

The Institute of Marine Affairs Marine Biodiversity Hub

Programme: BID
Project ID: BID-CA2020-004-INS
Project lead organization: Institute of Marine Affairs
Project implementation period: 1/7/2021 - 30/6/2023
Report approved: 4/9/2023

Final Narrative Report

Executive Summary

Key Achievements:

Key achievements of the project include the successful upload of several historical biodiversity datasets, including additional biodiversity data to those proposed. The main data consists of IMA's Marine Reference Collection, and coral reef biodiversity data from IMA's long-term monitoring programme to GBIF, both with much higher number of records than anticipated. The second major achievement was the development of IMA's Marine Data Hub, previously referred to as the Marine Biodiversity Hub. The name change acknowledges the fact that IMA houses an array of geospatial data types, additional to biodiversity information. Following the construction of the MDH, it was populated with most of IMA's geospatial data consisting of over 700 layers. The MDH has resulted in much more data discoverability by IMA staff and external parties, and access to tools for data collection and visualisation making the process of data management more efficient and effective. The public face of the hub is sleek, and user-friendly for searching IMA's publicly available data catalogue and also links to IMA's website, IMA's library, GBIF and the Caribbean Marine Atlas. These project outcomes have boosted IMA's ability to disseminate marine data to key stakeholders and to be used to inform on the state of Trinidad and Tobago's marine environment. Feedback on project output was positive with potential collaborations and data sharing opportunities, and was reflected in the growth of the MDH user network. The Hub has already assisted in identifying data gaps, which can inform on future research focus.

Key lessons learned and best practices identified:

The project had a couple learning curves that the team managed to complete. It was important to plan the design of the MDH with sustainability in mind, considering the staff and skills needed to manage the Hub, communications surrounding data uploads, site maintenance and the costs of the ESRI user's licences for the long-term. For this, we sought advice from experts in the field. With respect to IMA's data management, tools, such as metadata forms, field form tools and templates that arose out of the project will be recommended to research staff after the project completion to reduce data loss and improve on data standardisations. Researchers seemed to be keen on the use of these tools.

Challenges:

While most of the project activities were fulfilled, there were a couple activities that were delayed and therefore were incomplete by the end of the project. The first issue was the creation of reporting indicators of IMA's data for external reports. The report of interest was the State of the Marine Environment Report, a national bi-annual report providing the health status of key marine ecosystems across Trinidad and Tobago. However, external delays in the approval of previously published report (2018) by Cabinet, has delayed any further publications. The team sees the value of creating visual indicators (infographics) as an easy tool for communicating the state of the environment, detecting trends and informing decision making.

The second major challenge was having permission to publish a proposed dataset - Nearshore fish trawl surveys in the Gulf of Paria, a project IMA conducted under its technical advisory services. While IMA was unable to publish this data, two other higher priority datasets were substituted in as compensation. IMA in the future will try to access/ publish these data.

Post project activities:

Key to sustain success in the future is having allocated personnel, and resources to manage and maintain the MDH and GBIF repositories, as well as continued support from stakeholders and management. The Team will continue to perform in these roles beyond the project with monthly meet ups to ensure tasks are being fulfilled. All communication on the MDH will continue as part of the long-term management plan on the MDH. The Data Officer will be responsible for uploading the biodiversity data to GBIF, while the GIS Unit will assist researchers and collaborators in the use of the MDH. Discussions with management have highlighted the importance of having data submission and management as a Key Performance Indicator for researchers and to maintain best practice. The review of the IMA's data policy to include the MDH as an important tool is imminent and the team will investigate agreements with third party data providers to share their data responsibly on the MDH thereby unifying siloed data onto one platform. It is hoped that IMA's approach to a data hub will be an example to other entities to follow.

Progress against milestones

Has your project completed all planned activities?: Yes

Has your project produced all deliverables: No

Rationale: 1. Progress report indicators: The intention was to prioritise the State of the Marine Environment (SOME) national report. SOME is a technical report that presents changes in the coastal and marine environment of Trinidad and Tobago sourced from IMA's long term monitoring programme. The idea was to present the marine health infographics for the SOME in a digestible/ traceable way. The report is produced every 2 years and has a rigorous review by the Ministry and Cabinet of

Trinidad and Tobago. The most recently published SOME was in 2018, which took 3 years to be approved by the Cabinet, resulting in the delay in the finalisation of the SOME 2020. As a result, the SOME 2022 was not started and as such we were unable to complete this deliverable for lack of priority.

2. Nearshore fish trawl surveys in the Gulf of Paria – IMA was unable to get the permission from the former client to share this data freely. Therefore, the upload of this data is delayed until approval to share is given.

Report on Activities

Summary of the implementation of the project activities

Stakeholder engagement

IMA was able to complete all project activities over the last two years (July 2021 – June 2023), starting with project stakeholder engagement and data needs assessments, data cataloguing and standardising, hub development, capacity building and finally marketing and promotion. The first six months of the project was focussed on engaging our primary, secondary and tertiary data users to introduce the project and to identify their data needs, and to focus our data cataloguing and uploading activities on prioritised datasets. Between July and September 2021, the team hosted eight introductory meetings with internal staff (29 attendees), and external stakeholders (47 attendees) consisting of research collaborators, government partners, researchers and students. Internal meetings with researchers were followed up with one-on-one interviews to identify the types and amount of data for each of IMA's research programmes. During this time, the core team worked to build our internal capacity in data mobilisation through the BIDCA Data Mobilisation Workshop.

Digitisation and cataloguing

Inventory digitisation and marine data cataloguing activities began in September 2021, and while it was carded for completion by August 2022, the team worked on this activity for the remainder of the project to maximise the upload of biodiversity data by the end of the project period. In addition to the proposed biodiversity datasets, IMA was able to upload five additional datasets bringing the total to ten.

