

TEMPLATE FOR DEVELOPING DEMONSTRATION ACTIVITIES

Project Title: WATER QUALITY ASSESMENT FOR MARINE COASTAL WATERS OF ZANZIBAR.

Annex 1: Proposal Outline and Content

A. Applicant

Name of Organization:	Zanzibar Fisheries and Marine Resources Research Institute (ZAFIRI)
Established	2019
Number of members	37
Number of similar projects implemented	0
Number of similar projects ongoing	0
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Project Title	WATER QUALITY ASSESMENT FOR MARINE COASTAL WATERS OF ZANZIBAR.
Principal Officer (Name and Position)	Dr. Zakaria A. Khamis (The Director)
Project Contact/Manager (Name and Position)	Mr. Ali Said Ali (Head, Department of Research, Innovation and Outreach)
Proposed Starting Date	AUGUST, 2023
Expected Project Duration	1 YEAR

B. Project Proposal Content

Background/
introduction

Zanzibar is an archipelagic, semi-autonomous, state within the United Republic of Tanzania. The archipelago of Zanzibar resides within the Western Indian Oceanic region, the archipelago consists of two main island of Unguja and Pemba, and over 50 small islets. Administratively, Zanzibar is divided into 5 regions and 11 districts. It has an estimated population of 1.7 million people, of which 67 percent and 33 percent live on Unguja and Pemba respectively. Over 56 percent of the population of Zanzibar lives in the coastal rural areas, and 44 percent aggregates in the coastal urban areas. Zanzibar is experiencing drastic urban expansion (Staeher et al., 2017), coastal migration, coastal tourism and coastal developments (Khamis et al., 2017) that overwhelm the coastal marine environment and its ecosystems through the introduction of anthropogenic inputs of land-based pollutants (Juma et al, 2017; Mwevura et al., 2018; Bravo et al., 2021), but also marine-based pollutants from multiple sources that include ships.

The Zanzibar coastal and marine areas comprise a number of critical habitats that include coral reefs, mangroves, sea grass beds, sand banks, wetlands, beaches, and others. These habitats have been essential linked to the overall functions of the coastal areas; their ecosystem services support all forms of life in the coastal communities, where fisheries and related activities have played a soul role in the socio-economic development in those communities.

Tourism and Fisheries sectors are among the fundamental sectors of the Zanzibar economy. The sectors have proved to be crucial in alleviating poverty and supporting livelihoods through the creation of jobs, also representing important sources of government revenue, foreign exchange and GDP growth. In 2020, the GDP share of the fisheries and tourism sectors in Zanzibar to overall economic output was 4.9% and 20.3% respectively. The entire value chain of the fisheries sector employs over 78,000 people which is equivalent to about 8.5% of total Zanzibar's work force (HBS, 2020). Whereas, the tourism sector of Zanzibar provides over 35,000 direct jobs and about 70,000 indirect jobs (ZDV, 2050).

The wellbeing of coastal communities in Zanzibar largely depends on the coastal support through their daily activities to their intervention of the surrounded marine and coastal resources. While fisheries have been long traditional activities in

the coastal communities of Zanzibar, coastal tourism and mariculture (i.e. farming of Fish, Seaweed, Sea cucumber, Mud crab, Pearls, etc.) have recently emerged and become as well important economic activities. Zanzibar is the quintessential destination for coastal tourists with multitude tourist attractions ranging from white sand beaches and sand banks to magnificent coral reefs. Zanzibar is the leading Seaweed producer in Africa and the eighth in the world (FAO, 2019). Following the new government agenda of blue economy, Zanzibar is adventuring to diversify and expand its mariculture options to include Sea cucumber, Mud crab, Sponge and Oyster. Marine water quality remains essential to the success of these coastal economic options (notably tourism, fisheries and mariculture).

The Zanzibar Development Vision 2050 and the Zanzibar Blue Economy Policy of 2022 integrate Zanzibar into the Indian Ocean cluster of small island economies, a cohesive blue economy framework, that involve effective maritime governance and sustainable management of Zanzibar's coastal and marine environments. In an effort toward properly manage and control the marine environment from destruction and pollution, the Revolutionary Government of Zanzibar has established five Marine Conservation Areas (Table 1), and is highly emphasizing on marine environmental health for blue economy development (that include sustainable coastal tourism, fisheries and mariculture). However, rapid population growth, ever-increasing coastal tourism developments and urbanization have overwhelmed the marine environment of Zanzibar from over production of solid and liquid wastes, as well as organic and inorganic pollutants, industrial effluent and untreated sewage from municipalities, industries, agricultural activities and households. The generated wastes are in turn find their way to marine environments through runoffs and sewage systems.

