Article

Utilizing Marine Cultural Heritage for the Preservation of Coastal Systems in East Africa

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Abstract: This paper presents the key contributions of marine cultural heritage to the survival of coastal ecosystems and the communities that rely on them in East Africa. Marine cultural heritage (MCH) describes the evidence of past human interactions with coastal and marine space, encompassing tangible material culture remains and associated intangible cultural expressions within coastal communities. By incorporating the protection of MCH into local and regional environmental frameworks, we gain an essential indicator to monitor change dynamics in natural habitats, the cumulative impacts of climate change, and the development of social adaptation strategies. An essential aspect of this development is the move away from global sustainability strategies towards community-centric management and stewardship. Such processes utilise a combination of traditional knowledge systems and scientific approaches designed to harness targeted economic, ecological, and social sustainable development. To argue for the incorporation of MCH into local and regional environmental frameworks in the area, this paper presents four case studies from the Rising from the Depths Network, a challenge-led research network focusing on harnessing the potential of MCH to bring sustainable development strategies to East Africa.

Keywords: marine cultural heritage; Africa; sustainable development; climate change; resilience; traditional knowledge; coastal systems; biocultural heritage

1. Introduction

Systems approaches to the coastal environment aim to account for the vast environmental, social, and economic challenges faced by coastal communities and resources as a result of increasing anthropogenic and environmental pressures. Globally, such management strategies highlight the necessity of international conventions and agreements, coastal zone monitoring, and regional resource management frameworks to protect and develop natural and cultural coastal resources. Yet, despite the global uptake of far-reaching sustainability goals, the academic consensus has highlighted the need for connection between top-down and bottom-up approaches, using community-driven monitoring and the coproduction of data [1]. Further to this, the integration of coastal and marine cultural heritage (MCH) into marine policy and management has been deemed a necessary, yet largely overlooked, aspect of ocean sustainability [2–7].

Without linking these approaches and recognizing the importance of local action, coastal communities and their cultural heritage will remain disproportionally affected

by climate change pressures such as sea-level rise, coastal erosion, increasing storm frequency, freshwater salination, and habitat loss [8–10]. As a result, future predictions warn of irreversible damage to community resilience through the destruction of their biocultural heritage and aquaculture [9]. It is clear that innovative adaptation approaches are necessary to build coastal community and ecosystem resilience in the face of such challenges. Sustainable solutions need to take local cultural contexts into account to be able to effectively arm vulnerable communities with the tools necessary for both protecting the environment and fostering economic independence. To understand the role of MCH within this process, it is important first to understand its scope. This work follows and expands on the definition of MCH provided by Henderson et al. (2021), which understands MCH to represent 'all past human action on coasts as well as directly on the sea', encompassing 'tangible remains such as shipwrecks, submerged settlements, coastal settlements, ports and harbours, maritime ecologies and geology as well as equally vital intangible components such as cultural practices, artistic and linguistic expressions, local skills and traditional and historical knowledge' [3]. Considering this definition alongside the work presented in this paper, the reach of MCH as human action in the past informing present and future action is extensive and multi-layered. In particular, the cases presented below exemplify the role of MCH in connecting the past with the future of sustainable practice; environmental resilience; and economic development, thus solidifying the position of MCH as a vital resource within the ocean sciences.

A region in which the potential to utilise MCH as a tool for sustainable development is particularly significant is the East African coastline. The Western Indian Ocean (WIO) is one of the regions of the world most vulnerable to socio-political, climatic, and demographic changes, affecting the social, economic, and urban fabric of coastal areas. Geographically, the East African Coastal Zone (EACZ) is particularly low lying, resulting in higher-than-average rates of sea level rise, coastal erosion, and storm frequency [10]. Large-scale migration towards the coast is coupled with the steadily increasing development of coastal infrastructure and resource exploitation. National development strategies such as the Kenyan Vision 2030, the Tanzania Development Vision 2025, and the Development Strategy (2015–2035) in Mozambique focus almost exclusively on economic growth through major investments and strategic partnerships with infrastructure developers and the extractive industries. These initiatives are unsustainable in the long-term as they lack inclusive and participatory community approaches where the needs of local people, and the potential of their associated biocultural heritage and traditional knowledge systems, are recognised and included [4].

There is limited literature on the impacts and effects of development and climate change on the EACZ and the communities which rely on them, despite a significant community reliance on vulnerable livelihoods such as tourism, aquaculture, and agriculture. Of the available literature, Kenya and Tanzania represent the most studied regions, largely due to the significant economic importance of infrastructure development on their coastlines. Nevertheless, most of these studies have a predominant focus on large-scale GDP growth on an international scale, rather than on the economic stability of coastal communities and their livelihoods [10].

It is clear that climate change will have a significant impact on the livelihoods of coastal communities in this region through the drastic modification of their environment. In a 2010 study of the future effects of climate-induced sea level rise and coastal erosion in Africa, Tanzania, Mozambique, Madagascar, and Kenya consistently came out in the top ten most affected countries under the parameters of people flooded; people forced to migrate; and costs of residual damage projected in to 2030 and in 2100. It was estimated that by 2030, a total of 430,300 Tanzanians and 176,600 Mozambicans will have been forced to migrate from the coast since 2000. In a recent estimation of vulnerability to coastal change, 22% of the East African Coastline, and 3.5 million people, were estimated to be at risk of high levels of exposure to coastal hazards [11].

In 2021, alongside the right to participate in cultural life (Universal Declaration of Human Rights, Article 27), the United Nations Human Rights Council named access to a clean, healthy, and a sustainable environment a basic human right, thus recognizing the significance of human interactions with the environment for social and economic stability (UN resolution 48/13). Access to culture and the environment, and the interconnections between the two, is critical for the most vulnerable and marginalized members of society, who typically represent the lowest contributors to the anthropogenic impacts facing the coastal zone. Pressures on the EACZ, exerted by the development of marine resource extraction industries, the construction of mega ports, and the expansion of coastal tourism (implemented to meet the development objectives of the African Union Agenda for 2063) threaten the survival of MCH before its full potential to enhance socio-economic and environmental resilience in the face of such challenges can be realized. Likewise, although such development activities bring a certain degree of economic growth, much of this does not trickle down to local communities who instead see their local cultural practices diminished, even though many of these practices have reached a level of equilibrium with the marine environment [11]. As such, we cannot ignore the fundamental role played by MCH as a basic human right throughout the region, particularly with regards to improving quality of life, food and health security, environmental sustainability, and for sustainable economic well-being.

This paper exemplifies the potential for MCH in East Africa to become a key resource in the formulation of development strategies within coastal systems. Four case studies are presented from the Rising from the Depths Network (RftD), a challenge-led research programme aimed at understanding the uses of MCH for the sustainable development of the EACZ[1]. The results of these studies are then cross-analysed, identifying areas where the MCH can inform conventional knowledge systems to develop sustainable solutions. This, in turn, should contribute to the development of policies and recommendations towards the enhancement of MCH significance for coastal communities and environmental resilience in the face of climate change and coastal development.

2. Materials and Methods

This paper focuses on 4 of the 27 innovation projects funded by the Rising from the Depths (RftD) Network in East Africa. Coordinated by the University of Edinburgh, the RftD network aims to promote sustainable economic, social, and ecological development in Kenya, Tanzania, Mozambique, and Madagascar, through the use, preservation, and understanding of MCH. Running from 2017 to 2022, the network is funded by the UK's Global Challenges Research Fund (GCRF) through the Arts and Humanities Research Council's Network+ scheme. The Network represents a first attempt to look at the marine cultural heritage of East Africa in a coordinated and multidisciplinary way, uniting the various existing capacities in the region and giving agency to local communities in the elaboration of research agendas, project design, and resource management [3].

The primary aims of the Network were to (1) provide a platform for interdisciplinary collaboration in the ocean sciences, connecting researchers, practitioners, community groups, policy-makers, and coastal and offshore developers through marine and coastal cultural heritage. In doing so, the project aimed to (2) build regional capacities to enhance the utilization, protection, and potential of coastal and marine cultural heritage. As part of this, the project directly funded research in the region and organized a number of workshops and skills-training events across multiple demographics. Ultimately, the project aimed to (3) co-create a series of sustainable, MCH-based research projects that would directly benefit the target local communities and project partners. Further information regarding the RftD agenda is detailed in a methodological paper by the project's academic team in Henderson et al., 2021.

The following will introduce a selection of case studies, chosen with regard to their relevance to the theme of 'MCH in Coastal Systems'. Within the following work, various interdisciplinary concepts that intersect the boundaries between the natural sciences and

humanities will be introduced, such as *Traditional Heritage Knowledge* (THeK) and *Traditional Ecological Knowledge* (TEK), which describe the local and indigenous knowledge, practices, and beliefs relating to natural and cultural resources [12], and *Ecosystems Services* [13], which refer to the functions and provisions natural and cultural resources provide for humans. Within these themes, the RftD projects are able to focus on the study of MCH and its contribution to essential issues such as the protection of the environment and the effects of climate change; the involvement of traditional knowledge systems and heritage protection within national policies; the development of circular economy initiatives managed by local communities; promoting equality for minority and vulnerable groups in their access to and enjoyment of the benefits of heritage; and the incorporation of an inclusive vision of MCH within educational systems. By evolving these concepts through the lens of the following case studies, this work hopes to enhance interdisciplinary collaboration within the ocean sciences. In sum, using MCH, nature, and society as their main focus, the projects address the three main pillars of sustainable development: social development, inclusive economic development, and environmental sustainability.

