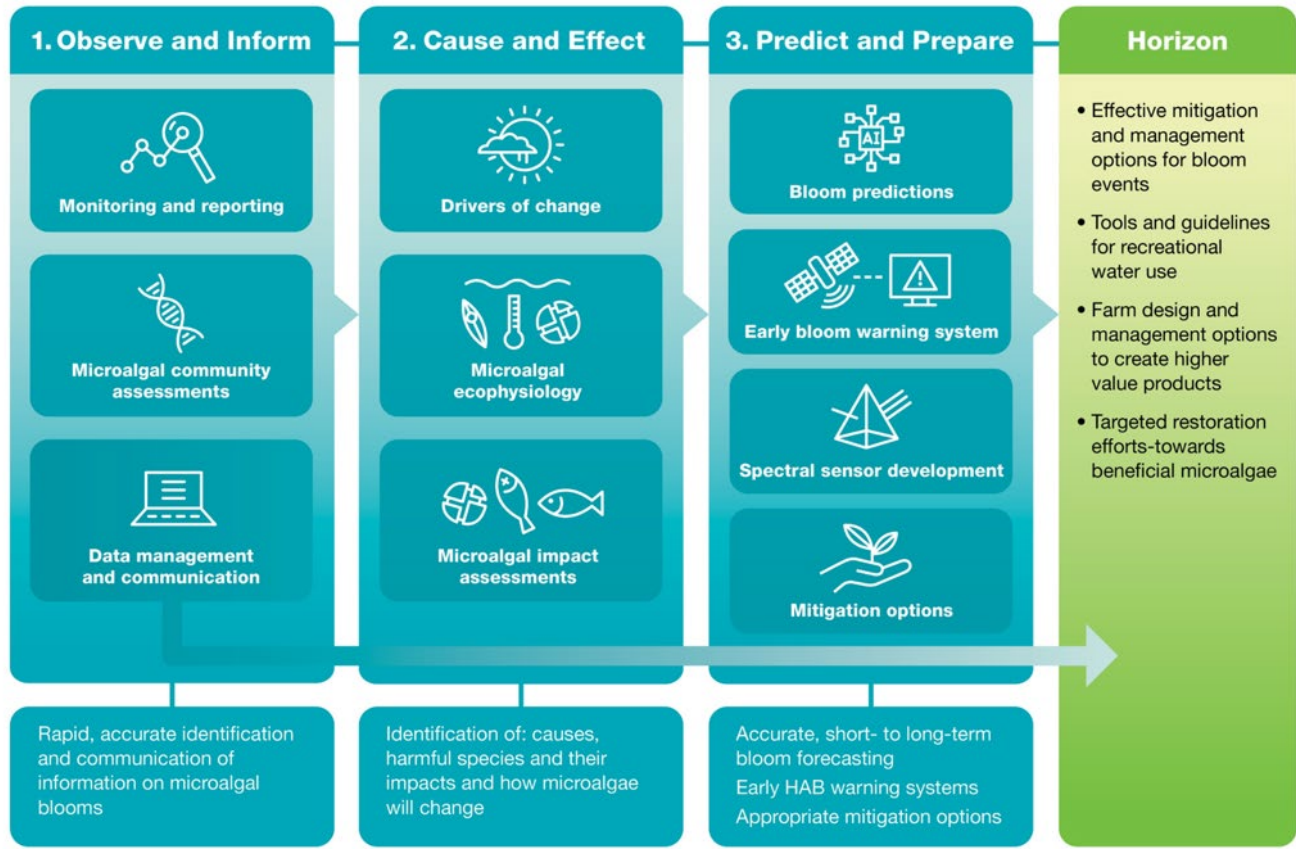


Output in a calm period



Operational conceptual model diagram to forecast *Alexandrium catenella* blooms in Chilean fjords.

# New Zealand



Contributed by  
Kirsty Smith

Five year government funded programme, started October 2024.  
Brings together scientists, Māori organisations, local & central government, and industry.





2<sup>nd</sup> UN Ocean Decade Regional Conference &  
11<sup>th</sup> WESTPAC International Marine Science Conference

“Accelerating Ocean Science Solutions for Sustainable Development”



United Nations Decade  
of Ocean Science  
for Sustainable Development

## Session C5: Mitigation and management of harmful algal blooms April 22, 2024 10:00 am – 5:00 pm

### Organizers:

**Kazumi Wakita:** Tokai University, Japan; **Pengbin Wang:** Second Institute of Oceanography, Ministry of Natural Resources, China  
**Aletta T. Yñiguez:** Marine Science Institute, University of the Philippines Diliman, Philippines; **Po Teen Lim:** University of Malaya, Malaysia

A total of 15 oral and 3 poster presentations were shared and attended by more than 50 participants for this session. There were contributions from 7 countries (Singapore, Malaysia, Japan, Philippines, Indonesia, Russia and China). Detailed observations of HABs in relation to environmental conditions were shared, and the significant impacts of HABs on ecosystems were highlighted. A variety of methods and tools to observe and understand HAB dynamics were presented ranging from traditional to newer methods such as genomics, and optics all the way to capacity and institution building. Importantly, methods to mitigate HAB impacts such as economic models and modified clay.



