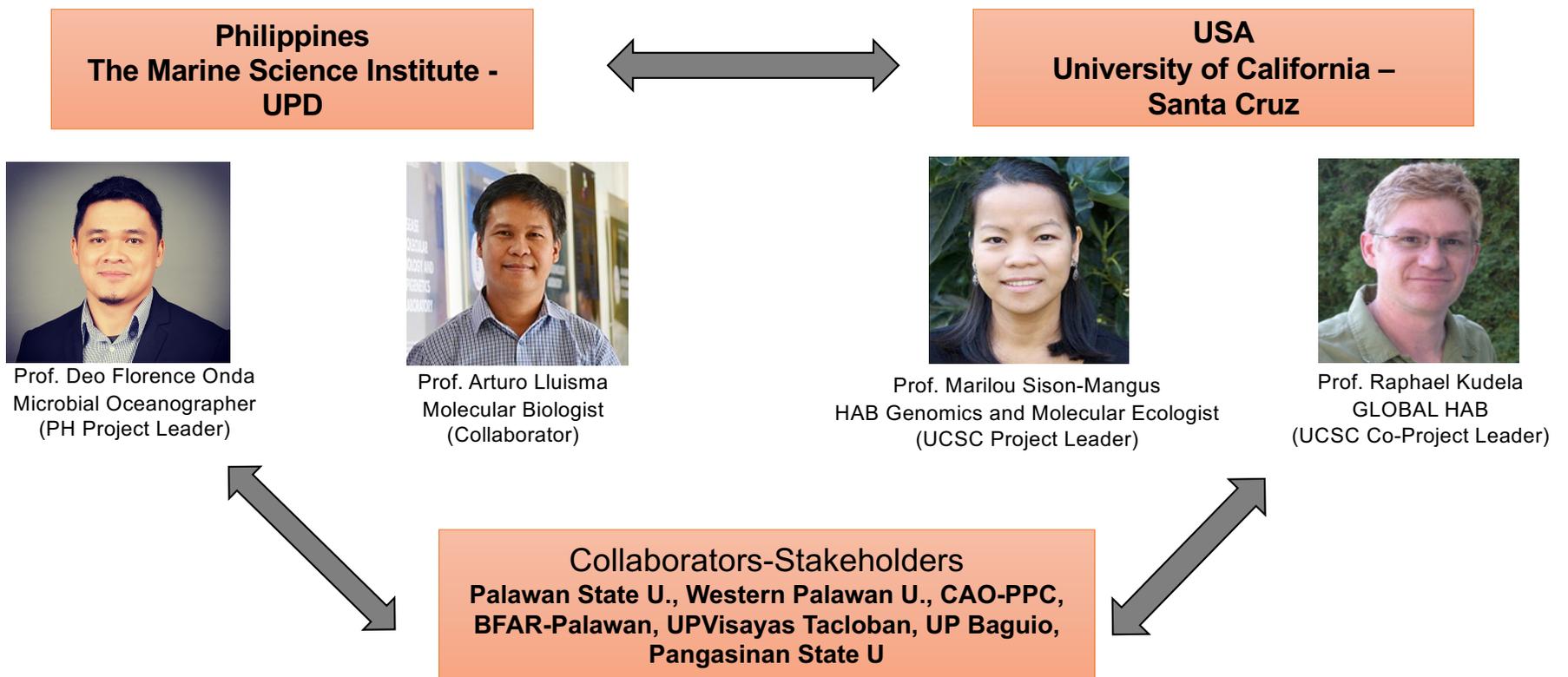


Real-time monitoring and early warning for HABs using high throughput imaging and molecular methods (HABs Watch)