Geospatial development

By the end of 2021, procurement activities for hiring of a geospatial developer began for the construction and development of the Marine Biodiversity Hub. GeoTech Vision Ltd was contracted and work on this activity began in March 2022. During this time, the team worked with our graphic artist to design the brand kit for the Hub. As IMA aimed to use this platform to house all our GIS data associated with our research from projects and monitoring programmes, including environmental and socio-economic data, the Hub was renamed to Marine Data Hub (MDH). Once the construction was completed in August 2022, Geotech Vision Ltd trained GIS and IT staff. IMA specific content was then shared (as requested and compiled based on input from internal users), and further development of the MDH transpired. In September, the MDH was shared again with the core team for user acceptance testing and functionality review surveys. Two weeks were spent testing the system. During this period, IMA's GIS team spent eight weeks transferring all the GIS data to the MDH through a data aggregation and integration process. Upon successful testing and review, the official hand over of the platform was done in October 2022 and the final deliverables from Geotech Vision Ltd were received and reviewed by November. The MDH was then internally evaluated by the IMA research, IC and IT staff.

Capacity Building

Capacity building occurred in three phases, (1) training of the GIS staff on back-end functionality of the MDH, (2) training of tier one data users - internal staff, and (3) training of our tier two data users – government partners and research collaborators, on the use of the MDH and exploring IMA's biodiversity data repository on GBIF in November and December 2022 respectively. The workshops trained users to navigating the MDH, how to input data, and use tools such as webmaps and designing metadata forms. While the workshops were all held in person, the final seminar held in June 2023 was a hybrid in-person and online event (64 persons attended). The seminar focused on how to effectively explore IMA's MDH and GBIF repository and targeted our tier three data users, the end users of our data for reporting, and decision-making. To initiate the formation of a Marine Data Sharing Network, both workshops had a discussion element, where attendees were asked to discuss potential uses of such database tools to encourage research collaboration and to make decision making processes more efficient. Several external stakeholders and partners were interested in also sharing their marine data on IMA's Data Hub as a central location. All workshop and seminar attendees were register to a mailing list to keep them informed of the regular updates on IMA's Marine Data. Post event surveys were sent to attendees to assess the effective use of the MDH by asking the likelihood of using the MDH in the future.

Marketing and Promotion of the MDH

The last six months of the project was largely focussed on completing biodiversity data uploads to GBIF, as well as generating promotional and training materials for the MDH. Materials included a brochure to highlight IMA's data on GBIF and the MDH, stickers, business cards and magnets with QR Codes for the MDH and link addresses to the GBIF site. These tokens will be shared at future IMA events, but also at school visits, science showcases by IMA's Educational Officers. A series of five tutorials on the MDH have been produced and accessible on IMA's YouTube Playlist. News on the development of the MDH was highlight in local newspapers and IMA shared social media posts promoting the MDH. Data will be promoted periodically through the mailing list and social media periodically following the project phase, and as new projects deliver new data.

Completed activities

Activity: Identification of stakeholders and engagement

Description: The IMA core team consisted of the Data Officer, GIS Officer, two Research Officers and two trainees. Two internal meetings were held with IMA researcher staff (primary data users) to identify database needs and functionality. Six external meetings were conducted for secondary and

tertiary data users largely composed of partner government agencies researchers, civil society, businesses and educators. The meetings introduced the project aims (1) the development of the MDH and (2) the upload of biodiversity data to GBIF and TTBIS. Discussions and post workshop surveys revealed existing marine biodiversity datasets present at the IMA and identified priority marine data needs by all stakeholders. Feedback from this stage was instrumental in the design and development of the MDH, and the quantity of biodiversity data available within the IMA.

Start Date - End Date: 1/7/2021 - 10/9/2021

Verification Sources: Zoom recordings and minutes of meeting and report with feedback from stakeholders

https://assets.ctfassets.net/uo17ejk9rkwj/1fyBJKYt0zvdtaBjJit8Cm/bb8e71af75f74c799f989c0ae6597ea6/IMA_MBHIntro_Results_GovPartners.pdf

Activity: BID Capacity Enhancement Workshop

Description: Ms. Alana Jute (Research Officer/ Curator of IMAs marine specimen collection) attended the three-day workshop and learned the technical aspects of data mobilization, including data standardisations and publishing data to GBIF platforms. The course consisted of video instruction, paired with quizzes and practical exercises. Online, self-learning exercises were carried out 19-30 July 2021 in preparation for the four-day virtual workshop (3-6 August 2021). The self-learning entailed learning about GBIF and how data is collated from around the world and how this data is processed, managed, and used.

Start Date - End Date: 19/7/2021 - 12/9/2021

Verification Sources: Badge from completion of training, attached document:
IMA_BID_BasicBadge_Jute

Activity: Inventory digitization and marine data cataloguing

Description: This activity was carried out by two geospatial technicians, the GIS Officer, Research Officer, on-the-job trainee, and Data Officer. The first month focused on determining data standards and protocols, including naming conventions and metadata requirements in keeping with geographic information cataloguing standards. This then was applied to the inventory and digitization stages thereby facilitating easy updating and additions to the database. The BID Capacity Enhancement Workshop and best practice for geospatial design guided this process. The geospatial technicians worked alongside Research Officers to review the standardizations, geocode the data where necessary and convert relevant biodiversity data, namely fisheries and benthic data. Digital records of the Marine Reference Collection data were prioritised for formatting to the Darwin Core format in preparation to be published on the GBIF site. The next step was the digitization and cataloguing of biodiversity data from research projects collected in IMA's Caribbean Marine Studies Journal from 1991 - 1998 and other historical records for the TTBIS/ GBIF sites. Biodiversity data from IMA's long-term coral reef monitoring programme was also collated and uploaded. All other geospatial data, including environmental data, water quality data, historical maps were digitised and catalogued for the MDH. Although this activity was prioritized for a year it continued until all the data types was completed.

