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NEWSBRIEF

WIOMSA
Coasts Ocean and People

WESTERN INDIAN OCEAN MARINE SCIENCE ASSOCIATION

WMA Beach Team Cleaners and Recyclers

WHAT'S INSIDE?

INTRODUCTION OF THE WIOMSA PRESIDENTIAL AWARD

The WIOMSA Board of Trustees held its 41st meeting virtually on 12 June 2020 and approved the introduction of the WIOMSA Presidential Award. The award aims to recognise excellent service provided to WIOMSA, more specifically individuals who have demonstrated extraordinary leadership or offered outstanding service to WIOMSA, thereby promoting the development of the Association. The first awards will be presented next year to recognize those individuals who have played a critical role in the Association achieving its Silver Jubilee. Thereafter, the award will be presented at the WIOMSA scientific Symposium every three years.

WIOMSA has three awards to recognise individual scientists/researchers and practitioners for their track record of achievements, inspire outstanding and emerging scientists and practitioners, and cultivate a healthy competition for quality and excellence in the region. These are the Honorary Membership, Fellow Membership and the Emerging Scientists award. The Honorary Membership award is the highest award WIOMSA confers, in recognition of an exemplary, outstanding and distinguished contribution towards the development of coastal and marine science in the Western Indian Ocean. It is awarded to individuals who have rendered notable service to the development of marine science in the WIO region. The Fellow Membership award is presented biennially to scientists (natural and social scientists) in recognition of outstanding work, or a significant contribution to coastal and marine scientific research in the region. The Emerging Scientist award promotes excellence and recognizes outstanding contributions made by emerging scientists in coastal and marine research. The WIOMSA's President Award is the latest addition to the WIOMSA awards.

The WIOMSA President Dr. Jacqueline Uku presents an award to Dr. Nirmal Shah for his contribution to the development of the WIO-COMPAS Programme during the programme's 10th anniversary, Seychelles, 2018.

Eligibility and nomination criteria for the WIOMSA's President Award:

The award is intended for individuals who have either been instrumental to the foundation of WIOMSA (pioneer/founding members of WIOMSA), or who have contributed to furthering the ideals of WIOMSA (e.g. donors, partners), or those who have contributed to the development of the various programmes of WIOMSA (such as MASMA, WIO-COMPAS), or WIOMSA employees who have 10 or more years of continuous service to WIOMSA. The award can also be granted posthumously. Each award recipient will receive a certificate of recognition and a presidential medal of honour.

Nominations may be submitted by WIOMSA members, past and current board members, members of the Programme Committees and the Secretariat. Self-nominations, as well as nominations of serving WIOMSA Board members, is not allowed. Nominators must maintain the strict confidentiality of their nominations and all nominations must be submitted electronically.

An eligible nomination will include a nomination letter written in English (maximum 1 000 words) which comprehensively describes the candidate's outstanding work in relation to WIOMSA.

Eligible nominees will be considered by an Award Selection Committee comprising members appointed by the WIOMSA Board of Trustees. After the Award Selection Committee's deliberations, the recommended recipients will be forwarded to the WIOMSA Board for formal ratification.

WIOMSA Fellow Membership plaque

NAVIGATING THE PANDEMIC: INSIGHTS FROM MASMA AND CITIES AND COASTS

The global coronavirus pandemic has brought unprecedented challenges to different sectors of society and the research and scientific communities have not been spared. While scientists are making every effort to understand the coronavirus and control the chaos it has unleashed, the epidemic is also creating chaos within science itself.

Ocean Acidification project grantees during field work in Mombasa, Kenya.

The WIOMSA Secretariat coordinates research projects under the Marine Science for Management (MASMA) and the Cities and Coasts (C&C) programmes. After the outbreak of the pandemic, the activities of the Secretariat and the MASMA and C&C research projects suffered some disruptions.

The effect of the pandemic began to be felt during the second week of March 2020. There was almost no interruption to the Secretariat's activities between January and 6 March 2020, but starting from the third week of March, most of the staff began working from home. **Board meetings, meetings of the Programme Committees for the MASMA and C&C programmes were postponed but later held online.**

The COVID-19 crisis has forced three training courses to be postponed. A regional marine protected areas training course organised by WIOMSA and Rhodes University that was to be held in March 2020 in South Africa, was postponed. Similarly, a training course on the use of underwater camera systems to sample benthic invertebrate communities, and a workshop on building the Western Indian Ocean global coral reef monitoring network to make coral reef data secure and accessible, was also postponed to 2021. Lastly, the "Regional training course on the use of Systems Dynamics to understand and plan mainstreaming climate change adaptation and coastal management making use of innovative climate services in the Western Indian Ocean" was postponed. The course was to be held in Zanzibar in March 2020 by the Climate Service Centre Germany (GERICS [HZG]) and WIOMSA. It may be months before these training courses and workshops can be held.

> *Social distancing measures to contain the spread of Covid-19 mean that researchers who conduct face-to-face fieldwork (interviews, focus groups, participant observation, etc.) are now faced with the challenge of either delaying or re-inventing their methods so that they can continue their research until these measures are relaxed.*

In order to gain insight into the extent of disruption to MASMA and C&C projects, the Secretariat has been collecting information on the impacts of Covid-19 from all the projects. The effect on research activities has not been equal. Some research projects were affected more than others, depending on the control measures on social contact and transmission that individual countries and institutions put in place. For example, due to the prohibition of social gatherings and instructions to minimize close interaction, projects that require interaction with stakeholders, field sampling, etc. have had to postpone these activities. The impact on the projects has also varied depending on the implementation stage of the project. Some recently approved projects had to delay their planned kick-off meetings with stakeholders. Research and academic institutions are involved in most research projects, and the closure of these institutions has restricted access to field equipment and laboratories. Most research projects and monitoring programmes whose sampling schedules included the long rainy season from April to June failed to take place. Research projects involving country visits had to cancel such visits. For example, the planned Miji Bora project exchange learning visit by Mombasa County officials to eThekwini Municipality in Durban, South Africa, had to be cancelled. Overall, research projects that required working in the field, face-to- face meetings with participants, and those that relied on physical laboratories seem to have been most affected.

Despite these challenges, project teams are seeking and finding creative opportunities to keep working. Most of the ongoing MASMA projects have opted for online meetings so that they may continue with different components of their projects and ensure the safety and well-being of project team members and staff. Some research projects have shifted their focus from data collection to data analysis of already collected data. Nearly all projects have reorganized their work plans to accomplish activities that can be done virtually.

Looking ahead, if the Covid-19 restrictions remain unchanged (although there are signs that these restrictions may be relaxed) project leaders are already taking measures to reduce the impact on their projects. In countries like Tanzania and Mauritius, some activities related to the monitoring of ocean acidification have resumed. Social distancing measures to contain the spread of Covid-19 mean that researchers who conduct face-to-face fieldwork (interviews, focus groups, participant observation, etc.) are now faced with the challenge of either delaying or re-inventing their methods so that they can continue their research until these measures are relaxed. New methods for collecting remote primary data e.g. using SMS survey methods and phone surveys are being considered by some projects. Many projects will continue with data analysis, report writing, virtual workshops/meetings and information dissemination. **At the Secretariat, WIOMSA will continue to ensure that the resources needed for research projects are availed promptly. MASMA and C&C programme activities planned for 2020, including the Programme Committee meetings and the annual grantee meeting, will be conducted online.**

COMING SOON: NEW WEBSITE OF THE MARINE PROTECTED AREA PRACTITIONERS NETWORK (WIOMPAN)

Marine Protected Areas (MPAs) in the Western Indian Ocean (WIO) are made effective by a host of practitioners, including managers, wardens, rangers, community members and others. These practitioners are faced with a multitude of different situations, issues and problems on a daily basis, often in remote locations, without easy reference to sources of information or help.

A number of tools have already been developed in the WIO to help MPA practitioners share solutions and lessons.

These tools include many publications and MPA toolkits, but the most valuable way to share knowledge is through peer-to-peer networking and MPA practitioners' networks are recognized as a cornerstone of MPA performance. The Western Indian Ocean Marine Protected Areas Management Network (WIOMPAN) is a network of MPA practitioners in the WIO. The network brings together MPA practitioners from 10 countries in the WIO – Kenya, Tanzania, Mozambique, South Africa, Comoros, Seychelles, Mauritius, Somalia, Madagascar and Reunion (France). It was established to facilitate exchanges between WIO MPA practitioners to deal with common issues in different local contexts. MPAs in the WIO context include all formal marine protected and managed areas under government, communities (locally managed marine areas, LMMAs) and privately managed MPAs. The first step in the establishment of this network is the launch of the WIOMPAN website – coming soon!

The website will be a one-stop-shop for MPA and LMMA practitioners to access:

- capacity development opportunities via **training, mentorship and professional certification** (WIO-COMPAS);
- **a forum where people can submit questions or issues** they are facing, which other MPA professionals or a panel of experts can respond to;
- **a marketplace** where institutions or individuals donating equipment, materials and educational resources can exchange commodities;
- **better understanding of current trends** in MPA management;
- **up-to-date research** and information pertaining to MPAs;
- a members' area to **promote networking** with other professionals;
- opportunities for career advancement;
- **MPA Champions and WIO-COMPAS MPA Professional pages** where individuals can showcase their strengths and competencies.

SPECIAL INITIATIVES

A NEW FREE MASSIVE OPEN ONLINE COURSE (MOOC) STARTS THIS OCTOBER

New online course

By the SOLTICE-WIO Project

Ocean Science in Action: Addressing Marine Ecosystems and Food Security in the Western Indian Ocean will introduce learners to **innovative marine technologies** and the way they are applied to **tackle the challenges** of the **sustainable management** of marine ecosystems.

The course has been developed by the National Oceanography Centre (UK) in partnership with Western Indian Ocean institutions as an output from the SOLSTICE-WIO project, a four-year collaborative project funded by the UK Global Challenges Research Fund.

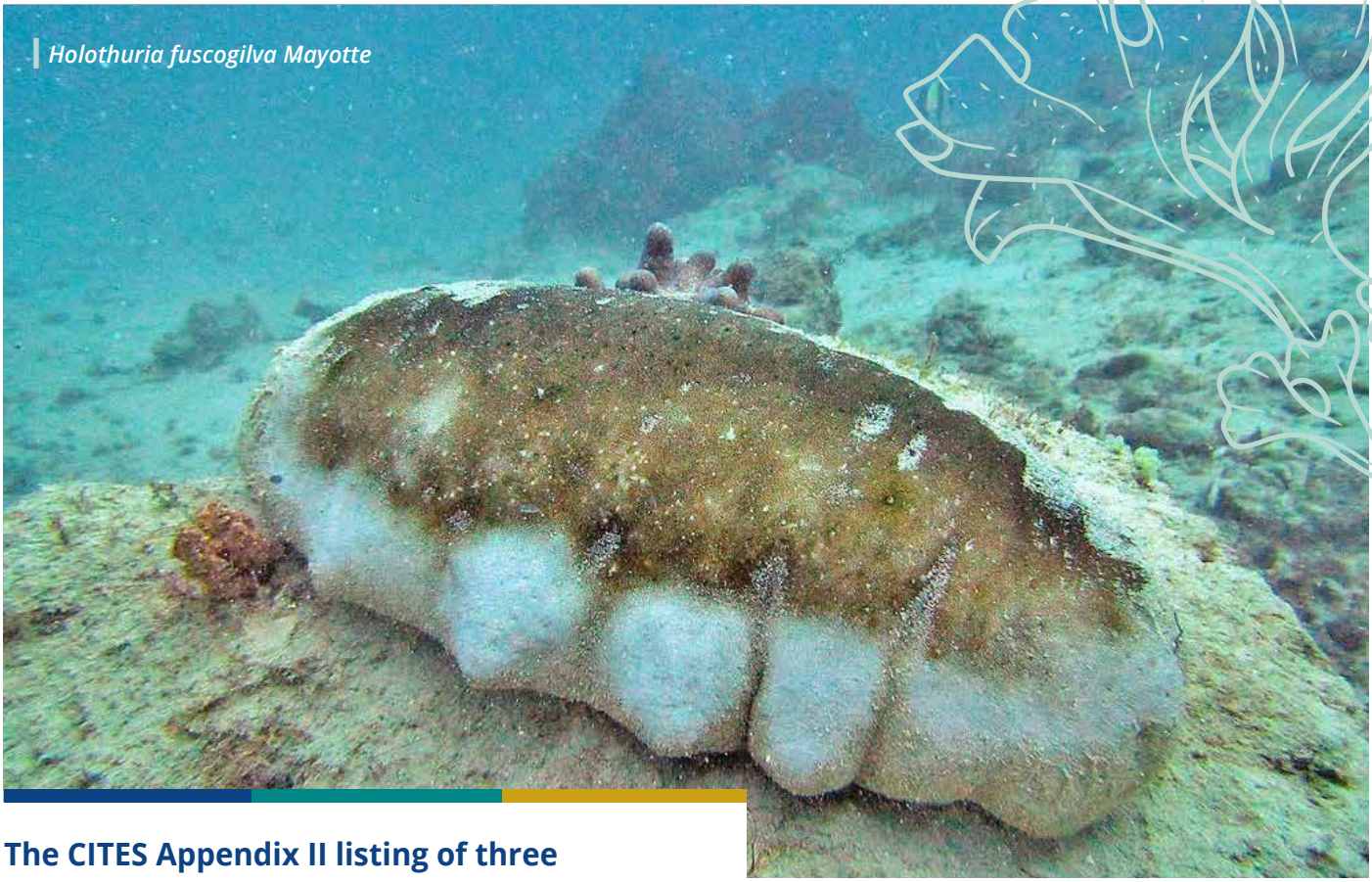
Launched in October 2017, the project brings together advances in marine technologies, local knowledge and research expertise, to address challenges facing the Western Indian Ocean region in a cost-effective way via state-of-the-art technology transfer, collaborative environmental and socio-economic research and hands-on training. In this four-week course, featuring over 30 video lectures, including footage of fieldwork, numerical ocean model animations and visualisations of the remote sensing data, learners will explore how these marine technologies can form the basis for environmental research and monitoring programs and deliver decision support for marine policy development and resource management. Using case studies from the Western Indian Ocean, learners will see how ocean science could be applied to the sustainable management of local marine ecosystems, and how this may contribute to global efforts to meet the United Nation's sustainable development goals.