Philippine Partners

COMMISSION ON HIGHER EDUCATION
PHILIPPINE-CALIFORNIA ADVANCED RESEARCH INSTITUTES (PCARI) PROGRAM



Dr. PS Ignacio, UPB



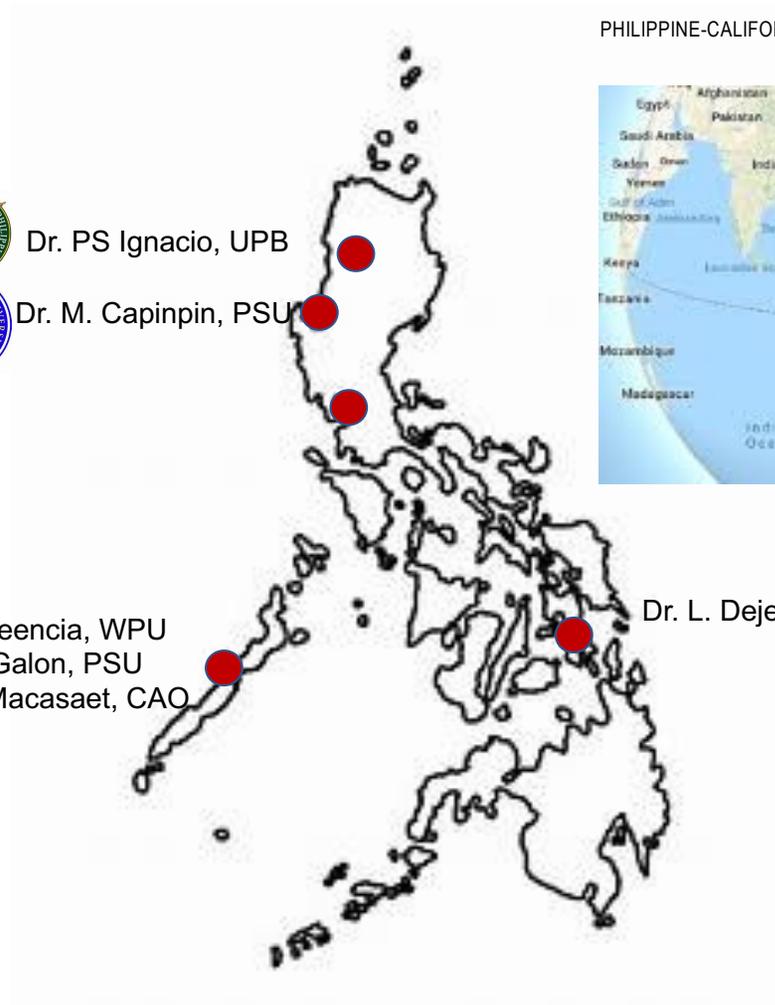
Dr. M. Capinpin, PSU



Dr. L. Creencia, WPU
Prof. F. Galon, PSU
Ms. M. Macasaet, CAO



Dr. L. Dejeto-Yap, UPV

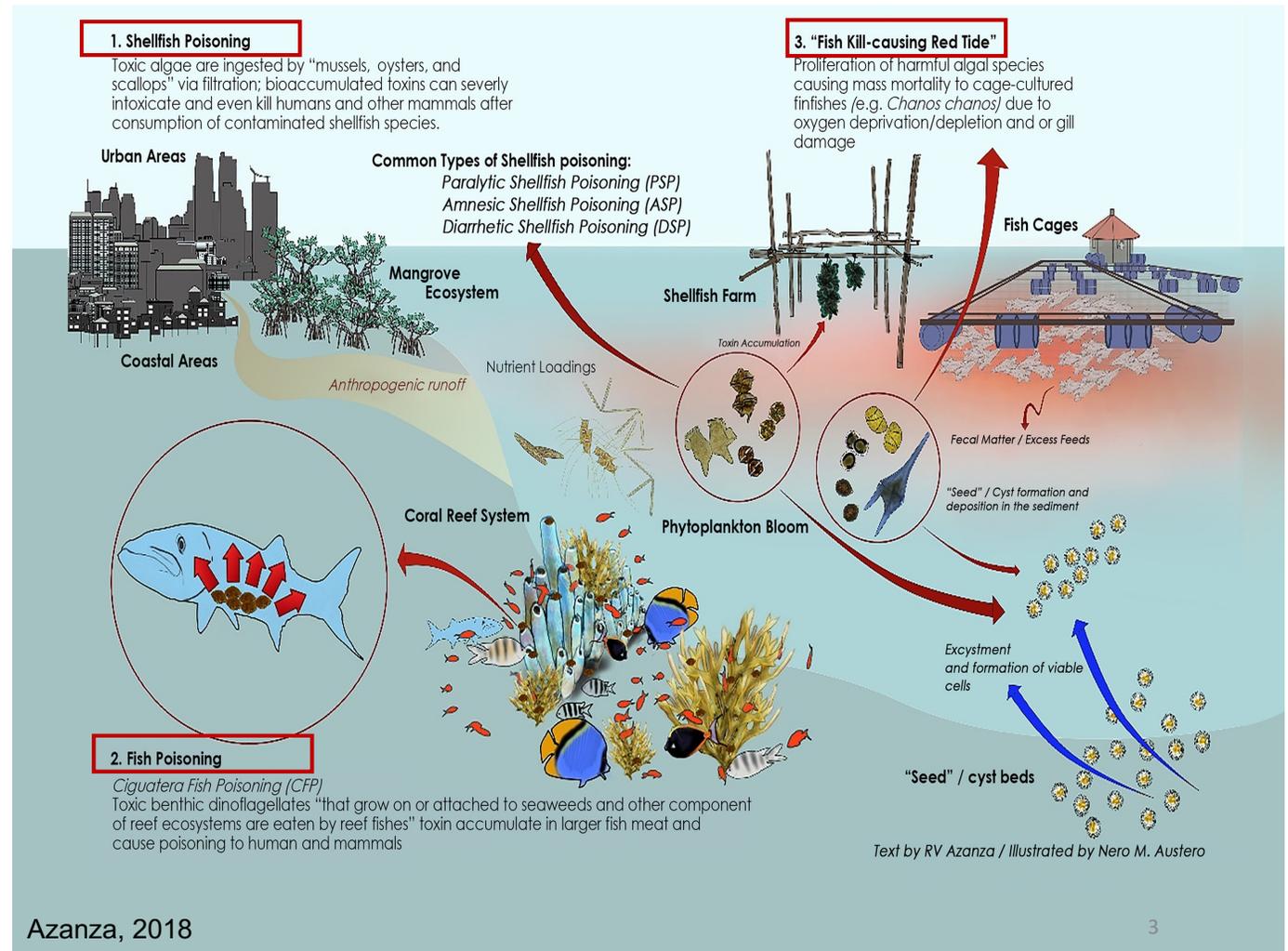


What are harmful algal blooms (HABs) or 'red tides'?

