

**UNITED NATIONS ENVIRONMENT PROGRAMME  
NAIROBI CONVENTION**

**WIOSAP FULL PROPOSALS TEMPLATE**

**Call title:** Implementation of the Strategic Action Programme for the protection of the Western Indian Ocean from land-based sources and activities (WIO-SAP)

**Participating countries:** Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa, Tanzania [and France (not project beneficiary)]

**Executing organization:** Nairobi Convention Secretariat

**Duration of demo projects:** 2 years

**Stage of the call:** Full proposals

**Submission dateline:** 15<sup>th</sup> July 2019

**INSTRUCTIONS**

<b>Organisation Name</b>	Universidade Eduardo Mondlane, Department of Biological Sciences
<b>Project Title</b>	SEAGRASS RESTORATION FOR SUSTAINABLE SHELLFISH FISHERIES AND DRAFTING OF A MANAGEMENT ACTION PLAN
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<b>Registration Details</b>	Type of organisation: Academic Country: Mozambique Year: 21th August 1962 Registration Number: NUIT 500003545

### **Executive Summary:**

Seagrass meadows play a significant role in providing ecosystem services, including food and habitat for marine organisms (shellfish and finfish), as well as many important services to a local communities in Maputo Bay (MB) and Inhambane Bay (IB), all in southern Mozambique. For instance, in western MB more than 300 people, mostly women assemble daily within seagrass dominated intertidal areas to harvest clams and other invertebrates for their basic livelihoods. However, in both sites, seagrass meadows have been threatened by anthropogenic pressures (e.g. use of destructive fishing gears) and natural causes (cyclones, flooding and related sedimentation) leading to an increasing loss of seagrass meadows. Nonetheless, effective conservation and restoration efforts of seagrass in MB and IB are still limited given lack of information and a need for awareness about the link between seagrass, fisheries and community well-being.

Given this, the present demonstrative project intends to establish a seagrass plan of action that would deliver ecological-economic and socio-anthropological science information on invertebrate fisheries and engage local community in a good practices for seagrass restoration and conservation, while implementing national agendas (e.g. 2017 Marine Policy and Fisheries Law and ICZM entailing blue carbon management and fisheries sustainability), and global agendas such as SDG 14.2 which highlights restoration initiatives to achieve healthy and productive oceans. Therefore, in order to achieve these objectives, the Eduardo Mondlane University (Department of Biological Sciences and Faculty of Arts Social Science) together with NGOs/CSOs and Municipalities, each of them with specific roles will collaborate to develop an integrated knowledge of seagrass resources, ecosystem management and restoration practices in Maputo Bay and Inhambane Bay.

The Project will be implemented in two(2) years, and it is expected to : i) document invertebrate fisheries, their use value; ii) document value chain of the invertebrate fisheries to communities ; iii) undertake thought key good practices a seagrass restoration in MB and IB based on standard sediment (plug, sod) and sediment free (staple, rod) restoration methods. Community members will be approached in one-to-one conversation and focal group discussions using semi-structured interviews with local communities and all relevant stakeholders, paying attention to gender sensitivity by engaging female researchers in the interaction with female participants. Furthermore, the project will also document local community routines with particular attention to their relationship with coastal ecosystems. For seagrass restoration, consideration given to the appropriate site selection, taking into account the historical and present distribution of seagrasses, analysis of root causes of their declining. We anticipate that this project intends to pay attention to some of the known impacted species such as *Zostera capensis*, *Thalassia hemprichii*, *Halodule uninervis* and *Cymodocea serrulata*.

Finally, the project was designed to benefit directly seagrass invertebrate fisheries gleaners, researchers and students and indirectly, the municipalities and government, private consultancy, NGOs and CSOs, and society and general. Moreover, the project implementation will take in consideration ethics and human rights, as well as will incorporate, balance and encourage gender issues.

### **I. BACKGROUND AND JUSTIFICATION**

Seagrass meadows are recognized worldwide as important coastal ecosystems providing ecological services including food, shelter and nursery areas for shellfish and finfish, as well as

important services to communities. Seagrass meadows support fisheries productivity and food security across the globe (Unsworth et al., 2018). In the WIO region, particularly Maputo Bay (southern Mozambique's largest population site) and Inhambane Bay, and important estuarine mangroves and seagrass are further north, marine resources are essential for the lives, cultures and economies of the inhabitants, especially in the context of poverty levels and limited employment opportunities to less advantaged people such as women. Around 60% of Mozambican people live on the coast. Most urban centres are also coastal (see 2017 populations census. [www.ine.gov.mz](http://www.ine.gov.mz)), These people are highly dependent on fisheries and, indeed, Mozambique is the largest seafood consumer country in SADC.