The course is available via **FutureLearn and starts on 5 October** 2020. Course enrolment is now open; you can view and **download the course outline brochure here.** Although the course is free to all participants, a paid upgrade is offered by the platform to receive unlimited access to the course materials and a certificate upon successful completion of the test at the end of the course.

A limited number of free upgrades are available to learners from WIO-based universities, organisations and companies involved in the conservation and management of marine resources. The first 200 learners to sign up via **https://www.solstice-wio.org/outputs/solstice-mooc/upgrade** will receive a free course upgrade. For any further enquiries, please contact: **solsticeMOOC@noc.ac.uk**

CITES LISTING OF VALUABLE TEATFISH AND CEDRELA SPECIES ENTERS INTO FORCE

By Nyawira Muthiga



Holothuria fuscogilva Mayotte

The CITES Appendix II listing of three species of sea cucumber or teatfish (*Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei*), which was adopted at the 18th Conference of Parties (CoP) meeting in August 2019, is now in effect.

At CoP18, the United States proposed an amendment that would delay the implementation of the listing for 12 months, which is why the listing is only taking effect now. Two of the listed sea cucumber species, namely *H. fuscogilva* and *H. nobilis*, occur throughout the Western Indian Ocean.

The only reservation entered on these species was by Japan for Holothuria fuscogilva.

The European Union is funding a study by the CITES Secretariat that will inform a *"toolkit"* for the implementation of these listings.

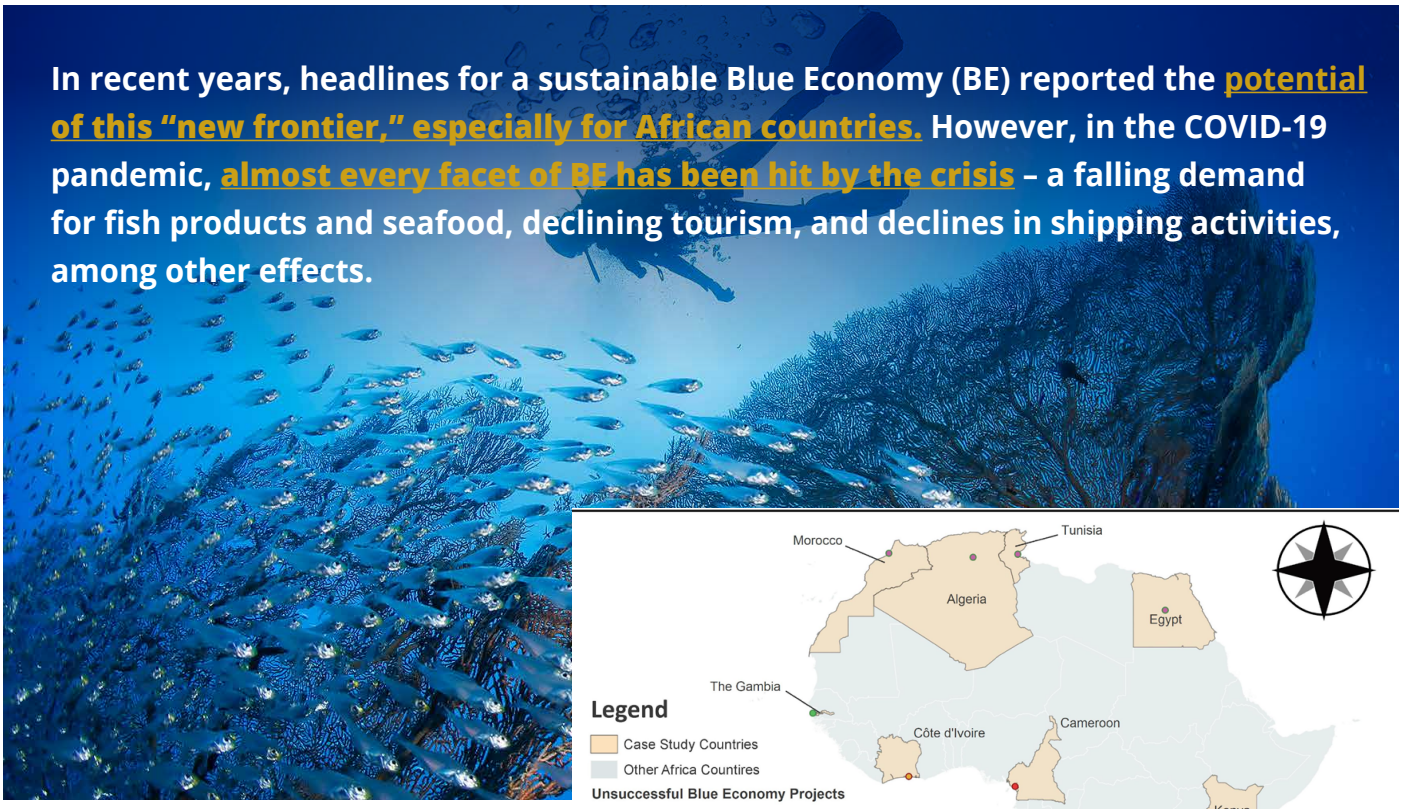
See here for more information.

Holothuria nobilis, Egipto

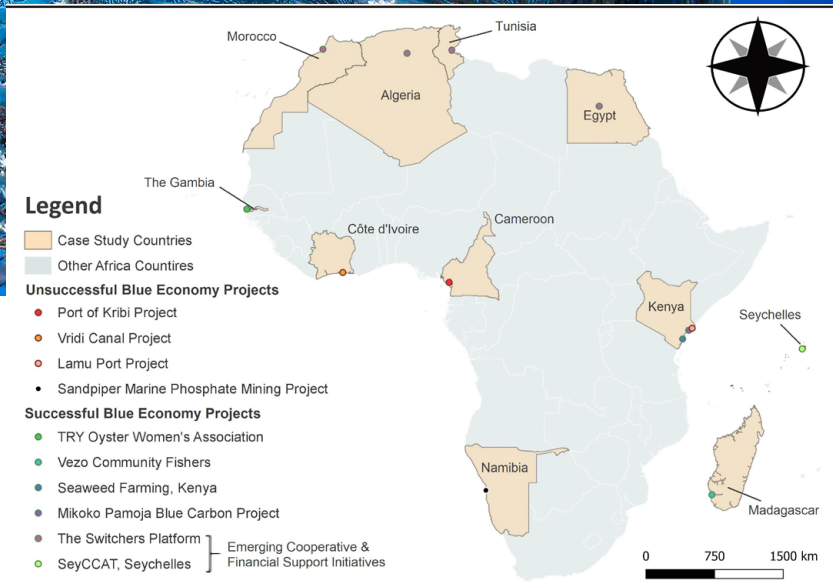
Holothuria whitmaei

WHAT WILL IT TAKE TO RECOVER, REIMAGINE AND REBUILD A SUCCESSFUL BLUE ECONOMY IN AFRICA?

By Nelly Isigi Kadagi



In recent years, headlines for a sustainable Blue Economy (BE) reported the potential of this "new frontier," especially for African countries. However, in the COVID-19 pandemic, almost every facet of BE has been hit by the crisis – a falling demand for fish products and seafood, declining tourism, and declines in shipping activities, among other effects.



Map of Case Studies for Successful and Unsuccessful BE Projects

As the impacts of COVID-19 on the BE sectors continue to pulse across African nations, efforts to achieve **Agenda 2063** of the *"Africa we want"* will be curtailed. Further, the effects on BE sectors have far-reaching consequences for sources of livelihood, resulting in increased vulnerabilities for local communities. Implementing successful BE interventions post-COVID-19 presents an unprecedented challenge and opportunity for African states to build resilient communities and inclusive economic growth while ensuring healthy aquatic resources.

Our paper, **"The Blue Economy–cultural livelihood–ecosystem conservation triangle: the African experience,"** published in Frontiers in Marine Science, evaluated nine case studies of successful and unsuccessful BE projects across 11 countries in Africa, including Kenya, Seychelles, Madagascar, Namibia, Cameroon, Côte d'Ivoire, The Gambia, Algeria, Morocco, Tunisia and Egypt. We make the case that a successful BE requires the commitment and political will of African countries to think beyond the economic gains and consider the needs of communities and environmental sustainability.

What is a successful BE in the African context?

Drawing from case studies and authors' experiences, we defined a successful African BE as one that pursues sustainable economic growth without degrading the environment and excluding local communities. Findings from successful BE projects showed that these interventions were people-centred and enhanced local communities and institutional capacities for economic growth while emphasizing ecological sustainability. The Seychelles Conservation and Climate Change Adaptation Trust (SeyCCAT) and Vezo Community Fishers in Madagascar, are prime examples, demonstrating the importance of multi-level engagements in the sustainable use and management of natural resources, which support livelihoods, the economy and biodiversity. These projects brought together multiple stakeholders from the public and private sectors, as well as diverse community groups.

Unsuccessful BE interventions had several characteristics in common. These projects excluded local communities in the decision-making process and emphasized economic gains with minimum focus on environmental sustainability. Such is the case of the Lamu port project in Kenya and the marine phosphate mining project in Namibia. We show that the development of these projects is primarily driven **by economic motives, which lead to the marginalisation of local communities and environmental degradation.**

READ THE FULL PAPER:

Okafor-Yarwood, I., Kadagi, N.I., Miranda, N.A.F., Uku, J., Elegbede, I.O. & Adewumi, I.J. 2020. ***The Blue Economy–cultural livelihood–ecosystem conservation triangle: the African experience. Frontiers in Marine Science.***

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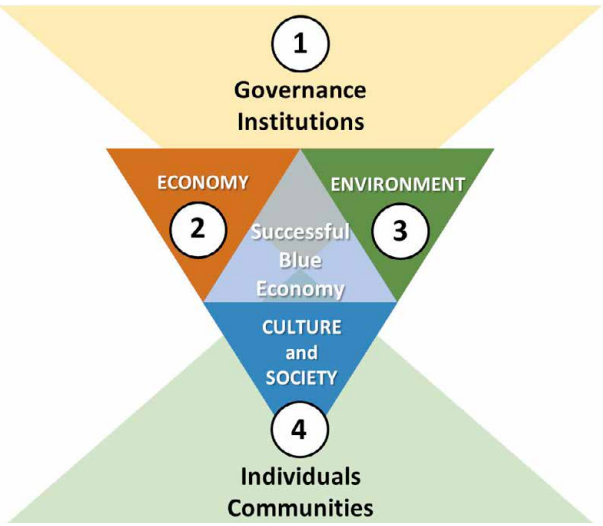


The Blue Economy triangle: *a combination of top-down and bottom-up management approaches that incorporate the economy, environment, culture and society, and governance.*

What is next for Africa's BE?

Given the apparent differences between successful and unsuccessful BE interventions, there is a need to adapt to a collaborative framework which can provide a springboard to revitalize a balanced BE. We make a case for the adoption of a collaborative blue management framework which combines the top-down and bottom-up approaches. This framework engages diverse stakeholders in the planning, implementation, evaluation and monitoring of BE interventions which promotes transparency in resource use and sustainability. As such, successful BE initiatives would need to evaluate socio-cultural, institutional, ecological and economic objectives as shown in the **Blue Economy triangle.**

A resilient BE for coastal and island nations in and post the coronavirus pandemic will require a hard reset. It would mean implementing a functional, equitable and sustainable institutional governance framework that integrates all BE sectors and actors. This can be achieved through capacity building and education to facilitate local communities' involvement in decision-making. In doing so, it will be possible to attain a balance between economic, social and environmental benefits.

HERBIVORE DYNAMICS CAN PLAY A BIG ROLE IN MARINE PROTECTED AREAS.

By Austin Humphries

A new study from Kenya shows that **transitioning coral reefs** into **marine protected areas** (MPAs) **requires consideration** of **how to promote the quick recovery of herbivorous fishes like parrotfish.**

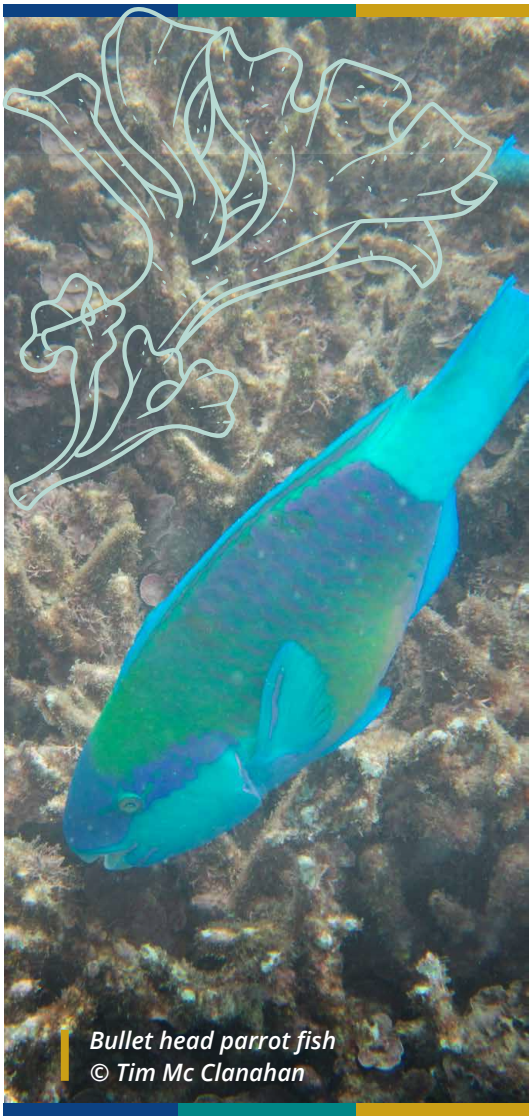
"Surgeon fish face".
© Tim McClanahan

Many coral reefs along the Western Indian Ocean coast are being considered for protection from fishing, but understanding how sea urchins are replaced by fishes is important for reef futures. In heavily fished reefs, sea urchins were the dominant herbivore working to effectively consume algae so that corals could dominate. However, when fishing was prohibited from these same reefs, sea urchins were not immediately replaced by fishes that play a similar role in the food web, leaving the reefs to accumulate algae.

Global targets set out by the United Nations hope to achieve 30 percent ocean protection in MPAs by 2030. **Coral reefs are a particularly important ecosystem to protect because they support diverse assemblages of organisms and provide livelihoods for millions of people worldwide.** To achieve positive ecological outcomes on coral reefs, herbivores are important for controlling the competition between corals and seaweeds for sunlight and nutrients. Previous studies have shown this to be true in the Caribbean and the Pacific Ocean. However, the mechanisms of algae

removal and the species responsible have yet to be fully understood for the Western Indian Ocean.

