

Chapter 6 – MarCOSIO: Marine & Coastal Observation for Southern Africa & the WIO (CSIR)

Marine and Coastal Operations for Southern Africa and the Western Indian Ocean – Lead Institution: Council for Scientific and Industrial Research (CSIR), South Africa

6.1 Background and Rationale

The Marine and Coastal Operations for Southern Africa and the Indian Ocean (MarCOSIO) consortium, under GMES & Africa, turns satellite Earth Observation (EO) and ocean-modelling outputs into day-to-day decision tools for a safer, cleaner, and more productive ocean economy. Phase I (2017–2021) established core services; Phase II (2022–2025) scaled and embedded them within fisheries/aquaculture operations, coastal ecosystem stewardship, maritime safety and surveillance, and marine-hazard early warning across Southern Africa and the Western Indian Ocean (WIO). Why this matters: the region faces compounding risks—stormier seas, coral bleaching, harmful algal blooms (HABs), shoreline erosion, and IUU fishing. Co-designed, routinely updated services bridge “space to action” for agencies and coastal communities.

6.2 Leadership, Partners, and Governance

Lead institution. CSIR (South Africa); Project Lead: Sives Govender, coordinating technical delivery and stakeholder engagement.

Core partners (illustrative). ABALOBI (small-scale fisheries platform), Benguela Current Convention (BCC), CORDIO East Africa, Institut Halieutique et des Sciences Marines (IHSM, Madagascar), University of Dar es Salaam—Institute of Marine Sciences (IMS, Tanzania), TAFIRI, KMFRI, Mauritius Oceanography Institute (MOI), National Sea Rescue Institute (NSRI, South Africa), WIOMSA, among others.

Regional operating model. Activities span Angola and Namibia through South Africa to Mozambique, Tanzania, Kenya, Madagascar, Mauritius, Comoros, Seychelles, and other WIO islands—aligned with SADC and Indian Ocean Commission constituencies.

6.3 Service Portfolio and Methods (Phase I → Phase II)

6.3.1 What the services deliver

| Service line | What users receive | Typical decisions supported | Phase trajectory |
|---|--|---|--|
| Ocean State Forecasts (Safety at Sea) | Daily 1–3-day outlooks (waves, winds, currents) with simplified risk categories; multi-channel dissemination | Harbour readiness, SAR planning, “go/no-go” for artisanal fleets; beach-flag risk comms | Phase I pilots → Phase II operational (incl. island SAR training) |
| Harmful Algal Bloom & Water-Quality Alerts | Maps/bulletins using chl-a, SST, turbidity from EO time-series; regional trend analysis | Aquaculture siting/operations; shellfish safety; tourism advisories | Pilots Phase I → scaled advisories/workshops (2024–2025) |
| Coral Bleaching Early Warning (WIO) | Near-real-time thermal-stress indicators (Hotspot, DHW) + seasonal outlooks; site time-series | Reef manager early action (temporary limits, stressor control), survey targeting | Phase I build → Phase II outlooks & field validation (CORDIO/IHSM) |
| Maritime Surveillance (MarCOSIO-STM) | Web platform integrating satellite AIS + Sentinel-1 radar for tracks, dark- | IUU patrol tasking; MPA enforcement; maritime crime detection | Operational showcases/trainings (2024–2025) with agencies |

| | | | |
|--|---|--|--|
| | target cues, behavioural flags | | |
| Small-Scale Fisheries Digital Support (ABALOBI) | Mobile app for catch logging, ocean info, market access, and safety alerts; community training | Co-management, traceability, livelihoods, safety | Phase II regional roll- out (from 2024) |

6.3.2 Methods (in brief)

Ocean forecasts leverage Copernicus Marine (CMEMS) model fields; HAB alerts combine EO chlorophyll and temperature thresholds; bleaching alerts use region-tuned SST climatologies (Hotspot/DHW); maritime surveillance fuses AIS with Sentinel-1 radar to flag “dark” vessels and suspicious loitering; ABALOBI translates science into usable advisories and digital records for small-scale fisheries.

6.4 Achievements and Activities

6.4.1 Phase I (2017–2021): Foundations

- Baseline services for ocean-state alerts, coral-bleaching monitoring, and pilot small-scale fishery tools (IMS/TAFIRI/KMFRI prototypes).
- Co-design with WIOMSA and national institutes to tailor thresholds, language, and dissemination channels.

6.4.2 Phase II (2022–2025): Scale-up, Institutionalisation, New End-Users

- **2023–2024:** Coral-bleaching forecasts/alerts published for the WIO; 2023 risk assessed as low to variable across sites—improving vigilance and targeting in-water surveys (with CORDIO/IHSM).