There are some existing studies on marine water quality in Zanzibar, that focused on organic pollutants (Haarr et al., 2021; Juma et al., 2017; Mwevura et al., 2018), toxic metals (Bravo et al., 2021), coliform bacteria (Moynihan et al., 2014) as well as the macro and micro particles (unpublished data), however the information about marine water quality in Zanzibar is patchy existing and the standardized methods for water quality assessment and monitoring in Zanzibar has never been established. Thus, necessitate for a comprehensive spatiotemporal assessment of the Zanzibar marine water quality along with the establishment of monitoring program for marine water quality. The monitoring program is very critical to control

pollution for better management of the Zanzibar marine waters toward successful and effective implementation of Blue Economy Policy of Zanzibar. The present work is also in line with the objectives of the project entailed “Addressing land-based activities in the Western Indian Ocean (WIO-LaB)” stipulated in Nairobi convention.

MARINE CONSERVATION AREA	DATE ESTABLISHED	AREA
Pemba Channel Conservation Area (PECCA)	2005	825.8km ²
Mnemba Island Marine Conservation Area (MIMCA)	2002	337.3 km ²
Menai Bay Conservation Area (MBCA)	1997	717.5 km ²
Tumbatu Marine Conservation Area (TUMCA)	2014	162.9 km ²
Changu-Bawe Marine Conservation Area (CHABAMCA)	2014	118.2 km ²

Source: Department of Marine Conservation, Ministry of Blue Economy and Fisheries

Project rationale: relevance and linkage to the project principal goal as well as national priorities

Marine water pollution is a global concern. The world oceans and seas, as well as their ecosystems are alarmingly threatened by the problems of pollution and degradation that jeopardize their health, Zanzibar is no exception. The ever-increasing number of tourism hotels and coastal developments, marine-based recreations, coastal agriculture, shipping, industrial development and urbanization *inter alia* are exerting immense pressures on the coastal waters of Zanzibar resulting into significant impact on marine water quality, due to anthropogenic inputs of pollutants including persistent organic pollutants, toxic metals, microorganism as well as the microplastic and marine litters. These pollutants have direct eco-toxicological impacts to marine life and humans who use the coastal water and beaches for recreations, fishing and aquaculture. As Zanzibar is adventuring in the blue economy, marine water pollution control and monitoring is of a greater concern. The present project will therefore focuses on the assessment of coastal marine water quality around Zanzibar Islands as part of the baseline for coastal water pollution monitoring in the archipelago.

Design principles and strategic considerations

The project set strategic objective to realize its output. The project set theory of changes that govern the project strategy to achieve the project outcome. The theory of change includes the

	design of project output and interventions that will be directed by strategic goals for achieving the planned project outcome.
Project Objective, Outcomes and Outputs/activities	<p>General Objective: To undertake water quality assessment for the marine coastal water of Zanzibar and establish marine water monitoring system.</p> <p>Specific Objectives:</p> <ol style="list-style-type: none"> 1. To examine the spatial variation of physico-chemical and biological parameters, and trace metals within the coastal water of Zanzibar 2. To assess the level of marine macro and micro litters in the surface of coastal marine water of Zanzibar. 3. To map and assess the potential land-based sources of pollution around the coastal zone of Zanzibar. 4. To establish Zanzibar marine water quality monitoring system for monitoring and control of marine water pollution in Zanzibar. <p>Project Outcomes.</p> <ol style="list-style-type: none"> i. Marine water quality data of the Zanzibar seascape that will add on to the preparation of marine spatial planning of Zanzibar is available. ii. Marine water quality data to improve the General Management Plans (GMP) of the MCAs is available. iii. Marine Water Quality Monitoring Plan (PMP) for the Zanzibar coastal water is developed. iv. Policy brief for Marine Water Quality Monitoring Strategies (PMS) in Zanzibar v. Zanzibar marine water quality monitoring system is developed. <p>Project Outputs:</p> <ol style="list-style-type: none"> i. Quality status for the coastal marine water of Zanzibar that include physicochemical parameter, trace elements and biophysical parameter is established ii. Pollution status of micro and macro liter is established iii. Nutrient pollutants with subsequent risk of eutrophication in coastal ecosystems established. iv. Reference sites for the coastal water quality monitoring system in Zanzibar seascape are generated. v. Information system for water quality of the Zanzibar coastal marine water is established.
Key indicators, risks and assumptions	<p>Key indicators:</p> <ul style="list-style-type: none"> • Levels of trace elements on coastal marine water on selected sampled area