3. Case Studies

The following section introduces four case studies that exemplify the relevance of marine communities and their MCH within environmental frameworks and coastal management, how these aspects of heritage can be translated as ecosystem services, and methods by which community and environmental resilience can be sustained through intergenerational engagement and education. A product of the interdisciplinary and community-led methodologies of the Rising from the Depths Network is the expansion of the often-restricted understanding of MCH largely as a static, underwater archaeological resource. Divergences in the understandings of MCH between the Global North and South, as well as between heritage practitioners, academics, policy-makers, and local people, were noted in the early stages of project conception [3]. Considering that the primary aim of the Network was to utilise MCH for community development and resilience, an inclusive understanding of MCH was used, which considered communities' uses and values, alongside the marine sciences, anthropology, and sociology. This approach took into account cultural relations to biodiversity, traditional ways of using and understanding MCH, and current social changes perceived in (or by) the marine natural and cultural resources.

The first two case studies exemplify how MCH can be utilised for the development of both the coastal environment, and the communities who depend on it. Firstly, the project *'Using Fishers' Traditional Maritime Knowledge to Improve Small-Scale Fisheries Management'* introduces the role of small-scale fishing communities within socio-ecological coastal systems. The importance of integrating evidence-based Traditional Ecological Knowledge (TeK: local knowledge of a community's surrounding environment, unique to a given culture or society [12]), Traditional Heritage Knowledge (THeK: knowledge, understandings, and practices that constitute and fortify the cultural heritage of a given community [14]), and scientific knowledge in management is highlighted. Through examining cultural taboos and customary management frameworks within coastal communities in Northern Madagascar, this form of MCH is utilised for environmental conservation, resilience, and education. To enhance education within the youth, a children's book was created and shared throughout schools in Madagascar. To build upon this understanding of heritage in coastal management, the potential for MCH to enhance the sustainable development and socio-economic status of coastal communities is reflected on in the case study from Kenya, '*MUCH to Discover in Mida Creek*', thus exemplifying the centrality of MCH for the socioeconomic and environmental sustainability of both the local people and the greater coastal system. In this case, MCH is used as the backbone to support the community's role in sustainable livelihoods such as ecotourism, boatbuilding, and bee keeping, thus exemplifying the role of MCH as a tool for engaging and empowering communities.

The final two case studies focus on the translation of MCH within environmental management and frameworks from the top down in the context of Ecosystem Service

Management, and from the bottom up with regards to community engagement, capacity building, and education. The project '*Embracing Social Learning in the Management of Ecosystem Services*' describes how community knowledge, as identified in the previous case studies, can be translated as a cultural ecosystem service within typical environmental management frameworks in Mozambique. Understanding MCH as a Cultural Ecosystem Service (CES) is an essential aspect of integrating culture and heritage into marine resource management [15]. This project exemplified different uses of MCH as a CES, particularly for human wellbeing and spirituality. Finally, the project '*MCH in Northern Mozambique*' exemplifies how the above findings can be translated and sustained within the community through school engagement and education. This project explored more conventional aspects of MCH by connecting heritage and the community, particularly through fishing and tourism, with underwater investigation.

By cross-examining the following 4 of the 27 projects conducted as part of the Rising from the Depths Network, it is clear that despite their different approaches and aims, all share the view of MCH as past and current practice in the marine space and as a resource that can inform solutions to present day challenges. Following these cases, a discussion will link the studies by examining the lessons learned and exemplifying how these outcomes may inform regional policy.

3.1. Using Fishers' Traditional Maritime Knowledge to Improve Small-Scale Fisheries Management

3.1.1. Introduction

The project 'Using Fishers' Traditional Maritime Knowledge to Improve Small-Scale Fisheries Management', coordinated by Community Centred Conservation (C3), focused on exemplifying the uses of the traditional knowledge of local fisherman for the social, economic, and cultural benefit of vulnerable groups within coastal communities. Fisher communities interact with, and form an identity alongside, the immediate marine environment [16]. This dynamic and evolving heritage is comprised in flux with the surrounding environment and socio-ecological systems and is referred to as Traditional Ecological Knowledge (TeK) and Traditional Heritage Knowledge (THeK). Although this information is passed down through generations, it is largely undocumented within the Western Indian Ocean and, as such, is under significant threat from poorly regulated development, population dynamics such as migration, and the effects of climate change such as coastal erosion [17].

The traditional knowledge of fishing communities has direct implications for the sustainable management of their natural and cultural marine resources [18,19]. Furthermore, as management frameworks are developed through generations of community knowledge and practice, they are much more likely to be respected, protected, and adhered to by local people [20–22]. However, the translation between scientific and traditional knowledge and practice can be difficult to effectively translate into formal legislature and, as such, is often disregarded [23].

The outcomes of this project were focussed on increasing the sustainability and socio-economic status of small-scale fisheries in Northern Madagascar and the communities that rely on them, thus potentially improving the socio-economic situation of over 5000 people. Significant economic and food security benefits can be improved by increasing the sustainability of small-scale fisheries. Indirectly, aspects of tourism, cultural, existence, and bequest values of the coastal environment may also be enhanced. Furthermore, a key aspect of this work was transcending the cultural boundaries within communities themselves, particularly between women, the youth, and elders.

3.1.2. Methodology

To both document and maintain the relevant traditional knowledge within and outside of the community, the methodology undertook a unique, multidisciplinary, and holistic approach, using semi-structured interviews with key informants (Figure 1). Key informants were individuals recognized within their communities as particularly knowledgeable about

the sea. These respondents were initially identified by local chiefs or heads of fishing associations and subsequently through snowball sampling until no new information was being gathered.

Figure 1. Key informant interview.

In particular, the use of *fady*—a network of taboos that act as codes of conduct [24,25]—and other traditional beliefs were examined to determine ways in which these ideas can be incorporated into sustainable marine resource management and stewardship at the study sites. Specific issues included taboos related to time, space, fishing, food, and any other behaviours or rituals related to the sea. Although the project aimed to interview a variety of ages, it was difficult to find anybody under 50 with any interest or knowledge of taboos, and many informants noted that the younger generations no longer respect taboos.

The study was conducted in the coastal areas of the Diana region of Northern Madagascar at villages within three main sites: Nosy Hara, a marine protected area established in 2007; Diego Bay, which includes the main city of Antsiranana; and Ambolobozobe, which includes a network of smaller community-managed marine protected areas. This area is dominated by the Sakalava people, whose religion was originally centred on royal ancestor worship, but was influenced by Islam from Arab traders in the seventeenth century and Christianity from the early 19th century. The Sakalava people have had historically poor relations and regular conflicts with the other major ethnic group in Madagascar, the Merina [26]. All communities had a high dependence on marine resources for their day-to-day subsistence and economic income.

The project aimed to utilize the information collected to feed into local management plans for marine conservation, to improve stakeholder inclusion and capitalize on traditional behaviours that are already well-supported in local communities. Part of this process was disseminating the knowledge to the youth, through theatre, song, and dance in coastal villages, to strengthen community resilience and to enhance the use of MCH for the benefit of local people and their environment.

3.1.3. Summary of Results

The taboos recounted by informants fell into three broad categories for the purposes of this work: (1) sacred places—often believed to be the home of ancestral spirits; (2) going to sea—including fishing rituals and items and behaviours that were prohibited at sea; and (3) hunting and fishing—including gear taboos and food taboos (Table 1).

Table 1. Summary of taboos recounted by informants categorized into 'sacred places', 'going to sea', and 'fishing and hunting'.

Sacred Places	Going to Sea	Fishing and Hunting
- Washing pigs at the beach - Allowing dogs onto the beach - Making loud noises - Urinating and defecating on the beach - Washing dishes - Sexual intercourse - Menstruation - Smoking - Merina and speaking the Merina language - Foreigners - Cutting mangroves - Looking in a certain direction - Wearing hats, the colour gold, the colour red, or hair down - Carrying a bright light or fire during the night	- Shouting or talking foolishly - Fighting or arguing - Pointing (esp. at whales) - Changing plans at short notice - Going to sea with a personal problem - Long hair - Ginger - Women - Tenrecs - Eating pork - Eating chicken or eggs before going to sea - Certain types of basketry and woven hats - Ancestral blessing required	- Taking more than needed - Eating sea turtles - Hunting birds - Fishing at night - Beach seines/fine mesh - Cutting a line which already has a fish on it - Certain type of woven canoe - Crab hand net is banned - Fishing using poisonous plants

Sacred places were generally recognized as such due to the presence of ancestral ghosts or spirits and were commonly burial grounds. In coastal areas, islands, beaches, and mangrove areas were often regarded as sacred, and their link to the sea and fishery resources was regularly recognized. More broadly, taboos were linked to ancestors' spirits, and breaking them was believed to result in supernatural retribution ranging from poor fish catch, to bad weather at sea, to death.

