KMFRI
Kenya Marine and Fisheries Research Institute

Mtafiti Monthly

ISSUE 55
January, 2025
@KmfriResearch

BY Phionalorna Nzikwa, Dr Jacob Ochiewo, Brian Isoe, Fridah Munyi, Lilian Daudi, Dr Isaac Mwaura, and Dr Amina Hamza

A VULNERABLE COAST: IMPACTS OF CLIMATE CHANGE ON KENYA'S MARINE ECOSYSTEMS

Impacts of Climate Change in Kenya

Climate change poses an increasingly significant threat to the delicate socio-ecological systems found in Kenya's coastal regions. The ecological systems consist of vibrant coral reefs, expansive seagrass beds, and resilient mangroves that line the shoreline. These ecological systems play an essential role in maintaining marine biodiversity and delivering critical services such as coastal protection, climate regulation, and the sustenance of livelihoods for millions of Kenyans.

Vanga landing-site, key fishing hub in Kwale County,

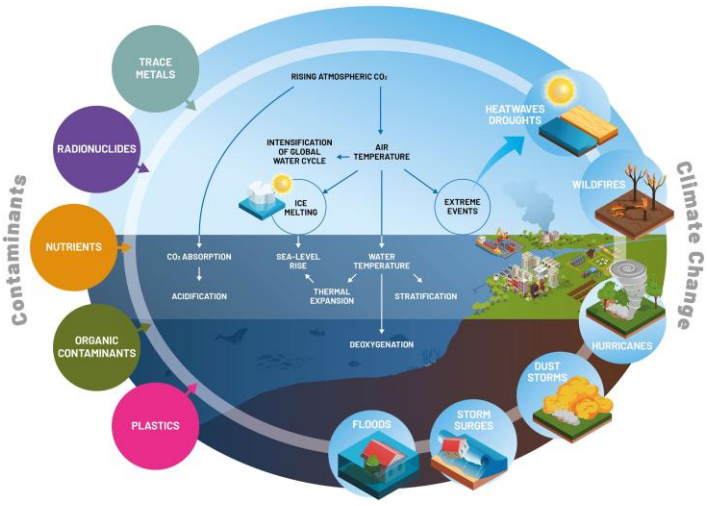
The threats posed by climate change, such as rising sea temperatures, ocean acidification, sea level rise and increased storm intensity, significantly heighten the vulnerability of these ecosystems. Rising sea temperatures lead to coral bleaching, which weakens coral structures and depletes the biodiversity that depends on them. Similarly, ocean acidification — resulting from increased carbon dioxide absorption— negatively impacts shellfish and other marine species that rely on calcium carbonate for their growth and survival. Sea level rise causes saltwater intrusion that negatively affects coastal agriculture in low-lying areas. Furthermore, the increased frequency and severity of storms can lead to erosion, habitat destruction, and loss of key species that provide ecological balance.

Dried-up River Umba in Kwale County due to Climate Change

As these marine ecosystems face decline, the repercussions extend beyond environmental

KMFRI
Kenya Marine and Fisheries Research Institute
Mtafiti Monthly
ISSUE 55
January, 2025
@KmfriResearch

degradation and into the economic and social fabric of coastal communities. Many people in these areas rely on fishing, tourism, and agriculture for their livelihoods. The depletion of fish stocks, the decline of important tourism sites like coral reefs, and the loss of natural barriers against storm surges threaten food security and economic stability for millions of coastal dwellers. It is a complex situation where the decline of these ecosystems jeopardizes not only the rich biodiversity they support but also the cultural identity and survival of human communities that have depended on them for generations.



Source: Frontiers in Marine Science

The image illustrates how climate change and human activities contribute to marine ecosystem degradation

Regrettably, there exists a substantial gap in our understanding of the intricate and multifaceted interactions between climate change and these marine environments. This gap is further compounded by an inadequate implementation of proactive measures designed to address and mitigate these environmental threats. Without concerted efforts to enhance community resilience, promote sustainable practices, and invest in ecosystem conservation, the consequences could be dire—both for the health of the marine ecosystems and the overall well-being of the human populations that rely on them for their daily lives. Addressing these challenges requires a coordinated approach that brings together scientific research, community involvement, and policy frameworks aimed at protecting these invaluable coastal ecosystems for future generations.

