

IMOOCEANUM



PHILANTHROPY FUNDING PROJECT

# **GALÁPAGOS DATA & KNOWLEDGE CENTER**

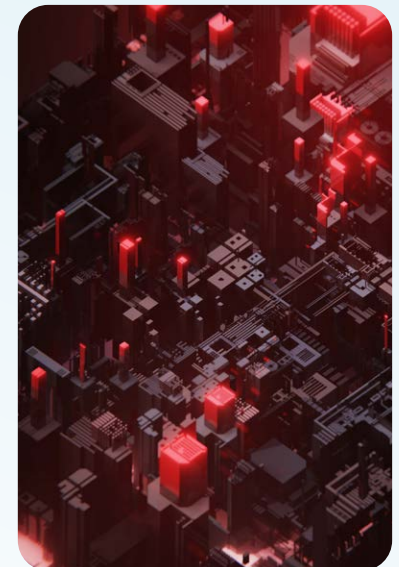
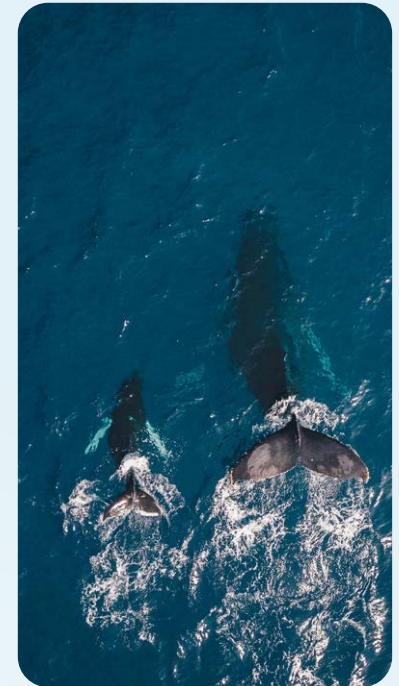
# SUMMARY

This document outlines the establishment of a new multi-institutional Data & Knowledge Center on the Galápagos Islands.

The center will allow for centralized management of research projects, on-site analysis, and secure storage of high quality data from both short- and long-term surveys as well as static monitoring stations.

Establishing a new Data & Knowledge Center will:

- ✓ Safeguard and preserve collected data for future generations of scientists
- ✓ Enable long-term, repetitive studies that produce vast amounts of data
- ✓ Promote scientific collaboration by centralizing data storage and management
- ✓ Be the first step towards a multi-institutional Knowledge and Research hub on the Galápagos Islands





## BACKGROUND

# GALÁPAGOS MARINE RESERVE

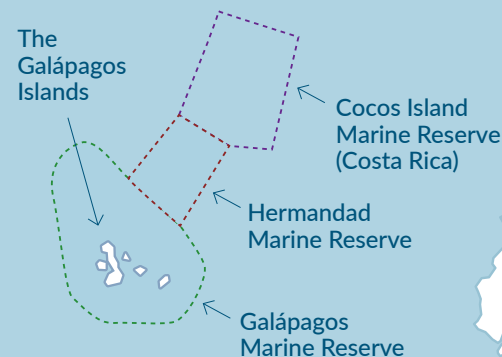
The Galápagos Marine Reserve is one of the largest and most biologically diverse in the world with a total area of 92,775 km<sup>2</sup>. The Hermandad Marine Reserve adds another 60,000 km<sup>2</sup> to the protected area. This new extension will protect the Galápagos-Cocos corridor in which a large number of different species thrive. Great efforts are underway to understand and protect this truly unique marine environment.

### A MASSIVE UNDERTAKING

The preservation of the Galápagos Marine Reserve is a massive undertaking. Researchers connected to various Non-Government Organizations (NGOs) collaborate with government funded initiatives to preserve the Galápagos Islands and their marine environment.