Researchers set out to quantify rates of algal consumption across reefs that were heavily fished, those that were recently designated MPAs, and reefs where fishing had been prohibited for greater than 20 years. At all reefs, substrate tiles were made from cross-sections of coral and placed where algae were allowed to grow. Cameras were then deployed to get a view of what species were utilizing the tiles. Samples were taken periodically to process in the laboratory and weigh the algal biomass. All observations were compared with controls placed in cages, where neither sea urchins nor fishes were able to enter. Results after one year showed that algae on coral reefs across Kenya quickly grew to values of around 150 g m-2 where there was no herbivory. **On the heavily fished reefs, however, sea urchins consumed nearly all of the algae, and in the older MPAs, parrotfishes served the same role and removed as much as 98 percent of algae.** On the reefs recently protected from fishing, sea urchins were not as abundant, nor were important herbivorous fishes like parrotfish. On these reefs, only 20 percent to 45 percent of algae was consumed. Consequently, the conservation priority to protect reefs from fishing was making them more vulnerable to the proliferation of algae at the onset.



Bullet head parrot fish
© Tim Mc Clanahan

While this research showed that sea urchins might be effective grazers to prevent seaweed dominance on heavily fished coral reefs, they are not a functional replacement for fishes – this is due to their ability to reduce reef accretion through bioerosion. Therefore, conservation initiatives aimed at increasing MPAs need to be cognizant of the recovery dynamics between sea urchins and fishes, especially in the early days of intervention. **If herbivorous fishes like parrotfish are not present, the reefs might be inadvertently put in a vulnerable position where seaweeds inhibit coral growth.**

READ THE FULL PAPER:

Humphries, A.T., McClanahan, T.R. & McQuaid, C.D. 2020. ***Algal turf consumption by sea urchins and fishes is mediated by fisheries management on coral reefs in Kenya.*** Coral Reefs, 39(4):1137–1146.

Available Here

MULTIPLE SUBSTRATES CHOSEN IN MASS *IN SITU* EGG DEPOSITION BY *DRUPELLA* IN MAURITIUS. A FIRST RECORD FOR THE WESTERN INDIAN OCEAN

By Deepeeka Kaullysing

This publication is the outcome of a collaboration between the University of Mauritius and the Conservation Diver in the United States. Led by Deepeeka Kaullysing, lecturer at the University of Mauritius, this work reports a mass egg deposition of the coral-eating gastropod *Drupella* in the reefs of Mauritius, a new record for the Western Indian Ocean.

Outbreaks of corallivorous gastropods are well documented as leading causes of coral mortality. Recent years have provided numerous records of outbreaks of *Drupella spp.* worldwide, impacting the resilience of coral reefs. However, literature on the reproductive ecology and early life history of *Drupella* spp. is scarce globally and non-existent in Mauritius. Furthermore, the substrates upon which these records are based provide remarkable insights into the ecology of *Drupella* spawning in reef environments.

To date, there are only four discrete substrate categories known for *Drupella* egg deposition globally. These are dead solitary fungiid skeletons, dead *Pocillopora* and *Acropora* skeletons, ventrally dead foliose *Montipora* fragments and living *Drupella* shells. Three of the substrate categories have been reported from Mauritius. The highest density of *Drupella* egg deposition recorded has been for those found under the dead fungiid skeletons in Mauritius (1 million embryos in less than 1m^2). Additionally, findings of egg deposition on the shell of a living, motile *Drupella* individual may indicate alternate or less stringent preferences for egg deposition. The motile nature of the substrate may have important implications for population dispersal. This documentation may allow researchers and reef managers in Mauritius and around the world to better assess the risk of coral sites to additional stress.

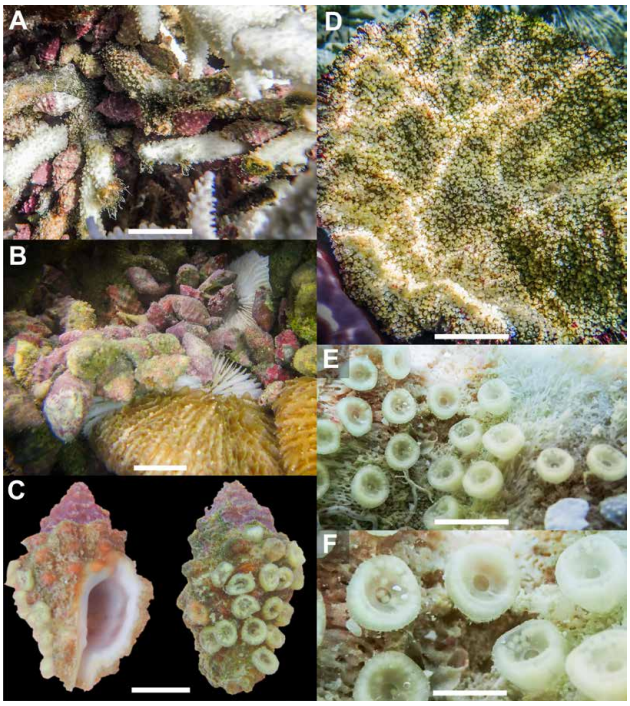


Figure 1. Corallivory and in situ egg deposition by Drupella spp. observed around Mauritius. A. Drupella predation on Acropora fragments. B. Drupella individuals feeding on live a live fungid. C. Drupella individual with egg bundles on its shell. D. Dead mushroom coral with the underside heavily used as a substrate for Drupella egg masses. E. Egg capsules attached to the underside of broken Montipora aequituberculata pieces. F. Close-up of egg capsules on M. aequituberculata. Scale bars: A, B, D = 10 mm; C = 5 mm; E = 3 mm; F = 1.5 mm.

READ THE FULL PAPER:

Kaullysing, D., Mehrotra, R., Arnold, S., Ramah, S., Allchurch, A., Haskin, E., Taleb-Hossenkhan, N. & Bhagooli, R. 2020. ***Multiple substrates chosen in mass in situ egg deposition by Drupella in Mauritius, a first record for the western Indian Ocean.*** Journal of Molluscan Studies, eyaa023.

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ADDRESSING COASTAL AND MARINE FISHERIES MANAGEMENT CHALLENGES IN KENYA COULD THE DPSIR FRAMEWORK PROVIDE A LASTING SOLUTION?

By Mumini Dzoga

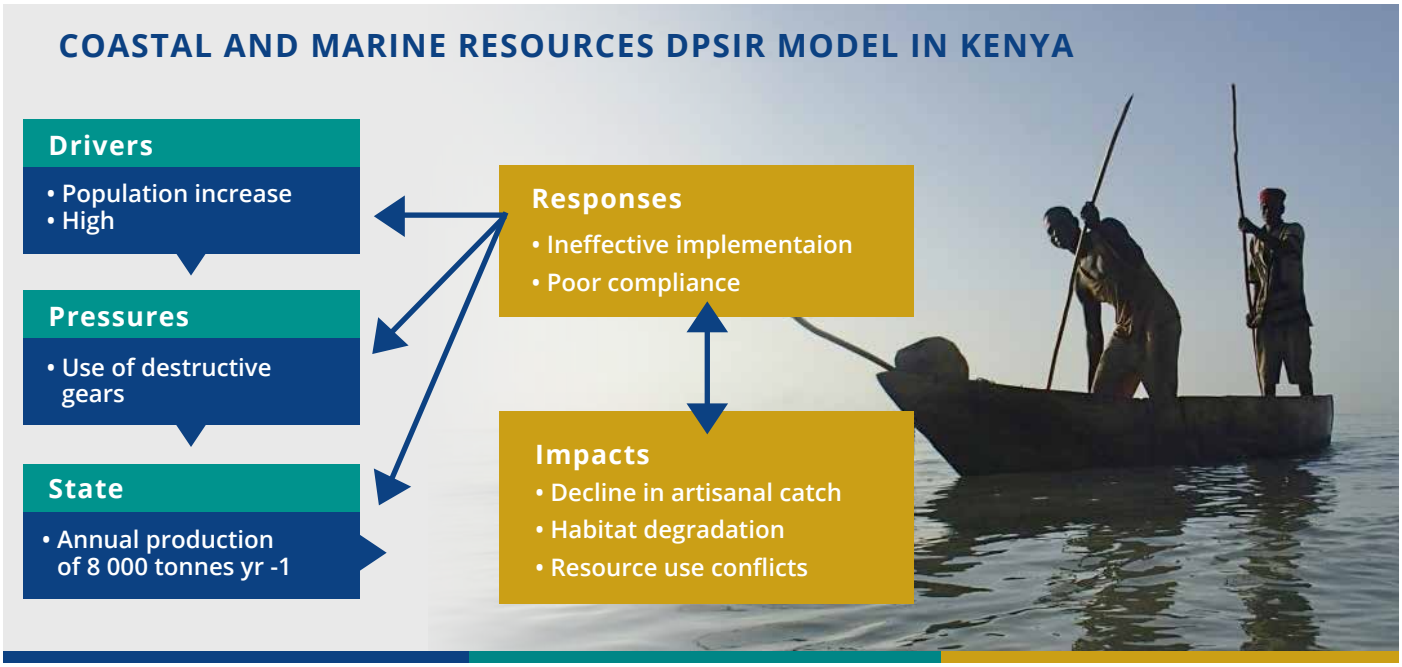

Figure. DPSIR assessment framework (modified from Kristensen, 2004)

Driver, Pressure, State, Impact and Response (DPSIR) is a framework for addressing the challenge of managing natural resources. The framework has been improved over time to overcome limitations for identifying and assessing natural resources issues that may warrant effective management.

On a global scale, the DPSIR framework has been widely applied in understanding the root causes of the challenge of managing natural resources for dependent communities. However, the majority of studies that have adopted this framework have been in the fields of terrestrial and inland aquatic resources; the application of the framework to coastal and marine fisheries resources is very new, especially in Kenya. **The artisanal coastal and marine fisheries resources in Kenya have been reported to be dwindling.** At the same time, habitats are known to be degraded by excessive fishing pressure and the unprecedented impacts of climate change. However, the actual root causes of these challenges have not been well understood.The identification and assessment of the root causes of the management challenges pertinent to coastal and marine fisheries resources require a holistic approach.

Such an approach enhances effective management responses. With this in mind, we reviewed the literature to establish the extent of the application of the DPSIR framework to coastal and marine fisheries resources management in Kenya. Despite positive feedback and continued improvement of the DPSIR framework in providing a holistic response to the management of natural resources management in other areas, we found

that it has been scantily applied to coastal and marine fisheries management in Kenya. This could be attributed to a lack of understanding of the potential of this framework to evaluate the management challenges associated with fisheries resources effectively.

Our review established that the major drivers of management challenges for coastal and marine fisheries resources in Kenya include a relatively high population growth rate of 3.7 percent, as well as a relatively high rate of dependence on fisheries resources among fishing communities. This was especially true for Ngomeni and Kipini fishing communities, both located on the north coast of Kenya. These communities registered dependency rates of 74 percent and 58 percent, respectively. Other findings indicate that reef fisheries production is unsustainable and ranges from 5 to 13 tons/km2 against the recommended 2 to 4 tons/km2 annually.

Apart from the well-known top-down management of marine national parks and reserves, Kenya is still in the process of adopting other consultative management initiatives to accommodate a collaborative approach towards fisheries resources management. In addition to the challenge of meeting the requirements of a collaborative approach, there are also challengesof incorporating an ecosystem approach to fisheries management. Excessive fishing pressure and continued degradation of nearshore coastal ecosystems is still rampant, despite the adoption – more than two decades ago – of a collaborative management approach to fisheries resources.

The lack of a holistic approach to the challenges of fisheries resources management may be the leading reason for the establishment of collaborative management initiatives that are still being piloted in Kenya and throughout Western Indian Ocean. Therefore, in addition to other methodological approaches, the DPSIR framework may be useful for visualising the root causes of issues related to coastal and marine resources. The framework provides a unifying platform where every component in an ecosystem is taken into consideration.

Fresh fisherman catch, Kipini, Kenya. © Pascal Thoya

READ THE FULL PAPER

Dzoga, M., Simatele, D.M., Munga, C. & Yonge, S. 2020. ***Application of the DPSIR framework to coastal and marine fisheries management in Kenya.*** Ocean Science Journal, 55: 193–201.