The distribution of seagrass meadows cover 50-80% of intertidal areas in WIO down to subtidal areas of around 10 m but can reach some 33 m in WIO (Bandeira, 2000, Titlyanov et al. 1995). These are areas dominated by small-scale fisheries, which sustain important coastal communities and populations centres. Current estimates of seagrass coverage in Mozambique is about 43 904 hectares, of which around is 3 875 ha in Maputo Bay and up to 6 199 ha in Inhambane (Bandeira & Gell 2003; Amone-Mabuto et al 2017). Inhambane is also home to the endangered dugong which are highly dependent on seagrass meadows (Fernando et al., 2014). Maputo Bay case relates extensive fisheries with existing wider coverage of both seagrass beds and mangrove forests (Nordlund and Gullström 2013, Bandeira & Paula 2014). The invertebrate fisheries in Maputo Bay are being carried out mostly within seagrass beds. Recent studies documented over 300 people, mostly women, whose basic livelihood is the invertebrate fisheries (Scarlet, unpublished, Inguane & Bandeira 2014). Scarlet, 2005 also reported that in Maputo Bay, the harvesting activities performed in intertidal areas up to 1.5 km in length occurred mostly in seagrass covered patches where these women target various species using low tech methods destructive to seagrass. Shellfish harvesting targeting dominate edible species prompted a reduction on stocks and somehow on known biodiversity on those shellfish (Mtwana Nordlund and Gullström 2013, Chitará 2017). These anthropogenic pressures, in addition to natural causes, (flooding and related sedimentation) have led to an increasing loss of seagrass meadows with the loss being reported as around 84% in NW Maputo Bay and 3% in eastern Maputo Bay (Bandeira et al 2014). Recent studies in Inhambane Bay also reported the existence of important seagrass meadows, sustaining extensive communities that have been impacted by cyclones and possibly various anthropogenic causes related to invertebrate harvesting. Related to impact by cyclones, Halare (2012) showed that 2001 was the year with the lowest annual catch of the pelagic sardine species *Amblygaster sirm* that feeds on nauplius of crustaceans, bivalves and gastropods larvae common in seagrass meadows. This following a pattern of seagrass losses in Inhambane Bay during this period (between 1999 and 2006). The Programme intends to examine historical evidence to determine the likely causes and steps needed for remediation and restoration. (see Amone Mabuto et al., 2017).

Currently, in the Inhambane Province north of Inhambane Bay, there is a community programme (UEM APCD) that seeks to bring a new approach to supporting seagrass resources in order to protect dugong foraging areas. A public discussion is underway for a possible local ban of seine nets in seagrass beds in sensitive areas and other activities aim to craft and deliver a dugong management initiative in the country. Maputo bay seagrass studies, among the first in WIO, resulted in extensive data collection and analysis of seagrasses (see Bandeira and Bjork 2001 and Bandeira and Gel 2003). This knowledge enabled a declaration of the African seagrass species *Zostera capensis* as unique and threatened. (Short et al., 2011, see also: <http://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T173370A7001305.en>). A new seagrass

species (*Thalassodendron leptocaula* Maria C Duarte, Bandeira & Romeiras was discovered and described primarily in Maputo bay and adjacent regions (Duarte et al 2012). A first carbon stock assessment of seagrass areas was carried out at Inhaca and in Zanzibar (Gulstrom et al 2013). UEM, (DCB & NHM) together with University of Lisbon and São tome e Principe Island (West Africa) are currently conducting a coastal biodiversity assessment and museum curation supported by the Agha Khan Development Network. UEM-DCB has recently embarked on pilot restoration exercises in western Maputo bay that have yielded positive initial results (see WIOMSA Symposium files and UEM undergraduate thesis). This pilot program of seagrass restoration trials began in 2016 /2017, in NW Maputo bay supported by social post-graduated students who interacted with the local communities of Bairro dos Pescadores.

Given this progress, we propose a blue carbon science-to-policy experimentation where the underlying problem is the existence of seagrass destruction in Maputo Bay by invertebrate food collection using perceived unsustainable methods of extraction and well as other natural causes as well as a lack of appropriate seagrass restoration practices and a need for a more robust understanding about the link between seagrasses, fisheries, and community well-being. We highlight the linkage of this initiative with national agendas such as the Strategy and Plan of Action for the Conservation of Biological Diversity in Mozambique (2015-2035) which advocates: reducing the direct and indirect causes of biodiversity degradation and loss; improving the conservation status of biodiversity, safeguarding the diversity of ecosystems, habitats, species and genes; improving the sharing of benefits from biodiversity and ecosystem services for all sectors of government and society; improving implementation through participatory planning, knowledge management and capacity building, and creating synergies between national and global targets for biodiversity conservation. Other national agendas are the 2017 Marine Policy and Fisheries Law and ICZM entailing blue carbon management and fisheries sustainability. These are linked with wider global agendas such as SDG14.2, which highlights restoration initiatives to achieve healthy and productive oceans while maintaining the blue carbon role, design of management plans and the engagement of society in wider ecosystem based management and good practices.

Given the above, the aim of the Programme is to **establish a seagrass plan of action** that would research and deliver ecological-economic and socio-anthropological information on **invertebrate fisheries** and demonstrate and engage in **good practices for seagrass restoration** and conservation. Specifically, the project will: (a) develop an integrated knowledge enabling management of blue carbon initiatives related to seagrass habitats; (b) conserve and restore, where appropriate, seagrass meadows; (c) bring new technologies for seagrass restoration; (d) understand invertebrate fisheries, and (e) document the value added chain of invertebrate fisheries as a tool for the empowerment and food sovereignty of these fishers, especially women and their families, ensuring the sustainability of these key livelihoods into the future.

## II. PARTNERSHIPS

The Eduardo Mondlane University (Department of Biological Sciences / DCB and Faculty of Arts Social Science) together with NGOs/CSOs and Municipalities will collaborate in the present project, playing an active role to develop an integrated knowledge of seagrass resources, ecosystem management and good practices, while implementing the SDGs14 goals and a seagrass blue carbon agenda.