### GREAT CHALLENGES AND OPPORTUNITIES

Although researchers, organizations and NGOs on Galápagos do an incredible job, the challenges are great and improvements are needed to facilitate coordination, collaboration and the sharing of knowledge. A major improvement for the whole scientific community would be to establish a multi-institutional Data & Knowledge Center where all types of research data can be stored and accessed as needed.



# SAFE-GUARDING COLLECTED DATA IN A CENTRALIZED DATA CENTER

To safely store data for both current and future research, a dedicated facility for data storage and management has to be established. The Galápagos Data & Knowledge Center would provide safe and long-term data storage as well as supporting all scientific projects in the Galápagos Marine Reserve.

## SAVING DATA FOR FUTURE RESEARCH

With a central data storage, both historic and new data from different surveys can be combined and analyzed. This allows for detection of correlations between data from different fields of research. Complex dependencies can be discovered that might not otherwise be found. Collected data can be reanalyzed in the future when new methods to extract information have been developed.

## CREATING A CENTER FOR KNOWLEDGE

With all data available, a new center for knowledge can be established. This will be a scientific hub where researchers and scholars from different institutions can collaborate in preservation of the Galápagos marine environment. Informed decisions can be taken, thereby providing sustainable routines for areas such as fishing and tourism.

- 💡 A centralized Data & Knowledge Center would offer unprecedented opportunities to current and future researchers on the Galápagos
- 💡 Collecting and combining data over time allows for new discoveries of complex dependencies



# CONNECTING ALL DATA STREAMS

The possible uses of a centralized data center are infinite. Here are a few examples of data that could be managed and stored in the new Data & Knowledge Center. Additional sources of data can be added over time.

- 💡 Data from many different sources are organized and saved.
- 💡 This data can be accessed and combined in new ways by researchers and scientists





# DATA AS AN ASSET

## DATA IS A VALUABLE RESOURCE

Data is valuable when collected over time and saved for future use. But the true value of the data is not always known from the start.

## UNDERSTANDING LONG-TERM CHANGES

The tools used by scientists on the Galápagos Islands to monitor and survey different aspects of the ocean produce huge amounts of data. In order to understand long-time changes, researchers rely on continuous or repeated surveys so data can be compared over time. As technology advances, both the amount of data and the demand for reliable data storage will increase exponentially.