- Level of physicochemical parameter on coastal marine water on selected area
- Level of biological parameter on sampled area in the Zanzibar seascape
- Level of micro-litters in coastal and marine waters of Zanzibar
- Marine Water Quality Monitoring Plan is in place
- Policy brief for Marine Water Quality Monitoring Strategy has been produced
- The Zanzibar Marine Water Quality Monitoring System is developed

Risk ratings:

- **Political and governance (moderate):** Zanzibar held its last general elections in 2020 which led to reshuffling of the establishment of new full-flagged Ministry dedicated for blue economy, the Ministry of Blue Economy and Fisheries. The ministry is structured into nine entities that include five Departments, two Companies, one Authority and one Institute (ZAFIRI). Despite of reformulation of ministries, the technical teams largely remain unchanged within ministries, thus ensure continuity in the Project activities and dialogue. Considering the existing tranquility in Zanzibar, no risk is foreseen to the research activities.
- **Macroeconomic (moderate):** The macroeconomic conditions in Zanzibar seem to be improving after a slowdown in economic growth due to the impact of the COVID-19 pandemic on the economy, in particular the tourism sector. The economy is rebounding to its states fueled by an increase in the tourist arrivals in late calendar year 2021 and strong GDP growth in the services sector. However, the extent of the recovery and its robustness to withstand other potential shocks (including surges in COVID-19) is unclear. If macroeconomic conditions may remain sustainable throughout the project cycle and support to the development of blue economy sectors particularly fisheries due to the ongoing project activities within the ministry of blue economy such as Boat manufacturing and fish processing factories, enhancement of SMEs and Private companies engaged in mariculture.
- **Sector Strategy and Policies (Moderate):** All proposed research activities are closely aligned with MBEF's current priorities and the current sector strategy. Zanzibar Development Vision 2050, Blue Economy Policy of 2022 which integrate Zanzibar into the Indian Ocean cluster of small island economies including fisheries and aquaculture

	<p>which are in line with marine conservation.</p> <ul style="list-style-type: none"> • Institutional Capacity for Implementation and Sustainability (Substantial): The proposed project will require close coordination of technical teams from ZAFIRI, also to acquire new capacity to adequately implement the activities and to ensure their sustainability beyond the project life. For example, despite having a number of competent technical experts, ZAFIRI will require an additional expertise for the effective execution of the research objectives as well as monitoring, reporting and evaluation. <u>Measures to mitigate this risk</u> will include capacity building to ZAFIRI technical team for effective delivery of the project results. In executing this project, ZAFIRI will collaborate with other potential stakeholders that include the State University of Zanzibar, Department of Environment and Zanzibar Environmental Agency during project implementation. <p>Assumptions:</p> <p>The assessment of marine water quality monitoring can detect trends in the quality of marine water that allows to examine the compliance with prescribed standards. Zanzibar coastal marine environments are exposed to several anthropogenic sources of pollutants such as untreated municipal and urban waste discharges, oil spills from garages, depots and ships, vehicular emissions, wastes from hotels and households. These wastes are either directly or indirectly discharged to the marine environment around the Zanzibar archipelago. Previous studies have reported the unprecedented levels of pollutants along the coastal ecosystems of Zanzibar (Juma <i>et al.</i> 2018; Staehr <i>et al.</i> 2018; Bravo <i>et al.</i> 2021). However, there has been a little effort in establishing marine water pollution assessment, monitoring and control in Zanzibar. Failure to establish such assessment, monitoring and control system for marine pollution will likely jeopardize the sustainability of blue economy initiatives and marine conservation measures in Zanzibar. Marine conservation is always considered important, as it increase resilience in maintaining marine ecosystem health and functions. Coastal water quality assessment, monitoring and control play a significant role in ensuring that the coastal and marine resources remain functional and provide refuge for the sustainable socio-cultural and economic development in the country and across the regions.</p>
Cost-effectiveness	The cost effectiveness of the project is planned according to the outcome that need to be realized by the project. The cost that will be used during the implementation of the project activities will provide the positive outcome to support the evidence generation,