### *Project Partners Role*

<u>Partner Name</u>	<u>Mandate</u>	<u>Role in the Project:</u>	<u>Resource Partner will provide:</u>
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<p>UEM-DCB (lead)</p>	<ul style="list-style-type: none"> <li>● Conduct ecological research on seagrass meadows (testing restoration techniques, assess intertidal fauna composition and structure)</li> <li>● Conduct Blue carbon studies</li> <li>● Establish technology of restoration (SDG 14.2)</li> </ul>	<ul style="list-style-type: none"> <li>● Infrastructures and laboratory facilities, which will include Inhaca Marine Biological Station of Inhaca (EBMI)</li> <li>● Training facilities</li> <li>● Students</li> <li>● Vehicle</li> </ul>
<p>UEM-Faculty of Social Science</p>	<ul style="list-style-type: none"> <li>● Value chain analysis of extraction of invertebrates within Maputo and Inhambane Bay</li> <li>● Gender Sustainability (understand the role of women activities on small-scale fisheries and local knowledge of the importance of seagrasses)</li> <li>● Household poverty analysis</li> </ul>	<ul style="list-style-type: none"> <li>● Social Science state of art methodologies</li> <li>● Participant observation</li> <li>● Community dialogue</li> <li>● Community engagement in restoration activities,</li> <li>● Students</li> </ul>
<p>Ocean Revolution Mozambique (Inhambane NGO)</p>	<ul style="list-style-type: none"> <li>● Contribute to participatory science program with local communities</li> <li>● Use direct interactions, media, and the school system to communicate the purpose, solicit advice on, organize, and communicate overall progress on the Programme.</li> </ul>	<ul style="list-style-type: none"> <li>● Links to CCPs, communities, traditional leaders. Ministry of Fisheries, District and Municipal governments, PRM</li> <li>● Project development and dissemination through Village Talks, social media, the existing secondary education program with the Department of Education, and the existing Radio Mozambique Program</li> <li>● Provide transport by boat and vehicle at the site</li> </ul>
<p>KUWUKA -JDA</p>	<ul style="list-style-type: none"> <li>● Contribute to Participatory science program by mobilizing local communities, specially the self-employed women who do the invertebrate fishery and the artisanal fishermen</li> <li>● Ensure the community engagement on the restoration program, in particular women in Maputo bay</li> </ul>	<ul style="list-style-type: none"> <li>● Community participation mobilization and engagement</li> <li>● Environmental education to communities, including school environmental clubs programs to engage the coastal community awareness raising</li> <li>● Public environmental education and awareness</li> </ul>

		raising on the restoration program
IIP-Inhambane	<ul style="list-style-type: none"> <li>● Conduct invertebrate assessment &amp; seagrass value-tion research in Inhambane</li> </ul>	<ul style="list-style-type: none"> <li>● Research facilities at Inhambane town</li> <li>● Vehicle</li> </ul>
Municipalities (Maputo and Inhambane)	<ul style="list-style-type: none"> <li>● Monitoring and supervising the activities being carried out</li> </ul>	<ul style="list-style-type: none"> <li>● Reinforcement of the seagrass management</li> </ul>
Community representatives (CBO, CCP)	<ul style="list-style-type: none"> <li>● Contribute to participatory science program with various stakeholders</li> <li>● Provide traditional ecological knowledge, historical context, and resource use information to the Programme.</li> <li>● Turn multi-stakeholder observations and recommendations into an action plan, a local management plan, and combined with their existing Conservation Areas Plan begin to structure a global management plan for IB with District and Municipal authorities.</li> <li>● Use direct interactions, media, and the school system to communicate the purpose, solicit advice on, organize, and communicate overall progress on the Programme.</li> </ul>	<ul style="list-style-type: none"> <li>● Resource management based on traditional knowledge and contemporary law and practice</li> <li>● Critical contributions to management plan</li> <li>● Through CCPs the primary enforcing agency for management plan</li> </ul>

### III. OBJECTIVES

#### A. Overall objective

To develop a management action plan for seagrass meadows based on concrete research questions that leads to a demonstrative outcomes of sustainability of seagrass invertebrate fisheries, its value to the community wellbeing, testing blue carbon restoration of seagrasses in southern Mozambique. This overall goal will be attained in a multi-stakeholder fashion involving university departments' researchers and students, NGOs, municipalities and relevant Government directorate, local communities and their representatives as well as a private consultancy firm.

#### B. Immediate objectives/specific objectives

1. To quantify the **use value of seagrass meadows, namely invertebrate fisheries** in two selected locations: Maputo and Inhambane Bays. Maputo Bay fisheries cover mostly clams, snails, octopus and are usually gleaned during low tides. In Inhambane Bay, clams, oysters, scallops, snails and crabs are harvested by hand in seagrass beds and from sand banks. Prawns and squid are harvested by ginia (a 2 person seine).in seagrass areas.
2. Describe widely the role of this fishery in the wellbeing of the communities by means of **surveying availability of edible clams and snails, revenues and key actors involved in this fishery and document value chains to communities** and related business such as markets and tourism.
3. To undertake a rather wider **seagrass restoration** in an already seagrass-declined sites as documented and published for Maputo. In Inhambane Bay identify possible restoration sites and begin a pilot program. . Standard techniques for seagrass restoration will be used and, restoration to be expressed in growth dynamics of both leaves / shoots but also rhizome or meadows expansion. Analysis of faunal assemblages will be compared between restored habitats and those of control meadows.
4. To document key **good practices of invertebrate fisheries also seagrass conservation** as well as specifically role of woman as guarantor of household income generating derived from seagrass invertebrate fishery. We intend to develop a CBO (community Based organization) dedicated to specific issues of good practices and restoration to be tested during project duration.
5. Given the above, to finally draft a **management action plan for seagrass meadows for Maputo Bay and add a seagrass component to the existing management plan for Inhambane Bay Community Conservation Network**. Such plan is relevant for key actors, government /municipality entities and communities' wider understanding and sustainability of seagrass invertebrate fishery. We intend to provide feedback of the action plan to the actors, especially on the issue of awareness and education on seagrass meadows and their fisheries.

#### IV. PROJECT IMPLEMENTATION AND MANAGEMENT PLAN

##### A. Expected project results and indicators

Expected results outcomes/outputs and indicators are detailed in the table below. We attempted to indicate in quantitative terms as well as positive unintended benefits of this Seagrass project.