Start Date - End Date: 1/7/2021 - 26/6/2023

Verification Sources: Published datasets on GBIF: <https://www.gbif.org/project/BID-CA2020-004-INS/marine-biodiversity-hub#datasets>

Attached document:
Data management and Data Publication Guidelines.pdf

Activity: Inventory Design

Description: The GIS Officer and the Data Officer liaised with researchers to collate an inventory of all the types of research data for the purpose of outlining a geodatabase schema. A wireframe structure of the MBH was developed, informed by the data needs assessment based on stakeholder survey results along with the recommendations from the developer. The geographic information was organised into data themes, i.e., layers of biodiversity data, which was integrated into a location or subject area. The Data Themes used were identified and the contents and features were represented in each thematic layer. Internal biodiversity data flows were identified based on previous activities to identify data sources. The appropriate design documentation was produced.

Start Date - End Date: 1/7/2021 - 31/1/2022

Verification Sources: Documents attached:
Introductory meeting minutes and data use results:

IMA_MDHIntro_DataUseResults_GovPartners
IMA_MDHIntro_DataUseResults_IMAResearchers.pdf
IMA_MDHIntro_DataUseResult_MarineDataUsers.pdf
IMA_MDHIntro_DataUseResults_IMA_InformationCentre.pdf
IMA_MDH_preiiminary_InventoryDesign.pdf

Activity: Construction and Development of Marine Data Hub (MDH)

Description: The Geomatics Unit, the Data Officer and a consulted geospatial database developer (GeoTech Vision Ltd) selected via a tender process conducted this activity. The MDH was constructed based on the stakeholder engagement, cataloguing of marine data, the inventory design, and a geodatabase framework. The architecture was developed to support optimum performance, reliability and system security. The consultant installed and configure ArcGIS Server, site creation, utilising virtualized hardware. The various components were upgraded to the latest version of ArcGIS Enterprise Software. IT personnel configured the host server and firewall security through a DMZ (De-Militarised Zone) of the peripheral ArcGIS server, and integrated the components (web adapter and Microsoft Internet Information Services). The ArcGIS Server Services Directory was connected to the portal. The Geodatabase was developed with the target Database Management software (DBMS, Microsoft SQL Server). The database was configured, and standardised data imported into the geospatial database instance(s). The database was registered with ArcGIS Server as a data source. The associated metadata and reference data was also imported into the database. The MDH geodatabase has back-end data capabilities for data management, organisation, upload, syncing and visualisations. The consultant conducted training with the Geomatics Unit and the Data Officer for maintenance and general administration of the geodatabase. Through administration of the geodatabase, the privileges and access for front-end users was designated and moderated. Following the creation and implementation there was a review and feedback period with the Geomatics Unit, the Data Officer, the Project Officer and the Reference Collection Officer to test the MDH.

Start Date - End Date: 1/3/2023 - 31/10/2022

Verification Sources: MDH constructed:
<https://mdh.ima.gov.tt>

MDH Manual:
Manual_Institute of Marine Affairs TT.pdf

Activity: Interface Structure and Branding

Description: The core team and IMA's graphic artist worked to design the brand kit for the MDH for a unique look and feel.

Start Date - End Date: 1/2/2022 - 31/3/2022

Verification Sources: Brand is represented on the site:
<https://mdh.ima.gov.tt>

Activity: Midterm Report

Description: The report includes a summary of activities up to June 30, 2022. Report included any adjusted timeline for activities and mitigations for successful completion. The progress report includes proof of publishing at least one dataset through GBIF.org, proof of certification at BID Capacity Enhancement Workshop and explanation of project management issues. The report was reviewed internally by the IMA management team and approved for submission on May 31st, 2022.

Start Date - End Date: 1/4/2022 - 31/5/2022

Verification Sources: Report submitted

https://assets.ctfassets.net/uo17ejk9rkwj/46pCQ9rPcad880WPkc5UBt/49136951fc1a53b87ad95997364e7941/Public_Midterm_Narrative_Report.pdf

Activity: Data aggregation, integration and visualisations

Description: The Geomatics Unit (4 persons) conducted this activity. Initial documentation and planning transpired to design the process of aggregation, integration and data visualisations for convention reporting. This documentation step and the data aggregation occurred once the MDH had been developed and constructed. The researchers assisted in determining datasets for information dashboards. Data sources, largely marine monitoring data (for e.g. the coral reef long-term monitoring), for visuals were identified and integrated into the MDH platform. Other visualisations of data in the geodatabase included web maps, web apps and dashboards which were utilised according to the nature of the data inputs, with symbols and widgets fully optimised. This rendered the data in a user-friendly format to convey the information of the data efficiently and effectively. These data visualisations also served to inform users of the data and engage them to use keywords and explore the data themes to further discover and access data.

Start Date - End Date: 1/6/2022 - 30/9/2022

Verification Sources: Gallery can be accessed through the Geportal Page
<https://mdh.ima.gov.tt/portal/home/index.html>

Data Catalogue accessed through the homepage, via thematic areas and data tags.

Examples,

Coral reef long-term monitoring:

<https://mdh.ima.gov.tt/portal/..apps/dashboards/5987dd6e353248499bd96304dcfb20f6>

Mangrove Dashboard:

<https://mdh.ima.gov.tt/portal/apps/dashboards/fe60d610da9c4a14ba237990a48f52fa>

Activity: Capacity Building

Description: This activity consisted of management training, two workshops and a seminar headed by the Project Officer, Research Officer, Data Officer and Geomatics team with assistance from Network Administrator. (1) There was the back-end training (August 29th 2022) of the MDH's systems operations to the wider Geomatics and Information Technology Staff undertaken to ensure the effective operation, management, and updating of the MDH for long-term sustainability.

(2) The first workshop was done to train all IMA research staff. (Nov 22nd, 2022)

(3) The second workshop (December 14th 2022) was done in partnership with the University of the West Indies (National BID Grant recipient) for the external research partners (secondary data users) on how to access and use the MDH and on the publishing of data to GBIF and TTBIS.

(3) The Seminar (June 1st 2023) was done with external partners and tertiary users of marine data to show what data we published on GBIF and how to access IMA's data on the MDH. Discussions with partners included the development of standards for other data types for future inclusion. The last part of the workshops included brainstorming sessions to come out with future collaborations to fill data gaps. Feedback from the workshops was documented and included into official data standards protocols and a training manual.