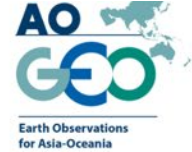


# Developing satellite tools to assess HABs and eutrophication in the region



Asia-Pacific Network for Global Change Research

Project with Indonesia, Japan, Philippines, Thailand, China, Malaysia



Article | [Open Access](#) | Published: 22 October 2021

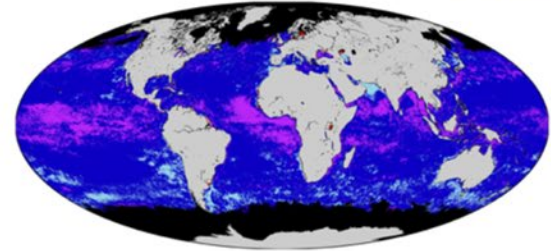
## Globally consistent assessment of coastal eutrophication

Eligio de Raús Mañé , Genki Terauchi, Joji Ishizaka, Nicholas Clinton & Michael DeWitt

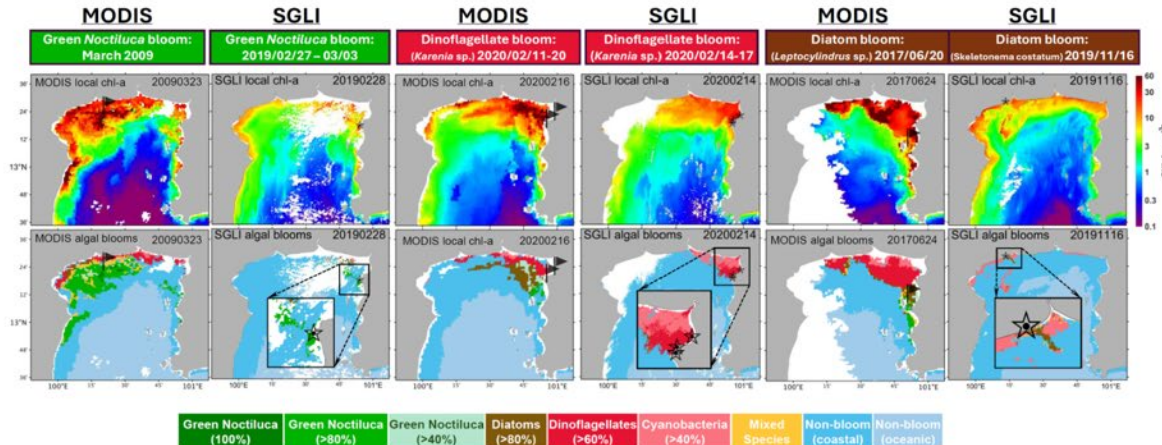
*Nature Communications* **12**, Article number: 6142 (2021) | [Cite this article](#)

