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**on Harmful Algal Blooms**

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Item 4.3.2 of the Provisional Agenda

**PROGRESS REPORT OF THE IOC REGIONAL WORKING GROUP ON HARMFUL ALGAL BLOOMS IN THE CARIBBEAN AND ADJACENT REGIONS (IOCARIBE-ANCA)**

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**INTRODUCTION**

The Caribbean Harmful Algae Network (ANCA), under the auspices of the Intergovernmental Oceanographic Commission of UNESCO (IOC) and its Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), presents its Progress Report for the period 2023-2025. This report highlights the achievements, challenges, and ongoing efforts of the network to address the critical issues posed by harmful algal blooms (HABs) in the Caribbean and adjacent regions.

During this period, ANCA has focused on expanding regional collaboration, advancing scientific research, and developing practical tools to mitigate the impacts of HABs. Key priorities have included addressing ciguatera food poisoning and red tides, which continue to pose significant threats to public health, fisheries, and coastal economies. The network has also made strides in enhancing early warning systems, increasing stakeholder visibility, and fostering capacity-building initiatives across the region.

This report outlines the progress made toward the network’s strategic objectives, including the publication of scientific research, the development of predictive indices, and the implementation of training programs. It also identifies the challenges that remain and proposes actionable steps to strengthen the region’s ability to monitor, manage, and mitigate the impacts of HABs.

By fostering collaboration among member countries and leveraging international cooperation, ANCA aims to ensure the sustainable management of marine resources and protect the livelihoods of coastal communities in the Caribbean.

# ANCA, A NETWORK OF THE IOCARIBE HAB PROGRAM - WORK PLAN 2023 - 2025

* 1. **Main Objective**

Improve the understanding of harmful algal blooms in the Caribbean region and adjacent areas and our ability to cope with its impacts.

* 1. **ANCA: Specific objectives**
* Collect and analyze information that allows making decisions related to HABs in the Caribbean region.
* Train HAB researchers for the region, taking advantage of the existing knowledge in the Caribbean and the international cooperation.
* Identify and characterize the microalgae responsible for the intoxications (PSP, DSP, ASP, NSP, Ciguatera), as well as the toxins vector species in the Caribbean and adjacent areas.
* Increased visibility among the different social stakeholders in the Caribbean region.
* Progress in initiatives on HAB early warning systems.
  1. **Background**

In recent years, the ANCA-IOCARIBE working group has developed proposals and initiatives that have led to tangible outcomes, which have been implemented in several Caribbean countries to advance research, management, and communication related to harmful algal blooms (HABs). As a result, the issue of HABs has evolved from being a largely anecdotal concern to a recognized problem, prompting a gradual shift from reactive measures to proactive policies in addressing these events.

However, the issue of HABs remains inadequately prioritized in a minority of IOCARIBE member countries. This underscores the need to reinforce regional efforts to raise awareness and foster greater engagement with HAB-related challenges. Unlike other threats to the marine environment, HABs are biologically driven, difficult to predict, and often occur sporadically, making them easily confused with other issues, such as bacterial contamination. Despite these complexities, HABs have significant socio-economic impacts, and their frequency and intensity are expected to increase in some areas due to climate change.

Given these challenges, the ANCA-IOCARIBE group is committed to promoting cost-efficient, high-impact regional actions that align with national initiatives and complement other regional efforts across the Greater Caribbean. By focusing on collaborative and strategic approaches, the group aims to enhance the region’s capacity to manage and mitigate the impacts of HABs effectively.

* 1. **Main activities:**

|  |  |
| --- | --- |
| **Activity** | **Objective** |
| Reactivate the current HAB introductory virtual reality course that is in the Play store | Increased visibility among the different social stakeholders in the Caribbean region. |
| Update of the IOC-UNESCO ANCA-HAEDAT platform | Collect and analyze information that allows making decisions related to HABs in the Caribbean region. |
| Conducting the Workshop: Ciguatera as a potential risk for the tourism industry | Increased visibility among the different social stakeholders in the Caribbean region. |
| ANCA`s Participation in Tourism working group meetings | Stakeholder’s engagements: HABs knowledge promotion to reduce vulnerability in the Caribbean to the threat of toxic events |
| Layout and publication in digital format of the Ciguatera book, already existing in Spanish and English | Increased visibility among the different social stakeholders in the Caribbean region. |

* 1. **IOC-ANCA List of Focal Points (2024)**

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| Focal Point | Julio MORELL | Puerto Rico |  |

* 1. **ANCA editors to HAIS – HAEDAT**

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# ACTIVITIES CARRIED OUT WITHIN THE FRAMEWORK OF THE ANCA WORK PLAN 2023 - 2025

* 1. **Activities to increase visibility among stakeholders & train HAB researchers for the region**

The achievements of ANCA for the 2023-2024 period are reflected in a range of impactful activities aimed at increasing visibility among stakeholders and enhancing the capacity of HAB researchers in the region. Key accomplishments include the publication of scientific research, the organization of training courses, active participation in workshops and seminars, and presentations at scientific conferences. Additionally, thematic conferences and outreach activities have been conducted at various academic and community levels to raise awareness and disseminate knowledge about harmful algal blooms (HABs).