KMFRI's Involvement in the CCVA Project

To understand the socio-ecological impacts of climate change, the Kenya Marine and Fisheries Research Institute (KMFRI) has been implementing a two-year Climate Change Vulnerability Assessment (CCVA), funded by UNEP and Go Blue. The project is a collaboration between the European Union (EU) and the Kenyan Government, guided by UN-Habitat under the United Nations Environment Programme (UNEP).

The project aims to develop innovative and integrated land-sea planning strategies to ensure the sustainability of Kenya's marine and coastal resources. By adopting the CCVA, the KMFRI team of experts has computed a Climate Change Vulnerability Index that has covered mangroves, seagrasses, coral reefs, and coastal communities which shows the extent to which these socio-

KMFRI
Kenya Marine and Fisheries Research Institute
Mtafiti Monthly
ISSUE 55
January, 2025
@KmfriResearch

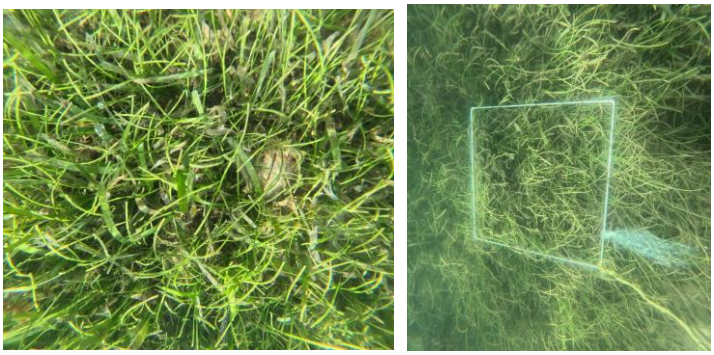
ecological systems are vulnerable to climate change. This assessment is essential for several reasons, including the formulation of targeted adaptation strategies, informed decision-making, effective resource mobilization, and the development of policies that enhance resilience.

The study conducted by experts employed a cross-sectional survey design to comprehensively gather data from both primary and secondary sources. This meticulous research followed a structured five-step methodology that included: establishing the contextual framework of the study, compiling pertinent data from various sources, evaluating different dimensions of vulnerability, synthesizing these dimensions to create a comprehensive composite index of vulnerability, and operationalizing and mainstreaming vulnerability findings into practical applications. Data was collected strategically across the five coastal counties in Kenya: Kwale, Mombasa, Kilifi, Tana River and Lamu.

From conducting Research to Drawing Conclusions

Seagrass scientist assessing seagrass species before diving to monitor the cover

Seagrass



Images illustrating different species of Seagrass

Seagrass are submerged plants found in coastal waters, covering approximately 317 km², with annual losses of 1.59% annually. In Kenya, 12 species have been reported, supporting over 14,000 artisanal fishers and a coastal population of 4.33 million.

These ecosystems sequester carbon at 2.9-9.31 tons per hectare and provide food and shelter for more than 150 fish species, including rabbitfish (*Siganidae*) and parrotfish (*Scaridae*). Kenya's seagrass ecosystems face climate stressors such as rising sea surface temperatures, extreme weather events, sea-level rise, and ocean acidification, compounded by human activities like destructive fishing and pollution. To assess their vulnerability, over 90 sites were studied across Lamu, Tana River, Kilifi, Mombasa, and Kwale.

“Results from our research showed high exposure in Mombasa and Kwale, with moderate vulnerability in Kilifi and Tana River, while Lamu had low exposure,” said Lilian Daudi, a Senior Research Scientist from KMFRI who was leading

KMFRI
Kenya Marine and Fisheries Research Institute
Mtafiti Monthly
ISSUE 55
January, 2025
@KmfriResearch

the seagrass team. Overall, the seagrass meadows exhibit medium exposure to climate change, with moderate sensitivity and adaptive capacity. Although impacts such as shifts in species composition and moderate biodiversity loss may occur, immediate ecosystem collapse is unlikely. To enhance the adaptive capacity of these habitats, management strategies should focus on reducing non-climatic stressors and improving monitoring to detect early warning signs of severe impacts.

Researchers conducting seagrass monitoring to assess the level of vulnerability to Climate Change

Coral Reefs

In their study, the coral reefs team aimed to understand the dynamic threats faced by coral reefs, such as overfishing, land-based pollution, and climate change, which is the major issue.

