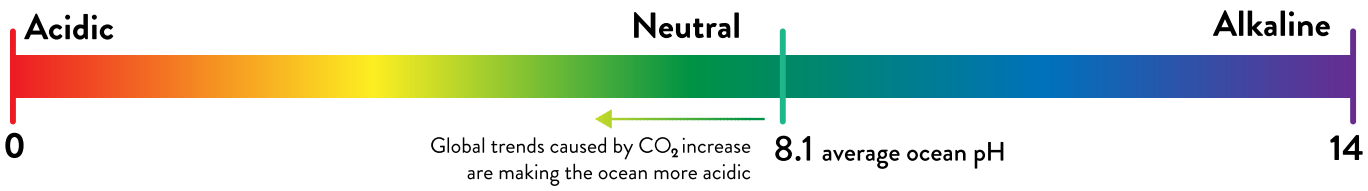
# GRAPHIC #1:
# POTENTIAL IMPACTS OF OCEAN ACIDIFICATION IN THE WIO

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

The ocean has absorbed approximately 30% of the carbon dioxide ($CO_2$) emissions released into the atmosphere since the Industrial Revolution and has absorbed 90% of the excess heat caused by the burning of fossil fuels.

The addition of $CO_2$ to the ocean is making seawater more acidified; we call this process "ocean acidification" or OA. The chemical reactions that occur in the ocean as a result of OA include lowering of pH and reductions in the concentration of carbonate minerals used by some marine species, such as coral reefs and shellfish, to form shells and skeletons.

## pH scale




Effect of changes in pH on animals like pteropods over time:


**Pteropods are a shell forming plankton that are important food source for many marine species.*

OA combines with other climate-ocean impacts like ocean warming and reduced oxygen levels, increasing the total stress marine species and ecosystems are experiencing. These changes are likely to intensify as this century progresses and have the potential to significantly alter marine ecosystems and associated ecosystem services for decades to come.

WIO marine ecosystems and resources are vulnerable to the cumulative impacts of OA and climate change. **This has impacts on the region's development goals, sustainable blue economy, and food security.**

Climate ocean impacts like

**ocean acidification, warming & oxygen loss**

lead to, and combine with, other stressors:

- MARINE **HEAT WAVES**
- INCREASED **STRATIFICATION**
- **POLLUTION**
- **EUTROPHICATION**

## That lead to:

- Weakening and reduced growth of **SHELLFISH**
- Impacts to **BEHAVIOR AND SURVIVAL**
- Weakening and slower growth of **CORAL REEF**
- Changes to natural **FOOD WEBS**

## This impacts on the region's:

### DEVELOPMENT GOALS

- More than 50% of countries have coastline and associated development pressures.
- 42% of population will live near coastline by 2035
- Renewable energy and blue carbon are growing sectors

### SUSTAINABLE BLUE ECONOMY

- $300 billion in economic activities
- 50 million jobs

### FOOD SECURITY

- Feeding 2.8 billion people by 2060
- 10.8 kilograms of fish consumption per person per year.

# GRAPHIC #2:
# POLICY GOALS AND MANAGEMENT ACTIONS INTERSECT WITH OA

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

Africa's marine resources can be harnessed to both achieve socio-economic development while also enhancing human health and resilience.

However, achieving regional developmental goals, delivering a sustainable blue economy, and feeding a growing population will require ever more increasing reliance on WIO's marine resources that are threatened by OA.


Existing marine management, climate change and sustainable development policies provide a crucial foundation for accelerating and utilizing OA information.

**Across these policy frameworks, there are several management actions that can be deployed now to combat OA and support vulnerable marine ecosystems and resources:**

- Reducing carbon emissions.
- Reduce land-based pollution, particularly in coastal and estuarine regions. By reducing such pollution sources that contribute to OA and eutrophication, the impacts on species can be lessened, and ecosystem function can be improved.
- Reduce non-climate stressors like habitat destruction, over-fishing and plastic pollution.
- Employ targeted regulations, seasonal closures, or other conservation measures like Marine Protected Areas (MPAs), and shared -use planning tools like Marine Spatial Planning (MSP) to protect areas at higher risk of OA. (icon; marine spaitial planning)
- Preserve and safeguard marine vegetation and blue carbon habitats like mangroves, seagrass, kelp forests and salt marshes that can absorb carbon from the water column and remediate OA in nearby areas.

The effectiveness of these OA management strategies depends on knowledge of local factors and conditions, alongside an awareness around the costs or benefits of available interventions.