The table below provides a summary of the most significant achievements during this period, highlighting the progress made in advancing research, training, and stakeholder engagement across the Caribbean region.

| **TYPE OF PRODUCT** | **DESCRIPTION** | **AUDIENCE** | **SUPPORTED BY** |
| --- | --- | --- | --- |
| **Research Papers** | Multiple scientific publications on benthic harmful microalgae, ciguatera, and HAB-related topics. Examples include:   * + Mafra et al. (2023): Benthic harmful microalgae and their impacts in South America. Harmful Algae.   + Mancera-Pineda et al. (2025): Ciguatera in the Seaflower Biosphere Reserve: Projecting the Approach on HABs to Assess and Mitigate their Impacts on Public Health, Fisheries, and Tourism.   + Mancera-Pineda, J.E., Osorio-Arias, A., Toro, C., Velasquez-Calderón, C.S. (Eds.) (2025): Climate Change Adaptation and Mitigation in the Seaflower Biosphere Reserve: From Local Thinking to Global Action. Springer Nature.   + Arteaga-Sogamoso et al. (2023): Morphology and phylogeny of Prorocentrum porosum sp. nov. (Dinophyceae): A new benthic toxic dinoflagellate from the Atlantic and Pacific Oceans. Harmful Algae.   + Díaz-Asencio et al. (2024): Establishing a Receptor Binding Assay for Ciguatoxins: Challenges, Assay Performance, and Application. Toxins.   + Gómez-Luna et al. (2024): Catalogue of Cyanobacteria from Eastern Cuba.   + Arencibia-Carballo et al. (2024): Ciguatera outbreak caused by Mycteroperca bonaci in Baracoa, Cuba. Brazilian Journal of Animal and Environmental Research.   + Van Tussenbroek et al. (2023): Temporal Changes in the Composition of Beached Holopelagic Sargassum spp. along the Northwestern Coast of Cuba.   + Arteaga Sogamoso & Mancera-Pineda (2024): Species behaviour affects recommended exposure times of artificial substrates to sample benthic dinoflagellates. HARMFUL ALGAE NEWS No. 77.   + Salzwedel & Mancera-Pineda (2023): The Colombian Ecoregion Ciénaga Grande de Santa Marta in the Public Media, 1990-2020. Editorial Unimagdalena.   + Pulgares-Balart & Gómez-Luna (2024): Implementation of a risk management protocol for toxic cyanobacteria in San Blas Lagoon, Camagüey, Cuba. Vol. 44, No. 2, ISSN: 2224-6185. | Academic sector, Research Institutes | Universities, Research Institutes, IOCARIBE |
| **Informative Book** | New edition of Ciguatera: A Potential Risk for Human Health – Frequently Asked Questions. | Environmental authorities, decision-makers | IOCARIBE |
| **Catalog** | * + Catalogue of Cyanobacteria from the Cerrón Grande Reservoir (Quintanilla et al., 2024).   + Catalog of Planktonic Dinoflagellates in the Pacific of Guatemala (Paz Cordón et al., 2024). | Academic sector, Environmental authorities | LABTOX-UES  USAC |
| **Seminars, Congresses, Courses** | Participation in events such as:   * + XII Latin American and Caribbean Phycology Congress (October 2024, Costa Rica).   + XIV Symposium of the Center for Marine and Limnology Research (December 2024).   + Workshop: HABs and their repercussions on human and environmental health (October 2024, Panama).   + Workshop: Advances in research on water quality risk factors and remediation proposals for integrated water resource management in coastal areas (TOXICROP Project). | Academic sector, other sectors | Universities, Research Institutes, International Organizations |
| **Free Virtual Reality Course** | Introduction to HABs – A free virtual reality course available on the Play Store. | Young people, adolescents, children | IOCARIBE, Universidad Nacional de Colombia, INVEMAR |
| **Training Courses** | * + Taxonomy and Ecology of Continental Dinoflagellates (2023, Panama).   + Biochemical Pathways of Marine Biotoxin Intoxications (2024, Panama).   + Marine Microalgae: Taxonomic Identification and Quantitative Analysis (2024). | Students, professionals | Private funding, Universidad de San Carlos de Guatemala |
| **Thesis** | * + Doctoral Thesis: Influence of Resources and Regulators on the Population Abundance of Benthic Dinoflagellates in the Southwestern Caribbean on Daily Scales (Arteaga, 2023).   + Master’s Thesis: Tool for Predicting the Risk of Mass Fish Mortality Associated with Harmful Algal Blooms in Tropical Estuaries (Santos Becerra, 2024). | Academic sector | Universidad Nacional de Colombia |