Objectives	Expected results	Outcomes/outputs	Indicators
Document invertebrate fisheries, their use value	Updated database of invertebrate fisheries within seagrass beds (incl ecological data). Information on the number of people enrolled in seagrass fisheries, especially by gender.	Improved understanding of linkage/ relationship between seagrasses meadows and fisheries, focusing on invertebrates. Training of students, NGOs	Peer review publications (up to 3). Relevant surveys undertaken.
Document value chain of these fisheries to communities; analyze the key actors, existing revenues and related business of	Diagrams of value chains, key actors and locations served by these fisheries documented. Monetary value and revenue reported per actor/site. SMART analysis of this fishery and options for improvement.	Sustainability analysis. Draft of a sustainability strategy and carrying capacity of the seagrass meadows for given invertebrate fishery (related also to the first objective). Role of women in this fishery. Economic value of seagrass meadows. EIA	Report done, Peer review publication (up to two ) Brochures and posters produced Engagement of private consultancy company. Socio-anthropological analysis

these fisheries		assessment of the fishery. Options for aquaculture of some invertebrate species	
Undertake a seagrass restoration in MB and a pilot program in IB.	Document areas for restoration. Also identify characteristics for donor seagrass sites. Amount of areas restored and seagrass survival rate per tide/days. Shoot /horizontal growth. Comparative studies on abundance of invertebrates between restored and non- restored sites	Improved habitat management practices. Role of seagrass on erosion/ shoreline protection Trained students, NGOs and community people Incl. gender training and capacity for seagrass restoration. Food security. Guideline for seagrass restoration. Contribution to SDG14.2 and seagrass blue carbon management	Number of people (students, NGOs, community members) engaged in seagrass restoration Report /peer review (one report). Size of areas restored. Training delivered to communities' representatives, NGOs and municipalities.
Document key good practices in seagrass fishery and role of women for household income as well as development of a CBO	List of good practice ecological and socio-anthropological. Woman role in the fishery well described specially as actor for poverty alleviation.	Reduce stress of fisheries methods employed by the invertebrates collectors in MB. Promote best practices on shellfish fisheries as related with sustainability. Contribution to blue carbon management.	One to one meetings with key actors. Feedback meeting with communities and municipality. Meetings held. Brochures produces Report / peer review. Steps undertaken to establish a CBO or community agents in MB and engage more women in existing CBO in IB. Community members and municipalities engaged; Posters / tools produced promoting awareness sustainable resource use.
Draft a management plan for seagrass meadows	Seagrass Management Action Plan (SMAP) drafted with clear items such as state of knowledge, issues, stakeholders/institutions and wider local, national and international principles and practices stated. Maputo and Inhambane plan of action with activities	Reduced vulnerability of small-scale fisheries in intertidal area. Improved institutional capacity, awareness, and positive actions for seagrass management. Prevention of loss of seagrass fisheries.	Number of meetings for the SMAP. SMAP for Maputo and Inhambane delivered to relevant actors Plan and good practices tested with participation of all stakeholders



	and roles documented for envisaged relevant local government/stakeholders. Such SMAP applicable/replicable locally in any similar WIO region. Good practices for seagrass management tested in a participatory fashion for the SMAP i.e. by involvement of the stakeholders	Expected abundance and diversity of the fauna and flora living in seagrass meadows due to implementation of good practices through SMAP	
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### B. Project activities and work plan

Objective	Planned activities	Timing & Duration	Responsibility (bold=coordination)
1. Assessment of seagrass invertebrate fisheries (diversity and amounts) in 2 bays	12-14 research visits per each site (each visit is one tide cycle)	From 1 <sup>st</sup> to 14 <sup>th</sup> first months	<b>-UEM Biology (DCB)</b> -IIP-Inhambane -UEM Social Sci.
2. Describe widely the role of this fishery to community sustainability (resource availability, revenues derived), key actors involved & document value chains	Planned two site visits per month, each during 5 days	Starts in the 1 <sup>st</sup> month till 15 <sup>th</sup> month of the project	<b>-NGO/CSO KUWUKA JDA &amp; NGO Ocean Revolution</b> - Private C. Firm -UEM
3. Undertake seagrass restoration (in seagrass declining sites) Analysis of faunal assemblages: restored vs control meadows.	Up to 10-50% of the degraded areas will be actively and passively restored on monthly basis	Starts in the 3 <sup>rd</sup> month of the project till duration of the project	<b>-Community Based Organization (CBO)</b> -UEM, FLCS -IIP Inhambane
4. To document good practices, role of woman as guarantor of income generated from this fishery. Develop a dedicated CBO/agent	Conducting dedicated surveys, group meetings and with com rep.on monthly basis	Start in the 2 <sup>nd</sup> month of the project till end by 22 <sup>nd</sup> month	<b>-UEM Social Sci.</b> -Municipality & Government rep. -NGOs
5. draft a management action plan for seagrass meadows. feedback to key-actores	Meetings with key actors incl. municipalities	From 15 <sup>th</sup> to 22 <sup>nd</sup> month	<b>Government Rep.</b> CSOs UEM Biology
6. To draft guidelines for seagrass restoration	Reviews & Technical meetings	Ready in the 18 <sup>th</sup> month	<b>UEM</b>

### C. Project Beneficiaries

This project will raise awareness about the importance of seagrass meadows.

*Direct beneficiaries:*

- (i) First, it intends to benefit seagrass invertebrate fisheries gleaners (majority of community affected) in Maputo and Inhambane bay (previous estimates indicate existence of 300 of those within one site in Maputo Bay). Quantification of the fisheries, revenue drivers, key stakeholders involved will provide hints to sustainability that will add on to the proposed analysis of the role of woman, her wellbeing from invertebrate fishery.
- (ii) Researchers and students and. Up to 8-12 people from UEM and up to 3 from IIP.
- (iii) At least two dedicated CBO will be created. An embryo of this already exists at Inhambane similarly to sister CBO Bitonga-Divers (see Amone-Mabuto et al 2017, also <https://www.bitongadivers.org/>). CBO is to take the lead and to be involved in awareness activities as well as get engaged with seagrass restoration and wider participation in good practices.