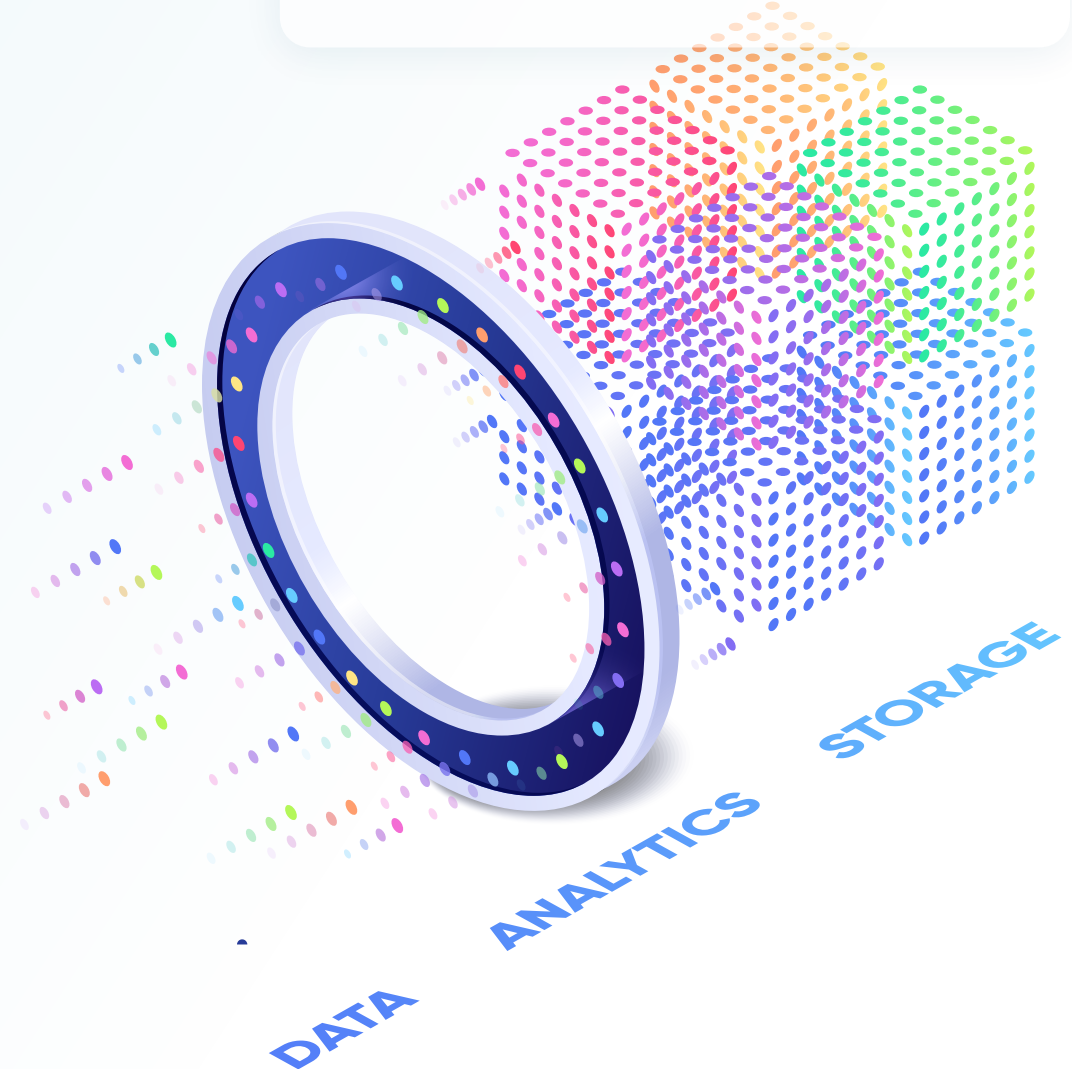
## DATA IN ITSELF IS NOT ENOUGH

Data has to be filtered, structured and put into context with meta-data to be useful. Expert knowledge is required to define the information models, but the processing can be automated.

## COORDINATION TO AVOID DATA SILOS

Today, there is no coordination or central storage of data on the Galápagos Islands. Each organization or NGO stores its own data in stand-alone systems. This makes it hard for other researchers or organization to access and use it. Even when data is shared, it may not be stored due to poor quality and insufficient storage space.

- 💡 Modern research methods produce vast amounts of data
- 💡 Saved data can provide value that is not apparent at first
- 💡 Centralizing and coordinating data benefits all institutions, researchers, and agencies for environmental protection



# MULTI-INSTITUTIONAL DATA MANAGEMENT

It is vital that all future research projects conform and contribute to the general protection plan for the Galápagos. The Ecuadorian authorities need to be involved in the initial project application, as well as continuously making sure that all projects meet the stipulated requirements.

## **CENTRALIZATION OF DATA FROM ALL RESEARCH PROJECTS**

A centralized center for data storage and management will contribute to future knowledge. Data collected from different surveys at different times can provide insights that might not be obvious at first, and lead to a deeper understanding of complex dependencies that would otherwise have been overlooked.

A center for data storage ensures future availability of shared data for researchers and scholars, all over the world.