* 1. **Identify and characterize the microalgae responsible for the intoxications (PSP, DSP, ASP, NSP, Ciguatera, Cyanotoxins)**

To achieve this objective, a variety of projects, theses, and monitoring programs are being carried out at both national and regional levels. These initiatives aim to identify and characterize microalgae responsible for harmful algal blooms (HABs) and their associated toxins, including paralytic shellfish poisoning (PSP), diarrhetic shellfish poisoning (DSP), amnesic shellfish poisoning (ASP), neurotoxic shellfish poisoning (NSP), ciguatera, and cyanotoxins.

Key projects financed by the International Atomic Energy Agency (IAEA) include:

* **RLA 7014:** Latin American regional proficiency test on the determination of trace elements and radionuclides in algae, soil, and spiked water.
* **RLA 7020:** Establishing the Caribbean Observing Network for Ocean Acidification and its impact on Harmful Algal Blooms, using nuclear and isotopic techniques.
* **RLA 7026:** Supporting the use of receptor binding assays (RBA) to reduce the adverse impacts of harmful algal toxins on seafood safety.
* **RL 7022:** Strengthening regional monitoring and response for sustainable marine and coastal environments.
* **ELS/7011:** Strengthening national capacities for sustainable environmental management in the context of climate change.
* **RLA/7028:** Strengthening regional capacities for the application of nuclear and isotopic techniques to enhance knowledge of stressors affecting sustainable marine and coastal management.
* **RLA7026:** Assessing organic and inorganic environmental pollution in aquatic ecosystems in Latin America and the Caribbean, and its impact on the risk of cyanobacteria producing cyanotoxins.

These projects are part of a broader effort to improve the understanding of HABs, enhance monitoring capabilities, and develop strategies to mitigate their impacts on public health, fisheries, and coastal ecosystems.

* 1. **Progress in initiatives on HAB early warning systems**

The countries within the ANCA-IOCARIBE group continue to advance risk management of harmful algal blooms (HABs) through various projects and monitoring programs, supported by partial and contracted funding opportunities. These efforts have led to the development of multi-parameter biotic and environmental databases, which are critical for understanding and mitigating the impacts of HABs.

In several countries, the development and implementation of early warning systems (EWS) for HAB risk reduction are ongoing. These systems rely on active participation from at-risk communities, ensuring they receive timely information, training, and opportunities to exchange knowledge with other stakeholders. As part of its priority activities, ANCA has focused on disseminating actions and results to various social sectors, as outlined in Section I of this report.

To date, countries such as Colombia and Cuba have made significant progress in developing predictive indices as tools for their early warning systems. These include the **IRMA** (Index for Risk of Mass Fish Mortality) in Colombia and the **IRCIGUA** (Ciguatera Risk Index) in Cuba.

**IRMA: Index to Predict Mass Fish Mortality During Harmful Algal Blooms in Tropical Estuaries**

In the Ciénaga Grande de Santa Marta (CGSM), Colombia’s largest and most productive estuarine system, HAB events are frequent. To address this, the IRMA index was developed as part of an early warning system. The index is based on a conceptual model of HABs in the CGSM, which links increasing phosphate (PO₄) levels to the massive growth of microalgae, particularly nitrogen-fixing cyanobacteria. These blooms eventually collapse, leading to hypoxia or anoxia.

The IRMA algorithm was built using over 30 years of monitoring data and more than 4,000 records, incorporating parameters such as PO₄, chlorophyll, and dissolved oxygen concentrations. The index was calibrated using historical fish mortality events and validated with additional physical and chemical variables. Given its high predictive accuracy, IRMA has significant potential as a tool for managing eutrophication and mitigating fish mortality in tropical estuaries.

**IRCIGUA: Ciguatera Risk Index**

In Cuba, the Fisheries Research Center (CIP) in Havana has continued developing the Ciguatera Risk Index (IRCIGUA) as part of its early warning system. This index establishes criteria for monitoring ecosystems to assess ciguatera risks. However, progress has been hindered by the country’s socioeconomic challenges, particularly in creating an automated database to consolidate and analyze available data for comprehensive ciguatera management in health centers.

