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# INTEGRATED MARINE AND COASTAL MANAGEMENT IN THE WESTERN INDIAN OCEAN: TOWARDS A SUSTAINABLE OCEANS ECONOMY

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*African perspectives. Global insights.*

## SOUTH AFRICAN INSTITUTE OF INTERNATIONAL AFFAIRS

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## ABSTRACT

The Western Indian Ocean (WIO) region has valuable and diverse coastal and marine resources, but much of its natural capital is either threatened or declining. As countries in the WIO region gear for a sustainable oceans economy, there is an urgent need for effective tools to ensure the resilience of coastal and marine biodiversity, to regulate sustainable resource use and to protect the livelihoods of millions of people. To achieve this, anticipatory approaches such as ecosystem-based, integrated resource management and coastal and marine spatial planning need to be used to promote sustainable Blue Economy pathways in the WIO, and facilitate the management of ecosystems and biodiversity in regional spatial planning. This essentially consists of designating and expanding effective marine protected areas (MPAs) and other priority areas for conservation, as well as including community-based models for sustainable management.

This paper addresses some key governance challenges in the WIO region related to the inclusive management needed to ensure that resource management approaches, specifically in and around MPAs, produce outcomes for nature and for people. Key to their success is the ability to demonstrate and enhance socio-economic development benefits and to communicate these benefits through thorough economic valuations. Attention must focus not only on expanding protected areas' coverage but also on enhancing the capacity of management agencies and communities to govern conservation spaces effectively and attract sustainable, long-term financing. Collaborative partnerships around the conservation and sustainable management of in-shore marine resources can significantly contribute to meeting the region's national development targets, the AU's Agenda 2063, the commitments set out in the 2030 global development agenda and the Aichi targets of the UN's Convention on Biological Diversity.

## ABOUT THE AUTHOR

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AIMS | Africa's Integrated Maritime Strategy |
| ASCLME | Agulhas and Somali Current Large Marine Ecosystems |
| BANP | Bazaruto Archipelago National Park |
| BCC | Benguela Current Commission |
| BMU | Beach Management Unit |
| CBD | Convention on Biological Diversity |
| CBNRM | community-based natural resource management |
| CCA | community conservation area |
| CMSP | coastal and marine spatial planning |
| EBA | ecosystem-based adaptation |
| EBM | ecosystem-based management |
| UNECA | UN Economic Commission for Africa |
| EEZ | exclusive economic zone |
| EMF | environmental management framework |
| ESIA | environmental and social impact assessment |
| GDP | gross domestic product |
| GIS | geographic information system |
| HDI | Human Development Index |
| ICM | integrated coastal management |
| IPCC | Intergovernmental Panel on Climate Change |
| IUCN | International Union for the Conservation of Nature |
| LME | large marine ecosystem |
| LMMA | locally managed marine area |
| MBREMP | Mnazi Bay-Ruvuma Estuary Marine Park |
| MPA | marine protected area |
| MSP | marine spatial planning |
| NGO | non-governmental organisation |
| RSOCR | Regional State of the Coast Report |
| SAP | strategic action programme |
| SDG | Sustainable Development Goal |
| SEA | strategic environmental assessment |
| TDA | transboundary diagnostic analysis |
| UNEP | UN Environmental Programme |
| WAVES | Wealth Accounting and the Valuation of Ecosystem Services |
| WIO | Western Indian Ocean |
| WIOMSA | Western Indian Ocean Marine Science Association |

## INTRODUCTION

The 'Oceans Economy' or 'Blue Economy' concept is being developed and expanded globally to sustainably harness all coastal and ocean wealth. As many terrestrial opportunities have already been exploited, the ocean has become a new frontier for economic growth and socio-economic transformation. As a result an increasing number of African states are formulating national Blue Economy strategies and road maps to diversify their economic base to further include ocean and coastal goods and services. In the past few years, in an attempt to unlock the economic potential of the ocean in a sustainable manner, the governments of the Seychelles and Mauritius have adopted the Blue Economy concept, and South Africa has introduced Operation Phakisa. The African continent is at a crossroads, presented with the opportunity to re-evaluate its development pathway within the context of the Blue Economy while balancing socio-economic, political and environmental considerations.

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The delivery of ecosystem services – the market and non-market natural services provided to us by nature – is inextricably linked with the sustainability of key industries within the Blue Economy. Therefore, at its core, the Blue Economy approach is premised on the sustainable use, management and conservation of aquatic and marine ecosystems and associated resources. Unless the environment is carefully explored and monitored, the potential benefits of an ocean-based economy will be diminished. This requires a 'toolbox' of integrative, adaptive and participatory processes. Existing and new strategies need to bring together multiple ocean users at various levels to make informed and coordinated decisions about how to use marine resources sustainably and equitably. These anticipatory tools need to be quickly adopted and implemented to better support the Western Indian Ocean's (WIO) current and forward-looking vision towards a truly sustainable Blue Economy. This research paper highlights the advantages of integrated, area-based, spatial planning frameworks such as coastal and marine spatial planning (CMSP) and integrated coastal management (ICM), which allow for areas of importance to be prioritised for their ecosystem service functions and their benefits to community livelihoods. It brings to the fore the importance of ecosystem-based management (EBM), which recognises the full range of social, ecological and economic interactions within an ecosystem rather than focusing on individual uses and species. This includes the establishment of marine protected areas (MPAs) – widely advocated as an effective tool for securing and restoring the health of our oceans and coasts. Conservation zones are especially pertinent in an environment hoping to withstand additional climate, population and extraction pressure and demands. The paper also considers other adaptive spatial planning tools and mechanisms that can be used to ensure compatibility with a variety of resource users and minimise resource trade-offs. These frameworks must be enhanced to help develop regional environmental management solutions for sustainable development within the WIO.

An essential component of a Blue Economy strategy for the WIO is a deepened regional commitment to ensuring the collective stewardship of its marine heritage, based on common principles and actions embedded in the WIO's coastal and marine policies and frameworks, such as the Nairobi Convention and the AU's 2050 Africa's Integrated Maritime Strategy (AIMS). These frameworks emphasise the need to expand holistic,

broad-based approaches to managing the entire exclusive economic zone (EEZ)[1] of the WIO. They also highlight the need to integrate biodiversity conservation into regional development practices. Aligning local and regional spatial planning with wider global challenges is critical to the delivery of the SDGs.

The focus of this paper is the countries of Eastern and Southern Africa that border the Indian Ocean. This region, the WIO, encompasses tropical and subtropical areas of diverse nature along nine countries' coastlines. It harbours biodiversity of global significance, characterised by high regional endemism. For the purposes of this paper emphasis is placed on, and examples are drawn from, the marine and coastal governance of mainland states within the region, including Kenya, Tanzania, Mozambique and South Africa.

The natural systems of the WIO are under immense pressure from rapid resource exploitation and habitat degradation through activities associated with oil and gas extraction (see Box 1, p.8); small-scale, artisanal and commercial fishing; maritime trade; mineral extraction from the coast and seabed; tourism; and new developments such as aquaculture and renewable energy projects. While these sectors present significant economic opportunities, the potential impacts and trade-offs associated with Blue Economy-related development must be considered carefully. Integrated spatial planning formulation is therefore particularly timely in the WIO, with the long-term ambition of member states' being to ensure that marine conservation is central to ocean use and planning, with nature conserved both for its biodiversity value and for its socio-economic benefits to communities. There are key opportunities for WIO member states to better incorporate conservation planning and MPA tools within their Blue Economy road maps, and to use these approaches to guide environmental management and activities within the context of rapidly developing sectors and industries.

Africa's marine conservation agenda cannot be seen as separate from its development agenda, as healthy marine ecosystems effectively underpin the long-term development of any ocean economy

This paper will attempt to produce evidence to illustrate how effective (inclusive, science-based and equitable) the conservation of ecosystems needs to be in order for all users to continue to enjoy, and increase, the benefits they receive from the ocean. The term 'conservation', particularly in developing countries, often has negative connotations and is suggestive of elitist preservation of ecosystems by privileged groups for their enjoyment of the natural environment. This paper will illustrate MPA success stories and highlight the true value of the environment, beyond the biodiversity benefits. This includes the market and non-market value of ecosystems and their services, which go largely unmeasured by traditional economic indicators but are widely used to alleviate poverty and reach the SDGs of all countries. Africa's marine conservation agenda cannot be seen as separate from its development agenda, as healthy marine ecosystems effectively underpin the long-term development of any ocean economy. Blue Economy planners and African decision makers must include these benefits within their development choices. This will in turn help justify their conservation decisions and attract additional investment to coastal and

1 The EEZ is the sea zone prescribed by the UN Convention on the Law of the Sea over which a state has special rights in terms of exploration and use of marine resources. It extends for 200 nautical miles from the baseline of the coast. An EEZ is an area subject to national jurisdiction.

marine conservation, thus making alternative, less sustainable economic activities less appealing.

## OVERVIEW OF THE WESTERN INDIAN OCEAN REGION

The WIO encompasses rich diverse tropical and subtropical areas along the coastlines of Somalia, Kenya, Tanzania, Mozambique and South Africa. This region also comprises vast oceanic areas and the island states of Madagascar, Seychelles, Comoros, Mauritius and Réunion. This paper focuses on the marine and coastal governance of mainland states in the region.

The WIO region has distinctive geomorphological and oceanographic features,[2] with unique characteristics of high biodiversity in both species and ecosystems. This makes it one of the most important ocean regions of the world. The Regional State of the Coast Report (RSOCR) for the WIO,[3] published in 2015 by the UN Environmental Programme (UNEP) and the Western Indian Ocean Marine Science Association (WIOMSA), describes the WIO's extensive and dynamic intertidal zone. This zone supports a wide diversity of habitats such as mangroves, seagrass meadows, sandy beaches, rocky shores and shallow corals, which in turn allow rich marine biodiversity with more than 11 000 documented species.[4] These vary from phytoplankton and zooplankton to several thousand species of larger invertebrates and fish. Many of these, such as tuna, lobster, shrimp, oysters and clams, are of economic importance. The region is also home to numerous iconic species, such as the coelacanth, dugong, turtles and many species of cetaceans.

The natural systems of the WIO are under immense pressure from increasing resource exploitation, habitat degradation and population growth. The combined population of WIO states in 2014 was approximately 212.6 million and is expected to double by 2050.[5]

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2 Paula J, 'Executive summary', in UNEP (UN Environment Programme) & WIOMSA (Western Indian Ocean Marine Science Association), *Regional State of the Coast Report: Western Indian Ocean*, June 2015, http://web.unep.org/nairobiconvention/regional-state-coast-report-western-indian-ocean-0, accessed 27 March 2017.

3 Bosire J *et al.*, *Regional State of the Coast Report: Western Indian Ocean: A Summary for Policy-makers*, UNEP & WIOMSA, 2016, http://web.unep.org/nairobiconvention/sites/unep.org.nairobiconvention/files/summaryrsocr_printedition.pdf_edited.pdf, accessed 27 March 2017.

4 Samoilys M *et al.*, *Resilience of Coastal Systems and Their Human Partners: Ecological and Social Profiles of Coastal Systems in Kenya, Mozambique and Tanzania.* Nairobi: IUCN (International Union for the Conservation of Nature) ESARO (Eastern and Southern Africa Regional Office), WIOMSA, CORDIO (Coastal Oceans Research and Development in the Indian Ocean) & UNEP Nairobi Convention, 2015, https://www.iucn.org/sites/dev/files/import/downloads/resilience_of_coastal_systems_and_their_human_partners_final_version.pdf, accessed 13 April 2017. Over 11 000 marine fauna are currently recorded from the WIO region (island states included). The species inventory is, however, incomplete, and there are large gaps in the data set.