## **STIPULATING PROTOCOLS**

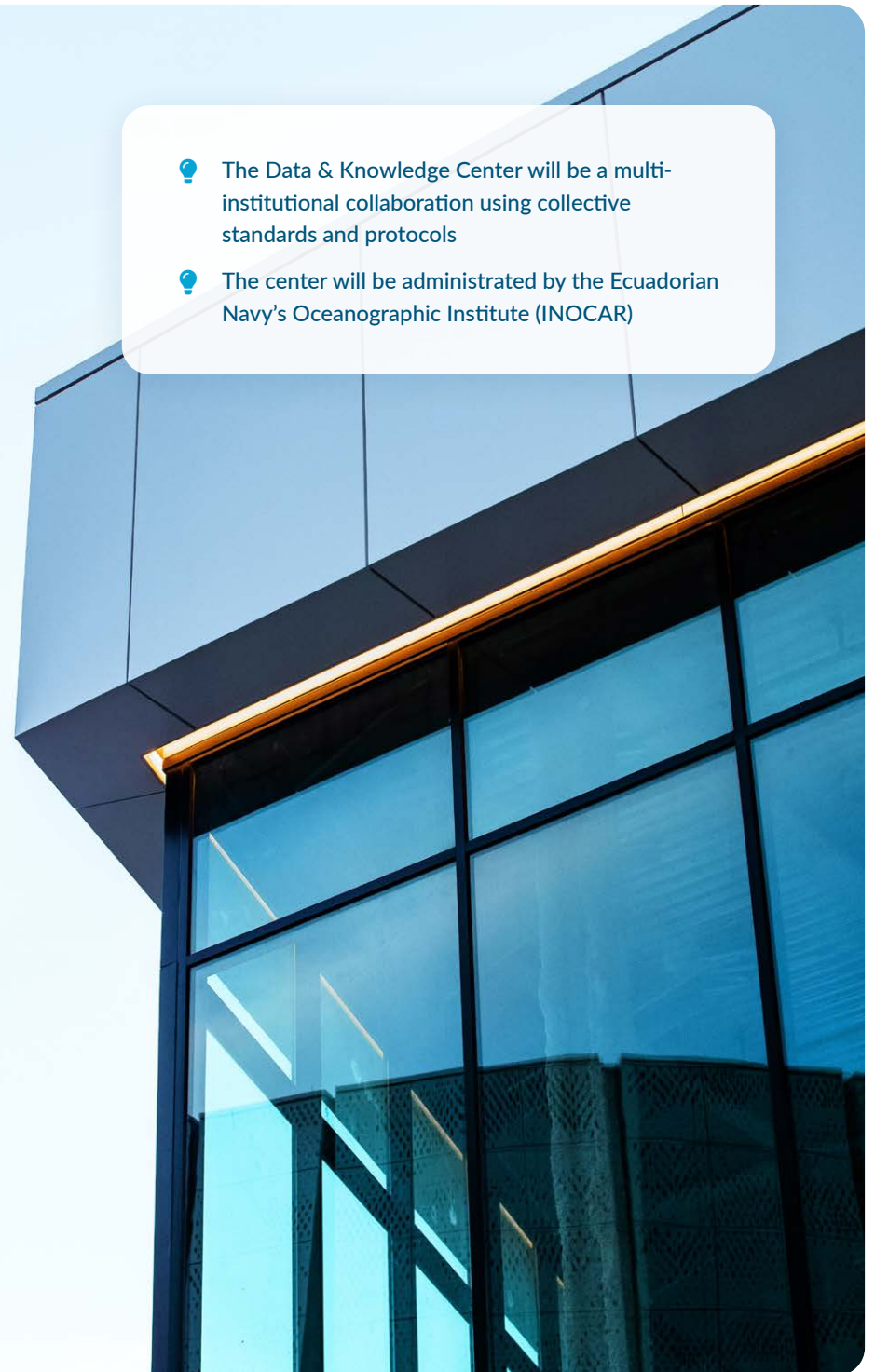
For the sharing of collected data to work, certain standards and protocols have to be established. Initially this

demands a great deal of effort from involved institutions, but over time the standards will be defined and easily shared at the start of all new projects. Standardization ensures that data can be used for different purposes in the future and that costly surveys do not have to be repeated in sensitive environments.

## **SHARING OF DATA**

In order to decide which information can be shared, and for what purposes data might be used, multiple institutions have to work together. They need not only to decide for themselves, but also to understand the implications of shared aggregated information. Each institution is responsible for providing and supporting its own information models.