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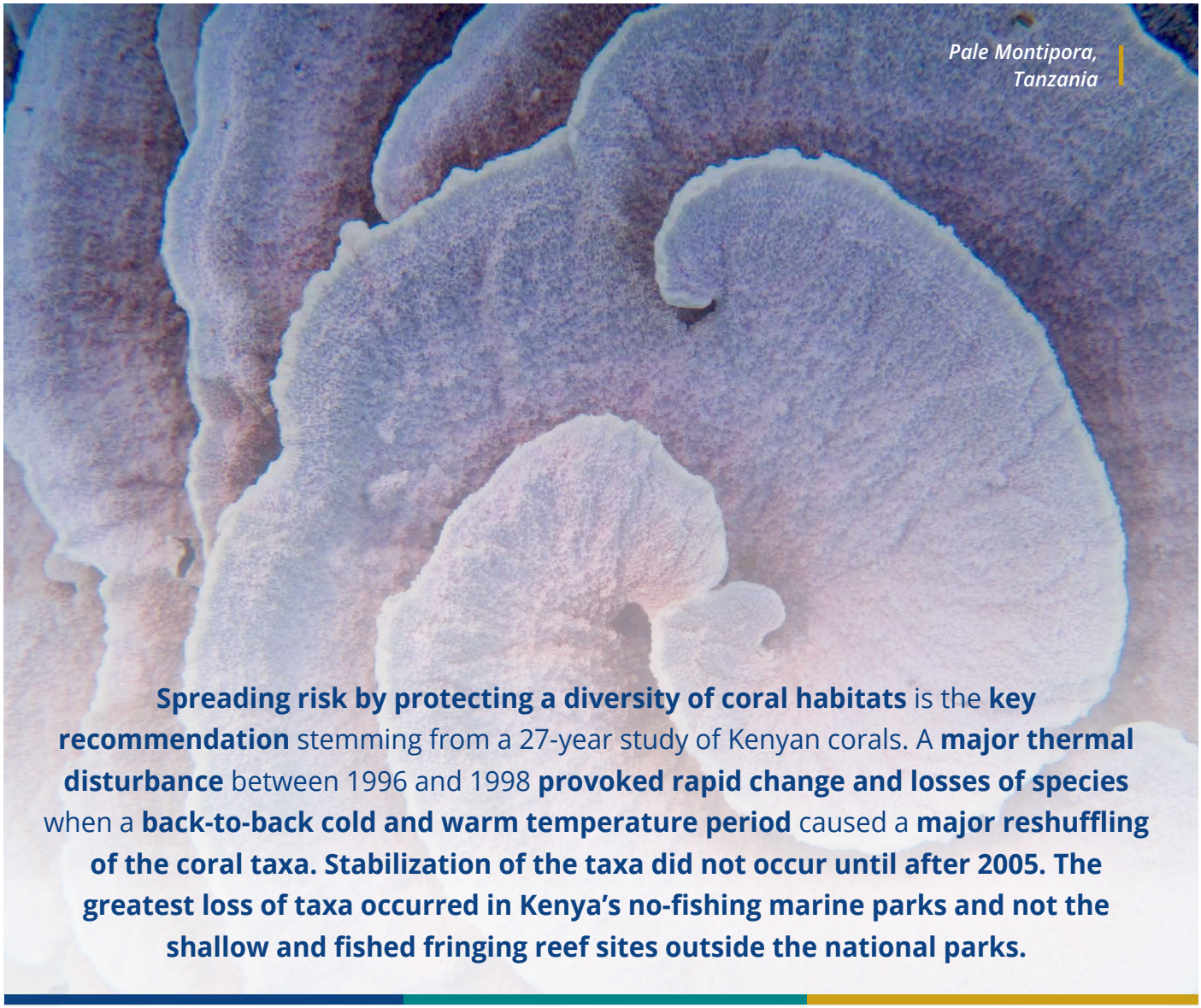
A MAJOR TURNOVER AND LOSS OF CORAL TAXA IN KENYAN REEFS, DESPITE MARINE RESERVE PROTECTION

By Tim McClanahan



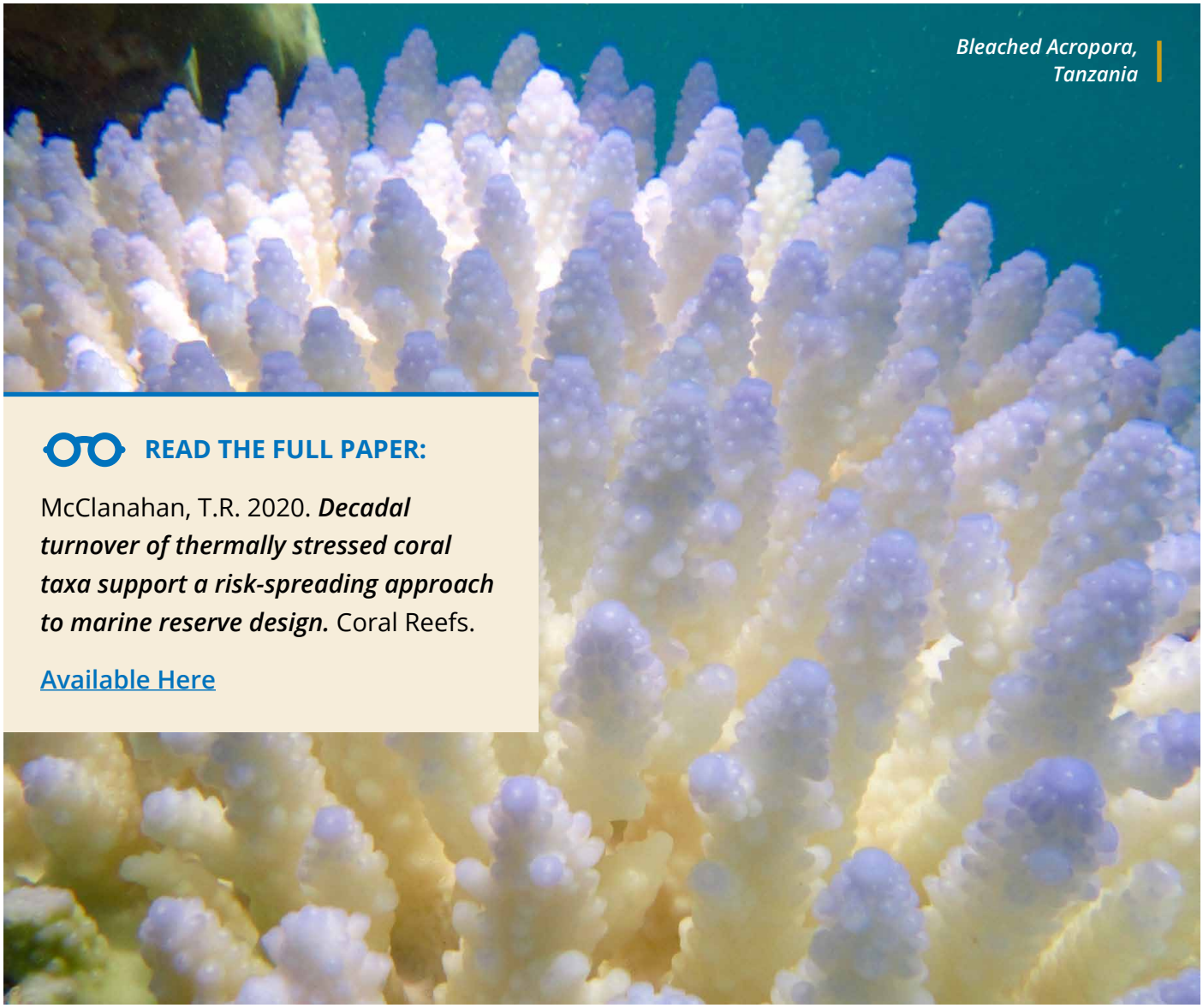
Pale Montipora, Tanzania

Spreading risk by protecting a diversity of coral habitats is the **key recommendation** stemming from a 27-year study of Kenyan corals. A **major thermal disturbance** between 1996 and 1998 **provoked rapid change and losses of species** when a **back-to-back cold and warm temperature period** caused a **major reshuffling of the coral taxa. Stabilization of the taxa did not occur until after 2005. The greatest loss of taxa occurred in Kenya's no-fishing marine parks and not the shallow and fished fringing reef sites outside the national parks.**

This conclusion was reached by examining the turnover of coral taxa at14 sites along Kenya's fringing reef between 1993 and 2018. Turnover is the change in the presence and absence of species and indicates how the whole assemblage of coral species responds to disturbances. Turnover was shown to differ significantly from the changes recorded for the dominant corals, which are frequently the main reported measure of change. Previous studies of change have either examined the total cover of hard coral or the dominant taxa, such as *Acropora*, *Porites*, and *Montipora*. Conclusions about change will differ based on these two ways of measuring change, according to the study's comparisons. Turnover is often used by biogeographers because it tends to be slow and conservative and represents large changes in time and space that often occur over evolutionary time. **Thus, periods of rapid turnover are indications of the emergence of new and unique species assemblages.**

Losses of taxa were most acute in the studied Kenyan parks where there was high diversity of corals, no fishing and stable background water temperatures. While being good for supporting high numbers of coral taxa, it did not prevent local losses of species. The parks lost 20 and gained 7 taxa, whereas fished reefs gained 16 and lost 15 taxa. Thus, there was a net loss in parks and a balance of gains and losses in fished reefs. This appeared to be caused by more variability in habitats outside of the parks, often habitats that are shallow and do not have high total numbers of species. Consequently, **the common conservation policy of protecting the most species diverse sites, failed to protect many taxa during highly stressful years.**

Including more types of reef habitats in conservation planning is expected to lead to a greater balance of gains and losses in species when times are tough. Given the increasing frequency of climate and ocean variability associated with climate change, it behooves managers to consider habitat diversity as a major consideration when undertaking marine spatial planning and promoting restrictions.



Bleached Acropora, Tanzania

READ THE FULL PAPER:

McClanahan, T.R. 2020. ***Decadal turnover of thermally stressed coral taxa support a risk-spreading approach to marine reserve design.*** Coral Reefs.

Available Here

SUSTAINABLE SHARK FISHERIES IN THE WIO? A CASE STUDY FOR SIMPLE FISHERIES ASSESSMENTS WITH THE BARAKA'S WHIPRAY

By Andrew J. Temple

Baraka's whipray

Fisheries pose the single greatest threat to the survival of many bony fish and elasmobranchs (sharks and rays) at the global level, with several recent studies painting a concerning picture for their future in many parts of the Western Indian Ocean. Assessing fisheries can be time consuming and expensive, often requires decades of data, and may mean missing the boat on sustainable, evidence-based management actions. So, how might we speed things up?

Trait-based approaches to fisheries assessment aren't new, but they are overlooked and underutilised. By combining a basic understanding of the life history traits of fishes, or even just best estimates, with some simple observations and good reference points, we can dramatically speed up the assessment process. Of course, there are caveats (aren't there always?!) but the benefits are clear if these are met.

To demonstrate a trait-based approach, my colleagues and I assessed the Baraka's whipray (*Maculabatis ambigua*) for which we had data from the WIOMSA-funded BYCAM project (BY-Catch Assessment and Mitigation in Western Indian Ocean Fisheries). This species was only described in 2016 but it is one of the most common in Kenyan and Tanzanian fisheries.

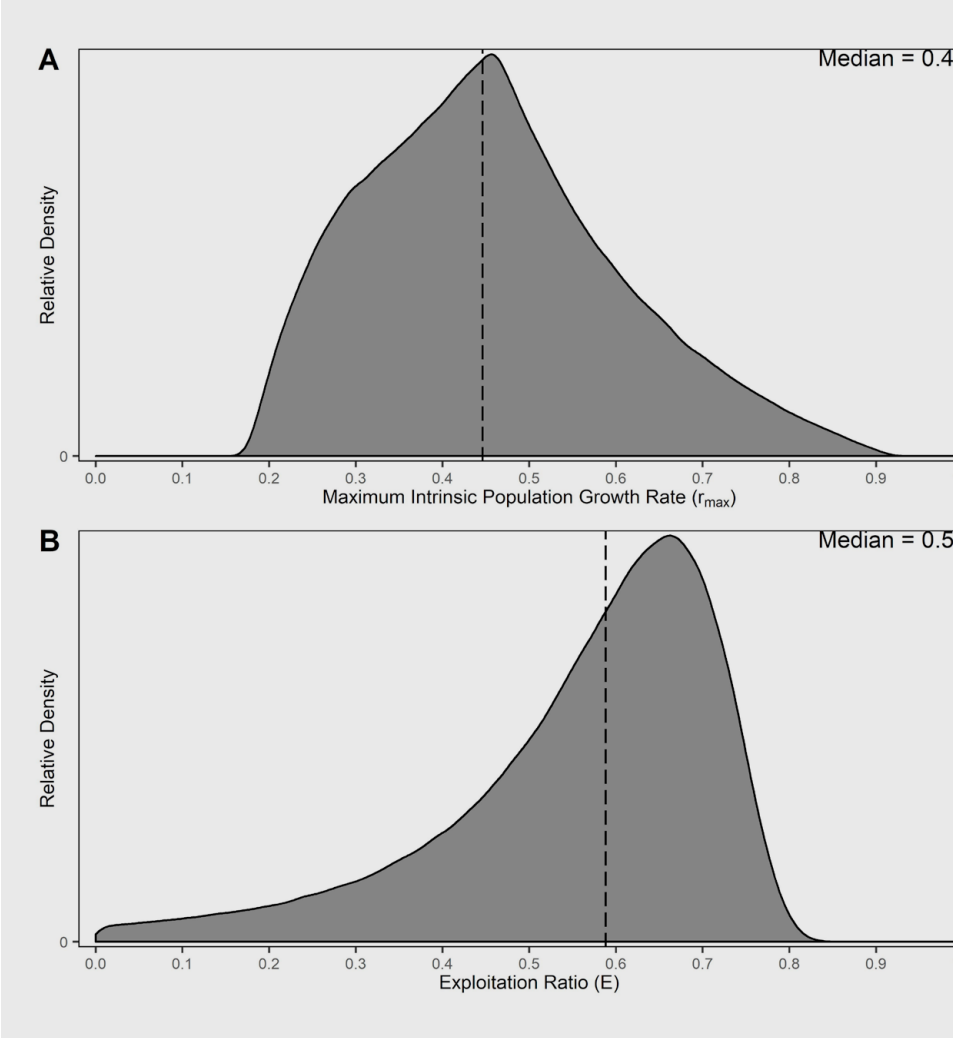
The traits we needed for this approach are:

1) age of **reproductive maturity** for females;
2) maximum **reproductive age** of females (essentially maximum age because fish reproduce throughout their lives);
3) **annual reproductive output** of female offspring.

We calculated values for these traits by combining the outputs of age-growth curves (plotting sizes against ages estimated from growth bands in thinly sectioned vertebrae) with examinations of reproductive organs, to classify maturity and the number of fertilized eggs in females. These can even be estimated in some cases, as long as you are clear about the uncertainty in your data, meaning that the approach is useful even when some of the required information is not available. For example, we estimated female maturity using male maturity because our sample of females was too small; in whiprays, females and males mature at around the same size.

However, if total mortality is greater than rmax the species is at imminent risk of extinction.

We can then use these estimates to calculate the maximum intrinsic population growth rate (rmax) – essentially the speed at which the population could grow with no external constraints – using the simplified Euler-Loktka equation whilst accounting for juvenile mortality. We can compare rmax to mortality estimates, calculated from our trait data alongside simple fisheries data (catch and size), as well as comparing estimates of total and fisheries mortality using the same data to get the exploitation ratio (E). We can then interpret these values quite simply: if fishing mortality accounts for over half of the total mortality rate then overfishing is likely to be occurring and thus be unsustainable in the long-term. However, if total mortality is greater than rmax the species is at imminent risk of extinction.



Our results show that, despite being only recently described and being resilient to fisheries (for an elasmobranch), overfishing is likely to be occurring for the Baraka's whipray. This is a worrying sign for this species and for the many less resilient elasmobranchs caught throughout the Western Indian Ocean. Yet, elasmobranch fisheries can and have been successfully and sustainably managed in several areas across the globe. Our hope is that our work might lead to better management for this and other elasmobranch species across the region's fisheries, to allow for sustainable elasmobranch fishing far into the future. Further, we hope that our approach might be replicated by other researchers for the many elasmobranchs and bony fish that remain unassessed and potentially at risk across the Western Indian Ocean.