They integrated three key components—exposure, sensitivity, and adaptive capacity—to evaluate the vulnerability of coral reefs in various locations along the Coast of Kenya. This

Image illustrating healthy coral reefs

assessment aimed to identify which coral reefs are more or less vulnerable to these threats, enabling the development of effective solutions to mitigate the risks for those that are highly vulnerable.

Dr Jelvas Mwaura, a Coral Reef Scientist at KMFR noted, "reefs in Kisite and Chale in Diani, Kwale County are highly vulnerable and exposed to rising sea surface temperatures. We will collaborate with County Fisheries officers to devise possible solutions to address the challenges posed by climate change."

Photo of KMFRI Scientist, Dr Juliet Karisa conducting coral reef monitoring

KMFRI
Kenya Marine and Fisheries Research Institute
Mtafiti Monthly
ISSUE 55
January, 2025
@KmfriResearch

Dr. Mwaura emphasized their efforts to support Marine Protected Areas (MPAs) to bolster the resilience of coral reefs to climate change. Healthy and well-protected coral reefs have a greater chance of surviving and recovering from disturbances. Larger MPAs are particularly advantageous as they provide greater protection from external threats and facilitate species migration and gene flow.

Mangroves

Image showcasing the community participating in a mangrove planting exercise

Mangroves are essential guardians of our coastlines, protecting them from storm surges and erosion while acting as natural buffers against the forces of nature. However, like many ecosystems, mangroves are increasingly threatened by climate change. Rising sea levels pose a direct risk to mangrove forests, flooding the areas where they grow and disrupting their delicate ecosystems.

Image illustrating mangrove forest at the shore of the ocean

The KMFRI mangroves team, in their research, adopted the 14 mangrove management blocks along the Kenyan coastline as outlined in the Mangrove Management Plan. Mr. Marvin Osuma, a Research Assistant in the CCVA project, states,

"Although the mangroves are affected differently along the coastline, the team found that the mangrove forests are moderately vulnerable to the effects of climate change, except for Kipini in Tana River County, which is less vulnerable." He noted that these findings were based on a review of existing literature and that the team would conduct field studies to compare their findings on the ground with the literature and draw conclusions from both. Mr Osuma emphasized the importance of intervening in mangrove areas and restoring degraded ecosystems to prevent further deterioration.

KMFRI
Kenya Marine and Fisheries Research Institute

Mtafiti Monthly

ISSUE 55
January, 2025
@KmfriResearch

Socioeconomics

Image illustrating activities that take place at a fish landing site

The socioeconomics component of the CCVA project aimed to highlight the interconnected vulnerabilities of ecosystems and communities. It also sought to protect the environment while simultaneously enhancing the livelihoods of local communities. Coastal ecosystems, such as seagrass beds, mangroves, and coral reefs, provide critical benefits not only to marine life but also to the communities that depend on them for food, jobs, and cultural identity. When these ecological systems are threatened, the socioeconomic consequences can be severe and far-reaching as they directly support livelihoods and human well-being.

Dr Jacob Ochiewo, the Director of Socioeconomics Research for KMFRI and the CCVA Principal Investigator stated that during their research, they noted increased occurrences of drought and insufficient rainfall, which have led to crop failures across the Kenyan Coast, resulting in food insecurity.

"Several communities are diversifying their livelihood options by combining fishing with alternative and/or complementary economic activities such as small-scale agriculture and small-scale businesses, due to a significant decline in fish catches. They have additionally assumed adaptation measures, such as forming groups to develop rehabilitation programs for various ecological systems. "

He intimates that awareness programmes have been rolled out to encourage community members to recognize that climate change is a present challenge that requires collaborative efforts to mitigate its impacts. As a society, we all have a role to play in combating climate change for a sustainable future.

