

NORTH PACIFIC MARINE SCIENCE ORGANIZATION (PICES)
PROJECT ON “*CREATING A PHYTOPLANKTON-FISHERY OBSERVING PROGRAM FOR SUSTAINING LOCAL
COMMUNITIES IN NDONESIAN COASTAL WATERS*”

FINANCIAL REPORT FOR YEAR 1 (ENDING MARCH 31, 2024)

1. PROJECT BACKGROUND, OBJECTIVES AND INITIATIVES

PICES member countries have significant resources for monitoring environmental conditions and fisheries in coastal waters. At the same time, developing nations are far more limited in their capacity to collect data needed to advance their management practices in these waters. Citizen-based monitoring is an approach designed to improve the efficiency and effectiveness of monitoring efforts when technical and financial resources are insufficient. There are many successful examples of citizen-based monitoring in developed countries. However, this approach has not yet been widely applied to collecting environmental and fisheries data in developing nations. Based on such recognition, PICES has conducted two citizen-based monitoring projects funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan: “*Building capacity for coastal monitoring by local small-scale fishers* (FishGIS: November 2017 – March 2020) and “*Building local warning networks for the detection and human dimension of Ciguatera Fish Poisoning in Indonesian communities*” (Ciguatera: April 2020 – March 2023).

The overall goal of the project, entitled “*Creating a phytoplankton-fishery observing program for sustaining local communities in Indonesian coastal waters*” (a.k.a. FishPhyto) is to establish, in collaboration with local fishermen, research institutes and universities, the capacity to develop and operate a phytoplankton-fishery observing program in the Lombok Island region (West Nusa Tenggara Province, Indonesia). This project is expected to use tools developed and refined during the previous two PICES/MAFF projects (2017–2023) that enable the detection of toxic benthic Harmful Algal Bloom (HAB) species that can threaten tropical reefs and other coastal fisheries and record images of the fishery catches for enumeration of fish species and sizes. The long-term objectives are to: (1) provide local communities with the operational capacity and knowledge to manage their fisheries resources and ensure sustainable seafood safety, and (2) identify research needs for deploying these tools in PICES member countries. The first year of this project (June 1, 2023 – March 31, 2024) was funded by MAFF, through the Fisheries Agency of Japan (JFA), from the Official Development Assistance (ODA) Fund.

Benthic HAB species, such as the causative organism underlying Ciguatera Fish Poisoning (CFP), arguably have the greatest human health and economic impacts of algal-based poisoning syndrome. CFP occurs when humans consume fish that contain toxins created by benthic microalgae of the dinoflagellate genera *Gambierdiscus* and *Fukuyoa*, which are the initial sources of ciguatoxin and are endemic in many tropical Pacific regions. The impact of CFP on the human dimension extends far beyond the proximate health and economic outcomes – chronically impacted communities in the Pacific Region and elsewhere can become fearful of local and other fish sources and transition from these traditional ways of life to one where all protein is imported from foreign sources, altering their cultural heritage. In addition to threats of benthic HABs and CFP in Indonesia, there also are pelagic blooms of toxic algae species (e.g., *Alexandrium* spp.) that produce potent neurotoxins, which bioaccumulate in both aquaculture and subsistence fisheries, yet there is no comprehensive monitoring of seafood safety for the majority of the Indonesian coastline. With only a handful of plankton experts available to identify when coastal conditions become toxic, Indonesia lacks the capacity to effectively mount the type of HAB monitoring that is common in developed countries.

The problem of toxic algal blooms appears to be increasing globally. Although Ciguatera and other toxin-producing benthic HABs appear in pristine environments, anthropogenic pressures and climate change are leading to its emergence in new regions and intensification in others. There is evidence of range extension of some of these species into the waters of PICES member countries, which is raising significant concerns. The expansion of dead corals and eel-grass habitats that replace healthy corals facilitates intrusion and establishment

of exotic populations of toxin-producing benthic algae. Despite the widespread impacts of benthic and other HABs, the resultant health and socioeconomic effects remain poorly understood.