- **2024:** HAB/water-quality briefings and aquaculture-siting workshops (e.g., KMFRI, Kenya) inform farm siting and contingency actions.
- **2024:** Search-and-rescue training for Madagascar, Mauritius, and Comoros teams using ocean-state forecasts standardises safety protocols.
- **2024–2025:** ABALOBI roll-out (South Africa, Mozambique, Tanzania, Kenya, Mauritius) consolidates Phase I pilots into a cross-country platform.
- **2024–2025:** MarCOSIO-STM demonstrated to DFFE, Police, SAMSA; UNODC-facilitated sessions support MDA integration.
- **17–18 June 2025:** Southern African Regional Stakeholder Workshop (CSIR, Pretoria) sets sustainability and impact metrics (“From data to impact”).
Related national system. South Africa’s OCIMS (with CSIR and partners) exemplifies a mature operational backbone for marine decision tools.

6.5 Decision Use and Effects

6.5.1 How information becomes action

- **Safety at sea:** Dashboards/alerts (plus colour-coded beach flags and SAR briefings) reduce departures in dangerous conditions and improve response readiness; NSRI operationally uses these in South Africa, with island SAR teams adopting similar workflows.
- **Aquaculture resilience:** HAB and water-quality trends inform siting and contingency (harvest timing, aeration, temporary closures), with KMFRI and MOI facilitating uptake.
- **Reef stewardship:** Coral-bleaching warnings enable managers (CORDIO/WIOMSA networks) to limit stress temporarily and target reef-health surveys.

- **Maritime security:** AIS + Sentinel-1 detections reveal “dark” targets and loitering; enforcement units use MarCOSIO-STM for IUU and maritime crime tasking.

6.5.2 Emerging indicators

| Indicator | Current status/examples | Planned publication |
|------------------|--|---|
| Public platforms | MarCOSIO website/training; partner portals (e.g., coral-bleaching) | Annual release notes: uptime, update cycles, user stats |
| Safety outcomes | SAR training delivered; beach-flag/ocean alerts in use | Trend in incidents per 10,000 small-boat trips; response-time metrics |
| Aquaculture/HAB | Workshops and advisories (Benguela & WIO coasts) | Farm-loss avoidance cases; cost savings from early harvest/relocation |
| Reef health | Seasonal outlooks; targeted field validations (CORDIO/IHSM) | Before/after health at sentinel sites; alert lead-time statistics |
| MDA/IUU | STM demos/trainings with enforcement agencies | Interception rate, time-to-tasking, “dark target” detections investigated |

6.6 Capacity, Inclusion, and Skills

- **Regional workshops** on maritime surveillance and fisheries analytics co-hosted by CSIR and partners (incl. 2025 Pretoria convening).

- **Digital learning & field clinics** for coral-bleaching monitoring (with CORDIO), aquaculture siting (with KMFRI), and water-quality mapping (with MOI).
- **Small-scale fisheries inclusion** via ABALOBI roll-outs: fishers (women and men) log catches, check conditions, access markets—supporting safer trips and better incomes.

6.7 Tools, Portals, and Discoverability (for general readers)

- **MarCOSIO hub:** services, partners, training, and stories.
- **Coral-bleaching narratives & forecasts:** regional pages and partner tools.
- **National backbones (example):** OCIMS/MIMS in South Africa for data/decision pipelines.

6.8 Alignment with Agenda 2063 and the SDGs

- **Agenda 2063.**
 - *Aspiration 1 (Prosperity & Sustainability):* safer seas, sustainable fisheries, resilient coastal ecosystems via routine EO services.
 - *Aspiration 2 (Integration):* transboundary surveillance and shared alerts across SADC and WIO islands.
 - *Aspiration 3 (Good Governance):* public portals and co-designed tools improve transparency and accountability.
 - *Aspiration 6 (People-Driven):* inclusion of artisanal fishers (ABALOBI) and tailored comms (flags/SMS/radio).
- **SDGs (primary links).** **SDG 14** (Life Below Water), **SDG 13** (Climate Action), **SDG 1 & 2** (livelihoods/food security for small-scale fisheries and aquaculture), **SDG 9** (innovation/operational infrastructure).

6.9 Risks, Lessons, and Outlook (Next 24 Months)

- **Sustainability & operations.** Formalise service **SOPs** mapping each alert to an agency action (SAR deployment checklist; fish-farm contingency; enforcement tasking from STM). Publish release notes on uptime and update cadence.
- **Impact metrics.** Co-publish “before/after” indicators: marine-incident rates, HAB-related losses avoided, reef-alert lead times, IUU detections leading to action.
- **Innovation links.** Maintain integrations with Copernicus Marine and national backbones (OCIMS/MIMS); explore marine-litter drift modules with WIOMSA networks.

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