

Community ICTs and Marine Innovation for Combating Natural Hazards in Lamu, Kenya

Evelyn Kimori

Communications Lead - Lamu Marine Conservation Trust (LaMCoT)
MSc Researcher, Pwani University

Why Coastal Disaster Risk Reduction Matters

40%

of the world's population
lives within 100km of a coast

[OECD. \(2021\)](#)

2×

coastal hazard frequency
has doubled since 1980

[Vitousek, S. et al. \(2017\)](#)

2027

EW4ALL target: every person
protected by early warning

[ITU. \(2023\)](#)

Coastal regions support millions of people and critical infrastructure: fisheries, tourism, ports, and the blue economy.

Climate change is increasing the frequency and intensity of coastal natural hazards.

Building resilient coastal communities is now a global priority, and ITU leads Pillar 3 of the EW4ALL initiative.

How can technology help protect coastal communities before disasters occur?

Why Lamu?

UNESCO World Heritage Site on Kenya's northern coast

Rich coral reefs, mangrove forests & critical sea turtle nesting beaches

Fisheries and tourism economy sustaining coastal communities

Home to the LAPSSET Port Corridor - industrial pressure on a fragile ecosystem

These assets also make Lamu increasingly vulnerable to coastal natural hazards.

LaMCoT has worked here for 30+ years.



Coastal Natural Hazards in Lamu

Coastal Flooding & Storm Surge

Lamu's low-lying communities face acute flood risk during extreme weather events, worsened by degraded mangrove buffers.

[IPCC, \(2019\)](#)

Sea-Level Rise & Coastal Erosion

Shoreline erosion is accelerating, threatening community infrastructure, nesting beaches, and coastal ICT connectivity.

[IPCC, \(2019\)](#)

Coral Bleaching & Marine Pollution

Rising SSTs and LAPSSET-linked pollution are stressing Lamu's reefs, collapsing fish stocks and food security.

Impacts span communities, livelihoods, fisheries, tourism, coastal infrastructure, and ecosystems.

Communities

Livelihoods

Fisheries

Tourism

Infrastructure

Ecosystems

The Original Early Warning System – From Response to Preparedness

Traditional approach:

Respond after disasters occur. React, rebuild, repeat.

Today, technology enables us to:

Monitor hazards · Predict events
Issue early warnings · Build long-term resilience

But in Lamu – communities were already there.

Seasonal Winds

Kaskazi & *Kusi* cycles signal fish migration and storm risk
- tracked for centuries.

Swell Patterns & Reef Stress Signals

Fishers observe changes in fish behavior that precede bleaching, before instruments confirm it.

Sea states read as natural hazard indicators before setting out.

This is not folklore. This is data - accumulated, tested, and refined across generations. The earliest early warning system.

[Nakashima, D.J. et al. \(2012\)](#)

The Lamu Traditional Calendar – A 365-Day Multi-Hazard Early Warning System

Phase 1 – 100 days <i>15 Jul → 22 Oct</i>	Phase 2 – 100 days <i>23 Oct → 30 Jan</i>	Phase 3 – 100 days <i>31 Jan → 10 May</i>	Phase 4 – 65 days <i>11 May → 14 Jul</i>
 Wind Kusi yaisha (SW monsoon ends)	 Wind Kaskazi kali (Strong NE monsoon, hot)	 Wind Kusi waanza (SW monsoon begins, rains & strong winds)	 Wind Less rain → Very cold, strong winds
 Fish Prawn season begins	 Fish Peak prawn season	 Fish Peak open-sea fishing	 Fish Transition
 Farming Harvesting (Vuli)	 Farming Choma matange (Burn farms for planting)	 Farming Kuchoma tange (Risky burn - rain imminent)	 Farming New Year's Eve (Chonda) — 14 Jul

Wapemba fishers navigate from Tanzania to Lamu and back, predicting monsoon winds months in advance, with no instruments. Inshore fishers know exactly which weeks each species peaks. This is a community MHEWS, centuries old. Source: Traditional ecological knowledge from Lamu coastal community. Documented by community knowledge holders, Lamu Archipelago, Kenya.