Several different origins were presented for some taboos; for example, the prohibition of certain types of basketry at sea was often attributed the fact that the same basketry was historically used to collect freshwater, and so using it in a seawater environment would be disrespectful to ancestors. Other informants noted that the Merina people wear hats made of the same type of basketry and so they were a reminder of conflicts between the Merina and Sakalava. Other taboos such as those associated with dogs, pigs, and pork could be attributed to the Islamic influences on the Sakalava people.

Many taboos had clear resource management benefits. Mangrove-harvesting taboos were common, and the origins of these were varied. For example, a story was recounted where a sea turtle was killed using a mangrove branch, and the turtle's spirit took the hunters to the Glorioso Islands, where they were forced to remain for a week, during which time their families believed them to be dead. It is believed that the branch that was used to kill the turtle was planted on the beach, and the whole forest sprung from this single tree. Because of this belief, the forest may not be cut, and the birds that live there may not be hunted (*pers comm.* Key Informant Nosy Hara).

The fishing and hunting taboos deserve particular consideration because they can be directly incorporated into contemporary marine resource management plans. All of these taboos had clear benefits for sustainable fishing as recognized by the informants, and one would expect wide acceptance, especially by older generations, who could use their influence to encourage compliance in younger people.

3.1.4. Outcomes

The primary results of this work exemplified the significance of behaviour-based and species-based local taboos and beliefs that are linked to the marine environment. Such taboos formed the backbone of traditional governance structures, which included protection for certain species that were considered dangerous and for areas that were feared or set apart for ritual and spiritual consultations. Furthermore, specific protections were found to be in place for valuable marine resources. These synergies between culture and sustainability have developed into cultural norms and customs that motivate community members to protect their landscape without the need for government enforcement. As has been exemplified in other studies [27,28], using TEK from systems such as the ones presented in this study can rebuild trust between resource users and managers both to recover fish stocks and to enhance the socio-economic resilience of coastal and fishing communities. To combat intergenerational inequalities regarding the use of taboos in marine conservation, the information collected in this research was used to create a series of children's educational books in Malagasy, which were distributed throughout schools in the region[2] (Figure 2). The books focussed on the story of a Green Sea Turtle and married the role of turtles in Malagasy culture alongside the essential role they play as part of a functioning ecosystem. The book introduces methods in which children can protect turtles and educate others as part of the story.

Figure 2. Sea turtle story book launch.

Madagascar's efforts toward the SDGs have been notable, including an emphasis on the country's natural resources and unique biodiversity, and such efforts have had strong support from the country's president [29]. The Madagascar Action Plan is consistent with the SDGs and includes a strong focus on 'cherishing the environment' and 'rural development', (UN, 2006). The Madagascar National Environment Action Plan (NEAP) also identifies the following priorities: (1) sustainable development activities, (2) coastal and marine ecosystems sustainably managed, and (3) positive behavioural change vis a vis the environment. In line with the priorities of the NEAP, it is clear that if properly integrated into local legislation and policy systems, those cultural practices which have high compliance among fishing communities, can increase the protection and conservation of

both the community and their natural environment [30]. Such co-developed, participatory methods may result in more sustainable systems, rather than those that typically divide or exclude communities and their cultural practices. This is particularly the case when combined with alternative sustainable livelihoods [31]. For the effective protection of such resources, local cultural maps need to be created which highlight spaces that hold cultural and historical significance, and that have the potential to boost culturally sensitive heritage tourism.

3.2. MUCH to Discover in Mida Creek, Kenya

3.2.1. Introduction

The *Maritime and Underwater Cultural Heritage (MUCH) to Discover in Mida Creek* project set out to improve community resilience through MCH knowledge and awareness, with the projected outcome of improving ecological preservation and protection and enhancing the socio-economic status of coastal communities in the region. Mida Creek is located 29 km south west of Malindi town and approximately 3 km west of Gedi, one of the most important ancient Swahili settlements on the east African coast [32]. The Creek is home to around 25,000 people, all of whom rely upon crisis-prone industries such as fisheries, forestry, or tourism [33]. The Creek itself faces significant threats from climate change, particularly with regards to reduced farmland, fishing grounds, forests, and built heritage, primarily due to rising sea levels and coastal erosion.

Coordinated by Ulster University and the National Museums of Kenya, and in partnership with the community-based organisation Bidii na Kazi Women's Group, this project aimed to identify sustainable methods by which MCH could be utilized as a resource for community benefit. This was achieved through integrating climate change mitigation into resource management and aiding in the creation of community-led initiatives that have the potential to generate governmental and international support and investment [34]. Key activities included maritime archaeological surveys to create a usable knowledge base of sites in and around the Creek, the development of an MCH interpretation centre, the identification of additional livelihood initiatives, the construction of a dhow house restaurant (Figure 3), and the training of Bidii na Kazi Women's Group on ecotourism and the sustainable utilization of MCH [35,36].

Figure 3. The Interpretation display inside the dhow house restaurant.

One of the primary activities conducted as part of this project was the documentation of the MCH of the Creek to understand the region's maritime history and ancient global connectivity [37–39]. This process involved recording the modes of seagoing crafts used at Mida Creek and the production of a geospatial and photographic record of coastal wrecks and landing sites. Several boat types were documented including dhows, outriggers, and dugout canoes, with the last being most common. Using Participatory Action Research (PAR) methods, community members shared the process of building traditional canoes

with the youth. The canoes are now used in the Creek's ecotourism circuit, and by the local fishermen, earning the Bidii na Kazi Women's Group a sustainable income.

3.2.2. Methodology

MUCH to Discover in Mida Creek undertook research in collaboration with all stakeholders in the region to identify appropriate and sustainable Additional Alternative Livelihood (AAL) initiatives. To achieve success in the different AAL, the project trained the local stakeholders and communities to identify their marine heritage and the best and most suitable AAL they could sustainably manage [40]. To do so, the project brought in different stakeholders to undertake various lines of training: agricultural office officials trained the community in organic farming, the Kipepeo butterfly project based at the Gede Museum trained the community on butterfly and bee keeping; and the Principle and Co-Investigators of the *MUCH to Discover* project trained stakeholders in marine and forest archaeology and ecotourism. Furthermore, the Kenya Forest Service through the Kenya Forest Research Institute was employed to train stakeholders on mangrove seedlings and nursery propagation, and the identification of ecotourism (Figure 4). They identified fishing, canoe/boat building, marine biodiversity, archaeological sites (such as the 15th century ancient port of Mida in Kirepwe Island [39,41] or the archaeological site of Chafisi), marine life, mangroves and mangrove forests, medicinal plants, shipwrecks, and cuisines as the primary resources for AAL in the area.
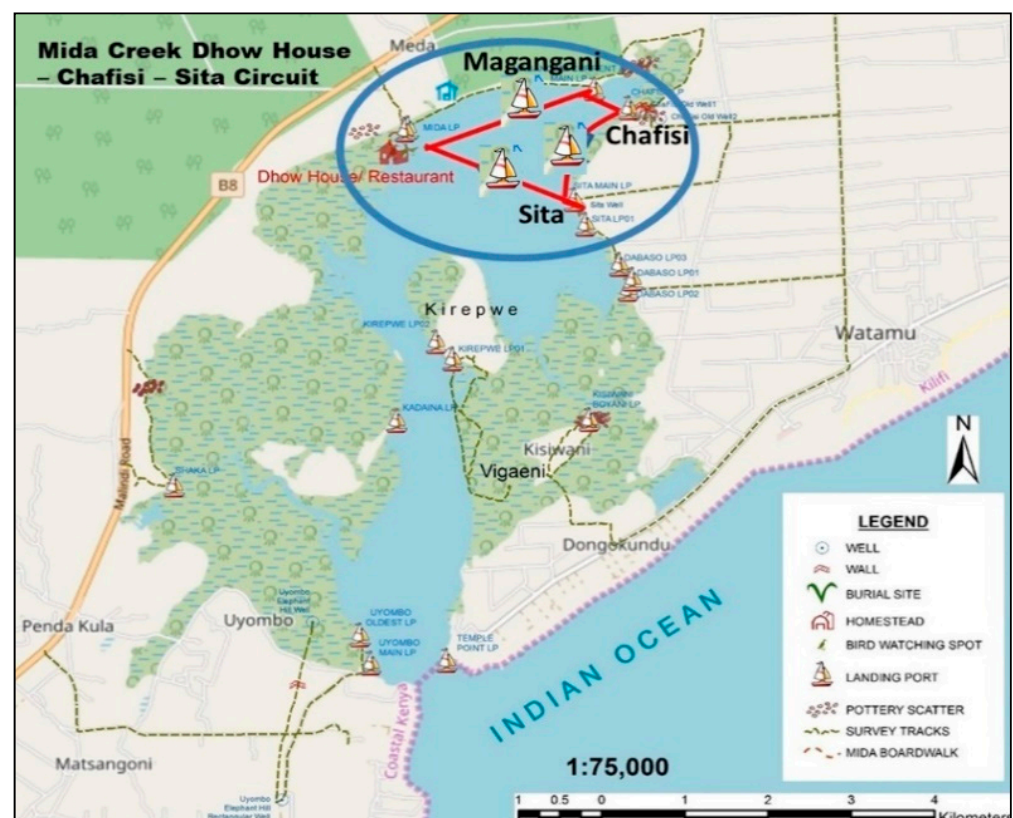

Figure 4. Mida Creek ecotourism circuit.