Recurring events - floating photosynthesizing microbes grow out of control

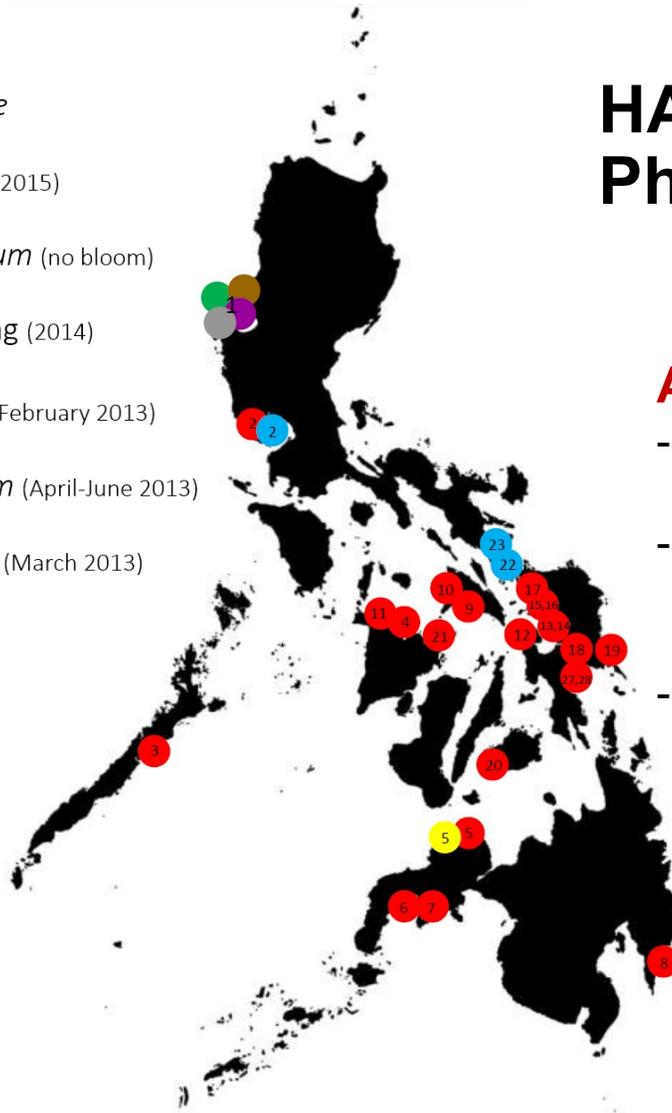
Effects - could be harmful depending on dominating species, resulting in

- Toxicity (poisoning)
- Hypoxia/Anoxia (fish kills)



HABs distribution in the Philippines

-  *Pyrodinium bahamense*
-  *Alexandrium spp.* (2014-2015)
-  *Gymnodinium catenatum* (no bloom)
-  Ciguatera Fish Poisoning (2014)
-  *Karenia c.f. mikimotoi* (February 2013)
-  *Prorocentrum minimum* (April-June 2013)
-  *Scrippsiella trochoidea* (March 2013)



As of 2018,

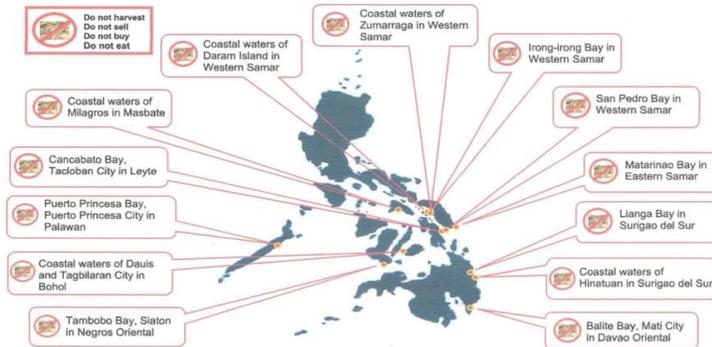
- 44 embayment/ coastal areas with HABs outbreaks;
- 88 bays have presence of at least 1 toxic or potentially HABs-causing species
- Predicted to increase with eutrophication, continued dispersal, and climate change.



Republic of the Philippines
Department of Agriculture
BUREAU OF FISHERIES AND AQUATIC RESOURCES
PCA Building, Elliptical Road, Diliman, Quezon City 1101
Tel. No. (632) 929-9597 Fax No.: (632) 929-8074

Shellfish Bulletin No. 21
Series of 2020
05 October 2020

Based on the latest laboratory results of the Bureau of Fisheries and Aquatic Resources (BFAR) and Local Government Units (LGUs), shellfishes collected at **Puerto Princesa Bay, Puerto Princesa City in Palawan; Coastal waters of Milagros in Masbate; Coastal waters of Daus and Tagbilaran City in Bohol; Tambobo Bay, Siaton in Negros Oriental; Coastal waters of Dararam Island, Zumarraga, and Irong-irong and San Pedro Bays in Western Samar; Cancabato Bay, Tacloban City in Leyte; Matarinao Bay in Eastern Samar; Balite Bay, Mati City in Davao Oriental; and Lianga Bay and Coastal waters of Hinatuan in Surigao del Sur** are still **positive** for paralytic shellfish poison that is beyond the regulatory limit.



All types of shellfish and *Acetes sp.* or alamang gathered from the areas shown above are NOT SAFE for human consumption. Fish, squids, shrimps and crabs are safe for human consumption provided that they are fresh and washed thoroughly, and internal organs such as gills and intestines are removed before cooking.