READ THE FULL PAPER:

Temple, A.J., Stead, S.M., Jiddawi, N., Wambiji, N., Dulvy, N.K., Barrowclift, E. & Berggren, P. 2020. Life-history, exploitation and extinction risk of the data-poor Baraka's whipray *(Maculabatis ambigua)* in small-scale tropical fisheries. Fish biology.

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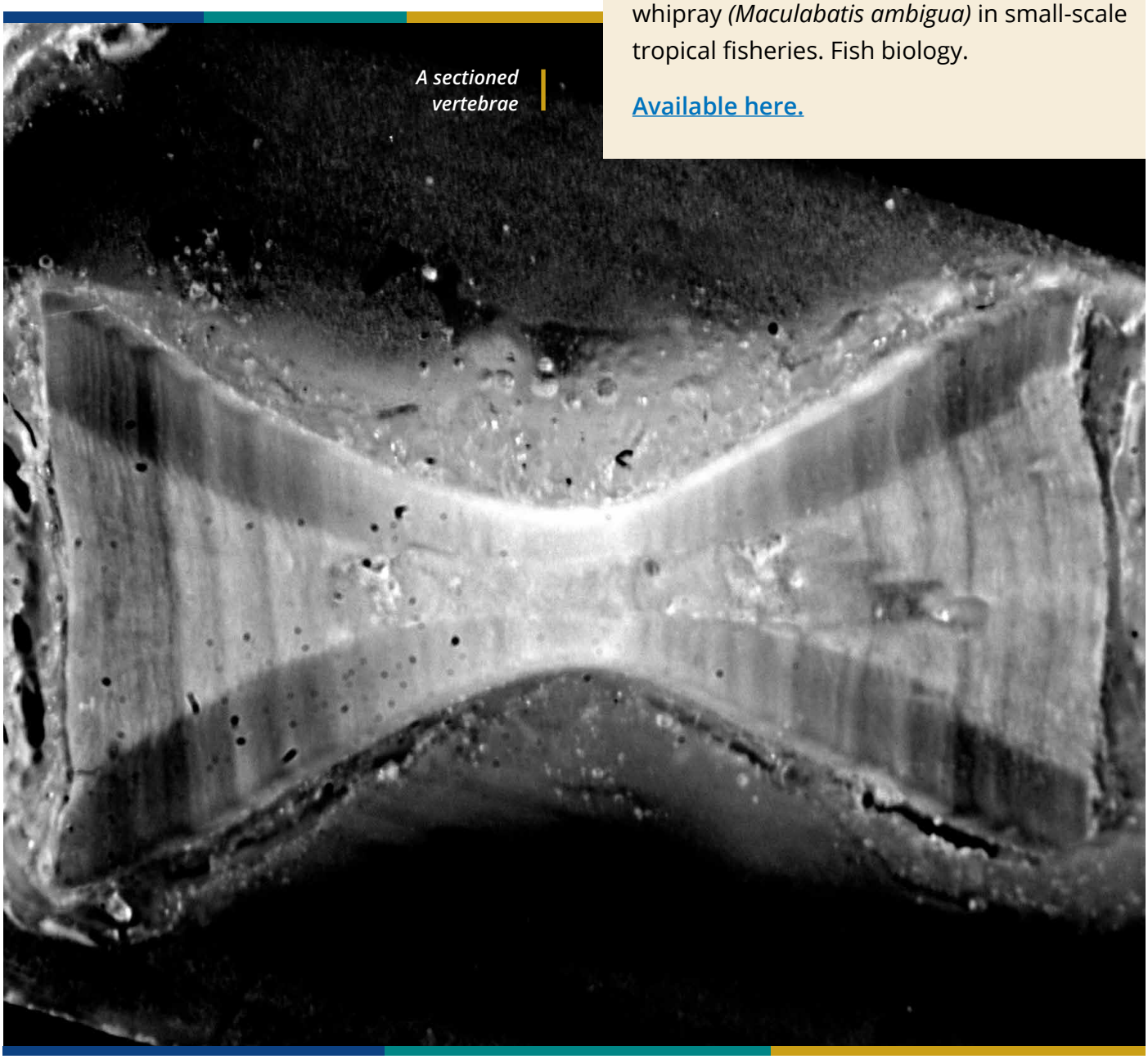
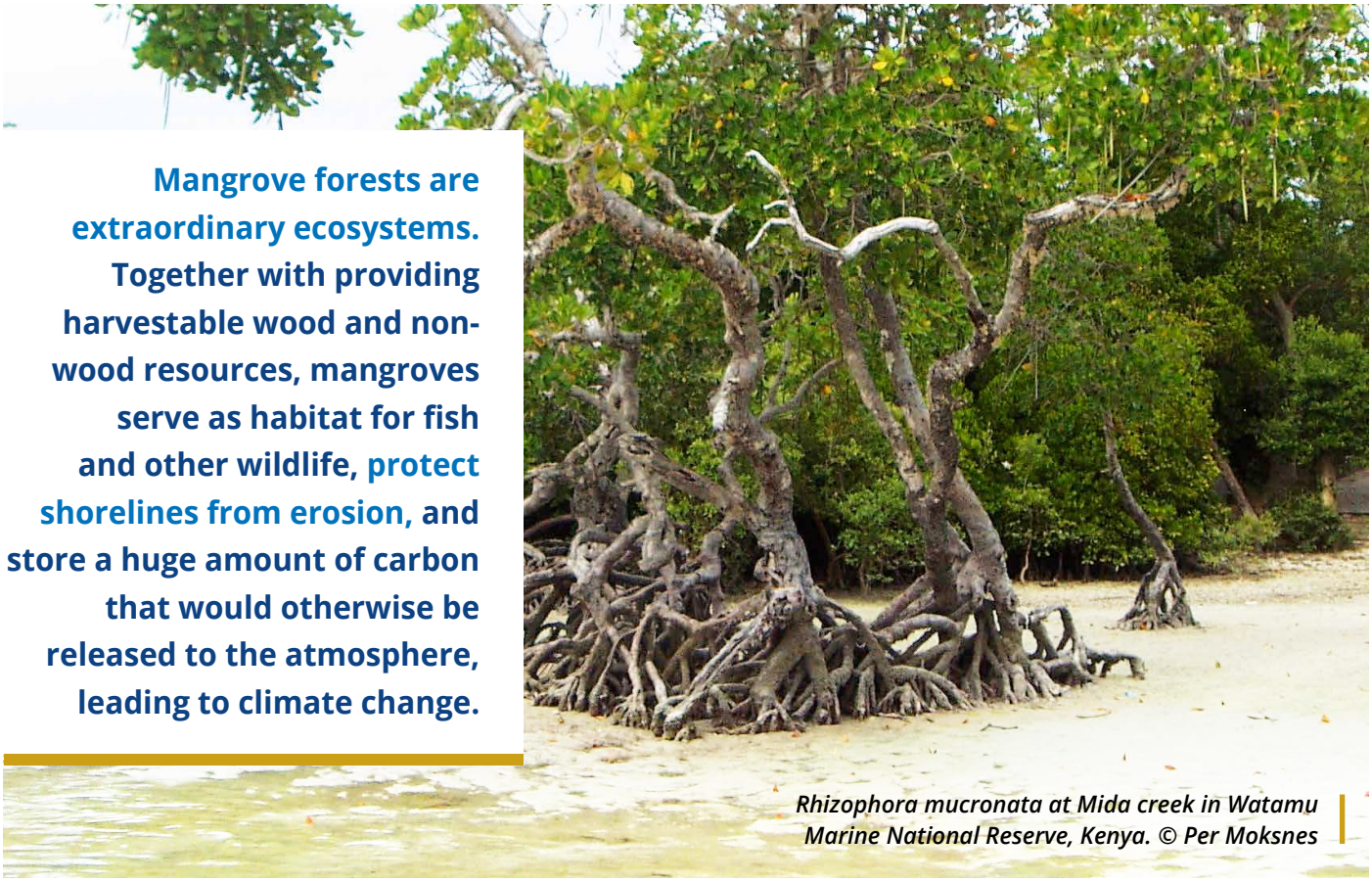


A sectioned vertebrae

DRIVERS OF CHANGE: EXTRACTION OF WOOD FOR CONSTRUCTION AND FUEL IS THE BIGGEST CONTRIBUTOR TO MANGROVE CHANGE IN KENYA. *By Amina Juma Hamza*



Mangrove forests are extraordinary ecosystems. Together with providing harvestable wood and non-wood resources, mangroves serve as habitat for fish and other wildlife, protect shorelines from erosion, and store a huge amount of carbon that would otherwise be released to the atmosphere, leading to climate change.

Rhizophora mucronata at Mida creek in Watamu Marine National Reserve, Kenya. © Per Moksnes

In developing countries, mangrove ecosystems are an intricate part of people's livelihood because communities heavily depend on mangrove resources. This overdependence on mangrove resources puts the coastal communities at risk, especially when mangroves are lost or their area is converted for other land uses. Hence it is vital to understand patterns of mangrove utilization and the drivers of change. Using Kenya as an example, the article systematically reviewed past and present utilization of mangrove resources in Eastern Africa; and factors driving their change. The study adopted a systematic review of literature from the Web of Science and Science Direct. A total of 132 articles were accessed then screened for relevance, and 32 articles were retained for extraction of information.

In Kenya, as is in other areas of Eastern Africa; mangroves have in the past (and present) primarily been exploited for their wood products. Mangrove wood is harvested for both subsistence and commercial use, for building poles, fuelwood, charcoal, fishing stakes and the construction of fishing boats. Other uses mentioned in the literature include making furniture, traditional medicine, dyes/tanning and honey harvesting.

Mangroves also support coastal fisheries in various ways, including providing nursery and habitat for many commercial finfish and shellfish.

Regulatory services provided by mangroves, such as shoreline protection, carbon sequestration and water quality controls, have also been acknowledged and monetary values associated with the function estimated. However, the cultural aspects associated with mangroves were not fully covered.

Despite the significant role mangroves play in local and national development in Kenya, they continue to be threatened by a combination of anthropogenic and natural factors, such as rising sea-levels, shoreline change and increased sedimentation. Direct human factors associated with loss and degradation of mangroves in the region are overexploitation of resources, conversion pressure and pollution. The increasing demand for mangrove wood products for construction and fuelwood have contributed significantly to the decimation of mangrove forests. The root causes for loss and degradation of mangrove resources in Eastern Africa have been identified as population growth, economic pressure, poverty and inequality, poor governance and climate change. Poor governance manifests itself in terms of illegal harvesting and encroachment into the mangrove area.

Losses and degradation of mangroves impact negatively on fisheries, community livelihood and shoreline stability. It is therefore imperative to identify ways in which changes in mangroves can be transformed into opportunities to improve coastal livelihood. In conclusion, an overview of mangrove utilization and drivers of change have been presented to provide insight for the pluralistic approach in mangrove ecosystem management. However, literature did not allow for an assessment of changes in uses through time.

The finding of this study prompts coastal managers and conservation professionals to effect innovative, sustainable practices that will improve the living conditions of the coastal communities in harmony with the changes observed.

Mangrove poles in a yard in Lamu, Kenya.

READ THE FULL PAPER

Hamza, A.J., Esteves, L.S., Cvitanovic, M. & Kairo, J. ***Past and present utilization of mangrove resources in eastern Africa and drivers of change.*** 2020. Journal of Coastal Research, 95(SI): 39–44.

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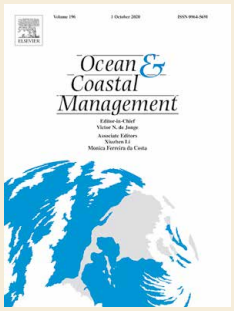
FARMING SEAWEED TRANSFORMS COASTAL VILLAGES IN KENYA

By David Mirera

An article published recently in ***Ocean and Coastal Management*** provides thrilling **insights** into the **contribution of seaweed farming to societal development** and **environmental integrity** in coastal Kenya. **The seaweed farming interventions initiated in Kibuyuni** – a remote village on the south coast of Kenya – in early 2009 by Kenya Marine and Fisheries Research Institute scientists, is associated with **observed transformative changes in the village.**



READ THE FULL PAPER

Mirera, D.O., Kimathi, A., Ngarari, M.M., Magondu, E.W., Wainaina, M. & Ototo, A. 2020. ***Societal and environmental impacts of seaweed farming in relation to rural development: the case of Kibuyni village, south coast, Kenya.*** Ocean & Coastal Management, 194: 105253.

Available Here

Kibuyuni sea weed farmers with their produce

Like most research interventions, there has been limited documentation of the contribution of seaweed research to society and the environment, despite the many significant research interventions undertaken. The paper elucidates the societal and environmental impact of seaweed farming enterprises concerning livelihoods, environmental health and community development. Further, the study provides an overview of the capital and time requirements involved in the seaweed farming investment to guide policy formulation for the sector.

Overall seaweed farming in Kenya is up-scaled through the use of model farms (3 km rope farms) using an off-bottom farming method to produce spinosum *(Eucheuma denticulatum)* in suitable sub-tidal areas, while cottonii *(Kappaphycus alvarezii*) is under experimental farming. The annual production has increased from about 1 tonne of dry seaweed in 2008 to a maximum of 45 tonnes in 2017, valued at USD 12 000, excluding income from value-added products like soap, shampoo, juice and fish feeds, among others.

The time required for seaweed production is expended in the preparation of ropes and tie-ties for planting, seeding and deployment of lines, harvesting, transportation and drying of seaweeds. The study revealed that a farmer would require about USD 300 to fully plant, harvest and dry seaweeds from a model farm that can provide revenue of USD 375 in one harvest that takes place in 45 days. The cost of production for seaweeds will reduce in subsequent harvestsbecause materials like ropes, tie-ties and sticks will be useful for more than two to three years, thus making seaweed farming a low capital investment with a high rate of return over short periods.

The study established that seaweed farming is a driver of positive social development in the village of Kibuyuni because it facilitates the provision of universally significant societal benefits like access to food, infrastructure (roads, electricity, education, housing and healthcare).