5 Bosire J *et al.*, *Regional State of the Coast Report: Western Indian Ocean: A Summary for Policy-makers*, UNEP & WIOMSA, 2016, http://web.unep.org/nairobiconvention/sites/unep.org.nairobiconvention/files/summaryrsocr_printedition.pdf_edited.pdf, accessed 27 March 2017.

Some 60 million people inhabit the coastal area of the WIO region, with large coastal urban settlements such as Dar es Salaam and Khartoum.[6] This region is highly vulnerable to large-scale climatic phenomena, especially the El Niño southern oscillation. This is accompanied by sea level variations, wind and precipitation.

**BOX 1** THE SUSTAINABLE MANAGEMENT OF THE OFFSHORE GAS INDUSTRY IN THE WIO

Many of the countries of the WIO region are experiencing new development opportunities, such as the offshore gas industry. Over the past 10 years, oil and gas exploration in the region has led to discoveries in seven countries, totalling billions of barrels of oil and trillions of cubic feet of gas. Significant finds include more than 600 million barrels of oil reserves in Kenya; 3.5 billion barrels of oil reserves in Uganda; 125 trillion and 7 trillion $ft^3$ of gas in Mozambique and Tanzania respectively; and 60 billion $m^3$ of methane gas in Rwanda.[a] According to Brownfield and others,[b] there is potentially a great deal more gas and oil to be found elsewhere in parts of the WIO that cover mainland Africa, western Madagascar and the Seychelles Plateau. Although important measurable economic benefits can come from these discoveries, any offshore oil and gas-related structures are likely to have environmental and social impacts. These may include interference from seismic surveys and drillships, floating liquefied natural gas plants, offshore oil and gas production platforms and seabed feed pipelines. All of which lead to increased noise for migrating species, discharged drilling muds and fluids, and the resultant degraded seawater quality around drilling platforms. In the cases where there have been oil discoveries, the impacts are potentially much larger and emergency processes must be developed at both national and regional levels in the event of a spill. Awareness development and capacity building are desperately needed in the WIO region, both for environmental regulators and for those charged with developing contracts and agreements with energy sector investors. There is also an urgent need to establish a rigorous fiscal regime with transparent tracking of generated income. In this regard there is a call for the enhanced participation of civil society watchdog organisations to help ensure equitable distribution of benefits.

a Van Wyngaardt M, 'East Africa oil, gas discoveries will lead to greater economic growth', *Engineering News*, 25 July 2015, http://www.engineeringnews.co.za/article/east-africa-oil-gas-discoveries-will-lead-to-greater-economic-growth-2015-07-29/rep_id:4136, accessed 13 April 2017.

b Brownfield ME *et al.*, *Assessment of Undiscovered Oil and Gas Resources of Four East Africa Geologic Provinces*. World Petroleum Resources Project, 2012–3039. Reston: US Geological Survey, 2012.

6 UN-HABITAT, *The State of African Cities 2014: Reimaging Sustainable Urban Transitions*. Nairobi: UN-HABITAT, 2014.

Despite promising economic growth projections for many countries in the WIO, poverty levels are high, in terms of both per capita gross national income and the Human Development Index (HDI). Mozambique has the lowest ratings in the WIO with an HDI score of 0.416, which in 2014 ranked it 180th globally. Kenya's HDI score was slightly higher at 0.548 (145th) and Tanzania's was at 0.521 (151st).[7]

## INTEGRATED MANAGEMENT AND CONSERVATION OF THE COASTAL AND MARINE AREAS OF THE WESTERN INDIAN OCEAN

Although certain policies are already incorporated into existing national and regional frameworks, policymakers in WIO countries must consider strengthening these tools to improve the governance of marine and coastal resources. This in turn will guide environmental management in the context of rapidly developing sectors and industries.

A suite of optional fishery and conservation management requirements and best-practice principles can be further entrenched in a region-wide Blue Economy plan. Examples include:

- developing and using space-based mechanisms for integrated planning and management to regulate marine usage and minimise trade-offs[8], with an emphasis on MPAs and conservation zones;
- incorporating ecosystem-based approaches to avoid managing species in isolation, including transboundary ecosystem-based adaptation (EBA) for large marine ecosystems (LMEs);
- promoting community-based models for conservation and management;
- improving analysis of the value of ecosystems and their contribution to livelihoods;
- collecting data and instituting scientific baselines to enhance informed decision-making; and
- obtaining innovative sources of financing to support the WIO's conservation initiatives.

## INTEGRATED RESOURCE MANAGEMENT AND SPATIAL PLANNING

### Coastal and marine spatial planning

It is imperative to better understand the use patterns and spatial linkages both within the marine domain and between maritime, coastal and inland domains. Various approaches can ensure that processes integrate multiple needs and uses, different sectors, stakeholders and management styles, over the entire EEZ and beyond. These spatial approaches generally make use of maps to create a more comprehensive picture of a marine or coastal area,

7 UNDP (UN Development Programme), 'Human Development Reports' (1980–2015), http://hdr.undp.org/en/data, accessed 14 December 2016.

8 The concept of trade-offs is a basic principle in economics that arises from the idea that resources are scarce and that a land-use choice to favour one approach may have an opportunity cost for another. For example, the choice to mine in a particular area will have implications for the surrounding environment and for water resources.

identifying where and how an area is being used and what natural resources and habitats exist. In this regard, broad lessons can be applied from land-based economic development.

CMSP is defined as a public process of analysing and allocating the spatial and temporal distribution of human activities in marine and coastal areas to achieve ecological, economic and social objectives that are usually brought about through a political process.[9] Essentially this is a future-oriented process – a mechanism to avoid conflict and select appropriate management strategies to maintain and safeguard necessary ecosystems.

If effectively implemented, CMSP can identify important biological and ecological areas, and ensure that biodiversity objectives are incorporated into decision-making. It can identify compatible uses within the same area of development and improve capacity to plan for new and changing human activities, including emerging technologies and their associated effects. It is able to identify improved opportunities for community and citizen participation, as well as the impact of decisions on the allocation of ocean space for communities, employment and the distribution of income. For example, CMSP involves specifying areas closed to fishing or other human activities; designating MPAs and zoning areas for specific uses, such as wind farms, military operations, sand and gravel mining, waste disposal, marine transportation and offshore aquaculture; or zoning areas by objective, such as development areas, conservation areas and multiple use areas.

The principal output of this tool is a comprehensive spatial management plan for a coastal marine area or ecosystem. This sets out general priorities for the area and time frames for their implementation (usually with a 10- to 20-year horizon). These spatial management plans are normally implemented through a zoning map, with accompanying regulations. ICM and marine spatial planning (MSP) are now formal processes in many WIO countries, at various stages of development and planning. South Africa, for example, is most advanced, with the formulation of the Marine Spatial Planning Bill (currently under review to provide the basis for the development of a marine spatial plan for South Africa's EEZ).[10] This bill was submitted to Parliament in February 2017.

### Integrated coastal management

CMSP is similar to ICM. Both are integrated, strategic and participatory – and both aim to maximise compatibilities between human activities and nature. ICM has evolved in various stages in different countries of the WIO. In 2008 South Africa formally adopted the Integrated Coastal Management Act, which was further amended in 2014 (Act 36 of 2014), to manage its coastal and estuarine environments more holistically. Other countries, such as Tanzania, have national integrated coastal management strategies and district ICM plans. An ICM protocol, under the Nairobi Convention, is also currently under development, with a regional framework for integrated climate change adaptation

9 Ehler C & F Douvere, *Marine Spatial Planning: A Step-by-Step Approach Toward Ecosystem-based Management*. Paris: UNESCO Intergovernmental Oceanographic Commission, 2011.

10 South Africa, Department of Environmental Affairs, Draft Marine Spatial Planning Bill 2016, http://www.gov.za/sites/www.gov.za/files/39847_gon347.pdf, accessed 2 April 2017.

and mitigation, and for large ecosystem management. See Box 2 for additional information on regional and global frameworks and conventions dealing with the management of marine and coastal resources.

While progressive ICM legislation exists in many countries, implementation is slow and often not upheld. There are other challenges as well. For example, while South Africa's ICM Act regulates the coast and ocean up to 12 nautical miles, there is not a cohesive framework for managing activities outside that area, hence the process currently under way to develop an oceans act that covers the entire EEZ. In many developing countries, officials are not capacitated or trained to carry out coastal zone legislation. Funding for the coastal zone also often competes with terrestrial resource management projects or is focused on climate change responses to protect infrastructure. Although not mutually exclusive, these strategies divert funding and focus and should be budgeted for separately.

**BOX 2** RELEVANT REGIONAL AND GLOBAL FRAMEWORKS DEALING BROADLY WITH MANAGEMENT OF THE MARINE SECTOR

Numerous regional policy frameworks deal with sustainable fisheries management and conservation. The AU has referred to the Blue Economy as the maritime dimension of the African Renaissance, while the AU's Agenda 2063 envisages Africa's Blue Economy as a major contributor to continental transformation and growth. At the heart of this shift is the 2050 AIMS, a comprehensive plan that aims to 'foster more wealth creation from Africa's oceans, seas and inland water ways by developing a thriving maritime economy and realising the full potential of sea-based activities in an environmentally sustainable manner'.[a]

The AU has put in place a number of instruments to support fisheries and aquaculture management. These include the NEPAD Action Plan for the Development of African Fisheries and Aquaculture, the Comprehensive Reform Strategy for African Fisheries and the Conference of African Ministers of Fisheries and Aquaculture. The AU's plans also include an AU-based African Fisheries Reform Mechanism and the African Charter on Maritime Security, Safety and Development, adopted in 2016 in Togo. Additionally, reference is made to marine conservation in the Food and Agriculture Organization's Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Alleviation[b] and the UN Economic Commission for Africa's Africa Blue Economy Policy Handbook.[c]

Apart from the UN's CBD, there is also a series of other binding international conventions related to the sustainable management of marine and coastal resources. These include the Ramsar Convention; the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (Nairobi Convention); the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78); the African Maritime Transport Charter; the African Convention on the Conservation of Nature and Natural Resources; and the World Heritage Convention. An important development with regard to the resources of areas beyond national jurisdiction is the recent decision by the UN's General Assembly (Resolution 69/292 of 19 June 2015) to

develop an international, legally binding instrument on the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction.

a AU, '2050 Africa's Intregrated Maritime Strategy', Version 1, 2012, p. 10, http://cggrp.org/wp-content/uploads/2050-AIM-Strategy_EN.pdf, accessed 26 April 2017.

b FAO (Food and Agriculture Organization), 'Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication', http://www.fao.org/3/a-i4487e.pdf, accessed 7 April 2017.

c UNECA (UN Economic Commission for Africa), *Africa's Blue Economy: A Policy Handbook*, 2016, http://www.uneca.org/publications/africas-blue-economy-policy-handbook, accessed 7 April 2017.