The following areas continue to be **FREE from toxic red tides**: coastal waters of Cavite, Las Piñas, Parañaque, Navotas, Bulacan and Bataan (Mariveles, Limay, Orion, Pilar, Balanga, Hermosa, Orani, Abucay and Samal) in Manila Bay; coastal waters of Bolinao, Anda, Alaminos, Sual and Wawa, Bani in Pangasinan; coastal waters of Pampanga; Masinloc Bay in Zambales; coastal waters of Pagbilao and Padre Burgos in Quezon; Honda Bay, Puerto Princesa City and coastal waters of Inner Malampaya Sound, Taytay in Palawan; coastal waters of Mandaon in Masbate; Juag Lagoon, Matnog and Sorsogon Bay in Sorsogon; coastal waters of Pilar, Panay, President Roxas and Roxas City in Capiz; Saplán Bay (Ivisan and Saplán in Capiz; Mambuquio and Camanci, Batan in Aklan); Altavas, Batan and New Washington in Batan Bay, Aklan; coastal waters of E.B. Magalona, Talisay City, Silay City, Bacolod City, Hinigaran and Victorias City in Negros Occidental; Calubian and Ormoc Bay, Ormoc City in Leyte; Dumaguillas Bay in Zamboanga del Sur; Panguil Bay, Tangub City in Misamis Occidental; Murcielagos Bay in Zamboanga del Norte and Misamis Occidental; Taguines Lagoon, Benoni, Mahinog in Camiguin Island; Coastal waters of Nasipit in Agusan del Norte; and Coastal waters of Cortez and Bislig Bay in Surigao del Sur. **Moreover, Siit Bay, Siaton and Bais Bay, Bais City in Negros Oriental are now free of the toxic red tides.**

DR. JUAN D. ALBALADEJO
Officer-In-Charge, Director

A food-secure Philippines
with prosperous farmers and fisherfolk



As of 2020...

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Honda Bay now positive of Red Tide toxins