3.2.3. Summary of Results

Regarding the sustainable livelihoods identified, the project, in collaboration with the Bidii na Kazi Women's Group, identified and shared a myriad of sustainable alternative livelihoods. These included the growing of drought resistant crops such as cassava, peanut, bee keeping, butterfly farming, basketry, and mangrove nursery farming. One of the flagship activities within the MUCH to Discover in Mida Creek project was the development of a dhow house restaurant and interpretation centre [42]. This is a sustainable, fully wooden

floating installation that met the approval of environmental conservation concerns. Built entirely of wood and palm thatch, the dhow house now acts as the Malindi–Mida Creek MCH interpretation centre with an exhibition of the MCH of the Creek. The restaurant acts as the starting and ending point for visitors to the ecotourism circuit. The exhibition was developed by personnel from the department of Coastal Archaeology at NMK, in collaboration with the Bidii na Kazi. It used data collected by the different project investigators and features Mida MCH, the different AAL initiatives in Mida, and various climate change mitigation strategies for the area.

Alongside ecotourism (Figures 4 and 5), bee keeping within the mangrove forests was found to be a viable initiative. Today, the group is able to produce honey, dubbed Mangrove Honey, which they sell locally in Malindi, Mombasa, and Nairobi.

Figure 5. Local tourists use the Women's Group canoe for ecotourism.

Another initiative is organic farming, in which the local farms grow spinach, pepper, okra, tomato, and cassava. Butterfly farming has also represented a useful venture, undertaken with experts from the Kipepeo Butterfly project[3] based at the National Museums of Kenya. Communities in Mida today have established butterfly farming gardens and make direct sales of pupae for export at the Kipepeo Project at the nearby Gedi Museum [35].

Finally, the centrality and cultural importance of fishing as a mainstay of the Mida residents was recognized. The project initiated an increased use of ecologically sustainable traditional fishing techniques using fence and basket fishing throughout the community. Made by local master craftsmen, this practice is now managed by the Women's Group, with the catch sold in the nearby markets and hotels and used in the Group's dhow house restaurant.

3.2.4. Outcomes

Communities have utilized the maritime landscapes since time immemorial. However, marine resources are becoming finite due to increased pressure from population increase, industrial development, and climate change. The *MUCH to Discover in Mida Creek* project has demonstrated multiple methods and ways in which MCH as a resource can be used to enhance sustainable economic development for coastal communities, and for climate change mitigation alongside the natural environment. Significantly, this project exemplifies the links between the coastal cultural practices in the region, such as fishing and bee keeping, with economic and environmental sustainability. To sustain the livelihoods discovered as part of this project within future generations, an outreach program was developed for schools around Mida Creek and Arabuko Sokoke Forest. As a next step, it is essential that local governments develop inclusive policies which ensure sustainable conservation and protection of MCH alongside the local communities which rely on them.

It is important to note, that of the multiple successful livelihoods introduced as part of this project, including basket and fence fishing, butterfly farming, the dhow-house

restaurant, ecotourism through hire of canoes and dhows, and mangrove nurseries, some have proven difficult to be maintained. For example, successive drought seasons have limited the success of organic farming, and bee keeping, although sustained, is continuing at a slower pace due to dry spells. Such extreme changes in weather only further exemplifies the severity and complexity of the impacts of climate change on the community, and the necessity of MCH-based alternative livelihoods to mitigate these factors. Furthermore, the COVID-19 pandemic significantly impacted the project.

In order to mitigate the threats posed by climate change, the project undertook community training on climate change adaptation in the Mida community. This primarily comprised of adapting new techniques for environmental and economic resilience, such as mangrove propagation for reforestation. As a direct result of this work, local communities have established mangrove nurseries and planted 300,000 seedlings (and continue to plant) in small plots in area covering 50 m^2. They sell the seedlings for reforestation efforts within the Creek [42,43] which has seen an area of over 3 acres, previously eroded by rising sea levels, replanted with mangroves. Bidii na Kazi women sell the seedlings at KSh 30 per piece, which is an investment that has attracted other women's groups around Mida to establish their own nurseries.

A further difficulty to the success of the project was the global COVID-19 pandemic. The pandemic occurred when the project was near completion and about to launch the tourism-related ventures of the canoes and dhow house restaurant. These investments grounded with the near collapse of the butterfly farming as all markets in Europe and the US were closed. This period of inactivity also led to the organic gardens being eaten away by weeds and the mangrove seedlings overgrowing, losing revenue. The greatest impact of the COVID-19 pandemic was, however, the demise of Madam Arafa Salim Baya, a conservationist and member of the Women's Group. The pandemic took away this Presidential Award Winner, and thus dealt a huge blow and loss to the project. The other community members took several months to recover from this loss.

Although the lessons learned from the *MUCH to Discover in Mida Creek* Project are yet to officially inform policy, its success has seen a change of approach to the way institutions are engaging communities in MCH management. Stakeholders were identified and continue to be engaged through meetings, collaborations, and partnerships. To ensure that there is uptake of the sustainable MUCH preservation in the future generation, the project developed a school outreach programme for 30 schools around Mida Creek and Arabuko Sokoke Forest to enhance awareness.

MUCH to Discover in Mida Creek is the first-of-its-kind in Kenya showcasing MCH as an asset that can be utilised sustainably for community development. It has achieved great interest at both local and national levels. Local communities in Mida have embraced MCH and are emulating Bidii na Kazi women by establishing their own mangrove nurseries, bee keeping, and butterfly farming ventures. The local government of Kilifi County has established close working relationships with Mida. The national government departments concerned with the conservation and management of Mida Creek are today closely working with the Mida community. Overall, with Kenya working towards developing its Blue Economy, the Mida Creek project has set a legacy. As such, the government, through NMK, is using Mida as a case study as it seeks to develop MCH in other areas along the coast.

3.3. Embracing Social Learning in the Management of Ecosystem Services in Chongoene District, Gaza Province, Mozambique

3.3.1. Introduction

The project '*Embracing Social Learning*' was a consultative pilot project conducted by the Universidade Pedagogica, which considered the potential role of cultural heritage knowledge as an ecosystem service. Ecosystem Services describe the benefits provided to human societies by their surrounding ecosystems. Originally coined as part of the Millennium Ecosystem Assessment[4], this terminology is used primarily within methodologies and frameworks for managing human uses of the environment [44]. This study

aimed to identify how MCH fits within the ecosystem services of Chongoene District, Southern Mozambique. The outcomes of the study worked to inform decision making in the management of coastal areas under development pressure. Furthermore, the project aimed to both contribute to school curriculum development and enhance communication capacities within policy and practice. By using qualitative research methods such as focus group discussions, informal interviews, and field visits, it was found that the study area presented a wide variety of benefits concerning the provisioning, material, and cultural services related to nutrition, particularly considering the variety of fish that can be found in the area.

Few studies are available regarding ecosystem services in Mozambique, and no studies yet exist on the perceptions and threats relating to coastal ecosystem services. Considering the importance of coastal ecosystems for local communities, one of the primary aims of this work was to provide a study of the coastal services to improve their preservation and sustainable development. As the soils on the coast of Southern Mozambique have a particularly poor nutrient load, the communities of this area rely heavily on livelihoods from both environmental and cultural marine goods and services [45]. This reliance, however, has been strained by years of war (1983–1992) together with further rapid urbanization and migration to towns. As a result, rural coastal dwellings have suffered significant losses of valuable knowledge of coastal ecosystem processes and function-generating services [46].

Furthermore, a new port infrastructure for the export of ilmenite from sands recently discovered 60 kms from the coast in Chibuto District is in development [45]. This development constitutes a significant threat to marine ecosystems and the resilience of local people, as it will eliminate access to essential ecosystem services on the coast. Previous local resettlements have fuelled conflicts and violence in Mozambique due to the severe undervaluing of livelihood sources such as farmland fruit trees [45]. This research will help to improve the compensation criteria by highlighting the value of these services to be included in future development mitigation plans.

Mozambique is still in the early stages of applying ecosystem service approaches. The emerging research in this field has centred its attention towards issues related to biological diversity and poverty reduction, and have particularly focused on land-use [47]. This focus is largely due to both mining and the development of new transport systems, which have led to an accelerated conversion of traditional land uses into modern uniform and patterned landscapes, which lack diversity for ecosystem services provision.

To aid in the integration of cultural ecosystem services within industrial and development mitigation plans, an attempt to assess the monetary value of MCH as a cultural ecosystem service in the coastal area of Mozambique was undertaken. This assessment particularly addressed the provision of fish, carbon sequestration, coastal erosion control, tourism, and recreation [48]. While ecosystem services studies in Mozambique are still in their early stages, it is essential that these studies are conducted in a manner that ensures all intangible services are captured in the assessment process.

3.3.2. Methodology

Due to the complexity of ecosystem service identification, a variety of methods was needed to adequately account for the extent of socio-ecological interactions in the area. The landscape diversity makes the Maciene community a paradigm case study for ecosystem service management. All livelihood activities discussed are climate-sensitive, and the existing resources have been deemed attractive for foreign investment.