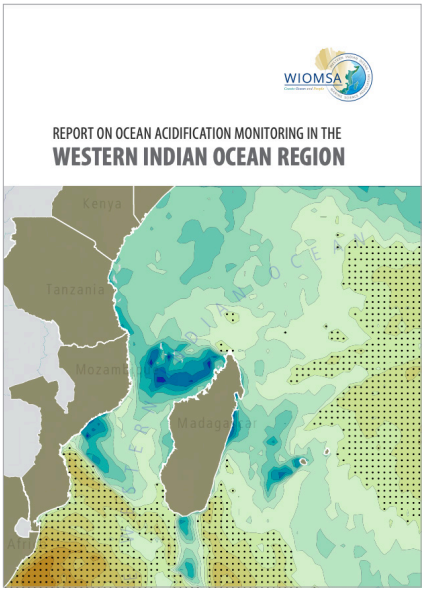
# GRAPHIC #3:
# WIOMSA OA REPORT, 2022

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

Bodies like the Western Indian Ocean Marine Science Association (WIOMSA) are critical players in increasing regional scientific knowledge, prioritizing discrete projects at local scales, and are well aligned to provide decision makers and communities with research and monitoring information on current and emerging marine socio-ecological threats and potential responses.

In 2018, the Western Indian Ocean Acidification (WIO) OA Monitoring project was established by WIOMSA in conjunction with regional institutions and experts. The monitoring project resulted in the WIO OA report in 2022, which examines the state of OA and makes recommendations for future research and information priorities across 6 countries: Kenya, Tanzania, Mozambique, South Africa, Mauritius, and Seychelles.

**Examples of OA monitoring and science recommendations from the report include:**




- Expanded coverage on monitoring assets in the region.
- Capacity for robust laboratory equipment.
- Increased funding for research assistants conducting ex-situ and in-situ experiments.
- Expanded research to incorporate multiple stressors of warming, OA and deoxygenation.
- Increased biological research on the impacts of OA to key fisheries, shellfish and coral.
- Monitoring OA conditions in coastal waters to identify hot spots or refugia (worse or better conditions).
- Research to evaluate the potential of mangrove and seagrass to remediate the effects of OA on nearby coral reef or near shellfish.
- Develop regional vulnerability assessments that prioritize and study species and ecosystems of socioeconomic importance/ dependence.

**This research initiative provides a baseline that can foster the development of a more comprehensive and integrated strategy for ocean acidification monitoring, research, and impact assessment across the WIO region. The research also identifies knowledge gaps that must be addressed to enhance management response to rising acidity.**

# GRAPHIC #4:
## RELEVANT GOVERNANCE ARRANGEMENTS FOR SUPPORTING— OR BENEFITING FROM— OA MONITORING AND RESEARCH

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

| | Global | Regional | Domestic |
|---|---|---|---|
| **Marine Management Goals & Targets** | United Nations Law of the Sea (UNCLOS)<br><br>Boundaries Beyond National Jurisdiction Agreement (BBNJ Treaty<br><br>Kunming-Montreal Global Biodiversity Framework<br><br>Convention on Biological Diversity (CBD) | Nairobi Convention & Decision CP 10/7 to Establish Regional Action Plan to address Ocean Acidification<br><br>Protocol for the Protection of the Marine and Coastal Environment of the Western Indian Ocean from Land-Based Sources and Activities<br><br>Convention for the Protection, Management, and Development of the Marine and Coastal Development in the East African Region<br><br>Protocol concerning protected areas and wild fauna and flora in the East African Region | Locally Managed Marine Areas (LMMAs)<br><br>Marine Protected Areas<br><br>Marine Spatial Plan<br><br>Fisheries and Aquaculture Management Strategies |
| **Climate Adaptation Goals & Targets** | United Nations Framework Convention on Climate Change<br><br>Paris Agreement | African Union Climate Change and Resilient Development Strategy and Action Plan<br><br>East African Community Climate Change Policy<br><br>East African Community Climate Change Master Plan 2011-2031<br><br>Southern African Development Cooperation Climate Strategy | National Determined Contributions (NDCs), National Climate Adaptation Plans (NAPs)<br><br>Domestic Climate Risk Assessments<br><br>Domestic Climate Mitigation, Adaptation and Resilience Strategies |

| | Global | Regional | Domestic |
|---|---|---|---|
| **Sustainable Development Goals & Targets** | UN – SDG Goals including goal 14.3 “to minimize and address OA”<br><br>SDG 1 – No Poverty<br>SDG 2 – Zero Hunger<br>SDG 13 – Climate Action<br>SDG 17 – Partnership for the Goals | Africa Agenda 2063<br><br>Africa Blue Economy Strategy<br><br>East African Community (EAC) Development Strategy 2050<br><br>Southern African Development Community (SADC) Vision 2050 | National development blueprints<br><br>For example:<br><br>Kenya Vision 2030<br><br>United Republic of Tanzania country strategic plan<br><br>Seychelles Vision 2033<br><br>Seychelles Blue Economy Strategy |