## Marine protected areas: Objectives and design

Although they have evolved over time (see Box 3), MPAs are areas designated for the protection of coastal and marine ecosystems, processes, habitats and species, which can contribute to the restoration and replenishment of resources for social, economic and cultural enrichment.[11] MPA sites, of whatever type, must safeguard or enhance ecosystems and their services to a degree that would not happen without such an intervention. Other objectives of MPAs include support for better fisheries management and resource utilisation.[12] They play an important role in protecting critical sites and growth areas for the reproduction of species (to provide spill-over addition in adjacent areas).[13] MPAs are thus an important tool in ensuring stock replenishment, long-term food security and fishing-related livelihoods. In addition, they provide sites for nature-based recreation and tourism, undisturbed reference sites serving as a baseline for scientific research, and protection for coastal communities against natural disasters such as tsunamis and tropical storms. This is important for a region such as the WIO that is highly susceptible to coastal climate impacts, especially with a high percentage of its population living within 25 km of the shoreline.[14]

11 Reuchlin-Hugenholtz E & E McKenzie, *Marine Protected Areas: Smart Investments in Ocean Health*. Gland: WWF (World Wide Fund for Nature), 2015, p. 5.

12 Hockey PAR & GM Branch, 'Criteria, objectives and methodology for evaluating marine protected areas in South Africa', *South African Journal of Marine Science*, 18, 1, 1997, pp. 369–383.

13 This spill-over effect applies to larvae, juvenile and adult fish moving beyond MPA boundaries; see Lester SE *et al.*, 'Biological effects within no-take marine reserves: A global synthesis', *Marine Ecology Progress Series*, 384, 2009, pp. 33–46.

14 In 2000 the percentage of people living within 25 km from the sea was 33% in Mozambique, 13.6% in Tanzania and just 6% in Kenya. See UNEP/Nairobi Convention Secretariat & WIOMSA, 'Regional Synthesis Report on the Status of Ratification and Implementation of International Environmental Conventions Relevant to Land-based Activities and Sources of Pollution of the Coastal and Marine Environment of the WIO Region'. Nairobi: UNEP, 2009, p. 6.



Oudekraal forms part of South Africa's marine protected areas network

MPAs include a medley of management approaches and conservation outcomes,[15] such as legally gazetted marine reserves, fully protected marine areas, no-take zones, marine sanctuaries, marine parks and locally managed marine areas (LMMAs). These have different levels of protection, and the range of activities allowed or prohibited within their boundaries varies considerably – from strict, exclusionary protection to managed seascapes that include a degree of sustainable utilisation. For example, marine conservancies are set up mainly to pursue biological conservation objectives, while marine parks are multi-use, with small no-take zones within larger sustainable use areas. This is the case in the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP) in southern Tanzania and in the Quirimbas National Park in northern Mozambique, where fish sanctuaries have been established and no-take areas represent 0.05% of the total marine area of the park.[16] The more inclusive

15 Spalding MD, Kainuma M & L Collins (eds), *World Atlas of Mangroves*. London: Earthscan, 2010.

16 Hoegh-Guldberg O *et al.*, *Reviving the Ocean Economy: The Case for Action – 2015*. Gland: WWF International, 2015.

design of these management approaches helps to distribute the social and economic costs of protected sites.[17]

**BOX 3** THE EVOLUTION OF MARINE CONSERVATION AND MPAS GLOBALLY

The concept of marine conservation is by no means new, and regulated marine usage by indigenous people far precedes the evolution of the Western concept of 'marine protected areas'. Many MPAs were established in the post-colonial era, and replaced these traditional systems with state-led, centralised approaches that had little community or stakeholder involvement. Early MPAs tended to be small no-take areas designed as a tool for piloting a science-based 'critical marine habitats' approach, aimed at conserving the most important ecosystems, endangered and charismatic species and high-profile habitats. Also, many MPAs were created as fisheries management tools, providing a spillover of eggs and larvae to repopulate surrounding fishing areas.

Over the years the objectives of MPAs have evolved to reconcile the long-term protection of biodiversity with sustainable human use, increasingly viewed as a means to meet a wide range of social-development needs and to support wealth generation. Thus, by the 1990s the emphasis had shifted to larger, multiple-use sites, based on more participatory forms of management.[a] Some of these areas were established in an ad hoc fashion, while others underwent long-term, systematic MSP processes for species- or habitat-specific values.

MPAs' principles and methodologies have shifted over time, with better science and information available to guide their establishment and design, and attention has turned to the qualitative aspects of MPA governance, such as their effective and equitable management. The large marine ecosystem approach to planning, for example, is also now widely accepted, dismissing the management of species in isolation.

Well-designed and managed MPAs provide one of the most viable approaches to marine conservation and biodiversity preservation, and as a result they have increased in both number and size worldwide. By 2014 some 17 000 sites were awarded a degree of protection,[b] suggesting that the total ocean area under some form of protection is 3.4%. More recently, the UN's CBD Aichi Biodiversity Target 11 (described in Box 4) has had an impact on MPA coverage, with a significant increase in the number of very large MPAs. The 2011 Aichi Target requires that 'by 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, are conserved through effectively and equitably managed ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes'.

17 It must be noted here that significant questions remain around whether these MPAs are actually providing enough protection to marine ecosystems. Without large, enforced no-take areas, fish stocks are still going to be negatively affected by activities within the MPA.

According to the CBD, the precise level of MPA coverage is difficult to determine because of the many different governmental processes involved in MPA creation and management. The Marine Conservation Institute has calculated that the upper limit for global coverage of MPAs now stands at only 2.18%, and just under 0.2% of that coverage is located beyond national jurisdictions. Statistics for no-take areas, which offer the highest level of protection to biodiversity, are not available, but their area is considerably smaller. The best estimate for global no-take MPAs coverage is 1.03% of the world's oceans.[c]

As literature has evolved there is growing consensus that MPA coverage alone does not equate to well-designed and/or managed MPAs likely to achieve their objectives. Evidence suggests that effective MPAs require at least five key features, namely no-take, well enforced, old (more than 10 years since their establishment), large (larger than 100 $km^2$) and isolated by deep water or sand.[d] Also, many designated MPAs are not yet implemented with a management plan, regulations or legislation. Thus some MPAs are considered 'paper parks', where protection is compromised by inadequate capacity to manage the site, weak regulations and poor compliance.[e]

MPAs are also not the only places where spatially focused marine conservation takes place. Multiple spatial tools are available to marine ecosystems. These include fisheries management areas, no-go zones for de manage structive practices, coastal and estuary protection zones and ICM zones. This suite of different mechanisms, and a combination of effective tools, should form the basis of effective MSP. However, many of the tools mentioned above are not being fully utilised.

In the WIO, the first MPA was established in 1965 in Mozambique, and within three years Kenya and Madagascar followed suit. Today all WIO countries, except Somalia, have registered MPAs. Seventy-five MPAs[f] have been declared in the WIO region with a total coverage of 183 975 $km^2$. This number is still below what is hoped for under the Aichi targets of the CBD.[g] However, it is hoped that new agreements at local, national and regional scales of the WIO will support the international push to protect at least 10% of representative areas and habitats by 2020.

A WIO regional review on marine conservation successes in the WIO[h] mentions only a few examples of successful government-established MPAs. And according to Rocliffe *et al.*, only 29.6% of reef-related MPAs in the WIO are viewed as effective.[i] In countries such as Madagascar, Somalia, Tanzania, Comoros and Réunion, threats to reefs are particularly high, owing to overfishing and watershed-based pollution. Also, many MPAs in the WIO are located in uninhabited or low-population density areas, with no definite boundaries, which results in a lack of enforcement and abundant illegal activities such as dynamite fishing, overexploitation and poaching. Improved WIO governance frameworks, efficient institutions and regulatory mechanisms are therefore essential to this discussion.

a Rocliffe S *et al.*, 'Towards a network of locally managed marine areas (LMMAs) in the Western Indian Ocean', *PLoS ONE*, 9, 7, 2014.

b Juffe-Bignoli D *et al.*, *Protected Planet. Report 2014: Tracking Progress Towards Global Targets for Protected Areas*. Cambridge: UNEP World Conservation Monitoring Centre, 2014.

c Marine Conservation Institute, http://www.mpatlas.org/, accessed 7 April 2017.

d Edgar GJ *et al.*, 'Global conservation outcomes depend on marine protected areas with five key features'. *Nature*, 506, 2014, pp. 216–220.

e Such failure can often be the result of challenges with sustainable financing, lack of adequate capacity, or ineffective actions being taken to manage human activities in the area. Even well-resourced parks may be ineffective when they are not integrated with adequate management frameworks outside the boundary of the protected area.

f A WIOMSA survey listed 83 MPAs in the south-west Indian Ocean.

g Rocliffe S, Peabody S & M Samoilys (eds), *op. cit.*

h Obura DO & MA Samoilys, *Marine Conservation Successes in Eastern Africa*, CORDIO Status Report 2011. Mombasa: CORDIO East Africa, 2014.

i *Ibid.*, p. 7.

Marine and coastal conservation tools must be designed to protect unique, productive, vulnerable and diverse coastal and marine habitats (areas with high diversity, endemism and productivity, including spawning and nursery grounds, migration stopover points and bottlenecks), as well as areas of importance to vulnerable species

The objective for each site varies according to context-specific realities, as do the techniques used to sustainably regulate particular sites. These can include temporal tools to close areas during certain seasons or during critical events such as spawning; extraction control to regulate the amount, types and methods of fishing allowed; restoration activities such as reef rehabilitation, coral nurseries and transplantation; and participatory, co-management measures. Participatory processes also differ according to site variables and the particular presence and involvement of a variety of actors. Models can include community-managed areas; protected areas led by non-governmental organisations (NGOs), such as Cousin Island, managed by Nature Seychelles; private sector–community arrangements, such as Chumbe Island Coral Park off Zanzibar; and collaborative local government–community management areas, such as the fisheries community councils in Mozambique and beach management units in Tanzania and Kenya. The governance challenges related to each model will be discussed in more detail later.

## Planning for priority areas for protection and MPAs

This integrated spatial planning framework necessitates the identification of priority areas of action for environment management, within and outside formally protected areas. Marine and coastal conservation tools must be designed to protect unique, productive, vulnerable and diverse coastal and marine habitats (areas with high diversity, endemism and productivity, including spawning and nursery grounds, migration stopover points and bottlenecks), as well as areas of importance to vulnerable species. Many scientific guides now inform the criteria for protection, such as the Convention on Biological Diversity's (CBD) Ecologically or Biologically Significant Areas model, the International Union for the Conservation of Nature's (IUCN) Key Biodiversity Areas, and the Food and Agriculture

Organization's Vulnerable Marine Ecosystems approach. Van der Elst and Everett[18] also identify 59 geographic sites in the south-western Indian Ocean as biodiversity hotspots.[19] These areas are important because of their vulnerability to fishing pressure and their contribution to the region's biodiversity. They also act as baselines to monitor fishing's impact on the environment.[20] It is crucial to include these important habitats and species in the management plans and frameworks required by law in each WIO country.

**BOX 4** MEETING GLOBAL MARINE CONSERVATION TARGETS

The most important international legal instrument related to the establishment of MPAs is the UN's CBD, which includes objectives for both the conservation of biological diversity and the sustainable use of its components. In 2004, the CBD's decision-making body, the Conference of Parties, agreed that 'marine and coastal protected areas are an essential tool for the conservation and sustainable use of marine and coastal biodiversity'.[a] The CBD's 2011 Aichi Biodiversity Targets, as well as its Strategic Plan 2011–2020, require that 'by 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, are conserved through effectively and equitably managed ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes'.