The study included focus group discussions, interviews, and workshop data through inclusive and participatory engagements with members of the community. In order to assure perceptions from both top-down and bottom-up perspectives, 48 people (25 male and 23 female, with ages ranging from 20 to 64) including local leaders, government officials, farmers, religious leaders, and traditional healers were interviewed using purposive sampling.

Interviews were undertaken in 2021 after a focus group discussion was held in November 2019. The aim of the focus groups was to identify the main ecosystem services provided

by the environment within the coastal community of the Chongoene District. Sixteen long-term dwellers of the Maciene area were invited to identify services, service availability, access, and location (Figure 6). The focus group participants were intentionally chosen using a snowball method but with indication to assure representativeness. We first contacted the traditional leader of the area and explained the aims of the study. When he accepted, we asked him to find local dwellers who possess knowledge about the livelihood activities and social life of fisherman, farmers, religious leaders, and traditional healers. Once 16 individuals were selected, a meeting for discussion was organised where participants were asked to speak about their life and the way they utilise the local environment. The answers given were classified as belonging to different types of ecosystem services: supporting, provisioning, cultural, and regulating.

Figure 6. Focus group conversation as a social learning tool.

The discussion was held in the Changana language and was recorded. The main content was translated into Portuguese and English. A map was drawn in the ground so that the participants could indicate the location of services and activities. Other than the focus groups, further information was collected through transversal walking and direct observation including the use of topographic maps and Google Earth images.

In order to assure the multiplier effect of the study in influencing environmental education and curriculum enrichment, students from Save University in Chongoene participated in field observations in order to clarify what was said in the focus group meetings. The session followed a participatory format, and participants were allowed to speak freely about their activities.

3.3.3. Summary of Results
Community and Ecosystem Services

Land use for agriculture was highlighted by the majority of interviewees as the main benefit from local ecosystems. Alongside agriculture, fishing in the sea and lake was also an important activity for their livelihood. Some also highlighted access to water from the lake and ground waters as important sources. Pastures for cattle growing were also important, primarily as a coping strategy against a lack of crops from droughts. In agriculture, the main crops identified included maize, groundnuts, cassava, cowpeas, sweet potatoes, mango, cashews, and pineapples. Furthermore, it was found that medicinal plants were the primary source for medicine within the Chongoene District.

Building materials for the construction of houses were reported as particularly integral, including the gathering of edible wild fruits from the forests. Agricultural products

and other goods were stated a necessity for both family consumption and for economic livelihoods. Wood fuel acquired from the indiscriminate cutting of trees was also deemed as particularly important.

The Chongoene District also displays significant potential for places of natural historical, cultural, and tourist interest. During the focus group discussions, it was found that the promotion of ecosystem services, including the fresh air; the cool breeze; the fruits of wild trees; the shade; the beach with its clear and fresh water; and the materials for baskets weaving, sieves, and ornaments were of central importance.

Besides the value of material use, ecosystems provide a symbolic use because of their participation in the construction of meaning that promotes cultural values and identities within the communities (Figures 7 and 8). During the field visits with local leaders, the cultural value of the water from the sea was identified as a hidden ecosystem service:

> *'The source of our strength is the waters of the sea, we get wet with it, our clothes gain power and strength of a great magnitude and we take the sand with us to put in our homes as a way to bring spirits to our surroundings and ensure spiritual protection against evil forces'. (Local leader of Maciene, pers. comm. 5.12.2019)*

Another central cultural ecosystem service in the area is the dunes. According to the community leader in the area, the Nhapangue dune was the origin of the lake Mwalute. Allegedly, in the mid 1990s, inhabitants of the community attempted to clear the sacred forest on the dune, but it is said to have responded with a huge serpent in order to deter the explorers. This is part of the local belief in a sacred tree that holds a spiritual protective structure for the community and draws a valuable liquid used for traditional medicine (Figure 9). Other aspects of sacred events include temporal behaviours such as changing colours of the sky and waters transmitting messages. This dynamic rather than static aspect of cultural ecosystem services is an important yet under-valued asset in decision making—particularly in the era of climate change. Taking into consideration the local knowledge and beliefs of changing climates is particularly necessary to understand the ways local people perceive and benefit from nature and the complex relationships between nature and society.

Figure 7. Maize and other vegetables growing in the slopes of ancient dunes in the Chongoene District.

Figure 8. Domestic utensils made from local timber and soils.

Figure 9. Nketche sacred forest in Maciene Chongoene District.

Environmental Change

Interviewees reported that they have perceived specific changes in the environment over generations, but mostly in the last decades. Alongside an increase in the frequency and strength of winds, such changes included a reduction in food production, rain, small game, and the quantity of fish in the sea and lake. When asked what was causing these changes, community members reported that the nature or climate was changing, that inappropriate fishing methods were being used, that there was an increasing number of fishermen, that rituals in sacred places had been abandoned by certain members of the community, and that forests were being destroyed.

The main consequence of these recent changes for the local community is a shortage of food. The majority of respondents reported that they could not produce enough food and fish from the local environment. The major strain affecting the overall ecological state, according to survey participants, was fish extraction in the ocean and lake. In and of itself, fishing is an important ecosystem service, but heavily fished coastal ecosystems may lack a diversity of ecosystem services that support human well-being, such as recreation and cultural value [49].

The communities in this study have developed a number of adaptation strategies for the recent changes in the availability of ecosystem services. In some cases, community members have been able to open more fields, cultivate wetter spots, look for off-farm employment, or practice other activities. It is clear, however, that these are not sustainable alternatives. The results of this study revealed that the majority of households continue to rely on agriculture as the main source of income. It also revealed that the proportion of households relying on farm sources is higher in the Chongoene District than in most other rural districts of Mozambique. As such, extreme weather or prolonged drought are important drivers of change in the availability of ecosystem services.

MCH as an Ecosystem Service

It is clear that landscape diversity is an essential aspect of coastal community resilience, but as exemplified in this study, there is a multitude of further MCH livelihood activities that enhance community stability, particularly regarding local knowledge and practice. Yet, maintaining the diversity of both natural and cultural services available in the landscape constitutes a management challenge for local authorities. Such management challenges include the use of unsustainable fishing practices in the sea and lakes, the allocation of land for agriculture and pastures, and the provision of water and land for residence construction.

Currently, traditional management approaches that take into account cultural ecosystem services emphasize the ecosystem as a place for tourists; inspiration, relaxation, worship, and aesthetics [50]. These views, however, are mostly from the perspective of western or urban policy-makers and academics who place importance on nature as a refuge under accelerated urbanization. This theme often comes hand in hand with placing pressures on economic value over intrinsic value. As such, the views of communities living within nature and drawing their livelihood from the close relationships with the local environment are missing.

In this study, the focus group discussions showed that sacred places include landforms such as dunes, forest, and lakes, and these areas are not only places to visit and worship but also represent deeper narratives about their functions and influence on local livelihoods through the provision of ground waters, rains, and blessings. The fact that sacred places are situated in different but relevant parts of the landscape makes them useful for modern conservation purposes, particularly regarding local protection and the utilization of coastal forests, dunes, and soils. As such, the cultural value of sacred places shows significant importance for the resilience and sustainability of the local communities who use them, irrespective of touristic value.

Therefore, it is important that these issues are raised both from a top-down perspective, by educating policy-makers, and from a bottom-up perspective. During the focus group work, some participants raised questions regarding the content of school education materials not taking into consideration local contexts. As such, this research aims to encourage environmental education to address local agendas. This will be achieved by identifying the key concepts and processes in the coastal environment and introducing this knowledge in the local school curriculum so that the pupils may interact with elders and enrich the content of education.

3.3.4. Outcomes

Cultural and environmental diversity in Chongoene provides a variety of essential services for the livelihoods and the resilience of the local community. The local management

of this diversity has produced instrumental knowledge regarding the biocultural heritage, spiritual beliefs, and moral values that are intertwined with the ecology of the area, and so need to be elucidated with scientific research regarding their potential to inform sustainable management and environmental education. The provision of cultural and environmental services is vital to human well-being. Both the favourable impacts of ecosystem and cultural services and the negative impacts of climate change and development pressures on Chongoene's communities are clear.

It is important that there is recognition of the role that TEK and THeK has played in the preservation of coastal systems, minimizing the impacts that come from the exploitation of natural resources, leading to accelerated impacts on biodiversity in the region. As such, it is necessary to initiate dialogue with local communities regarding the interactions between ecosystems and culture so as to understand the qualities and intricacies of biocultural and socio-ecological systems. At the same time, there is a need to clarify the concept of 'cultural ecosystem services' and their importance.

Considering the above, the main recommended actions for policy development in the region focus on raising awareness and capacity within and between the local communities, resource managers, and policy makers; increasing environmental education in school curriculums and vulnerable groups; and creating various socio-economic livelihood and preservation opportunities in the form of biological, cultural, and archaeological parks.

The co-creation of knowledge on local environments and marine heritage is currently being pursued through the promotion of social learning events in the Chongoene District, where local schools, farmers, and researchers share knowledge on ecosystems and marine heritage. The Chongoene Archaeological and Biocultural Heritage Park project, funded by the 'patrimonies' funding initiative of the German Gerda Henkel Foundation—Stiftung and coordinated by Mozambique University, is a key legacy of this work. The park aims to preserve Chongoene's archaeological, ecological, and biocultural coastal resources through the creation of a public-use-protected areas and an ecotourism site. The project will employ members of the community as guides, guards, and gardeners, and routine monitoring of exposed archaeological remains and ecological fluctuations will be undertaken.