Meanwhile, the Center for Environmental Studies in Cienfuegos has successfully consolidated its System for Monitoring and Managing HAB Events. This system emphasizes an integrative approach to managing HAB phenomena in coastal areas and maintains a strong working relationship with the Fisheries Research Center. The process involves five key stages: Surveillance, Communication, System Activation, Direct Event Management, and Impact Assessment. Additionally, a project to identify areas with ciguatera biotoxin-producing microalgae has been operational since 2024.

* 1. **Collect and analyze information that allows making decisions related to HABs in the Caribbean region**

A consultancy is currently underway to update the IOC-UNESCO ANCA-HAEDAT platform, conduct statistical analyses of harmful algal bloom (HAB) data, and support the training of regional stakeholders. As of now, the activities have progressed by 30%, with the completion of the first task: an initial review and diagnostic assessment of the HAEDAT database for IOCARIBE member countries.

The initial report, submitted on February 15, 2025, provides a detailed analysis of the current state of the database, identifying key gaps and offering recommendations to enhance data quality, accessibility, and usability. This report also includes a statistical analysis of HAB event trends in the ANCA and CCA regions, highlighting geographical, temporal, and causative species patterns, as well as their associated impacts.

The 30% progress milestone also marks the initiation of new data collection efforts through collaboration with ANCA-IOCARIBE focal points. This step is critical for ensuring the platform is updated with the most recent and accurate information. Additionally, technical challenges and opportunities for improving the database structure have been identified, such as the inclusion of metadata and the optimization of column organization to streamline data management and analysis.

These advancements lay the foundation for the next phases of the consultancy, which include:

* Uploading new and verified HAB records to the HAEDAT platform.
* Conducting advanced statistical analyses to identify trends and inform decision-making.
* Developing training materials and organizing capacity-building sessions for regional stakeholders.

By addressing these tasks, the consultancy aims to strengthen the region’s ability to monitor, analyze, and respond to HAB events effectively, ultimately supporting sustainable management of marine resources in the Caribbean.

# NEEDS IDENTIFIED IN THE ANCA GROUP

To strengthen the capacity of the ANCA group and enhance its effectiveness in addressing harmful algal blooms (HABs) in the Caribbean and adjacent regions, the following needs have been identified:

* Expand Regional Participation: Increase the number of participating countries from the Caribbean and adjacent areas, and establish comprehensive monitoring plans for HABs, including investigations of unforeseen cases.
* Support Early Warning Systems: Provide technical and scientific inputs to develop and improve early warning systems for HABs, ensuring timely and accurate risk assessments.
* Enhance Scientific Training: Strengthen scientific training programs on toxic algae and HABs, adopting an ecosystem-based approach to improve regional expertise and response capabilities.
* Facilitate Access to Certified Toxin Standards: Develop mechanisms to acquire certified toxin standards for analytical purposes, ensuring accurate and reliable toxin detection and quantification.
* Expand Outreach and Education: Broaden dissemination, outreach, and education strategies on HABs to reach all social sectors, with a particular focus on the tourism industry, which is highly vulnerable to HAB impacts.
* Secure Funding for Infrastructure: Increase access to international project calls that provide funding for research and monitoring infrastructure, enabling long-term sustainability of HAB monitoring efforts.
* Improve Communication and Collaboration: Establish mechanisms such as a dedicated website and stronger links with international groups to foster constant and effective communication among ongoing projects and stakeholders.
* Conclude Previous Period with a Face-to-Face Meeting: Organize an in-person meeting to finalize the outcomes of the previous work period, ensuring alignment and continuity in regional efforts.

Addressing these needs will enhance the ANCA group’s ability to monitor, manage, and mitigate the impacts of HABs, ultimately contributing to the protection of public health, marine ecosystems, and coastal economies in the Caribbean region.

# APPENDIX

* 1. **Additional Information provided by the Countries**

**Costa Rica**

Costa Rica has identified specific needs to strengthen its capacity to address harmful algal blooms (HABs). These include:

* Training and equipment for the early detection of toxic events.
* Support for the manipulation of cultures to extract toxins (PSP, ASP, DSP, NSP, ciguatera) using chemical methods.
* Assistance in conducting molecular analyses for species identification.
* Development of new methods for species identification.
* Regional support for coastal monitoring efforts.