	<p>hence support the sustainable blue economy development. The budget planned in all the activities was done following the cost baseline review from other stakeholders to understand the actual cost during budget planning. Additionally, the budget considers price fluctuation and depreciation during cost analysis.</p>
Sustainability	<p>As part of the project implementation, trainings on water quality assessment, analysis and monitoring will offered to ZAFIRI staffs and the stakeholders involved in the project. Capacity building of the ZAFIRI staffs and the stakeholders will ensure for the sustainability of the project within its life-time and beyond the life-time of the project. Additionally, the project implementation activities are intrinsic to the scope and functions of ZAFIRI. On the other words, water quality analysis and monitoring are supposed to be among the routine activities of ZAFIRI. Therefore, the activities will continue to be implemented in ZAFIRI even after the ended of the project through internal funds of the institute. Moreover, this project will provide a kick-off for marine water quality data collection that will continue to be collated for continuous monitoring and reporting of marine environment.</p>
Replicability	<p>This project intends to lay down the foundation and system for marine water quality assessment in Zanzibar. While this project will only cover part of seascape of Zanzibar, the established methodology will be replicated in other areas of the Zanzibar seascape, i.e. around Unguja island and extend the methodology to Pemba island. Again, the established methodology and monitoring system will be replicated periodically to gather data for monitoring of marine water quality and evidence based results.</p>
Project Results Framework	<p>Please refer to the annex 2</p>
Detailed Budget and Annual Work Plan	<p>Please refer to the annex 3 and 5</p>
Management Arrangements	<p>The project will be managed under the ZAFIRI operational organogram. ZAFIRI will select a project team from its dedicated technical staffs. The team will be led by a Principal investigator (PI) and assisted by Co investigator (Co-PI). The principal investigator will be responsible for all the project activities assisted by the Co-PI. The project team will be provided with Terms of Reference (ToR) to guide for project results and outcomes.</p> <p>The financial management of the project will be managed based on the financial principles of the Revolutionary Government of Zanzibar, but also to comply with the funder's financial principles and regulations. The project will adhere to the Foreign exchange policy, financial manual, Treasury Management policy and auditing principles for financial management. The project will be audited by internal and external auditor to ensure proper financial management. In case of any procurement, the project the</p>

	<p>procurements will be done based on procurement manual and policy.</p> <p>Recruitment of staff (if any) for the project will be based on the Public Service Act and guidelines of the Revolutionary Government of Zanzibar.</p>
Monitoring and Evaluation Framework	<p>The MEAL framework will be developed to support effective monitoring and evaluation of the project. The project objective, output and activities will be used to develop project indicators and target that will help the project monitoring and evaluation. Additionally, the project assumption, methodology and result verification will be developed to support effective monitoring and evaluation of the planned activities and output. Finally, the assumption will be developed and used to support the verification of planned output targeted to be realized in this project.</p>
Stakeholder Involvement Plan	<p>The project will engage all necessary stakeholders during the implementation of this project that include local communities. The stakeholder's involvement plan will include mapping of all necessary stakeholders, identification of project beneficiaries' and stages of their involvement. The stakeholders will be involved during process of project activities development, implementation and results dissemination and communication. The project will use various platform to communicate with stakeholders on project results in order to support for policy formulation and changes.</p>
Compliance with UN Safeguards	<p>The project is designed to adhere to United Nations environmental compliance policy, social safeguards policy, codes of conduct, gender safeguards, human right policy, anticorruption police, and health and safety policy.</p>
Exit strategy	<p>The project will be closed after the planned duration ended. However, the exit of project implementation will ensure the sustainability of project activities and impacts. During the implementation of the project, ZAFIRI will ensure the project support for capacity building to transfer knowledge and skills to the ZAFIRI staff and the stakeholders. ZAFIRI will ensure the lesson learned during the project implementation, that include protocols and methodologies, are well documented and skills are transferred staff and stakeholders for the sustainability of the project. Moreover, the Project outcomes and activities are well aligned with ZAFIRI core functions. Thus, ZAFIRI will continue to implement the project activities as among its routine functions.</p>
Legal Context	<p>The project will legally observe all local, regional and international frameworks during implementation. The project will prepare mitigation plan for all forms risks. The project will ensure the endorsement of all required contract during project implementation. In case of violation of any contract, misconduct and conflicts, the project will use internal court.</p>

C. Proposed Budget

Requested Fund	US\$ 112,150
Fund from other sources including in-kind contribution	US \$ 15,200
Total project budget	US\$ 127,350

D. Organizational Background and Capacity to implement the Propose Project

Zanzibar Fisheries and Marine Resources Research Institute (ZAFIRI), is a new Institute established on April 23, 2019 by the Legal Notice Number 32. The institute was established for the purpose of conducting research on fisheries, aquaculture, marine resources and marine science in Zanzibar to improve the fisheries and aquaculture sectors, and the conservation of the marine environment for the sustainable development of Zanzibar.