Red tide up anew in Honda Bay

Dec 6, 2017 9:11 pm | Keith Anthony Fabro | CITY NEWS, NEWS OF THE DAY | 359

BFAR confirms red tide alert in Honda Bay

Man dies of red tide poisoning in Palawan

Carolyn Bonquin, ABS-CBN News
Posted at Aug 09 2017 08:14 PM

philstar GLOBAL

P21.9 million milkfish dead in Pangasinan fish kill

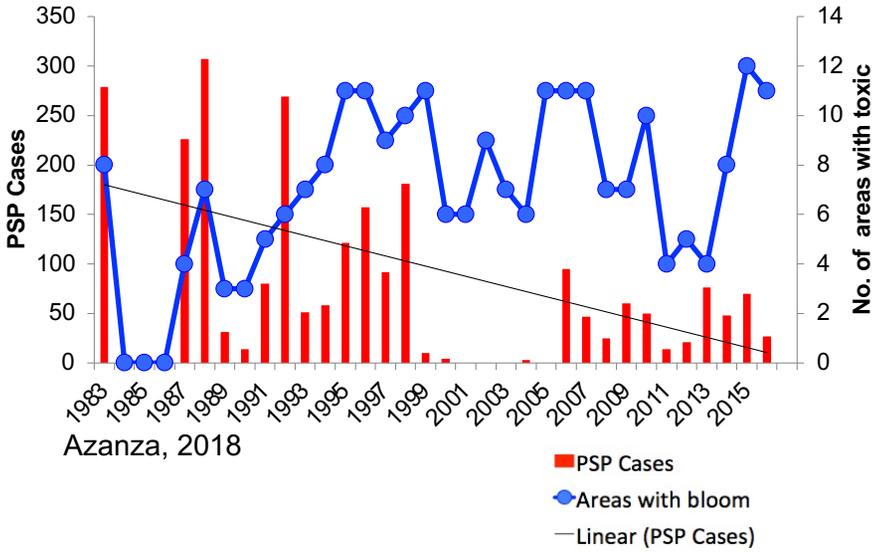
Eva Visperas 5/22/2020

f t w m l

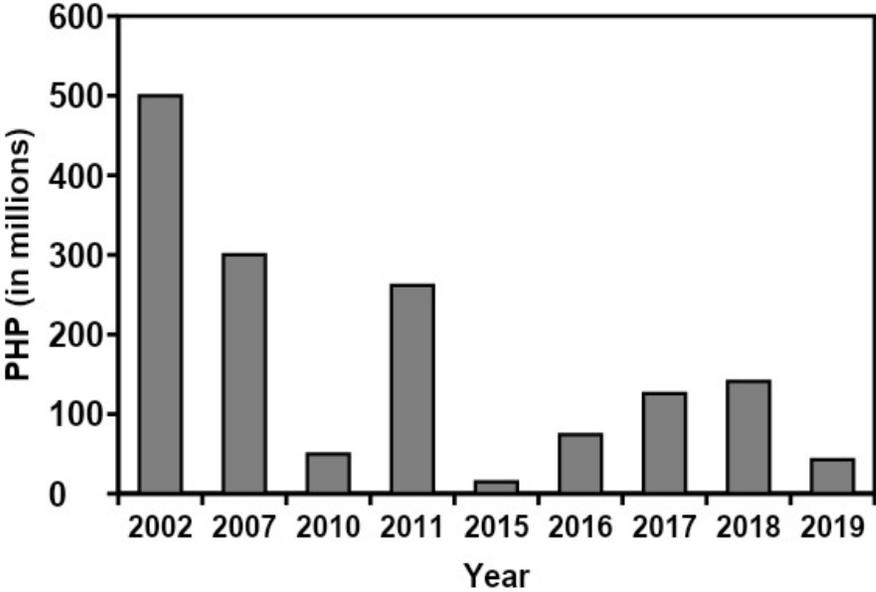
5

Positive Impacts of HAB Monitoring Efforts

Safeguarding public safety: declining PSP cases

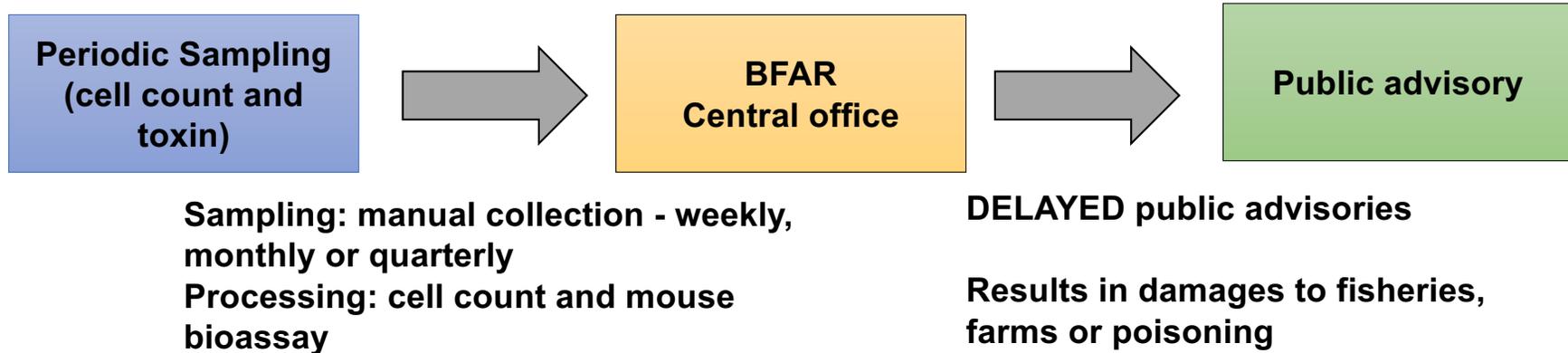


Decreasing economic losses

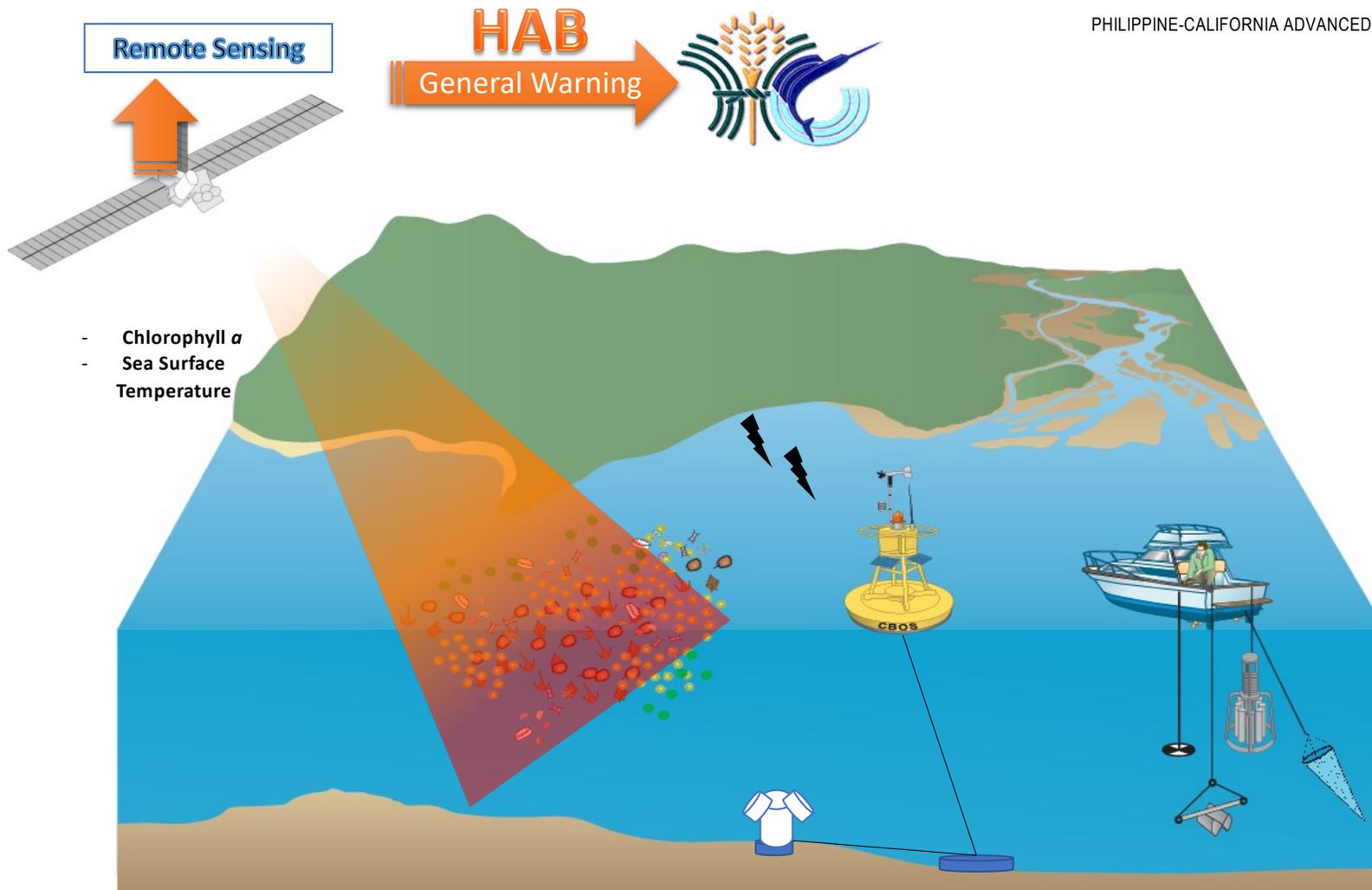


At present... monitoring efforts and public advisory is highly reactive and too centralized!