Coastal and Ocean Technologies for Natural Hazard Monitoring

Observe

Predict

Inform

Protect

Global tools

- Satellite sea surface temperature (SST) data
- Ocean observing systems & tide gauges
- Remote sensing & drone imagery
- GIS and spatial mapping
- Numerical forecasting models

Lamu-specific tools

- AI-assisted IoT sensor arrays at Kinyika Rock
- Temperature loggers at turtle nesting sites
- KoBo community data collection platform
- NOAA Coral Reef Watch for bleaching alerts

The Role of ICTs: LaMCoT's Four-Layer Community System

Ocean data alone does not save lives. ICTs ensure information reaches decision-makers and communities.



Achievements and Ongoing Work

Data-Driven Monitoring

20 trained data collectors, 10 BMUs, 110km² mapped. KoBo platform generating Lamu's first fish identification book.

Mangrove Restoration

300,100 mangroves restored since 2012. Mangrove Offset Tool launched 2026 for mCDR at community scale.

Research & Partnerships

MSc coral core research underway at Pwani University. Partnerships with KMFRI, government, and international bodies.

Community Surveillance

Active marine conservation intelligence network communication via mobile telecoms.

Sea Turtle Protection

Active nest monitoring and relocation. Temperature loggers procured for sand temperature tracking.

Coral Cores as Climate Data Infrastructure — Building the Retrospective Baseline

MSc Research — Pwani University

Species: *Porites lutea* coral cores + surface sediments

Site: Manda, Lamu Archipelago (4–6 depth)

Method: Trace metal ICP-MS analysis on annual bands

Reconstructing 15-year pollution & climate history

Linked to LAPSSSET port development impacts

Supervisors: Dr. Mwadzombo (Pwani University) and Dr. Mariam Swaleh (Technical University of Mombasa)

[Lough, J.M. & Cooper, T.F. \(2011\)](#)

Why this matters for ICT and DRR:

Coral cores are nature's own data loggers — recording temperature, ocean chemistry, and pollution in annual growth bands, decades before any sensor network existed.

This research provides the historical baseline against which all future ICT monitoring and AI learning models are calibrated.

Without retrospective data, early warning systems are calibrated against an unknown starting point.

Challenges & Opportunities

Technical

Limited coastal monitoring infrastructure

Temperature loggers not fully deployed (training gap)

ICT

WhatsApp is our emergency telecoms - informal and fragile

No dedicated last-mile warning dissemination system

Kinyika Rock IoT camera.

Community

Need for multilingual local warning systems

Indigenous knowledge not sufficiently recorded

Research Intergration

Scientists, technocrats and indigenous communities working together.

My research will provide baseline data that will inform future AI learning models.

Recommendations

INVEST

Expand coastal observing systems in underserved areas

Improve last-mile ICT infrastructure for warning dissemination

Fund community-scale technology deployments with training bundled in

EMPOWER

Build technical capacity alongside every hardware deployment Integrate

Improve digital literacy in coastal fishing communities, and integrate AI.

Develop multilingual, localized warning dissemination systems

COLLABORATE

Connect governments, ITU, universities, research institutions

Always integrate indigenous knowledge into formal early warning systems

Key Takeaways

- 01** Coastal natural hazards are increasing globally and disproportionately impacting communities in the Global South who contributed least to the problem.
- 02** Integrating coastal and ocean technologies with ICTs, from satellite SST to community WhatsApp networks, is essential for effective disaster risk reduction.
- 03** Lamu demonstrates both the opportunities and the remaining challenges: the infrastructure gap, the capacity gap, and the recognition gap.
- 04** Strong partnerships, investment, and innovation are essential, but so is recognizing indigenous and community knowledge as a form of early-warning data.
- 05** Community-based ICT systems, connected to formal frameworks like EW4ALL Pillar 3, are the most cost-effective and trusted early warning infrastructure available to coastal communities.

The Ocean Is Talking. Community ICTs Help Us Listen.

*The communities of Lamu have been listening to the ocean for a thousand years.
Natural hazards are making that ocean harder to read.
We are building the ICT bridge between indigenous knowledge,
community data systems, and emerging technologies
to combat natural hazards, together.
We are not finished. But we are building.*

Asante sana. | Thank you.

Evelyn Kimori | eve@lamcot.org | lamcot.org