*Indirect beneficiaries:*

- (iv) The Municipality and Government representatives will benefit by getting to know about a seagrass resource that feeds and has value to vast number of families in Maputo and Inhambane. The administrative structure of the municipality will benefit from regular exchanges with university and communities; prompting a better organization and relationship to communities.
- (v) The private consultancy firm will bring to the project skills for EIA, monitoring and mitigation needed to quell seagrass and fishery decline.
- (vi) CSOs and NGOs (KUWUKA JDA and Ocean Revolution) to interface communications between academia, authorities and communities, including the public in general on environmental awareness and the importance of good practices for seagrass shellfish livelihoods and economy sustainability.
- (vii) Society in general including tourism that will benefit given sustainability from seagrass meadows shellfish, in near future.

*Project design:*

Those beneficiaries were widely consulted at various stages of this project design namely: their roles, commenting on methodologies contribution to desired project results and outputs/outcomes, management, also co-funding contribution.

*Gender considerations:*

Gender analysis is incorporated in the project approach. Project implementation will ponder, balance and encourage gender issues (part pilot trial restoration of seagrasses has a registered participation of around 2/3 woman). Ethics and human rights will be considered in all stages of project presentation, we will also rely on expertise of UEM social science school as well as the reputed CSO KUWUKA JDA. This project will follow guidelines for research ethics in science and technology as developed in Norway <https://www.etikkom.no/globalassets/documents/english-publications/1/guidelines-for-research-ethics-in-science-and-technology-2008.pdf> . Project decisions will be on consensus basis.

**D. Implementing agency management of project**

Overall project operations will be coordinated by UEM, represented by the Department of Biological Sciences (DCB), see [www.uem.mz](http://www.uem.mz). Other project partners will be responsible for the specific deliveries. The NGO (KUWUKA JDA – [www.kuwukajda-moz.org/](http://www.kuwukajda-moz.org/) and Ocean revolution Mozambique <http://www.oceanrevolution.org/>) will be responsible for the activities related with sensitization and dialoguing with communities' representatives on issues of furnishing good practices and seagrass restoration. They will empower community representatives and organization to carry out sensitization and awareness raising, for continuation of restoration activities. Indeed those two NGOs will together with UEM create and uplift the CBO to be dedicated on specifics of good practices and restoration activities. The social sciences faculty of

UEM will work close together with the NGOs and communities representatives to ensure also appropriate methodologies and knowledge capture and transfer to relevant actors. It will facilitate knowledge co-production by creating enabling environment that brings together indigenous practices and conventional scientific knowledge in the search for sustainable management of seagrasses and other coastal resources. It will ensure that communities are engaged not as mere sources of information but active partners in knowledge generation. IIP-Inhambane (Fisheries Research Institute) is to undertake specific research activities on invertebrate fishery. The government at central level (MITADER and MIMAIP) will have an involvement in interactions with NGOs, communities and researcher's specially emanating country and global agendas and practices with critical habitats and strategic resources such as fisheries, seagrasses. Municipalities (Maputo and Inhambane) will be responsible for monitoring and compliance norms, existing instruments, and overall ethics for the desired research for management project.

The implementing agency- UEM - will hire an assistant and a communication persons to be dedicated to this project. A Project Management Unity (PMG) will be established and having meetings and reports every two months of the project. Reference staff for the project: UEM: Assoc. Prof. Salomão Bandeira, Dr. Marlino Mubai, Dr Perpetua Scarlett, Ms. Damboia Cossa, Ms Vilma António, Dr. Almeida Guissamulo; Dr Célia Macamo, Assist Prof. Esmeralda Mariano; For IIP- Inhambane, Mr Eduardo Avene and Ms Paula Santana Afonso; for KUWUKA JDA, Director Camilo Nhancale; For Ocean Revolution Mozambique, Director Tim Dykman; for Maputo Municipality, Arq. Jorge Ngove Junior. Enrolled also the relevant directorates at MITADER and MIMAIP Ministries'.

## V. PROJECT METHODOLOGY

Communities harvesting invertebrate for consumption will be assessed using field visits and detailed observation. Samples gathered and identification following standard biodiversity methodologies. In order to evaluate the human exploitation on the resource, clam collectors at each site was counted and registered during the daily sampling. To quantify catches, collectors up to 5 randomly selected each day of sampling and catches weighed.

For seagrass restoration, consideration to be given to the appropriate site selection, taking into account the historical and present distribution of seagrasses, analysis of root causes of their declining. Sediment-free methods for seagrass restoration (stable, rod) will be implemented depending on species; also sediment methods (plug, sods) to be widely implemented too. Two main site will be tested for seagrass restoration, Maputo Bay having Inhaca Island but also the western Maputo Bay (north of Maputo City) and Inhambane Bay. Analysis of seagrass bioecology to include survival rates, and growth dynamics of shoots and leaves. Standards methods of focal group discussions (FGD) and key informants will be used to access and complete documentation and analysis of stakeholders involved in invertebrate fisheries from hawering to final consumers. Fisheries data to include aspects of species and quantities harvested and their specific periods. Sites/locations where the harvested product reach the final consumers will be mapped as well as value chains, prices across the chain. Interviews will occur widely across the sites. Quantified products or use value derived from seagrass meadows is the main target however expected to document also some non- extractable values such as soil protection.