Similarly, in 2014 the IUCN World Parks Congress's Promise of Sydney, supported by over 6 000 participants from 170 countries, recommended an 'urgent increase in the ocean area that is effectively and equitably managed in ecologically representative and well-connected systems of MPAs or other effective conservation measures by 2030; these should include strictly protected areas that amount to at least 30% of each marine habitat and address both biodiversity and ecosystem services'.[b] Motion 53 at the IUCN World Conservation Congress in September 2016 in Hawaii reiterated this target.[c]

The UN's post-2015 agenda, which includes the SDGs, also attempts to establish global ambitions, outline practical policy steps and guide investment in sustainable development for the next 15 years. SDG 14 focuses specifically on the ocean, aiming to conserve and sustainably use the oceans, seas and marine resources. Indicators under this goal address challenges such as habitat destruction, overfishing, illegal fishing and marine pollution.[d]

18 Van der Elst RP & BI Everett, 'Biodiversity hotspots in the southwest Indian Ocean', in ORI (Oceanographic Research Institute), *Offshore Fisheries of the Southwest Indian Ocean: Their Status and the Impact on Vulnerable Species*, Special Publication, 10, 2015, http://www.seaworld.org.za/uploads/files/Ch13-biodiversity_hotspots_(1).pdf, accessed 27 March 2017.

19 A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans.

20 Of the 59 hotspots, only 38 are fully protected and nine have no protection. Tanzania has 12 of these hotspots, including the MBRMP.

These internationally agreed targets, and others, are invaluable in accelerating action and investment in the establishment of MPAs. This is not just about the extent of the area protected but also about establishing representative networks of MPAs that are most important in delivering outcomes for biodiversity, food security and livelihoods. They play a significant role in galvanising efforts and mobilising new actors and funding for establishing protected areas. However, these goals have short time frames (until 2020) and should only be considered as interim goals. More ambitious, longer-term targets will hopefully be established, as was done for terrestrial protected areas. All WIO states have signed the UN's CBD and adopted Aichi targets. To date, however, overall compliance is low, with only 2% having been achieved in the WIO thus far.

Also, these targets give no indication of the stated objectives or design features of MPAs, the coverage of biodiversity or provision of ecosystem services, the level to which sites are being effectively or equitably managed, or their efficacy in achieving conservation outcomes. Although the Aichi targets call for attention to the most important areas, in reality many protected areas are not so targeted, and may in fact be selected on grounds of ease of establishment, political expediency or opportunism.[e]

South Africa ratified the CBD in 1992, and is thus bound by it. At present, 23.2% of the length of its coastline is protected through MPAs (9% of which are no-take), while less than 0.5% (by area) of its mainland ocean ecosystems are formally protected, compared to approximately 8% of terrestrial areas.[f] In 2016 the minister of environmental affairs published a draft notice to propose a network of 22 MPAs (20 new and two expanded MPAs) with the aim of creating approximately 70 000 $km^2$ of additional MPAs. This is a component of South Africa's oceans economy proposal, Operation Phakisa. If proclaimed, it will bring ocean protection within the South African EEZ to approximately 5%.

a Convention Biological Diversity, Conference of Parties decision VII/5, https://www.cbd.int/decision/cop/?id=7742, accessed on 26 April 2017.

b IUCN World Parks Congress, 'A strategy of innovative approaches and recommendations to enhance implementation of marine conservation in the next decade', http://cmsdata.iucn.org/downloads/promise_of_sydney_theme_marine.pdf, accessed 13 April 2017.

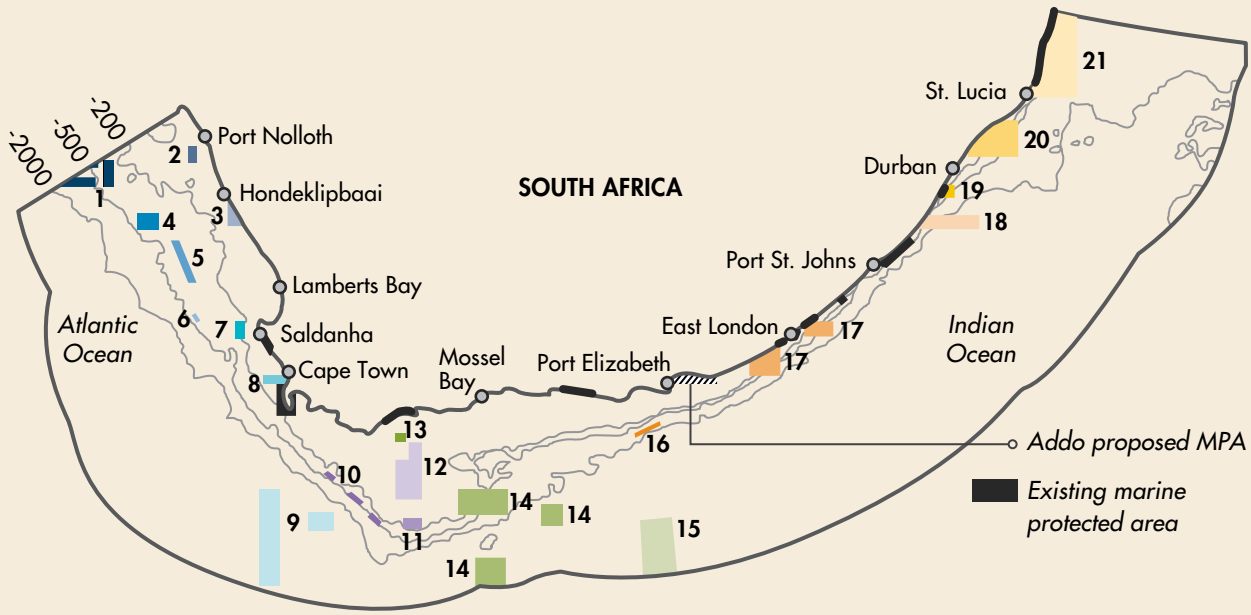
c IUCN, World Conservation Congress, 1–10 September 2016, Hawaii, https://portals.iucn.org/congress/assembly/motions, accessed 26 April 2017.

d UN, 'Sustainable Development Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources', http://www.un.org/sustainabledevelopment/oceans, accessed 26 April 2017.

e Devillers R *et al.*, 'Reinventing residual reserves in the sea: Are we favouring ease of establishment over need for protection?', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 25, 2015, pp. 480–504.

f Duncan J *et al.*, 'Oceans facts and futures: Valuing South Africa's ocean economy', Cape Town: WWF-SA, 2016, p. 6, http://awsassets.wwf.org.za/downloads/wwf_oceans_facts_and_futures_report_oct16.pdf, accessed 7 April 2017.

**FIGURE 1** OPERATION PHAKISA AND MPA DESIGNATION




| | | | | | |
|---|---|---|---|---|---|
| 1 | Orange Shelf Edge | 8 | Robben Island | 15 | Agulhas Front |
| 2 | Namaqua Fossil Forest | 9 | Southeast Atlantic Seamounts | 16 | Port Elizabeth Corals |
| 3 | Namaqua National Park | 10 | Brown Bank Corals | 17 | Amathole Offshore |
| 4 | Childs Bank | 11 | Brown Bank Complex | 18 | Protea Banks |
| 5 | Benguela Bank | 12 | Agulhas Bank Complex | 19 | Aliwal Shoal |
| 6 | Benguela Muds | 13 | Agulhas Muds | 20 | uThukela |
| 7 | Cape Canyon | 14 | Southwest Indian Seamounts | 21 | iSimangaliso Wetland Park |

Source: WWF-SA 2016, 'Oceans facts and futures: Valuing South Africa's ocean economy'. WWF-SA. Cape Town, South Africa, http://awsassets.wwf.org.za/downloads/wwf_oceans_facts_and_futures_report_oct16.pdf, accessed 7 April 2017

Besides key habitats and species, MPA design also must include a process for the identification and prioritisation of areas vital to ecosystem services. There is considerable value in defining, mapping and prioritising large-scale areas of critical importance for ecosystem services. These include areas that provide maximum benefits to people (many people and/or high value) and areas with high potential values (through improved management or restoration). Within these sites it is important to identify areas of absolute highest value for individual ecosystem services (for example, the most important blue carbon stores) and areas where multiple services and or multiple ecosystems provide combined high value. For example, the annual economic value of mangroves (income from the products and services they provide) has been estimated at $2,000–$9,000 per

hectare.[21] These areas and systems then need to be incorporated into legally gazetted conservation spaces, with no-take zones protecting sites of critical importance.[22]

Another design priority is to identify climate-change refugia (resilient locations that are buffered from climate impacts)[23] to reconfigure MPAs to include them. For example, as oceanographic regimes change and species move towards the poles in search of cooler water, MPA networks must be designed across latitudinal gradients in order to ensure the continual protection of species as their ranges change. Resilient habitats become ever more important under these circumstances. They need to be identified quickly and prioritised carefully for inclusion within MPA networks globally, and also within the context of the WIO specifically.[24] For example, Mozambique's northern reefs in the Quirimbas Archipelago are some of the healthiest, most resilient and diverse coral reef systems in the WIO, and it has been recommended that they be considered for special protection within a World Heritage site. Tanzania's reefs in Mnazi Bay, Mafia Island and the Songo Songo Archipelago are also highly diverse and resilient to climate change.[25]

To date, efforts to map areas important for ecosystem services in the WIO region have focused mostly on small spatial scales. There is an urgent need for region-wide models and maps, in order to understand the spatial distribution of value and the underlying social, economic and ecological drivers of change. Further debate is needed on the relative importance of MPAs in conserving or enhancing different natural services. It is thus important to develop spatial databases designed to be used alongside and in conjunction with protected areas databases.

### Addressing multiple objectives and potential trade-offs

Within the spatial framework, strategic environmental assessments (SEAs) and environmental management frameworks (EMFs) are useful mechanisms to balance multiple objectives and minimise trade-offs related to the management of natural resources. SEAs are particularly useful in many places in the WIO where important concerns overlap. Within the expanding Blue Economy framework there are numerous current and expected examples. These include the prospecting rights for marine phosphate granted by the South African Department of Mineral Resources in the country's EEZ, which cover more than 150 000 km$^2$, or 10% of the EEZ. The three prospecting

21 Spalding MD, Kainuma M & L Collins, *op. cit*.

22 Putting a price tag on ecosystems is a relatively new concept, backed up by the theory that the cost of damage to ecosystems cannot be assessed accurately if they have not been given a value in the first place. It is a contentious topic, as many analysts rightly declare that not all ecosystems can be valued using current economic models, and not all natural assets have a tangible 'provisioning' value.

23 The ecological principle of 'resilience' refers to communities that are able to recover after experiencing a stressful event such as coral bleaching or sea-level rise.

24 Morelli T *et al*., 'Managing climate change refugia for climate adaptation', *PLoS ONE*, 11, 8, 2016.

25 Samoilys M *et al*., *op. cit*.

areas overlap with a number of critically endangered ecosystems, existing fishing grounds and several proposed MPAs.[26] The Bazaruto Archipelago National Park (BANP) in Mozambique has challenges related to overlapping artisanal fisheries dependence, sensitive biodiversity (the dugong), gas exploration, tourism and the diving industry. In southern Mozambique there are proposals to develop a deep-water port in Techobanine. The site is in the Maputo Special Reserve and Ponta do Ouro Partial Marine Reserve, which are frequently visited tourist destinations and rich in marine life and endangered biodiversity. In Kenya, the Lamu Port and Transport Corridor – which is being developed to provide a second transport corridor to give Ethiopia, South Sudan and Uganda an outlet for their oil – is likely to cause irreversible environmental, social and demographic damage to what is an environmentally and culturally unique area.[27] In all these cases SEAs can be useful to assess a particular site's environmental policy and broader planning guidelines (for example, local spatial plans, municipal master plans, detailed plans and development plans). This approach is evident in Mozambique's draft coastal SEA,[28] which provides an overview of coastal zone dynamics and contains important recommendations for harmonising development and economic progress with the maintenance of natural coastal systems. It also identifies concerns that urgently need to be addressed in order to improve Mozambique's legislative framework for governing biodiversity in coastal areas.[29] At the local level there is also a localised SEA that has been initiated for the BANP to assess the costs and benefits of conservation. The BANP's management strategy (2014–2018) includes tools to reduce conflicts of interest and minimise environmental impacts.