# GRAPHIC #5:
# NAIROBI CONVENTION CALLS FOR REGIONAL OA PROGRAMME

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

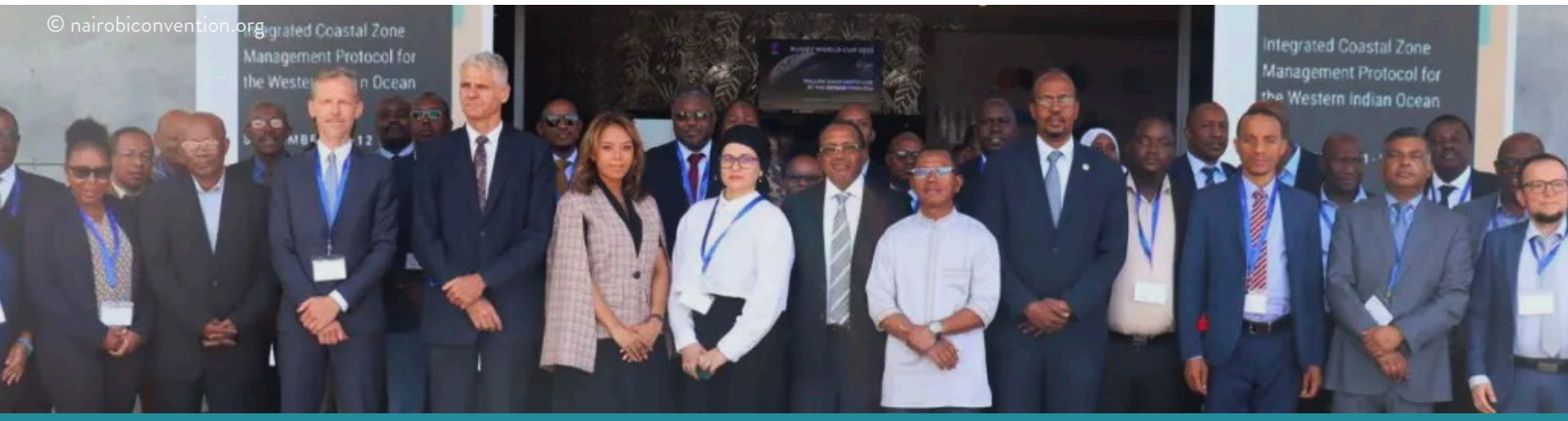
The Nairobi Convention provides a legal framework for parties to protect, manage, and sustainably develop the coastal and marine environment in the WIO.

In 2021, the Conference of Parties to the Nairobi Convention requested the secretariat to develop, "A regional action plan to both monitor and enhance national climate change intervention strategies to minimize the impacts of ocean acidification." (Decision CP 10/7)

The decision has established an opportunity for integrating ongoing OA monitoring and research work into the broader governance mandates of the Convention.

With this approach, OA monitoring, research, and impact assessment need not be viewed as isolated, stand-alone activities, but as integral components of a larger resource management agenda in the WIO.

- **A regional OA monitoring program—as called for by the Nairobi Convention—should be part of the WIO's approach to integrated marine and coastal management in the context of climate change and regional development.**
- **Development of a robust regional OA programme should integrate monitoring, research, and impact assessment as to directly inform mitigation, and adaptation efforts across regional and national policy priorities.**
- **There are political and practical opportunities of such a regional OA monitoring program established under the Nairobi Convention, including a deeper relationship to policy, management strategies and communications about OA.**
- **Under the Nairobi Convention, existing marine management, climate change, and sustainable development policies provide a crucial foundation for accelerating and utilizing OA information.**



# GRAPHIC #6:
# EXAMPLE OF DOMESTIC POLICIES FOR UTILIZING OA MONITORING AND RESEARCH IN THE WIO

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## SEYCHELLES:

### Domestic Policy:
Nationally Determined Contribution

### OA monitoring and Research occurring through WIOMSA:
Monitoring and evaluating the potential of seagrass to remediate OA and promote blue carbon sequestration policies.

### Relevance to implementing policy:
Supports country in establishing a long-term monitoring program for seagrass and mangrove habitats by 2025, while incorporating the greenhouse gas (GHG) sink of Seychelles' blue carbon ecosystems within the National Greenhouse Gas Inventory by the same year.

## KENYA:

### Domestic Policy:
National Ocean and Fisheries Policy

### OA monitoring and Research occurring through WIOMSA:
Research to determine the responses of organisms and ecosystems to OA with an emphasis on critical coral habitats of keystone fisheries that are critical to food security in the region.

### Relevance to implementing policy:
OA data collected should be layered with fisheries management data and made available to decision makers by Kenya Marine and Fisheries Research Institute (KMFIRI.) This will inform the National Ocean and Fisheries Policy with a focus on ensuring food security and conserving and managing fish resources, including coastal and marine fisheries and their habitats.

