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NEW DIGITAL TECHNOLOGIES FOR MARINE BIODIVERSITY DATA HANDLING IN EAST AFRICA (NeDIT)

**Summary Report for Workshop on Biodiversity Data
Handling in Tanzania, 2nd – 3rd May 2019**

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Executive Summary

We live in times of rapid environmental, human-made environmental change. Ecosystems are changing rapidly and fish stocks are in decline under increasing anthropogenic impacts. This also directly influences terrestrial as well as marine biodiversity. In a first comprehensive worldwide report, more than 1 million species have reportedly vanished due to human influences, this makes the 6th mass extinction entirely man-made. To mitigate further loss and maintain as much of the critical biodiversity up-to-date, comprehensive and processed data on the status of marine biodiversity and resource use are critical, not only to identify biodiversity threats, but also to determine conservation priorities and to address increasing conflicts on space use in coastal environments. This is one factor to enable informed and long-term valid management decisions at different levels of administration from local conservation areas to regional marine spatial planning. A further precondition is the rapid communication of data and processed information between relevant actors, such as governmental administration and research institutes. The timely availability of reliable biodiversity data on East African coasts is still a major concern in many areas: internationally, data are distributed on mostly sectoral data bases (NGOs, EU, US, UN, and Africa-wide¹), while at the national level, data are frequently distributed across numerous ministerial departments, often lacking easy-to-use options to merge information and clear rules on competences and responsibilities.

This Partnership Project implemented by ZMT in cooperation with the Institute of Marine Sciences at the University of Dar es Salam (IMS) aims to support the use of new and innovative digital technologies for policy-making in marine resource management in Eastern Africa. The overall objective is to contribute to improved handling of biodiversity data in East Africa, which includes providing and assessing data as well as communicating data. A focus of the project is on integrating data and raising the awareness and capacities for exchange of data building on the existing experiences. Thereby the project will gather stakeholders involved in marine biodiversity data handling to a networking group, compile the most relevant data bases and assess the experience in sustainable data handling and sharing. Furthermore, the project will evaluate how new and innovative digital technologies can contribute to advanced integration of data from different sources and their overarching analysis. Resulting from this partnership project, actors in the region will have an overview on experiences and lessons learned in applying new data technologies in East Africa and beyond. Capacities for data handling are strengthened and proposals for initiatives to implement new data technologies are developed. Policy-makers are part of this work and have a better overview on new digital technologies, biodiversity data bases and can use the developed policy recommendations on improving the handling of marine biodiversity data for respective policy decisions. Thus, through the partnership project and the collaborative approach of scientist and policy-makers working together, the project contributes to a sustainable management of coastal biodiversity and resources in East Africa.

¹ See e.g. : ODINAfrica, African Marine Atlas, Moving Sushi, OBIS, keNODC, Kenyan Biodiversity Atlas Project, Tanzania Biodiversity Information Management Tool (BIMT), ASCLME



This very first project workshop was initiated to get together relevant Tanzanian stakeholders involved in the handling of marine biodiversity data. These included representatives from universities, governmental agencies and institutions as well as key regional platforms and NGOs. The main aim was to disseminate the scope of the project and get an overview over ongoing projects and activities. It was also used to come to a common terminology concerning biodiversity and biodiversity data handling among the participants.

Day 1 focused on reports of data collection and handling practices from the attending institutions. Those presentations were followed by discussion rounds and a workshop focusing on improving the data handling protocols and options for a data base hosting.

On day 2 emphasis was given to new digital tools to collect, analyse and disseminate biodiversity data, as well as choosing the right platform to foster an open exchange on what data is needed and how it can be provided to decisions makers and managers.



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I. Presentations Day 1

Day 1: Major Issues that Transpired

1. Introduction of the workshop objectives

The day started by introducing the objectives of the workshop by the project implementors/coordinator which were:

- To have a common understanding of marine biodiversity data
- Explore existing frameworks for marine biodiversity data handling and management
- Examining the current marine biodiversity data management efforts
- Explore ways to improve capacity for handling marine biodiversity data
- Explore possibilities of establishing an expert network for data management and databases