SEAs and EMFs can also be used to inform the expansion of new industries, underpinned by robust environmental and social impact assessments (ESIAs). Mariculture, which is expanding in response to a growing market demand, must not repeat the mistakes made in Asia, where mangroves were cut down for pond construction. Without the protection offered by the mangroves, the 2004 tsunami caused far greater damage than it would have otherwise. The same can be said for the expanding offshore oil and gas industries of the WIO. (See Box 1.)

26 Currie J, 'Brief Overview of Potential Ecosystem Impacts of Marine Phosphate Mining in the Western Cape, South Africa', CER (Centre for Environmental Rights) 2013, http://cer.org.za/wp-content/uploads/2016/08/Ecosystem-Impacts-Report-WEB.pdf, accessed 27 March 2017.

27 Samoilys MA, Osuka K & GW Maina, 'Review and assessment of biodiversity values and priority areas for conservation along the Tana Delta–Pate Island coast, Kenya', in Obura DO & MA Samoilys (eds), *CORDIO Status Report 2011*, CORDIO East Africa, 2011, https://www.iucn.org/sites/dev/files/import/downloads/resilience_of_coastal_systems_and_their_human_partners_final_version.pdf, accessed 27 March 2017.

28 Mozambique, MICOA (Ministry of Coordination of Environmental Affairs), 'Presentation and discussion of the draft report of the Strategic Environment Assessment of Mozambique', http://www.oecd.org/dac/environment-development/SEA%20workshop_%20Mozambique.pdf, accessed 27 March 2017.

29 WIOMSA, 'Marine protected area of the Western Indian Ocean', http://www.wiomsa.org/mpatoolkit/Themesheets/Map_Eastern_Africa_to_Madagascar.pdf, accessed 13 April 2017.

### Multi-objective spatial planning

A recent guide produced by the University of Cape Town[30] gives further clarity on incorporating human dimensions and societal concerns into MSP and MPA management, highlighting the need to take account of context-relevant social vulnerabilities, poverty levels, culture and ethnicity. Marine conservation efforts must be nested within broader social management settings, linking the need for development and continued delivery of ecosystem service benefits with biodiversity conservation. Conservation and development agencies need to encourage multi-objective spatial planning as a means to avoid conflict and streamline benefit flows. Regional responses therefore should consider poverty-alleviation strategies, land-use priorities, ecological thresholds and vulnerability tipping points, as well as strategies to enhance communities' resilience.

### 'Reef to ridges approach'

MPAs function more effectively if they are linked to terrestrial protected areas, either as buffer zones or as part of an integrated regime. This is because they may be degraded by land-based activities, nearby fishing or the spread of pollutants. They may also depend on new life (eg, larvae) arriving from beyond their boundaries, or on nutrients, sediment or the migration of transient species from further afield, including from other protected areas. Equally, MPAs can exert a critical positive influence on their surroundings, generating fish for harvest, removing pollutants and supporting the survival or recovery of otherwise unprotected biodiversity. As a result it is important to adopt a 'reef to ridges' approach – involving territorial waters, river basins and catchments affected by coastal systems. The establishment of biosphere reserves has also become common practice within well-managed protected spaces. This approach attempts to develop a spatial hierarchy of core, buffer and transitional areas designed to reconcile the need for the long-term protection of natural and semi-natural ecosystems with human uses. Understanding the drivers and impacts of environmental change is essential to better devise and implement integrated policy responses to support ecosystem services and poverty alleviation.

### Use of technology

A geographic information system (GIS) allows us to view, understand and visualise data in ways that reveal relationships, patterns and trends in the form of maps, reports and charts. This makes information easily visible and accessible to a non-specialist audience. As GIS allows datasets to be overlaid, it also allows decision makers to gain a better understanding of geographical spaces so that informed decisions can be made. Currently, there are too few of these systems in the WIO region.

30 Sowman M, Raemaekers S & J Sunde, *Guidelines for Integrating Human Dimensions into MPA Planning and Management*. Cape Town: University of Cape Town, 2014, http://awsassets.wwf.org.za/downloads/hd_of_mpa_guidelines_full.pdf, accessed 27 March 2017.

### Transboundary resource collaboration

Sovereign countries with differing levels of socio-economic development and dependency on natural resources face challenges in aligning their national policy frameworks with emerging regional priorities. Although WIO member countries are closely connected geographically and on many other levels, their legal, institutional and policy frameworks are not adequately coordinated or integrated. Although efforts are under way to produce clearer, more coherent approaches to the management of shared coastal and marine resources, this is politically and practically difficult to achieve. Many living marine resources within the WIO are migratory, including tuna and billfish, and travel long distances through high seas and EEZ waters. Other species are more sedentary, but are still distributed across geopolitical borders. This requires the cooperative management of shared resources and habitats in the coastal zone and its terrestrial and marine surrounds. A regional approach is needed to regulate individual countries' harvesting activities, which may influence the opportunities of another.

The Nairobi Convention, signed in 1985, offers a legal platform for the protection, management and development of the marine and coastal environment in Eastern and Southern Africa. The convention is guided by the governments of the region through a network of national focal points and thematic groups of experts. Its decision-making organ, the Conference of Parties, is a biennial meeting that brings together WIO ministers and legal and technical experts in an attempt to strengthen policy coordination around key regional priorities. Task groups, comprising a variety of government and non-governmental actors, have been established to assist with information exchange and knowledge management, as these transboundary processes and appropriate management responses must be underpinned by strong and broad-based evidence.

Practically, the Benguela Current Commission (BCC) offers an example of how regional collaboration across Angola, Namibia and South Africa can be institutionalised. Established in 2007, the BCC emerged to support the Benguela Current LME approach, working towards an integrated, science-based and regional approach for the conservation, protection and sustainable use and management of this transboundary marine ecosystem.

### Ecosystem-based approaches to management

CMSP is best addressed through the application of EBA. EBA differs from approaches that focus on a single species, sector, activity or concern, as it considers the cumulative impacts of different sectors. According to a Marine Spatial Planning manual produced by UN Educational, Scientific and Cultural Organisation (UNESCO) and the Intergovernmental Oceanic Commission, 'EBA specifically emphasises the protection of ecosystem structure, functioning and key processes, and explicitly accounts for the interconnectedness within natural systems, recognising the importance of interaction between many target species

or key services and other non-target species'.[31] It acknowledges the interconnectedness of systems such as air, land and sea, and integrates ecological, social, economic and institutional perspectives, recognising their strong interdependences. EBA is applied to the planning and management of development and activities in the marine environment by safeguarding ecological processes and overall resilience, to ensure the environment has the capacity to support social and economic benefits (including those benefits derived directly from ecosystems).

Global LMEs are shared by two or more countries, underscoring the need for regional collaboration to advance sustainable development. This includes regulatory, institutional and decision-making aspects, as well as scientific information on conditions, contaminants and resources at risk within the geographic extent of the ecosystem.[32]

The WIO encompasses two of the world's 64 identified LMEs: the Somali Current LME, which extends from the Comoros Islands and the northern tip of Madagascar up to the Horn of Africa; and the Agulhas Current LME, which stretches from the northern end of the Mozambique Channel to Cape Agulhas. Nine countries share the resources of the Agulhas and Somali Current LMEs (ASCLME).

Various processes and tools are used to engage decision-makers and resource managers in the establishment of ecosystem-based priorities for transboundary issues. For example, transboundary diagnostic analysis (TDA) documents the environmental threats faced by the countries of the region and informs the development of a strategic action programme (SAP), which sets out a collective strategy for the future. The TDA identifies potential preventive and remedial actions, while the SAP enables cooperating nations to jointly determine what policy, legal and institutional reforms and investments are necessary to address the TDA priorities. In order for a TDA to be effective in developing an SAP it requires sufficient and accurate baseline data on a multitude of ecosystem-related parameters and issues. This will in turn inform management.

### Data and evidence to inform decision-making

Some of the main barriers to the development of a transboundary ecosystem management approach within the WIO are limited data for the ASCLME, the lack of regionally based and coordinated monitoring and information systems, and the lack of national and regional capacity. For example, there is insufficient information on ecosystem productivity, nutrient distribution, water quality parameters, larval transport, spawning and nursery areas that may require protection or management, and artisanal fisheries (in relation

31 'Marine Spatial Planning – A Step-by-Step approach towards Ecosystem-based Management', UNESCO (UN Educational, Scientific and Cultural Organisation) and the Intergovernmental Oceanic Commission (IOC), 2009, http://unesdoc.unesco.org/images/0018/001865/186559e.pdf, accessed on 12 May 2017.

32 Sherman K & G Hempel (eds), The UNEP Large Marine Ecosystem Report: A Perspective on Changing Conditions in LMEs of the World's Regional Seas, UNEP Regional Seas Report and Studies, 182. Nairobi: UNEP, 2009.

to catch effort, sustainability and management needs), as well as too little definition of certain critical oceanographic processes that are driving the ASCLME. Data is therefore needed in order to fill important information gaps for management purposes.

## ECONOMIC VALUATIONS OF MPAs AND OTHER CONSERVATION INITIATIVES

Oceans and coasts are highly valuable for a number of reasons. (See Box 5 for a full explanation of benefits.) However, despite the recognition of their value, conservation targets for marine and coastal spaces are lagging behind terrestrial conservation goals.

In many countries in Africa MPAs are awarded low priority because they are seen merely as biodiversity conservation tools and not recognised for their benefits in creating socio-economic opportunities. In some scenarios, conservation initiatives have even resulted in negative social consequences for local communities, including displacement and lost livelihood opportunities. The term 'ocean grabbing' has emerged to describe actions, policies or initiatives that deprive artisanal fishers of resources or dispossess vulnerable populations of coastal land. Not surprisingly, this has created resentment at conservation initiatives, with questions about their legitimacy and appropriateness. Considerable concern over and resistance to MPAs remain, in the WIO and elsewhere.[33] It is therefore imperative to highlight effective and well-implemented MPAs that produce tangible results and are valued appropriately.

### BOX 5 THE CRITICAL IMPORTANCE OF OCEANS AND COASTS FOR IMPROVED LIVELIHOODS

**Oceans regulate the weather:** Covering 70% of the Earth's surface, the oceans help to regulate the planet's climate and weather patterns through cycling critical greenhouse gases such as carbon dioxide ($CO^2$). At present an estimated 30% of the $CO^2$ released into the atmosphere from human activity dissolves into the oceans.[a] Oceans therefore play a critical role in the global hydrological cycle, in sea and air interaction, phytoplankton primary production (based on oceanic food webs) and ocean-sourced carbonate production (which drives the calcification that builds coral reefs and forms lagoons and beaches).