Indonesia is part of the Coral Triangle, the most biodiverse marine area on Earth, and these extensive reefs are vital to maintaining the ecological products that contribute to fisheries in this region. However, presently only about 7% of these coral reefs are in excellent condition, while anthropogenic stressors have left more than 35% in poor condition. Decreasing coral health in Indonesia is a relatively new phenomenon compared to other areas of the world, and the human populations living adjacent to the deteriorating corals are not yet fully aware of the consequences of this change. Current reports of benthic and pelagic HABs occurrences are low in Indonesia, almost certainly because diagnosis is difficult without proper training and experience.

Knowledge transfer is essential. Maintaining a healthy environment is critical to a sustainable relationship between the country and the marine environment. Communities must understand the risks of exposure to keep the impact of benthic HABs to a minimum. The highest risk is when the reefs, that communities depend on for fish, have large patches of dead coral or large seagrass mats, as these surfaces are ideal for the growth of benthic algal cells. Pelagic HABs, on the other hand, are much less predictable, so vigilance with the proper tools is essential. The project will offer technology-assisted, community-based training that drives community awareness of emerging problems and will foster surveillance and management skills that can reduce the incidence of HAB-related illnesses. Communities should engage in three levels of surveillance: the health of the corals and coastal waters, the biology of the benthic and pelagic HAB species, and the harvesting of potentially contaminated fish or bivalves to the communities.

The foundation of this project is the robust collaborations developed over the previous four PICES/MAFF projects (conducted in the period from 2007 to 2023) with two Indonesian research institutions, the Indonesian Agency for the Assessment and Application of Technology (BPPT) and the Indonesian Institute of Sciences (LIPI), now integrated into the Indonesian National Research and Innovation Agency (BRIN). In addition, in March 2022, PICES has signed a Memorandum of Understanding with the Indonesian Institute of Technology (ITI) with the goal of integrating both faculty expertise and student involvement into the project to enhance its longer-term sustainability. Project activities are expected to be supported by the Provincial Government of West Nusa Tenggara, which already provided invaluable assistance in organizing a Ciguatera project's community training and knowledge dissemination workshop in January 2023 in Lombok, and expressed strong interest and political will to assist in implementation of future projects.

Four long-term goals guide the project. First, consumers will come to rely on information from local communities and researchers about HABs when purchasing marine goods or services. Secondly, the socio-economic basis of local communities will gain resilience by not depending on products with neurotoxic risks. Thirdly, coral reef health and signals of declining health are better understood by developing nations. Through these capacity-building goals, coastal Indonesian communities can be sustainably improved, with fewer uncertainties and risks from CFP and degradation of coral ecosystems, and the emerging threats of pelagic HABs. The fourth long-term goal, and most directly relevant to PICES, is that lessons learned in this project inform and benefit PICES member countries facing the emergence of climate-driven benthic range extension of HAB species into their marine systems.

The project is proposed to focus on the following major initiatives:

1. Provide a scientific basis to inform local communities about the influence of benthic HABs on their sustainable use of marine resources. This will be underpinned by developing a database from coastal ecosystem monitoring activities by local fishers and community members to detect ecosystems changes.
2. Develop automated image analysis strategies for quantifying fisheries-relevant information from image analysis of the smartphone application data collections. These data will be combined with known benthic HAB toxin vectors to inform risk assessments.
3. Detect the presence of toxin-containing dinoflagellates in the reef environment using two approaches:

- (a) implementation of smartphone and internet-capable automated microscope and species identification tools developed during the previous PICES/MAFF projects, and (b) employing internationally-standardized sampling protocols for toxic benthic algae.
4. Training of “local trainers” and community members to utilize these tools and collected data in local decision-making on coastal fisheries regions to avoid the potential transfer of contaminated fish and shellfish from the damaged environment to the tables of families.

These primary initiatives are being supported through regular capacity building workshops, led by scientists from PICES member countries. The workshops aim to work with local communities to increase the sustainability of their fishing resources by providing them with HAB information. The combination of training and citizen-science contributions in the project is expected to (1) generate the needed capacity for monitoring HAB hotspots in Indonesian waters, (2) provide valuable datasets for the study of *Gambierdiscus*, *Fukuyoa*, *Alexandrium*, and other toxic algae, along with the factors controlling their abundance in reef and coastal systems, and (3) increase human wellness by identifying fishing regions where the health of community members is at risk.