Our approach of community dialogue applies historical method to capture the processes and apprehend changes throughout time. This method is key in helping people to build from past experiences by reconstructing their memory of both best and bad practices of coastal resources management. Our dialogues will include one-to-one conversations and focus groups. Semi-structured interviews with local communities and all relevant stakeholders to be used. Semi-structured interviews have the advantage of giving agency to the interviewee in the conduct of conversation. Keeping in mind the main objectives of this research project, our conversational

partners will be provided autonomy to tell their life stories with interference. All community members will be approached not as mere repositories of information to be collected and processed by specialists but as equal partners in knowledge co-production. In this process, we will pay particular attention to gender sensitivity by engaging female researchers in the interaction with female participants. Within the two-year period of project implementation, we will observe and document local communities' daily routines with particular attention to their relationship with coastal ecosystems. Overall, our methodology values the appreciation of positive practices and encourages their dissemination among the communities' members. This will be ensured by creating a friendly environment of dialogue where community members identify themselves with the ultimate goal of the project. The communities will be introduced and trained in basic methodologies of seagrass restoration, valuation of seagrass meadows in sustaining important invertebrate food security. Therefore, we will be able to capture the role of fisheries in the wellbeing of communities. Community members will be acquainted with appropriate training on basic principles of seagrass restoration, analysis of root cause of seagrass degradation and needed intervention of either active or passive (or assisted) seagrass restoration; the latter is letting the seagrass plants themselves to thrive due to lowering of anthropogenic impacts. We will trace value chains to communities and related business including markets and tourism.

In Inhambane Bay, we will continue our collection of semi-structured video interviews in local language on changes over time of the location and health of seagrass beds, changing climate and severe weather events that impacted seagrass beds, changes in the local population, political regime, fishing methods, and the resulting impacts (positive and negative) to the indigenous communities. We will use these interviews to provide a virtual database for community members, and produce media promoting the Programme and enhancing the sustainability of the Programme through fundraising and global awareness of pioneering conservation actions being employed in Mozambique. See our current documentary on establishing community-drive conservation areas in Inhambane Bay [Mukhedzessili](#)

The Seagrass management plan is meant to be a platform for best practices in tackling issues related with seagrass anthropogenic and climate related impacts that affects also peoples livelihoods and wellbeing of both seagrass and communities. The plan of action envisage targets, implementers and stakeholders, defined milestones and indicators to be tested and validates with focus on seagrass restoration, methods and positive outcomes.

## VI. SUSTAINABILITY AND REPLICABILITY

### Sustainability

This project ultimate goal is to develop, present and test a seagrass management action plan that targets highly valuable resources. Sustainability of this project is expected to be attained by: (i) mainstreaming expected project legacies (e.g. restoration, community engagement, good practices implementation, and building local support for responsible resource utilization through association with perceptions of good governance, social impacts, and ecological effectiveness. Local, provincial and national government will progress successfully with activities and outcomes meeting national and international goals such as SDGs, making inclusive Blue Economy decisions, ICZM; (ii) CBOs will grow in influence and capacity; (iii) the Programme will serve as a model for replication of seagrass restoration practices in other areas of Mozambique and WIO in general.

### Replicability

The replicability of this study is supported given existing root cause analysis patterns within WIO that is comparable to that of Mozambique. As examples, South African seagrasses is dominated by *Zostera capensis*, spreading over 62 estuaries (covering 2535.42 ha in total), impacted by hydrological cycles and human activities (Adams 2016). The 2013 Cyclone Haruna, 150 Km/h prompted a reduction of seagrass coverage, canopy weight in SW Madagascar (Côté-Laurin *et al.* 2017). Overgrazing by seurchin *Tripneustes gratilla* degraded seagrasses in Kenya and Zanzibar (Eklöf *et al.* 2008). This related also to removal of seurchin natural predators. Zanzibar (Tanzania) seaweed mariculture impacted on seagrasses too. Removal and dredging of seagrasses to create a sandy beach for tourists; also sugarcane effluents impacted on Mauritius (Daby 2003, Bandeira and Gel 2003). Boats and anchoring were also blamed across WIO and drag nets accidentally caught dugongs and sea-turtles. For Mozambique seagrass reduction varying from a merely 0.26% a year in an MPA (Inhaca Island, due to sand accretion) to estimates of 7.2% a year (W Maputo Bay) impacted by sedimentation from flooding and seagrass uproot for clams collection (Bandeira and Gell 2003, Bandeira *et al.* 2014.); its overharvesting prompting reduction on invertebrates (Nordlund and Gullström 2013). A 51% seagrass area decrease over 21 years observed in Inhambane Bay, Mozambique , mainly due to cyclones impact (Amoné Mabuto *et al.* 2017).The examples above, of other WIO countries may benefit from both restoration methodologies being implemented in sites in Mozambique, for example anthropogenic impacted areas may be restored actively or passively following outcomes of this application. Assessment of practices and resources extracted and dwindling and experience of community engagement in seagrass conservation and restoration will form base of lessons learned for future similar initiatives within WIO.

## VII. PROJECT MONITORING AND EVALUATION

This project will designate a PMG (Project Management Group); all partners representative from University, NGOs, IIP-Inhambane, Municipality, Government Rep., Community Representative and Private Sector Rep. will be part of PMG. PMG will host skype meeting in every second month, and will discuss planning and implementation of activities.

A detailed logical framework table with objectives, activities, timings, results, meetings, and outcomes and challenge will be the basis for the PMG meetings and overall coordination. Long and short term goals will be discussed and agreed and time scale for implementation set and monitored on monthly basis.

PMG will mainly assemble via Skype. Each PMG meeting will be registered, minutes taken and kept for distributed. A web page of project will be maintained. A 3-4 days seminar kick off and final workshop are envisaged.

The project will hire an assistant with a prime role to keep track of the PMG and foster regular communications with all participants of the project, We intend also to hire (on part time basis) a communication officer who will also maintain a webpage and store and distribute information, blogs and briefs.