About 20 to 25 million tonnes of $CO^2$ are being added to the oceans each day, disrupting the balance of the global carbon cycle.[b] This $CO^2$ absorption is increasing the acidity of oceans, disrupting marine food chains and altering ocean biogeochemistry. This is happening concurrently with a multitude of other threats that reduce the resilience of marine ecosystems, as a result of which they become more vulnerable to the effects of global climate change. During the 1998 El Niño–Southern Oscillation event, which caused the strongest oceanic warming in recorded history, many of the coral reefs around

33 Bennett NJ, Govan H & T Satterfield, 'Ocean grabbing', *Marine Policy*, 57, 2015.

the globe suffered high coral mortality due to bleaching. The WIO region registered the highest coral mortality,[c] with Kenya's reefs having suffered mortality levels of more than 80%.

**Food security and livelihoods:** The oceans are a key source of protein both locally and globally. Seafood now accounts for almost 17% of the global population's intake of protein,[d] and global per capita seafood consumption has doubled since 1960. In South Africa approximately 312 000 tonnes of seafood are eaten annually, with per capita seafood consumption at 6.25kg in 2010.[e] However, some coastal communities that harvest marine resources, such as subsistence mussel harvesters in KwaZulu-Natal, are far more dependent on this resource for their protein needs. Although not as economically important as agriculture, fisheries contribute 0.5% of South Africa's gross domestic product (GDP) and play an important role in meeting food security needs and providing livelihoods for more than 100 000 people.[f] At present a number of marine resources are overexploited, which results in a loss of potential food protein, livelihoods and income for all WIO coastal communities.[g]

In Kenya, Tanzania and Mozambique small-scale fisheries supply 93%–98% of the marine catch and are the principal income-generating activity for a large number of households. In Mozambique an estimated 280 000 people work as fishers and another 54 000 in fish processing.[h] In 2010, of the total annual marine catch in Mozambique of some 160 000 tonnes, around 85% came from artisanal fisheries, representing a monetary value of at least $200 million. The coastal area in Tanzania supports around 56 000 artisanal fishers,[i] while in Kenya it supports around 12 000 people and generates an estimated $3.2 million per year.[i] Population growth and high levels of poverty in the coastal regions have contributed to increases in the number of small-scale fishers.

**Oceans economy:** Rich and productive coastal waters support thousands of jobs and contribute to the national economy of each WIO country. Globally, the oceans have been estimated to contribute a total of $24.2 trillion per year to human welfare[k] and provide 60% of the total economic value of the biosphere.[l] Coastal goods and services are estimated to contribute 35% to South Africa's GDP.

**Importance of the coastal belt:** Covering only 8% of the world's surface, the coastal zone makes vital contributions to human well-being and ecological functioning.[m] Approximately 3 billion people live within 200 km of the coast.[n] By 2025 the coastal population is likely to double, with as much as 91% of the world's coastline likely to be affected by some form of development.[o] Thirteen of the world's 20 megacities (cities containing more than 10 million people) are located along the coast, and nearly 700 million people live in low-lying coastal areas that are less than 10m above sea level.[p] With the increasing pressure on coastal resources, a number of adverse environmental trends have emerged. It is estimated that half of the world's wetlands disappeared in the 20th century and that 50% of all mangroves, and nearly 60% of the world's coral reefs, are seriously degraded – in some cases beyond recovery.[q]

**Ecotourism:** According to the WWF's State of the Ocean and Coasts Report,[r] in 2014 global tourism linked to the scenic beauty and recreational opportunities of coastal areas was estimated at nearly $30 billion (nature-based and dive tourism in coral reefs).[s] The contributions of tourism as a percentage of GDP of WIO countries range from 6.8% to 63% for the island states (Comoros and Seychelles, respectively) and 7.5% to 13.5% for mainland states (Mozambique and Tanzania, respectively). The direct value of marine ecotourism in South Africa was estimated at ZAR[t] 400 million (approximately $30 million) and its indirect value at more than ZAR 2 billion (approximately $150 million).[u] Tourism has immense potential to enhance socio-economic development and contribute to environmental rehabilitation. Diversifying away from national parks to beaches makes sound economic sense. In Kenya coastal tourism now contributes around 60% of overall tourism earnings, while in Mozambique almost all tourism is related to the coastal areas and contributed to an estimated 3.2% of GDP in 2003 while employing around 350 000 people, roughly the same number of people as employed in artisanal fisheries.[v] Tourism on the Tanzanian mainland is concentrated around wildlife, but coastal tourism is an important income earner for Zanzibar.

**Ecosystem services:** Coastal and marine ecosystems provide us with abundant provisioning, regulating, supporting and cultural services. The coastal zone performs a multitude of ecosystem services: it helps to attenuate floods and gives protection from storm surges, while coastal habitats sequester carbon dioxide and assist with waste assimilation, offering habitats for a diverse array of organisms and providing amenity services, such as tourism and recreation. Other services include marine genetic resources and bio-prospecting. The spiritual importance of oceans is also often neglected.

a Hoegh-Guldberg O *et al.*, *op. cit.*

b UNESCO, 'Research shows the oceans becoming more acidic', Press Release, 2014, http://portal.unesco.org/en/ev.phpURL_ID=21758&URL_DO=DO_TOPIC&URL SECTION=201.html, accessed 17 March 2016.

c Ateweberhan M & TR McClanahan, 'Relationship between historical sea-surface temperature variability and climate change-induced coral mortality in the Western Indian Ocean', *Marine Pollution Bulletin*, 60, 7, 2010, pp. 964–970.

d FAO, *op. cit.*

e Duncan J et al., *op. cit.*

f Coastal Livelihoods Assessment, 'Agulhas and Somali Current Large Marine Ecosystems Project Programme Report', 2010, http://www.asclme.org/reports2013/Coastal%20Livelihoods%20Assessments/44%20ASCLME%20CLA%20South%20Africa%20final%20draft%2019-11-2010.pdf, accessed 13 April 2017.

g Duncan J *et al.*, *op. cit.*

h Mozambique, Ministry of Fisheries, 'Fisheries statistics', 2013, http://www.mozpesca.gov.mz/index.php/en/economies-and-policies/fisheries-statistic, accessed 13 April 2017.

i UNEP, *Transboundary diagnostic analysis of land-based sources and activities affecting the western Indian Ocean coastal and marine environment*, 2009, http://www.unep.org/nairobiconvention/sites/unep.org.nairobiconvention/files/unepdepi_eaf_cp_6_

inf_6_transboundary_diagnostic_analysis_of_land-based_sources_and_activities.pdf, accessed 5 May 2017.

j Government of Kenya, *State of the Coast Report: Towards Integrated Management of the Coastal and Marine Resources in Kenya*. Nairobi: National Environment Management Authority, 2009.

k Hoegh-Guldberg O *et al.*, *op cit.*

l Costanza R *et al.*, 'The value of the world's ecosystem services and natural capital', Nature, 387, 1997, pp. 253–260.

m Agardy T *et al.*, 'Synthesis: Condition and trends in systems and services, trade-offs for human wellbeing, and implications for the future', in Hassan R, Scholes R & N Ash (eds), *Ecosystems and Human Wellbeing: Current State and Trends: Findings of the Condition and Trends Working Group*. Washington DC: Island Press, 2005b, pp. 823–834.

n UNEP, *Marine and Coastal Ecosystems and Human Well-Being: A Synthesis Report Based on the Findings of the Millennium Ecosystem Assessment*. 2006.

o Sale PF *et al.*, *Stemming Decline of the Coastal Ocean: Rethinking Environmental Management*. Hamilton: UNU-INWEH, 2008.

p Zhao P *et al.*, 'Understanding resilient urban futures: A systematic modelling approach' in *Ecological Resilience: Response to Climate Change and Natural Disasters*. Waretown: Apple Academic Press, 2016, p. 4.

q Creel L, *Ripple Effects: Population and Coastal Regions*. Population Reference Bureau, Measure Communication, 2003.

r DEA (Department of Environmental Affairs), *State of the Oceans and Coasts around South Africa 2014*, 2015, http://awsassets.wwf.org.za/downloads/wwf_oceans_facts_and_futures_report_oct16.pdf, accessed 27 March 2017.

s Wynberg R & M Hauck, 'People, power, and the coast: A conceptual framework for understanding and implementing benefit sharing', *Ecology and Society*, 19, 1, 2014.

t Currency code for the South African rand.

u DEA, *op. cit.*

v Government of Kenya, *op. cit.*

MPAs often produce relatively little direct benefit for people and fall short of their original purposes due to inadequate long-term funding and widespread management failures. There is an urgent need for evidence that economically justifies their existence in terms of the support they provide for a wide array of social and economic benefits, such as jobs, livelihoods, community safety nets, and social and environmental resilience. This economic evidence is needed to build a broader constituency and the political will to support protected areas and move beyond the tensions between environment- and people-focused conservation and development, particularly in poor areas dependent on resources from the ocean.

Research is now available that highlights the economic case for protecting ocean and coastal assets through expanding MPAs globally.[34] An example of this is work commissioned by the World Wide Fund for Nature (WWF) in 2015 to assess the net benefits of protecting marine habitats. Researchers developed scenarios for expanding MPAs globally, modelling MPA expansion at both the 10% and 30% target levels. They concluded that the economic rate of return in expanding networks of MPAs is as high as 24%, and that the benefits of expanding no-take MPAs significantly outweigh their costs. This indicates that MPA expansion is economically viable. According to the authors, 'expanding ocean protection could return an increase in jobs, resources and services that far outweigh the costs'.[35] The analysis by Brander *et al*. shows that every dollar invested to create MPAs is expected to be at least tripled in benefits returned through, for example, employment, coastal protection and fisheries. The report also found that the increased protection of critical habitats could result in net benefits of between $490 billion and $920 billion from 2015–2050. Based on these findings, the WWF also recommends that there be a 30% global coverage by MPAs by 2030 in order to secure the most complete benefits for people and the ocean.[36]

The economic quantification of ecosystem services generated from conservation efforts, and its subsequent communication, is of growing importance. Community awareness is essential so that people are better informed about both the value and the vulnerability of marine and coastal natural capital.

According to the WIO's RSOCR, experience in ecosystem services evaluation is limited in the region and unevenly distributed across particular types of marine habitats, ecosystem services and geographic locations. Studies within the WIO have mainly focused on the provisioning values of the near-shore environment, such as coral reefs, sandy beaches, commercial fisheries and coastal properties. At the regional level there is only limited awareness of these economic tools to justify conservation, and they are seldom applied by decision makers, legislators, the private sector and civil society.[37] While the quantification of ecosystem services helps to place a value on marine ecosystems, unless there are mechanisms through which this value can be realised in the short to medium term, it is unlikely to be useful.

To date there have also been limited returns on ecosystem services projects in the Eastern and Southern African region. Governments need to make use of natural capital accounting at the national level to understand the full contribution that nature makes to the wealth of their economies and to their people. Assessments are currently under way in the WIO

34 Brander L *et al*., *The Benefits to People of Expanding Marine Protected Areas*. Amsterdam: IVM Institute for Environmental Studies, VU University of Amsterdam, 2015.

35 *Ibid*.

36 Reuchlin-Hugenholtz E & E McKenzie, *Marine Protected Areas: Smart Investments in Ocean Health*. Gland: WWF, 2015, p. 4.

37 UNEP & WIOMSA, 'Regional State of the Coast Report: Western Indian Ocean', June 2015, p. 448, http://repository.udsm.ac.tz:8080/xmlui/handle/20.500.11810/1859, accessed 27 March 2017.

in countries such as Madagascar that seek to demonstrate the tangible value of nature's benefits to different sectors and stakeholders.