Research on fisheries and marine resources in the country started since 1900s, under management of FAO and the East African division which was known as "East" African Marine Fisheries Research Organization" (EAMFRO). In 1978, once after the dissolution of the East African Union (EAC), University of Dar es Salaam (UDSM) through its Institute of Marine Sciences (IMS) continued to conduct researches on fisheries and marine resources. Most of the researches during those early times focused on fisheries in general, marine biology and environment. In 2000, the Revolution Government of Zanzibar established the State University of Zanzibar (SUZA) which, among its functions, is to conduct researches on multiple areas that include fisheries and marine sciences.

However, the University of Dar es Salaam (UDSM) through IMS and the State University of Zanzibar (SUZA) are solely academic, thus their researches are often academic researches. Due to the great need for policy-based and applied researches and innovation on fisheries, aquaculture, marine resources management and marine science, the Revolutionary Government of Zanzibar established the Zanzibar Fisheries and Marine Resources Research Institute to fill in the gap of policy-based and applied researches in Zanzibar. ZAFIRI is, on the other hand, doing research and/for development (R&D).

E. Proposed Methodology and Approach to implement the Project.

Sample collection, treatment and storage

The total of three hundred and sixty (360) water and sediment samples (Table 3) will be collected along the four MPAs of Unguja, Zanzibar. 1 litre sample of surface water and water at a depth of 10m will be collected in pre-labelled (sample ID, date and short description) into a clean and pre-sterilized glass bottle for microbiology analysis which will also pre-treated with Sodium thiosulphate to prevent chloride activity over the bacteria. The water sample for chemical analysis, both organic and inorganic pollutants will be collected into 1-litre amber glass bottle, preserved as described in Ogata et al., (2009) for organic pollutants and nitric acid for the stabilization of trace metals – Hg, Cd, As and Pb (Li et al., 2021), respectively. The water samples for the analysis of nutrients (Chlorophyll “a”, Phosphate and Nitrate) will be treated with chemicals instead will be immediately preserved into cool box full of cooling elements, the activity which will also be done for all other samples even after the chemical treatment. The samples will be brought to ZAFIRI laboratories and stored at – 20°C until chemical analysis. The samples for biological and nutrient analysis will be preserved in refrigerator set at 2-8°C and analysed in the following days before 24h of collection.

The samples for the analysis of marine litter will be collected using the modified method by Wessel et al, (2016) and Doyen et al, (2019). Briefly, 100m transect within 20m sub-transects at a depth of 2cm in 0.5m² quadrat will be developed. The same transect will be used to collect any marine litter which is above 5cm using the method in UNEP (Cheshire and Adler, 2009) and OSPAR (Wennerker and Oesterbaan, 2010) guideline.

Table 3: Samples descriptions

Sample types	Parameters to be analyzed	Amount of sample to be collected from every site	Total number of samples
Water	Coliforms and <i>E. coli</i>	1 liter	80
	Heavy metals – Hg, Cd, As, Pb	1 liter	80
	Nutrients – NO ₃ ⁻ , PO ₄ ³⁻ , NH ₄ ⁺ and Chlorophyll ‘a’	1 liter	80
	Physical parameters	Analysis will be done <i>in-situ</i>	
Microplastics	Microplastics characteristics	200m drug along the coastal waters	40
Marine litters	Marine litters categories based on UNEP guidelines	Litters will be collected within 100m transect along the beach.	40
Sediments	Persistent organic pollutants (POPs) and Polycyclic Aromatic Hydrocarbons (PAHs).	100gram	40
Total			360

Samples analysis

Physico-chemical analysis of water samples

The physical and chemical parameters of water samples will be analyzed using the method in table 2 and 3 respectively.

Table 1: Methods of analysis of physical parameters

PARAMETER	INSTRUMENT	METHOD
pH	pH meter	Electrometric Method
Temperature	Digital Environmental Thermometer	Electrometric Method
Conductivity	Conductivity Meter	Electrometric Method
Total dissolved solids	TDS meter	Electrometric/ Gravimetric
Turbidity	Turbidity Meter	Electrometric/ Nephelometric Method
Dissolved Oxygen (DO)	-	Winkler's Method
Light penetration	Secchi Disc	Secchi depth Method