Besides the primary initiatives, three secondary initiatives will be explored during the project: (1) deploying several new low-cost compact, internet-capable flow-through microscope systems for rapid detection and quantification of pelagic and benthic phytoplankton, (2) developing image analysis libraries for rapid automated identification of toxic species within the generated datasets, and (3) modifying the FishGIS smartphone application with preliminary steps towards artificial intelligence-based assessment of fish stock from the collective fish catch data reported by community members.

2. ORGANIZATIONAL AND FINANCIAL PRINCIPLES

The request from MAFF to undertake the project was approved by PICES Governing Council on May 30, 2023, and the project principles agreed to by MAFF/JFA and PICES are listed in Appendix.

The project has strong connections with the PICES Scientific Committees on Human Dimensions (HD), Fishery Science (FIS), and Marine Environmental Quality (MEQ) (through the Section on *Ecology of Harmful Algal Blooms in the North Pacific — S-HAB*), PICES Technical Committee on Data Exchange (TCODE) and on Monitoring (MONITOR), and the PICES FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems) science program (specifically, Research Theme 3 on “*How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?*”). The HD Committee serves as the parent committee for the project.

In accordance with the organizational principles agreed to by MAFF/JFA and PICES (Appendix, Clause 3), the project is being directed by a Project Science Team (PST) formed by PICES Science Board based on principles and procedures detailed in the PICES Policy for approval and management of special projects (Decision 2017/A/7). All PICES member countries and all relevant Scientific and Technical Committees are represented on the PST, co-chaired by Dr. Mitsutaku Makino (University of Tokyo, Japan; mmakino@aori.u-tokyo.ac.jp) and Dr. Mark Wells (University of Maine, USA; mlwells@marine.edu). The PST Co-Chairs are responsible for the detailed planning and execution of the project, and annual reporting on scientific progress to MAFF/JFA and to PICES Science Board through the HD Committee. In PICES, Science Board takes on the task for reporting to Governing Council on the progress and achievements of the project. The Year 1 progress report will be submitted simultaneously with this financial report.

According to the financial principles agreed to by MAFF/JFA and PICES (Appendix, Clause 4), Dr. Alexander Bychkov was appointed by the PICES Executive Secretary to serve as the Project Coordinator and is responsible for the management of the fund and annual reporting on its disposition to MAFF/JFA and to PICES Governing Council through the Finance and Administration Committee (F&A). In PICES, the F&A Committee takes on the task for reporting to Governing Council on the financial and management aspects of the project.

3. PROJECT BANK ACCOUNT

The special account for the project was established at the bank used by PICES:

Bank name: TD Canada Trust
Bank number: 004
SWIFT code: TDOMCATTOR
CC Code: CC000407210
Transit/Branch number: 07210
Transit/Branch address: 2406 Beacon Avenue, Sidney, BC V8L 1X4
Account number: 5232914
Account holder: North Pacific Marine Science Organization (PICES)
Account holder address: 9860 West Saanich Road, Sidney, B.C., Canada. V8L 4B2

4. BUDGET EXECUTION FOR FISCAL YEAR 1

The set of documents requesting funding for Year 1 (June 1, 2023 – March 31, 2024) was sent to MAFF/JFA, through the Consulate General of Japan in Vancouver (Canada), on July 4, 2023, and funds in the amount of \$73,813 were received at the PICES/MAFF bank account on September 5, 2023.

Allocations and actual expenses for each budget category are shown in Table 1. Table 2 provides more details on expenses for specific activities.

Table 1 Allocations and expenses (in \$ CAD) for Year 1 (June 1, 2023 – March 31, 2024)

Category	Allocations	Expenses	Difference
Travel/meetings	37,500	23,400	14,100
Contracts	24,500	39,178	(14,678)
Equipment	1,800	1,394	406
Miscellaneous	417	245	172
Overhead	9,596	9,596	0
Total	73,813	73,813	0