This study has shown that traditional communities' knowledge and their contribution to culture and economy in East Africa is fundamental for the sustainability of both the environment and the people who depend on it. Capacity building for the improvement of the local school curriculum, such as in the project 'Using Fishers' Traditional Maritime Knowledge to Improve Small-Scale Fisheries Management', is necessary to integrate local contents related to ecosystem and MCH intergenerationally. In order to address the existing diversity of cultural and natural ecosystems, an interdisciplinary approach is required to connect scientific and local traditional knowledge. The sustainable use of ecosystem services relies on challenge-led, bottom-up approaches, as the prevailing top-down approaches and lack of participation of local people in the decision-making process has, so far, led to environmental and cultural degradation and loss of biodiversity [3].

3.4. Marine Cultural Heritage in Northern Mozambique

3.4.1. Introduction

The *Marine Cultural Heritage in Northern Mozambique Project* is a joint initiative between the Universities of Ulster, Eduardo Mondlane, and Kwa-Zulu Natal (UK, Mozambique, and South Africa, respectively). Focusing largely on Mozambique Island and the Baie de Mozambique in Nampula province, it also partners with the local research centre, *Centro de Arqueologia Investigação e Recursos da Ilha de Moçambique* (CAIRIM). Together, these organisations have a long-standing interest in marine archaeology, paleo-environments, anthropology, and the applications of remote-sensing technologies in marine environments. Much of the marine heritage effort has been directed at underwater sites—locating, identifying, and characterising shipwrecks. Therefore, the project attempted to compliment this approach as well as widening both the themes and methods used. Under the over-arching

aim of building a robust case for improving the protection and sustainability of marine heritage, the project sought to integrate both natural and cultural environmental concerns.

As a component of the Rising from the Depths initiatives, the project worked closely with Mozambican partners to formulate a set of aims beneficial to the work carried out to date on the Island and to the local community. Mozambique Island is one of the country's most well-known heritage assets. A UNESCO World Heritage Site since 1991, the island was designated based largely on its built architecture, comprising a series of religious, military, and secular buildings dating to its former position as a capital in the Portuguese colonial period [51]. Situated within a broad, shallow embayment protected from the ocean, the island provided a sheltered anchorage and was a natural focus for bustling shipping and trading activity. Overseen by military fortifications on its approaches, this intense maritime activity has left a legacy in a range of shipwrecks within the Bay dating to the colonial period and earlier. Despite being largely overlooked by UNESCO at the time of its designation, this MCH has attracted unwelcome attention by salvage companies. Removing artefacts from largely European shipwrecks for commercial gain, these activities threatened the integrity of the heritage assets until action by local advocates brought an end to the operations [52,53]. Since the cessation of such activity Mozambican archaeologists have worked with research partners (most notably the Slaves Wrecks Project) to strengthen capacity on the island, culminating in the establishment of CAIRIM in 2018 [54]. Furthermore, some work with the local community to establish goodwill and interest in preserving MCH has been undertaken by the Centre for International Heritage Activities [55].

The key strands of this project were:

1. Focused engagement with the community and stakeholders on the perceptions, memory, and value of marine cultural heritage. This sought to understand how coastal environmental change is affecting heritage and the livelihoods of coastal communities and the formulation of a set of policy and protection recommendations for MCH on the island.

2. Understanding past and contemporary marine processes. This sought to establish historical marine baseline data to inform an understanding of past sea-level and coastal geomorphological change. An underwater survey (seismic profiler transects) was used to establish the area's broad-scale stratigraphic sequence and provide data for reconstructing past sea-level change. This was combined with a bathymetric survey (MBES) of the shelf and nearshore to provide the baseline environmental context in which marine cultural heritage is presently preserved.

An underwater (geophysical) survey was carried out in late 2019 encompassing the inner bay and continental shelf. In 2021, the project returned to the island to host a series of meetings and workshops aimed at addressing the community aspects of the project.

3.4.2. Summary of Results

Sea, Heritage, and Community

The activities and outcomes of the project can be considered under its two major objectives, heritage and community, alongside the underwater investigation. One of the most pressing challenges facing coastal communities is the threat caused by climate change, and in this regard, the work of the project on sea-level change was of interest. In addition to the paleo-environmental reconstructions of changing conditions at various points in the past, the project used modelling to suggest future scenarios of change facing the coast. Such models were based on 'medium' or 'high' temperature rise scenarios, leading to sea level changes of ~25 cm by 2050 and ~62 cm by 2100 or ~32 cm in 2050 and ~94 cm by 2100, respectively. Community representatives took a keen interest in the differing scenarios and the relevance of the marine surveys for immediate concerns. To facilitate this interest and to collect information of the cultural importance of the site, climate change was one of the environmental themes addressed by the project via 20 semi-structed interviews with island stakeholders representing business, fishing, heritage, government, NGOs, and education sectors. In addition to climate, themes of value, and accessibility of heritage, its

intersection with livelihoods, and challenges around its communication and protection were also discussed.

Although being inscribed on the UNESCO World Heritage list, the island's heritage faces considerable conservation challenges in maintaining the historic building stock. The island was considered in danger in 1996 and almost removed from the list. It has since seen some improvement, but there are severe deficiencies in skilled labour and resources for conservation [56]. That the World Heritage status lacks direct financial support baffles many local people. Nevertheless, the island remains Mozambique's most prominent heritage asset, with multiple agencies and organisations conducting work and research. A good deal of this work involves institutional and thematic overlap, and the need for better coordination for efforts to safeguard terrestrial and marine heritage is recognized.

The key conservation institute (established by the Ministry of Tourism) is Gabinete de Conservação da Ilha de Moçambique (GACIM). Its role, defined in legislation, includes developing strategic development plans aimed at benefiting the island, ameliorating the decay of its heritage assets, and training in conservation expertise. GACIM's sphere of activities could extend to MCH, but few of its members have the training and ability to conduct diving and underwater research. Improved coordination could aid the allocation and effectiveness of funding (currently short-term and sporadic), as well as in developing longer-term strategies to secure the impact and permanence of the various heritage initiatives.

The two areas of economic life most aligned with MCH are fishing and tourism. In recognition of this, organisations such as the island Museum have been making efforts to focus on historic fishing practices as well as developing their collections to reflect the relevance of such activity. Fishermen too are aware of MCH, whether as custodians of traditional practise or, more practically, are aware of the sites of shipwrecks as a danger to nets and nurseries for fish. Fishing traditions and the challenges brought by climate change were an important part of discussions, as well as the need to conserve stocks. Discussions around fishing underlined the need to curtail fishing techniques that are damaging and/or illegal (e.g., using mosquito nets or capulanas (Mozambican sarong), fishing too close to the shore, damaging nurseries, net dragging). Large-scale industrial fishing is also a threat, with boats visiting the continental shelf using strong lights to fish (which is illegal), contributing to dwindling fishing stocks. As elsewhere on the EACZ, the economic contribution of heritage is viewed largely through the prism of tourism. Most tourists come from Mozambique (often Nampula residents on weekend trips) and some from abroad. Tourism had been one of the constant sources of income (pre-COVID-19), but the number of residents that benefit directly from it is still relatively small. This includes people working in hotels and restaurants in Stone Town, retail owners, and tour guides (whose income is insecure). It is not unusual for the island to be a venue for meetings on the part of politicians and large groups of NGO workers. The attractiveness of the island for this purpose is perhaps an under-exploited means of not only benefiting economically but also reaching decision makers and influencers on development issues.

The need to reach the local community is recognized, and a number of agencies have programmes involving community representatives or volunteers. The largely voluntary Association of Tourism (APETUR) has proposed a series of environmental initiatives to protect natural resources and alleviate pollution (Cássimo and Costa Pereira pers comm.). Although these are all good projects with potential beneficial results, they are largely carried out on a pilot basis and are often discontinued or not implemented. Hand in hand with community efforts is the creation of opportunities for education at every level of schooling, in particular on the necessity for the safeguarding and study of heritage and natural assets. Community and educational activities are often underdeveloped, and long-term structural as well as organisational improvements could be made to better harness the goodwill of the residents.

Underwater Investigation

The underwater geophysical techniques were identified by the project as the most appropriate means of shedding light on new areas of interest for CAIRIM. These techniques had not formerly been employed in the area and provided a vital new dimension to understanding cultural heritage as well as the region more widely. From a methodological perspective, they offered advantages over traditional, archaeological diving and excavation. Importantly, they are non-invasive techniques and so conform to the principles of a number of international conventions that emphasize the in-situ preservation of sites, e.g., the UNESCO-2001 Convention on the Protection of the Underwater Cultural Heritage.

At the height of the last Ice Age (roughly 20,000 years ago), global sea level was −120 m to −130 m lower than at the present. Along the African coastline, the fall in sea level exposed large tracts of land, allowing rivers to cut across what is now the continental shelf and pushing coastlines out towards the shelf edge. Over time, global climate warmed, the ice melted, and sea level rose. These landscapes, and any archaeological evidence they contained, were flooded and now lie on or are buried under the seabed.