"Farmers are now able to buy iron sheets and blocks to build good houses and pay school fees for their children," says Fatuma Mohammed, chairperson of the seaweed farmers' cooperative.

Through seaweed farming, farmers (especially women) can own assets, which previously they could not attain in their lifetime. This is because seaweed farms earn money, and farmers can use their assets to access credit when in need of services.

Seaweed farming requires a large labour force during the preparation of ropes, planting and harvesting. Therefore it provides employment at the local level (one farmer can employ about five people per five-day tidal cycle. There is also the flexibility of working time in seaweed farming that enables farmers to undertake other livelihood activities like fishing, businesses and farming. The study also revealed that seaweed farming contributed positively to influence dynamic food web interactions. Herbivorous fish species increased with the introduction of seaweed farms due to the provision of shelter and food, in addition to trapping sand sediments that may impact ecosystems like coral reefs. Despite the positive contribution to society and the environment, seaweed farming can be a source of conflict for the community because of fighting for space and ocean resources. Consequently, as the industry expands, there is a need for zoning farming areas.

MOLLUSC SHELL FISHERIES IN COASTAL KENYA LOCAL ECOLOGICAL KNOWLEDGE REVEALS OVERFISHING

By Victor Alati

Marine **shelled mollusc** fisheries are often conducted by **gleaning, i.e. walking in shallow waters and fishing with bare hands** or with simple gear (see photograph). Gleaning is **especially important and common in the tropics**, where it **provides a source of protein and income** for fishing families.

However, given that gleaning is often conducted by women and children, it is often overlooked in management and lacks ecosystem-impact assessments because it is not considered to be fishing. In addition, there is limited documentation on the status and dynamics of fished marine shelled mollusc species in many countries. This is compounded by the fact that we are unaware of the drivers behind declining stocks, making it difficult to formulate management plans.

In this study, we assessed the fishers' perceptions of changes in abundance of targeted marine shelled mollusc species and the status of associated fished habitats in coastal Kenya. **We also used local ecological knowledge to reconstruct mollusc shell catches from 1970 to 2010, to study shifting environmental baselines because community perceptions could be changing.** This was achieved by interviewing 132 marine shelled mollusc gleaners at five sites in coastal Kenya.

We found that a multispecies marine shelled mollusc fishery is present in Kenya. Both women and men conduct this fishery. Through interviews with 132 marine shelled mollusc gleaners, we distinguished 158 different shelled mollusc species being targeted.

Results from the study indicate that many marine shelled mollusc species that were once plentiful experienced a severe decline between the 1970s and 2010s along the Kenyan coast. **Many species are currently perceived to be rare; therefore**

A woman gleaning shells in Mkwiro village, Kenya

they could be at risk of local extinction. Gleaners with high gleaning experience observed a greater number of species being rare, as well as a greater decline in shell populations compared to gleaners with low experience. More experienced gleaners perceive a greater decline, indicating a baseline shift in perceptions. A greater proportion of gleaners with low experience did not observe temporal changes in shell species abundance. This is likely because they started gleaning when stocks had reduced or depleted.

Our results also indicate that seagrass was the preferred habitat for gleaners of shelled molluscs in Kenya. Gleaning occurred primarily in moderate-sized to extensive seagrass meadows. Individuals with high gleaning experience perceived a greater decline in seagrass distribution compared to those with low gleaning experience.

We found that the gleaners perceived overfishing of shells, elevated sea-surface temperature and habitat destruction as the main causes of a temporal decline of gleaned shells in coastal Kenya. Other causes, in order of the most mentioned, include sea urchin herbivory of seagrass meadows; predation by fish and sting rays; disregard of traditional taboo practices and beliefs; weak law enforcement; and migrant fishers.

Our findings suggest that local ecological knowledge is useful to understand historical changes in fisheries lacking long-term scientific data and in revealing unnoticed species losses. Information on rare shell species can be used in setting up local management goals and plans for sustainable management. **The study recommends the incorporation of shifting baselines in marine resource management programmes to contribute to the long-term conservation and management of fisheries resources.** Moreover, Beach Management Units can be used as platforms upon which shell fisheries management goals can be entrenched in the existing management plans.

READ THE FULL PAPER:

Alati, V.M., Olunga, J., Olendo, M., Daudi, L.N., Osuka, K., Odoli, C., Tuda, P. & Nordlund, L.M. 2020. ***Mollusc shell fisheries in coastal Kenya: local ecological knowledge reveals overfishing.*** *Ocean and Coastal Management,* https://doi.org/10.1016/j.ocecoaman.2020.105285

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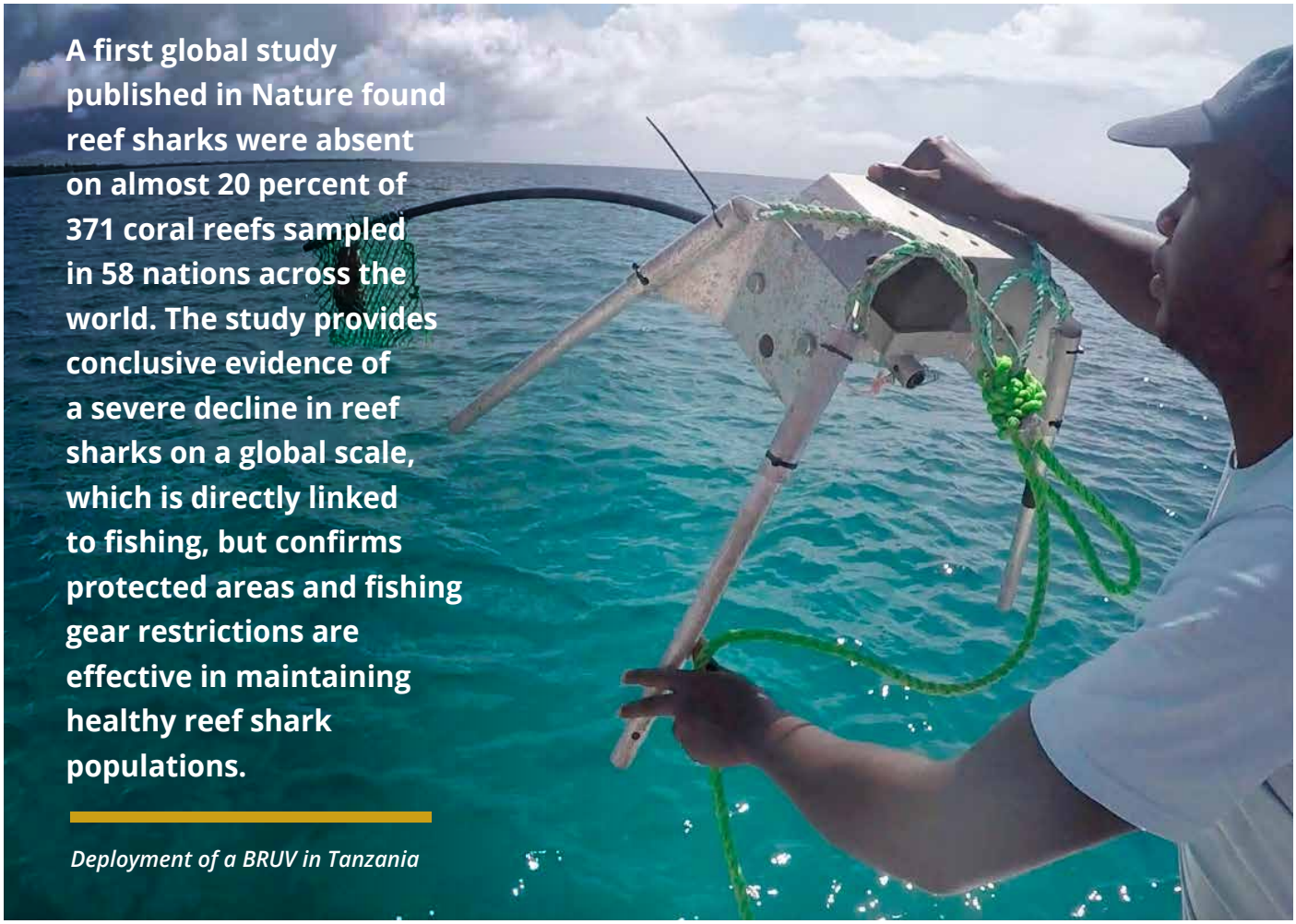
A woman gleaning shells in Mkwiro village, Kenya

RESTORATION OF REEF SHARKS MAY BE POSSIBLE THROUGH CONSERVATION AND POLICY MEASURES.

By Kennedy Osuka



A first global study published in Nature found reef sharks were absent on almost 20 percent of 371 coral reefs sampled in 58 nations across the world. The study provides conclusive evidence of a severe decline in reef sharks on a global scale, which is directly linked to fishing, but confirms protected areas and fishing gear restrictions are effective in maintaining healthy reef shark populations.

Deployment of a BRUV in Tanzania

The results were based on 15 165 hours of baited remote underwater video (BRUV) footage gathered around the world.

The severe depletion of reef sharks was particularly high in parts of the Western Indian Ocean (WIO) where 22.6 percent of BRUVs were expected to record sharks. Based on this regional expectation, some populations were found to be **"functionally extinct"**. For example, Kenya was ranked as one of the 11 **"zero reef shark"** countries in the world while only 8.1 percent of BRUVs in Tanzania recorded sharks. In contrast, in Seychelles and South Africa, populations had densities greater than the regional average, at 60.0 percent and 32.1 percent respectively. Populations in Mozambique were moderately depleted with 18.2 percent of the BRUVs recording sharks. A similar case was found in Madagascar and Mayotte (France) where 17.9 percent and 17.3 percent, respectively, recorded sharks. It is notable, however, that sampling in the WIO was very sparsely spread compared to other regions.

The regional average number of shark species in the WIO was seven, comparable to that recorded in Madagascar. Mozambique and South Africa populations had the most species at 10 each, which was above the regional score. Countries that recorded a lesser number of species than the regional score included Seychelles (6), Mayotte (3), Tanzania (1) and Kenya (0).


Preparing bait

Coastal sharks comprise two-thirds of species traded globally and their widespread decline, which had remained undocumented on a global scale, will have great socio-economic implications for communities directly dependent on them as important food resources or tourism attractions. In addition, the loss of reef sharks will have considerable ecological knock-on effects in these ecosystems because of the important role they play as top predators.

Overfishing by longlines and gillnets was the main cause of the loss of reef sharks. The study also revealed the decline to be strongly related to socio-economic conditions, including the size and proximity to the nearest market, poor governance, and the density of the human population. Factors that promoted high numbers of sharks were good governance, remoteness and presence of directed shark fisheries management or shark sanctuaries[1].

There is a clear lack of established management schemes for reef sharks in most WIO countries, but positive effects of conservation were evident in Madagascar and Mayotte. These two nations showed increased benefits if they were to invest in shark fisheries management, large no-take Marine Protected Areas (MPAs), or became shark sanctuaries. No-take MPAs were in place in these countries, and the study noted reef sharks were healthy in large MPAs where compliance is good. Similar positive effects of management were seen in South Africa where both no-take MPAs and domestic shark regulations were present. Gear restrictions specifically ban on gillnets and long lines in certain areas, are recommended. Indeed, the FinPrint study found these gear restrictions were associated with higher numbers of reef sharks, and in some cases were more effective than no-take MPAs. The benefits of no-take MPAs increase two-fold when their size is sufficiently large (~20000 km2) to cover the home range of reef sharks. Overall, shark sanctuaries were found to be an effective conservation tool with the greatest benefits at the national scale and could be considered in the WIO.

The good news is that restoration of reef shark populations is possible and can be achieved through dedicated conservation approaches and effective management measures, provided key socio-economic aspects of reef shark fisheries are understood and incorporated. Economic policy measures to improve governance conditions are also essential in the restoration and management of reef sharks. In summary, the study provides a global benchmark for the status of reef sharks and specific guidance on the relative effectiveness of long-term conservation measures for their protection and recovery.

[1] *No targeted catch or trade in shark or shark products.*

THE STUDY WAS LED BY AARON MACNEIL, WITH CO-AUTHORS FROM THE GLOBAL FINPRINT PROJECT (HTTPS://GLOBALFINPRINT.ORG/FINDINGS/INDEX.HTML#2) AND OVER 100 OTHER CO-AUTHORS WHO PARTICIPATED, INCLUDING THREE CORDIO STAFF MEMBERS.

READ THE FULL PAPER

MacNeil et al. 2020. ***Global status and conservation potential of reef sharks.*** Nature, 583: 801–806.

Available Here

HIGHLIGHTS FROM A MARG I STUDY: SEAWEEDS AS A POTENTIAL SOURCE OF BIOACTIVE PHYTOCOMPOUNDS TO SUPPLY THE BIOTECHNOLOGICAL INDUSTRY.

By Valera Dias

Seaweed farm in the ocean

The use of natural products in food, medicine and other industries has been a focus in many different societies. Particular attention is given to bioactive compounds found in marine organisms.

In fact, marine organisms possess specific physiological capabilities that allow them to support complex environments such as extreme temperatures, or variation in temperature, salinity and pressure. Consequently, they produce diverse secondary metabolites that cannot be found anywhere else.

From the marine organisms investigated, seaweeds or marine macroalgae are known to be rich in a broad range of compounds, and researchers suggest they may be a promising resource to provide novel phytocompounds – a chemical group obtained from natural sources such as plants, seaweeds and microalgae that exhibit a range of biological activities. Despite the broad application of seaweed extracts worldwide, this is under-exploited in Mozambique.

We took the opportunity that the MARG I grant offered by WIOMSA to perform phytochemical characterization of some seaweeds that occur in the south of Mozambique. During this study, three sites were visited, namely Inhaca Island, Ponta de Ouro and Chongoene. A total of 126 species of seaweeds were registered. Most of the seaweed species are already known from previous studies but several species found in Chongoene and Ponta de Ouro will be reported for the first time *(in preparation)*.