Table 2: Methods of analysis of chemical parameters

PARAMETERS	INSTRUMENT	METHOD
Acidity - Titration	-	Titration
Alkalinity	-	Titration
Salinity	-	Argentometric
Total Hardness	-	Titration
Nitrites	Hanna Multiparameter kit/	Colorimetric Method or
Nitrate	Hach machine	Cadmium reduction Method
Phosphate/phosphorous (Orthophosphate)	Hanna Multiparameter kit	Colorimetric Method or Ascorbic Acid method

Microbiological (coliforms and *E. coli*) analysis:

The analysis water samples will be done by MPN method (USEPA, 2005) with some modifications. Briefly, water sample will serially diluted from 10ml, 1ml, 0.1ml into 10ml double strength lactose broth and 5ml of the same broth respectively, as presumptive test confirmed with Brilliant Green Bile Lactose broth (BGLB) and MUG agar for completed test.

Analysis of inorganic pollutants

The inorganic pollutants (trace metals – As, Cd, Hg and Pb) will be analysed using the

method adopted in Bravo et al. (2021) with some modifications. Briefly, the 1-litre water samples will be acid digested and analysed by using Atomic Absorption Spectroscopy coupled with graphite furnace (AAS-GF) for the analysis of As, Cd and Pb and Cold vapor for the analysis of Hg.

Analysis of organic pollutants

The organic pollutants (POPs and PAHs) will be analyzed by the method outlined in Mwevura et al., 2018 and Juma et al., 2017, respectively. Briefly, 0.5-litre water sample will be extracted with 3-folds 0.5-litre Dichloromethane:Hexane (3:1) using 1-litre separating funnel. The sample will be concentrated by rotarvap until 2ml, dried with sodium thiosulphate and cleaned in column chromatography. The 1-ml extracted sample will be injected into Gas Chromatography Mass Spectrometry (GC/MS).

Nutrient analysis

The nutrient (Chlorophyl “a”, Phosphate and Nitrate) analysis will of water samples will be done by using UV-VIS using the standard method.

Analysis of Microplastics and marine litters

The samples for microplastic analysis will first be tested for the moisture content followed by density separation and filtration in 0.1, 0.3, 1 and 5mm sieve. The results will be recorded based on the characteristics (colour, texture and shape of the microplastic) under stereo microscope. Marine litter will be analysed using UNEP and OSPAR guidelines.

F. Quality of Personnel and Suitability for the implementation of the Project – CVs (Attached)

G. Additional information

Project Goal/ principal Objective	To undertake water quality assessment for the marine coastal water of Zanzibar and establish marine water monitoring system
Output 1	Quality status of coastal marine water for physicochemical parameter, trace elements and biophysical parameter will be detected.
Activity 1.1	Sampling and analysis trace elements on marine coastal water
Activity 1.2	Sampling and analysis of physicochemical parameter
Activity 1.3	Sampling and analysis of Biophysical parameter

Activity 1.4	Sampling and culture of microorganisms
Output 2	Quality status of micro litter and macro litter will be established
Activity.2.1	Sampling and analysis of Macro litter
Activity 2.2	Sampling and analysis of Micro and meso-liter
Activity 2.3	Data processing, analysis, and interpretation
Output 3	Nutrient pollutants with subsequent risk of eutrophication in coastal ecosystems established.
Activity 3.1.	Sampling and analysis of nutrients in coastal water
Activity 3.2.	Data processing, analysis and interpretation
Output 4	Reference sites for water quality monitoring system within the Zanzibar coastal water established
Activity 4.1.	Mapping of reference sites and incorporate them in monitoring plan
Activity 4.2.	Collect and organise information on the reference sites
Output 5	Scientific database for the quality of Zanzibar coastal marine water is established
Activity 5.1	Data collection, organization and manipulation
Activity 5.2	Data cleansing, structuring and transformation
Activity 5.3	Data validation, visualization and publication

Annex 2. Project Results Framework

	Indicator	Baseline	Targets End of Project	Source of Verification	Risks	Assumptions
Project Objective	To undertake water quality assessment for the marine coastal water of Zanzibar and establish marine water monitoring system					
Outcome 1	Availability of scientific data that will help in the preparation of marine spatial planning as well as the improvement of General Monitoring Plans (GMPs) for mariculture activities and management of coastal ecology of Zanzibar.					
Activity1.1 Sampling and analysis of trace elements on marine coastal water	Levels of trace elements in coastal marine water of the selected sampled areas	Significant levels of Al, As, Cd, Co, Cu, Fe, Mn, Ni, Pb, V and Zn in coral reef sediments (Bravo et al., 2021),	Levels of trace elements for the 360 sampled area are known	Using the publication results of the few sampled sites from marine and coastal water monitoring project in Zanzibar, by SUZA. The results from analysed collected samples from	The project will use experts skills and experience on sampling and analysis	The project team will be engaged during sample collection and analysis so as to get the planned results.