In order to detect flooded features, a sub-bottom profiler (SBP) was used to provide a cross-section through the seabed on a series of transects designed to understand the seabed within the Bay and on the shelf. They provide an indication of the position of past shorelines and the process of reclaiming the land. Profiles retrieved across the shelf edge beyond Baie de Mozambique and the outer islands of Goa and Sena revealed a paleo-delta probably deposited during or immediately after the peak of the last Ice Age (−130 m). Moving landward, a submerged cliff and relict sand dune was formed when sea level was approximately 75 m below present levels. Above the cliff, a series of drainage channels was detected meandering across the bay that were inundated as the sea rose. By comparison with sea-level data from along the East African coast, they are estimated to date to a period of sea-level stability around 11,400 years ago, when sea level was about 60 m lower than at the present (Figure 10).

The data derived from SBP was complimented by a multibeam echo sounder (MBES), deployed across the deep shelf fronting the Baie de Mozambique and the shallow historic anchorage behind the Ilha de Mozambique. This provided a detailed seabed topography and a range of interesting features. These include a number of upstanding anomalies, such as shipwreck mounds. Wreck mounds could be correlated with known wreck sites and their extent and debris field could be re-assessed. It also provided information about the seabed environment (e.g., sand waves and the implied processes of sediment movement) and, thus, conditions for surviving cultural heritage.

The underwater surveys revealed evidence of post-Ice Age sea-level rise and the processes by which it occurred. Indicators of such processes are important in the absence of direct dating evidence and can be compared with patterns and dates established elsewhere on the EACZ. Mozambique Island's river channels, deltas and shorelines occur at similar depths (e.g., −130 m, −90 to −100 m, −65 to −75 m) to features observed elsewhere in the region [57]. This newly established evidence from northern Mozambique is therefore a major step in broadening the geographical scope of the regional model of sea-level change.
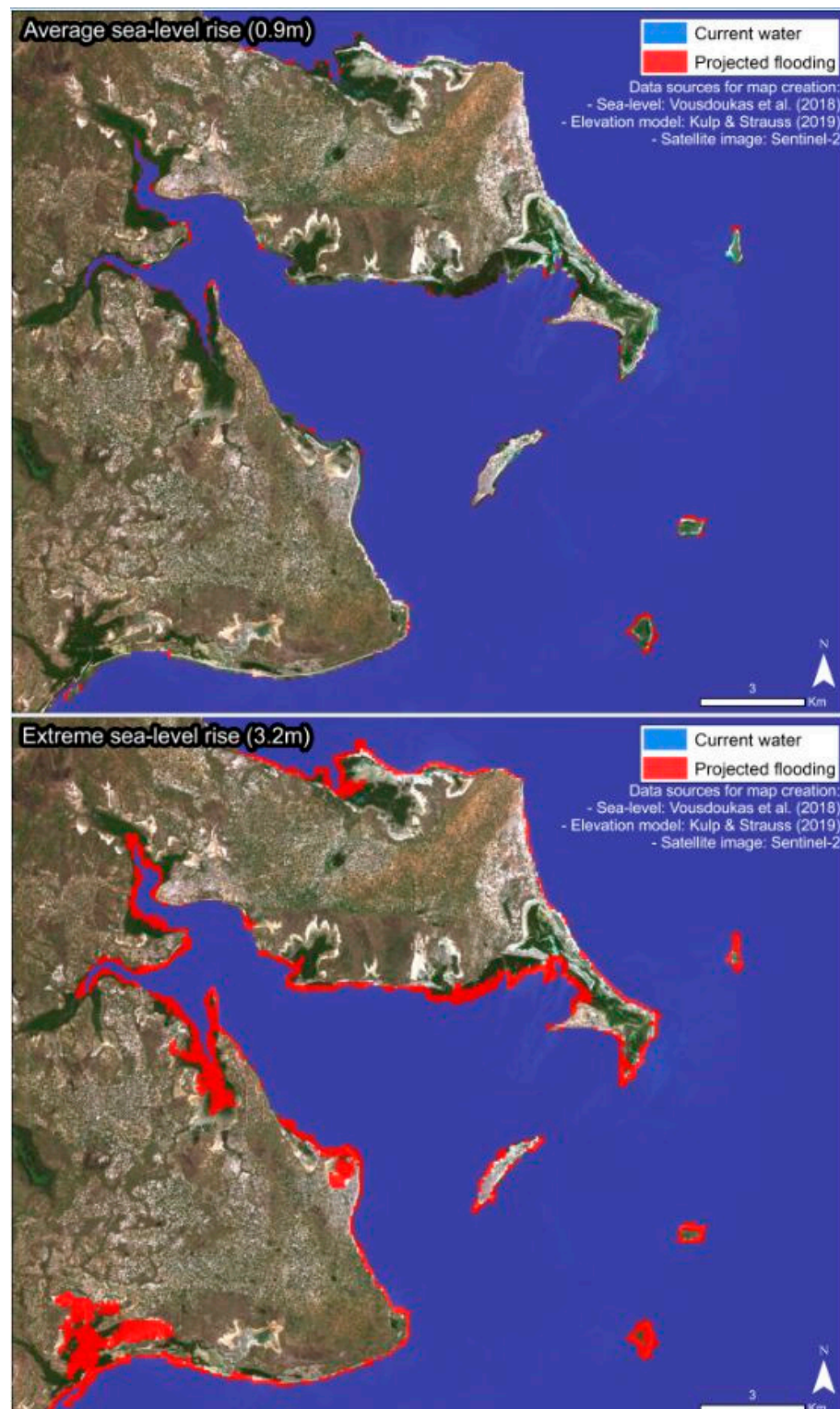
Figure 10. Sea level rise scenario. Credit: K.Westley/MCH in Northern Mozambique/RftD Network.

3.4.3. Outcomes

The work of the project has contributed a further strand to the MCH of Mozambique Island, and one that has resonance beyond archaeological or paleo-environmental enquiry to tackle issues of climate change and resilience, livelihoods, and culture. As noted above, there are challenges of support, organisation, and logistics; however, there is also tremendous potential for MCH to act in support of decision-making, policy, and,

ultimately, livelihoods. To do so, its effective protection and promotion are crucial. There is a well-developed body of legislation for cultural protection, and its place has been articulated in policy documents such as Política e Estratégia do Mar in 2017 (POLMAR). The emergence of multiple, systematic attempts by heritage practitioners and the community to recognise, catalogue and describe MCH effectively answers POLMAR's assertion that a lack of information is available, and few investigations have been carried out in the area of MCH. The case can now be made for enhancing the protection offered to the Island by considering precedents set by natural assets, such as the establishment of Marine Parks that benefit both the environment and local economies. To fully protect the natural and cultural assets of such parks, it is essential that the MCH of local communities is integrated into the early stages of park development. Effective articulation by practitioners remains key to realising this aim.

4. Discussion: A Policy and Practice Paradigm Change

Together, the results of the four case studies presented in this paper have exemplified the vast benefits of understanding, documenting, utilizing, and protecting MCH as part of the marine environment, for the purposes of community and environmental resilience. In order to fully examine the results as a whole, the following section will discuss (1) the contributions of MCH presented in this work; (2) how these may be integrated into environmental frameworks as services; and (3) how this integration can be sustained in practice. To provide an example of the potential of regional policy to champion the work undertaken in these studies, (4) an examination of how MCH could fit within Tanzania's National Adaptation Plan (NAP) is presented. Finally, a summary of the primary lessons learned will conclude this work.

1.   MCH as part of the marine environment

All case studies gave evidence for both the vulnerability and the centrality of MCH for vulnerable coastal communities and the marine environment in East Africa. Through the use of taboo and customary regulatory frameworks in Northern Mozambique, the project 'Using Fishers Traditional Knowledge in Sustainable Development' showed how, if fully documented and understood, scientific and traditional knowledge systems can benefit each other through integrating cultural values and practices into management. In the project 'Much to Discover in Mida Creek', evidence was given for both the significance and fragility of the maritime cultural landscape as well as the necessity of MCH for socio-economic independence within the community. Further examples of this were built upon in Southern Mozambique in the project 'Social Learning in the Management of Ecosystem Services', whereby the interconnected biocultural heritage of coastal communities in the Chongoene District was shown to form the building blocks of natural and cultural diversity in coastal systems. Similarly, the project 'MCH in Northern Mozambique' exemplified how the connections between natural and cultural environmental concerns can inform community-led management of the coastal zone. Ultimately, understanding the significance of MCH for environmental protection is dependent on interdisciplinary research both within and outside of academia. In doing so, stringent definitions of MCH are tested and expanded into more practical and relevant understandings, which translate between communities, practitioners, and academics [3]. It is clear that the effective protection of the natural environment cannot occur through community exclusion. As such, the understandings of cultural heritage presented in these case studies encapsulate the inherent connections between sustainable development and livelihoods which, if fully realized, can catalyse the success of natural and cultural marine resource management.

2.   Integrating MCH within environmental frameworks

While the above studies exemplify how lines may be blurred between the understanding of nature and culture as part of a functioning maritime cultural landscape, each project also commented on difficulties in the practicality of measuring, monitoring, and valuing MCH alongside natural resources. An institutional lack of capacity at a governmental level

regarding the understanding of MCH not simply as a static resource to be protected but as a socio-economic and environmental service proved a significant challenge throughout the RftD network as a whole. As such, projects have focused on increasing communication and engagement both across intergenerational boundaries within communities and between community stakeholders, resource managers, and policy-makers.