Start Date - End Date: 29/8/2022 - 1/6/2023

Verification Sources: Uploaded following documents:

GTV training certificates

IMA_Internal_CapacityBuildingWorkshop_Report.pdf

IMA_UWI_GBIFworkshop_Minutes.pdf

IMA_MDH_Seminar_Minutes.pdf

Activity: Formation of a Marine Data Sharing Network

Description: This activity was led by a Research Officer, GIS Officer and IC Staff member. To build a mailing list, we started with the intended MDH users, who had the option of joining the mailing list through the user registration process on the IMA website. Feedback online forms are available through the MDH site. We have encouraged our stakeholders to share with their associated stakeholders to widen the reach of our network. Intended network users are identified with tags on the mailing list for easy identification and targeting.

Start Date - End Date: 1/1/2023 - 31/3/2023

Verification Sources: IMA_MDHUserNetwork_MailingList.pdf

Activity: Marketing and promotion of IMA's Marine Data on TTBIS and GBIF

Description: The Research officer, GIS Officer, Graphics Artist and Digital Content Specialist conducted the activity.

(1) Five Marine Data Hub "How To" videos on how to access marine data on MDH was produced for the public which can be viewed through the IMAs YouTube channel.

(2) A post about the GBIF Project was posted on IMAs social media showing the digitization of the Marine Reference Collection

(3) Newspaper article about the MDH was produced before the final workshop.

(4) A brochure was produced for navigating to the MDH and IMA's repository on GBIF

(5) Fridge magnets and business card with the MDH QR Code was given out to participants who attended the seminar and will be used post-project to promote the MDH and GBIF.

Start Date - End Date: 1/5/2023 - 1/6/2023

Verification Sources: Links to IMA Marine Data Hub training videos:
https://www.youtube.com/playlist?list=PL_OPg0aLYCG9DKjmLR7IT6bzb4dBqxGGt

Link to seminar recording:
https://youtu.be/e_9wpmcfGF0

Documents attached:
Designs of the brochure, magnet and business card:
IMA_MDH_Card_Magnet_Artwork.pdf
IMA_MDH_GBIF_Artwork_Brochure.pdf

Copy of the Newspaper Article:
IMA_MDH_Newspaper_Article.pdf

Social media post can be found on IMA's Facebook Page: IMAGovTT

Activity: Assessing the effective use of the MDH

Description: Data use and feedback forms, designed by the Data Officer, Research Officers, and Geomatics Team, has been conducted along with IT staff to gather qualitative information on the MDH to identify system faults and recommendations for improvement. The feedback process following every capacity building event. The feedback process will continue to be done every six months in the first two years of the MDH use, then annually for the long-term. Data analytics (Google Analytics) and the MailChimp reporting mechanisms will be used to assess the number of people/ organisations accessing the IMA's marine data on MDH and subscribing to the network. Additionally, a contact form linked to the Data Officer's email is present on the MDH site and in the mailing list emails to allow direct correspondence to assist with finding data and determine the types of data in demand. An annual feedback survey on the use of MDH and TTBIS for accessing marine data will be sent to network users to help improve data discoverability and identification of data gaps.

Start Date - End Date: 1/1/2023 - 30/6/2023

Verification Sources: MDH Internal workshop feedback form:
<https://forms.gle/tczw558nbjzJN3SM9>

Pre-external workshop user capacity survey:
<https://forms.gle/ZQgLqgUACFnERpdc9>

Post external workshop feedback form:
<https://forms.gle/eg3KxPS7bCGdoy4M9>

Post seminar feedback forms:
<https://forms.gle/6VoapVkXrmKTYZaP8>

Contact us page:
<https://mdh.ima.gov.tt/portal/apps/sites/#/datahub/pages/contact>

How it can be accessed:
https://www.youtube.com/watch?v=tqJACJDxjQE&list=PL_OPg0aLYCG9DKjmLR7IT6bzb4dBqxGGt&index=5

Document upload:
IMA_MDH_TechnicalEvaluation.pdf

Activity: Final Report

Description: The core team conducted this activity with reviews from the Deputy Director (Ag.) and the Director (Ag.). Write up of the Final Report for GBIF includes a status on the completion of activities, and the production of all deliverables, along with necessary explanations and links. The report will be completed for internal review 20 June 2023, and then submitted on 30 June 2023.

Start Date - End Date: 1/6/2023 - 30/6/2023

Verification Sources: Submitted report

Report on Deliverables

Deliverables - Summary

Data deliverables:

These included eight of the nine proposed datasets consisting of 3,258 records, and five additional biodiversity datasets, consisting of 638 records resulting in a combined total of 3,896 records. Multiple datasets were compiled into single sampling events. Please see below for details:

- (1) The Marine Reference Collection - published 673 records with 323 more records than what was proposed
- (2) Coral Biodiversity Data - published as a sampling event with 2026 records
- (3) Benthic Biodiversity Data - will be published with 69 records (data validation phase)
- (4) Nearshore fish trawl surveys in the Gulf of Paria - Not published. Unable to get the permission to share this data freely. Therefore, the upload of this data is delayed until approval to share is given.
- (5) Species distribution of Invasive species *Perna viridis* - will be published with 63 records (data validation phase)
- (6) Seagrass biodiversity data - Seagrass species occurrence (100 records) and Seagrass faunal community in William's Bay (43 records) will be published as one sampling event on GBIF (data validation phase)
- (7) Checklist of Marine Polychaetous Annelids for Gulf of Paria, Trinidad - 185 records published as proposed.
- (8) Species Composition of Coastal Demersal Fish Stock with 99 records and combined two other datasets to be published as Fisheries and associated macrofauna.