- 💡 The Data & Knowledge Center will be a multi-institutional collaboration using collective standards and protocols
- 💡 The center will be administrated by the Ecuadorian Navy's Oceanographic Institute (INOCAR)



# DISASTER-PROOF LOCATION

Several factors come into play when establishing the new Galápagos Data & Knowledge Center. In the search for a location, the following criteria have been given special attention:

## PROTECTED LOCATION

The location should offer protection against exceptional events like tsunamis, fires, floods, earthquakes, and volcanic eruptions.

## INFRASTRUCTURE

To avoid costly installations, electricity and water must already be present. The location must be easily accessible by road and allow systems for data communication to be established

## SCALABILITY

The location must be large enough to allow for expansion and establishment of related facilities in the future.

## SECURITY

The installation must be protected against physical and digital attacks.

## SEPARATE SERVICE MODULES

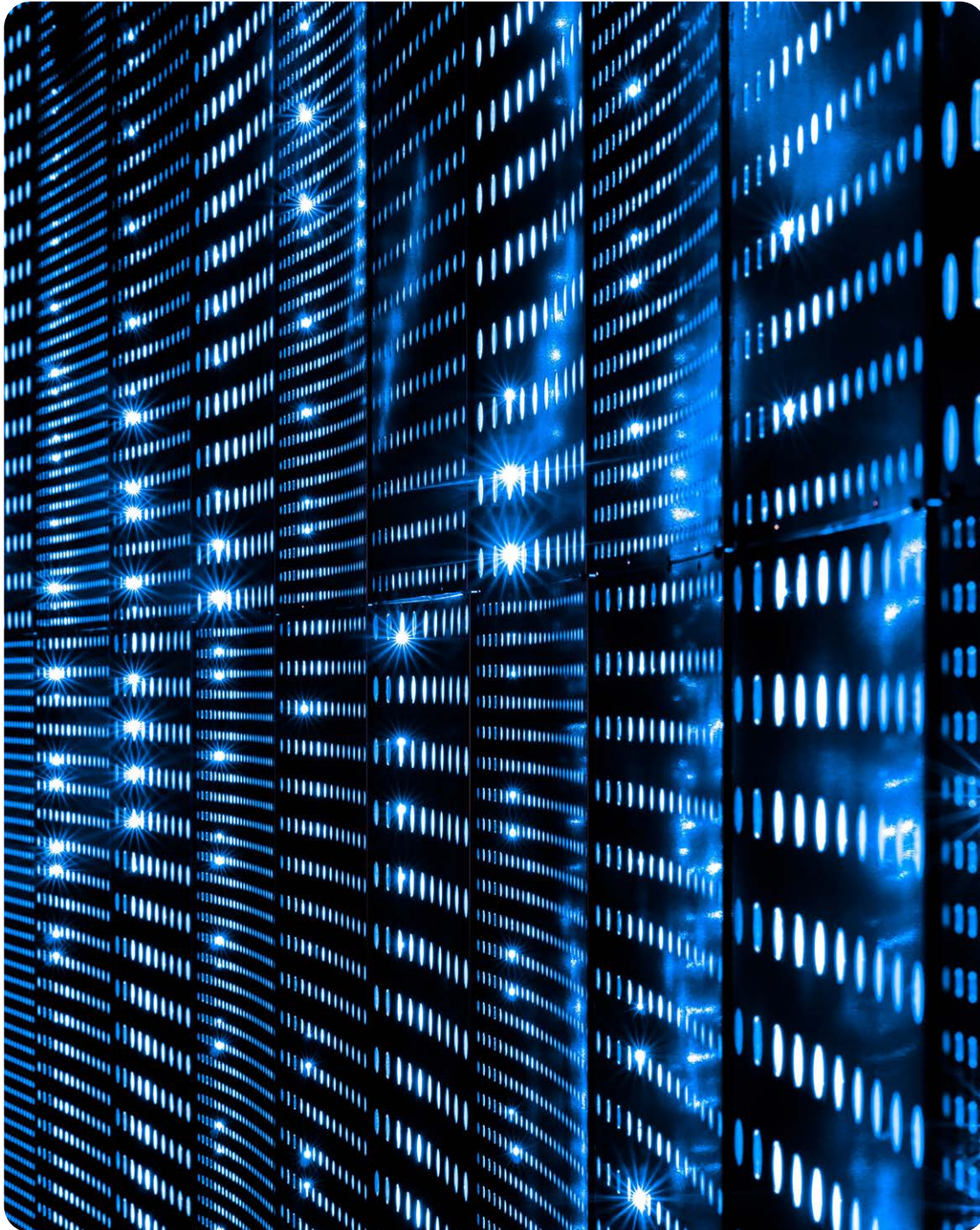
Certain functions should be separated and easily accessible, including separate service systems for uninterrupted power and cooling.