The integration of MCH into ecosystem-based frameworks and management structures has been shown to be an essential step for the sustainability and survival of coastal communities [4,5,58], yet issues have been raised regarding siphoned translations of MCH as a cultural ecosystem service, as the resource is often only measured though tourism and recreation, as in the Chongoene project.

The previous literature has presented methodologies by which to understand the functions, services, and values of cultural heritage within environmental frameworks [59,60], and various examples exist regarding the practical integration of MCH into coastal management, such as Marine Spatial Planning and Marine Protected Areas, and policy frameworks, such as the Blue Economy and Blue Growth [58,61]. To build upon this work, the projects presented in this paper have exemplified the necessity to integrate, translate, and develop the role of community within the early stages of the identification and management of MCH resources. This is a particularly new aspect of marine resource management that moves away from the conventional implementation of multi-signatory international frameworks and policies and towards the co-creation of endemic, bottom-up, challenge-led management systems. This is a lesson that can be shared across natural and cultural marine resource management, not only as a method to integrate cultural heritage into marine management frameworks but also as a way to extend the longevity and sustainability of coastal systems for the communities who rely the most on them. A methodology by which to conduct this may be proposed through the integration of typically 'ecological' and 'cultural heritage' language to create interdisciplinary terminologies such as '*keystone communities*', referring to the centrality and dependence of communities and their livelihoods within socio-environmental food webs. In doing so, the biocultural heritage and traditional knowledge and practices of local people may be fully realized as a paradigm contributor to the functioning of socio-ecological systems. As such, communication and research between interdisciplinary communities may be enhanced.

3. The sustainability of utilising MCH within coastal systems

It is clear that the MCH of the EACZ is of direct importance to the sustainability of local communities [11,36,42]. Within this work, the direct contributions of MCH were shown to enhance socio-economic stability through traditional subsistence practices; social cohesion through the use and maintenance of spiritual practices and places; improved community resilience in the face of climate change through sharing practice and traditional ecological knowledge across cultural and demographic groups; and the development of economic independence through ecotourism. Despite such benefits, it is also clear that the role of MCH as a fundamental human right is directly threatened by climate change and population pressures [8,9,62–64]. Furthermore, the projects have uncovered a distinct lack of understanding, awareness, and capacity, both laterally across policy and governmental representatives and vertically across age, sex, and socio-economic demographics. Deficiency in the transgenerational transfer of traditional ecological knowledge, customary systems, and how this relates to environmental baselines was also identified as one of the main challenges limiting the communication between community knowledge and environmental challenges.

To extend the above benefits of MCH through generations, maintaining the sustainability of MCH as a part of a coastal system is fundamental. To do so within communities themselves, projects aimed to minimize oppositional constructs between particular demographics through group discussions and workshops, such as those undertaken in Chongoene. To enhance community awareness, materials were created for school curriculum use, such as the books created in Madagascar and the school curriculum material in Mozambique. To strengthen community initiatives, groups were supported as part of the

projects such as the Women's Group in Mida Creek. Along with the community, discussions are in place regarding the potential creation of an archaeological park, following the Embracing Social Learning Project in southern Mozambique, and a community-led MPA, following the project MCH in Northern Mozambique. It is clear through the use of community engagement and knowledge-transfer that MCH can be used as a tool for sustainability within a coastal system through engaging and integrating community protocols and practices within environmental protection measures.

4.   MCH in Regional Policy

In terms of integrating the above findings into policy, one study from RftD undertook a different approach, examining the inclusion of MCH as a climate adaptation priority in Tanzania's National Adaptation Plan (NAP). The NAP considers medium- and long-term adaptation needs to reduce vulnerability and build adaptive capacity[5]. Although various studies in the Network demonstrated the significance of community-centric management and stewardship for the sustainability of utilizing MCH within environmental frameworks, it was also deemed necessary to provide the foundation upon which such strategies can operate effectively through policy. To do so, a robust NAP is needed to ensure that priorities, challenges, and required resources are also identified at the national level.

Currently, MCH is largely omitted from states' NAPs. Including it as a priority could attract significant funding and support from the United Nations Framework Convention on Climate Change's (UNFCCC) Global Environment Facility, which would remove economic limitations on capacity building to preserve heritage and provide opportunities for green growth nationally, regionally, and locally. This could bolster the resilience of coastal communities to the negative effects of climate change. However, more than this, its inclusion facilitates the consideration of MCH's community-relevant values and the traditional knowledge systems that have developed around them, enabling their integration into multi-level adaptation efforts. For example, MCH has substantial scientific and environmental value as an essential indicator in monitoring change dynamics in natural habits and the cumulative impacts of climate change, the knowledge of which will largely be localized.

The findings of the presented studies in amalgamation with the other projects from RftD not only recommend that MCH should be included in NAPs as an adaptation priority but also emphasise that local input is required to execute successful adaptation plans, as an exclusively top-down approach constrains efforts. It recommends multistakeholder involvement, particularly the effective integration of local and indigenous communities, in drafting the NAP document to provide an additional bottom-up approach. This will ensure that MCH-related traditional knowledge systems are considered and integrated into adaptation planning at the national level, enabling a more holistic and accurate assessment of risks and responses. Concurrently, increasing community awareness and understanding of the broad values of MCH in the context of climate change will encourage the incorporation of measures to protect it within local and regional environmental frameworks.

The integration of MCH within the NAP is one step towards its protection regionally. It is also clear that a shift needs to occur in the methods by which MCH is monitored, measured, and managed over time, from the ground-up. Challenge-led, community-centric narratives are a key component for sustainability beyond the goals provided by international treaties. In this case, re-integrating cultural heritage into the management of the natural environment is less complicated, as the traditional silos between nature and culture created by academics and policy-makers are less prevalent.

5. Conclusions

The East African countries targeted by the RftD projects display a number of vulnerabilities and challenges, common to most countries in the Global South, that make it difficult to develop infrastructure, skills, and knowledge to manage MCH. The methodological and conceptual approach presented by RftD proposes to focus the study and protection of heritage on its potential to improve the development challenges of local communities, while

proposing sustainable ways of economic, political, ecological, and social governance. As a part of this, the role of MCH as an essential indicator of environmental change has been exemplified to be a useful, yet undervalued, resource for the survival of coastal ecosystems.

The four projects presented in this paper are representative of the main scientific, social, and policy gaps relevant to the cultural heritage and ecology of coastal systems, which were identified by the Rising from the Depths Network. As has become clear throughout these studies, marine heritage—whether in its natural, cultural, or combined bio-cultural assets —is an integral aspect of the coastal systems in East Africa and is essential for livelihood activities and ecosystem services.

Identifying and understanding the traditional knowledge of coastal communities regarding MCH is of primary urgency due to the rapid changes and development trends that result in its disappearance. The establishment of traditional knowledge-mapping tools and databases emerges then as an important necessity to study future resilience and adaptation plans. This should be complemented with capacity building and knowledge transfer programmes so the advantages and deficiencies of traditional knowledge in coastal systems are widely understood while they are linked to modern scientific approaches. Ultimately, understanding MCH within coastal systems policy relies upon the recognition of the roles of culture, heritage, communities, and biocultural heritage as part of a functioning ecosystem. To use the terminology of ecosystem services, provisioning, regulating, cultural, and supporting qualities need to be translated from the perspective of humans for the environment, as well as vice versa. Furthermore, the threats of climate change, population growth, and development pressures on coastal communities, including their cultural heritage, need to be included within environmental mitigation plans for the benefit of both people and the environment.

Such work will create the basis to establish a sustained dialogue between traditional knowledge holders, policy-makers, practitioners, and academics, ensuring traditional knowledge approaches to environmental change and MCH usage are fully recognised in the formulation of climate change policies and actions, as for instance within the National Adaptation Plans. These policies need to ensure effective local and indigenous community participation within their development. Traditional knowledge systems of coastal communities in East Africa can also inform adaptation policies and contribute to the elaboration of good practices, as has often been noted within the International Indigenous People's Forum on Climate Change (IIPFCC) and the Local Communities and Indigenous Peoples Platform (LCIPP).

Finally, the projects discussed here, together with the wider outcomes of the Rising from the Depths Network, are beginning to demonstrate how sustainable development and climate change adaptation strategies can benefit from understanding the importance of local community connections with the tangible and intangible MCH within coastal ecosystems. Integrating MCH into environmental management strategies, and sustaining dialogue between local knowledge and wider conventional social and natural sciences, can contribute to the effective formulation and implementation of regional and international policies. Without respecting local traditions and without community support, input, and understanding, climate mitigation plans and sustainable development initiatives can only fail in the long term.

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Notes

1. https://risingfromthedepths.com/ (consulted on 1 April 2022).
2. https://risingfromthedepths.com/research-publications-2/ (consulted on 1 April 2022).
3. https://kipepeo.org/ (consulted on 16 March 2022).
4. https://www.millenniumassessment.org/en/index.html (consulted on 7 March 2022).
5. https://unfccc.int/topics/resilience/workstreams/national-adaptation-plans/overview (consulted on 14 March 2022).

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