Philippines Red Tide Monitoring Agency (1988) under the Bureau of Fisheries and Aquatic Resources of the Department of Agriculture (DA-BFAR)

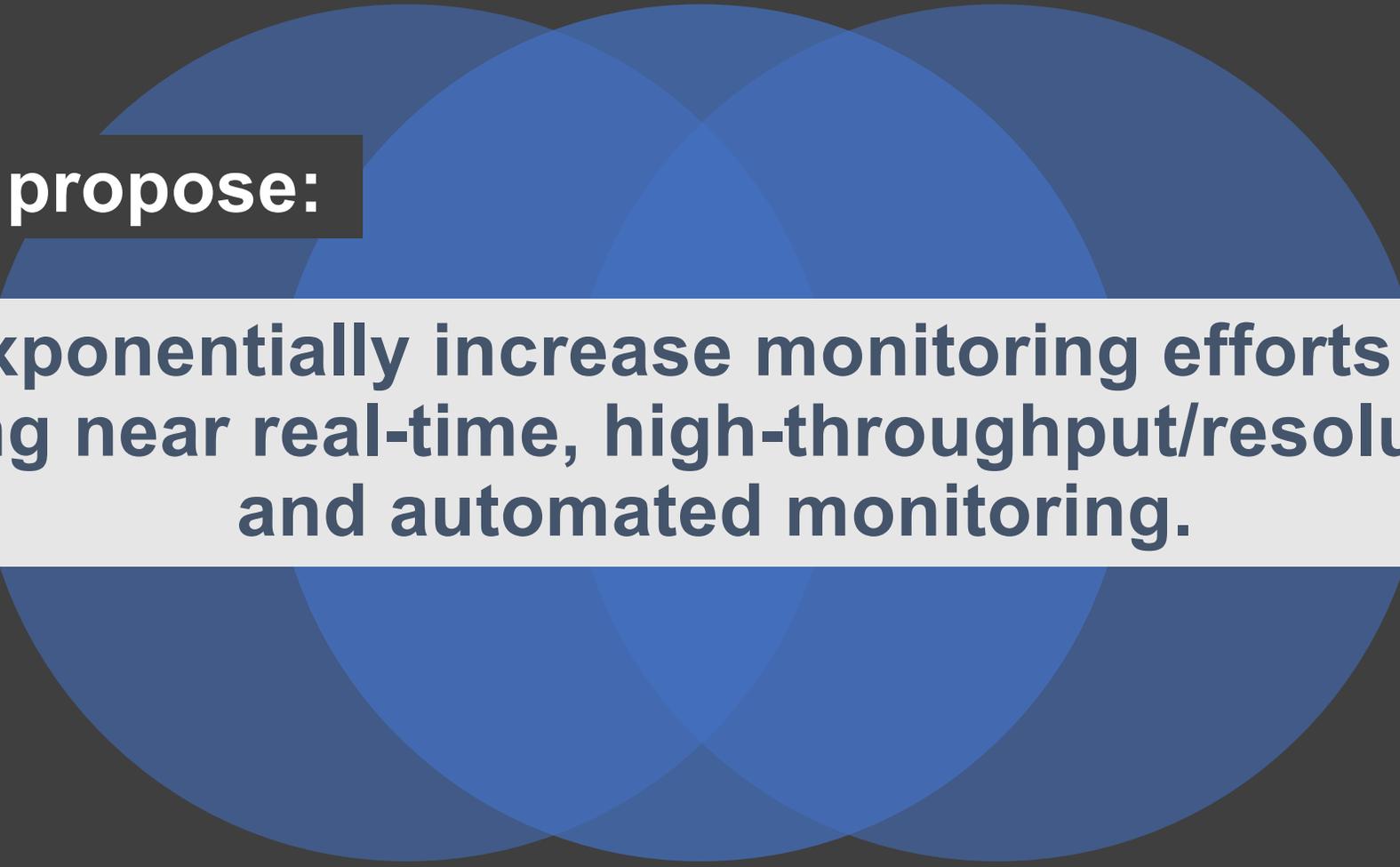


REACTIVE response rather than **PROACTIVE!**



There are current efforts to create an integrated model-based approach in monitoring

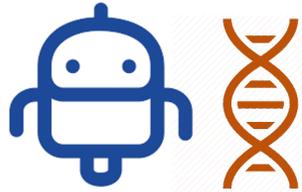
However, model based approach remains low resolution and still needs on-site validation



We propose:

Exponentially increase monitoring efforts by doing near real-time, high-throughput/resolution, and automated monitoring.

Aims



Develop early warning systems for HABs using new and automated imaging technologies



Transfer technology to local researchers and stakeholders

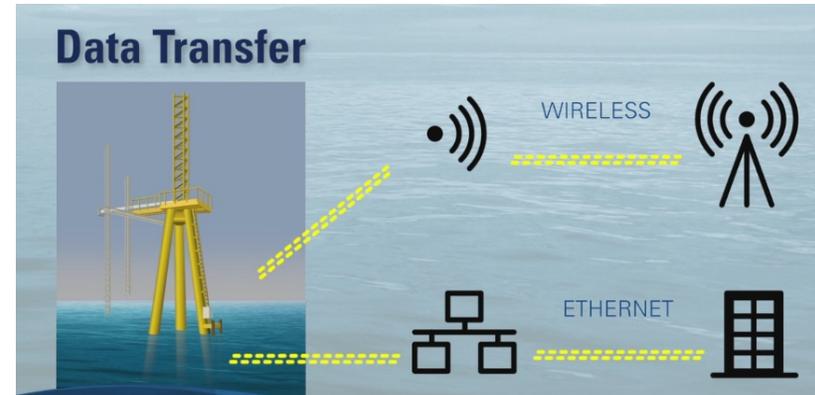
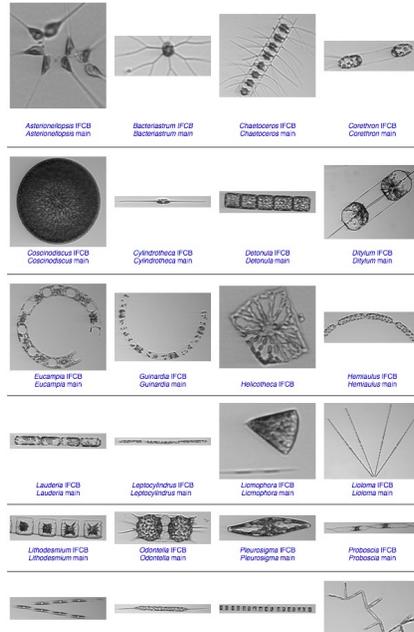