				this project		
Activity 1.2 Sampling and analysis of physicochemical parameter	Level of physicochemical parameter on sampled area in marine coastal water ecosystem	Significant levels of nutrients - NH ₄ ⁺ , ¹⁵ N, NO ₃ ⁻ (Moynihan et al., 2015).	360 Sampled areas known its level on physicochemical parameter	The project will analyse sampled area on assess level of physicochemical parameter and verify it with project of marine water monitoring.	The project will use experts skills and experience on analysing physiochemical parameter	Engagement of experts during sample collection and analysis will provide the status of physicochemical parameter in coastal marine ecosystem
Activity 1.3 Sampling and analysis of Bio parameter.	Level of biological parameter on sampled area in marine coastal ecosystem	Significant levels of microbial indicators along Stone town marine water (Moynihan et al., 2015).	360 sampled are known it level of biological parameter.	The project will verify the biological data base of microbial organism and verified it with detected during project activities implementation.	The project will engage skilled experts to analyse biological parameter	Baseline information on biological parameter on marine ecosystem will provide direction on safety and quality of marine water system.
Activity 1.4 Sampling and analysis of macro litters	Level of micro-litters in coastal and marine ecosystem are known	The higher levels of marine litter has been identified, with plastic based litters accounting for the highest proportions (Staeher et al., 2018).	60 Sampled area are known types, size, forms of macro litter	The data will be collected in selected area and sampled to identify types of plastics, size and forms of plastics	The project will prepare tools for macro plastics analysis	Identification of macro plastic will provide baseline of macro litter pollution in marine and coastal ecosystem
Activity 1.5.	Level of	Microplastic	60 sample of	The project will	The project will	Assessing of

Sampling and analysis of Micro litters	microlitter in coastal and marine ecosystem are known	pollution in coastal ecosystems (Lundsør et al., 2019).	area in known their level of microliter	provide evidence data of microliter in in water and sediment	use prepared tools and guideline to provide data	microliter will provide status of water quality on marine and coastal ecosystem.
Outcome 2	Availability of Pollution Monitoring Plan (PMP) and Pollution Monitoring Strategy (PMS) for Zanzibar coastal water					
Activity 2.1. Develop the Pollution Monitoring Plan (PMP)	Pollution Monitoring Plan is in place	Not existing, will be the product of this project.	The levels of pollution by trace metals, marine macro and micro-litters, biophysical and nutrients have significantly been minimised, controlled and monitored. Pollution Monitoring sites are in place	Availability of periodic pollution assessment reports, publications and intervention activities.	Staff turn-over, Covid-19 resurges, Ebola Virus outbreak, Reshuffling of ZAFIRI management	The PMP is a significant monitoring tool for coastal and marine water which could positively impact the growth of blue economy through artisanal fisheries and coastal tourism exacerbated by sustenance of ecosystem health and functions
Activity 3.2. Develop the Pollution Monitoring Strategy (PMS)	Pollution Monitoring Strategy has been established	Not existing, will be the product of this project.	The levels of pollution by trace metals, marine macro and micro-litters, biophysical and nutrients have	Availability of periodic pollution assessment reports, publications and intervention activities.	Staff turn-over, Covid-19 resurges, Ebola Virus outbreak, Reshuffling of ZAFIRI management	The PMS is also a significant monitoring tool for coastal and marine water which could positively impact the growth of

			significantly been minimised, controlled and monitored. Monitoring sites are in place			blue economy through artisanal fisheries and coastal tourism exacerbated by sustenance of ecosystem health and functions
Outcome 3	Zanzibar marine water quality monitoring system (ZMQMS) developed					
Activity 3.1. Develop the Zanzibar Marine Water Quality Monitoring System (ZMQMS)	Availability of ZMQMS	Not existing, will be the product of this project.	Coastal and marine water quality is controlled and monitored.	Availability of periodic monitoring and control data.		