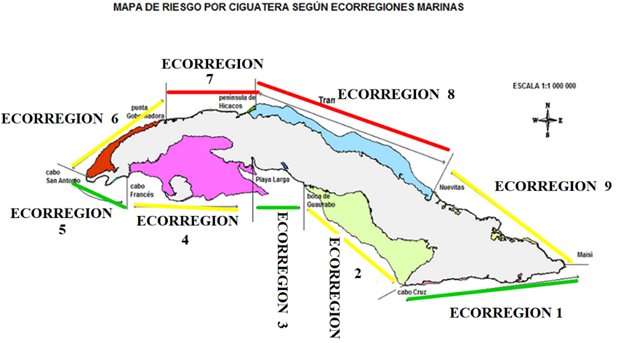
**Panama**

The FAN-Panama group provides technical support to the Ministry of the Environment and the Aquatic Resources Authority of Panama in response to algal blooms and aquatic organism mortality events. The group is divided into three sections covering the eastern, central, and western Pacific regions of Panama.

A project monitoring dinoflagellates in the southern Azuero Peninsula evaluates physical-chemical water parameters and phytoplankton diversity. The presence of toxin-producing species, such as Alexandrium tamaerense, Dinophysis caudata, Dinophysis ovum, and Dinophysis acuminata-ovum-sacculus, has been documented. These species are linked to fish mortality events caused by anoxia or hypoxia.

**Cuba**

Cuba has established the first laboratory in Latin America and the Caribbean capable of detecting ciguatoxins in marine organisms, thanks to close cooperation with the IAEA. Ciguatoxins, responsible for ciguatera poisoning, cause numerous cases annually due to the consumption of contaminated seafood. The IAEA has supported capacity-building efforts to monitor ciguatera in the region using nuclear and isotopic techniques.

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**Venezuela**

As part of the ANCA-IOCARIBE program, Venezuela collaborates with Caribbean countries to exchange information on HABs, seafood poisoning events, and national HAB management protocols. Key institutions involved include:

* The School of Applied Marine Sciences of the Universidad de Oriente (ECAM-UDO).
* The Venezuelan Institute for Scientific Research (IVIC).
* The National Center for Fisheries and Aquaculture Research (CENIPA), under the Ministry of Fisheries and Aquaculture (MINPESCA).
* The Ministry of Ecosocialism (MINEC).

These entities are working together to monitor and manage HAB events in Venezuelan waters.

**Colombia**

Research on potentially toxic epiphytic and benthic dinoflagellates in Colombia began following toxic events affecting tourists and residents on San Andrés Island in 2007. To date, 11 species of dinoflagellates associated with macroalgae and seagrass have been identified, including Dinophysis acuminata, Gambierdiscus toxicus, and Ostreopsis ovata. Additionally, 12 species of dinoflagellates have been found on drifting substrates, highlighting their role as dispersal vectors for toxic species in the Caribbean.

**El Salvador**

During the 2023-2024 period, LABTOX-UES operated through three specialized units:

* **Microscopy Unit**: Conducts research on toxic algal and cyanobacterial blooms.
* **Radioecology Unit**: Applies nuclear and isotopic techniques for toxin quantification, sediment dating, and marine radioactivity analysis.
* **Water Pollution Unit**: Focuses on heavy metals, microplastics, and nutrient (phosphorus and nitrogen) monitoring.

LABTOX-UES remains a key center for developing scientific skills among students at the Faculty of Natural Sciences and Mathematics.

**Mexico**

Mexico implements precautionary closures when algal cell abundance exceeds thresholds set by the Mexican Bivalve Mollusk Health Program (PMSMB) or when toxin screening tests yield positive results. These measures are primarily enforced on the northern coasts of the Gulf of California (Baja California and Sonora). Sanitary actions have increased significantly since 2020, with 24 of the 25 nationwide closures in 2024 occurring in Baja California.

**General Considerations**

Despite the challenges faced by the IOCARIBE-UNESCO Caribbean Harmful Algae Group, significant achievements have been made. However, urgent needs remain, including:

* Increasing participation from more countries in the region.
* Implementing comprehensive training and dissemination systems to strengthen regional capacity.
* Enhancing the impact of HAB management efforts on economic and tourism sectors.

Regional integration projects are essential to demonstrate the group’s resilience and effectiveness, even amid socio-political and developmental challenges. By fostering collaboration and communication, the group can continue to address the threats posed by HABs and protect the Caribbean’s marine ecosystems and coastal communities.

* 1. **Conference “Ciguatera: a global threat”**

**Personas alrededor de una mesa

El contenido generado por IA puede ser incorrecto.**

* 1. **Book and scientific publications**