1657 Accesses | [Metrics](#)

## Global Eutrophication Watch

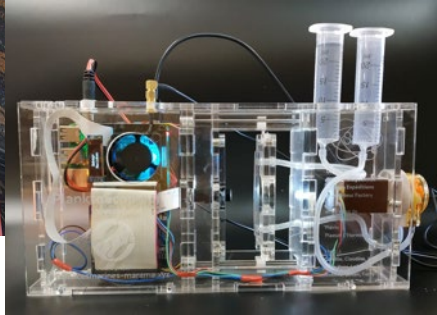


## HAB and Algal classification algorithms

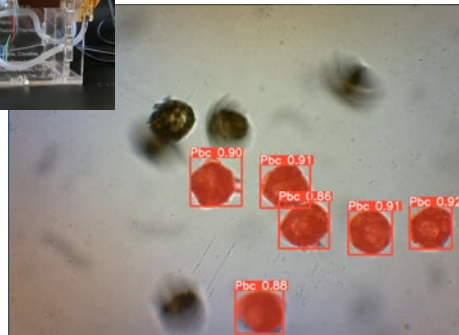
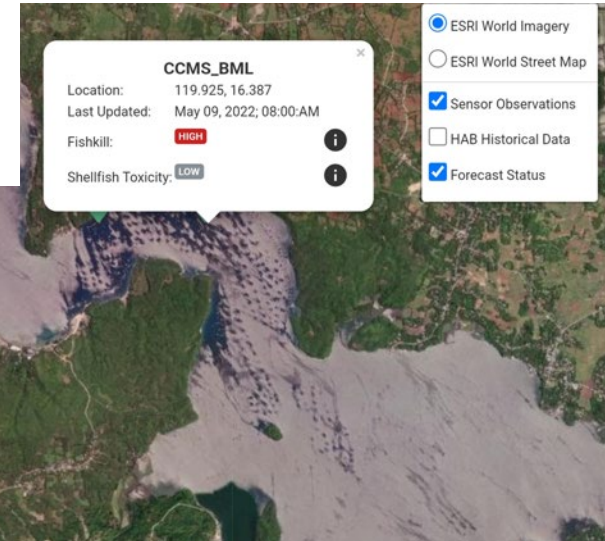
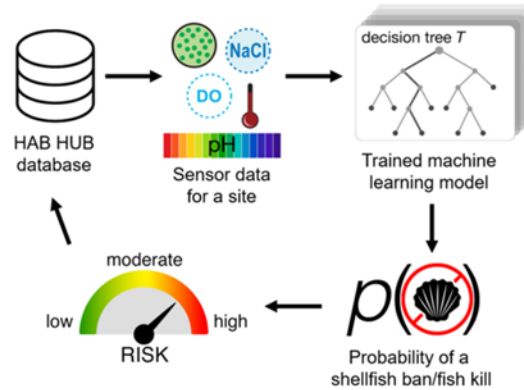


# Developing Early-warning Systems in the Philippines

Enhancing ocean observation capacity



Local EWS through low-cost sensors and AI



# Planned and suggested activities 2025-2027 and need for resources

- Workshop Automated plankton analysis using imaging in flow methods  
24-26 September, Oslo, Norway
  - Travel and accommodation for invited specialists and young scientists – USD/Euro XXX
- Workshop EWS 2025 in connection with ICHA 2025 in Chile, planned for Friday 24 October
  - Travel and accommodation for invited specialists and young scientists – USD/Euro XXX
- Citizen science series of online seminars on low cost methods
  - In cooperation with HAB-Solutions
  - Seminar series coordinator – provided by the IOC HAB program
  - Acquisition/Building costs for low-cost microscopes – USD/Euro XXX
- Promoting the use of novel satellites and sensors for observing HAB
  - Special session during the Ocean Optics meeting in 2026
  - Collaboration with GOOS, NASA and ESA funded workshops, seminars or conferences
  - Travel costs for selected specialists and young scientists
- Pending funding - Open science meeting 2026 in cooperation with HAB-Solutions
  - Ocean colour, imaging in flow, toxins, modelling (AI, advection etc.)
  - Meeting coordinator – provided by the IOC HAB program
  - Travel and accommodation for invited speakers and young scientists – USD/Euro XXX
  - Venue – provided by the IOC or FAO
- Continued work in Morocco and Namibia? New country for capacity building?

# Suggested ToR 2025-2027

1. Serve as a strategic and advisory group for the establishment of guidelines, recommendations, and advancement of Early Warning Systems, ensuring the alignment with UN Ocean Decade challenges, objectives and actions
2. Interact with HAB working groups and committees (e.g. ICES -IOC/WGHABD, PICES, IOC/FANSA, IOC/HANA, IOCARIBE/ANCA, IOC/WESTPAC-HAB) in the development of regional EWS and in the standardization of alerts, harmonization of key messages and initiating sessions on near real time HAB Observing and Early Warning Systems at forthcoming international and national science meetings (e.g. ISSHA, U.S HAB Symposium)
3. Invite the scientific community and stakeholders, e.g. from the desalination industry, To be modified to contribute by identifying early warning research topics, assessment of capabilities, seeking for transformative solutions, promoting strategies for engagement, and communicating scientific information to policy makers, managers and other end-users
4. Promote the presence of HAB observations in the IOC Global Ocean Observing System and its regional components such as USA-IOOS and EuroGOOS, and the consolidation of integrated multi-hazard Early Warning Systems that employ scalable and affordable HAB technologies and methodologies for the continuous monitoring of coastal and ocean ecosystems

# New members of Task Team on EWS are welcome

- A few persons are retiring from the team
- Dr. Michael Brosnahan, Woods Hole Oceanographic Institution, USA, is joining the team
- Dr.. Kirsty Smith, Cawthron Institute, New Zealand, is joining the team
- South America, Africa, Asia and Oceania are underrepresented in the team