2. Speech by the Guest of Honour (Ms. Tekwa)

- The Guest of Honour stressed on the importance of marine biological diversity and what the Government of Tanzania is doing to protect the marine environment in terms of putting in place the various policy and legislative frameworks
- She identified a number of anthropogenic threats to marine biodiversity in Tanzania. These include eutrophication, pollution and overfishing on a regional level, as well as the climate crisis.
- Ms. Tekwa also pointed out various challenges related to data collection and handling in Tanzania
- She stressed on the need to devise platforms/mechanisms for fair data sharing and handling
- She also stressed the role of data in supporting management of marine resources and policy formulation

3. Introduction of the NeDiT project (PD Dr. Hauke Reuter)

- General background as given about ZMT as the only German research institute dedicated to tropical marine and coastal ecology research
- A description of the 'Digital ZMT' was given. In brief, it is an initiative starting in 2020 to transform the way how data is collected, stored, analysed and managed. A large component will also include support and advice for ZMT partner institutions and countries
- A short description of the GIZ-funded 'African-German Partners for Ocean Knowledge' initiative was given.
- The goal and specific objectives of the NeDiT project were presented:
- it will gather stakeholders involved in marine biodiversity data handling to a networking group, compile the most relevant data bases and assess the experience in sustainable data handling and sharing.



- Furthermore, the project will evaluate how new and innovative digital technologies can contribute to advanced integration of data from different sources and their overarching analysis.
- Resulting from this partnership project, actors in the region will have an overview on experiences and lessons learned in applying new data technologies in East Africa and beyond.
- Capacities for data handling are strengthened and proposals for initiatives to implement new data technologies are developed. Policy-makers are part of this work and have a better overview on new digital technologies, biodiversity data bases and can use the developed policy recommendations on improving the handling of marine biodiversity data for respective policy decisions.
- Thus, through the partnership project and the collaborative approach of scientist and policy-makers working together, the project contributes to a sustainable management of coastal biodiversity and resources in East Africa.

4. Extent of marine biodiversity data and existing collection efforts (Dr. Muhando)

- During the discussion it was suggested that there was a need to re-define on how biodiversity is measured and represented in policy documents
- It was also agreed that , although there is a wide range of marine biodiversity in Tanzania, our focus has be narrow i.e. we have been concentrating on very few taxa of marine plants and animals
- Such narrow coverage was attributed to limited taxonomic expertise
- There was also an insistency on the need to re prioritize our efforts as currently, focus is on most abundant or economically-important taxa
- The need to go beyond inventory data was also highlighted i.e. we need to go beyond the species names and their habitats; also need to decide on how we are going to report/account for impact of environmental changes on species
- A number of initiatives/efforts were presented – e.g. on biodiversity of fished stocks by FAO, notwithstanding weaknesses related to broad-grouping of the fish taxa; also Ngatunga et al
- Major conclusions from the discussion: marine biodiversity data is a huge area, but only interesting groups/taxa are covered under current effort; there is a need to prioritization of taxonomic coverage; substantial work has been carried out especially on corals and commercial fish stocks; there is a need for inclusion of other species

5. Fisheries catch assessment surveys (Mr. Mayala)

- In this presentation highlights on fisheries and fisheries data collection was narrated; including discussion on the importance of fisheries sector; historical trends in fisheries data collection efforts; type of data collected; and collection tools
- Highlights on ICAS- a mobile system (app) for collecting fisheries data currently being used in Kigamboni, Rufiji, Kilwa and Mafia Districts targeting 32 families of fish, under which priority species fall



- Current challenges for data collection were also identified: human and financial capacity limitations; inadequate working tools/equipment; inadequate/unreliable data; gaps in collection, processing and analysis; and lack of data/information management system

6. CAS Data collection process for Zanzibar (Mr. Nassor)

- Description on the ZCAS system for fisheries data management for Zanzibar was given where between 2-4 landing sites for each district are involved
- We learned of the five ZCAS stages for collection and management of the fisheries data ie from ZCAS-1 at the fishing auctioning site to ZCAS-5 managed at the Department of Fisheries
- The SAMAKIS – the Fisheries Information System (FIS) for Zanzibar was also described, being an authenticated web-based information system being used to generate various reports on catch, effort, CPUE and value for various types of gear and species caught
- Challenges identified for CAS system include overcrowding during fish auctions impeding data recording; limited number of data collection personnel; and use of paper-based method for recording the data
- Recommendation given is for the use of mobile devices for data recording and a web-based data management system
- One of the major issues which came up during the discussion was the sustainability of the system including issues to do with capacity to host and administer/manage the system in the long term