## VIII. BUDGET

Co-funding will totalize: \$US 39 000,00: with UEM having to cover \$US 20 000 of salaries, lab and land transport. Inhambane NGO Ocean revolution to cover \$US 10 000 for use of their office, vehicles and boats mainly; NGO KUWUKA-JDA to cover \$US 4 000 with their work time, use of own office for work, own vehicle and salaries in Maputo Bay. IIP-Inhambane will cover \$US 1 500 with cost of vehicle and use of their facilities for research. Maputo and Inhambane municipalities to cover \$US 2000 in total of their work time, use of their office for meetings and their transport to the sites and meetings. Government will participate with \$US 1 500 of their salaries and cover their transport in Maputo.

### Annex1: Workplan and Logical Framework

Tasks		YEAR 1				YEAR 2				Proposed budget US\$)
		Q 1	Q 2	Q 3	Q 4	Q1	Q2	Q3	Q4	
<b>Strategic objectives/Outcomes/Outputs/Activities</b>	<b>Responsible</b>									-
<b>Specific Objective 1:</b> By 2021, To quantify the use value of seagrass meadows, namely invertebrate fisheries in two selected locations: Maputo and Inhambane Bay and thereafter to describe the role of this fishery in the wellbeing of the communities by means of surveying availability of edible clams and snails, revenues and key actors involved in this fishery and document value chains to communities										-
<b>Outcome 1.1:</b> Updated information of invertebrate fisheries within seagrass beds as well as gather data on key actors involved in seagrass fisheries their value chains. Improved understanding of linkage/ relationship between seagrasses meadows and fisheries, focusing on invertebrates.										-
<b>Outputs 1.1:</b> Biodiversity list of edible invertebrates of MB and IB documented. Ecological data collected on sites.										-
<b>Activity:1.1.1.</b> Research visits per each site (each visit is one tide cycle every second month).	UEM-DCB, IIP Inhambane /Ocean Revolution									5000
<b>Activity: 1.1.2.</b> Identify the biodiversity of species collected including ecological data.	UEM-DCB									9000

<b>Output 1.2:</b> List of stakeholders and agents involved in seagrass fisheries, Diagrams of value chains including monetary pathways with the chain document in MB and IB										-
<b>Activity:</b> 1.2.1. Conduct a survey of stakeholders/agents involved in the seagrass fisheries for socio-ecological analysis . this to follow standards socio-anthropological procedures such as involving Focus group discussions and key informants	UEM-Social Sciences, Kuhuka JDA, Ocean Revolution									9411
<b>Activity:</b> 1.2.2 Produce diagrams and analysis of value chains,gains/ revenues throughout the chain	UEM -DCB, UEM Social Sciences, Kuhuka JDA, Ocean Revolution									5000
<b>Output 1.3.</b> Documentation of gender participation in invertebrate fisheries in MB e IB										-
<b>Activity:</b> 1.3.1. Document daily routine of people,focus to woman. Exist practices that can sustain initiative of seagrass restoration and conservation.	UEM -Social Sciences, Kuhuka JDA, Ocean Revolution									12000
<b>Specific Objective 2:</b> By 2021, To undertake a detailed seagrass restoration in an already seagrass-declined or impacted sites as documented and published for Maputo and conduct pilot restoration within Inhambane Bay.										-
<b>Outcome 2.1:</b> Seagrass recovery in selected sites of MB specially Inhaca and well documented way forward for a rather detailed restoration within IB.										-
<b>Output: 2.1.1:</b> Undertake a seagrass restoration in MB and a pilot program in IB										-

<p><b>Activity: 2.1.1.1:</b> Training of community members on restoration techniques and best practices.</p>	<p>NGOs, Municipality</p>										<p>20000</p>
<p><b>Activity: 2.1.1.2</b> Conduct seagrass restoration in critically areas (anthropogenically and natural impacted). Active and assisted seagrass restoration will be followed</p>	<p>UEM-DCB, UEM-Social Sciences, NGOs, Municipalities</p>										<p>70000</p>
<p><b>Objective 3:</b> By 2021, Draft a management action plan for seagrass meadows for Maputo Bay and add a seagrass component to the existing management plan for Inhambane Bay Community Conservation</p>											<p>-</p>
<p><b>Outcome 3.1:</b> First guidelines for seagrass habitats management made available for application by managers and Policy makers.</p>											<p>-</p>
<p><b>Output: 3.1.1:</b> Develop an outline for management plan of seagrass habitats. The management plan is to be site specific and harmonized for given anthropogenic or climate rated impacts. Items for management plan:role of stakeholders including communities, NGOs, municipalities and research institutions. description of methodologies of seagrass restoration, time lines, indicators. form to be filled by trained community members.</p>											<p>-</p>
<p><b>Activity: 3.1.1.1:</b> Meeting undertaken within academia, NGOs, Municipalities and communities aiming at drafting a plan of action for impacted seagrass meadows (focus for MB)</p>	<p>UEM-DCB, UEM-Social Sciences, NGOs, Municipalities</p>										<p>7000</p>
<p><b>Activity: 3.1.1.2:</b> Conduct one-to-one meeting for presentation of a draft seagrass management plan of MB to key stakeholders at municipal and NGOs</p>	<p>UEM-DCB, UEM-Social Sciences, NGOs, Municipalities</p>										<p>6000</p>