Make the data available for public information and science-based decision making



Develop early warning system for HABs using new and automated technologies

Tech 1: Submersible Imaging FlowCytobot (IFCB)



- Submersible to 6 months
- Real-time transmittal of data
- Kudela and Sison-Mangus Lab - monitoring HAB species in Monterey Bay, California

Approaches

UP MSI
Central Server



Model Site 1
Shellfish Poisoning
Puerto Princesa Bay

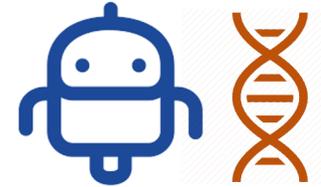


Model Site 2
Fish Kill
Bolinao, Pangasinan



Model 3
Mobile Monitoring Team
All over the country

High-throughput imaging and
molecular methods for HABs
monitoring



High throughput imaging

Real-time monitoring
i.e. web- or app-based

Imaging FlowCytobot
(IFCB)

HT-CLS Microscopy
(HT-CLSM)

Molecular Methods

PCR-based
(HT-Sequencing, qPCR)

Hybridization
-ISH, blotting

Toxin assays

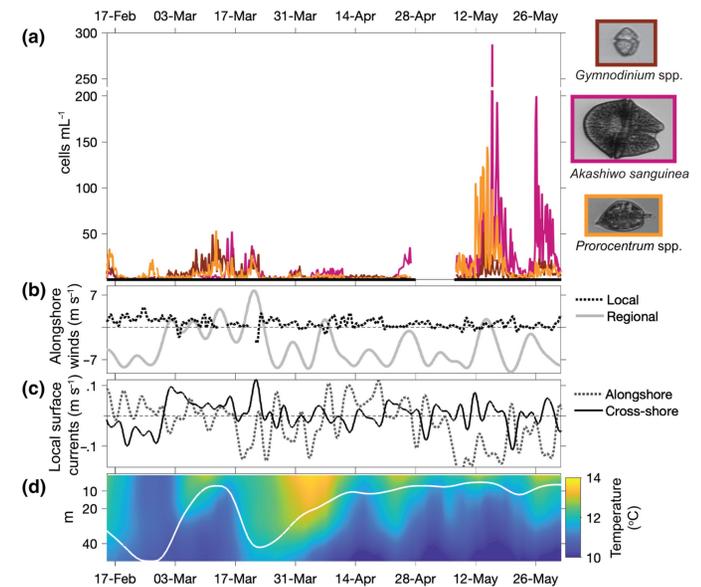
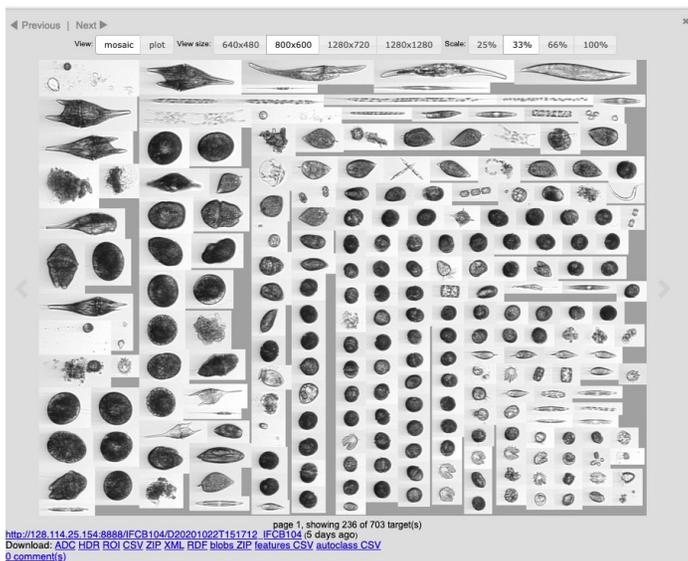
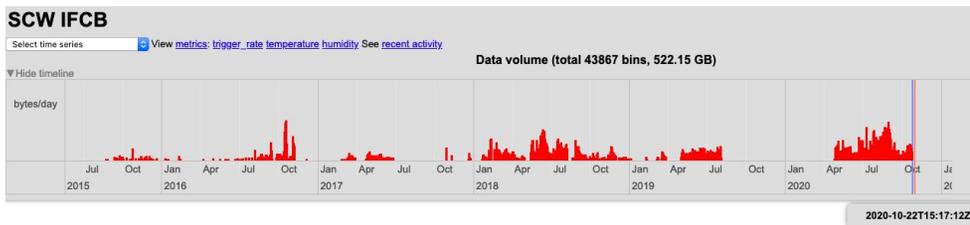
Technology 1