Six additional datasets from IMA's historical publications were uploaded. These included:

- (1) An Analysis of fish kills in coastal and inland waters of Trinidad and Tobago (56 records) and
- (2) The distribution and abundance of wetland ichthyofauna, and exploitation of the fisheries in the Godineau Swamp, Trinidad (27 records) compiled into the Fisheries and associated macrofauna published on GBIF
- (3) Institute of Marine Affairs Species Checklist published 431 records
- (4) Amphipod Data derived from Bon Accord Lagoon, Tobago, Trinidad and Tobago, occurrence data with 68 records
- (5) Macro zoobenthic populations of the Caroni Swamp, Trinidad and Tobago with 56 records

Other Deliverables:

- (1) A major deliverable was the development of the Marine Data Hub including the upload of 740

layers. About 351 of these layers are publicly available, and the rest are only available to primary data users within the organisation, and potential data collaborators (secondary data users), who require login credentials. Accompanying the MDH, is a manual on the standard operating procedures and best practices in the use of the MDH to assist with the effective use of the MDH.

(2) Deliverables in capacity building included two workshops (one internal and one external) and a final seminar (https://youtu.be/e_9wpmcfGF0). Following every workshop or seminar, attendees contact information were used to develop a list of users for a mailing list that would periodically showcase IMA's data and report on new data uploads.

(3) For marketing and promotional activities, IMA created onscreen tutorials on how to navigate and use the MDH (https://youtube.com/playlist?list=PL_OPg0aLYCG9DKjmLR7IT6bzb4dBqxGGt). Promotional materials (brochures, magnets and business cards) for accessing the MDH and IMA's repository on GBIF were produced and handed out at IMA events (materials attached in documents section). With more to be uploaded over the next few months, these are geared towards greater use of the MDH.

(4) To assess the effective use of the MDH from November 2022 to June 2023, IMA combine data from post workshop and seminar surveys, along with the engagement of the MDH for the mailing list to report on the use of the MDH. The report will inform on the necessary action to boost use in the following six months.

Delayed deliverables:

Unfortunately, we were unable to complete the deliverable on "Progress report indicators," as there was significant delay in the approval process and writing of previous State of the Marine Environment Reports for Trinidad and Tobago. Some progress has been made on creating visuals for the coral reef long-term monitoring programme, but more work is needed to develop visual indicators of marine health for all marine ecosystems and for physical (coastline changes – erosion/ accretion rates) and chemical (pollution indicators etc) metrics as well.

Deliverables produced by the project

Dataset deliverables

Institute of Marine Affairs Species Checklist

Dataset type: Checklist

Dataset scope: January 1, 1978 - December 31, 2006 Trinidad and Tobago's Exclusive Economic Zone

Number of records: 431

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Completed upload to GBIF

DOI: <https://doi.org/10.15468/yv8g62>

Expected date of publication:

Checklist of Marine Polychaetes for Trinidad and Tobago

Dataset type: Checklist

Dataset scope: January 1, 1979 - December 31, 1986 The Gulf of Paria

Number of records: 185

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Uploaded to GBIF

DOI: <https://doi.org/10.15468/brqmf8>

Expected date of publication:

IMA Coral Reef Monitoring Tobago for years 2010 to 2021

Dataset type: Sampling Event

Dataset scope: January 1, 2010 - December 31, 2021 Tobago

Number of records: 2,026

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Completed and uploaded to GBIF

DOI: <https://doi.org/10.15468/fae95q>

Expected date of publication:

Institute of Marine Affairs Marine Reference Collection

Dataset type: Occurrences

Dataset scope: January 1, 1978 - December 31, 2006 Trinidad and Tobago and Venezuela.

Number of records: 673

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Constitutes the fish samples only from the Marine Reference Collection.

DOI: <https://doi.org/10.15468/9p4zhe>

Expected date of publication:

Amphipod Data derived from Bon Accord Lagoon, Tobago, Trinidad and Tobago

Dataset type: Occurrences

Dataset scope: August 21, 2018 - August 21, 2018 Bon Accord Lagoon, Tobago

Number of records: 68

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Uploaded to GBIF

DOI: <https://doi.org/10.15468/y4wwy8>

Expected date of publication:

Macro zoobenthic populations of the Caroni Swamp, Trinidad and Tobago

Dataset type: Occurrences

Dataset scope: June 13, 2018 Caroni Swamp, Trinidad and Tobago

Number of records: 56

Data holder: Institute of Marine Affairs

Data host institution: Institute of Marine Affairs

% complete: 100%

Status update: Completed and uploaded to GBIF
DOI: <https://doi.org/10.15468/eh6agc>
Expected date of publication:

Historical assessments of Coastal Demersal Fish Stock for Trinidad and Tobago

Dataset type: Occurrences
Dataset scope: January 1, 1990 - December 31, 2004 Gulf of Paria, Trinidad and Tobago
Number of records: 184
Data holder: Institute of Marine Affairs
Data host institution: Institute of Marine Affairs
% complete: 100%
Status update: Completed and uploaded to GBIF
DOI: <https://doi.org/10.15468/j7hua7>
Expected date of publication:

Species distribution of invasive species *Perna viridis*

Dataset type: Sampling Event
Dataset scope: Trinidad and Tobago, surveyed in 2011
Number of records: 63
Data holder: Institute of Marine Affairs
Data host institution: Institute of Marine Affairs/ GBIF
% complete: 95%
Status update: There were challenges estimating the uncertainty measurements, as datasets were not digitized. The metadata is complete for the data publication task and all uploads are estimated to be completed by the 6 of July.
DOI:
Expected date of publication: 2023-07-06

Seagrass communities within Trinidad and Tobago

Dataset type: Sampling Event
Dataset scope: Geographic: Spatial distribution of seagrass species across Trinidad and Tobago in 2001
Number of records: 143
Data holder: Institute of Marine Affairs
Data host institution: Institute of Marine Affairs/ GBIF
% complete: 95%
Status update: There were challenges estimating the uncertainty measurements, as datasets were not digitized. The metadata is complete for the data publication task and all uploads are estimated to be completed by the 6 of July.
DOI:
Expected date of publication: 2023-07-06