Vanga Fish Landing Site during off-peak hours

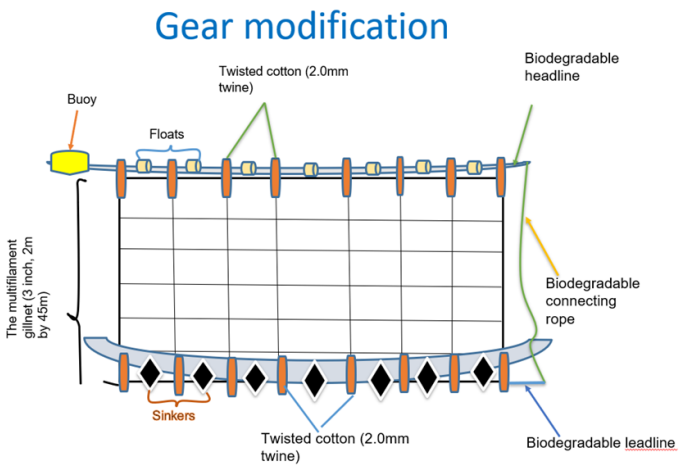
KMFRI
Kenya Marine and Fisheries Research Institute

Mtafiti Monthly

ISSUE 55
January, 2025
@KmfriResearch

Written by: Phionalorna Nzikwa, Brian Isoe, Maliki Fumbwe, Dr Erick Okuku, and Maureen Kombo

ALDFG Fishing Gear: A Growing Threat in the Marine Ecosystem



An illustration of a modified fishing net

Abandoned, lost, or discarded fishing gear (ALDFG) makes up 10% of marine litter. ALDFG has become increasingly critical as a result of rapid growth of fishing activities and the expansion of fishing grounds amplify the prevalence and distribution of this debris. Once fishing nets and equipment are lost, they drift through the ocean and become what is commonly referred to as "ghost nets," silently lurking in the ocean's depths posing significant threats to marine ecosystems.

These ghost nets continue to ensnare marine life, trapping targeted fish species and countless non-target organisms. The consequences are severe: boats risk becoming entangled in these abandoned nets, leading to accidents, operational disruptions. As they wear and tear, they release fragments of plastics that are ingested by various marine organisms. These fragments act as carriers for adsorbed contaminants which have the potential for biomagnifying up the food chain. Moreover, these ghost nets damage fragile coral reefs and seabed habitats, leading to long-lasting ecological harm. They also create significant safety hazards for all who navigate these waters.

In Africa, the consequences of ALDFG are particularly alarming. Over 200 million people rely on fish as a vital source of high-quality and affordable protein, while around 12 million individuals count on the fishing industry for their livelihoods. This situation underscores the urgent need to address the issue of ALDFG to protect vital marine ecosystems and safeguard the communities that depend on them for sustenance and employment.

Principal Scientist Dr Okuku engaging stakeholders in Malindi, Kilifi County

KMFRI
Kenya Marine and Fisheries Research Institute
Mtafiti Monthly
ISSUE 55
January, 2025
@KmfriResearch

Tackling the ALDFG Menace

The Kenya Marine and Fisheries Research Institute (KMFRI), led by Principal Scientist Dr. Erick Okuku, implemented an initiative to address plastic pollution. The initiative was funded by several organizations, including the Glo-Litter project by the Food and Agriculture Organization of the United Nations (FAO) and IMO, the Sustainable Manufacturing and Environmental Pollution (SMEP) programme and ICDO under the Catch Green project. The project brought together a diverse group of local stakeholders in the first phase of implementation, including Tudor Creek fishers, Kibuyuni seaweed farmers, Wasini coral farmers, and Kibuyuni basket trap fishers.

Stakeholders interacting with the modified fishing gear and probing on the process and durability

The initiative focused on; **Gillnet modification**- The project replaced the synthetic twine used to hang the multifilament net on the headline with twisted cotton, and replaced the synthetic headline and lead line with a biodegradable rope made from biodolomer ocean material. The goal was to reduce the catchability of fishing nets when they are lost during a fishing activity.

Seaweed farming the project introduced the use of biodegradable ropes in seaweed farming replacing the traditional plastic ropes. **Coral reef restoration** the project introduced use of biodegradable ropes for coral restoration replacing the traditional concrete blocks, which are costly and time-consuming. All these pilots aimed to assess how these environmentally friendly alternatives could be integrated into communities' daily operations, ensuring that they are not only accepted but also adopted by the communities. By engaging these different groups, the project sought to examine the potential benefits of biodegradable ropes for marine conservation and sustainable fishing practices, while also considering the economic implications for local livelihoods.