Technology 2



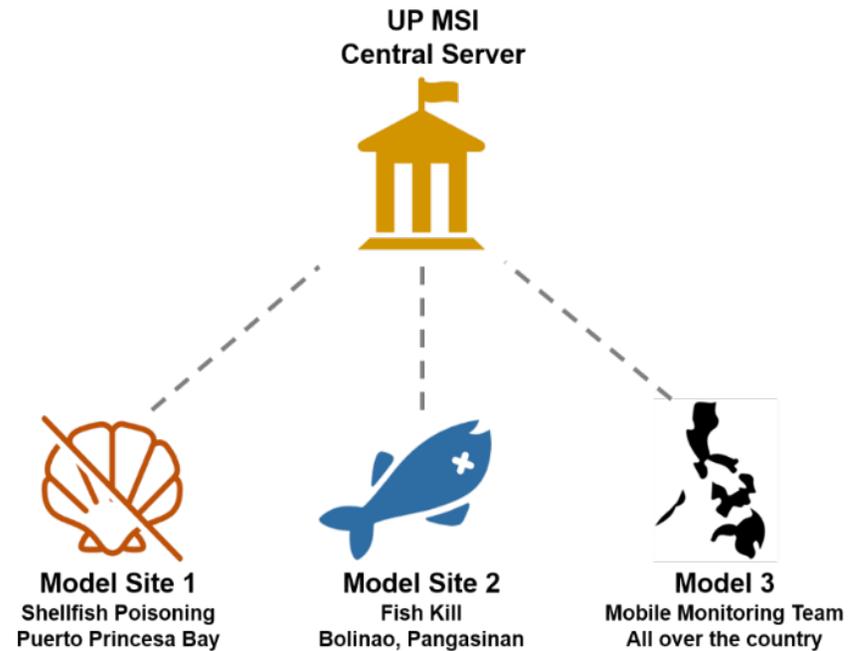
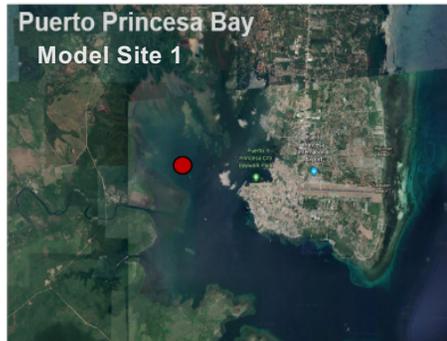
Make the data available for public information and science-based decision making

“A go-to site, user-friendly dashboard”



Fischer, A.D., Hayashi, K., McGaraghan, A^{1,3} and Kudela, R.M. (2020), *Limnol Oceanogr*, 65: 2125-2141

IFCB Deployment, Monitoring, and Reporting





Employ and optimize new and emerging automated technologies for HABs monitoring

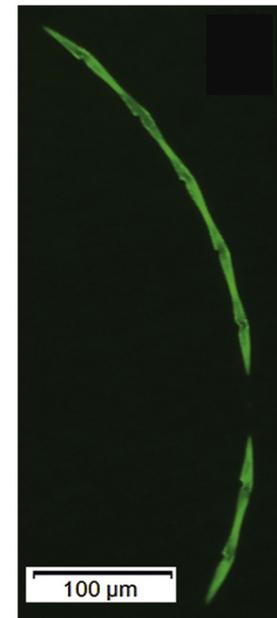
Tech 2: Molecular Methods

1. Develop genetic markers for PCR, RT-PCR or hybridization-based approach for local HABs species
2. Verify molecular approach with toxin analysis (SPATT)

Benefits:

High resolution validation of toxin-bearing algal species.

Methods transferable to local agencies without site-deployed IFCB



FISH probing toxic *Pseudo-nitzschia australis* using genetic marker

Expected Outputs



Publications

Scientific Articles
Sci Comm materials
Manuals, reports,
etc.



Products

Operational
monitoring station,
early warning
system, web/phone
app, etc.



People Services

Trainings,
workshops,
seminars, capacity
building and
upgrading



Partnerships

Operational
monitoring station,
early warning
system, web/phone
app, etc.



Policy

Policy briefs and
recommendations to
improve monitoring,
Adaption of tech,
and management
approaches



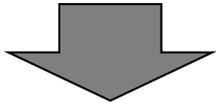
HABs Watch

Transfer technology to local researchers and stakeholders

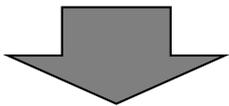
**Puerto Princesa Bay
Guiguivanen, Bolinao**

model sites

(Floating marine observatory)



**Public usage and information
(fishermen, farm owners)**



**Expand to other areas
(Manila Bay, Leyte,
Davao)**

Academic Training



Prof. Flor Galon (PSU) + 13 other faculty
Prof. Lota Creentia (WPU) + Mol Biol and Micro Dept
Prof. Leni Yap (UPV)
Prof. Manny Capinpin
Dr. Samuel Paul Ignacio

Total HEI collabs: **23 faculty**

4 RAs (MSc) and other enrolled graduate students in MSI
1 student faculty, **2** MSc, and undergraduate students from PSU
2 MSc, and undergraduate students from WPU
1 Filipino PhD, **1** Postdoc, **2** MSc in UCSC (under PCARI scholarship)

Total: at least **12** graduate students

**Other beneficiaries:
LGU/NGA**



HABs Watch: Addressing key issues

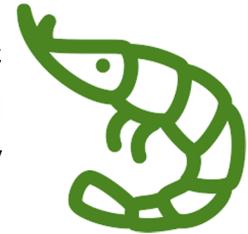


Capability and expertise

Transfer of technology, training of local researchers and young/new scientists

Health and economic

Information and technology platforms to safeguard health and food security



Public information and education

Go-to site for HABs monitoring and related information, campaign against pollution and environmental degradation, public access to scientific information

Thank you.