Benthic Biodiversity Data

Dataset type: Sampling Event
Dataset scope: Data from four different sites throughout Trinidad and Tobago, namely: Caroni Swamp; William's Bay, Chaguaramas; Point Galeota and Bon Accord Lagoon, Tobago.
Number of records: 69
Data holder: Institute of Marine Affairs
Data host institution: Institute of Marine Affairs/ GBIF
% complete: 95%
Status update: The metadata is complete for the data publication task and all uploads are estimated to be completed by the 6 of July.
DOI:
Expected date of publication: 2023-07-06

Polychaetes obtained from the Bon Accord Lagoon Tobago, Trinidad and Tobago

Dataset type: Occurrences
Dataset scope: Temporal scope: August 21, 2018 - August 21, 2018 Geographic scope: Bon Accord Lagoon Tobago, Trinidad and Tobago
Number of records: 68
Data holder: Institute of Marine Affairs
Data host institution: Institute of Marine Affairs/ GBIF
% complete: 100%
Status update: Completed and uploaded to GBIF
DOI: <https://doi.org/10.15468/4vwz99>
Expected date of publication:

Other deliverables

The Marine Data Hub

Description: IMA's MDH for the storage of all marine data for research and other data types, along with data visualisation capabilities for assessing and reporting trends and highlighting information gaps. The database has a subset of data on TTBIS Interface which is accessible via the MDH website.
% complete: 100%
Status update: Marine data Hub (formerly known as the Marine Biodiversity Hub) has been constructed with links to the IMA library, TTBIS, GBIF, Caribbean Marine Atlas from the MDH site.
Sources of verification: <https://mdh.ima.gov.tt/>

List of intended Marine Data User

Description: A contact list of government agencies, civil society and research collaborators to provide regular updates on the marine data availability at the IMA has been compiled into a mailing list.
% complete: 100%
Status update: Subscriber links have been established for continual subscription
Sources of verification: IMA_MDHUserNetwork_MailingList.pdf

A seminar: Exploring IMA's Marine Data

Description: Presentations to partners and the intended network of marine data user on accessing IMA's marine data on GBIF and the MDH. Seminar will include presentations from researchers to explain the different types of data available.
% complete: 100%
Status update: Completed
Sources of verification: Seminar video recording: https://www.youtube.com/watch?v=e_9wpmcGF0

'How To Videos' for the general public / external stakeholders for access marine data on the MDH

Description: Video instructions for accessing, downloading, visualising data on MDH uploaded on to the IMA's YouTube channel and shared on IMA's social media and website.

% complete: 100%

Status update: Completed.

Sources of verification: <https://www.youtube.com/watch?v=tqJACJDxjQE> – MDH Part V
<https://www.youtube.com/watch?v=FmQdhjhZhnw> – MDH Part IV
<https://www.youtube.com/watch?v=JGmdv6pQYQQ> – MDH Part III
<https://www.youtube.com/watch?v=tj8FjgGCenM-> MDH Part II
<https://www.youtube.com/watch?v=jeawna9OD2Q&t=6s> – MDH Part I

Report to assess the effective use of the MDH

Description: This report was compiled from all the feedback reports, registration information, as well as mailing list clicks and subscribers. Google Analytics was used to analyse the website traffic of MDH for the post project phase

% complete: 75%

Status update: Google Analytics was set up too close the project end date to get direct data on website use. Instead, the report on the effective use is based on feedback surveys and mailing list metrics.

Sources of verification: IMA_MDH_TechnicalEvaluation.pdf

Midterm Report

Description: Report to GBIF on the activities for the first half of the project. It included tasks completed, adjusted timelines and ongoing activities. The midterm report also included the publication of at least one dataset through GBIF.org (IMA species checklist), and proof of certification at BID Capacity Enhancement Workshop. Report was submitted and approved in June 2022

% complete: 100%

Status update: Completed

Sources of verification:

https://assets.ctfassets.net/uo17ejk9rkwj/46pCQ9rPcad880WPkc5UBt/49136951fc1a53b87ad95997364e7941/Public_Midterm_Narrative_Report.pdf

Final Report

Description: Report to GBIF will include a project summary, a breakdown of activities, costs, issues that may have occurred during the project's lifetime and tasks completed, using the GBIF reporting format

% complete: 100%

Status update: Completed

Sources of verification: Submitted document

The Marine Data Hub Manual for Best Practices

Description: Standard Operating Procedures for the upload, cataloguing, sharing and visualisation of all marine data on the MDH. The manual includes information on the training tools for the IT and geomatics team. Compiled separately is guidelines for publishing IMA data to GBIF

% complete: 100%

Status update: None

Sources of verification: Marine Data Hub Training Manual_Institute of Marine Affairs TT.pdf
Data management and Data Publication Guidelines.pdf

Two training workshops on the Marine Biodiversity Hub (MDH)

Description: (1) MDH data visualisation and back-end training for the geomatics and IT staff by GeoTeach Vision Ltd. (2) Training for all Research Officers on data collection standards and the use of ArcGIS mobile to collect data and how to use the MDH via the ArcGIS Portal. (3) Training for all research collaborators and government partner at external workshop with UW1, and final seminar

% complete: 100%

Status update: Complete

Sources of verification: Meeting on metadata standards:

https://assets.ctfassets.net/uo17ejk9rkwj/7m05qMemQaqj9M8zmeAHso/1596aba4604ded45a21bdef38067055b/IMA_MBHUupdate_MetadataStandards.pdf

Backend training of IMA staff by GeoTech Vision Ltd: Attached training certificates
Internal workshop:

IMA_Internal_CapacityBuildingWorkshop_Report.pdf
External workshop:

IMA_UW1_GBIFWorkshop_Minutes.pdf
Seminar: IMA_MDH_Seminar_Minutes.pdf

Events

Identification of stakeholders and engagement

Dates: 2021-07-01 - 2021-09-10

Organizing institution: Institute of Marine Affairs

Country: Trinidad and Tobago

Number of participants: 76

Comments: A total of 8 introductory meetings with stakeholders

Website or sources of verification: IMA_MDHIntro_DataUseResults_IMA_InformationCentre.pdf;

IMA_MDHIntro_DataUseResult_MarineDataUsers.pdf;

IMA_MDHIntro_DataUseResults_GovPartners.pdf;

IMA_MDHIntro_DataUseResults_IMAResearchers.pdf

Events

Internal training of IMA GIS staff on MDH

Dates: 2022-08-29 - 2022-08-30

Organizing institution: Geotech Vision Limited

Country: Trinidad and Tobago

Number of participants: 8

Comments: Attendees consisted of Geomatics Unit staff, Data Officer and Network Administrator.