7. Biodiversity status in Tanzania (Ms. Teikwa)

- Reminded on the fact that Tanzania is a major biodiversity hotspot, but various natural and anthropogenic phenomena are threatening such diversity
- Highlighted on the various efforts being undertaken for biodiversity conservation – including the various legal and institutional frameworks are at global, regional and national level
- Identified major challenges regarding marine biodiversity data management to include: limitations with data availability, data handling, data access, and data/information sharing; as well as lack of specific guidelines for marine biodiversity data handling
- A national strategy for enhancing the collection, analysis and sharing of data needs to be established; establishment of science-policy platform to facilitate exchange and sharing of data and information

8. Coral reef monitoring and associated biodiversity data issues (Dr. Yahya)

- Highlighted on the monitoring activities for coral reefs in Tanzania starting in early 1990s supported by a number of institutions and projects
- Major issues related to data management included need for centralized data storage system (clearing house); broadening focus beyond coral species to include other taxa such as algae and



other invertebrates; standardization of data collection methods; collection of data in such a way that total numbers are derived rather than the averages only

9. Reef monitoring in MPAs

- Gave highlight on the short and long term monitoring activities of coral reefs in the Marine parks, include support being provide to carry out the monitoring
- Recommendations provided included: capacity building (equipment and gear) and training; establishment of a standard database for data processing and storage; and coral reef restoration

10. Publication of biodiversity data in Tanzania (Dr. Gideon)

- Described the role and activities undertaken by COSTECH as a focal point for GBIF and host of TanBIF
- Described the activities of TanBIF in the promotion for the mobilization, digitization, and publication of biodiversity data
- Highlighted on the key contributors for biodiversity data originating from Tanzania and the discrepancies that exist between georeferenced data originating from Tanzania against those contributed by Tanzanians or Tanzanian institutions; and the fact that less data from Tanzania is represents in the TanBIF system, meaning a lot data is still not shared adequately; there is also a large discrepancy between data available/held and data need for scientific use
- Gave results of a survey assessing factors affecting publication of data identified as: Inadequate skills; poor data quality; data sensitivity; inadequate data sharing policy; lack of awareness; financial issues
- Recommendations provided included: updating TanBIF data hosting software (from Linus II to ALA); improved biodiversity research, data mobilization, publication and use; and outreach

11. African marine species database (Dr. Wambiji)

- Gave highlights on regional and global marine data and information management system in the name of OBIS, WoRMS, AfReMas and GBIF; and how such systems are integrated
- Described how OBIS as a marine counterpart of GBIF has contributed enormously to various global processes eg its contribution in the identification of global biodiversity hotspots (EBSAs) and support for World Ocean Assessment (WOA)
- Pointed out that while African are leading consumers of biodiversity data, we lag behind in terms of contributing data
- Recommendations given were: need to make AfReMaS a more complete system; and providing support to AfReMaS editorial board

12. WIOMSA (Dr. Igulu)



- The role of WIOMSA as a regional organization supporting research activities and hence data generation was highlighted
- Also described how Sweden who are the funder for WIOMSA activities have laid out frameworks ensuring access to data/information for research funded by public money.

II. Workshop Day 1

Three issues were up for discussion:

- ***What can be done to improve data collection protocols?***
 - Most people felt that the existing protocols are good, but need some improvements
 - There is a need to make the existing systems more interoperable
 - Need for geo-referencing of the data
 - Need for inclusion of environmental metadata
 - Need for capacity building and awareness raising
 - Need for centralized system for coordinating expertise e.g. on taxonomy
 - Need to increase taxonomic resolution
 - Need to include more taxa, other than fish
- ***Prioritization of species data collection effort?***
 - Criteria for prioritization were discussed to include: species level of threat, economic importance, endemism migration status (i.e. whether species is migratory)
- ***Is there a need to establish a database, and where should it be hosted?***
 - Most people felt that it is better to adapt the existing databases and customize them to suit our needs
 - COSTECH, TAFIRI, IMS were mentioned as some of the institutions which can possibly host and administer the database
 - But need for capacity building in IT infrastructure (software etc), taxonomy