Communicating Findings through Stakeholder Engagement Forums

The project held dissemination forums across the five coastal counties to share the findings from the ALDFG surveys that had been conducted. In November 2024 to estimate the amount of lost fishing gear and the results of the pilots using biodegradable ropes and twines. The stakeholder workshops brought together fishermen, County Fisheries Officers, Kenya Fisheries Officers, and KMFRI research scientists. The workshops provided an opportunity for KMFRI scientists to raise awareness of plastic pollution, proper gear

disposal and the need to report lost gear. Additionally, the workshops aimed to understand the challenges these communities face regarding marine litter pollution reduction and control.

Ms Maureen Kombo engaging fisher communities on how the piloted the biodegradable fishing gear

The series of county-level dissemination workshops culminated in a National Stakeholders Workshop on ALDFG and EoLFG (End-of-Life Fishing Gear), which aimed to raise awareness on the scale and causes of ALDFG. This event brought together stakeholders from various sectors, including the Ministry of Mining, Blue Economy and Maritime Affairs; State Departments for Blue Economy and Fisheries; Coastal County Governments; NEMA (National Environment Management Authority); the Kenya Association of Manufacturers; The Nature Conservancy; and JILL Industries. During the workshop, KMFRI showcased the piloting of biodegradable ropes and twines for gillnet modification, seaweed farming, and coral reef restoration. This presentation provided an opportunity for public-private partnerships to encourage the development of cost-effective solutions for managing Marine Plastic Litter (MPL).

Way Forward to Ensure Sustainability

Stakeholders called for collaborative efforts in fighting ALDFG/EoLFG which is a big threat to Marine life, and human beings that consume fish. By working together, stakeholders can develop initiatives that would be effective in mitigating these threats and ensuring the protection of marine life and the well-being of communities that depend on the ocean. Through collaborative efforts, stakeholders can also develop policies for adoption that guide a gradual transition from fishing gears and materials that are currently in use, and harmful to the marine environment to those that are less hazardous and sustainable.

Dr Eric Okuku presenting on the ALFDGs during a national stakeholders' forum

The workshop proposed the development of gear marking and loss reporting procedures so that in the event the fishing gear is lost at sea, fishermen would be equipped with clear guidelines on where to report lost equipment, to enhance the chances of tracking the gears down and retrieving them from the sea. Moreover, integrating fishing equipment into comprehensive Extended Producer Responsibility (EPR) schemes would reduce the volume of waste entering the ocean since the schemes will compel producers to design products for circularity thus promoting environment conservation. The EPR programs would also facilitate initiatives including those that involve the collection and recycling of these materials to conserve resources.

What Next?

The next steps in the fight against ALDFDs require a multidimensional approach. First and foremost, the initiative should be grounded on robust policy frameworks to ensure adoption. KMFRI will work with the Ministry of State Department and Blue Economy, Kenya Fisheries Service, and other stakeholders to ensure that the research, data collected, and insights on ALFDG issues gathered during the implementation of this project inform policy. This will ensure shared best practices and improved monitoring and enforcement of regulations against gear abandonment. Public awareness campaigns on effectively combating this persistent threat should be implemented to foster responsible fishing practices and widespread behavioural change.

Image of fisherman using biodegradable net.
Source: Gencraft.com

KMFRI
Kenya Marine and Fisheries Research Institute

Mtafiti Monthly

ISSUE 55
January, 2025
@KmfriResearch

PICTORIALS

Dr. George Morara from KMFR's Kegati Aquaculture Centre with scholars from Kisii University's Department of Chemistry and Biological Sciences for a consultative meeting

The board members pose for a photo onboard KMFRI RV Mtafiti.

KMFRI BOM and Senior Management, led by Dr. Wenwa Akinyi Oranga and Dr. James Mwaluma, pay a courtesy visit to the Kenya Navy offices at Mtongwe, Mombasa

KMFRI BOM and Senior Managers pose for a photo onboard RV Mtafiti

KMFRI
Kenya Marine and Fisheries Research Institute

Mtafiti Monthly

ISSUE 55
January, 2025
@KmfriResearch

Major Rashid K. Mohammed delivers a talk on the history, capabilities, and operations of the RV Mtafiti.

A marine specimen under study during the Fish Taxonomy training at KMFRI Mombasa HQ

Participants engage in Hands-On Training on Fish Identification, Adaptations, and Classification at KMFRI Mombasa