Website or sources of verification: MarineDataHub_TrainingManual_IMA_TT.pdf;

GTV_IMA_MDHTraining_Lectures.pdf

Events

Data Management at the Institute of Marine Affairs, GBIF Internal workshop

Dates: 2022-11-23 - 2022-11-24

Organizing institution: Institute of Marine Affairs

Country: Trinidad and Tobago

Number of participants: 40

Comments: Attendees consisted of IMA research, IC and IT staff. It reviewed IMA's data policy and

recommended management plans using the MDH and GBIF as tools for data storage, visualisations etc.

Website or sources of verification: IMA_Internal_CapacityBuildingWorkshop_report.pdf

Events

Accessing Trinidad and Tobago Biodiversity Data Workshop

Dates: 2022-12-14 - 2022-12-14

Organizing institution: Institute of Marine Affairs/ University of the West Indies

Country: Trinidad and Tobago

Number of participants: 34

Comments: Guest presenters included the Environmental Policy and Planning Department, Ministry of Planning and Development on TTBS, and BID Regional Project Support Team. Attendees represented ~ 23 organisations that largely consisted of researchers, government partners, NGOs and businesses.

Website or sources of verification: IMA_UWI_GBIFWorkshop_Minutes.pdf;

IMA_UWI_AccessingTTBiodiversityDatPostworkshop_Survey.pdf

Events

Exploring IMA's Marine Data Seminar

Dates: 2023-06-01 - 2023-06-01

Organizing institution: Institute of Marine Affairs

Country: Trinidad and Tobago

Number of participants: 64

Comments: The seminar was a hybrid event of online and on-person attendees. It gave an overview of the project timeline, introduces IMA's data on GBIF, and the MDH.

Website or sources of verification: <https://www.gbif.org/event/7eb4de-1aa1-4ba7-9953-b623d61/exploring-imas-marine-data> ; https://www.youtube.com/watch?v=e_9wpmcfGF0 ; IMA_MDH_Seminar_Minutes.pdf

Communications and visibility

The project communications plan focussed on the three tiers of data users (internal staff, external research collaborators and government partners and the wider data users). Following all workshops and seminars conducted – internal workshop with IMA research and IC staff, external workshop with collaborators and a seminar on exploring IMA's data – data users were sent feedback surveys that accompanied post workshop packages (workshop minutes, presentations, useful links etc). A Marine Data Hub email address (mdh@ima.gov.tt) was created for all correspondence, including event invitations and updates, as well as to share any new datasets or feature historical datasets. The email is linked to team member's (Data Officer, GIS Officer, and Research Officer) email for timely responses. A subscribed mailing list was established with specific tags to match the following focal groups – IMA research staff, IMA IC staff, government partners, universities, businesses, NGOs, education and individuals.

Over the last six months of the project IMA created a range of informational material (MDH brochure, MDH business cards with QR code), and branded tokens (MDH magnets) to be shared with stakeholders to encourage the use of MDH Hub and exploration of IMA's repository on GBIF. The brochures and tokens were shared during the seminar and will be used by our Information Centre to give away at school trips, University Open Days booths, and any relevant external education events that IMA participates in. Aligned with our seminar, IMA published an article on MDH in the national newspapers (see documents attached; <https://planning.gov.tt/content/portal-ima%E2%80%99s-marine-data-hub-mdh-%E2%80%93-get-excited-about-data-sharing>).

During the post project phase, IMA will share updates through our mailing list at minimum every 3- 6 months depending on the types of projects. We will have a feedback feature attached to our emails to track the effective use of the MDH. Aligned with this is the IMA's monthly internal newsletter, and external newsletter that is published three times per year and shared with government partners and general stakeholders.

Furthermore, discussions on the ability to use the MDH to support the data of other organisations who also gather marine data (independently), but with no avenue for sharing came up during the workshops and seminars. IMA sees this as an opportunity for the MDH to serve as a central repository of marine data for Trinidad and Tobago and will investigate capacity needs to house external data and a policy framework to permit data sharing and responsible use.

Please see the documents sections for the following attached documents:

1. Minutes for two workshops (internal and external) and the final seminar
2. A list of Marine Data Network (mailing list)
3. Brochure, magnet and business card design
4. Newspaper article on the MDH

Monitoring and evaluation

Final Evaluation

Monitoring and evaluation of all activities was conducted throughout the project both informally through our weekly team meetings, and formally, captured in post workshop feedback surveys, and discussions from the events. For internal evaluation, over the two years, the project team met weekly to discuss activities, designate tasks and problem solve any issues that arose to ensure the project remained on track. Meetings were held with the management team every six months to give an update of the project status. With respect to the GBIF biodiversity dataset deliverables, the Data Officer and Research Officers met regularly with the BID Regional Project Support Team for guidance on data preparation and uploading to GBIF platform. The team worked effectively with each other, and having persons of different expertise in suitable roles kept the multiple project components progressing. There was general support from management and research staff with regular discussions on long-term sustainability. The Deputy Director over saw some aspects of this project.

For the most part, most internal project activities were completed within the allotted time frame. The team assisted research staff during the marine data cataloguing activity by meeting with the researcher one-on-one to train them on Darwin Core standards and data entry formats. Team

members then checked in regularly with the researchers as they worked on biodiversity datasets and then worked with them to correct any errors. There was willingness from the researchers to continue to upload data to GBIF in the future as they received the training.