APPENDIX

PROJECT PRINCIPLES

1. A 3-year (June 1, 2023 – March 31, 2026) project, entitled “*Creating a phytoplankton-fishery observing program for sustaining local communities in Indonesian coastal waters*”, is funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA), from the Official Development Assistance (ODA) Fund. The objective of the project is to build, in collaboration with local fishers and research institutes and universities, a phytoplankton-fishery observing program in the Lombok Island region (Indonesia) using tools developed in the 2017–2020 PICES-MAFF project “*Building capacity for coastal monitoring by local small-scale fishers*” (FishGIS) and refined during the 2020–2023 PICES-MAFF project “*Building local warning networks for the detection and human dimension of Ciguatera Fish Poisoning in Indonesian communities*” (Ciguatera), to enable the detection of toxic benthic Harmful Algal Bloom (HAB) species that can threaten tropical reef fisheries, and to record images of the fishery catches for enumeration of fish species and sizes. The long-term goals are to: (1) provide local communities with the capacity and knowledge to sustainably manage their fisheries resources and ensure seafood safety, and (2) identify research needs for deploying these tools in PICES member countries.
2. The maximum duration of the project is 3 years, with the ending date set as March 31, 2026.
3. The following organizational principles agreed to by MAFF/JFA and PICES apply to the project:
 - The project will have strong connections and interactions with, and support relevant activities of, with the PICES Scientific Committees on Human Dimensions (HD), Fishery Science (FIS), and Marine Environmental Quality (MEQ) (through the Section on *Ecology of Harmful Algal Blooms in the North Pacific* — S-HAB), PICES Technical Committee on Data Exchange (TCODE) and on Monitoring (MONITOR), and the PICES FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems) science program (specifically, Research Theme 3 on “*How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?*”). The HD Committee will serve as the parent committee for the project.
 - The project will be directed by a Project Science Team (PST) formed based on principles and procedures detailed in the PICES Policy for approval and management of special projects (Decision 2017/A/7). All PICES member countries and the above-mentioned groups are expected to be represented on PST.
 - The PST will be co-chaired by PICES members, with one Co-Chair from Japan, representing HD, and another from the USA, representing S-HAB. These Co-Chairs will provide the geographical balance and the balance of expertise between the human dimension and harmful algal bloom components of the project. The PST Co-Chairs are responsible for the scientific implementation of the project and for the annual reporting to MAFF/JFA and to PICES Science Board through the Committee on Human Dimensions. This report should be submitted to JFA within 90 days after the close of each project year ending March 31, and include a summary of the activities carried out for the year, with an evaluation on the progress made, and a workplan for the next year.
4. The following financial principles agreed to by MAFF/JFA and PICES apply to the project:
 - A separate bank account shall be established to deposit the remitted funds.
 - The PICES Executive Secretary, or a Project Coordinator designated by the Executive Secretary, is responsible for the management of the fund and for the annual reporting on its disposition to MAFF/JFA and PICES Governing Council, through the Finance and Administration Committee, within 90 days after the close of each project year ending March 31.
 - The main elements of the budget are organized into the following categories:
 - Travel and meetings – this category covers travel costs associated with project activities such as field studies, organizational trips, project meetings, workshops, scientific sessions and public events.
 - Contracts – this category covers grants/fees to be paid to consultants and experts employed to implement the project. Tasks and deliverables for contractors are to be determined by the PST Co-Chairs. To support the objectives of the project and to ensure that its activities have minimal

- impact on the workload of the existing staff of the PICES Secretariat, the Project Coordinator can employ additional staff as required.
- Publications – this category covers costs associated with publishing findings of the project in special issues of peer-reviewed journals, reports and brochures, and dissemination of these materials.
 - Equipment – this category covers purchases and shipment of equipment for laboratory/field data/sampling processing/analysis, computer hardware/software for the development of database(s) and the project website.
 - Miscellaneous – this category covers expenses associated with the project (mail and phone charges, bank charges, *etc.*) and includes contingencies such as fluctuations in currency exchange rates.
 - Transfers of up to 10% of allocations between the budget categories are allowed based solely on the decision by the PICES Executive Secretary or the Projects Coordinator. In special cases, transfers up to 20% between the budget categories can be authorized by JFA. All transfers shall be reported at the end of the fiscal year.
 - A 13% overhead on the annual budget shall be retained by PICES to offset expenses related to the Secretariat's involvement in the project.
 - The interest earned by the fund shall be credited to the project and used in consultation with JFA.
 - Any funds remaining after the completion of every fiscal year of the project shall be reported and disposed of in consultation with JFA.
5. Ownership of the outcomes of the project, including materials, data, copyright and intellectual property rights, will be vested to PICES and the Government of Japan. Either Party may use those outcomes but will give full credit to their source.