Annex 3. Budget

Project title:			
	Objective: To undertake water quality assessment for the marine coastal water of Zanzibar and establish marine water monitoring system		
	Activities	Activity budget (US\$)	Costs /output (US\$)
Output 1: Status of coastal marine water such as physicochemical and biological parameters, trace metals and nutrients will be detected.	Activity 1.1: Sampling and Analysis of marine water quality during wet and cold season (May-June 2023): Chemical parameters, Marine Litter, Microbes, Nutrients		81,521.76
	Sub activities: 1.1.1: Field work and sampling		
	1.1.2: Samples treatment and storage		
	1.1.3: Sample analysis		
	1.1.4: Data processing and analysis		
	1.1.5: Quota Report writing		
	Activity 1.2: Sampling and Analysis of marine water quality during tourism high season (July-August 2023): Chemical parameters, Marine Litter, Microbes, Nutrients		27,173.92
	Sub activities: 1.1.1: Field work and sampling		
	1.1.2: Samples treatment and storage		
	1.1.3: Sample analysis		
	1.1.4: Data processing and analysis		
	1.1.5: Quota Report writing		
	Activity 1.3: Sampling and Analysis of marine water quality during dry season (Dec 2023-February 2024): Chemical parameters, Marine Litters, Microbes, Nutrients		27,173.92
	Sub activities: 1.3.1: Field work and sampling		
	1.3.2: Samples treatment and storage		
1.3.3: Sample analysis			
1.3.4: Data processing and analysis			
1.3.5: Quota Report writing			
Output 2: Reference sites for water quality	Activity 2.1. Mapping of land-based pollution sources		7500
	Sub activities: 2.1.1. Perform spatial data collection for the land-based		

Project title:			
monitoring system in Zanzibar.	Objective: To undertake water quality assessment for the marine coastal water of Zanzibar and establish marine water monitoring system		
	Activities		Activity budget (US\$)
	pollution sources		
	2.1.2. Data analysis and modelling		
2.1.3. Web-based visualization of marine water quality			
Output 3: Scientific database for the quality of Zanzibar coastal marine water is established	Activity 3.1. Develop scientific database for the marine water quality of Zanzibar		9,000
	Sub activities: 3.1.1. Development of database for marine water quality data		
	3.1.2. Development of Protocols for water quality data management		
Project management	Coordination, Final report writing, dissemination and M&E		12,628.24
	Travel		1,500
OVERALL TOTAL			112,150

Annex 4 : Umoja Class based Budget

Category	Nairobi Convention Support	Co-financing	Total (US\$)	
A. Personnel (for B + C)	17,695.66	In Kind from the Government's allocations	3,200	20,895.66
B. Laboratory analysis	67,826.10		8,500	76,326.10
C. Mapping + Geospatial analysis	12,500		0	12,500.00
D. Operating costs	12,628.24		2,200	14,828.24
E. Contract Services	0		0	0.00
F. Travel from ZNZ to DAR	1,500		1,300	2,800.00
Sum in USD	112,150		15,200	127,350.00

Budget Justification

Category	Description
1. Personnel	<ul style="list-style-type: none"> It includes all staff of ZAFIRI which participate in field work, Sample treatment and standards preparation. The supporting staff for monitoring and evaluation of activities Sampling collection such as Litter, water, sediments The laboratory scientist for sample analysis The car and boat driver
2. Laboratory analysis	<ul style="list-style-type: none"> It covers the costs for the Laboratory analysis of samples The cost for field work during sample and in-situ data collection. The cost for the sample collection tools Standards cost for sample analysis
3. Operating costs	<ul style="list-style-type: none"> This will include the stationary cost. It also covers the cost communications cost. Fuel for vehicle Inception meeting cost

		<ul style="list-style-type: none"> • Stakeholders meeting • Dissemination • Publications • Boat hiring for sample collection. • Sample equipment and tools • Also, it will cover the financial administration cost. • The ICT services such computers and internet
4.	Travel	<ul style="list-style-type: none"> • It will cover the DSA to ZAFIRI staff who will send sample to Dar-es-salaam • Boat ticket and car transport cost

Annex 5. Project Work Plan

Institution	Zanzibar Fisheries and Marine Research Institute
Country	Tanzania
Project Title	WATER QUALITY ASSESMENT FOR MARINE COASTAL WATERS OF ZANZIBAR.
Project Brief Description	
Output 1	Quality status of coastal marine water such as physicochemical and biological parameters, trace metals and nutrients will be detected
Output 2	Quality status of micro- and macro-litters will be established
Output 3	Reference sites for water quality monitoring system in Zanzibar.
Output 4	Scientific database for the quality of Zanzibar coastal marine water is established

Project Period	One years	Total resources required	127,350
Start date	01/09/2023	Total allocated resources	
End Date	31/08/2024		112,150

Agreed by Institution: _____

Agreed by National Focal Institution (Point): _____

Agreed by Nairobi Convention Secretariat: _____