For all capacity building events, the team provided participants with forms to evaluate workshop structure, along with the understanding of the role of the MDH, its benefits and how to use it, as well as how find IMA's repository on GBIF. In general, participants were willing to use the MDH as a data repository in the near future. At the internal workshop, staff was interested in using the additional tools in information sharing (WebMap and StoryMaps) and data capture (field forms) to streamline the fieldwork process and reduce transcription errors. They were also interested in follow up training session specifically for these tools, until they're versed. The MDH was introduced within the broader context of marine data management and the IMA Data Policy. Discussions revealed several gaps in the policy and the need to update the policy as soon as possible. At external events, feedback was positive and discussions revealed interest by NGOs to use the MDH to share their data given the accessibility, thus giving rise to future data-sharing collaborations.

Best Practices and Lessons learned

Unfortunately, there was some challenges throughout the project. It was difficult to encourage stakeholders to provide timely feedback after workshop with frequent reminders resulting in a less than 50 % response rate. In the future, time should be allotted at the end of the workshop or after each session to get immediate feedback, which can then be discussed and recorded. The time to conduct the stakeholder engagement activities and the planning for the workshops were underestimated, as there were several activities in the lead up and following the event to ensure attendance and to obtain necessary evaluation information respectively. Often the most useful information collected (e.g. stakeholder need assessment) was revealed during one-on-one meeting or through formal and informal communication (outside of surveys) during events. Having a person dedicated to recording meeting minutes and compiling for review shortly after the events was critical to tracking effectiveness of the MDH and communication of it. Again, having dedicated time to discuss conversationally during the workshop helped. We also got more feedback and lively discussions during in-person meetings versus online.

One activity that we underestimated with respect to the time allocation was the construction and the development of the Marine Data Hub. There were many choices and decisions made from the point of drafting the Request for Purchase for the construction and development of the MDH to the technical handover by the contractor, Geotech Vision Limited to the ongoing maintenance and data visualisations. The team learned considerably about the process of procurement but also on determining the suitable technical requirements to fulfil our need, and the requirements for long-term sustainability (please see details in the MDH evaluations and monitoring report).

Challenges with the functionality of the national biodiversity repository - Trinidad and Tobago Biodiversity Information System (TTBIS) - limited the ease at which IMA was able to add data to the site. While data has been uploaded, internal site maintenance has limited the access of the biodiversity data to the users.

Overall, the team was able to achieve much success over the two years, but care should be made to avoid promising too much given the internal governmental process for seeking approvals that can take considerable time and is outside the control of the team. Having, a BID regional support team was an incredible asset to facilitate timely trouble shooting. Thank you to Leo Buitrago.

Post Project activities

In the post project phase, IMA will retain the core team functions of the administrations and maintenance of the Marine Data Hub. Periodical uploads will also continue on to the TTBIS site, once site issues are resolved. Additional funding from the Government's Public Sector Investment Programme to increase the user license of the Marine Data Hub, so that more data users can access in tandem. Biodiversity data will be requested from research staff every six months and at the end of any research project to upload to GBIF. IMA will also continue to work on activities that were incomplete during the project, including the development of health indicators for the State of the Marine Environment reports, once the Institution is given approval to proceed. Indicators would include health indicators of coral reefs, seagrasses, mangrove, coastal and rocky areas, as well as indicators of water quality. IMA will also begin requesting biodiversity data sharing permissions for project conducted under IMA's Technical Advisory Services - consultancies that IMA did in the past.

Sustainability

Sustainability Plans

Personnel Sustainability

To be able to complete all activities, additional staff was hired including four trainees (2 specialising in GIS, and 2 in biology) to assist in the following activities – construction and development of the MDH, data aggregation, integration and visualisation, capacity building and inventory digitization and marine data cataloguing. The two GIS trainees have been retained by the GIS unit and will continue to utilise and maintain the MDH. One biologist was retained primarily for research.

Sustaining data management workflow

The Standard Operating Procedures for the MDH are housed on the IMA's servers, along with Darwin Core templates, and metadata forms to accompany all biodiversity data. These procedures will be shared to new researchers by the Data Officer. The Data Officer created a metadata form for researchers to fill out, to supplement the biodiversity data for the upload on to GBIF site. Periodic reminders and refreshers will be done with staff, and steps will be taken by management to ensure the data upload to MDH will be part of the Researcher's annual workplan.

MDH Sustainability

IMA got approval for funding under the Government's Public Sector Investment Programme to increase the user license of the Marine Data Hub. The additional licence provides three more users for ArcGIS Pro, the software used internally and one additional creator user-type that will be linked to the Hub. This additional creator type will be allocated to research projects with the portfolio for data sharing with their stakeholders, thus allowing for optimal use of the MDH. This additional licence is set to be installed and configured during the first week of July 2023. Furthermore, the MDH will be sustained under the same PSIP fund for the Service Level Agreement with Geotech Vision Limited for eight months (February to September 2023). By September, the team will draft a long-term sustainability plan that will include upgrade timelines. IMA also received PSIP funding to streamline IT functionality and capacity of the IMA thereby building IMA's capacity for data storage and security mechanisms.

User Sustainability

The use of the MDH will be part of all IMA's projects for the storage and the visualisation of all data for reporting. All project partners will be given permission to access the data associated with the project for easy collaboration. Following the interest of having independently obtained data from third parties (NGOs etc) showcased on the MDH for public access, IMA will develop a streamline protocol for responsibly sharing external data. For responsible data use, IMA will insert citation recommendation to our publicly accessible data, so that our data use can be tracked for effective use. The citation feature on GBIF does this automatically for IMA's biodiversity data.

Impact of COVID-19 pandemic on project implementation

There were limited impacts of COVID-19 to the progress of the project. The adoption of online meetings facilitated meetings when social distancing was being enforced as a government regulation. Online platforms increased our stakeholder reach by having multiple meetings and being more flexible with the stakeholder's time. However, it was harder to garner high level engagement of stakeholders compared to in-person meetings.

GBIF leads the Biodiversity Information for Development (BID), a programme funded by the European Union. The programme provides supplementary support for activities addressing the needs of regional researchers and policymakers through mobilization and use of biodiversity data.