## Annex 2: Project Monitoring Plan

<b>PROJECT TITLE: SEAGRASS RESTORATION FOR SUSTAINABLE SHELLFISH FISHERIES AND DRAFTING OF A SEAGRASS MANAGEMENT ACTION PLAN</b>			
<p><b>Project overall objective:</b> By 2021 seagrass restoration techniques implemented successfully in Maputo Bay and pilot restoration tested in Inhambane Bay; these aiming at awakening of communities and other relevant stakeholders (NGOs and governments) for the importance of seagrass invertebrate fisheries and the need for appropriate plan of action for seagrass management</p>			
<b>Project Results</b>	<b>Indicator</b>	<b>Target/baseline</b>	<b>Method</b>
<p><b>Outcome 1.0:</b> Updated information of invertebrate fisheries within seagrass beds as well as gather data on key actors involved in seagrass fisheries their value chains. Improved understanding of linkage/ relationship between seagrasses meadows and fisheries, focusing on invertebrates.</p>	<p><b>IND.1.1:</b> Detailed list of invertebrate species found on seagrass meadows</p>	<p><b>Target:</b> common species harvested/traded by primary invertebrate collectors</p>	<p>Field surveys; species identification of edible invertebrate; photographs; ecological methods</p>
		<p><b>Baseline: 1</b></p>	
	<p><b>IND. 1.2:</b> # of key actors involved in invertebrate fisheries found on seagrasses, also value chain diagrams drafted</p>	<p><b>Target:</b> Key actors/stakeholders and knowns destination of the invertebrate fishery</p>	<p>Focus groups, key informants, free listing</p>
		<p><b>Baseline: 1</b></p>	
<p><b>Outcome 2.0</b> Seagrass recovery in selected sites of MB specially Inhaca and well documented way forward for a</p>	<p><b>IND.2.1:</b> # of plug/sods or sediment free modules</p>	<p><b>Target:</b> restoration methodologies tested and implemented for over a year (in at least one site)</p>	<p>Sediment free methods (rods, stables), sediment methods (pluds, sods); assisted restoration</p>

rather detailed restoration within IB.	implanted in seagrass depleted areas	<b>Baseline:</b> 1(MB), 0 (IB)	
	<b>IND.2.2.</b> Statistics of trips, rates of survival of restored seagrass species	<b>Target:</b> Testing at Inhambane and survival rate of over 50% in most planting within Maputo Bay  <b>Baseline:</b> 0	Excel file, data analysis
<b>Outcome 3.0:</b> First guidelines for seagrass habitats management made available for application by managers and Policy makers.	<b>IND.3.1.1:</b> # meetings undertaken within academia, NGOs, Municipalities and communities aiming at drafting a plan of action for impacted seagrass meadows (focus for MB)	<b>Target:</b> one meeting with each stakeholder category  <b>Baseline:</b> 0	Standard meeting with stakeholders and communities; sensitization, application of updated analysis of best practices for habitat and communities adaptation
	<b>IND.3.2:</b> # of one-to-one meetings for presentation of a draft seagrass management plan of MB to key stakeholders at municipal and NGOs	<b>Target:</b> at least four stakeholders (1-2 NGOs, 2 Municipalities, 2 government representative)  <b>Baseline:</b> 0	One-to-one meetings with key stakeholders and documentation of their feedback
	<b>IND.3.3:</b> # feedback report	<b>Target:</b> 3-4 one to one meeting	Meeting with stakeholders aiming to present project

	for one-to-one meetings	<b>Baseline: 0</b>	results and to collected their reaction/feedback to these
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### Annex 3: Budget

Category	Sub category	Quantity	Unity coast, \$US	WIOSAP Support(Sum in US\$)	Co funding
Field work	Fuel for vehicle & boats	3000	1.1	3300	2300
	perdiem 4P@ 8 days @ 15 month	480	40	19200	
	accommodation 4P@ 8 days @ 15 month	480	40	19200	
	community members 3 P @ @8 days @ 15 month	450	20	9000	
Equipment & consumables	restoration material (PVC, wires, etc)	50	20	1000	
	stings for restarion	25	20	500	
	shovel, boots, gloves etc for 20 people in 20 months	50	25	1250	
	GPS	1	300	300	300
	snorkel equipment	4	40	160	
	computer (2)				1600
	software	1	500	500	500
	cartridges and other office suppliers	5	180	900	
	printing of sensitization material, baners, brochures	100	30	3000	
Meetings	communities/municipalities, 2 @ 20 months	40	50	2000	300
	CBO development & sensitization (2 sites @ 20 months)	40	50	2000	
	for drafting seagrass management action plan	20	900	18000	5000
Incentives	5 people @ 24 months, Incl assistant, communication	120	200	24000	16000
	CBO activities as interacted with NGO: 2 sites@ 2 people @ 15 months	60	100	6000	4000
	for 2 Municipalities and Government	45	100	4500	5000

	Dept: 3 @ 15				
	project coordination	24	300	7200	4000
Seminar	Kick off proj. meeting (travelling, accomod & Perdiem, 3 days)	15	400	6000	
<b>Subtotal</b>				128010	
overheads (10%)	fees from incentives, unexpected, exchange rates, possible flight to Inhambane (500Km north of Maputo)			15401	
<b>GRAND TOTAL (in \$US)</b>				<b>\$US 143411</b>	<b>\$US 39000</b>

### Annex 3.1: Budget justification

A detailed budget and justification is presented in the attached Table. We propose a total budget of \$US 143 411,00 in addition to 27.20% of co-funding, as stated above. This project builds on several tangible goals in two locations (Maputo and Inhambane, all southern Mozambique) - from valuation of seagrass shellfish fishery, total value of seagrass meadows in invertebrate fisheries, also undertake extensive seagrass restoration and craft a seagrass management action plan - and involving several entities (UEM, NGOs, IIP-Inhambane, two municipalities, government and community representatives).

For the budget the following items are envisaged: trips to sites for ecological and socio-anthropological research; purchase of small material especially for seagrass restoration process, expenditure with accommodation and transportation to IB and MB specially Inhaca Island. Further resources needed for wider stakeholder interaction, items for management and CBO development and implementation of good practices and development of a seagrass management action plan. We also propose further funds allocation for incentives, students and some for project management.