Initiatives such as the Wealth Accounting and the Valuation of Ecosystem Services (WAVES), a partnership led by the World Bank and the Gaborone Declaration for Sustainability in Africa, are engaging many African governments to advance this concept in practice. A key component of this is to compare use and non-use values, as well as consumptive and non-consumptive use. For example, restricting the harvesting of timber from mangrove forests prioritises one ecosystem service over another. Restriction implies carbon sequestration, fish and shellfish provisioning, tourism and recreation opportunities; harvesting provides mangrove timber for boats and fuel wood. Similarly, where tourism economically trumps consumptive uses such as fishing and offshore mining, WAVES is helpful in providing an economic justification for the continued preservation of coral reefs and pristine areas. Also, it is important to understand the governance of revenue distribution related to equity, as communities often do not sufficiently gain from non-extractive uses and yet suffer immediate losses when extraction is limited. Compensation mechanisms must be thoroughly understood and applied in all countries.

### Highlighting the socio-economic contribution of management tools and MPAs

It is imperative to use measurable instruments that highlight MPAs' values beyond biodiversity, particularly to demonstrate their income-generating potential. If accounted for appropriately, these social and economic benefits can secure support for the creation, continued existence and expansion of MPAs, and inform decisions about the management priorities of these conservation zones and the broader landscape.

Innovative livelihood alternatives and opportunities for nodes of growth in most MPAs are essential to lessen the pressure on over-harvested resources, or to replace traditional fishing rights lost to conservation or commercial initiatives. Overall, there needs to be value addition for communities. In the MBREMP, for example, villagers (mainly engaged in fishing) were encouraged to accept the marine park, which in practice meant abandoning their illegal gear and only fishing in designated zones outside the bay with regulation size mesh. In exchange for their compliance, various livelihood schemes and fishing technology projects were initiated by the park authorities, such as beekeeping, land-based aquaculture and poultry farming.[38] Community-based turtle monitoring and fisheries data collection were also increased, with remuneration from the MBREMP Park Authority. However, in many cases communities felt that they did not economically prosper from these park-related activities. Many of the alternative livelihoods projects failed, owing to a lack of ownership and skills. As a result many fishers in the community reverted to their previous behaviour – undermining the conservation activities of the MBREMP.

38 These included mariculture activities concentrated in Tanzania, where finfish, seaweed and mud crab are being farmed all along the coast. Pearls and prawns are being farmed in a few places such as Mafia and Tanga.

Within the WIO there are also job opportunities in the restoration and rehabilitation of marine and coastal ecosystems. Increasingly, coastal ecosystems are recognised for their important role in fighting climate change through carbon sequestration and, conversely, their potential to become sources of carbon emissions when degraded.[39] Coastal vegetation such as seagrass beds, mangroves and salt marshes, all of which are abundant in the WIO, store and sequester carbon. The protection and restoration of coastal vegetation could provide coastal and island communities with important economic opportunities in the carbon offset market,[40] for example in the Blue Ventures' Blue Forest Programme in Madagascar and the Mikoko Pamoja mangrove project in Gazi Bay in Kenya. Such initiatives could be expanded within subtropical environments home to natural carbon sinks. However, these are location specific. There are also other climate change mitigation opportunities for the protection of coral reefs and mangroves through climate change adaptation funding. Abundant and healthy coastal ecosystems improve the resilience of coastal communities. In addition, community-based participation can go beyond carbon markets, in other 'payment for ecosystem services' approaches such as biodiversity and water markets.

Lessons can be learnt from South Africa's Expanded Public Works programmes such as 'Working for Wetlands' and 'Working for the Coast', which employ local unskilled labour to implement land-based invasive alien vegetation clearing, wetland rehabilitation, and waste management and collection. This model is replicable in other WIO countries where, for example, it is necessary to remove high densities of crown-of-thorns starfish from coral reefs or invasive vegetation from important estuaries.[41]

Communities can also participate in monitoring, data collection and surveillance. On-the-ground information gathering, especially in remote locations, will assist governments, scientists and conservation managers. Many successful species-specific community-led management programmes can also be up-scaled, such as the various endangered turtle nesting monitoring programmes in the WIO.[42] In addition, amnesty programmes can be expanded, where former offenders are trained to become eco-monitors. For example, dynamite fishers in Tanzania are now employed to protect coral reefs. Increased comparative research is needed in the region to disseminate good practices and innovative methods such as those applicable to species-specific conservation.

39 Crooks S *et al.*, 'Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Nearshore Marine Ecosystems: Challenges and Opportunities', World Bank Environment Department Paper, 121. Washington DC: World Bank, 2011.

40 Hastings J *et al.*, 'Safeguarding the blue planet: Six strategies for accelerating ocean protection', *Parks*, 18, 1, 2012, p. 13.

41 The impacts of reduced freshwater input on marine biodiversity and resources include those on physical habitat, reduced nutrient inputs and alterations to important ecological processes, such as nursery functions, food webs and energy flow.

42 Extensive turtle research in the WIO dating back to the 1990s has been central to marine planning exercises for mainland East Africa. However, more specific data is needed on turtle feeding and breeding, and juvenile and adult migratory routes.

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Marine Park officer checking the fishing data of a local fishers monitor, Mnazi Bay Ruvuma Estuary Marine Park

The other aspect of this discussion is the need for MPAs to be intentionally structured and managed to ensure that social benefits are maximised. One of the challenges for the WIO and, more broadly, for the region, even where appropriate tools and technology exist, is translating scientific knowledge into appropriate spatial arrangements that benefit local stakeholders. It is therefore imperative that MPAs are designed and managed to fulfil local SDGs.

## INCLUSIVE, COMMUNITY-BASED MANAGEMENT OF CONSERVATION AREAS

Enhancing community involvement in natural resource governance is central to literature on commons governance. Often referred to as community-based natural resource management (CBNRM), it describes the imperative to manage land, forests, wildlife, water and other natural resources by local institutions for local benefit. CBNRM has expanded throughout Africa over the past three decades in response to the failure of centralised colonial and post-colonial policies to effectively manage natural resources, promote equitable benefit sharing and secure the cooperation of communities in sustainable resource governance practices.

More equitable MPA processes and inclusive outcomes are instrumental in developing support for conservation initiatives in all regions. This includes the need to incorporate local and indigenous communities, traditional resource users and other stakeholders

into the planning, implementation and management of protected areas. Such support is a critical guarantor of the success of any conservation intervention over time, but may also encourage the uptake of MPAs and the replication of good practice in other settings. MPA management must include programmes to support additional livelihoods, as well as benefit-sharing agreements and compensation packages. Effective benefit-sharing mechanisms must ensure that those who bear the costs of the MPAs (often local communities) are the ones who receive the benefits. At present this is often not the case.

Marine and coastal governance MPAs were initially introduced as largely state-driven structures for resource governance, followed by fewer privately managed MPAs and an increase in the number of community-based systems. At present, community conservation areas (CCAs) and LMMAs are considered the most 'socially-responsive' structures of governance in the WIO region.[43] These areas elicit a sense of local ownership and 'appear to be embedded in the wider social-cultural context of the local communities'.[44] LMMAs are managed by the community in conjunction with local government, for sustainable use rather than conservation per se, employing locally determined management techniques that are context specific, such as periodic closures, gear restrictions, species-specific reserves and permanent no-take zones.[45]

Mainland Tanzania, Kenya, Mozambique and Madagascar all have legislation to decentralise marine resource management. CCAs or LMMAs are now found in nine countries in the region, protecting some 11 000 $km^2$ of marine resources, with Madagascar and Tanzania having the largest areas of LMMA coverage.[46] In Tanzania LMMAs cover 3.5 times more area than MPAs, and in Madagascar 2.6 times more than MPAs.[47] In Kenya and Tanzania the local governance structures at the community level are named beach management units (BMUs), in Mozambique they are fishing community councils and in Madagascar village fisheries committees. The main roles of these co-management units are to strengthen the management of fish landing sites, issue fishing permits and administer compliance, and facilitate stakeholder participation and reduce conflicts.

However, local governance structures are highly heterogeneous in nature and employ a variety of models and management approaches across different regions. As a result the management effectiveness within and between LMMAs sites is highly variable. The success of these systems is often determined by a sense of local responsibility for resources and commitment to resource ownership across horizontal scales. Also, as with other forms of community-based resource management, these systems face challenges related to

43 Rocliffe S *et al.*, 'Towards a network of locally managed marine areas (LMMAs) in the Western Indian Ocean', PLoS ONE, 9, 7, E103000, 2014.

44 Westerman K & CJ Gardner, 'Adoption of sociocultural norms to increase community compliance in permanent marine reserves in southwest Madagascar', Conservation Evidence, 10, 2013, pp. 4–9.

45 Rocliffe S *et al.*, *op. cit.*

46 *Ibid.*

47 Madagascar has the largest network of community managed areas, consisting of 64 LMMAs coordinated under a national network, Mihari, that is facilitated by NGOs such as Blue Ventures, the WWF and the Wildlife Conservation Society.



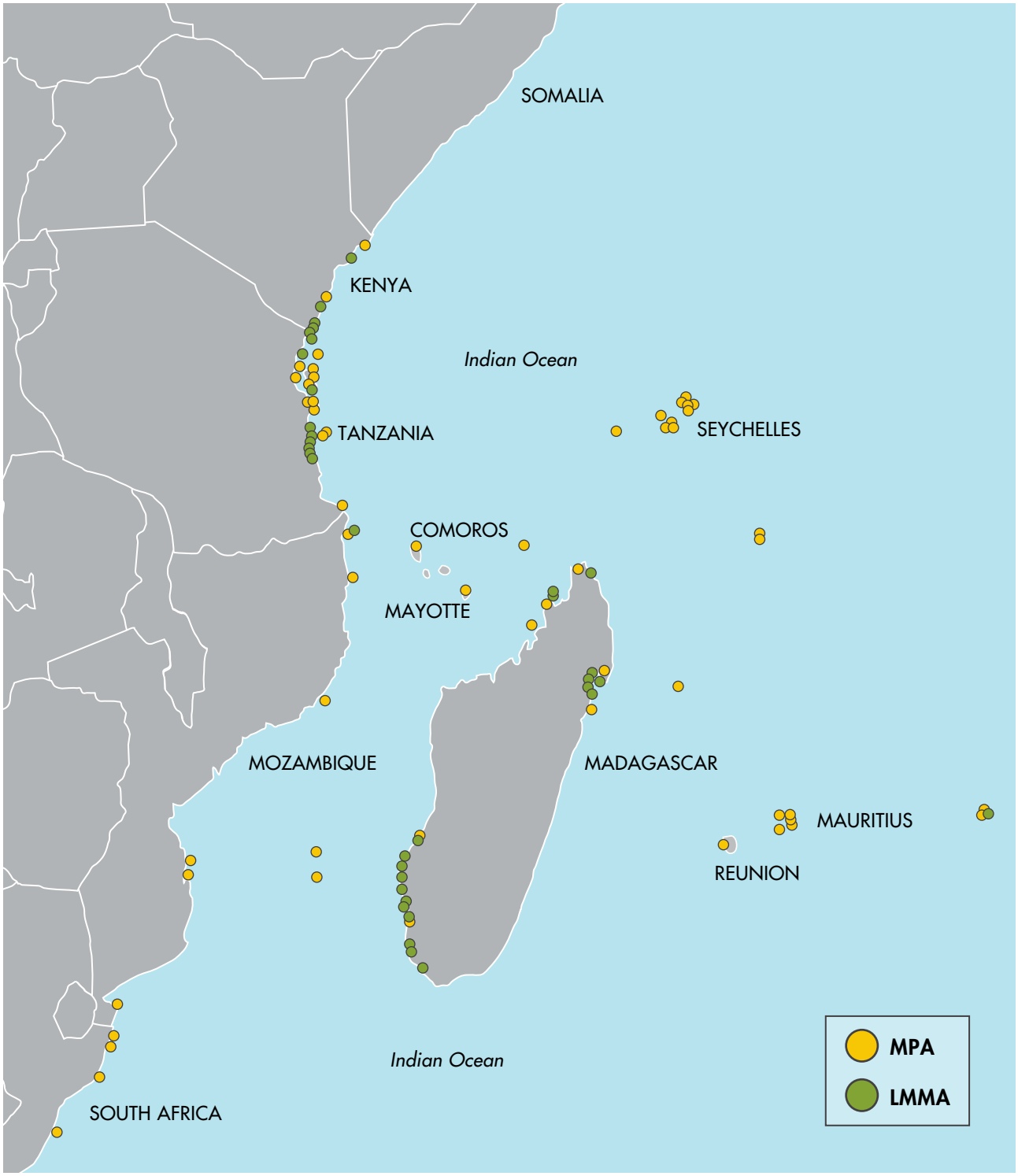
Local fishing community council discussing the management of fisheries in Vilanculos, Mozambique

inadequate funding; legal complications in governance, especially overlapping or ambiguous management authority; a lack of technical expertise; and infrastructure deficiencies. In many cases their performance depends on individual leadership and representation.