In the first stage of the project, we analysed the phytocompounds of 15 species of seaweeds (which included green, brown and red seaweeds), applying GC-MS, highly sensitive equipment and one of the most precise ways to identify various compounds in extracts from different solvents. This enabled the identification of more than 90 phytocompounds, such as n-Hexadecanoic acid, Cholesterol, Phytol, Phytol acetate, cis-13-Eicosenoic acid, Tetradecanoic acid, and Z-8-Methyl-9-tetradecenoic acid (which were the most common). The less common compounds identified included Cetene, 9-Octadecenoic acid (Z)-methyl ester, and Oleic acid. Campesterol, gama-Sitoesterol, Cholest-5-en-ol 24-propylidene-(3.beta) are steroids only identified in green seaweeds. Due to their relevance in different industries such as the pharmaceutical, nutrition, agriculture and cosmetic industries, these seaweeds are good candidates for further research in terms of isolating and validating the phytocompounds identified in this study. Particular attention should be given to Neophytadiene because this is a strong bioactive compound with several applications, such as antibacterial, antifungal, antipyretic, antioxidant, analgesic and vermifugic properties. Additionally, this compound was reported to have the potential to be used in inflammatory disorder.

As a follow up study, the second stage of the project is evaluating the potential use of some of the seaweeds as antibiotic agents, specifically against bacteria and fungi which are harmful to human skin. However, more effort is being expended to understand the active principle of the phytocompounds, since seaweeds are reported to have action as antioxidants, antimicrobial, anti-parasitic, anti-inflammatory, antiallergic, antifeedant, anti-thrombic, anti-carcenogenic and anti-ulcer. Nevertheless, we would like to go further in our investigations, covering the areas of nutrition and cosmetics in long-term studies.

This MARG I grant allowed four undergraduate students to finish their studies (in the fields of marine ecology, marine chemistry and applied biotechnology). These students learnt different skills during their fieldwork and data analysis, enhancing their ability to be successful in their future career.

On the other hand, the results of this work will be presented to our fellow researchers through two scientific reports (in preparation), which will focus on the importance of the phytocompounds identified in seaweeds collected in the south of Mozambique, and the antimicrobial activities of the seaweeds extracts.

Marcelino, a student in the chemistry lab

CONTRIBUTIONS OF LOCAL COMMUNITY ORGANIZATIONS TO SEA TURTLE AND MARINE MAMMAL CONSERVATION IN ZANZIBAR

By Frank Mirobo

Group Photo of symposium participants

A workshop hosted by the Nansen Tutu Center for Marine Environmental Research in Cape Town, South Africa, brought together more than 85 delegates from Namibia, Mozambique, Madagascar, South Africa, Tanzania, France, Germany, Norway, Netherlands and the United States.

I had the opportunity to showcase how far Tanzania has moved ahead in the conservation of endangered marine animals, specifically sea turtles and marine dolphins, with the involvement of local communities.

The oral and poster presentations reported on work done in collaboration with Dr Salum Hamed from the University of Dodoma and Dr N. Jiddawi from the Institute of Fisheries Research, Zanzibar. The purpose of the workshop was to bring together marine scientists from the Western Indian Ocean, Pacific Ocean and the southern Atlantic Ocean to share knowledge, build networks and work together to solve existing challenges. It also aimed to bring together early career marine scientists to take the lead in the tenth Nansen Tutu Center 10th anniversary symposium themed **"Ocean, weather and climate, science to the service of society".**

Recently, a study was conducted to examine what local communities contribute to the conservation of endangered marine organisms. And the findings from this study were the topics of my presentation at the Nansen Tutu symposium. The study used key informative interviews, questionnaires and focus group discussions and revealed that aquarium construction, protection of nesting sites, turtle tagging and the spread of awareness of turtle conservation in the community were the main methods used for turtle conservation.

Training workshops that taught ethical boat driving techniques, the use of pingers on fishing nets and the conservation awareness of local communities contributed to the conservation of endangered marine animals. There are fewer women involved in conservation activities. Still, involvement does lead to the opportunity to gain employment and earn income: all these activities influence village and town growth within the island of Zanzibar.

From a management perspective, the study strongly suggested that gillnets of small mesh size should not be used in conservation areas because they accelerate the bycatch of sea turtles and marine dolphins. There is a need to evaluate the incidental catch of endangered marine organisms, stratified according to geographical areas, fishery and seasons. This is because Zanzibar island is affected by the two monsoon periods. Such an evaluation will help the management sector to intensify efforts to curb incidental by catch of sea turtles and marine dolphins. More surveys and boat patrols to estimate the abundance and distribution of these animals are also important for the evaluation of incidental catch. As pointed out by the conservation organisation WWF, the strategy for sustainable conservation is to involve local communities in marine resource conservation at all levels. It is equally important that the government of Zanzibar focuses on empowering women and supporting the participation of local communities in marine resources conservation at all levels.

Government support is critical for the success of community-based tourism associations. The failures of groups like the Kizimkazi Dolphin Tourism Operator Association (KIDOTOA) is partly due to little government support. Such support is vital for newly established local groups who are committed to supporting and protecting the endangered marine dolphins. Furthermore, the government of Zanzibar needs to specifically promulgate rules and regulations that protect and ensure the safety of endangered marine dolphins because there are currently no rules governing dolphin tourism in Zanzibar. The number of boats that can be operated simultaneously during the dolphin tour must be strictly limited to reduce chasing and disturbing dolphins. This will encourage ecologically responsible dolphin tourism

Since the Nansen Tutu Center 10th anniversary symposium, there have been many developments. We had several discussions about how we can improve the existing database of sea turtles, working with scientists from Kenya, Mauritius and South Africa. We agreed to identify the gaps within our respective areas and come up with regional research for the entire Western Indian Ocean region. Also, we had preliminary discussions about dolphin monitoring models with colleagues from Stellenbosch University in South Africa. Unfortunately, it has been challenging to meet physically and conduct an initial survey owing to the COVID-19 pandemic and the resultant travel restrictions. With the support of the non-governmental organization, African Impact, we are preparing a memorandum concerning rules and regulations for dolphin tourism in Zanzibar. This will be a first step towards the establishment of a legally binding document. As part of my personal development, I submitted an extended abstract to the Nansen Tutu Center for Marine Environmental Research so that it may be included in the main symposium report.

ACKNOWLEDGEMENT:

I have also been acknowledged by the International Ocean Institute Southern Africa, under the Western Indian Ocean Governance Exchange Network, and African Impact foundation pages as one of the upcoming, early career marine scientists in the field of megafauna conservation (https://wiogen.org/2020/06/05/frank-mirobo).

DEVELOPING A FRAMEWORK TO ASSESS THE ECOLOGICAL CONDITION OF MANGROVE FORESTS

By Denise Nicolau, Celia Macamo, Sean Nazerali, Hugo Costa and Naseeba Sidat

A view of Pomene National Park

Mozambique holds the largest mangrove coverage in the Western Indian Ocean region and the third largest in Africa. More than 70% of the country's coastal population depends on mangrove ecosystem services for its subsistence.

Over the last decade there has been a significant increase in the exploitation of natural resources in Mozambique, as well as the development of infrastructure, which have resulted in several negative environmental and social impacts. Consequently, there is an urgent need to find ways to reconcile economic development with biodiversity conservation in Mozambique, in order to secure long-term ecosystem services provided by mangrove forests, for current and future generations.

In 2018, BIOFUND – the Foundation for Conservation of Biodiversity – in partnership with the mangrove research team from University Eduardo Mondlane and the Wildlife Conservation Society (WCS)/COMBO Project* started the development of a framework to assess the ecological condition of mangrove forests in Mozambique.

This framework has been developed under the Biodiversity Offsets Program, an initiative implemented by BIOFUND in partnership with WCS/COMBO and the Government of Mozambique, to support the development of procedures for effective implementation of the mitigation hierarchy, resulting in better development and industry practice in Mozambique.

**www.combo-africa.org*

"We consider this process to be a valuable learning and research experience for Mozambique, especially at a time when the country has approved the National Management Strategy for Mangroves (2020–2024), which recommends the development of tools for mangroves assessment and monitoring.

Mangrove Metrics Workshop in Maputo, 2019 © Denise Nicolau

It is intended that the metric tool is developed through a participatory and inclusive process, with a solid scientific basis that allows an accurate and robust assessment on the ground, thus facilitating an appraisal of biodiversity losses and gains with respect to mangrove forests. In this way, government, project developers, conservationists and local communities in Mozambique will be able to assess the ecological condition of mangrove forests across the country by using standardized procedures.

In 2019, a multi-stakeholder workshop was held in Maputo city with the aim of presenting the concept of the metric; presenting the set of tools currently used to determine the condition of mangrove forests in national, regional and global studies and identifying those that are applicable in Mozambique; identifying possible indicators for the development of the tool with national experts; and discussing the next steps for the development of the tool to assess the condition of the mangrove ecosystem in Mozambique.

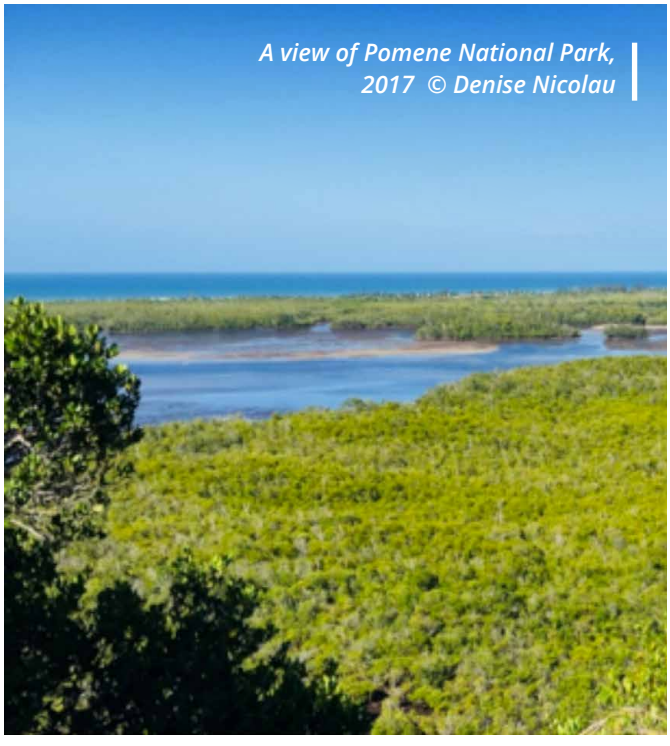
Partners

UNIVERSIDADE EDUARDO MONDLANE

WCS

COMBO PROJECT

All experiences and lessons learned throughout this process will be documented in order to inform WIO countries and support regional research of mangroves.



A view of Pomene National Park, 2017 © Denise Nicolau

TURNING "TRASH INTO CASH" MARINE LITTER REDUCTION AND PLASTIC RECYCLING OPPORTUNITIES ON THE KENYAN COAST

By Steve Trott

For more information about WMA and EcoWorld Recycling *email stevetrott@watamumarine.co.ke*

All Photos: "The Watamu Blue Team Beach Cleaners and Ecoworld Recycling teams at work in various recycling activities"

Every year an estimated 9 million metric tonnes of plastic waste enter our oceans and more than 1 million sea turtles, dolphins, sea birds and other animals become entangled and die as a result. Worldwide, people use 1.4 billion plastic bottles every single day!

At a local level, in the Watamu National Marine Park in Kenya, plastic litter has been polluting our beautiful beaches and threatening our endangered marine life, including whales, sea turtles and coral reefs.

With growing populations and urbanization at the coast, the management of solid waste is becoming a major environmental concern. Lack of waste management infrastructure and facilities, and lack of public awareness, is resulting in solid waste pollution of both terrestrial and marine environments.

The impact of marine litter and plastic pollution is deteriorating the aesthetic value of our beaches and discouraging tourists from visiting coastal resorts. This is a serious socio-economic concern because many coastal communities in Kenya depend on tourism as their primary source of employment and income.

The solution

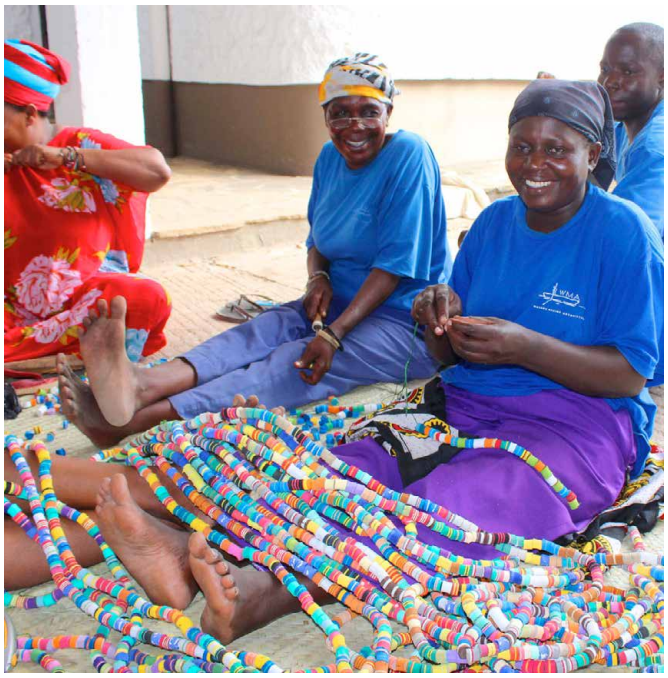
In 2010 we created a local solution to the global problem of marine plastic pollution. As a community we decided to take action and the Watamu Marine Association (WMA) set up a dynamic partnership between local women and youth groups and the local tourism industry. The Watamu Marine Park hotels and

WMA partner organizations sponsor the groups to clean the beaches. All of the collected plastic and other recyclable waste goes to our EcoWorld Recycling and Up-cycling facility were we "turn trash into cash". In addition, we take all of the plastic waste from hotels, guest houses and residents for recycling. This reduces the huge volume of waste going to the local landfill. **Over the past 10 years in Watamu we have "turned the tide on trash" by creating a circular economy that employs local people to clean beaches and provide work for plastic recyclers.** Local artists also benefit by up-cycling plastic waste to make artwork and sculptures which are sold in hotel boutiques and at the EcoWorld Recycling shop.

This innovative project has achieved its mission by establishing a community-operated waste collection service and recycling facility which benefits:

- the community through **employment and income**;
- the environment through a **reduction in the impact of plastic waste** and pollution;
- the County Government through partnership and r**educing the amount of waste going to landfill**;
- the local **tourism industry** through providing an environmental service and **cleaner beaches**;
- other communities through support, **information sharing and training provision**;
- communities, government and educational institutions through **education on waste management best practices**.

The enterprise is substantially reducing the amount of waste that directly impacts the health and biodiversity of our marine protected area. This not only has measurable conservation results but encourages tourists to visit, thereby boosting tourism revenue and the local economy.