III. Presentations and Discussions Day 2

1. New digital tools in biodiversity data handling (Dr. Kegler)

- The talk gave an overview of the transition on how integrated biodiversity and environmental data collection will likely shift in the future to enable an improved, science-based management of biodiversity.
- New (open source) tools were presented, which can increase the options to monitor biodiversity.
- Additionally an outlook into new perspectives of data management were given, as well as new tools to streamline data management
- To deal with the large amounts of data being created, ways to apply big data approaches to biodiversity and environmental data were shared.
- To prepare customized fact sheets and tool-boxes concerning new digital tools in biodiversity assessment is one important package of the NeDiT project, therefore input on needs and ideas is desirable from the participants.
- The project will also intend to contribute to the development of data collection protocols and online training materials on new digital biodiversity assessment tools.

Discussion: Possible improvements in data handling

- This was a discussion on what should be done to improve data handling practice in Tanzania, and below are some of the suggestions given:
- Improvement of the data management platforms by: involving the relevant experts; improving hosting and administrative capacity
- Capacity development/training in taxonomy
- Regular evaluation of data collection systems at landing sites
- Need to digitize the current data collection mechanisms
- Need to identify current collection and handling tools, analyse their limitations and make improvements
- Need to adopt new and more efficient technologies for data collection e.g. underwater photography and videography for coral reef monitoring
- Need to take advantage of platform of opportunities for data collection e.g. cruises and projects such SOLSTICE
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2. Development or improvement of a marine biodiversity database specially tailored for Tanzania need abut with links to regional marine databases (Dr. Muhando)

- Major components/inclusions suggested are:
 - Trends and abundances
 - Threats
 - Water quality parameters
 - Socio-economic attributes
 - Spatial components e.g. names of landing sites for fisheries data

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3. A common learning and exchange environment for biodiversity data management (Dr. Kegler)

- A community of practice (CoP) was proposed as an important exchange tool for practitioners, politicians and scientists.
- A CoP is an online community of persons with a common problem or interest with the goal of advancing their field and who wish to share their knowledge
- Potential advantages include an increased network of like-minded people, increases their organisation, the shared context the CoP creates, a platform to enable dialogue and the capture of diffuse knowledge.
- There is a plethora of available tools already, so often there is no need to reinvent the wheel but rather chose the right solutions.
- There are some success factors, which facilitate the establishment of such a community of practice: a large and inclusive community, regular exchanges among participants, a sense of ownership by the community as well as

Establishment of marine biodiversity working group/network

- A working group was suggested to coordinate data compilation and establishment of a database
- Need for an office for biodiversity data handling either at COSTECH or VPO; but currently IMS can volunteer

IV. Conclusions and future steps

The reports and presentations made clear that there is a strong need for an improved handling and more timely dissemination of biodiversity data in Tanzania. This data is crucial, as Tanzania is home to diverse coral reefs and many migratory fish species cross its waters regularly. To protect these valuable assets and resources a more timely availability of high resolution spatial information is essential. Additionally, data is often collected according to different standards/protocols, distributed among various institutions and only shared to a limited degree. This situation further hampers conservation and management efforts of endangered or economically valuable species.

To address these issues several steps and activities were proposed by the participants:

- There is a need to make the existing systems, standards and protocols more interoperable
- Need for geo-referencing of the data
- Need for inclusion of environmental metadata
- Need for capacity building and awareness raising
- Need for centralized system for coordinating expertise e.g. on taxonomy
- Need to increase taxonomic resolution
- Need to include more taxa, other than fish
- Existing databases were preferred as a storage solution, but should be customized to suit the needs of Tanzanian biodiversity monitoring efforts



- COSTECH, TAFIRI, IMS were suggested as some of the institutions which can possibly host and administer the database
- But need for capacity building in IT infrastructure (software etc) and taxonomy

Concerning the means of communication and exchange it was appreciated that representatives of many different institutions and backgrounds were present at the meeting. Only with all concerned parties involved can we achieve a sustainable and inclusive improvement of data handling and storage. To improve communication between stakeholders it was recommended to create an online community of practice to coordinate data handling, the establishment of interoperable protocols as well as efforts for a national biodiversity database. It was also discussed to institutionalise an office for biodiversity data handling at a later stage. But as a first step an online community of practice will be implemented by ZMT to facilitate and continue relevant discussions.