This is the case in many WIO coastal communities. According to regional experts, it is necessary to establish a network of LMMA practitioners in the WIO to share experiences and best practice. The network could work to cascade best practice down to the local level, where there is a particular need to ensure that the processes of establishing, monitoring, adaptively managing and enforcing LMMAs are driven by the community throughout. This can also help to maintain awareness-raising programmes on the benefits of LMMAs within communities, and to build robust and flexible long-term relationships between communities, NGOs and governments.[48]

48 Rocliffe S & S Peabody, Locally-Managed Marine Areas: Towards a Global Learning Network, Blue Ventures Report, World Conservation Congress, Jeju, South Korea, September 2012, https://blueventures.org/wp-content/uploads/2015/09/WCC_LMMA_Workshop_0757_Report.pdf, accessed 27 March 2017.

**FIGURE 2** LMMAs AND MPAs IN THE WESTERN INDIAN OCEAN




Source: Rocliffe S *et al.*, 'Towards a network of locally managed marine areas in the Western Indian Ocean', *PLoS ONE*, 7, E103000, 2014

## SUSTAINABLE FINANCING OF CONSERVATION SITES AND MPAs

Given the significant benefits that MPAs generate, it is vital that financial mechanisms be created to increase investment in their protection and effective management. It is important to explore and increase opportunities for private investment and new markets, such as trading in environmental goods and services, payment schemes for ecosystem services, sustainability-certified products and innovative insurance programmes. In this regard the WIO region can learn from regional and global best practices. For example, in some countries local taxes are levied on ocean users. In the Antilles divers, snorkelers and surfers are taxed. Tourism fees are charged in the Galapagos and the Great Barrier Reef, and airport fees and cruise ship fees are charged in Belize. Some countries have established trust funds for MPAs in perpetuity, such as the Mesoamerican Reef Fund, which works to protect the Mesoamerican barrier reef,[49] the Conservation Trust for the Phoenix Islands and an endowment fund for the Bird's Head Seascape in West Papua.

However, many marine and coastal areas are protected for ecosystem reasons without being viable for large-scale ecotourism or conservation funding. This includes regions that are inaccessible or volatile, or less aesthetically attractive. For example, the MBREMP in southern Tanzania does not receive the same number of visitors as other, more convenient and aesthetically pleasing islands closer to Dar es Salaam. Where tourism is absent, alternative livelihood options and income streams need to be devised.

In the absence of funding, capacity and private sector interest, coastal and ocean livelihood projects must be initiated and run via a number of different partnership structures. New financing options should be explored, such as those from development banks, gas mining operations and other Blue Economy industries that can help fund sustainable local economic growth initiatives and stimulate alternative livelihood projects. Lessons can be learned from the terrestrial environment, where conservation-focused NGOs give communities and governments technical assistance. Africa Parks, for example, works with numerous national parks to compile a business plan to determine the capital investment necessary to cover the park's operating and management costs through entrance and concession fees. It seeks financial partnerships with commercial investors, donors, conservation NGOs and philanthropists to develop and operate tourism lodges. Social enterprise partner Blue Ventures is also worth noting for its work on non-tourism-related income-generating activities that benefit local communities. Blue Ventures is working with the Madagascan coastal communities to introduce the short-term closure of fishing grounds to boost octopus catches, in turn building support for management efforts that are led by communities, for communities.

There is also potential for privately funded enterprise-based conservation areas similar to Chumbe Coral Park in Zanzibar and Velondriake in Madagascar, demonstrating cost-effective financing mechanisms. Private companies can lend important technical assistance to communities regarding land claims, capital investment, enterprise development and the marketing of their own tourism products.

49 See MARFUND, http://www.marfund.org/, accessed 7 April 2017.

## RESEARCH AND COMMUNICATION TO STRENGTHEN THE SCIENCE–POLICY INTERFACE

Within the WIO scientists conclude that there is still a lack of information about the area, not only in absolute terms but also relative to other geographic ocean areas. In order to develop effective systematic management frameworks for LMEs and their associated habitats, information on ecology, oceanography, biophysics and human requirements should be better integrated. Links that reinforce the science–policy interface should also be strengthened.

There are ongoing efforts within the WIO to improve awareness and capacity through regional networks and knowledge exchange programmes. The Western Indian Ocean Marine Science Association (WIOMSA)[50] hosts science-based symposia and has developed a professional MPA management certification programme for regional practitioners.[51]

One obstacle to improving management is the limited documentation of MPA successes, despite the data on and arguments for the stakeholder benefits and economic livelihoods they can provide. 'Success stories' are limited mainly to relatively small-scale situations and particular species and habitats, such as coral reefs and marine turtles. Long-term monitoring programmes that link positive trends in ecosystem health and species demographics to particular conservation management interventions are a fundamental requirement for MPA planning and adaptive management. Although a complex procedure, methodologies to assess the management effectiveness of protected areas are increasing in importance and proving to be a key incentive for improving management.

Good scientific baseline data is also essential. Numerous donor-funded programmes have been set up in the WIO to assist with information gathering, such as the South West Indian Ocean's Fisheries Programmes, initiated by the UN Development Programme and the World Bank, that have contributed towards scientific information on distribution patterns, biological characteristics and reference points, stock status and the effects of fishing. More data on biodiversity and ecosystem services is needed to make informed land-use decisions and underpin robust ESIAs.

### Addressing capacity constraints

MPA designation and expansion is only the beginning of a much longer road to successful management. As with the management of other natural resource sectors, many developing countries face difficulties in overcoming institutional, human or financial capacity constraints for the implementation and management of conservation zones and their monitoring, control and surveillance. A major reason for this is the lack of political priority

50 WIOMSA is a non-governmental membership organisation, established in 1993, to promote the educational, scientific and technological development of marine science throughout the WIO region with a view towards sustaining the use and conservation of its marine resources.

51 Wells S *et al.*, 'Building the future of MPAs: Lessons from history', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 26, 1, 2016, pp. 101–125.

given to the protection of resources, which translates into a lack of financial resources to monitor and enforce the boundaries of MPAs and control illegal activities more broadly. An article in Nature[52] demonstrates the importance of considering enforcement during MPA design. The open access nature of coasts and oceans has meant that the establishment of an MPA requires careful consideration of existing uses, and the involvement of users. Sustainable financing, adequate technology and logistical partnerships are just a few of the elements necessary to successfully monitor and enforce large MPAs. Unfortunately these elements are not available to all countries, particularly developing ones.[53]

## CONCLUSION

The WIO region has valuable and diverse coastal and marine resources, but much of its natural capital is threatened. This paper demonstrates the advantages of an integrated approach to coastal and marine management, with anticipatory spatial planning at its core. A key principle of this approach is ecosystem-based, people-centred management. A suite of other adaptive planning tools and mechanisms can also be used to ensure compatibility with a multiplicity of resource users. These frameworks must enable efforts to develop regional environmental management solutions for sustainable development within the WIO.

MPAs are a key element of this integrated approach and have been widely advocated as an effective tool for securing and restoring the health of our oceans and coasts. This is especially pertinent in an environment hoping to withstand additional stress from an expanding coastal and marine economy, population expansion and climate pressures. However, in order to ensure buy-in to Blue Economy strategies, conservation sites and MPAs must be visibly aligned with local development priorities and be co-managed by local resource users. In Africa, balancing human and biodiversity objectives may mean a greater focus on multi-zoned MPAs, with the nesting of small no-take zones within spatially larger management and planning frames, to help distribute costs more broadly and equitably. Within this framework it is necessary to consider equity concerns, particularly the possibility of compensation to local communities in cases where the costs of maintaining ecosystem services is borne locally while the benefits of those services are enjoyed externally or in the future. If these conditions were fulfilled the conservation objectives of MPAs would gain broader support in the African context, and would be viewed as 'legitimate' management tools beyond biodiversity conservation. This would in turn stimulate participation in and buy-in to the conservation goals of MPAs, and hopefully reduce illegal exploitation and destructive practices within their boundaries.

However, while many nations in the WIO move towards a Blue Economy, amid hopes that MPAs can contribute to this through the goods and services they provide, the original purpose of such sites (ie, biodiversity and ecosystem protection) must not be forgotten.

52 Edgar GJ *et al.*, 'Global conservation outcomes depend on marine protected areas with five key features', *Nature*, 506, 2014, pp. 216–220.

53 Laffoley D *et al.*, 'Building networks of MPAs: The legacy from the 2014 Sydney World Parks Congress', Aquatic Conservation: *Marine and Freshwater Ecosystems*, 26, 2, 2016.

After all, sustainable development depends on the health and vitality of ecosystems and the ability of nature to respond to threats. Thus, recognising the true value of natural capital (beyond its market value) can help local authorities and conservation managers to justify the establishment and continued protection of MPAs in economic terms. Research and the integrated costing of biodiversity and ecosystem services therefore need to be scaled up into policy to establish cost-benefit models for biodiversity conservation and biodiversity loss. Innovative schemes and pilot mechanisms that enhance the revenue-generating base of MPAs and conservation areas, for both conservation and biodiversity purposes, are also essential and particularly important for people living near MPAs. More research must be undertaken to produce evidence that demonstrates what works and what doesn't – so that the cases of success can provide lessons for future projects.

Much like the management of other natural resource sectors, many national and regional constraints within the WIO region need to be overcome. Existing institutional constraints include short-term planning horizons and lack of participation; a weak policy and regulatory environment for encouraging shared resource use and collective restraint with regard to the impacts of growth; poor understanding of the true value of nature; and inadequate financial resources to manage conservation areas and enforce their protection. One of the challenges of poor knowledge management is inadequate scientific and socio-economic data to support policymaking, monitoring and enforcement – both at a member-state level and in the region.

The formation of an 'Ocean Alliance' of concerned WIO countries can provide leadership and make a case for a rapid and comprehensive set of actions to protect the marine and coastal environment. Such a coalition could build regional will, foster shared responsibility for a truly sustainable and inclusive oceans economy for the region and move forward on implementing good practices.

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