# TANZANIA:

## Domestic Policy:

Bahari Mali Project

## OA monitoring and Research occurring through WIOMSA:

Monitoring to establish OA baselines and identify suitable locations for successful research across the Tanga-Pemba seascape.

In time, this work can support the assessment of various mitigation and adaptation priorities within Tanzania, which support development of the blue economy sector.

## Relevance to implementing policy:

The Bahari Mali Project is dedicated to promoting the sustainable development of the blue economy by enhancing the livelihoods of coastal communities and the conservation of ecosystems in the Tanga-Pemba seascape.

# GRAPHIC #7:
# CONCLUSIONS & RECOMMENDATIONS

*Designing a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean*

## CONCLUSIONS:

- WIO marine ecosystems are highly vulnerable to the cumulative impacts of OA and climate change. The risks across the region and Africa are both ecological and developmental. These include threats to achieving regional developmental goals, delivering a sustainable blue economy, and feeding a growing population.

- There is a need for enhanced coordination and scaled investment in OA monitoring and targeted research across the Continent. OA science and knowledge can inform effective and location relevant mitigation, adaptation, and response strategies.

- There is a diverse suite of existing legal and policy arrangements whose implementation would benefit from integrating OA information in the governance of WIO.

- Existing policies can be used to increase avenues for mainstreaming OA information and strengthening local capacity to respond. Across these policy frameworks, there are several local management actions that can be deployed now to combat OA and support vulnerable marine ecosystems and resources.

- Bodies like the Western Indian Ocean Marine Science Association (WIOMSA) are critical players in increasing regional scientific knowledge, prioritizing discrete projects at local scales, and are well aligned to provide decision makers and communities with research and monitoring information on current and emerging marine socio-ecological threats.

## RECOMMENDATIONS:

### Operationalize a Regional OA Program Under the Nairobi Convention

- Implement a regional OA program, as advocated by the Nairobi Convention, that supports the WIO's approach to resource management.

- Under the Nairobi Convention, governments should advance the development of a robust regional OA programme that integrates monitoring, research, and impact assessment as to directly inform mitigation, and adaptation efforts across regional and national policy priorities.

- A coordinated and well-funded regional OA programme can help support the realization of regional developmental goals, deliver a sustainable blue economy, and assess how to feed a growing population. Such an OA programme would provide a model for the Continent.

## Integrate OA Information Across Relevant Policy Goals in the WIO

- A diversity of existing management strategies and their governance mechanisms can be leveraged to stimulate early OA actions and bolster the resilience of marine ecosystems and resources in the WIO. Existing marine management, climate change, and sustainable development policies provide a crucial foundation for integrating and utilizing OA information.
- Parties to the Nairobi Convention should include OA within their technical and financial support mechanisms for critical policy priorities, including those related to, marine management, climate action, sustainable development, blue economy, and food security.
- These efforts ensure that OA information becomes an integral component of broader policy objectives. National policies can be leveraged to promote adequate and equitable investments in OA information, conduct gaps analysis, and highlight capacity or technology transfer that result in better preparedness, mitigation, and adaptation choices on the ground.

## Increase Climate Adaptation Funding to Support OA Knowledge and Response

- Funding proposals should be put forward to entities like the Green Climate Fund, Global Environment Facility, UN programmes and Development Banks, making the case that well-funded and intentionally coordinated regional OA programme is an imperative and a necessary use of climate-adaptation financing at regional scales.
- Climate finance mechanisms like Green Climate Fund, Global Environment Facility, relevant Development Banks, and UN programmes must serve as incubators for projects that build technological capacity for short-term and long-term observations of local conditions and risk assessments, as well as evaluations of potential interventions and adaptation strategies.
- Funding entities have existing project mandates that increased OA information could further support and enhance. Examples include projects focused on developing the blue economy, strengthening coastal adaptation, supporting sustainable aquaculture, and accelerating ecosystem restoration.

## Institutionalize and Enhance Science-Governance Collaboration

- Enhance regional frameworks that bridge the gap between scientific knowledge and governance. This facilitates the identification and utilization of the most influential marine, climate and developmental policy frameworks that can benefit from and mainstream the existing and emerging scientific information. This fosters a more profound connection to policy responses aimed at addressing current and emerging socio-ecological challenges in the region.

WIOMSA
Coasts Ocean and People
WESTERN INDIAN OCEAN MARINE SCIENCE ASSOCIATION

OA ALLIANCE
INTERNATIONAL ALLIANCE TO COMBAT OCEAN ACIDIFICATION

*Citation: Makomere R., Tuda A., and Turner J. (2024) "Benefits of a Regional Ocean Acidification Program to Support Climate, Marine and Sustainable Development Goals in the Western Indian Ocean." A collaborative policy communications project between the International Alliance to Combat Ocean Acidification and the Western Indian Ocean Marine Science Association.*