The future

In August 2017, Kenya banned plastic bags which had an immediate impact and significantly reduced plastic pollution in the country. The Ministry of Environment and Forestry is also committed to reducing single use plastics such as plastic water and soda bottles, and to working with the plastic manufacturing industry to develop recycling capacity. On 5 June 2020, the government banned single use plastics in all National Parks in Kenya. In response to this desire and effort from the government to develop plastic recycling infrastructure in Kenya, WTA is advocating for the support and development of community-based waste management and recycling enterprises at the coast.

In line with Blue Economy goals, this would create employment and new sources of income for a large number of waste pickers and recyclers. EcoWorld Recycling is soon to set up a "weigh and pay" scheme in Watamu where people can bring their plastic waste to a weigh station and be paid by the kilogram for what they have collected.

This Watamu case study has demonstrated the potential for empowerment of coastal communities to manage solid waste and reduce the impacts of marine litter on our beaches.

Latest project:

In 2020, WMA, in partnership with the International Union for Conservation of Nature, started a Marine Plastic and Coastal Communities project in Kenya. This MARPLASTICCS project aims to:

- systematically collect plastic waste for recycling from resort towns along the Kenya coast;
- establish PET recycling value chains (putting a value on single use plastic bottles);
- invest in plastic recycling technology;
- develop small-scale community recycling enterprises;
- advocate for responsible plastic consumption and management.

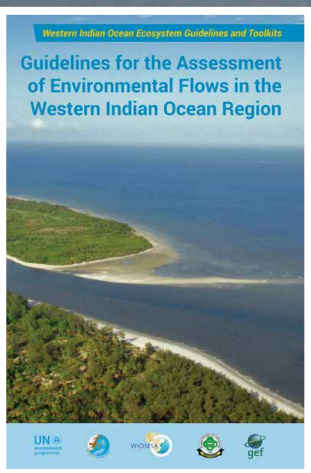
Through this project, WMA seeks to enhance the re-use, recycling, and up-cycling of plastic waste materials; further develop community-based circular economy enterprises and increase employment opportunities and income benefits; strengthen circular economy partnerships among civil society and the private and public sectors; and improve information sharing within these partnerships.

WMA aims to replicate the project model in other coastal resort towns which will be a win-win result for coastal communities and our ocean.

NEW GUIDELINES FOR THE **ASSESSMENT OF ENVIRONMENTAL FLOWS** TO **HELP COASTAL COMMUNITIES PROTECT** AND BENEFIT FROM **AQUATIC ECOSYSTEMS**

By Angela Patnode

Critical marine habitats – such as coral reefs, seagrass, and mangroves – play an outsize role in the economies, lives, and health of coastal communities in the Western Indian Ocean region.



Coastal ecosystems are also intimately connected with freshwater ecosystems, such as rivers and wetlands. Deforestation and erosion many miles away in rivers can have devastating effects on ecosystems at the coast. Other pressures, such as pollution, dam construction, or unsustainable irrigation and livestock practices – have also had an enormous impact on rivers, changing the quality, quantity, and timing of their water flows. These changes can have a profound impact on life for riverside communities. Residents may no longer be able to find as many fish to eat or clean water to drink. Crops may dry up, hurting both agricultural and livestock farmers. Communities could get sick from bathing or drinking contaminated water.

To address this threat, many stakeholders around the world have begun to implement environmental flow (Eflow) assessments, which seek to determine the magnitude, frequency, timing, and quality of water and sediment flows necessary to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Nairobi Convention states, in recognition of the importance of Eflow assessments to freshwater, coastal, and marine ecosystems, have worked to create a new set of *Guidelines for the Assessment of Environmental Flows in the Western Indian Ocean Region*.

The guidelines, which were produced in partnership with WIOMSA and the Sokoine University of Agriculture, are the first to provide a standardized, region-wide approach to conducting an Eflows assessment and outline a step-by-step guide on how to conduct such assessments to enable learning and cross-fertilization across the region. The E-Flow guidelines were launched on the 25th September 2020 and can be found on ***https://www.unenvironment.org/nairobiconvention/.***

NEW PUBLICATION PROVIDES MOMENTUM FOR DEVELOPMENT OF AN OCEAN GOVERNANCE STRATEGY FOR THE WESTERN INDIAN OCEAN REGION

By Angela Patnode

In 2015, the globe took a historic step. All member states of the United Nations adopted the Sustainable Development Goals (SDGs) – which simultaneously aim to "promote prosperity while protecting the planet" by 2030. Of the 17 goals adopted, Sustainable Development Goal 14 – which commits countries to protect 'Life Under Water' – is of particular significance, as one of the first universal acknowledgements of the critical role that coastal and marine ecosystems play in the health of our planet and ourselves.

Five years later, countries in the Western Indian Ocean (WIO) have made enormous strides in achieving certain SDG 14 targets. The Seychelles, for example, has designated a staggering 30% of its marine areas as protected, blowing past SDG 14.5 committing countries to protect at least 10% by 2020. WIO countries have developed a Regional Action Plan on Marine Litter, which will help drive actions to achieve SDG 14.1 to reduce this form of marine pollution. All around the region, meanwhile, efforts are underway to restore and protect coral reefs, seagrass, and mangroves, contributing SDG 14.2 on safeguarding critical habitats.

Nevertheless, comprehensively achieving SDG 14 by 2030 could remain difficult without comprehensive and coordinated action amongst WIO countries. The ocean is a complex and diverse resource with many users, ranging from local fishers and tourists all the way up to international shipping and mining companies, and their activities the ocean all impact one another and indeed, the wider population. For example, irresponsible fishing practices could damage the integrity of critical habitats, thereby lessening the appeal of a tourist attraction. Yet despite the interconnected nature of these resources, the management of ocean activities is often scattered amongst many different institutions and sectors. This can lead to inadequate coordination when it comes to efforts to conserve and sustainably use the ocean, as called for under SDG 14.

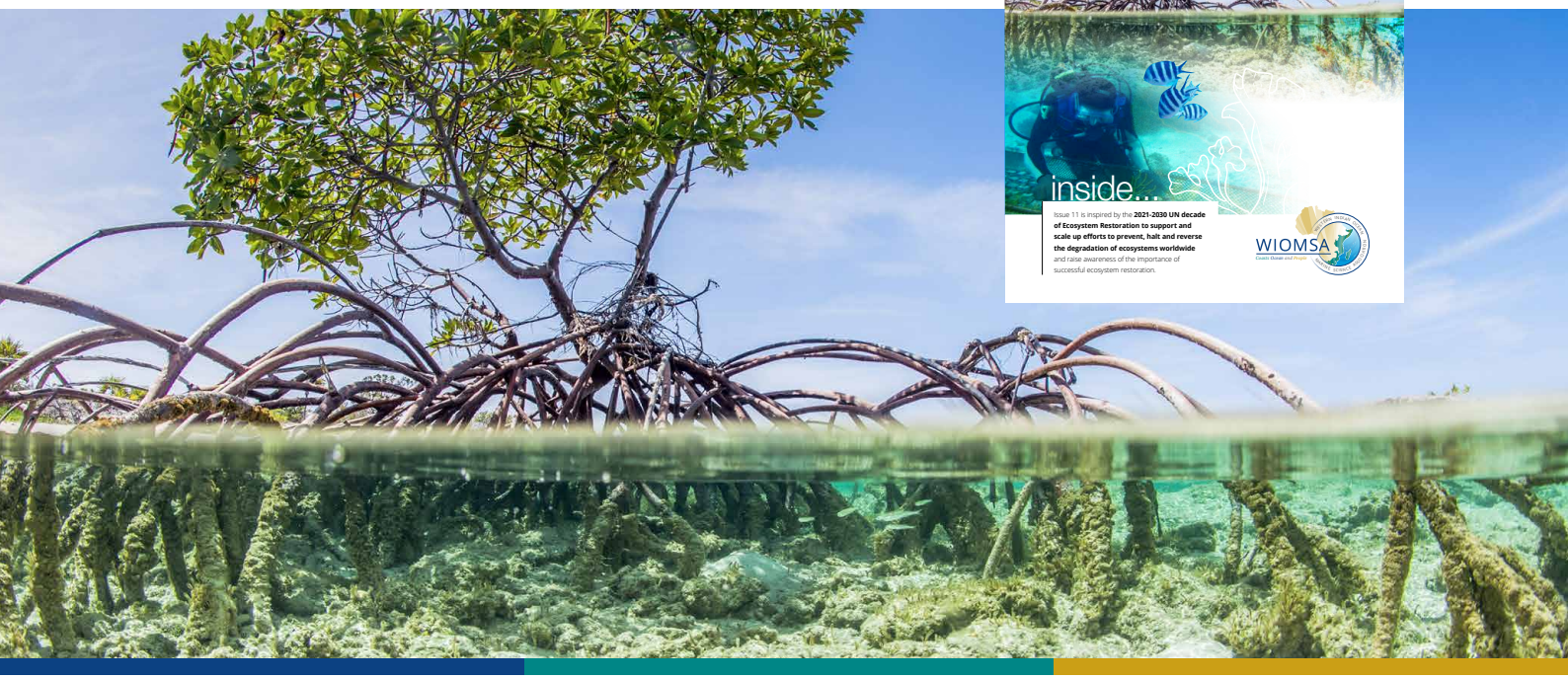
A stronger ocean governance framework at the national, regional, and global levels could help achieve such coordination. Policy harmonization, new legislation, and institutional reform – i.e. improved ocean governance – can help ensure that the ocean is managed and protected so that its resources can be enjoyed for generations to come. For this reason, the Nairobi Convention, in executing the **SAPPHIRE** project and in partnership with WIOMSA, developed *The State of Ocean Governance in the Western Indian Ocean Region*, a publication that reviews the status and trends in ocean governance in the WIO and identifies key gaps, challenges, and opportunities in relation to global norms and best practices.

Specifically, it focuses on the policy and legal instruments and strategic plans at the global, African, and WIO levels; addresses the governance arrangements in sectors like maritime security or fisheries; summarizes features of national ocean governance; and describes selected international experiences in regional ocean governance.

The publication was launched at a meeting with the African Union (AU), Regional Economic Commissions (RECs) relevant to the WIO, Nairobi Convention Focal Points, WIOMSA and other key partners on 16 September 2020. he document can serve as a resource for stakeholders looking for an assessment of the current state-of-play of ocean governance at the national and regional level. It can help them address identified gaps, act on opportunities to increase cooperation, share resources and knowledge, and secure financing for common objectives. The Nairobi Convention therefore hopes that this publication and meeting can help serve the AU, RECs, states, and other ocean stakeholders as they consider how to move forward on developing an ocean governance strategy for the region.

Read the document on www.nairobiconvention.org!

ISSUE 11 OF THE WIOMSA MAGAZINE FOCUSING ON ECOSYSTEM RESTORATION

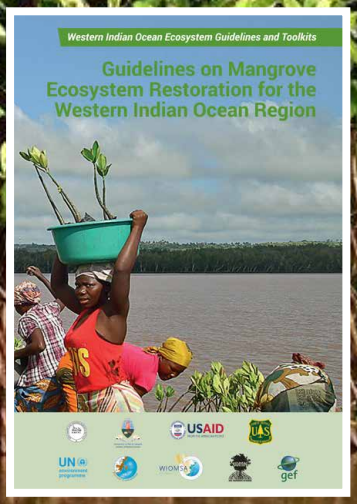


WIOMSA and the Nairobi Convention have jointly produced two issues of the WIOMSA Magazine focusing on restoring damaged coastal ecosystems. The publication of this issue of the Magazine in 2020 is quite timely, coinciding with the start of the decade of ecosystem for which the United Nations has unequivocally reaffirmed that "restoring damaged ecosystems is an efficient and cost-effective way people can work with nature to address the most pressing challenges humanity is facing today".

The case studies documented in Part 1 of this series showcase how much restoration work has been undertaken across the WIO Region in both the mainland and the Island states. From many of these case studies, bold lessons have been learnt for sharing within and even outside the region. These lessons include the adoption of innovative technologies. For example, in Seychelles the coral gardening technique is being applied at a scale not attempted anywhere else in the world and in Mozambique, hydrological restoration has been found to be more successful than the direct planting of mangroves, with Mother Nature helping with the restoration effort. The stories highlight some inspiring benefits of the restoration projects including an increase in fish abundance and the income of people living in a village in Kenya; an increase in tourist numbers at a restored coral lagoon in Zanzibar; and carbon credits that generate a combined income of USD 45 000 per year for communities involved in the world pioneering Mikoko Pamoja mangrove project on the southern coast of Kenya. **Issue 11 features stories from projects implemented in the Seychelles, Kenya, Mozambique, South Africa, Tanzania and Madagascar.**

NEW GUIDELINES TO STRENGTHEN EFFORTS TO PROTECT AND RESTORE MANGROVE ECOSYSTEMS

By Angela Patnode



Despite their economic, environmental and societal benefits, mangrove ecosystems have been under threat in the WIO region. Governments and advocates in the region have recognized the urgent need to take action to protect mangroves, which is reflected in numerous restoration projects undertaken over the years.

However, some of these projects have failed, which is why the Nairobi Convention worked with WIOMSA, the United States Agency for International Development and the WIO Mangrove Network to support the development of the *Guidelines on Mangrove Ecosystem Restoration in the Western Indian Ocean*. The Guidelines are the first in the region to analyze the reasons behind past failures and provide solutions. They provide a step-by-step guide on how to build successful restoration projects, suitable for the WIO, and highlight case studies from around the region. In order to develop the Guidelines, the project's partners coordinated several in-country and regional consultations and expert knowledge-sharing sessions, as well as a comprehensive literature review of past and ongoing mangrove restoration efforts. Before producing the final version, the first draft of the Guide was reviewed by regional experts. The Guidelines have been tested in the field and used to establish mangrove demonstration projects in Kenya with the support of The Nature Conservancy and other agencies even as they get adopted across the region.

It is hoped that these Guidelines will help countries in the region achieve sustainable development goal 14.2 on protecting coastal and marine habitats, as well as sustainable development goal 13 on climate action. The Guidelines also provide a vital means to help actors contribute to the upcoming **UN Decade on Ecosystem Restoration**. Also, since mangroves are important carbon sequesters, states can incorporate mangrove restoration into their Nationally-Determined Contributions under the **Paris Agreement.**

WIOMSA
Coasts Ocean and People

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