## ENVIRONMENTAL CONSIDERATIONS

The Galápagos Data and Knowledge Center is intended to be established and run with minimal environmental impact. A local sustainable system for the treatment of wastewater is required. Additional electricity can be generated by incorporating solar panels in the basic design.







# FUTURE-PROOF DATA STORAGE

The Galápagos Data & Knowledge Center must have the ability to extend and adapt its storage capabilities in the future.

## **FUTURE-PROOF STORAGE**

Since storage technology undergoes improvement over time, it is important to be able to incorporate new technologies and not be restricted to one specific solution. Apart from storage, the Galápagos Data Center has to provide computing power which can be used for data and information processing.

## **BACKUP AND REDUNDANCY**

The collected data has to be protected using one or multiple off-site backups. A back-up facility located on the mainland could be used for the automatic transfer of data at regular intervals.

Redundancy will be required for some systems, especially those involved in on-line monitoring. It is important to have the ability to upgrade or transfer information into redundant systems if needed in the future.



# POSSIBLE FUTURE EXPANSIONS

The Galápagos Data & Knowledge Center can be the first step towards a future science park, where new functions for research, laboratories and preservation are added over time.

## COLLABORATION FOR THE EXCHANGE OF KNOWLEDGE

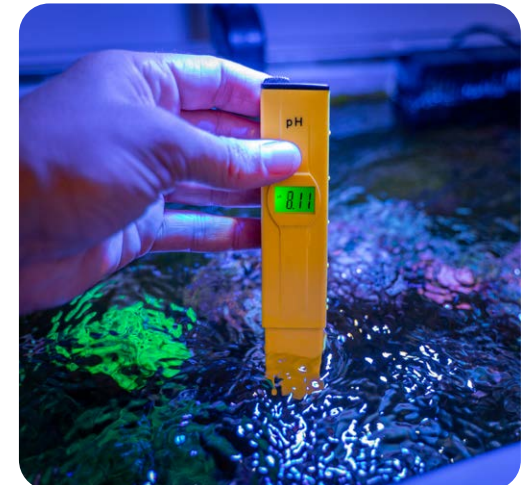
With a science park created, researchers can come together to share knowledge and ideas. The Galápagos Marine Reserve provides a unique opportunity to combine results from different research groups and specializations. Multidisciplinary collaboration makes it possible to find the best solutions for protecting and preserving the reserve. The acquired knowledge and scientific methods for preservation and protection can also be adapted and applied in other parts of the world.

## TRANSFORMING THE LOCAL ECONOMY

The Galápagos Islands depends on income from tourism. Young people often have no other choice but to leave the islands if they want to pursue another career. With the establishment of laboratories and research centers, new jobs and career opportunities would be created locally, providing not only job opportunities, but also ensuring continuity and the preservation of knowledge.

## REQUIRES LONG-TERM COMMITMENT AND FUNDING

The Galápagos Data & Knowledge Center is a requirement to effectively protect and preserve the Galápagos marine environment. It will also increase the efficiency of already established functions and services. To ensure proper management and maintenance of the center, a long-term commitment is necessary in addition to the initial funding.





# HOW TO CONTRIBUTE

Please visit [imo-oceanum.org](https://imo-oceanum.org) for more information  
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